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Early infant social behaviour
and maternal perinatal depression
in Kiang West, The Gambia

by
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A thesis submitted in partial fulfilment of the
requirements for the degree of
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Declaration and inclusion of material from prior work

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. It has been composed by myself and has not been submitted in any previous application for any degree.

The work presented (including data generated and data analysis) was carried out by the author except in the cases outlined below:

- Main study data collected by members of the BRIGHT team in The Gambia, including:
 - Edinburgh Postnatal Depression Scale and other mental health questionnaires
 - Most Neonatal Behavioral Assessment Scale sessions
 - Mother-infant interaction videos
 - Infant anthropometric data
 - Delivery and baby check form
 - Family socioeconomic and demographic questionnaires
- Mother-Infant Interaction videos coded according to the Global Rating Scales by BRIGHT UK affiliates Laura Bozicevik and June Pastor

Parts of this thesis have been published by the author, as follows: parts of chapter 2 section 2.51. (Parent-child interaction and infant regulatory development) and section 2.5.2 (Understanding infant behaviour as communication) – have been taken from an author's publication written as part of this degree:

Bartram, S. C., Barlow, J., & Wolke, D. (2015). The Neonatal Behavioral Assessment Scale (NBAS) and Newborn Behavioral Observations system (NBO) for supporting caregivers and improving outcomes in caregivers and their infants. *Cochrane Database of Systematic Reviews*. <https://doi.org/10.1002/14651858.CD011754>

The text including previously published components is copied and pasted in italics below, with published text highlighted in grey; their previous use is indicated by footnotes in the main body of the thesis, though without highlighting, to reduce distraction.

'2.5.1 Parent-child interaction and infant regulatory development

Neurobiological research indicates caregivers' key role in the development of an infant's brain and physiology through regulation of the infant's developing stress response system before and after birth (Gunnar, Brodersen, Nachmias, Buss, & Joseph Rigatuso, 1996; Gunnar & Donzella, 2002; Schore, 2002; Schore & Schore, 2008).

As described in research on foetal programming (e.g. Glover, O'Connor, & O'Donnell, 2010), a mothers' influence on her infant's Hypothalamic-Pituitary-Adrenal (HPA) system begins in the womb. Glucocorticoids, such as cortisol, act as the "primary mediators" of the development of this system, and perturbations in the physical and social environment, including antenatal "physiological or psychological stress," can lead to over-exposure to these hormones (Xiong & Zhang, 2013), which has been associated with negative outcomes such as shorter gestation and higher HPA reactivity in the newborn period (see Duthie & Reynolds, 2013, for a review). Other associations have been found between the antenatal environment and newborn physiology, including Lundy and colleagues' identification of maternal antenatal dopamine and norepinephrine levels as predictors of these hormones in the newborn (Lundy et al., 1999)

After an infant is born, caregivers continue to exert influence on the development of the HPA axis through their behaviour with the infant during routine caregiving and social interaction. A caregiver who is able to interpret an infant's behavioural cues and respond appropriately to meet the child's emotional and physical needs, called an 'attuned' or 'responsive' caregiver, uses his or her vocalisations, facial expressions, and

physical handling to provide continuous psychobiological regulation of the infant's ever-changing states of stress and arousal (Schoore, 2001).

Over time, this dyadic regulation allows the infant to develop adaptive strategies for responding to and regulating stress independently, which then enables the child to be less vulnerable to future stress (Sroufe, Egeland, Carlson, & Collins, 2005). When a caregiver is severely and chronically mis-attuned, however, typical dyadic regulatory processes are disrupted, such that, in the face of chronically high levels of stress that are not successfully co-regulated by the caregiver, the infant may develop only minimal or maladaptive strategies for self-regulation (Gunnar & Quevedo, 2007; Lyons-Ruth, Yellin, Melnick, & Atwood, 2005).

Infant regulatory difficulties expressed as 'excessive crying' and problems with attachment, sleeping, and feeding are the primary reasons for referral to infant mental health services. DeGangi and colleagues found that all but 5 per cent of a group of infants who were experiencing moderate regulatory problems at 7 months (i.e. problems with sleep and feeding, ability to self-soothe and modulate affect states, ability to regulate mood, and emotional and behavioural control), were experiencing caregiver-child relationship problems or developmental delays in the cognitive, motor, and language domains at the age of 3 (DeGangi, Breinbauer, Roosevelt, Porges, & Greenspan, 2000). This highlights the importance for children of having attuned caregivers to support them in developing adaptive stress response systems and regulatory capacity, as well as indicating the long-term implications of regulatory difficulties that can be measured in early infancy.

2.5.2 Understanding infant behaviour as communication

The successful shift from co-regulation to self-regulation happens within the context of a secure attachment relationship with a caregiver who can meet the infant's needs (Beebe et al., 2012). In order to successfully identify and meet these needs, a

caregiver must understand that infants use behaviour to communicate their needs, wants, and preferences, and that these behavioural cues can be interpreted and merit a prompt appropriate response (Nugent, Keefer, Minear, Johnson, & Blanchard, 2007).

When caregivers understand that infant behaviour represents communication of needs, they can support babies' growing ability to be co-regulated enough to enter into and remain in the quiet-alert, interactive state (Hawthorne, 2005; Nugent et al., 2007), by ensuring all other physical needs are met. This facilitation may allow for longer or more frequent periods of contingent communication to take place.

As previously described in this chapter, as early as 5 weeks of age, infants of caregivers who meet their needs and provide social interaction when the infants are available for it, have been found to participate more readily during interactions by doing more "gazing, smiling and vocalizing [sic]" than infants of less responsive caregivers (Markova & Legerstee, 2006). In turn, the more infants look, smile, and vocalise at their mothers, the more affectionate the mothers' behaviour toward the infants becomes, emphasising the bi-directional influence of both caregivers and infants to their interactive context (Clarke-Stewart, 1973).

Ultimately, effective co-regulation via caregiver-infant interactions in early infancy tends to correlate with a secure attachment classification. Alan Sroufe (1996), in fact, defined attachment as "the dyadic regulation of emotion." Perhaps the most prolific author on the topics of regulation and attachment, Allan Schore, indicated in 1994 the dominance of the right brain hemisphere during the first 3 years of postnatal development, identifying it as central in the processes of socio-emotional processing, affect regulation, stress management, and attachment-related behaviour (Schore, 1994). All of these processes are "experience-dependent" and therefore influenced by the quality of the caregiving environment, implicating the quality of caregiver-infant interactions in early regulatory development via the HPA axis as well as later attachment classification (Schore, 2001; Schore & Schore, 2008).'

Abstract

Background: Previous research evidences the influence of caregivers' mental health on early infant development. Maternal perinatal depression (MPD) has been studied in Lower- and Middle-Income Countries (LMICs) in relation to infant health outcomes, but infant social and behavioural development has been less commonly studied. This research assesses the relationship between early infant social behaviour and MPD in a novel LMIC setting.

Methods: Data was collected as part of the BRIGHT (Brain Imaging for Global Health) study. Piloting involved contextualisation interviews and adapting the Neonatal Behavioral Assessment Scale (NBAS). The core sample included 106 mother-infant dyads. NBAS was conducted at 2-3 weeks, mother-infant interaction (MII) behaviour filmed at 1 and 5 months, and MPD symptoms self-reported by EPDS at 34-36 weeks' gestation and 1 and 5 months postpartum.

Results: MPD period prevalence on the EPDS was 7.5%, though during 1-month MII, 20.4% had low mood. The NBAS was acceptable and orientation scores mid-range, with marginally better orientation to non-social stimuli. At 1 and 5 months infants were highly visually attentive, but had low-to-moderate active communication and positive vocalising (PV). NBAS scores were significantly, negatively associated with maternal parity and EPDS item 10. No significant associations were found between maternal depression and infant social behaviour at 1 month. Antenatal EPDS total score was significantly associated with infant 5-month PV (PV-5), and was a significant predictor in a preliminary regression equation.

Conclusions: This was the first study measuring both MPD and infant behaviour in The Gambia. Analyses indicated significant relationship between antenatal MPD and infant social behaviour at 2 weeks and 5 months. The comparatively low MPD prevalence, and inconsistency between measures, implicated further research on MPD expression and measurement in KW, with a view to developing a more comprehensive account of the relationship between MPD and infant development in this setting.

List of Abbreviations

AC-1 / AC-5	Infant active communication at 1 month / 5 months
ADif	Auditory social/non-social NBAS differential
AM	Anthropometric Measures
ATN-1 / ATN-5	Infant visual attentiveness to mother at 1 month / 5 months
B	Ball
BRIGHT	Brain Imaging in Global Health
BSREC	Warwick Biomedical & Scientific Research Ethics Committee
BW	Birth weight
CD1-1 / CD1-5	Composite infant GRSMII dimension 1 at 1 month / 5 months
CES-D	Centre for Epidemiological Studies Depression scale
CMDs	Common Mental Disorders
<i>CI</i>	Confidence Interval
<i>df</i>	Degrees of freedom
DOB	Date of birth
DSS	Demographic Surveillance System
EBF	Exclusive Breastfeeding
EF	Executive functioning
EFSTH	Edward Francis Small Teaching Hospital
EPDS	Edinburgh Postnatal Depression Scale
FGC	Female Genital Cutting
FO	Face only
FOA-1	Maternal focus of attention at 1 month
FV	Face plus Voice
GA	Gestational Age
GRSMII	Global Rating Scales of Mother-Infant Interaction
HICs	Higher-Income Countries
HPA	Hypothalamic-Pituitary-Adrenal
HSD11B2	11 β -hydroxysteroid dehydrogenase type-2
IBQ	Infant Behavior Questionnaire
IQR	Inter-Quartile Range

IMH	Infant mental health
KFS	Keneba field station
KS	Kolmogorov-Smirnov
KW	Kiang West region
LBW	Low Birth Weight
LMICs	Lower- and Middle-Income Countries
<i>M</i>	Mean
MA	Mean performance on auditory items
MDD	Major Depressive Disorder
<i>Mdn</i>	Median
ME-1 / ME-2	Maternal energy at 1 month / 5 months
MHQs	Mental Health Questionnaires
MII	Mother-Infant Interaction
MM-1 / MM-5	Maternal mood at 1 month / 5 months
MPD	Maternal perinatal depression
MRCGU	Medical Research Council Unit The Gambia at London School of Hygiene and Tropical Medicine
MUAC	Mid-Upper Arm Circumference
MV	Mean performance on visual items
MVA	Mean performance on visual-auditory items
NBAS	Neonatal Behavioral Assessment Scale
NBO	Newborn Behavioral Observation system
OC	Orientation cluster mean score
<i>p</i>	Calculated probability
PCA	Principal Component Analyses
PCI	Parent-Child Interaction
PCMDs	Perinatal Common Mental Disorders
PIL	Participant Information Leaflet
PMH	Parental Mental Health
PND	Postnatal Depression
PV-1 / PV-5	Infant positive vocalisations at 1 month / 5 months
Q10	EPDS Question 10

R	Rattle
R^2	Coefficient of determination
RS	Rattle to the Side
r_s	Spearman's Rho
SCC	Scientific Coordinating Committee
SD	Standard Deviation
SE	Standard Error
SES	Socio-economic situation
SFP	Still-Face Paradigm
SumA	Summary of alertness
SW	Shapiro-Wilk
t	t-statistic
TBA	Traditional Birth Attendants
TNR	Tonic Neck Reflex
VA	Village Assistant
VADif	Visual and auditory social/non-social differential
VDif	Visual social/non-social differential
VS	Voice to the Side
WEIRD	Western, Educated, Industrialized, Rich and Democratic
WSRT	Wilcoxin Signed Rank Test

Researcher Initials

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1 Background, aims and objectives

1.1 Background

In recent decades, theoretical and empirical investigation of the influence of early life experiences on later outcomes has been directed toward increasingly younger age groups. Following the emergence of the field of infant mental health (IMH), research concerning early infancy now extends to experiences during the newborn period and even prior to birth.

In 1973, Stone, Smith and Murphy published 'The Competent Infant,' a tome collating evidence that "from his earliest days, every infant is an active, perceiving, learning and information-organizing individual" (p. 4). Numerous studies on infant abilities have amassed since then to contribute to a vast body of research describing the behaviours and abilities that have now been studied in young infants in both Higher-Income Countries (HICs) and Lower-Middle Income Countries (LMICs), using observational and experimental paradigms.

The caregiving environment comprises young infants' primary "external" context in which they develop, including physical growth, the development of physiological and emotional regulatory capacities, socialisation into group behavioural patterns, and attachment blue-prints for future relationships (Waxler, Thelen, & Muzik, 2011, p. 42). In line with Belsky's model of influences on parenting behaviour (Belsky, 1984), parents' mental health, and associated caregiving behaviours during parent-infant interaction, are contextual influences on infant development that have received much research attention. A large body of evidence from HIC and LMIC settings indicates that parental mental health problems such as depression negatively affect multiple domains of infant development, including the parent-child relationship (Parsons, Young, Rochat, Kringelbach, & Stein, 2012).

1.2 The influence of parental mental health on infant development

The relationship between parents and infants is of vital significance for infant development and well-being in the earliest months, with implications for long-term outcomes (e.g. Malekpour, 2007). Interactions between infants and their caregivers form the basis of, and can even predict, the developing attachment relationship (Beebe et al., 2010). The quality of parent-infant interactions is a primary influence on infant development across multiple domains, affecting social and emotional (Stewart-Brown & Schrader-McMillan, 2011) as well as physiological (Luecken & Lemery, 2004; Schore & Schore, 2008) and physical health outcomes (Bell & Belsky, 2008; Surtees et al., 2003).

As suggested above, one of the key factors affecting the quality of parent-infant interaction quality is parental mental health (PMH). Poor PMH, in the forms of, for example, stress, depression, anxiety, and other common mental health problems, has been found to adversely affect parent-infant interaction via parental behaviour and dyadic interactional 'tone' in terms of reductions in contingency (e.g. Nicol-Harper, Harvey, & Stein, 2007), positive engagement (McKelvey, Fitzgerald, Schiffman, & Von Eye, 2002), sensitivity (Murray, Fiori-Cowley, Hooper, & Cooper, 1996), responsiveness (Forman et al., 2007), and affective display and warmth (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Additionally, poor PMH has been associated with increases in parental irritability, hostility (Lovejoy et al., 2000) and negative touch (Herrera, Reissland, & Shepherd, 2004), or, conversely, in withdrawn and passive presence (Malphurs, Raag, Field, Pickens, & Palaez-Nogueras, 1996), during interaction.

In addition to observed differences in *en face* parent-infant interaction, poor PMH has been found in HICs to be associated with broader interactive deficits and infant dysregulation. For example, a large longitudinal study in the United States found significant inverse correlations between parents' depressive symptoms and

time spent in developmentally ‘enriching’ interaction with children, including play, reading, and singing (Paulson, Dauber, & Leiferman, 2006), activities known to support later development (Field, 2010). Another study in Canada found higher likelihood of dysregulation, in the form of persistent crying and disturbed sleep, in infants of mothers with symptoms of Major Depression (Dennis & Ross, 2005).

While a positive quality of interaction is foundational for infant’s “healthy development” (De Falco et al., 2014), exposure to poor PMH, and the related negative quality of the interaction, both adversely affect later infant development. Associated outcomes include: more time spent in self-comforting touch compared to tactile engagement with caregivers or objects of interest (Herrera et al., 2004), increased likelihood of an insecure or disorganised attachment (e.g. Beebe et al., 2008), reduced linguistic expressiveness and cooperative behaviour in toddlerhood (NICHD Early Child Care Research Network, 1999), and risk of later mental health problems (Perry, 2002; Weissman et al., 2006).

1.3 Parental mental health and infant development in LMICs

Early studies of parent-infant interaction and infant development were based largely in Europe, the United States, and other ‘Western’ HICs (Haub & Kaneda, 2013), but the importance of the interplay between PMH and infant development is not restricted to HICs or low-adversity settings – it is of universal relevance.

Parental mental health in LMIC settings is attracting greater research attention as decreasing maternal mortality has implicated addressing maternal morbidity (Satyanarayana, Lukose, & Srinivasan, 2011), and as it has become clearer that PMH can critically impact aspects of infant development such as physical growth (Patel, DeSouza, & Rodrigues, 2003; Stewart, 2007), nutritional status (Harpham, Huttly, De Silva, Abramsky, & Harpham, 2005; Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004),

and even the likelihood of receiving preventative medical care (Balbierz, Bodnar-Deren, Wang, & Howell, 2015; Rahman et al., 2004).

More recently, an increased interest in parent and infant mental health research in LMICs has been facilitated by an increase in funding focused on this area (Tomlinson & Morgan, 2015). Furthermore, PMH is now recognised as universally relevant for improving maternal and child health, such that parents' mental well-being is not merely a desirable 'upgrade' for wealthy families on top of adequate provision of physical caregiving, or a "luxury item on the health agenda of less resourced countries" (Patel & Prince, 2010, p. 2), but a developmental necessity that can play a protective role in contexts of adversity (e.g. Tomlinson & Landman, 2007).

Some researchers have argued that maternal mental health and behaviour influence infant development even more critically in LMIC settings than in low-risk HIC settings due to the higher degree of environmental risk and adversity. In such contexts, inadequate maternal caregiving and negative behaviour may expose the infant to immediate physical and survival risks such as poor nutrition, poor hygiene, inadequate care and supervision, and failure to receive medical care (Rahman, Harrington, & Bunn, 2002).

Highlighting the risk of poor maternal mental health to both physical and psycho-social and cognitive outcomes, Patel and colleagues (Patel, DeSouza, & Rodrigues, 2003) found that infants of depressed mothers in Goa, India, were significantly more likely not only to fare poorly on an assessment of mental development at 6 months compared to infants of mothers without depression, but to be underweight as well. Another study in South Africa found that mothers' mental health symptoms were associated with their infants' developmental delays, both in a global sense, and specifically in terms of motor skills and interpersonal functioning (Hadley, Tegegn, Tessema, Asefa, & Galea, 2008).

A second study in Goa revealed a significant association between maternal early postnatal depression and infant underweight at 6 months, even when controlling for breastfeeding practices, infant physical health and weight, and parental education (Patel, Rahman, Jacob, & Hughes, 2004). Many other studies in LMICs have reported such an association between maternal depression and infant underweight or stunting (see Stein et al., 2014, p. 1808 for an overview).

Beyond survival and physical health, exposure to poor PMH in a context of adversity has been associated with behavioural problems at age 2 (Avan, Richter, Ramchandani, Norris, & Stein, 2010; Gao, Paterson, Abbott, Carter, & Lusitini, 2007); lower motor, cognitive, learning, and language skills in infancy and early childhood (Galler, Harrison, Ramsey, Forde, & Butler, 2000; Hadley et al., 2008; Hamadani et al., 2012; Quevedo et al., 2012); and ultimately with failure to achieve optimal academic and social potential over the life course (Grantham-McGregor et al., 2007).

Due to recent recognition that poor psycho-social outcomes have economic and societal consequences in addition to loss of potential for individuals (Stewart-Brown & Schrader-McMillan, 2011), interventions have been designed and implemented in a number of LMIC settings to support children's psycho-social development by supporting mothers in their ability to interpret and sensitively respond to their infants' cues. For example, health workers in Pakistan were trained to deliver cognitive behavioural therapy sessions to pregnant women with Major Depression with the aim of improving infant health and reducing maternal symptomatology (Rahman, Malik, Sikander, Roberts, & Creed, 2008).

As will be further outlined in the following chapter, studies in LMICs have identified associations between poor PMH and adverse infant development across multiple domains (Madlala & Kassier, 2018). Although associations between PMH and infant behaviour and development are not identified in every sample or setting (e.g.

Servili et al., 2010), a large body of literature now evidences the salience of parents' well-being and behaviour for children's later outcomes.

1.4 The mediating role of caregiving behaviours in LMIC settings

Numerous studies have demonstrated the mediating influence of maternal caregiving behaviours, such as contingent responding and sensitivity, on infants' later outcomes (see O'Connor & Scott, 2007 for a review), including in the context of poor PMH (e.g. van Doorn et al., 2016). The majority of evidence from HICs has focused on psycho-social outcomes (Rahman, Harrington, Bunn, & Harrington, 2001), and despite the research emphasis on child physical health in LMIC settings, research in HICs and LMICs have identified the mother-infant relationship as either a 'buffer' or 'exacerbating factor' of other environmental risks on psycho-social development. For example, Poehlmann and Fiese (2001) found that the positive quality of mother-infant interaction (MII) at 6 months mediated the influence of neonatal risks such as low birth weight (BW) and medical complications on infant cognitive outcomes at 1 year, even when controlling for neonatal and maternal sociodemographic risk factors.

Similarly, several LMIC studies cited in a recent review (Herba, Glover, Ramchandani, & Rondon, 2016) identified aspects of caregiving behaviour that acted as mediating factors in the relationship between infant exposure to poor PMH and risk of adverse outcomes. For example, Cooper and colleagues' study of mothers and infants in a peri-urban area of South Africa found that poor MII quality in the form of intrusiveness mediated the influence of mothers' depression on the infants' attachment classification (Cooper et al., 1999; Tomlinson, Cooper, & Murray, 2005).

In order to promote optimal developmental outcomes for infants and children in LMICs, the way social and emotional development occurs in a given context, and how this relates to risk factors reported in other settings (including maternal depression and poor MII quality), must first be understood. Importantly, caregiving

and mental health are both culturally situated and contingent, and therefore previous research in one setting is not necessarily applicable in another (Stewart-Brown & Schrader-McMillan, 2011). Only once these psycho-social aspects of infant growth and development have been accurately assessed in a specific setting can methods of support be developed that are tailored to the infants and families who live there.

1.5 Measuring parental mental health and infant social behaviour

Approaches to measuring infant behaviour, parent-infant interaction and PMH have included parent-report questionnaires and developmental assessments (e.g. Ages and Stages Questionnaire [Singh, Yeh, & Boone Blanchard, 2017], Bayley Scales of Infant and Toddler Development [Ballot et al., 2017], etc.); elicited behavioural assessments (e.g. Neonatal Behavioural Assessment Scale, Assessment of Preterm Infants' Behavior), observational assessments of interactional constructs such as contingency and affect, typically coded from videos (e.g. the CARE-Index [Crittenden & Bonvillian, 1984]; Nursing Child Assessment Feeding Scale [Hodges, Houck, & Kindermann, 2007]; Assessment of Mother-Infant Sensitivity, etc.); and self-report questionnaires of mental health symptoms (e.g. Edinburgh Postnatal Depression Scale [Cox et al., 1987], Centre for Epidemiological Studies Depression Scale [Radloff, 1977], Kessler Psychological Distress Scale [Kessler et al., 2003], etc.), as well as clinical or diagnostic interviews (e.g. Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders [Sanchez-Villegas et al., 2008], Mini International Neuropsychiatric Interview [Orlandi, Pinho, Murad, Rocha, & Rodrigues-Machado, 2016], etc.).

Tools for assessing behaviour in newborns in particular have tended to emphasise physical health and reflexive behaviour (e.g. Dubowitz Scale [Dubowitz, Ricci, & Mercuri, 2005], Neuromotor Behavioural Assessment [Carmichael, Burns, Gray, & O'Callaghan, 1997], Prechtl's Assessment of General Movements, [Einspieler & Prechtl, 2005], etc.), pain or stress reactivity (e.g. Neonatal Infant Pain Scale

[Lawrence et al., 1993], Liverpool Infant Distress Scale [Horgan, Glenn, & Choonara, 2002], etc.), and developmental care needs (e.g. Newborn Individualized Developmental Care and Assessment Program [Ohlsson & Jacobs, 2013]), presumably because newborn research has often been medically purposed, although a subset of NBAS-related measures do aim to assess interactive behaviours, such as the Mother's Assessment of the Behavior of her Infant (Hart, Field, & Nearing, 1998), and the NICU Network Neurobehavioral Scales (Ed Tronick & Lester, 2013). The Still Face paradigm has also been used to explore newborn behaviour in infants as young as the day of birth (Nagy, Pilling, Watt, Pal, & Orvos, 2017).

For the purposes of this thesis, the NBAS, GRSMII and EPDS were selected to measure newborn behaviour, MII, and maternal depression. As will be further detailed in the methods chapter, these tools were selected over alternative measures due to pragmatic factors such as cost and availability as well as suitability for the aims of BRIGHT (Lotzin et al., 2015).

1.6 Measuring parental mental health and infant social behaviour in LMIC settings

Over the last decade, specific tools have been developed or modified to measure parental depression and other common mental health problems (Sweetland, Belkin, & Verdelli, 2014), parent-infant interaction (Lotzin et al., 2015), and infant development (Kammerer, Isquith, & Lundy, 2013) in an expanding number of LMIC contexts. For example, the Global Rating Scales of Mother-Infant Interaction (GRSMII; Gunning, Fiori-Cowley, & Murray, 1999) were adapted for use with dyads in Ethiopia (Knight, 2016). Other tools, such as the Brazelton Neonatal Behavioral Assessment Scale (NBAS; Brazelton & Nugent, 2011), are considered to have universal or trans-cultural application and acceptability, due to the nature of the outcomes measured.

Although some frequently-used tools have been validated across multiple settings, locally-developed tools for assessment may be preferable to ‘transplanted’ measures, due to issues with score interpretation and cultural and linguistic accuracy (Sweetland et al., 2014). The Kilifi Developmental Inventory (Abubakar, Holding, van Baar, Newton, & van de Vijver, 2008), designed to assesses infant psycho-motor development in a low-resource area in Kenya, is one such example of a measure created specifically for use in a novel LMIC setting.

The use of both adapted and tailored measures across LMIC settings and in longitudinal projects is improving our ability to identify correlates of infant development and PMH, explore possible models of cause and effect, and measure long-term outcomes in infants and parents in particular contexts. Longitudinal studies including measures of psycho-social development and PMH are still less common in LMICs than in HICs. However, as research interest in global mental health increases; as evidence of the interplay of nature and nurture in infant development in high-risk settings accumulates (Stewart-Brown & Schrader-McMillan, 2011); and as associations between physical and psycho-physiological development become clearer (Avan et al., 2010), such studies are necessary for contributing high-quality research to expand the existing IMH literature.

1.7 The BRIGHT study

One longitudinal study of infant development measuring such early contextual factors as newborn social behaviour, PMH, and parent-child interaction with participants in an LMIC setting is the Brain Imaging for Global Health (BRIGHT) study. Investigators Clare Elwell (UCL), Sophie Moore (International Nutrition Group, The Gambia Unit and KCL) and Sarah Lloyd-Fox (Birkbeck, University of London) initiated BRIGHT in order to develop brain-function-for-age curves in infants growing up in rural villages in The Gambia, West Africa, alongside brain-function-for-age curves in infants growing up in Cambridgeshire, United Kingdom.

Funded by the Bill and Melinda Gates foundation, the BRIGHT study follows 200 Gambian infants and 60 Cambridgeshire infants from the third trimester of pregnancy until 2 years of age, using brain imaging techniques, psycho-social measures, behavioural assessments, socio-economic measures, demographic information, nutrition questionnaires, and, in the Gambian cohort, biological samples, to explore the effects of nutritional and contextual influences on infant development. Notably, BRIGHT is the first study to conduct brain imaging with infants anywhere in Africa.

My role within BRIGHT was primarily in the training and set-up phases, as well as initial data collection, from April 2015 to April 2017. Having become certified in the Neonatal Behavioural Assessment Scale (NBAS) in 2015, I was invited to conduct these assessments for BRIGHT in The Gambia and was accommodated there for a total of 12 months. I piloted and adapted the NBAS for use in Kiang West (KW); conducted 21 of the first NBAS's in KW; supported training and supervision of NBAS sessions for the duration of data collected for this thesis; and led re-scoring of NBAS's conducted by pre-certified trainees. During the planning phases, I led a small team in translating the mental health measures, and supervised the first staff members responsible for administering them. In exchange for this involvement, I was given access to the data.

1.8 Aim, objectives, and research questions

1.8.1 *Aim and objectives*

There are two main variables of interest in the present study: infant social behaviour and maternal mental health. The aim of this study is to assess the prevalence and stability of infant social behaviour and maternal depression, and to evaluate the relationship between them, across the third trimester and first 5 months after birth, in sample of mothers and infants living in KW, The Gambia. Four research objectives were set to achieve this aim.

- | | |
|--------------------|---|
| Pilot phase | <ol style="list-style-type: none"> 1. To contextualise the project within KW 2. To pilot, adapt, and translate measures not previously used in KW, with particular emphasis on the NBAS, and to train staff as needed |
| Main phase | <ol style="list-style-type: none"> 3. To measure the prevalence and stability of infant social behaviour and maternal depression in KW 4. To assess the relationships between measures in KW, including associations between earlier measures and later infant social behaviour |

1.8.2 *Research questions*

Four primary research questions correspond to the objectives.

- | | |
|--------------------|--|
| Pilot phase | <ol style="list-style-type: none"> 1. What is the context in which parenting and mother-infant interaction take place in KW? 2. Can the NBAS, which has not been used previously in The Gambia, be adapted for KW? |
| Main phase | <ol style="list-style-type: none"> 3. What is the prevalence and stability of infant social behaviour and maternal depressive symptoms in the main sample, between 34-36 weeks' gestation and 5 months postpartum? 4. How do infant social behaviour and maternal depression relate to one another in this sample? For example: is maternal depression during pregnancy associated with infant social behaviour at 1 and 5 months? |

1.8.3 *Hypotheses*

Pilot phase

1. The first question is exploratory; no hypotheses were made and the views of parents and community members living in Keneba were sought directly.

2. The NBAS is expected to be an acceptable measure overall to parents in KW, as it is designed to be culturally flexible.

Main Phase

3. It is hypothesised that mean NBAS orientation scores across the full sample will not differ markedly from scores in previous research.

Additionally, more optimal infant social behaviour (GRSMII) is expected at 5 months compared to 1 month, as the mean duration of waking time increases rapidly between 1 and 3 months (Wolff, 1973), such that caregivers may become more accustomed to engaging with their infants by this time.

Finally, it is hypothesised that the period prevalence of maternal depression, as measured by the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987), will be broadly similar to the 10-15% previously cited for HICs and in other African countries (Beck, 2001; Sawyer, Ayers, & Smith, 2010), with the possibility of slightly lower or higher prevalence due to translation effects less familiarity discussing mental health in KW. Mothers' depressive symptoms are hypothesised to be higher during pregnancy and 1 month than at 5 months.

4. The BRIGHT study was designed to address broader research questions primarily based on measures not utilised in this thesis (e.g. neuroimaging data, maternal nutrition, and language acquisition). Additionally, there has not been any previous research in The Gambia on newborn behaviour (with the exception of the pilot), infant behaviour during interaction with the mother, or maternal depressive behaviour (as opposed to assessment of symptoms via questionnaire or interview). Research questions regarding the relationship between these measures are therefore necessarily exploratory, though

findings are expected to align broadly with previous research as discussed in the literature review in the following chapter. For example:

- a) Higher antenatal EPDS scores are hypothesised to be associated with lower NBAS orientation scores and infant social behaviour (GRSMII) at 1 month, but not necessarily at 5 months
- b) NBAS orientation scores are hypothesised to be associated with infant social behaviour (GRSMII) at 1 and 5 months
- c) Antenatal and 1-month EPDS scores, and socioeconomic situation (SES), are hypothesised to be associated with EPDS scores at 5 months

1.9 Thesis outline

After providing a review of extant literature (chapter 2) and outlining the methods used in this study (chapter 3), chapters 4 and 5 first provide an understanding of the cultural setting of parents and infants living in KW, and then assess how best to adapt the NBAS for the KW setting.

The second part of the thesis reports the demographic composition of the main sample (chapter 6), and then reports the prevalence and stability over time of maternal depressive symptoms and infant social behaviour (chapter 7).

The third and final part of this thesis reports associations between infant social behaviour and maternal depression (chapter 8). It will also consider the role of relevant demographic factors such as infant weight in these associations. This thesis concludes with a discussion of the main findings of the report and their implications for future research and practice.

2 Literature review

2.1 Introduction

Infant mental health (IMH) is an emerging discipline that contributes research on the well-being and development of babies and their caregivers. In the last 70 years research with newborn infants, and babies prior to birth, has increased, and altered the way these young infants are viewed. There has also been increased interest in early infancy and the importance of psycho-social influences in infant well-being, including parental mental health (PMH) and the influence of the contexts in which infants develop, including socioeconomic factors and the wider 'culture'.

These factors have been more heavily researched in 'the West,' where psychological research has traditionally been situated, but more recently are being examined in Lower-Middle Income Countries (LMICs) as well, where the majority of the world's infants are born. One LMIC in particular, The Gambia, has contributed much in the way of medical research, due to the presence of the British Medical Research Council. In the last 10 years, several papers including psychosocial research from within The Gambia have been published; however, the present study is based on data from the only known project in The Gambia to measure psychosocial aspects of infant development using direct assessments with both parents and infants, in multiple domains, longitudinally.

2.2 Review methods

Using a non-formal scoping-style narrative approach (e.g. with similarity to the methods described in Arksey & O'Malley, 2005 and Cacchione, 2016), the aim of this literature review is to provide a broad overview of the historical and current body of evidence regarding infant social behaviour across the earliest months, PMH before and after birth, and parent-infant interactions. This review includes existing evidence from both Higher- and Lower-Middle Income Countries (HICs and LMICs), and

concludes with a brief review describing the literature base on infant behaviour and maternal mental health in The Gambia in particular.

The objective of this review was to describe the following:

- A) The historical trajectory of research on early infancy
- B) Extant literature on newborn social behaviour and social development in early infancy
- C) The influence of and extant literature on parent-infant interaction
- D) The extant literature on maternal depression, with emphases on prevalence and implications for infant development
- E) Any differences between research on these topics in HIC and LMIC settings
- F) The existing literature base on these topics in The Gambia, with an emphasis on any gaps that this thesis will address

Two additional developmentally relevant variables – infant weight and family socioeconomic situation (SES) – arose during the process of writing the review, and are described in relation to the topics of interest.

There were no primary research questions other than ‘what is the extant literature on infant social behaviour and development, mother-infant interaction, maternal mental health, and aspects of development relevant to these topics, worldwide?’. Secondary research questions included: a) is there a difference in findings or number of available studies between HIC and LMIC settings?, and b) are there any gaps in the literature in The Gambia in particular that the present thesis will help address?

As stated, this literature review was not conducted systematically; rather, a scoping-style, narrative approach was taken to provide an account of existing literature in the topics of interest to this thesis. Therefore, there was no formal set of search terms or databases; rather, thematic search terms relevant to the topics of interest (e.g. “newborn behaviour,”; “mother-infant interaction,” and “perinatal depression”) were first entered into the Warwick library search function and generic

internet searches in order to locate papers, and organised by topic within Mendeley as well as printed and annotated in hard-copy folders. The central method of identifying further articles was searching reference lists by hand based on relevance to the topics of interest, alongside further online searches for more specific areas of interest (e.g. “maternal depression in Sub-Saharan Africa”). Several books were also consulted where fewer articles were available (e.g. for developmental milestones in early infant social behaviour).

The review approach was broadly inclusive. Articles were only excluded if they were irrelevant, unavailable in English, or inaccessible. No date, design, or country exclusions were applied. Studies could be conducted in any setting, as long as the outcomes (or study focus) included infant social development (and related influences, such as infant weight and family socioeconomic circumstances), parent and infant mental health, or parent-infant interaction.

Included studies were not systematically appraised for methodological quality, because the aim of this review was purely to gather and describe studies around key topics of interest (e.g. Parbhoo, Louw, & Grimmer-Somers, 2010). Furthermore, data was not extracted in a systematic manner. Descriptive information was utilised from each study as relevant during the writing process.

Following this review, the aims of the thesis are outlined, before study procedures are defined in the following methods chapter.

2.3 Getting a “handle” on infancy research: a historical overview

The advent of the twentieth century saw an increase in research on the development and behaviour of infants (Horowitz & Colombo, 1990). Initially, throughout the 1920s and 1930’s, the primary focus within infancy research was

normative developmental trajectories, and the development of scales (e.g. Bayley Scales in 1935; McKee et al., 2011) for measuring behaviour and development (Horowitz & Colombo, 1990). Then, in the 1930's and 1940's, research on auditory and visual perception became more prevalent (Yarrow, 1979), and by the 1950's there was a clear shift in the way infants were conceptualised and the kinds of assessments used to measure their abilities.

In the space of a single life-span, psychologists have moved from an understanding of infants as little more than reflexive organisms to social beings capable of contributing to and interacting with the world around them (Yarrow, 1979, p. 897). However, the consensus did not change overnight. Although several early studies seemed to demonstrate competency¹, the view of infants as passive and largely incompetent beings with poor sight and hearing persisted throughout the 1940's and early 50's, at which point there appeared to be a distinct and sudden increase in research on infant abilities in the newborn period that implied visual, auditory and interactive competency.

Now, in 2018, it is a commonly accepted fact that infants not only can see and hear from birth, but perceive, prefer and respond – rather than merely react – to their environment (Stone, Smith and Murphy, 1973, p. 5). This trend in recent decades toward research with infants in younger and younger age groups and toward an understanding of newborns as interactive, capable individuals is a far cry from William James' now-infamous claim in 1890 that newborn experience consists only of a passive reception of “blooming, buzzing confusion” (James, 1890).

¹ See, for example Valentine's (1913) and Murchison and Langer's (1927) studies of newborn visual abilities; Buhler, Hetzer and Tudor-Hart's (1927) study on newborn auditory perception; or Arnold Gesell's (1934) book on newborn behaviour; all cited by Joy Osofsky in her *Handbook of Infant Development* (1979).

Stone, Smith and Murphy (1973) liken this shift to the growth of “handles” on an un-formed expanse of literature on infant abilities, such that:

[research on infant abilities] became graspable and manageable; all at once it seemed possible to obtain empirical answers where previously there had been largely theoretical speculation and inference. As the handles emerged, there were plenty of hands to grasp them (pp. 5-6).

Infancy research is now underpinned by the view that infants actively process and contribute to their surroundings, and encompasses the study not only of infants in the earliest months postpartum, but in the earliest days and even before birth, with antenatal behaviour acting as the most recent ‘final frontier’ in research on ever-younger infants. Although such interest in antenatal development was present in the 1970’s, technological advances and novel assessment paradigms have increased the evidence base, and recently found that visual preference for “face-like stimuli” begins *in utero* (Reid et al., 2017).

Thus, in just 8 decades, infancy research has changed dramatically in light of the shift toward viewing infants as capable from birth. The current field is better described by assertions that even newborn babies are social individuals (Brazelton & Nugent, 2011; Nugent, Keefer, Minear, Johnson, & Blanchard, 2007) than previous descriptions of the newborn infant as “helpless” [1948], “pre-cordate” [1942] and “largely a reflex organism” [1966] (see Stone et al., 1973, pp. 3-4), which no longer seem appropriate in light of the evidence.

A complete overview is not feasible in this chapter, and can be found elsewhere², but as a brief summary, some of the behaviours studied in the newborn

² Stone, Smith and Murphy (1973) provide an account and reference list of this evidence base through its date of publication.

period include: organisation of behaviour within observable states (e.g. Wolff, 1959), visual abilities and preferences (e.g. Fantz, 1958; 1963), auditory perception and distinction including auditory orientation ability in 8-hour-old newborns (Barten, Birns, & Ronch, 1971; Wertheimer, 1961; see Eisenberg, 1976 for a review) and preference behaviours with caregivers (DeCasper & Spence, 1986; Walton, Bower, & Bower, 1992).

2.2.2 Emergence of the field of infant mental health

One area within infancy research that has come to the forefront in the last 30 years is the study of infant mental health (IMH), the focus of which is the “social and emotional well-being of infants and their caregivers and the various contexts within which caregiving takes place” (Fitzgerald & Barton, 2000, p. 1). Therefore, the field of IMH can be understood as the study not only of infant development, but also of relationships and systems. As famously explained by Winnicott (1964), it is not possible to study infants in isolation, as infants necessarily exist as “part of a relationship” (p. 88). Instead, IMH research uses a dynamic understanding of the infant’s developmental or contextual system – a constellation that includes infants, their caregivers, and the environmental context, as well as the relationships amongst these 3 components (Fitzgerald & Barton, 2000). It is within such a framework that this thesis is situated.

2.4 Viewing newborn behaviour as social

I am impressed by the great repertoire of newborns, but you must give them the chance to show it. (H.F.R Prechtl, in Ambrose, 1969, p. 98)

2.4.1 Social behaviour in the newborn period

Of particular relevance to IMH research, and to this thesis specifically, is the study of infants’ social and interactive behaviours in the earliest months, as IMH

research is underpinned by the premise that infant behaviour reflects meaningful underlying processes, including communication and social behaviour. A number of leading researchers, including Bob Emde, Ed Tronick, T. Berry Brazelton, and Kevin Nugent suggest that infants are 'born ready' for social interaction, equipped with preferences for human faces and voices, and "predisposed" for interaction (Brazelton & Nugent, 2011, p. 3; Trevarthen, 2001), such that even newborn infants are co-creators of their own social contexts, through their influence on the caregiver-infant system (Als, 1977; Brazelton & Nugent, 2011).

As outlined in the first section of this chapter, human infants were, until relatively recently, regarded as passive recipients of environmental stimuli, but it is now generally accepted that newborns are 'social' from birth (e.g. Reddy, 2008), displaying ability and preference for engaging interactively with other humans. For example, from birth, newborn babies display an interest in mutual gazing, this being preferred over looking at faces that are not looking back at them (Farroni, Csibra, Simion, & Johnson, 2002). Within 10 minutes of birth, infants have been shown to prefer face-like stimuli over all other forms of visual input (Goren, Sarty, & Wu, 1975). Newborns also display an ability to distinguish amongst social partners and show preference for those with whom they have become familiar; for example, newborns display, via preferential operant sucking, a preference for the face of their mother by 2 days postpartum (Walton et al., 1992), and for their mother's voice from birth (DeCasper & Fifer, 1980; DeCasper & Spence, 1986; Freeman & Spence, 1996).

By 2 months of age, infants on a typical developmental trajectory can be observed engaging in "complex, highly responsive" interactive sequences with their caregivers (Bornstein & Tamis-LeMonda, 2001, p. 270), including proto-conversational engagement (Bateson, 1979) and turn-taking "in the form of coos, gazes, smiles, grunts and sucks" (Bornstein and Tamis-LeMonda, 2001, p. 270).

Many of these social abilities were unrecognised in the literature until the last century; this may be due to the low frequency of social availability relative to the frequency of sleeping – up to 16 hours a day – and crying during the newborn period (Nugent et al., 2007). During their first week of life outside the womb, newborns may spend only 10% of their waking hours in the quiet-alert state required for social interaction (Berg, Adkinson, & Strock, 1973), requiring caregivers and researchers to be aware of and responsive to the cues for this state, and be ready to take advantage of each opportunity to communicate (Nugent et al., 2007). By the third month, these windows of availability to interact socially may span between 50 and 80% of an infant's waking hours, offering more chances for caregivers to encourage communication (Wolff, 1987).

The recognition of newborn behaviour as organised and semi-predictable came from documentation of distinct behavioural states and recognition that various competencies were available for measurement in certain states rather than others. For example, visual and auditory pursuit behaviour would appear absent if measured during sleep and crying states, but may be apparent during an awake and quiet state. This changed the way that researchers had historically viewed newborn behaviour, as random and primarily or even wholly reflexive (Bremner & Fogel, 2001).

The systematic research of Peter Wolff (1959, 1973, 1987), with concurrent work by Heinz Prechtl (1965; 1974), and Sibylle Escalona (1962) – though the latter two had reservations about 'how far' the term "state" should be taken – served to catalyse research on newborn behaviour by facilitating the development of assessments including the Neonatal Behavioral Assessment Scale (NBAS; Brazelton, 1973). These assessments took behavioural state into account and were predicated upon an understanding of infant behaviour as organised and in part responsive rather than random, a much more "attractive" scenario for both laboratory and observational research with newborns (Bremner & Fogel, 2001, p. 240). Using tools

such as the NBAS, which measured responses to social stimuli such as a human face and voice, as well as physical or inanimate stimuli, encouraged researchers to view the human newborn as capable of social behaviour from the earliest days.

By the late 1960's, newborn competency was commonly acknowledged. Bowlby articulated the prevailing view of newborn behaviour as a transactional model in which the infant is an active player:

(...) some sounds make him cry whereas other quieten him; to some things he pays much attention and to others far less (...) By means of these differential responses, it is evident, a child exerts a not inconsiderable influence over the sensory input he receives, greatly increasing some sorts and reducing others to zero. Again and again, it is found, these inbuilt biases favour the development of social interaction. (Bowlby, 1969, p. 324)

Incorporating the perspective of a competent, active infant, Harriet Rheingold (1966) provided a set of 4 “principles” by which newborn behaviour could be defined as social: newborns show responsiveness to social stimuli; newborns are active instigators of social events; responses to newborn social behaviour may influence infants’ subsequent social behaviour; and, likewise, a newborn’s social behaviour may influence the behaviour of those with whom they interact (Rheingold, 1966, p. 2).

2.4.2 *What is meant by ‘social’ behaviour*

Although generally in agreement that newborns have perceptive and behavioural competency, and are not merely passive or reflexive, researchers fall along a continuum of opinion about the extent to which a newborn’s behaviours can be considered *intentionally* social as with older infants and adults. For example, Prechtl (in Stratton, 1982, p. 43) emphasises a distinction between brain-stem based

visual and auditory orientation behaviour, and more corticated functions, objecting thereby to the idea of orientation behaviour as social behaviour.

Others describe infant communicative behaviour in a more nuanced way, as Colwyn Trevarthen does, saying that “the acts of communication in early infancy,” while undeniably present and indicative of early intentionality and subjectivity, are nevertheless “very immature” (Trevarthen, 1979, p. 321)

Still others, such as Gergely and Unoka (2008), understand newborn social behaviour in terms of innate expressions of emotional states and predispositions toward interaction with caregivers. They describe a connection between the infant’s affective states and the caregivers’ innate tendency to interact with their infants in a way that provides information about emotions and rules for communication, and explain that this connection triggers and develops the infant’s ultimate experience and regulation of emotional states and perceived subjectivity during daily engagement with his or her caregivers. For these theorists, therefore, innately produced interactional tendencies in both the caregiver and the infant contribute to a pedagogical co-construction of social engagement, indicating the critical importance of parent-child interaction (PCI) not only for attachment but for the very early learning of social behaviour, and movement from innate interactive tendencies toward becoming a fully-fledged social member and partner.

In other words, unlike previous theorists such as Trevarthen (1979) and Meltzoff (Meltzoff & Moore, 1998), who understood intersubjectivity as innate and immediately present in newborns, Gergely and Unoka take the view that while certain behaviours related to as social by caregivers are innate in newborns, their social meaning is learned over time through PCI by the same processes through which the infant learns about emotional states and regulation, and about him or herself as a ‘socio-emotional self’.

Throughout this thesis, behaviours displayed by infants that are directed toward the caregiver, including activities such as gazing, positive vocalisations, and grasping, are considered to be social, or at least proto-social – innate behaviours that may develop into intentional communication but which the caregiver may perceive as sociable even in the first weeks, depending on their own and their culture’s views regarding infant social competency and the meaning of newborn behaviour. Therefore, in keeping with Rheingold’s (1966) definition of infant social behaviour as behaviour that is “evoked, maintained and modified by the presence or behaviour of another organism” (p. 2), even visual or auditory orientation responses directed at the caregiver or other interactive partner in the newborn period are interpreted as social, or at least interactive proto-social, behaviour.

2.4.3 *Newborn behaviour across cultures*

Importantly, although essentially the same basic reflexes and orientation responses can be seen in healthy, full-term infants across cultures, even in the newborn period, the “universal” abilities underlying newborn behaviour are variably enabled or constrained within the parameters of the shared “cultural processes” of an infant’s environment, sometimes subtly and sometimes distinctly (Greenfield, Keller, Fuligni, & Maynard, 2003, p. 462), in keeping with Super and Harkness’s (1986) developmental niche hypothesis. As Lester and Brazelton (1982, pp. 27-28) explain, “infant behaviour [should be viewed] in its appropriate cultural context, both as a shaper of and as shaped by cultural expectations”.

This is not to say that there is not potential for “biological predispositions of temperament” in newborn behaviour (Lester & Brazelton, 1982, p. 33). Rather, it would seem that newborn behaviour “represents the phenotypic expression of the *interplay* of genetic and environmental influences” (emphasis added; Lester & Brazelton, 1982, p. 23).

The following two studies of neonatal behaviour across cultures provide examples of this interplay. Keefer, Dixon, Tronick and Brazelton (Keefer, Dixon, Tronick, & Brazelton, 1978) found in a sample of 24 Kenyan (Gusii) and 54 American (Caucasian) newborns that even at 2 days after birth, the Gusii infants displayed significantly better motor maturity than the Caucasian infants, to the extent that the scale for measuring this item had to be adapted. This difference was attributed not to prenatal experience, but to “vigorous handling practices” including being “jostled in outstretched arms” at birth, being “picked up by one arm” and “tossed into the air after a bath to shake off excess water” (in Lester & Brazelton, 1982, p. 33). These practices fit under the umbrella term of “cultural processes” (Greenfield et al., 2003, p. 462) and were presumably not common in the Caucasian sample.

Freedman and Freedman’s early study (1969, as detailed in Lester & Brazelton, 1982) of neonatal behaviour according to the NBAS 2 days after birth in a sample of 24 Chinese-American and 24 European-American infants found similar results. The Chinese-American infants showed a behavioural profile that Freedman and Freedman called “imperturbability”. Compared to the European-American infants, the Chinese-American infants were more easily consolable, demonstrated more self-consoling activities, were less likely to try to remove a cloth placed over their eyes, less likely to turn their head when placed face-down, and had a slower build-up to higher states in the presence of external stimuli.

That such marked differences are present within 2 days of birth may suggest that (a) there may be some underlying tendencies or genetic pre-dispositions in different groups, in addition to the infant’s behaviour adapting to cultural practices over time; (b) an infant’s early behaviour may influence the kind of caregiving they receive (rather than being influenced uni-directionally by caregiving practices); and (c) caregiving practices may incite differences in infant behaviour between groups as early as 2 days after birth.

Newborn behaviour as measured by the NBAS has been studied in a wide variety of cultures, including Mexico (Brazelton, Robey, & Collier, 1969), Guatemala (Brazelton, Tronick, Lechtig, Lasky, & Kelin, 1977), Zambia (Brazelton, Koslowski, & Tonick, 1976), Kenya (Keefer et al., 1978), the United States (Brazelton et al., 1976; Freedman & Freedman, 1969), China and Japan (Loo, Ohgi, Zhu, Howard, & Chen, 2005), and Greece (Brazelton, Tryphonopoulou, & Lester, 1979). These studies have shown 3 tiers of newborn behaviour: (1) universal features that can be expected across cultures, (2) features that appear to show trends based on group differences between cultures, and (3) a range of scores showing individual differences between infants within cultures.

Not only do behaviours need to be studied across cultures to consider possible variation at a broader environmental level, but also within cultures to explore individual infants' behaviours, since the behaviour of individual infants "may be differentially affected [by the influences of] so-called control variables" such as being full-term, or living in one context versus another (Lester & Brazelton, 1982). Assessment of within-group as well as between-group factors is therefore important to supporting an accurate understanding of variation in newborn behaviour.

2.5 The development of infant social behaviour in the first 6 months

Social or proto-social behaviours in the newborn period can be considered pre-cursors to communicative behaviours in later development. In addition to the glimpses of visual and auditory orientation behaviours seen in the brief windows (e.g. 1 to 5 minutes at a time in non-feeding situations) of alert and awake behavioural states in the first days after birth, by the end of the first month, infants may spend up to 30 minutes alert and awake at a time (Wolff, 1973 as cited in Tighe & Leaton, 2016), providing an increase in opportunity for caregivers to observe and respond to their infants' communicative behaviours such as gazing and smiling.

Toward the end of the second month after birth, there is a 'shift' in the kinds of behaviour displayed by infants. This concept of the 2-month shift refers to the noticeable, measurable increase in interactive abilities, including maintenance of visual attention (Lavelli & Fogel, 2002, 2005; Wörmann, Holodynski, Kärtner, & Keller, 2012), which occurs around 8 weeks after birth. By 2 months of age, infants show awareness of variations in the level of maternal contingency during mother-infant interaction, as demonstrated by studies using a modified still-face procedure (Fogel, 1982; Murray & Trevarthen, 1985; Nadel, Carchon, Kervella, Marcelli, & Reserbat-Plantey, 1999; all cited in Wörmann *et al*, 2012).

Research from cross-cultural studies indicates that trends in behavioural development vary across settings. For example, in a previous study by Kärtner and colleagues (Kärtner *et al.*, 2010), specific patterns of maternal contingent behaviours in response to infant vocalising were found to be related both to cultural context and to the '2-month shift'. In a small sample of 44 pairs, urban German and rural Cameroonian mothers shared approximately the same level of mutual gaze and physical contingency when their infants were 4 weeks old. Between the 6- and 8-week visit, however, German dyads showed significantly increased amounts of time spent in mutual gaze, while Cameroonian dyads maintained a gaze duration comparable to the 4-week visit. By 8 and 12 weeks, the mutual gaze time of German dyads was significantly higher than that of the Cameroonian dyads, who themselves had increased their level of physical contingency – whereas a decrease in physical contingency had been seen in the German dyads. The authors of this study inferred that there was something about the 2-month shift that began to reveal culture-specific patterns of contingency, with aspects of the shift – such as increased duration of alertness (Wolff, 1987) and ability to maintain visual attention (Lavelli & Fogel, 2005) – interpreted and responded to “selectively” by the two groups of mothers (Kärtner *et al.*, 2010).

Following the 2-month shift, caregivers tend to increase their engagement in mirroring – imitation of the infant’s expressions – and marking – use of facial expression, tone of voice, and other cues to emphasise a particular aspect of interaction (Murray, 2014). Marking has been proposed as a mechanism by which infants begin to learn that the marked behaviours have meaning or significance (Gergely & Unoka, 2008) and are affirmed (Murray, 2014); over time, this may help the infant to organise and make sense of their emotional experiences and promote their developing sense of self.

During the period between 2 and 4 months, infants demonstrate increasing sensitivity to patterns of interaction with their caregivers, with numerous studies demonstrating via the Still Face Paradigm (SFP) (Tronick, Als, Adamson, Wise, & Brazelton, 1978) infant sensitivity to disruption of normal patterns (Bertin & Striano, 2006), with infants of typically more responsive parents reacting more intensely to the momentary elimination of responsiveness during the SFP (Carter, Mayes, & Pajer, 1990; Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Tronick, Ricks, & Cohn, 1982).

By 4 to 5 months, infants engage with the environment beyond the caregiver to a greater extent, in line with improvements in visual acuity and motor coordination to allow reaching and grasping. Along with this shift away from intensive periods of face-to-face gazing which characterised the earlier newborn period, infants and caregivers increasingly engage in physical games and play with toys or other objects, marking a maturation in social engagement patterns, which can now include an external focus and move beyond simply sharing affect and imitating (Murray, 2014).

Beginning with a preference for human-face-like organisations in the womb, and an ability to orient toward human faces and voices from birth, a human infant in

the first postpartum months rapidly develops a social repertoire to enable reciprocal, sustained interaction with caregivers.

2.6 The importance of interaction with caregivers

Infant development is influenced by factors within the infant's immediate and wider social environment (Leclère et al., 2014). In the earliest months during which the wider context is largely experienced via the relationship with the caregiver, the infant's relationship and interactions with his or her parent(s) may be particularly salient influences on the infant's behaviour during interaction within the parent-infant system.

2.6.1 *Parent-child interaction and infant regulatory development*³

Neurobiological research indicates caregivers' key role in the development of an infant's brain and physiology through regulation of the infant's developing stress response system before and after birth (Gunnar, Brodersen, Nachmias, Buss, & Joseph Rigatuso, 1996; Gunnar & Donzella, 2002; Schore, 2002; Schore & Schore, 2008).

As described in research on foetal programming (e.g. Glover, O'Connor, & O'Donnell, 2010), a mothers' influence on her infant's Hypothalamic-Pituitary-Adrenal (HPA) system begins in the womb. Glucocorticoids, such as cortisol, act as the "primary mediators" of the development of this system, and perturbations in the physical and social environment, including antenatal "physiological or psychological stress," can lead to over-exposure to these hormones (Xiong & Zhang, 2013), which has been associated with negative outcomes such as shorter gestation and higher HPA reactivity in the newborn period (see Duthie & Reynolds, 2013, for a review). Other associations have been found between the antenatal environment and newborn

³ Much of the text in this section is reused from part of my own previously published work with little change, as noted on the Declaration page of this thesis (Bartram, Barlow, & Wolke, 2015)

physiology, including Lundy and colleagues' identification of maternal antenatal dopamine and norepinephrine levels as predictors of these hormones in the newborn (Lundy et al., 1999)

After an infant is born, caregivers continue to exert influence on the development of the HPA axis through their behaviour with the infant during routine caregiving and social interaction. A caregiver who is able to interpret an infant's behavioural cues and respond appropriately to meet the child's emotional and physical needs, called an 'attuned' or 'responsive' caregiver, uses his or her vocalisations, facial expressions, and physical handling to provide continuous psychobiological regulation of the infant's ever-changing states of stress and arousal (Schoore, 2001).

Over time, this dyadic regulation allows the infant to develop adaptive strategies for responding to and regulating stress independently, which then enables the child to be less vulnerable to future stress (Sroufe et al., 2005). When a caregiver is severely and chronically mis-attuned, however, typical dyadic regulatory processes are disrupted, such that, in the face of chronically high levels of stress that are not successfully co-regulated by the caregiver, the infant may develop only minimal or maladaptive strategies for self-regulation (Gunnar & Quevedo, 2007; Lyons-Ruth et al., 2005).

Infant regulatory difficulties expressed as 'excessive crying' and problems with attachment, sleeping, and feeding are the primary reasons for referral to infant mental health services. DeGangi and colleagues found that all but 5 per cent of a group of infants who were experiencing moderate regulatory problems at 7 months (i.e. problems with sleep and feeding, ability to self-soothe and modulate affect states, ability to regulate mood, and emotional and behavioural control), were experiencing caregiver-child relationship problems or developmental delays in the

cognitive, motor, and language domains at the age of 3 (DeGangi et al., 2000). This highlights the importance for children of having attuned caregivers to support them in developing adaptive stress response systems and regulatory capacity, as well as indicating the long-term implications of regulatory difficulties that can be measured in early infancy.

2.6.2 Understanding infant behaviour as communication⁴

The successful shift from co-regulation to self-regulation happens within the context of a secure attachment relationship with a caregiver who can meet the infant's needs (Beebe et al., 2012). In order to successfully identify and meet these needs, a caregiver must understand that infants use behaviour to communicate their needs, wants, and preferences, and that these behavioural cues can be interpreted and merit a prompt appropriate response (Nugent et al., 2007).

When caregivers understand that infant behaviour represents communication of needs, they can support babies' growing ability to be co-regulated enough to enter into and remain in the quiet-alert, interactive state (Hawthorne, 2005; Nugent et al., 2007), by ensuring all other physical needs are met. This facilitation may allow for longer or more frequent periods of contingent communication to take place.

As previously described in this chapter, as early as 5 weeks of age, infants of caregivers who meet their needs and provide social interaction when the infants are available for it, have been found to participate more readily during interactions by doing more "gazing, smiling and vocalizing [sic]" than infants of less responsive caregivers (Markova & Legerstee, 2006). In turn, the more infants look, smile, and vocalise at their mothers, the more affectionate the mothers' behaviour toward the

⁴ Much of the text in this section is reused from part of my own previously published work with little change, as noted on the Declaration page of this thesis (Bartram et al., 2015)

infants becomes, emphasising the bi-directional influence of both caregivers and infants to their interactive context (Clarke-Stewart, 1973).

Ultimately, effective co-regulation via caregiver-infant interactions in early infancy tends to correlate with a secure attachment classification. Alan Sroufe (1996), in fact, defined attachment as “the dyadic regulation of emotion.” Perhaps the most prolific author on the topics of regulation and attachment, Allan Schore, indicated in 1994 the dominance of the right brain hemisphere during the first 3 years of postnatal development, identifying it as central in the processes of socio-emotional processing, affect regulation, stress management, and attachment-related behaviour (Schore, 1994). All of these processes are “experience-dependent” and therefore influenced by the quality of the caregiving environment, implicating the quality of caregiver-infant interactions in early regulatory development via the HPA axis as well as later attachment classification (Schore, 2001; Schore & Schore, 2008).

2.7 Influences on parent-infant interaction

Jay Belsky (1984) conceptualised a model of influences on parenting behaviour comprised of 3 sources: the parent’s “psychological resources,” the child’s individual characteristics, and the context surrounding the parent-child dyad. In other words, the way parents are with their infants during interaction may be influenced by the external contributions of the environment, as well as by internal factors of the infants and parents themselves.

Contextual factors influencing the parent-infant dyad could, as Belsky proposed, take the form of the quality of marriage or partner relationship the parent has (Pauli-Pott, Mertesacker, Bade, Bauer, & Beckmann, 2000; Uriyo, Abubakar, Swai, Msuya, & Stray-Pedersen, 2013), sources of social support or lack thereof (Sawyer, Ayers, & Smith, 2010; Sroufe, 2005), and could also come in the form of household income available for meeting family needs (see Kinyanda et al., 2011; Sareen et al.,

2011, for associations between depression and income in HIC and LMIC settings), the influence of predominant parenting ethnotheories on parenting practice (as in Keller & Otto, 2009), or other influences specific to a culture or context. The following sections examine some of these factors in more detail.

2.7.1 Infant weight

Infant weight may be an individual factor associated with proximal influences in the infant's developmental context, especially with regard to parental mental health (PMH) and infant behaviour during interaction with caregivers.

Lowered infant weight at birth has been previously considered to be related to antenatal depression. A recent longitudinal study (Evans, Heron, Patel, & Wiles, 2007) contradicts this assumption, failing to find, in 10,967 women in the UK, any independent association between antenatal depressive or anxiety symptoms and full-term infant birth weight. A second study (Husain, Cruickshank, Tomenson, Khan, & Rahman, 2012) of British Pakistani mothers (N=63 depressed; N=173 non-depressed) and their infants also failed to find an association between antenatal depression and infant birth weight or weight at 6 months. As will be noted later, associations between antenatal anxiety and factors related to infant birth weight (such as pre-term birth) have been more consistently evidenced.

An interesting study in 2015, however, suggests that there may be effects on birth weight related to other infant characteristics; namely, infant sex and PMH. Kaitz and colleagues (Kaitz, Mankuta, Rokem, & Faraone, 2015) found in their sample of 212 infants in Israel, from families with average incomes for the country, that the infants of antenatally anxious mothers had either significantly higher birthweights (for male infants) or lower birthweights (for female infants) than the infants of non-antenatally depressed mothers, an effect that persisted a month after birth. Although this was a single study in a specific cultural context, it indicates some possibility of an

interactive influence of an individual parent factor (anxiety) and another individual infant factor (gender) on the individual infant factor of weight.

Unlike antenatal PMH, infant weight in the months following birth has been associated with maternal mental health symptomatology in multiple studies in LMICs. A longitudinal study including 891 dyads in Johannesburg, South Africa, found a non-significant association between maternal depression at 6 months and likelihood of growth stunting at the age of 2 (Avan et al., 2010). Another study conducted in Goa, India (Patel et al., 2003) found significant associations between maternal depressive symptoms as measured using the Edinburgh Postnatal Depression Scale (EPDS) and the likelihood of their 6-month-old infants being underweight, present even when considering infant birth weight and maternal literacy (both factors related to infant weight). This finding suggests a relationship between the individual parental factor of mental health and the individual infant factor of weight, although it could not indicate a direction of causality.

Another study in Nigeria (Adewuya, Ola, Aloba, Mapayi, & Okeniyi, 2008), with 242 women and their infants, assessed mothers' depressive symptoms by clinical interview at 6 weeks postpartum, and infant weight at 6 weeks, and 3, 6 and 9 months postpartum. They found a significant association between maternal postnatal depression (PND) and infant weight at all time points, with the strongest correlation at 6 months, whereby infants of depressed mothers were significantly lighter than the infants of non-depressed mothers. These researchers also assessed whether mothers were still breastfeeding at each time point, as well as infant illnesses, and found significant associations at every time point between maternal depression and the percentage of mothers still breastfeeding, as well as a significant association by 9 months between depression and instances of infant illness such as diarrhoea. Along with 2 additional variables that may help to explain the association – breastfeeding duration and episodes of illness – this study demonstrated a relationship, over the

first 9 months after birth, between experience of maternal PND and lower infant weight in an LMIC.

2.7.2 Influence of infant weight on parenting

As well as being correlated with later outcomes such as behavioural difficulties, and antecedents such as maternal antenatal mental health, infant weight has been shown to influence the kind of interactions infants experience with their caregivers.

Although difficult to assess the specific influence of infant weight and pre-term birth on PCI, due to the high frequency of studies on pre-term birth and PCI and relative dearth of studies on PCI and infant weight, a few studies have indicated that, even within samples of infants born at full-term, infants with lower weights have more negative interaction qualities with their caregivers. For example one small study (N=60 dyads) in rural Ethiopia found significant association between 6-month-old infants' weight-for-length and quality of maternal response during interaction (Woltamo, White, Hubbs-Tait, Stoecker, & Hambidge, 2012).

Infant weight may also contribute to the 'look' of parent-infant interaction via the infant's contribution, which may be linked with infant weight directly through infant energy resources available for social interaction, or indirectly, perhaps through parents' perceptions of their infant's availability or ability for social interaction, or parents' perception of presence or lack of requests from infants for interaction. For example, in the Ethiopian study referenced above, infant weight-for-length was significantly associated with frequency of infant vocalisations during interaction with the mother, and infants' weight-for-age was significantly associated with level of infant distress (Woltamo et al., 2012).

Another, smaller, study of 12 Texan dyads between birth and 3 months found that heavier infants looked significantly more frequently at their mothers, and were significantly more alert, during a feeding interaction (Moore, 2016). This study also showed a significant positive association between heavier infant weight and infant activity level during the interaction, suggesting that heavier infants may have had more 'excess' or 'expendable' energy.

Additionally, emphasising the inter-relationships of developmental influence, infant unadaptable temperament was significantly, inversely associated with infant weight-for-age (as well as motor development), in a large sample (N=652) of dyads in rural Bangladesh (Nasreen, Nahar Kabir, Forsell, & Edhborg, 2013). This same study identified significant associations with infant weight and maternal depression, with maternal antenatal depression predicting infant stunting and maternal postnatal depression predicting infant underweight.

As described in this section, the individual infant factor of low weight has been associated with lower qualities of MII. The following section reviews the influence on infant behaviour and interaction of one heavily researched independent parent factor: mental health.

2.7.3 Infant temperament and its exclusion from this thesis

Apart from the effects of pre-term birth, perhaps the most widely studied individual infant factor relevant to early psycho-social development is temperament, at least since the 1980s (Zentner & Bates, 2008).

Temperament is thought to remain stable over time (Degnan & Fox, 2007) and to predict later developmental outcomes in childhood and adolescence (Abulizi et al., 2017). There are a number of distinct schools of thought with regard to its definition and measurement, but overall, temperament may be conceptualised as epigenetic;

influenced by neurological sensitivity and the environment (including wider socialisation processes and parent-infant interaction); and comprised of aspects such as: an infant's negative responses to novel situations (e.g. behavioural inhibition), positive behaviours (e.g. smiling), the ease and degree to which an infant becomes irritated, motor activity, attention span (including persistence), and sensory sensitivity (Derauf et al., 2011; see Zentner & Bates, 2008 for a review).

One aspect of temperament that can be measured in the newborn period is irritability, which may be considered equivalent to the temperament concept of reactivity to stimuli. Worobey (1986) considered certain NBAS items to pertain to aspects of temperament. Associations have subsequently been shown between these items, such as irritability and peak of excitement, and later outcomes, including onset of early post-partum depression, independent of previous maternal mood or rating of infant temperament (Lynne Murray, Stanley, Hooper, King, & Fiori-Cowley, 1996).

Additionally, perception of irritable temperament in the newborn period has been correlated with higher levels of reported parenting stress (Mantymaa et al., 2006), making yet another link between individual infant factors and individual parent factors. Black and colleagues' (2007) study with 221 infants in Bangladesh found an association between infant irritability, maternal mental health, and infant outcomes. They identified a compounding effect of mothers' perception of infant irritability and mothers' report of depressive symptoms, in that the infants whose mothers reported depressive symptoms as well as infant irritability were more likely to attain fewer skills in cognitive, motor, and engagement domains (Bayley Scales) between 6 and 12 months than infants whose mothers reported neither depression nor irritability, or only one. This association between infant irritability, maternal depression, and infant outcomes – at least in the cognitive domain – was partly mediated by the quality of Mother-Infant Interaction (MII) and the caregiving environment, emphasising the

continuous and multidirectional influence on the quality of interaction by parents, infants, and environmental factors.

Despite relevance to the key variables of interest, temperament was not a central focus of the present thesis primarily because there was no direct measure of temperament available within BRIGHT. Although certain NBAS and GRSMII items could be considered proxy measures of physiological components of temperament (e.g. NBAS irritability and motor activity; and GRSMII activity level), no formal measure of temperament (e.g. the Infant Behavior Questionnaire [IBQ; Rothbart, 1981]; Bayley Scales emotionality items [Bayley, 1969]) was included.

Furthermore, parental *perception* of infant temperament is arguably of greater importance for the relationship between temperament and PMH than objective reactivity measures (Mantymaa et al., 2006). For example, Pauli-Pott and colleagues (2000) found, in a sample of 101 German dyads, that between 4 and 8 months and between 8 and 12 months, primary caregivers' ratings of infant temperament on the IBQ consistently preceded the infants' Bayley Scales scores; the implication being that parents' expectations, perceptions and behaviours exert influence on their infants' developing temperamental qualities (Wolk, Zeanah, Garcia Coll, & Carr, 1992). Therefore, despite having a sub-set of proxy infant irritability indicators available, the lack of a measure of parental perception of infant temperament was a significant barrier to including temperament as a focal variable.

Conversely, direct measures of newborn social behaviour and interactive behaviours during MII at 1 and 5 months were available, and due to the vast data set comprising the BRIGHT study, selectivity was necessary. Although they are inter-related, it was not feasible to include both infant social behaviour and temperament in the present thesis, and the social items were considered more theoretically relevant as well as directly measurable with the tools available in BRIGHT.

2.7.4 *Parental psychological factors*

Individual parent factors that have been found to influence the quality of interaction with an infant include parental age – with older mothers tending to display greater sensitivity than teenage mothers, for example (see Ragozin, Basham, Crnic, Greenberg, & Robinson, 1982) – and, to a larger extent, their mental health, the influence of which has been and continues to be a key area of research due to its significance as a global “public health concern” (Sawyer, Ayers and Smith, 2010).

Much of the previous research on mental health problems and infant development has focused on PMH challenges in the postnatal period (Halbreich & Karkun, 2006). More recently, researchers have studied the existence and influence of mental health problems during pregnancy, noting that poor antenatal mental health is significantly associated with poor postnatal mental health (Josefsson, Berg, Nordin, & Sydsjö, 2001; Robertson, Grace, Wallington, & Stewart, 2004), and with several studies indicating a more statistically significant association between antenatal compared to postnatal PMH and infant behavioural outcomes (Davis et al., 2004) and physiological reactivity (Capron, Glover, & Ramchandani, 2015). Given the evidence of the effects of mental health problems before and after birth, this thesis surveys literature in the perinatal period, comprising pregnancy and the first few months after birth, rather than only after birth.

First, the definition of common mental health problems, and an overview of their impact on child development, is given, and the focus on depression presented. Then, an account of the global significance of maternal depression is presented, including estimated prevalence of ante- and postnatal depression in HICs and LMICs. Finally, potential pathways of influence for depression in the antenatal and postnatal periods are described, and a more detailed account of literature on its impact on mother-infant interaction (MII) and infant behaviour.

2.7.5 Definition, impact and prevalence of Common Mental Disorders in the perinatal period

2.7.5.1 Conceptualising Common Mental Disorders

Although individually diagnosed in the UK, maternal mental health problems and distress in the perinatal period have also been collectively conceptualised, especially in research in LMICs. The term ‘postnatal Common Mental Disorders’ (CMDs) has been used in several recent publications based on participants in Ethiopia (Tesfaye, Hanlon, Wondimagegn, & Alem, 2010), Ghana (Weobong et al., 2009), Tanzania (Uriyo et al., 2013) and Uganda (Nakku et al., 2016) to denote a range of distressing, frequently co-occurring but sub-psychotic mental health problems. ‘Postpartum morbid unhappiness’ has likewise been used to describe the contextually-specific symptoms of Major Depression in the postpartum period across cultures (Oates et al., 2004).

There does not appear to be a universal definition of CMDs within the existing literature, but generally speaking, the term refers to mental health problems such as unipolar Major Depression, dysthymia, generalised anxiety, obsessive-compulsive disorder, phobias, and various somatising symptoms (Krueger et al., 1999; Tesfaye et al., 2010; Weobong et al., 2009). These disorders may be experienced at varying degrees of impairment; the term ‘common’ is used to distinguish CMDs from more ‘severe’ mental health problems such as bipolar depression, schizo-affective disorders, and disorders involving psychosis (Nakku et al., 2016). When experienced during pregnancy or in the variably-defined postpartum period, CMDs may be referred to as perinatal CMDs (PCMDs).

The most frequently researched PCMD to date has been depression (Weobong et al., 2009), followed by anxiety and stress, comprising the 3 most relevant CMDs in terms of the concerns of the current research. Co-occurrence of symptoms typically associated with these CMDs is common in both clinical practice and in large-scale

research, as noted in an early article by Krueger and colleagues (1999). Krueger suggests a “dimensional” conceptualisation of mental disorders, whereby CMDs as a whole are understood as “extreme points” in a conglomerate of inter-related psycho-behavioural phenomena, rather than trying to parcel frequently over-lapping sets of symptoms into “discrete, dichotomous entities” (see also Angst, Vollrath, Merikangas, & Ernst, 1990). Considering only persons presenting with a single symptom set (e.g. of depression *or* anxiety), although considered methodologically more ‘pure,’ is problematic if symptoms often co-occur, as a sample of persons without co-occurring symptoms may not be typical, and furthermore, may experience less ‘severe impairment’ from only one set of symptoms.

Despite the theoretical strength of conceptualising CMDs dimensionally, discrete measures for symptoms of anxiety, depression, and stress in mothers were used in the BRIGHT study due to the availability of appropriate measures, the desire to compare results in a novel setting to previous research, and to maintain as much of the original validity of the scales as possible. In the case of measuring depression, the EPDS was particularly attractive as it had been previously used in the region, allowing more direct comparison with previous studies.

Due to the inability to include all relevant data in this report, depression was selected as the focal PCMD for this thesis, as it has been measured previously in The Gambia, and because a second measurement in the study, MII, was also capable of assessing signs of possible depression in maternal interactive behaviour.

2.7.5.2 Global prevalence of maternal perinatal depression (MPD)

Poor PMH is not a so-called ‘first world problem.’ A large evidence base indicates a range of negative outcomes for children associated with perinatal mental health problems in HICs as well as LMICs (Stein et al., 2014). Depression is recognised

as a leading cause of disability and disease burden not only in Western countries but globally (Lim et al., 2012; Sweetland et al., 2014).

Individual studies of depression in the perinatal period outside of HICs do not report consistent prevalence rates, but three main reviews considering perinatal mental health problems in LMICs (Halbreich & Karkun, 2006; Parsons et al., 2012; Sawyer et al., 2010) present averages ranging approximately from the 10-15% cited for HIC countries (Beck, 2001) to significantly lower or higher, depending on the country and the study, as detailed below.

Parsons and colleagues' (2012) study of postnatal depression in 28 LMICs reported prevalence rates ranging from 4.9% (in Nepal) to 50% (in Guyana), with 22 of the 28 studies describing prevalence rates above the 13% average cited as representative of HICs. Halbreich and Karkun's review of LMICs and HICs also noted a higher prevalence of depression in LMICs above their HIC-representative rate of 10-15%, with prevalence rates ranging from 0.5% (in Singapore) to 57% (in Guyana).

Even in HICs there is great variation in prevalence. For example, 24% of "nationally representative" American mothers in one study (Surkan, Ettinger, Ahmed, Minkovitz, & Strobino, 2012) reported mild depressive symptoms, and 17% reported moderate to severe symptoms, at 9 months postpartum, higher than the 10-15% typically cited for HICs.

This degree of variance points to possible methodological differences, such as the use of different perinatal time points (e.g. antenatal versus postnatal), cut-off scores and screening tools (e.g. questionnaires like the EPDS compared to clinical diagnoses via psychiatric interview), as well as to sample differences and genuine differences in prevalence rates across settings (Parsons et al., 2012; Uriyo et al., 2013).

Focusing more exclusively on African countries, a recent review (Sawyer et al., 2010) of 35 studies in seven countries in Africa (19 in Nigeria; six in South Africa; two in Ethiopia and one each in The Gambia, Zimbabwe and Malawi) found equivalent or slightly higher prevalence rates of ante- and postnatal mental health problems in their pan-African, LMIC sample as has been reported for HICs. Poor antenatal mental health problems were reported in the majority of studies at between 12 and 19%, with depression during pregnancy at a mean of 11.3% and postnatally at 18.3%.

For comparison, a recent meta-analysis (Gaynes et al., 2005) of 30 studies of perinatal depression in 10 primarily HICs (e.g. US, UK, Japan, Canada, Spain, Portugal, Hong Kong, Netherlands and Australia) calculated a mean prevalence rate of antenatal depression between 8.5 and 11%, depending on the trimester, and 6.5 to 12.9% for depression within the first year.

Regardless of variations in prevalence estimates, individual studies and reviews consistently indicate the existence and influence of perinatal mental health problems in at least some percentage of women. Such universally prevalent experience of poor mental health following birth is a salient factor in infants' development.

2.7.5.3 Impact of PCMDs

Although children exposed to PCMDs are not predestined to a negative trajectory, there is evidence to suggest that PCMDs are associated with disruptions in children's development, with at least small to moderate effect sizes for most of these correlations (Stein et al., 2014). A brief overview of previous literature on maternal depression in particular is provided below to outline its influence on infant development in LMICs and HICs.

A range of developmental domains have been significantly associated with PMH problems in the perinatal period (see Stein et al., 2014 for a review), including internalising and externalising behavioural problems in childhood (Leis, Heron, Stuart, & Mendelson, 2014); risk of later mental health problems for the child (Pearson et al., 2013); difficulties with peer socialisation and school adjustment (Kersten-Alvarez et al., 2012); reduced language learning (Letourneau, Tramonte, & Willms, 2013); risk of disorganised attachment (Hayes, Goodman, & Carlson, 2013); and delays in cognitive development (Kaplan, Danko, Diaz, & Kalinka, 2011). The majority of these studies have been conducted in HICs, but associations between parental CMDs and child outcomes have also been identified in LMICs (Galler, Harrison, Ramsey, Forde, & Butler, 2000 [Barbados]; Hadley, Tegegn, Tessema, Asefa, & Galea, 2008 [Ethiopia]; Hamadani et al., 2012 [Bangladesh]; Quevedo et al., 2012 [Brazil]).

Antenatal CMDs have been associated with negative physical and psychological outcomes including pre-term birth, poor mother-infant interaction (MII), and infant physiological reactivity. CMDs in the postnatal period have likewise been associated with a range of developmental outcomes. Although not the case in all studies (Stein, Malmberg, Sylva, Barnes, & Leach, 2008; see Lovejoy, Graczyk, O'Hare, & Neuman, 2000 for a review), maternal perinatal depression (MPD) has been identified as a significant risk factor for negative MII quality (see Parfitt et al., 2013), and poor developmental and health outcomes for children (Leiferman, 2002; Rahman et al., 2004). A selection of these associations is provided here.

2.7.5.3.1 Physical outcomes of MPD

The impact of MPD on infant development is not restricted to psychosocial outcomes. Research in LMIC settings has found significant associations between MPD and infant physical growth (see Stewart, 2007 for a review). In one study in Pakistan, exposure to antenatal maternal depression in the third trimester was significantly

associated with infants' low weight at birth as well as poor physical growth at 2, 6 and 12 months postpartum (Rahman, Iqbal, et al., 2004).

Similarly, a more recent study with a population of 652 dyads in rural Bangladesh measuring maternal depression in pregnancy, and at 2-3 months, and 6-8 months, found independent associations between maternal antenatal depression and infant growth stunting and between maternal postnatal depression and infant underweight (Nasreen et al., 2013). Several LMIC studies have also shown associations between maternal postnatal depression and being underweight or growth-stunted (Avan et al., 2010; Patel et al., 2004), especially for infants whose mothers experienced multiple episode of depression over time (Wojcicki et al., 2011). For some of these studies, the effects persisted until the child was 5 years old, highlighting the potential for long-term impact of exposure to MPD.

Stein and colleagues (2014) identified two recent meta-analyses indicating a significant association between antenatal maternal depression and risk of pre-term birth, with a stronger association in LMICs and low-socio-economic situation (SES) groups in the US than high-SES groups in the US or in European HICs (Grigoriadis et al., 2013; Grote et al., 2010). The second of these reviews, including both LMICs and HICs, also found a significant association between risk of infant low birth weight (LBW) and maternal antenatal depression, again with a stronger association in LMICs. It may be that maternal mental health is particularly salient for infant physical development in LMIC contexts, where women are tasked nearly exclusively with caregiving and health-seeking behaviour (Rahman et al., 2002; 2013).

2.7.5.3.2 Physiological outcomes of MPD

Returning to the prior discussion of the importance of the infant's developing HPA axis and mothers' antenatal influence, during pregnancy 80-90% of glucocorticoids in the mothers' stress response system are filtered out before

reaching the infant; however, “excess cortisol” above a normal quantity may still reach the placenta, and maternal anxiety has been found to ‘weaken the barrier’ (see Glover, Bergman, Sarkar, & O’Connor, 2009; Mairesse et al., 2007; O’Donnell et al., 2012; Ponder et al., 2011; Welberg, Thrivikraman, & Plotsky, 2005, cited in Duthie & Reynolds, 2013).

Similarly, Capron and colleagues (2015) identified a significant association between HPA reactivity in infants at 4 months as measured by infant salivary cortisol during a stressful situation (SFP) and symptoms of antenatal maternal depression on the EPDS, but no such association with postnatal symptoms, suggesting a pathway of direct influence between antenatal depression and infant outcomes specific to the infant’s developing regulatory capacities.

In 2011 a further study found that infants of mothers reporting antenatal depressive symptoms had significantly lower state organisation scores on the NBAS, as well as marginally significantly lower motor, irritability and reflex scores (Goodman, Rouse, Long, Ji, & Brand, 2011), indicating that exposure to antenatal depression may influence newborn behaviour via an effect on the infant’s developing HPA system.

2.7.5.3.3 Behavioural outcomes of MPD

Abrams and colleagues (1995) identified a significant effect of postnatal depression (PND) on newborn infants’ behaviour even at 24 hours after birth as measured by the NBAS, with the infants of depressed mothers showing greater irritability, worse orientation performance especially toward inanimate objects, and lower muscle tone, lower activity level, less endurance, and more stress-related behaviours, perhaps representing a ‘mirroring’ of depressive affect. These results were repeated the following year by Lundy, Field and Pickens (1996), in which infants of postnatally depressed mothers achieved significantly worse orientation scores, lower activity levels, lower endurance scores, and higher excitability scores on the

NBAS 24 to 72 hours after birth than infants of non-depressed mothers. Taken together these results suggest that PND could exert influence on infant behaviour in the earliest days after birth.

It should be noted, however, that antenatal depressive symptoms were not measured in Abrams' study, and therefore it is entirely plausible that antenatal exposure played the key role in these findings, accounted for by continuation of depressive symptoms after birth.

2.7.5.3.4 Interactive outcomes of MPD

In terms of interaction quality, Cohn and colleagues (1990) found that mothers' symptoms of postpartum depression were associated with greater maternal irritability, more intrusive behaviour, more negative affect, and reduced ability to mirror an infant's positive affect during engagement at 2 months of age, compared to mothers not reporting depressive symptoms.

In a study of more than 900 British dyads, Pearson and colleagues (2012) found that antenatal maternal depression had significant predictive value of lower maternal responsiveness during MII at 12 months, regardless of the presence or absence of depression at 8 months. Mothers who had been antenatally depressed, and subsequently reported no depression at 8 months, were 30% more likely to be rated as low in responsiveness during MII at 12 months than mothers who had low depression at all time points.

Flykt and colleagues (2010) found in their sample of 59 mother-infant dyads that mothers' prenatal depressive symptoms as measured by the EPDS were more predictive of maternal unresponsiveness during interaction with their 4-5-month old infants than postnatal symptoms. These researchers also found that mothers' symptoms of depression before birth were more strongly associated with maternal

unresponsiveness after birth than symptoms of depression postnatally. However, not all studies demonstrate such an association, and it should be kept in mind that prenatal depression is not necessarily a causal factor in maternal sensitivity to infants after birth (e.g Parfitt et al., 2013).

Interestingly, research in HICs have tended to find no significant association between infant growth and maternal perinatal depression in typical populations (Ertel et al., 2012; Husain et al., 2012); to only find this association in families with deprived SES (as in 3 studies cited in Stewart, 2007); or to find the opposite effect, with maternal postnatal depression significantly associated with infants being overweight rather than underweight (Gross, Velazco, Briggs, & Racine, 2013), with depression across multiple occasions rather than single episodes predicting overweight (Lampard, Franckle, & Davison, 2014). Such differences in findings between HICs and LMICs, and within low- and high-SES HIC populations, again highlight the developmental significance of context as a moderating variable in the relationship between parental mental health and infant outcomes.

2.7.5.4 Pathways of influence: PCMDs in the antenatal versus postnatal period

Even when identified across a number of studies, significant associations between PCMDs and child outcomes are not found in every sample (Ertel et al., 2012; Tse, Rich-Edwards, Rifas-Shiman, Gillman, & Oken, 2010), suggesting that the potential pathways of influence between PCMDs and infant development are not inevitable or universal. Rather, a range of pathways (see Stein et al., 2014) have been proposed, including influence via biological factors, genetic factors, epi-genetic mechanisms, and direct environmental experiences after birth. The influences of antenatal CMDs are considered to exert their primary influence via a different set of pathways than CMDs occurring only in the postnatal period (Herba et al., 2016).

Briefly, according to several prominent theorists (e.g. Herba et al., 2016), antenatal CMDs are proposed to exert their influence primarily via foetal programming, for example through factors such as genetic (and epigenetic) influences, environmental influences including maternal malnutrition or illness, and influences on the maternal-placental-foetal neuroendocrine axis and developing infant's HPA axis. Postnatal CMDs, on the other hand, are proposed to exert influence on the infant via environmental factors including child illness and exposure to the effects of interpersonal symptoms of CMDs, including caregiver responsiveness (Feldman et al., 2009). These pathways are similar whether operating in HICs or LMICs, with associations between PCMDs and infant outcomes differing in HICs and LMICs due to increased exposure in LMICs to additional risk factors simultaneously (Herba et al., 2016). This theory is congruent with an earlier review of developmental risk factors which identified the concurrence of risk factors in LMICs as an amplifier of the influence of adverse circumstances (Walker et al., 2007).

Antenatal CMDs are often present postnatally as well, so it is sometimes unclear whether a given outcome is due to the "direct effect on fetal [sic] development" or the fact that the antenatal symptoms continued after birth (Stein et al., 2014, p. 1812). To complicate matters further, a host of mediating and moderating influences have been identified that can further influence the strength or presence of association, including timing of exposure (Evans et al., 2012), chronicity of exposure (Sutter-Dallay et al., 2011), family SES (Lovejoy et al., 2000), and, most notably, parenting quality in terms of, for example sensitivity to the infant during interaction (Feldman et al., 2009). Finally, shared genetic predisposition to CMDs, and the epigenetic modification of these, may be relevant both pre- and postnatally (Oberlander et al., 2008; Szyf, 2013).

The quality of the early caregiving environment, and namely, quality of interaction with caregivers, has received theoretical and empirical attention due to its

potential to “exacerbate[e] or ameliorat[e] the effects of prenatal stress on infant development” (Glover, 2011 as described by Hayes et al., 2013, p. 4). Mother-infant interaction quality has been associated with maternal ante- and postnatal CMDs (Tronick & Reck, 2009), especially for mothers with disadvantaged SES (Lovejoy et al., 2000).

Not limited to families in HICs, notable research from LMIC countries suggests that caregiving plays a mediating role in the pathway between postnatal CMDs and infant development through to childhood outcomes. For example, one study with 147 dyads in a settlement near Cape Town, South Africa (Tomlinson et al., 2005) found that when considered separately, maternal depression at 2 months, and MII quality at 2 and 18 months, were all significantly associated with disorganised attachment at 18 months, but that the influence of maternal depression became non-significant when considered alongside the influence of MII quality. Such studies highlight, once again, the significance of the quality of the caregiving environment in mediating the effects of other influences during infant and child development.

A further pathway for influence of MPD on infant development in LMICs was cited in Rahman and colleagues’ (2007) study of 265 infants and their depressed (N=130) or well (N=135) mothers in Pakistan, which found a significant association – independent of the infant undernutrition, maternal education, or family SES – between children’s rates of diarrhoea and exposure to maternal postnatal depression, underpinning the significant association between MPD and infant underweight in LMICs (Stein et al., 2014), as previously discussed.

Importantly, the influence of CMDs in the postnatal period may be ameliorated by the presence of positive interactions with the caregiver, as found in Hayes and colleagues’ research (2013) with nearly 80 American infants and their mothers. They found that antenatal maternal depression was only significantly

associated with disorganised infant attachment at 12 months when the quality of MII at 3 months was poor; this association became non-significant for infants whose MII was rated as optimal. Such findings highlight both the complex interactions between early developmental influences such as PCMDs and MII, the potential protective influence of positive MII, and the potential risk-inducing influence of negative MII, over and above the known developmental risk factor of exposure to MPD.

As has been indicated in this brief overview, ante- and postnatal mental health problems have a global presence, with significant implications for MII and infant growth and behaviour, and with differential impact and pathways of influence in the antenatal and postnatal periods. Still, parental mental health is only one source of parent-specific influence in the complex web of factors relevant to IMH research, and individual infant factors have also been shown to be significant.

2.8 Wider socioeconomic factors and infant development

Returning to Belsky's (1984) conceptualisation of individual infant and parent factors as well as environmental features, a remaining and notable variable to be discussed in the context of infancy research is the categorical construct of SES.

In this thesis, the relevance of the context or setting in which an infant is raised on his or her development is viewed from a perspective combining developmental contextualism (Ford & Lerner, 1992), biopsychosocial transaction (Sameroff, 2010), and bio-ecological theory (Bronfenbrenner, 1999), accepting the "reciprocal (...) influence" of the infant's "biological and psychological (...) processes and environmental (or contextual) conditions" (Ford & Lerner, 1992, p. 11), by which is meant that the environment and the infant are viewed as mutually influential, with multi-level dynamic, transactional processes – not merely interactive in a linear sense.

As infant and maternal mental health have become increasingly recognised as key influences on infant development in contexts of material comfort as well as adversity (Sawyer et al., 2010), such psycho-social variables have gradually made their way into the research portfolios of institutions and organisations arguably primarily dedicated to physical health, such as the World Health Organization (e.g. World Health Organization, 2004; World Health Organization Programme on Mental Health, 1997).

As previously outlined, aspects of the parents' psychological resources – such as mental health – as well as an infant's individual characteristics – such as BW and ability to regulate stress – can influence the infant's behaviour and growth⁵. This is not to say, however, that the physical environment, or factors broader than the parent-infant unit, are not key factors in an infant's developmental trajectory. As described by theorists like Urie Bronfenbrenner (1999) and Arnold Sameroff (2010), in addition to immediate interactions with parents, numerous influences on an infant's development exist within the infant's wider context, including the family's geo-political setting, cultural socialisation goals, prevailing religious beliefs or institutions, and financial resources.

As one example of the influence of contextual factors on infant development, in a sample of 32 American infants, by 6 months of age, infants rated as low-SES (low maternal education) scored significantly worse on tasks related to attention, both to humans and to toys, than infants rated as high-SES (Clearfield & Jedd, 2012).

⁵ Although, of course, these factors are themselves associated with environmental influences. Take for example the infant's stress regulation system; this may be influenced by exposure to cortisol *in utero*, which may be associated with the mother's degree of stress or anxiety, which in turn may be associated with exposure to stressful life events or chronic adversity such as poverty, which in turn may be associated with the family's SES and, in a wider sense, the income level of the country.

Because parenting itself is “particularly sensitive to perturbations in the psychosocial context” (Tomlinson, 2010), a family’s SES plays a key role in influencing the parent-infant system, through its influence on the aforementioned factors related to Belsky’s parenting model (1984).

These factors include the parents’ individual resources such as their mental health quality, and the infant’s individual factors such as temperament, which then all have an impact on parents’ behaviour toward the infant, dyadic parent-infant interaction, and the infant’s behaviour and development.

In other words, SES may exert influence on various aspects of family functioning and infant development either directly or indirectly (Katz, Corlyon, La Placa, & Hunter, 2007). For example, poverty can directly influence infant development through risk of malnutrition and disease, but SES may also exert its influence indirectly when poverty – increasing ‘family stress’ (Conger, Conger, & Martin, 2010) – restricts parents’ coping resources and influences their behaviour toward their infant.

As described by Gelhert and colleagues (Gehlert et al., 2008), family SES can be viewed as an “upstream” or indirect influence on infant behaviour and development, via the direct influence of parenting behaviour (Tomlinson & Morgan, 2015). While SES does not always exert influence via parenting behaviour, this pathway is most relevant to the current research.

The present study measures SES, maternal behaviour, maternal mental health, and infant behaviour, and as such allows preliminary assessment of relationships between them. One pertinent area of research that has combined the influences of SES and parents’ individual resources has been the study of PMH in families of varying SES.

2.8.1 *SES and parental mental health*

Associations between SES and PMH have been shown in a range of studies (e.g. Kinyanda et al., 2011; Sareen et al., 2011; Uriyo et al., 2013). A fairly recent study of 944 mother-infant dyads at 10 and 36 months in the UK (Stein, Malmberg, Sylva, Barnes, & Leach, 2008) found that a significant negative effect of depressive symptoms at 3, 10 and 36 months on maternal caregiving with their 10 and 36 month old infants was stronger for mothers from lower-income families than for mothers of higher-income families, to the extent that by the time the infants were 36 months old, there was no significant association between maternal depression and caregiving interaction quality in the higher-income group.

Similarly, an earlier study of 42,000 people in Sweden (Johnson et al., 1999) found that depression and anxiety symptoms were significantly more prevalent amongst respondents who were rated as experiencing economic hardship, suggesting that even within a HIC country, variation in SES may be associated with different likelihood of experiencing a mental health problem.

Conversely, a recent review (Fisher et al., 2012) of 19 LMIC studies, including measurements of CMDs in the postnatal period as well as measurements of SES factors such as marital status, age, and income, contained 10 studies with a significant association between CMDs and economic disadvantage, and 7 studies showing no such association. Despite the inconclusive findings of Fisher's review, there is further evidence to suggest that the degree of influence of SES may be more or less salient depending on whether the family is based in a higher or lower-middle income country. For example, in a review of studies undertaken in Nigeria, Uganda and South Africa, social adversity was not found to be a significant predictor of MPD, a finding on which the authors comment: "contrary to research undertaken in Western cultures, social adversity was not found to be a major risk factor, possibly because many African women are exposed to high levels of prolonged social adversity" (Wittkowski, Gardner, Bunton, & Edge, 2014, p. 120).

It is also possible that factors related to SES underlie the relationship between SES and mental health. Studies included in Sawyer and colleagues' review (2010) of studies in African countries consistently identified social support as a significant influence on both ante- and postnatal mental health quality in women, while notably, other socio-demographic factors were, overall, not consistently or significantly associated, suggesting a more salient influence on PMH of whether or not a mother experiences adequate social support in the perinatal period, compared to the relevance of SES.

Such a wide array of inter-related factors cannot in reality be fully disaggregated (as explained by O'Connor & Scott, 2007) and, as illuminated by Sameroff's early work (e.g. Sameroff & Seifer, 1983), using "single risk factors" (Tomlinson & Morgan, 2015) in studies on infant development is inadequate and problematic. However, in research there are constraints on the number of variables that may be considered at any one time together, from sample size to access to measurements to statistical restraints. In the absence of a study design that considers the full myriad of influences, this thesis allows SES, and infant weight and maternal depression to serve as proxy estimates of environmental and individual factors, respectively.

2.9 Research in HICs and LMICs

These relationships between infant and maternal behaviour, maternal mental health, and the mother-infant interactive relationship, have been often and originally – like most topics in this discipline – studied in high-income, low-adversity settings. Although assessed in several early studies in LMICs – for example Ainsworth's early study in Uganda (1967) – it has been relatively recently, since the late 1970's, that the value of cross-cultural research for understanding universal and individual aspects of infant development has contributed to a marked increase in the number of studies on infant behaviour, PMH, and even MII, in LMICs and higher-adversity settings.

Despite this increase, research on infant development and experience is still heavily weighted toward HIC populations (Tomlinson & Morgan, 2015). For example, in Tomlinson and Swartz's review (2003, cited in Tomlinson & Morgan, 2015) of infancy research conducted between 1996 and 2001, only 5% were from LMICs – or any countries outside of “North America, Europe, or Australasia” – despite the fact that more than 90% of babies are born in LMICs (Haub & Kaneda, 2013).

This disparity in research available in HICs versus LMICs would not be problematic, necessarily, if the evidence resulting from research in both arenas were unanimous. However, while there are similarities in some domains, in many areas of psychological research, the results of HIC studies are not generalisable to LMICs, as the participants of HIC studies – typically citizens of “WEIRD” nations⁶ – are not representative of people living in LMIC conditions (Henrich, Heine, & Norenzayan, 2010).

Specific to infancy research, cross-cultural study has helped to elucidate aspects of infancy that appear to be universal, as well as those that seem to be highly influenced by contextual factors.

The ‘look’ of MII is a salient feature of an infant's early life for which some studies have shown cross-cultural similarity, while others have shown dissonance, depending on the aspect of interaction considered. As one example, leading anthropologist and psychologist Super and Harkness (1982) describe their observations that interactions between American and Kenyan (Kipsigis) mothers and their babies contain similar rates of smiling and *en face* interaction. In addition to this similarity, a notable difference is the rate of speech by both mothers and infants in these 2 samples, with Kipsigis dyads producing fewer vocalisations than American dyads. In their own words, “while the interaction appears equally warm and affectionate in the 2 settings, it is quieter in Kokwet.”

⁶ Western, Educated, Industrialised, Rich and Democratic; a conceptualisation by Henrich et al., 2010

As a similar, but more recent example, a study comparing Kenyan 2- and 4-month olds with 3-month old term and pre-term infants in the US (Whaley, Sigman, Beckwith, Cohen, & Espinosa, 2002), Kenyan infants vocalised significantly less during observed interactions with caregivers at home than either term or pre-term US infants, but cried significantly more than US term infants and cried more than US pre-term infants at a level approaching significance. The Kenyan infants were also held or carried significantly more, and their caregivers were more responsive to their vocalisations than either of the US samples. Notably, the amount of mutual gaze and talking to the infant increased in the Kenyan sample two-fold when other caregivers were considered, rather than just the mother (compared to the 2% increase in the US sample), indicating a significant interactive and social role by non-maternal caregivers in this sample. Such multi-caregiver arrangements and input have been described in other LMIC samples in Sub-Saharan Africa (e.g. Fouts & Brookshire, 2009).

Even beyond the HIC and LMIC conceptual divide, differences in early MII have been attributed to differing cultural conceptualisations of parenting and infant behaviour. For example, Fogel, Toda and Kawai (1988) found in their samples of 72 middle-class American and Japanese mothers and their 3-month old infants, that the American infants displayed 3 times as much smiling as the Japanese infants during interaction with their mothers, and that the mothers' responses to their infants differed in a manner mirroring Kärtner and colleagues' (2010) study with German and Cameroonian mother-infant dyads. The American mothers' responses to their infants were primarily facial and vocal behaviour, while the Japanese mothers' responses were primarily physical interaction such as establishing body contact, stroking, or repositioning the infant.

The experiences of the majority of families around the world who live in poverty, and the kinds of "demands" placed on these parents as well as the developmental context of their infants, are not equivalent to those of families living

in contexts of adequate provision (Tomlinson & Morgan, 2015). While it may be pragmatic in the short term to make inferences about infant development in LMICs by using similar research in HICs, ultimately research must be conducted in LMICs directly, as developmental research is not automatically translatable across such diverse contexts (see Klasen & Crombag, 2013, cited in Tomlinson & Morgan, 2015).

This thesis contributes to the growing body of infant psychosocial research in LMIC settings. Although, as will be noted in the final chapter, there are limitations to single-site research especially with regard to the danger of misinterpreting findings as specific to a given 'culture', the BRIGHT study as a whole takes a step toward ameliorating this problem by conducting the same research in two different sites.

In this thesis, the concept of culture is treated as an umbrella term to encompass the environmental make-up of an infant's experience, such that a more fitting label for this variable may be 'location', since most of the various influences related to culture specifically are not directly measured.

2.10 Review of relevant literature in The Gambia

The specific LMIC context relevant to this thesis is the Kiang West region (KW), a rural area of around 750 square kilometres comprising 36 villages of the Lower River Region in The Gambia, West Africa (Hennig et al., 2015). The demographic makeup of the area is described in more detail in the following chapter, but as a very brief overview, KW is an almost exclusively Muslim region; the predominate ethnic group and language is Mandinka (79.9%); the primary source of subsistence is farming and gardening; and education levels differ generationally, with over 50% of adults without education while nearly 90% of children between 7 and 12 years old are enrolled in school (Hennig et al., 2015).

Research has been conducted at the Medical Research Council Unit The Gambia at London School of Hygiene and Tropical Medicine (MRCGU) field station in Keneba (KFS) since the 1950s (Hennig et al., 2015). This research has been mostly quantitative in approach and primarily focused on physical health issues such as malaria, immunology, bone health, nutrition and epidemiology, though the author was aware of several studies of relevance to this thesis, conducted primarily at neighbouring MRCGU field stations.

To ensure awareness of all relevant literature in The Gambia, in addition to reading done throughout the thesis as presented in this chapter, a series of structured searches was conducted for studies on maternal depression, infant social behaviour, and MII in The Gambia. The following databases were used: Medline, PsycInfo, ScienceDirect, and Cochrane Library. The key search terms included 'depression AND Gambia\$' (and later, mother\$ OR maternal AND depression AND Gambia\$), 'infant\$ OR newborn\$ AND Gambia\$,' and 'mother\$ AND infant\$ OR child\$ AND Gambia\$'. Appropriate operators and truncations were selected for each database.

The vast majority of results in each case were articles either related to maternal or infant physical health or health care in The Gambia, or on a relevant topic but conducted outside The Gambia. There were no studies related to infant social behaviour or MII in The Gambia in any of the databases.

Literature on depression in The Gambia was comparatively more available, and the search revealed 10 relevant articles (Table 1). Six of these measured depression in high-risk samples less directly relevant to this thesis: one with transgender women and men who have sex with men (Poteat et al., 2017), two with HIV-positive populations (Klis, Velding, Gidron, & Peterson, 2011; Peterson, Togun, Klis, Menten, & Colebunders, 2012), one with female sex workers (Sherwood et al., 2015), and two with refugees from neighbouring countries living in The Gambia (Fox & Tang, 2000; Tang & Fox, 2001).

Table 1. Studies relevant to depression in The Gambia

Study	Location	Sample features including <i>M</i> or <i>Mdn</i> age	Sample size	Depression measure used	Prevalence (%)
Poteat, Ackerman, Diouf, et al. (2017)	Banjul	Cisgender men who have sex with men, and transgender women, across eight countries including The Gambia <i>M</i> = 24 years	N = 206 in The Gambia (202 cisgender men, 4 transgender women)	Two items: “Have you ever felt sad or depressed in the last 2 weeks?” and “Have you ever felt like you wanted to end your life in the last 2 weeks?”	Gambian sample: 0.4% in transgender women; 5.5% in cisgender men who have sex with men
Sherwood, Grosso, Decker, et al. (2015)	Greater Banjul Area, Barra, Farafenni, Basse, Soma	Female sex workers <i>Mdn</i> = 30 years	N = 251 (57.7% from outside The Gambia)	Single item: “reporting a sad or depressed mood for more than 2 weeks at a time in the past 3 years”	62.6%
Peterson, Togun, Klis, Menten and Coleblunders (2012)	Fajara	HIV+ adult out-patients on antiretroviral medication <i>M</i> = 41 years	N = 252 (67% women)	CES-D 10-item Depression Scale	7%
Klis, Velding, Gidron and Peterson (2011)	Fajara	HIV+ adult out-patients prior to antiretroviral medication <i>M</i> = 32.3 years	N = 44 (80% women)	CES-D 10-item Depression Scale	40.9%
Coleman, Morison, Paine, Powell and Walraven (2006)	Villages around Farafenni	Women of reproductive-potential age (15-54 years) Mean age not reported	N = 3,934 women completed EPDS; 565 assessed by clinical interview	EPDS (al) and Present State Examination (565 participants)	10.3% in full sample, by clinical interview Prevalence by EPDS not reported

Nabwera, Moore, Mwangome et al. (2018)	Villages around Kiang West	Children in the Early Nutrition and Immune Development study, and their mothers – cases (showing wasting or stunting) and matched controls Maternal $M = 34$ years (controls) or 35 years (cases)	$N = 77$ cases, 203 controls	EPDS	13% cases, 12% controls
Fox (1997)	Banjul, 'North Bank', and 'South Bank'	Adult 'volunteers' (generic description) Male $M = 32$, Female $M = 29$	$N = 40$ (20 men, 20 women)	CES-D 20-item Depression Scale	Not reported ($M = 14$, below cut-off of 20)
Fox and Tang (2000), identified in Lindert et al. (2009)	Ker Al-Hassan refugee camp near Basse	Sierra Leonian refugees in The Gambia $M = 31.3$ years	$N = 55$	25-item Hopkins Symptoms Checklist	85.5%
Tang and Fox (2001)	Two refugee camps in The Gambia (no further description)	Senegalese refugees in The Gambia $M = 41.3$ years	$N = 80$ (39 women, 41 men)	25-item Hopkins Symptoms Checklist	58.8%
Sawyer et al. (2011), identified through Wittkowski, Gardner, Bunton and Edge (2014)	Old Jeshwang in Kanifing Municipality	Women giving birth in the last year $M = 27.7$ years	$N = 55$ women	Depression not measured. Thematic analysis of semi-structured interviews about pregnancy, birth, and caregiving	Themes around depression: stigma, lacking social support, unwanted pregnancy, relationship difficulties

The remaining four studies were conducted with typical-risk samples. One was a qualitative study of women's experiences in pregnancy, birth, and the postnatal period (Sawyer et al., 2011), and while highly relevant, did not actually *measure* depression. An earlier study of attribution style and depression found a prevalence of 0% when using the Centre for Epidemiological Studies 20-item Depression Scale (CES-D; Fox, 1997), but notably the report gave no indication that the scale had been adapted for the local context, unlike other scales used in their study. Only two studies measured depression in parents (Coleman et al., 2006; Nabwera et al., 2018).

Based on these 10 studies, the prevalence of depression across higher- and lower-risk samples in The Gambia has ranged from 0.4% (based on two questions, about mood and suicidal ideation, in a sample of transgender women; Poteat et al., 2017) to 85.5% (amongst Sierra Leonian refugees; Peterson et al., 2012). However, these samples are unlikely to be generalisable to typical Gambian populations due to their unique demographic features.

Similarly, the utility of Fox's early study (1997) is severely reduced due to poor reporting quality regarding the depression measure. For example, only the mean CES-D score was reported, rather than the range of scores or the prevalence of scores above cut-off. The sampling method was likewise not reported. Additionally, the use of a non-adapted measure of depression reduces the trustworthiness of the results in a context in which mental health is not commonly discussed.

More relevant studies to this thesis were the two studies conducted with parents in particular, in typical-risk samples (Coleman et al., 2006; Nabwera et al., 2018), which reported prevalence rates of 6.6% by clinical interview, and 13% by EPDS, and a qualitative study of women's experiences in the perinatal period (Sawyer et al., 2011).

The most relevant study was Helen Nabwera and colleagues' research with mothers and infants in KW (Nabwera et al., 2018), which employed a translation of the EPDS to assess whether there was any significant association between maternal depression and infant or child stunting. No such association was found; however, the prevalence rate of depression amongst the 280 women was approximately 13%, using a cut-off score of 12.

An earlier study in a neighbouring region had also used a translated EPDS. Coleman and colleagues (2006) assessed the relationship between women's reproductive status and depression in Farafenni on the North Bank of the river Gambia. Nearly 600 women (N=565), of Mandinka (53%), Wolof (34%) and Fula (13%) ethnicity, who had taken part in a survey in 1999, were included in the analysis. The interview included questions about their reproductive histories, and an oral administration of a modified version of the EPDS to measure self-reported depression symptoms, with a sub-sample of participants also receiving a diagnostic clinical interview. The weighted prevalence of clinically diagnosed depression in this sample of women was 10.3%, approximately 6.6% of pregnant and postnatal women, with a 41.2% prevalence in those women who had scored at or above 10 on the EPDS compared to 6.4% in women who had scored below 10. This indicated that the EPDS, as used in this sample, was a relatively sensitive screening tool (78.5% of cases detected) for identifying women with clinical depression.

Coleman and colleagues' study also showed that individual maternal factors such as obesity, infertility and Female Genital Cutting (FGC), as well as having been widowed or divorced, were significantly associated with depression in their sample, and found that women who had delivered within the previous 18 months were less likely to be depressed than the women who were menstruating and had not given birth during that window, indicating a strong relationship between depression and reproductive health factors – including reproductive potential and being in the

postnatal period. Perhaps most interestingly, there was no association between depression and being in the postnatal period, despite this being an identified risk factor in other settings. An especially troubling finding was that Mandinka women, 98% of whom had FGC, were significantly more likely to be depressed than Wolof women, only 5% of whom had FGC.

Notably, there was a relationship between depressive illness and experience of somatic symptoms, and a trend toward lack of treatment for the psychological symptoms of depression, in that 83% of the depressed women in the study reported attendance at a health clinic for treatment of somatic symptoms, but none had reported or been treated for poor mental health. This is in line with previous claims that non-somaticised complaints related to depression are often unrecognised at LMIC primary health facilities (Gureje, Simon, Ustun, & Goldberg, 1997).

Additionally, Sawyer and colleagues' (2011) qualitative study of mothers' experiences of birth and the ante- and postnatal periods was conducted with 55 women who had given birth in the previous year in the urban municipality of Kanifing near the coast. The women in this study were 54.5% Mandinka, 21.8% "other," 10.9% Wolof, and 7.3% Fula. While not comprised of participants in KW, this study provides a window into women's experiences in a neighbouring area of The Gambia. Key themes emerging from interview transcripts with these women were that being pregnant and giving birth conferred status; the increased responsibility for the child reduced time with husbands or friends; pregnancy and childbirth was acknowledged as physically difficult, with "serious threats to life and health" (p. 533); having a baby conferred security within the marriage, with more value placed on having a boy; raising children entailed financial and physical strain, especially if there are many previous children or if the mother is very young; unhappiness results from giving birth while still in school and therefore having to stop education; and a sense from many of

the women that, despite the view that “having a child is a joint issue” (p. 535), a lack of support from the husband during pregnancy or after birth is a cause of distress.

Women in Sawyer and colleagues’ sample reported feelings of anxiety during pregnancy in particular, due to worries about birth complications, as well as feelings of intense relief after a safe delivery of a healthy baby, or severe distress if they lose a baby either before or during birth. The authors themselves note that these results should not be assumed to generalise to all Gambian women, especially as this sample was in an urban setting with women giving birth at a health centre, whereas in most rural areas women may not have access to health care during birth.

The methodological and reporting quality of these studies was not systematically assessed; however, as a brief appraisal, the risk of bias of the four most relevant studies was considered in terms of the following factors where appropriate to the study design, as selected from Mallen, Peat and Croft (2006): representativeness and description of the population; clear description and appropriateness of outcome measures; description of and adjustment for confounders; use of power calculation; appropriateness of statistical tests; clear description of main findings; and conclusions corresponding to main findings.

As previously stated, the quality of Fox’s (1997) study was low, with issues in methodological choices as well as reporting. There was no power calculation, consideration of confounders, or statement about the representativeness of the population, and while the mean and standard deviation of depression scores were reported, there was no indication of range or prevalence. As noted, the 20-item CES-D was an appropriate measure but was not adapted to the setting, reducing the trustworthiness of the data.

Coleman and colleagues' (2006) had good methodological quality overall, though with several reporting issues. For example, the population was presumably representative of the wider region, and a variety of characteristics were reported, but no clear statement was made. In addition, the EPDS and a clinical measure of depression were both described and included, but the prevalence based on EPDS was not reported. Whether these authors' conclusions – including that the postnatal period was protective against depression in this community – were correct interpretations of results is addressed in chapter 7.

Nabwera and colleagues' (2018) study had high methodological and reporting quality. Of those considered in this overview, the only missing factor was a statement on representativeness, although characteristics of the general KW population were described, and the characteristics of the case and control participants were compared. Other than this slight omission, Nabwera and colleagues described methodological choices in detail and had a robust design.

Finally, Sawyer and colleagues' (2011) study also had good methodological and reporting quality, though some of the factors considered were not applicable to their qualitative approach. The one unmet criterion was a non-representative population, but this was clearly stated and the differences detailed. In considering the methodology, Sawyer and colleagues translated their interviews into English before transcribing them, a limitation shared by this thesis (described in chapter 4).

Overall, the quality of these four studies was moderate to high, with the exception of the earliest study (Fox, 1997), which could still be applauded as a first attempt to measure depression in The Gambia.

The quality of the remaining six studies varied widely. One key methodological limitation shared by two (Poteat et al., 2017; Sherwood et al., 2015) was the use of

stand-alone questions as the sole measure of depression. Furthermore, although sample characteristics were well-described, they were not generalisable beyond their small and high-risk populations (e.g. female sex workers, transgender women, men who have sex with men, Senegalese or Sierra Leonian refugees, or persons with HIV).

Beyond these studies identified through specific database searches, other qualitative studies conducted recently in The Gambia have focused on physical health and health care experiences during pregnancy and after birth (Anya, Hydera, & Jaiteh, 2008; Jammeh, Sundby, & Vangen, 2011a; Lowe, Chen, & Huang, 2016; Telfer, Rowley, & Walraven, 2002), the role of traditional birth attendants in the community (Nyanzi, Manneh, & Walraven, 2007), nutrition and health related practices for children, including conceptions of malaria and breastfeeding promotion (O'Neill et al., 2015; Semega-Janneh, Bøhler, Holm, Matheson, & Holmboe-Ottesen, 2001) and men's and women's fertility reporting (Ratcliffe, Hill, Harrington, & Walraven, 2002).

Notably, although not explicitly about PMH or infant behaviour, a study by Mwangome and colleagues (2010) conducted focus groups with women in three villages in KW, including Keneba, and notable themes that emerged during their discussions of barriers to mothers' practice of positive child health practices included gender role inequality, poverty, and the role of support networks, including support received from MRCGU KFS. These influences may also emerge in research with other mothers in KW, including the current study.

Although there is now some precedent for mental health research in high-risk populations and, more recently, with Gambian mothers, to date there is an absence of such research with fathers, and in particular of IMH research, such as research on non-physical infant development, behaviour, or interactions with parents, in The Gambia. This thesis represents a contribution to some of these areas.

2.11 Summary

As IMH research has emerged and expanded to include research with infants and their parents in the earliest periods, as well as families in diverse social and cultural contexts, the complex and interdependent associations between the influences of infants' and parents' individual characteristics, as well as influences in the environment – including prevailing caregiving norms and families' SES – and how variations in these factors may be observed in dyadic interactions between infants and their caregivers, have come to be better understood. However, controversy remains regarding the precise nature of these relationships, and further research is needed in order to study these interactions more closely in a wider array of settings, especially in LMICS.

2.12 Review of aims and outline

In light of this trend toward understanding infant development across various cultural settings, this thesis aims to explore infant social behaviour in a new setting - KW (The Gambia) – to assess the prevalence of maternal depression, and to assess the relationship between these two variables.

The main focus of this thesis is infant social behaviour in KW in the early months after birth, and especially whether there is continuity in infant social behaviour across the first 5 months after birth. This will be measured at 2 weeks by the NBAS and then by infant contribution to MII at 1 and 5 months.

Another key area of interest is the influence on infant behaviour of one key aspect of the infant's environment, namely the mother's mental health and behaviour, and this will be measured via mothers' self-reported depressive symptoms, and their behaviours toward the infant. This will be measured before birth and at 1 and 5 months by the EPDS, and at 1 and 5 months in terms of maternal mood and energy during interaction with the infants.

SES and infant weight are also assessed as markers of individual differences across infants, although these are very much over-simplified estimations of the full range of contextual and individual influences in a family's environment.

Having overviewed the current evidence for maternal depression, newborn and infant social behaviour, and MII, with reference to the influence of SES and infant weight, in both HIC and LMIC countries, and having reviewed the aims of the present study to contribute an assessment of these factors in a sample comprised of families in KW to this knowledge base, the following chapter will outline the protocols by which the data was collected and analysed.

3 Methods

3.1 Introduction

This chapter outlines the methods used to conduct the piloting and main study comprising this thesis. The study site is described, followed by study design, data collection, and data analysis methods, with training, adaptation, and translation procedures detailed in brief.

3.2 Study setting

As described in chapter 1, the main study was conducted in Kiang West (KW; The Gambia). A secondary, comparison sample was recruited in Cambridgeshire (United Kingdom) for the BRIGHT study, but this thesis focuses exclusively on the KW cohort.

3.2.1 *Kiang West*

Situated almost entirely within its neighbour, Senegal, The Gambia is one of the smallest countries in Africa, stretching only 475km from coastline to westernmost border. The Gambia River separates the country into the North and South Bank regions (Figure 1). The capital, Banjul, is located on the South Bank near the Atlantic coastline. Between 2010 and 2015, the population increased at an annual rate of 4.3%; there are now nearly 2 million people living in The Gambia (Central Intelligence Agency, 2016), with 60% living in and around the urban area at the coast. The remaining 40% live rurally. Notably, it has been reported that as of 2013, 16% of children under 5 in the country were underweight for their age (Central Intelligence Agency, 2016).

Figure 1. Map of The Gambia highlighting Kiang West region

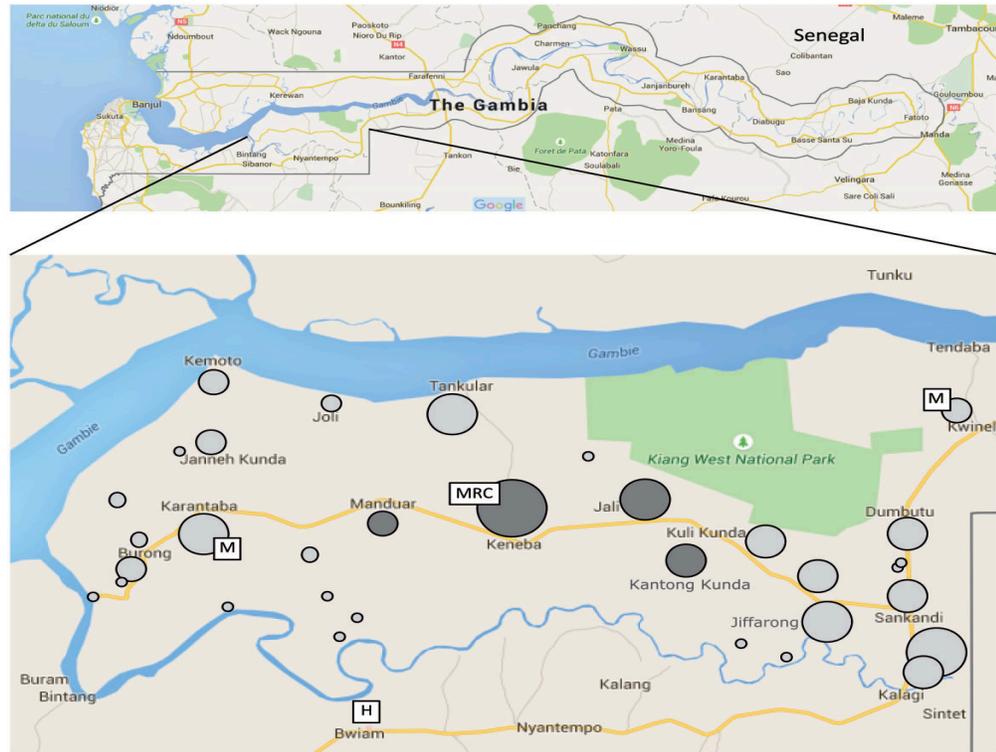


Figure 1 reproduced from Hennig *et al.* (2015) with permission. Keneba Field Station (KFS) is located in Keneba, and indicated by the central “MRC” rectangle. The dark grey circles indicate the original, “core” villages involved in KFS research; the light grey circles indicate villages included in later research. Along with the original villages, these now comprise the villages involved in KFS research and are included in the KW Demographic Surveillance System (DSS).

The villages comprising KW are rural and of lower socio-economic situation (SES), with most people supporting themselves through subsistence agriculture (Hennig *et al.*, 2015). Most of the population in KW (79.9%) is of the Mandinka ethnic group (Hennig *et al.*, 2015), a much higher proportion than in country overall (34%; Central Intelligence Agency, 2016), making Mandinka the primary language in the area. The region is comprised of 36 villages, which are sub-divided into compounds, and within which reside family units of between 1 and 170 people, with an average of 16 members (Hennig *et al.*, 2015).

The main religion in the region is Islam (Hennig *et al.*, 2015; Nyanzi *et al.*, 2007). There have historically been low levels of formal education, with more than

half of adults in The Gambia never having received formal schooling (Hennig et al., 2015). This trend is now changing, with overall school enrolment of students age 7 to 12 years at 88% and children aged 13 to 15 years at 66% (Hennig et al., 2015). Although girls' enrolment has been increasing, there are still fewer girls than boys in formal education, and according to data from 2007, over half of girls 15 to 19 years old were married (Nyanzi et al., 2007).

A common family arrangement is polygamy (Hennig et al., 2015), such that over half of women are in a household with at least one other wife. The average birth rate has decreased from 7.5 to 5.5 children per woman (comparing data from Hennig et al., 2015 and Nyanzi et al., 2007) with a low rate of contraceptive use (less than 9%), and an average spacing 33 months between births (Nyanzi et al., 2007). The fertility rate in KW is higher than the 3.6 children per woman reported for the country as a whole (Central Intelligence Agency, 2016). The average age at first birth in The Gambia was reported as 20.9 years in 2016 (Central Intelligence Agency, 2016), although this was based on data from 25- to 29-year-old women. It is likely to be younger in rural areas such as KW (personal communication with KFS staff).

3.2.2 MRCGU Keneba Field Station

Located in the Kiang West region of The Republic of The Gambia, West Africa, Keneba is a large, rural village surrounded by subsistence agricultural land and 'bush' savannah and scrubland. Figures 2 and 3 are photos typical of public areas in Keneba.



Figure 2. The main highway through Keneba, toward Manduar



Figure 3. Donkeys and a motorcycle in front of the Keneba market

The MRCGU KFS can be traced back to 1950, developing an enduring relationship with the local community for more than 60 years (Hennig et al., 2015). The station is approximately a 3-hour drive inland from the coastal, tourist area of Banjul (Figure 4). The station is self-sufficient due to its isolated location, and maintains an independent infrastructure for water, electricity, vehicles, clinics, and satellite communication necessary for the research undertaken there. Figure 5 shows an area inside the KFS compound.



Figure 4. Kairaba Avenue at the Coast



Figure 5. Near the BRIGHT study room at KFS

The unit provides extensive out-patient general health clinics to all KW residents, at the rate of approximately 1500 people each month, including ante- and postnatal clinics for mothers and infants, and an emergency out-of-hours clinic 24 hours a day (Hennig et al., 2015). KFS is not equipped to provide in-patient care; such cases are referred to hospitals at the coast or to the coastal MRCGU clinic (Hennig et al., 2015). Free health care may have an impact on regional longevity, with average life expectancy at birth 73.5 years for women and 65.3 for men in KW (Hennig et al., 2015) compared with 67.3 years for women and 62.5 years for men in The Gambia as a whole (Central Intelligence Agency, 2016). Just outside KFS, a supplemental nutrition centre treats malnourished children and their mothers on an in- or out-patient basis.

3.3 Overview of the main study design

The main study was longitudinal and observational, in accordance with the study design of the BRIGHT project. Qualitative and quantitative methods were used, in parallel, to collect and analyse data in order to meet the aims and objectives of this thesis, but no formal processes of triangulation (e.g. Denzin, 2012) were conducted between qualitative and quantitative data⁷. The pilot phase was primarily qualitative, and consisted of contextualising the study, preparing study materials through translation and cultural adaptation, and training staff. The main study was primarily quantitative, and consisted of collaborative data collection within the broader BRIGHT study, and analysis of that data.

3.4 Detailed methods for the piloting phase

3.4.1 *Piloting aims and ethics*

The original pilot phase aim was to prepare for a previously proposed project (an implementation and evaluation of the Newborn Behavioral Observation system [NBO], the clinical version of the NBAS) by seeking to understand the daily experiences of mothers and fathers of newborns in KW, through interviews and field observation. Rather than make assumptions from a ‘foreign’ positionality and an approach to newborn development very much influenced by T. Berry Brazelton’s work, the aim of the contextualising interviews was to assess whether the NBO would be a relevant form of support, given parents’ experiences and concerns. This was done by asking parents directly about their caregiving activities, their understanding of their newborn infants’ behaviour, and their goals and concerns for themselves and their children. The results from these interviews later became the basis for contextualising data from the main study for this thesis.

⁷ Due to the overall study design within BRIGHT, the only point at which a form of triangulation could have been conducted was between different respondent categories in the caregiver interviews (e.g. mothers versus fathers versus community members) as indicated in Cooper and Endacott’s study of emergency care (2007), but this was not done formally.

The second aim of the pilot was to demonstrate the NBO to a sub-set of families and obtain feedback about whether the items were acceptable, given that the NBO had not been used previously in West Africa. Collaboration with the BRIGHT study meant that the NBAS rather than the NBO was assessed for acceptability, and although the focus of this thesis changed following collaboration, these piloting sub-phases proved valuable in allowing a better understanding of the caregiving context in which infants in KW are growing and developing, and in achieving the adaptation of the NBAS for use in a novel setting.

Local ethical approval was granted on 2nd March 2015 by the Scientific Coordinating Committee (SCC) for field observation, caregiver interviews and pilot NBAS sessions under the reference SCC 1413v2, “A pilot study for the implementation of the Neonatal Behavioral Assessment Scale (NBAS) in The Gambia”. Additional ethics approval through Warwick was not required for field observation and interviews with caregivers, but full approval was granted on 2nd July 2015 by the Warwick Biomedical & Scientific Research Ethics Committee (BSREC) for the NBAS pilot sessions, under the reference REGO-2014-1300 AM01, “The Neonatal Behavioral Assessment Scale (NBAS) for supporting caregivers and newborns in Keneba, the Republic of The Gambia: development, piloting and feasibility.”

Neither SCC nor BSREC approval was required for translation and adaptation work for the majority of measures used in BRIGHT (Mother-Infant Interaction [MII], Mental Health Questionnaires [MHQs], etc.), as these were undertaken primarily within the BRIGHT team with feedback from volunteers mostly comprised of KFS staff.

3.4.2 Methodological orientation

An inductive, or interpretative, approach to understanding and describing parents’ experiences and perceptions was required for the exploratory phases of the study (Cooper & Endacott, 2007). The methodological orientation could best be

described as a generic qualitative investigation (Caelli, Ray, & Mill, 2003; Merriam, 1998), an increasingly common approach for inductive research compared to “traditional methodologies” like grounded theory, phenomenology, or action research (Cooper & Endacott, 2007, p. 816). Generic qualitative methodologies are suitable when the aim is to “discover and understand (...) the perspectives and worldviews” of the respondents themselves (Merriam, 1998, p. 11), especially as these relate to a particular event or experience (Caelli et al., 2003, p. 2).

My positionality as an ‘outsider’ was acknowledged from the outset, and underpinned my theoretical orientation and methodological choices. Field observation was a crucial first step in beginning to challenge assumptions of the context. In line with an inductive or investigative approach, the second part of the qualitative phase was to seek parents’ own descriptions of their experiences. Further details of these steps are provided below

3.4.3 Field observation

Due to my positionality as an ‘outsider,’ field observation was first undertaken to gain understanding of the social and cultural context of Keneba, the village in which the project was conducted. I began learning the primary language, Mandinka, prior to arrival and supplemented learning through daily contact with native speakers in the staff compound and in the village.

As a non-native person unfamiliar with the context, it was necessary to spend time exploring the setting at a basic level. The first week of the first visit (6/3/15 – 13/3/15) was spent in the clinic waiting area with a field log, counting women with infants appearing to be under 2 years old, and recording whether the women were holding or carrying the infants, the types of interactions between presumed mothers and children, and whether any men or apparent-grandparents were with infants of the same age range. Although this exercise was stopped within a week, having served

its purpose, the field log itself was maintained throughout the duration of the project, noting observations related to parents, children, family, religion, or other patterns of life in the village, as well as Mandinka learned. At the close of the analytic process, I engaged in further reflection on my positionality. A summary of these reflections as they relate to my analysis and findings is given in the final chapter.

3.4.4 Caregiver interviews

Next, 30 semi-structured interviews were developed and conducted in Keneba, to seek parents' experiences of infants and caregiving directly. Semi-structured interviews were favoured over unstructured discussions due to the time cost of fully training an interviewer in open interview techniques tailored to the topics of interest, in addition to managing cross-language issues in open interviewing, compared to the time required to familiarise the interviewer sufficiently with the subject matter to provide prompting as needed while proceeding through a pre-translated script.

The interviews were restricted to one village in order to reduce resource expenditure. Ten mothers, 10 fathers, and 10 community members were recruited. Most of the interviews were conducted in Mandinka by my field colleague, Mustapha Minteh (MM), who I accompanied during recruitment and interviews, with the exception of three community members' and two fathers' interviews, which I conducted in English.

As previously noted, the original aim of this piloting phase was to assess whether the NBO would be an appropriate support tool in KW, based on parents' expressed concerns for their children. The first iteration of the survey that formed the basis of the interview schedule for this study was, therefore, based in large part on the Parent Concerns Questionnaire (Sheppard & Watkins, 2000; permission granted by the authors on 28 August 2014). A sub-set of questions about who young infants

spend time with during routine caregiving was developed based on anecdotal assertions that infants have multiple caregivers within the extended family system in Keneba. After initial field observation and consultation with KFS staff, the final categories of caregivers' daily experiences and perceptions of newborn behaviour were added prior to translating the schedule.

The schedule was finalised and written in Mandinka through a process of forward and backward translation over an 8-day period. Firstly, the author met with MM to describe the purpose of the study and discuss each question on the schedule. MM then proposed a translation of each question. The following day another KFS staff member bilingual in English and Mandinka listened to MM read the questions in Mandinka, and re-stated them in English. Discrepancies between the original and back-translated English versions were discussed and the Mandinka version adjusted accordingly. A third, bilingual member of staff, who was unfamiliar with the project and had not seen the schedule in either English or Mandinka, was consulted next, again listening to MM read the questions in Mandinka and re-stating them in English, with discrepancies discussed and resolved. In consultation with a member of staff typically assigned to translation work (Alhagie Darboe), the introduction to the schedule was translated into Mandinka, and minor adaptations made (e.g. to pronouns, from 'your child' to 'children') to create a schedule for community members. The back-translation process was repeated with a fourth member of staff unfamiliar with the project, and after resolution of minor discrepancies the questions were considered to express the intended content in Mandinka. The schedule for mothers and fathers was then piloted by MM with a volunteer and finalised.

Prior to conducting the interviews, MM's training primarily involved discussion of the interview topics and rationale, reviewing the questions overnight, and clarifying any queries. The translation process provided practice in following the schedule. Throughout the field work conducting interviews, MM discussed the purpose of the

project and the meaning behind questions, and commented on interesting responses given by participants. Though his training was largely informal, via independent practice, the translation process itself, and ongoing discussion during field work, MM's genuine interest in the project and high degree of familiarity with the questions provided confidence in his administration of the interviews.

The final interview schedule contained 45 questions, plus an additional question for community members, divided into four sub-sections. These focused on: (1) Daily Experiences, (2) Understanding Newborns, (3) Goals, and (4) Concerns. The English translation of the interview schedule for parents can be found in Appendix A.

3.4.4.1 Recruitment

Participants eligible for the interviews were (a) mothers or fathers of an infant between birth and 2 years old living in Keneba, or (b) members of the Keneba community with insight into the needs and concerns of parents of young children, such as paediatricians, community health workers and teachers. There was no upper age limit for participants, but they needed to be 18 years or older.

A target sample size of 30 participants was determined as the maximum number able to be recruited, interviewed and translated during a 6-week trip. It was also considered likely that this target would yield a variety of responses sufficient to provide an initial exploration of the context of caregiving in this village. Due to limited staff resources for translation, saturation of themes could not be assessed *in situ* during sampling; however, despite room for improvement had a longer timeframe been possible, a good level of saturation was found to have been reached during analysis of the transcripts, with fewer than five novel references after the 26th respondent. This is concordant with Kuzel's (1992) estimate that thematic saturation is typically met after 12-20 respondents in a heterogeneous group.

The recruitment strategy incorporated purposive and convenience sampling techniques. Following KFS protocol, a staff member with access to the Demographic Surveillance System (DSS) first derived a list of potential participants based on the inclusion criteria above. Recruitment attempts then prioritised parents with the youngest infants (most recent experience of newborns), before applying convenience sampling techniques to recruit participants based on their availability until the desired number of respondents in each group (e.g. mothers, fathers, and community members) was reached.

Despite the bias introduced via this form of sampling (for example, limiting respondents to Keneba residents, who have greater proximity to KFS than other villages in the region, thereby reducing generalisability), this approach promoted recruitment of respondents who were most familiar with the interview topics despite the practical constraints of conducting this exploratory study across a short visit with limited resources, including staff.

On first contact with persons meeting the inclusion criterion, MM gave each person a Participant Information Leaflet (PIL), written in English, and relayed the study information in Mandinka. Participants interested in taking part in an interview were read the consent sheet line by line, emphasising that the interview would be audio-recorded. Participants indicated informed consent by providing their thumb-print or a wet ink signature, and were assigned a random study ID by the database office to anonymise their interviews.

3.4.4.2 Data collection

Over the course of 3 weeks, 10 mothers, 10 fathers, and 10 community members were identified, and all interviews conducted. MM and I met with participants in their homes or workplace at an agreed time, returning until convenient. Where possible, we asked to hold the interviews indoors to reduce noise and disruption, but most interviews took place outside due to the heat.

Upon arrival, we greeted the family and found a place to sit. We repeated that the interview would be audio-recorded and for those who had previously given consent to audio-recording, we confirmed that they maintained consent. MM then introduced the interview and read each question aloud, while I audio-recorded the participant on a laptop using Garageband⁸ (“Garageband,” 2011), and followed the interview schedule to identify any skipped items.

3.4.4.3 Translation and transcription

Most interviews (N=24) were audio-recorded (N=22 audio-recorded in Mandinka, N=2 audio-recorded in English). Where participants did not consent to audio recording (N=6), the interview was either conducted in English (if participants were fluent) and answers typed item by item (N=3), or conducted by MM in Mandinka with answers translated roughly into English after each item and typed directly into a Word document (N=3).

Upon each return from ‘the field’ to the KFS compound, recordings were transferred onto a backup USB and saved using only the anonymised study ID and date of interview.

The field worker typically assigned to translation work at KFS, Alhagie Darboe (AD), dedicated 2 weeks to translation. While AD translated the recordings phrase by phrase from Mandinka into English, I typed the English translation directly into a Word document. This collaboration allowed clarification of material and access to contextual information about local sayings. Once transcribed, recordings were deleted, and the Word documents containing transcriptions were saved with the study ID and date of interview only.

⁸ A handheld Dictaphone was used first; a laptop improved the sound quality

3.4.4.4 Analysis

The program NVivo (QSR International Pty Ltd., 2015) was used to organise and store transcribed interviews, enter participants' demographic data (e.g. gender, age, and job of each respondent) and to facilitate an inductive analysis.

Although more time-intensive, an inductive approach to coding was more appropriate than a deductive methodology, since, to the author's knowledge, there had not been any previous research on parents' everyday experiences in KW specific to newborns (Burnard, Gill, Stewart, Treasure, & Chadwick, 2008). Thematic content analysis, which has arguably been the most frequently utilised inductive approach for analysing qualitative data, was selected (Pope, Ziebland, & Mays, 2000).

Line by line thematic micro-analysis of the translated transcripts, with a view to recording emergent topics, was employed to "examine and [begin to] interpret" the data (Strauss & Corbin, 1998, p. 58). In parallel, data were organised through a process of conceptual ordering into "discrete categories (...) according to their properties and dimensions" (Strauss & Corbin, 1998, p. 19). This process was documented both through analytic memo's – including records of assumptions, coding decisions, and initial interpretations about data and relationships between data, as well as reflections on the process of coding – and through coding frameworks.

Coding frameworks were developed iteratively by using open thematic coding to identify emergent concepts within the interview transcripts, categorising the 'blocks' hierarchically into themes, sub-themes and sub-sub-themes, and always describing the properties of the themes and sub-themes in order to facilitate consistent organisation. This process occurred not in a fixed but a flexible manner, updated as necessary based on each transcript considered (Strauss & Corbin, 1998, p. 101). Throughout the analytic process, theoretical comparisons stimulated consideration of the emerging 'story' of the potential relationships between themes;

for example, comparing gendered language used to the reports of caregiving tasks listed by mothers compared to fathers.

Following coding, a descriptive account of the themes was created, and tentative relationships between themes presented; however, acknowledging the limitations within this exploratory report, description and some degree of interpretation served as the foundation for this report, and attempts were not made to develop theories based on this data, with the exception of using findings to postulate potential explanatory power in other cases within the main study. Rather, these findings were strictly exploratory and not considered generalisable.

3.4.5 NBAS acceptability piloting and adaptation

In July 2015, the second phase of the pilot study was initiated. By this point, the NBAS had been selected over the NBO for use in the BRIGHT study, due to its specific design as an assessment tool and its previous use in multiple majority-world contexts. The aim of this second phase was to assess whether the NBAS was acceptable to parents in KW, as it had not been used in West Africa before.

3.4.5.1 Development of feedback forms

The NBAS feedback form was developed with the goal of gathering information directly from parents of newborns, and their own parents in the previous generation, on: (a) parents' and elders' overall positive or negative impressions of the NBAS; (b) whether parents felt that each item they saw was acceptable; and following on from findings during the caregiver interviews, (c) whether respondents believed the infant they observed could see or hear. Each parent was asked 32 questions, including overall impressions, feedback on individual NBAS items organised into the 5 administration packages (Habituation, Motor-Oral, Truncal, Vestibular, and Social-Interactive), questions about sight and hearing abilities, and a space for further comments. A copy of the feedback schedule for parents can be found in Appendix B.

A shortened version focusing on overall impressions and infant sight and hearing was administered to elders, using the first 10 questions of the parents' form. The questionnaire was shortened for elders for several reasons. Firstly, due to experience with the lengthy translation and transcription process during the caregiver interviews, a shortened questionnaire for at least some of the sample was necessary for the 3-week trip. Additionally, there was awareness from the previous pilot about the importance of participants' time and the fact that older respondents may not have the energy or desire to complete a long interview. Underlying these reasons was that, although elders' opinions were considered valuable and a source of influence on parents' opinions, parents were expected to be the primary attendees during NBAS sessions in the main study.

3.4.5.2 Recruitment

Participants eligible for this phase were (a) mothers and fathers of infants under 2 months, or (b) grandparents living in the target infant's compound. There was no upper age limit for participants, but they needed to be 18 years or older. A target sample of 15 infants and their family members was selected for the 3-week trip due to time constraint and estimation that feedback from 30 respondents would reveal any unacceptable components.

A KFS staff member used the DSS to produce a list of potential participants meeting these inclusion criteria. At first the target village was Keneba to reduce resource use, but without enough newborns, the list was expanded to include Kuli Kunda and Tankular, villages within 30 minutes' drive of Keneba with at least 5 newborns. From that point, participants were recruited via convenience sampling.

Between 7th and 16th July 2015, myself and one of two fieldworkers, MM or Malang Jammeh (MJ), approached 15 families from the potentials list in Keneba, Tankular, and Kuli Kunda. In Keneba and Tankular we went directly to potential

participants' homes. In Kuli Kunda we spoke to mothers attending a postnatal clinic. Following standard KFS procedure, we gave participants a PIL, written in English, and MM or MJ relayed the study information in Mandinka. Participants interested in taking part in a session were read the consent sheet line by line in Mandinka, emphasising that their feedback would be audio-recorded. Participating respondents provided their thumb-print or wet ink signature to indicate informed consent and were assigned a random study ID by the database office to anonymise their feedback. All families that were approached joined.

3.4.5.3 Conducting feedback sessions

Fifteen NBAS sessions were conducted, comprising 14 families. Fourteen mothers, eight fathers, two grandmothers and three grandfathers participated, including one mother who also served as a pilot for the parents' feedback form.

MJ or MM and I met with participants in their homes at a time named by the participants. As with the caregiver interviews, we usually had to return on multiple occasions and, due to the heat, all sessions and interviews took place outdoors.

Repeating the interviews' protocol, when we first arrived at each home, we greeted the family and reminded them about the NBAS and that all adults giving feedback needed to observe the full NBAS session. We reviewed that the feedback interviews would be audio-recorded and confirmed whether all participants maintained consent for recording. I then conducted an NBAS with each infant, while participants observed, and made a running commentary of the items as I did them, with MJ or MM translating.

After the NBAS we conducted the feedback interviews. We abided by local customs and interviewed, as relevant, the male elders first, followed by fathers, and then female elders, and then mothers. I stated the introduction to the interview and

asked each question in English, with MJ or MM translating after each sentence and listening to participants' answers in Mandinka. Audio-recordings were made using a Dictaphone due to needing to transport the recording equipment outside Keneba. For the lone participant who did not give consent to audio-recording, and for the three sessions when the Dictaphone was unavailable, the interview was conducted in Mandinka, with the answers to each item written down following rough *in situ* translation by MJ or MM.

3.4.5.4 Analysis

Due to limited time between completing the pilot sessions and developing the NBAS protocol for BRIGHT, an informal review of participants' responses provided feedback to the BRIGHT team during development of the NBAS protocol. Unlike the caregiver interviews, the purpose of the NBAS feedback sessions was to identify any needs for modification rather than to explore participants' experiences in depth; therefore, this analysis was conducted at a summary level.

Analysis was conducted using Excel and hand-written notes in two stages, corresponding with the two 'sections' of the feedback interviews. The first 10 questions broadly explored participants' observations and opinions of the session. Questions 11-32 then addressed the acceptability of individual items. With the exception of Questions 10 and 33, responses were re-coded from qualitative comments into numerical categories and organised in Excel, with every item undergoing the same re-coding: positive evaluations (e.g. "I like it") were re-coded as 2; neutral evaluations (e.g. "it's fine") as 1; and negative or uncertain evaluations (e.g. "it's not good") as 0. Negative or uncertain responses were retained word-for-word, along with any other memorable statements.

The final question, a space to ask questions or make comments, was reserved for consideration alongside the equivalent question in the more qualitative section

(Question 10). These responses were coded as “0” if there were no questions/comments, and “1” if there were, with comments retained for analysis.

3.5 Detailed methods for the main study

Measures not previously employed in The Gambia – namely, the MHQs, MII, and NBAS – required adaptation prior to use in the main study, with 6 months required for MHQs translation. BRIGHT staff working at KFS were trained on each of the measures, with varying degrees of intensity required; for example, KFS staff were trained explicitly in sensitivity during MHQ administration but not during refresher training for taking infant anthropometric measures. The NBAS required the greatest extent of training for the KFS staff, taking place across 11 months (Figure 6).

Table 2 outlines the visits and measures in the main phase of the study within BRIGHT, to provide a context for the detailed descriptions to follow.



Figure 6. Feedback on NBAS administration during training period

Table 2. Measures collected at each contact point

Visit	Measures	Collected By	Location
Late pregnancy	<ul style="list-style-type: none"> • Invitation to participate & consent 	KFS field staff	Home
Late pregnancy	<ul style="list-style-type: none"> • “Booking” visit (mothers only) to estimate gestational age 	Senior midwife	KFS
34-36 weeks	<ul style="list-style-type: none"> • Mental health questionnaires • Socioeconomic/demographic questions • Home environment measure 	KFS field staff	KFS
Birth	<ul style="list-style-type: none"> • Anthropometrics • Maternal, infant health 	Senior midwife	Home, or clinic if complications
7-14 days	<ul style="list-style-type: none"> • NBAS 	KFS field staff	Home
1 month	<ul style="list-style-type: none"> • Caregiver-infant interaction • Maternal, infant health • Mental health questionnaires • Anthropometrics • Developmental milestones 	KFS field staff	KFS
5 months	<ul style="list-style-type: none"> • Caregiver-infant interaction • Anthropometrics • Mullen Scales of early learning • Maternal, infant health • Mental health questionnaires • Developmental milestones • Sleep diary • Home environment measure 	KFS field staff	KFS
Fortnightly	<ul style="list-style-type: none"> • Infant feeding questionnaire 	KFS field staff	Home

3.5.1 Ethical approval

Local ethical approval for the BRIGHT study, reference number SCC 1451v2, was given 13th January 2016. The final substantial amendment encompassing protocol changes affecting the data used in this thesis – e.g. having a separate PIL for any participating fathers, video-recording NBAS sessions, and the final version of PIL’s for mothers – was approved by SCC 12th January 2017 (L2016.52, Re: SCC 1451v2). Warwick’s BSREC granted provisional ethical approval for my role in BRIGHT on

28th January 2016, full ethical approval including amendments given on 8th June 2016, under reference REGO-2015-1725.

3.5.2 Study design

As stated previously, the main study was longitudinal and observational, and based primarily on quantitative data collection and analysis. The study design was developed by the Primary Investigators of BRIGHT. I contributed to the development of the procedures for the NBAS, MHQs, and MII.

3.5.3 Sampling and eligibility criteria

Participants eligible to be approached for the BRIGHT study in KW were mothers estimated (using the DSS) to be in the second trimester of pregnancy, and their infant's father, with recruitment typically during the third trimester. Other inclusion criteria included: fluency in Mandinka; healthy, full-term singletons; and mothers and infants being resident in KW.

Exclusion criteria were applied across multiple visits between recruitment and 5 months, as follows. At point of recruitment, mothers were excluded if they reported that they were not pregnant; if they were not a fluent Mandinka speaker; if they were currently enrolled in another MRCGU study; if they were taking medications known to interfere with pregnancy (e.g. the contraceptive pill, etc.); or if, based on midwife opinion, their medical notes indicated a need for exclusion, with the rationale being that all women recruited were medically well at enrolment.

After giving consent, participating mothers were invited to attend a 'booking visit,' in which a midwife assessed their health and approximated their GA using a Siemens Acusons1000 scanner, or a portable Sonosite Micromaxx when the Siemens was unavailable (Yusupha Dampha, senior midwife, personal communication). GA scans taken in the second and third trimester are less accurate than those taken early

in the first trimester (Committee on Obstetric Practice of the American Institute of Ultrasound in Medicine, 2017); however, previous studies at KFS using the same scanning techniques and timing have found a normal distribution of GA's and BW's, indicating a good level of accuracy (Sophie Moore, personal communication). At the scanning visit, a mother was excluded from the study if she was carrying twins, or had exempting medical complications or ill health, such as HIV or a learning disability. Exemptions on medical grounds were determined by the attending clinical staff using participants' medical notes and were not detailed in order to maintain confidentiality in a small community (e.g. of the results of Voluntary Testing and Counselling for HIV).

Most infants with birth complications (e.g. neonatal sepsis, emergency birth assistance, hypoxia, etc.) were not excluded on those grounds, but such events were noted in birth records if the delivery had been attended by a midwife. Mothers of infants who passed away during birth or in the neonatal period were also withdrawn, as infants were the focus of the study. Finally, infants receiving a diagnosis indicative of a delay in cognitive development (though not necessarily those receiving a diagnosis indicative of physical disability), including Down's Syndrome, were withdrawn from the study following assessment, due to the broader study's aim of creating developmentally typical brain-function-for-age curves in a novel setting. Additionally, infants who were known (e.g. marked in notes at the birth visit) to have been born pre-term or LBW were excluded, again due to the emphasis on typical development in the BRIGHT study.

A brief description of the number and type of exclusions that took place within the sample used for this thesis are given in in chapter 6.

Families were recruited from the following villages: Keneba, Kuli Kunda, Manduar, Jiffarong, Kemoto, Kantong Kunda, Jattaba, Janneh Kunda, Karantaba, Bajana, Jali, Tankular, Sankandi, Joli, Dumbuto, and Gissay.

The full BRIGHT study has a target sample of 200 infants and their mothers in KW. The rationale is the likelihood that around 25% of the infants will be severely under-nourished; therefore, a sample size of 200 will allow comparison of under-nourished and healthy infants by the age of 2 years.

Due to the author's thesis deadline and the BRIGHT recruitment rate (of 8 to 10 infants per month), a sample of 100 infants at birth from KW was the target for this thesis.

3.5.4 Recruitment

In line with local MRCGU procedures, pregnant mothers were identified by BRIGHT study inclusion criteria using the DSS and the antenatal trekking team (field workers who attend antenatal clinics in KW to locate newly pregnant mothers to add to the DSS). Two dedicated, trained field personnel, Ousman Kambi (OK) and Ebrima Drammeh (ED), approached these mothers and gave them a PIL and consent sheet, both of which were written in English (Appendix C).

The person giving the leaflet explained in Mandinka all of the PIL information and what was stated on the consent form, to ensure that the potential participant understood what their participation would entail. The person giving the PIL asked the mother to share the study information with the father, in accordance with local customs regarding the head of household. Visual aids were approved, including photos of the brain imaging equipment and example blood sample vials, to facilitate understanding and check for questions.

During training, OK and ED were encouraged to invite potential participants to ask any questions they might have concerning the study. Interested potential participants were then given time to consider whether they wanted to participate, with OK or ED returning the next day to follow up, although potential participants who

wished to give consent on first approach were allowed to do so. The husband of each participating mother was then approached and given a PIL and consent sheet, following the same procedure. It was made explicit at each visit that participation was voluntary, and that participants were free to withdraw at any time.

Those approached were free to enrol in the study or to refuse to enrol. The reason given for the majority of outcomes of non-consent during a recruitment attempt was that the mother was living away from KW either temporarily or permanently. Other reasons were that the mother was deemed by the recruitment staff as medically unable to participate, or that the mother chose not to enrol. A non-consent outcome with no reason given occurred on only one occasion.

Between initial recruitment (May 2016) and 5 October 2017, 203 mother-infant dyads had been recruited into BRIGHT in KW, although only 165 had attended at least one visit, and 12 were subsequently withdrawn due to infant death. Further withdrawals were made prior to the booking visit (e.g. delivering prior to the booking visit), at the booking visit (e.g. found to be carrying twins, or not pregnant) and after the booking visit (e.g. moving away). As will be detailed in chapter 6, the final core sample for this thesis included 106 KW dyads, 67 of whom had data for the antenatal, 7-14-day, 1-month and 5-month visits.

3.5.5 Data collection

The BRIGHT collaboration also collected neuro-imaging, biological, and nutritional data. Only measures relevant to this thesis are described here: newborn social behaviour (NBAS), maternal depression (EPDS), mother-infant interaction (GRSMII), infant anthropometry (weight and height), infant birth information (e.g. gestational age) and family socio-demographic details. Firstly, an overview of data

collection time points is given. Secondly, a summary of the standard protocol for each measure is provided⁹.

Following completion of the main study, participants will be debriefed. Conclusions and recommendations will be disseminated through articles, conference presentations and letters to funding bodies.

3.5.6 The Neonatal Behavioral Assessment Scale

The NBAS is a structured assessment of infant neurology and behaviour that contains 52 score-able items. It can be administered from the first hours after birth up to 8 weeks corrected gestational age. The NBAS (Brazelton & Nugent, 2011) was selected in favour of possible alternatives due to previous use in numerous LMICs and its ability to capture information relevant to range of variables of interest to the wider BRIGHT study – namely, habituation during sleep (possibly related to infants’ neuro-cognitive responses during sleep to auditory stimuli during the 1-month fNIRS protocol) and orientation responses (possibly related to infants’ neuro-cognitive responses during fNIRS to social and non-social visual and auditory stimuli). A copy of the NBAS scoring form, as adapted for BRIGHT, can be found in Appendix D. This thesis focuses on the orientation items, including orientation to social and non-social sources (Table 3). Figure 7 depicts the three social and three non-social orientation items.

⁹ Descriptions of the measures are modified from the overall projects’ SCC application

Table 3: Description of NBAS items selected for analysis

	Items	Description	Score range; optimal*
Orientation to Social Stimuli	Face only (N=88)	Ability to locate, focus on and track a moving human face	1 to 9*
	Face and Voice (N=84)	Ability to locate, focus on and track a moving human face and voice together	1 to 9*
	Voice to the Side (N=86)	Ability to locate and orient toward a static human voice out of sightline	1 to 9*
	Social items average score (N=80)	Average score on the three social orientation items (Face Only, Face plus Voice, and Voice to Side)	1 to 9*
Orientation to Non-social Stimuli	Ball (N=81)	Ability to locate, focus on and track a moving, red ball	1 to 9*
	Rattle (N=81)	Ability to locate, focus on and track a moving, shaking red rattle	1 to 9*
	Rattle to the Side (N=85)	Ability to locate and orient toward a static rattling sound out of sightline	1 to 9*
	Non-social items average score (N=75)	Average score on the three non-social orientation items (Ball, Rattle, and Rattle to Side)	1 to 9*
Summary Scores	Alertness (N=89)	Summary description of alertness to orientation items	1-9*
	Mean Orientation items score (N=71)	Mean score of the three social and three non-social items within the social-interactive package, excluding the summary Alertness score	1-9*
Social/Non-social Differential Scores	Face compared to Ball (N=80)	Difference in score between the visual social and visual non-social items	-8 to +8

	Face plus Voice compared to Rattle (N=76)	Difference in score between the visual and auditory social and visual and auditory non-social items	-8 to +8
	Voice to the Side compared to Rattle to the Side (N=83)	Difference in score between the auditory social and auditory non-social items	-8 to +8
Mean Score by Modality	Visual mean (N=78)	Mean score for visual orientation items (Face Only and Ball)	1-9*
	Visual-Auditory mean (N=76)	Mean score for visual-auditory orientation items (Face plus Voice and Rattle)	1-9*
	Auditory mean (N=83)	Mean score for auditory orientation items (Voice to Side and Rattle to Side)	1-9*

Figure 7: Examiners administering NBAS social and non-social orientation items



First row of photos: Face Only (Left); Face Plus Voice (Middle); Voice to the Side (Right)



Second row of photos: Ball (Left); Rattle (Middle); Rattle to the Side (Right)

Data from the pilot study indicated that the NBAS was practically feasible and culturally acceptable, requiring only minor practical modifications for the facilitators as detailed in chapter 5.

A minimum of two BRIGHT staff attended every NBAS, with a trained or certified assessor conducting the session and a second person writing down observations to aid in scoring. All but three sessions were conducted in participants' homes – the remaining sessions were conducted in the BRIGHT study room at KFS when the mother attended the clinic. All sessions were intended to occur between the 7th and 14th day after birth, with 20.8% (of the main sample for this thesis) occurring after the 14th day, primarily due to lack of communication with Village Assistants (VA's) regarding the infant's birth. At least one caregiver was present for all but two sessions (for which this data is available); the mother was usually present (96.1% of sessions with this data available) and the father was also present in 19% of the sessions.

I attended 21 study NBAS's, 16 as the examiner and five as an observer. Once I returned to the UK, the BRIGHT staff responsible for the NBAS in KW were Tijan Fadera (TF) and Fabakary Njie (FN). The standard protocol was then as follows: TF and FN arranged the date and time of the visit with the family via the relevant VA and then arranged transport. Typically, only one NBAS was conducted per day, but when two NBAS's were conducted, they returned to KFS for scoring in between sessions, to reduce likelihood of recall error. Each session was filmed, typically by the VA. TF and FN consistently conducted NBAS sessions together, alternating roles of examiner and observer. After arriving at the participants' home, whoever was acting as examiner would greet the family and remind them of the content of the session, then request to conduct the NBAS indoors to reduce noise and interruption.

After ensuring all equipment was ready and the room was as close to ideal conditions as possible (e.g. asking children to leave the room, turning off a radio, requesting a footstool, etc.), the examiner would explain the purpose of the visit and summarise the NBAS for the mother or other observer, reminding her that the NBAS would be filmed and confirm her maintained consent. The examiner would then conduct the NBAS, with the observer taking notes on an observation sheet and giving feedback to the examiner as needed (e.g. forgotten items or errors), while the VA (or, on occasion, the driver or other observer) filmed the session under the supervision of the observer (Figure 8).



Figure 8. NBAS set-up: one examiner, one observer, and VA filming

After completing the NBAS, the examiner would give feedback to the mother and ask if she had questions or comments. The examiner would then fill out his own observation sheet while the observer conducted other measures collected at the 7-14-day visit, including the SES form and infant anthropometry.

Once back at KFS, both TF and FN drafted NBAS scoring forms independently, before completing a joint scoring form, resolving discrepancies using their observation sheets or the video. This meant that all NBAS sessions were double-coded, at a minimum. In addition, prior to TF and FN reaching certification status, these joint forms were sent to the author along with the videos so that the orientation

scores could be verified. After re-coding, the author then submitted her NBAS form to the data office as the final version. After they became certified, TF and FN continued to score independently, discuss, and write a joint scoring form, which was sent to the data office directly and entered. In theory, reliability between TF, FN, and the author could be calculated based on the paper trail of these forms, but, as will be noted as a limitation in the final chapter, reliability was not calculated.

3.5.7 Edinburgh Postnatal Depression Scale

Five mental health questionnaires (MHQs) were selected for BRIGHT, with the intention of measuring anxiety, depression, and stress as indicators of Common Mental Disorder (CMD) symptoms in KW and Cambridge. Questionnaires were favoured over clinical interviews as no clinician was available to administer them.

Other factors relevant to questionnaire selection included validity in previous studies (particularly in LMICs), availability, cost, and length (with shorter administration times preferred). In addition to these pragmatic factors, the EPDS was chosen from among numerous alternative depression measures as it had been previously used in KW (Coleman et al., 2006; Nabwera et al., 2018).

The Perceived Stress Scale (S. Cohen, Kamarck, & Mermelstein, 1983), and a combination of the Pregnancy-Related Anxiety Scale and the measure of Pregnancy-Specific Anxiety (Guardino & Dunkell Schetter, 2014) were selected as indicators for stress and antenatal anxiety. The negative scale of the Positive and Negative Affect Scale (D. Watson, Clark, & Tellegen, 1988) was selected as a proxy indicator of anxiety in the postnatal period. The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) was selected to indicate depressive symptoms.

From this point forward, due to its focus on depression, this thesis will exclusively attend to the EPDS rather than other MHQs utilised within BRIGHT.

Along with the other MHQs, the EPDS was administered as an interview during the third trimester and at 1 month and 5 months postpartum. Interviews were preferred to written self-report due to lower levels of formal education in the adult population of KW (Hennig et al., 2015) and also due to the oral nature of the Mandinka language. A copy of the EPDS can be found in Appendix E.

The EPDS was administered in one of the two study rooms used for BRIGHT by a local staff member trained in sensitive and accurate administration and in the referral procedure. The EPDS was conducted verbally and in Mandinka at each visit, with the administrator following the script in the packet, reading each introduction and question, listing the possible answers, and noting down the participant's response on the packet. Sessions were conducted in privacy between the administrator and participant, except during sessions supervised for training purposes, with verbal assent from the participant.

If the EPDS score reached or exceeded 10, the participant was offered a referral to the KFS clinic. According to protocol the administrator would ask another trained administrator to double-check the scores (by re-calculation) to ensure accuracy, before submitting the packet to the data office. In the case of trainee administrators, Kassa Kora (KK) and Buba Jobarteh (BJ), any final decisions about whether to offer a referral was made by TF or FN, as the senior MHQ administrators.

3.5.8 Mother-Infant Interaction

A 5-to-10-minute video was recorded to assess interaction between mothers and infants. At 1 month, mothers were instructed to interact with their infant as they normally would at home. Mothers and infants were positioned on a mat with a mirror behind the infant so that both infant and mother's face could be captured on film. The infant was normally in a supine position, on a changing mat at a slight incline supported by a rolled towel, with the mother seated on the floor beside them.

At 5 months, mothers were instructed for the first 5 minutes to interact with their infant as they normally would at home, using the same setup. During the following 5 minutes, they were provided with a set of toys and asked to continue interacting (though the toy segment was not utilised for this thesis). Filming took longer in the case of disruptions such as crying, with the aim of recording a total of 5 minutes of interaction at each visit.

According to protocol, the mother and infant were left alone in the room with the intent of reducing inhibition. In a few instances, a staff member was present in the adjoining room and could be heard, but continued training reduced these occurrences as the study progressed.

Mother-infant communication was then assessed from the video recording of this session. The Global Rating Scales of Mother-Infant Interaction (GRSMII; Gunning et al., 1999) was selected as the coding schema for these videos because it had been successfully used in two Sub-Saharan African settings (Knight, 2016; Tomlinson et al., 2005) and contained a variety of sub-scales relevant to this thesis (e.g. infant visual attention and maternal depressive behaviour) as well as to the wider BRIGHT study.”

The GRSMII contains 16 possible scales specific to maternal behaviour, seven scales specific to infant behaviour, and five scales dedicated to dyadic behaviour. Not all scales were selected for use within BRIGHT. After consultation with coder Laura Bozicevik (LB) based on her experience adapting the GRSMII for a study in Ethiopia (Knight, 2016) and practical constraints such as time required for coding, a sub-set of the available scales were coded (Table 4).

The sub-scales most directly relevant to this thesis were maternal Dimension 3 and infant Dimension 1. Each item is scored on a 5-point scale, with a score of 5

indicating an interaction with the highest quality on the scale. A breakdown of scores for each item used in this thesis can be found in Appendix F.

Table 4: GRSMII items coded for BRIGHT

(A) Maternal Scales	(B) Infant Scales
<p>Maternal Dimension 1: “Good to Poor”</p> <ol style="list-style-type: none"> 1. Warm/positive to cold/hostile 2. Responsive to unresponsive 3. Sensitive to insensitive <p><i>(Excluded – Non-demanding to demanding)</i></p>	<p>Infant Dimension 1: “Good to Poor”</p> <ol style="list-style-type: none"> 1. Attentive to avoidant 2. Active communication to no active communication 3. Positive vocalisations to no positive vocalisations
<p>Maternal Dimension 2: “Intrusive to Remote”</p> <ol style="list-style-type: none"> 1. Non-intrusive to intrusive behaviour 2. Non-intrusive to intrusive speech 3. Non-remote to remote 4. Non-silent to silent 	<p>Infant Dimension 2: “Inert to Fretful”</p> <ol style="list-style-type: none"> 1. Engaged with environment to self-absorbed 2. Lively to inert 3. Happy to distressed <p><i>(Excluded – Non-fretful to fretful)</i></p>
<p>Maternal Dimension 3: “Signs of Depression”</p> <ol style="list-style-type: none"> 1. Happy to sad 2. Much energy to low energy 3. Absorbed in infant to self-absorbed <p><i>(Excluded – Relaxed to tense)</i></p> <p><i>(Excluded – Maternal Dimension 4: Additional Scales for 4-5-month old infants)</i></p>	<p>(C) Dyadic Scales</p> <p>Dyadic Dimension 1: Good to Poor</p> <ol style="list-style-type: none"> 1. Smooth/easy to difficult 2. Much engagement to no engagement 3. Excited engagement to quiet engagement <p><i>(Excluded – Fun to serious)</i></p> <p><i>(Excluded: Satisfying to unsatisfying)</i></p>

3.5.9 Infant anthropometry

Infant weight and height (length) were recorded at the 7-14-day home visit and each clinic visit using standard protocols and regularly calibrated equipment (Figure 9). For the 7-14-day visit, anthropometric measures (AMs) were always taken *after* the NBAS. At the 1 and 5-month visits, AMs were taken when convenient within the various measures.



Figure 9. Taking infant weight and length at the 7-14-day home visit

3.5.10 Infant birth information

A KFS midwife made a home visit within 72 hours of birth to record labour and delivery data, including any complications, and to record infants' gestational age, weight, height, and check for any signs of illness (Figure 10). On occasion, the midwife was not informed of the birth in a timely manner, so only partial information was collected (e.g. delivery mode ascertained but birth weight omitted).



Figure 10. A KFS midwife oversees measurement of infant birth weight within 72 hours

3.5.11 Family demographic and socio-economic details

A pre-existing, population-specific SES questionnaire, and a questionnaire collecting family demographic data, were administered verbally in Mandinka (written in English and translated *in situ*) at the 7-14-day home visit, after the NBAS session, by either TF or FN, who were trained in administration by the BRIGHT project coordinator (Figure 11). Input from both the mother and father was typically required, sometimes necessitating phone calls to fathers not present at the session to provide information. A copy of the first page of the SES questionnaire, including the questions relevant to SES calculation in this thesis, can be found in Appendix G.



Figure 11. FN fills in the SES and Demographic forms at a 7-14-day visit

3.5.12 Data analysis

Quantitative data for the main study was first cleaned in Excel, including searching for or labelling missing data and clarifying values beyond the expected range, before being imported into SPSS (IBM Corp, 2016). This data was then analysed using descriptive (e.g. mean and standard deviation or median and interquartile range; frequency distribution, correlation tables, etc.) and preliminary analytical methods (e.g. linear regression). Descriptive summary tables will be presented for key variables at each visit.

3.6 Summary

Having detailed the protocols used in this study to train staff, adapt measures, and collect and analyse data, the following four chapters will describe the results of the pilot and main phases, as well as contextual information, including demographics of the sample, as follows:

- Chapter 4: describes the results from the caregiver interviews conducted in Keneba to support an understanding of parenting experiences and perceptions at the primary site.
- Chapter 5: presents a discussion of the results of the NBAS acceptability pilot at the main site, including adaptations.
- Chapter 6: outlines the demographics of the main sample.
- Chapter 7: provides descriptive statistics for each measure of interest (NBAS, EPDS and GRSMII) in KW.
- Chapter 8: explores relationships amongst the measures of interest in KW
- Chapter 9: comprises a discussion of results, and of the study's limitations and strengths, and future avenues for research

4 Results of interviews with Keneba parents and community members

4.1 Introduction

Given my positionality as a foreign (“*tubab*”), young, female, American, non-parent, Christian, student and of someone with little previous experience in qualitative research, I conducted an exploratory study using a generic qualitative approach, with the aims of directly seeking the personal experiences of local parents (both men and women) and testing some of my own assumptions based on anecdote, such as that parents in Keneba believe newborns cannot see or hear, and that women shoulder the majority of domestic and childcare responsibilities.

Especially given my role within a wider team of experienced quantitative researchers who were also primarily foreign, female, and European or British, reflexivity – though mostly occurring after data collection – on the role of our world-views and research approaches was an important component of understanding how our perspectives influenced the ‘on-going process’ of this research (Bourke, 2014). A selection of reflections on these influences and limitations is given at the end of this chapter.

Prior to commencing the piloting phase of this study, interviews were carried out with 20 local parents and 10 community members, with the aim of gaining a better understanding of the context in which this study would take place and in which the participating parents and their infants live, work, grow, and interact. Special attention was given in the interview schedule to parents’ perceptions of their newborns’ abilities and behaviours, as this was considered to relate to two measures in the main study – the Neonatal Behavioral Assessment Scale (NBAS), and the Mother-Infant Interaction (MII) – and one question was explicitly asked regarding depressive symptoms, considered to relate to the Edinburgh Postnatal Depression Scale (EPDS).

Therefore, although 10 overall themes were identified within these interviews, selections from the sub-themes considered directly relevant to measures in the main study, or those providing contextual information (e.g. cultural and religious influences), are given primacy in this chapter. First, descriptions of parents' day-to-day experiences (theme 4), including time devoted to caregiving and the pressures of other work, illustrate what it is like to be a parent in this setting. The second section details contextual influences discussed by respondents, giving a further sense of parenting in Keneba by discussing the specific cultural, religious and physical setting in which these parents raise their infants.

Third, understanding infants (theme 7), is presented nearly in its entirety, as this relates to perception of newborn behaviour as well as theories of infant needs, and ways of interpreting and responding to crying, one form of communicative behaviour. Fourth, emergent data on mental states and emotions (theme 2) in adults and infants are discussed as relating to the topic of parental mental health.

Finally, these findings are discussed in relation to field observation and previous studies as outlined in the literature review, and possible implications for the findings of the main study are explored.

In summary, this chapter addresses the following questions:

- A) What is it like to be a parent in Keneba?
- B) What contextual factors influence parenting in Keneba?
- C) How do parents in Keneba perceive and respond to their newborns' behaviour?
- D) How do parents in Keneba describe their own and their infants' emotions?

4.2 Description of participants

Thirty-four people were approached to participate in these interviews, four of whom declined. One declining couple were members of a non-Mandinka group anecdotally reluctant to participate in Keneba Field Station (KFS) research. The remaining two persons declining to join were an unrelated father and mother, and their decision not to participate was unfortunately not explored.

Despite being told by KFS staff that no fathers would participate in interviews about parents' experiences with newborns, an equal number of fathers and mothers were recruited. Ten mothers, 10 fathers, six female community members, and four male community members were interviewed. Interviews took place in Keneba, as all participants either lived or worked there. Twenty-three of the participants were originally from Keneba, while three came from neighbouring villages (Jali, Kantong Kunda, and Kuli Kunda), three from other regions of The Gambia (Banjul, Central River Region, and Jirrof), and one from Nigeria.

The participants ranged in age from 18 to 75 years, with most of the parents being 26 to 55 years, and most of the community members being 56 to 75 years. The number of biological children reported by each participant ranged from 1 to more than 15, with nine participants reporting between 6 and 10 biological children. The number of children (biological and non-biological) for whom participants were responsible ranged from 1 to more than 20, with most participants reporting responsibility for between 2 and 10 children.

All of the participants were married. There were four couples amongst the 20 mothers and fathers interviewed and one polygamous family comprising the husband and two of his wives.

Occupations reported by participants included clinical (N=3) and non-clinical (N=5) work at KFS; traditional birth attendants ('community midwife'; N=3); subsistence agriculture including farming and gardening (N=7); 'domestic work' (N=3); carpentry (N=1); butchering (N=1); teaching (N=4); cooking (N=1); and security or livestock work with the neighbouring International Trypanotolerance Centre (N=2).

The composition of this group is roughly typical of Keneba, in the sense of being comprised mostly of Mandinka's; with no single parents; and parents reporting a large number of children (e.g. Hennig et al., 2015). There are some factors, however, which limit generalisability to other parents in Keneba. One of these factors is that while approximately a third of participants were engaged in un-salaried or low-wage employment (e.g. agriculture; cooking; security; and domestic work), a further third were employed in situations which place them at close proximity either to 'Western' influence via KFS, to the urban environment of the coastal region, or to higher education programmes (e.g. teaching). Participants with greater exposure to persons and ideas beyond Keneba may espouse views that are not as representative of other residents, and equally, this sample may have a greater number of salaried workers compared to the proportion of subsistence agricultural workers in Keneba.

As will be further described, it should be additionally noted that even if this population were completely generalisable to other parents in Keneba, it may not be generalisable to parents in Kiang West (KW) more widely, because residents of Keneba have easier access to health care and live in closer proximity to the 'non-local' institution of KFS.

4.3 Summary of analysis

Thematic analysis indicated nine overall themes, as well as a miscellaneous category: (1) cultural environment, (2) mental states and emotions, (3) goals and concerns, (4) parents' experiences, (5) physical health, (6) "*topa to*" (child care), (7)

understanding infants, (8) the influence of gender, (9) what matters in being a good parent, and (10) miscellaneous. Some topics were emergent, as they were not explicitly prompted (e.g. religion), whereas most themes had been asked about in the interview schedule.

Each them was organised according to various sub-themes, as illustrated by Table 5.

Table 5: Organisation of themes and sub-themes in the caregiver interviews

Theme	Sub-themes
Cultural Environment	<ul style="list-style-type: none"> 1.1 Culture 1.2 MRCGU KFS 1.3 Seasonality 1.4 Religion
Mental States and Emotions	<ul style="list-style-type: none"> 2.1 Adult mental states and emotions 2.2 Child mental states and emotions 2.3 Infant mental states and emotions
Goals and Concerns	<ul style="list-style-type: none"> 3.1 Being a good parent 3.2 Education 3.3 Family responsibilities 3.4 Physical care, health and development 3.5 Pro-social training and behaviour 3.6 Psychological/emotional 3.7 Religion 3.8 Self-care and agency 3.9 Success and achievement 3.10 Unclear items
Parents' Experiences	<ul style="list-style-type: none"> 4.1 Parental problems 4.2 Presence or absence of support in caregiving 4.3 Reproduction and loss 4.4 The value of being a parent 4.5 Work and leisure

Table 5 cont.

Physical Health	5.1 Facilitating physical health through bed nets, Exclusive Breastfeeding (EBF) and MRCGU KFS 5.2 Theories of infant physical health 5.3 Developmental milestones
<i>“Topa to”</i> (Child Care)	6.1 Care of infants, including references to EBF and infant location 6.2 Playing with an infant or children 6.3 Care of older children
Understanding Infants	7.1 Interpreting and responding to infant crying 7.2 Observing behaviour to understand infants 7.3 Basic physical abilities – sight and hearing 7.4 Theories of infants’ needs
Gender’s Influence	8.1 Gender’s influence in family role expectations 8.2 Gender’s influence in time spent on childcare 8.3 Gender’s influence in perceptions of presence or lack of support 8.4 Gender’s influence in power
What is a Good Parent?	9.1 Responses to explicit question about good parenting 9.2 Implied understandings of what makes a ‘good’ parent
Miscellaneous	10.1 ‘I don’t know’ or ‘no answer’ answers 10.2 Interviewer errors 10.3 Use of English in answers

Where relevant, quotations from respondents are given as supporting evidence of the descriptive account. An element of content analysis, counting the frequency of themes in the sample, was also used, as this became interesting during the analytic process (Joffe, 2011, p. 3).

4.4 Results

4.4.1 Question 1: What is it like to be a parent in Keneba?

The first section of the interview schedule sought parents' views about their day-to-day experiences in caregiving. Responses to these questions were categorised primarily in three themes. The concept of "*topa to*" (child care) comprised theme 6, with descriptions of activities comprising child care in this setting. Parents' experiences (theme 4) resulted in, among other sub-themes, parents' time investment in caregiving, work responsibilities and leisure activities, and sources of support or an absence of support in caregiving. How much time various caregivers spend on childcare, due to the nature of the responses, comprised a sub-theme within theme 8 (gendered influences on time spent on childcare), which is also discussed here. Excerpts from these themes are provided, with selected quotations. The respondent's anonymised ID, participant category, and age range accompanies each quotation.

4.4.1.1 Caring for infants in Keneba is primarily physical

The first set of questions in these interviews explored caregiving practices of mothers and fathers in Keneba, including feeding and sleeping practices; who provides care; how much time caregivers spend on childcare; and which aspects of caregiving, for example physical and emotional aspects, are most emphasised.

The resulting theme (theme 6: "*topa to*") therefore gives insight into the caregiving activities parents engage in with their infants on a daily basis. The Mandinka phrase "*topa to*" seems to mirror the meaning of "taking care of" or "looking after" in English. As with the concept of looking after, "*topa to*" seems to carry a sense of what kind of care a parent is 'expected to' provide for the children or family, and therefore is not without pre-suppositions or pre-existing meaning. This may or may not have influenced or limited participants' responses, but is also likely

to give some insight into what kind of care parents in this sample understand as centrally important for infants and young children.

According to this sample, parenting infants in Keneba is primarily physical. When discussing the daily care provided to infants, physical caregiving tasks were emphasised, with particular importance given to breastfeeding, feeding or preparing food for the baby, and washing the infant.

In the morning I give them food and give them good clean clothes to wear, and when the laundry is finished I give them food to eat. Or for the baby, any time I feel he is hungry I give him food to eat. When it is hot I will wash the baby and put on clean clothes. – 16B, Mother, 36-45

As will be discussed further in the following section, fathers were typically described as participating in infant caregiving either through provision, play, or advising the mother about infant care, but not through routine caregiving such as feeding or washing. This is unsurprising given the importance attributed to the caregiving task of breastfeeding for young infants in this setting.

Although ‘play’ was not usually given as part of an answer to the question “what do you do each day to care for your baby?”¹⁰ it was described as a daily occurrence in several answers to “how much time do you spend talking or playing with your baby each day?” Play, therefore, was not typically recognised within the definition of “*topa to*,” but was still a part of interaction with infants, if not for all parents, then certainly for some.

When I’m working the baby is always with me. When the baby needs to eat, then I will stop and breastfeed the baby. And during that time I

¹⁰ It is possible this is due to a translation difference in the way playing was intended to be understood and the way it was interpreted by respondents.

will be playing with the baby. Then afterward I will continue my work.

– 03B, Mother, 26-35

At night, sometimes when the baby is not sleeping, I would play with

the baby (...) – 09K, Father, 46-55

Other physical caregiving tasks included: putting lotion or oil on the baby; stretching the baby; washing their clothes and dressing them; picking up and carrying the baby; giving them water; and putting him/her on the bed. Non-routine physical or emotional caregiving was referenced far less than physical caregiving, and included attention or comfort, being with the infant (general), and keeping the baby safe.

4.4.1.2 Childcare roles, responsibilities, and time spent on childcare are influenced by gender (sub-themes 8.1 and 8.2)

The differing responsibilities of mothers and fathers was salient. Twenty-one of the 30 respondents explicitly discussed differences between mothers and fathers, despite only one question in the community members' interview schedule alluding to mothers separately from fathers or men separately from women. Echoing the gendered division of responsibility in parenting reported in other contexts¹¹, according to the respondents in this sample, women are responsible for routine infant caregiving, including carrying babies and taking sick children to the clinic, while men are responsible for financial provision for the family, including paying school fees, and making decisions and giving advice to women with regard to childcare.

¹¹ See Musick, Meier and Flood (2014, p. 27) p. 27 for a description of such division in the US

There was some overlap between mothers' and fathers' responsibilities, for example with regard to pro-social training.

The baby is between the mother and the father. The father provides food for the family. Sometimes the father will be at home, with the baby in the house, 1 hour. And after, the father will go out. (...) But for the mother, the mother will be staying with the baby for 24 hours. She is always with the baby. – 22W, Father, 26-35

This clear divide extended to mothers' and fathers' descriptions of their time investment in caregiving activities. Some respondents reported that mothers have nearly constant contact with their children, spending up to 20 hours a day in caregiving; a few others reported mothers spending only a few hours a day on such tasks. The majority of references about mothers' time spent on childcare, however, indicated time-intensive involvement:

When I am at home resting there is enough time, so I will ask the mother to bring the baby because they are the people cooking for us, fetch water, and things like that. – 11N, Father, 56-65

I have only 3 hours to spend with the baby and other children. In the morning, I take care of them; in the afternoon I also take care of them; and at night the same thing. – 07Z, Mother, 36-45

Conversely, fathers in this sample reportedly spend far fewer hours on childcare than mothers, especially in the first few months after birth. Many mothers and community members reported exclusive care of infants by mothers and little to no involvement by fathers. While two fathers reported heavy involvement in childcare outside of their working hours, many fathers stated that they were involved for only a few hours a day, and community members were even less generous in their

evaluation of fathers' involvement in childcare. Respondents largely agreed on the roles and time investment of mothers, but perceptions of fathers' involvement varied.

Every day I spend more than 3 to 4 hours to take care of the baby and the other children. – 05C, Father, 36-45

A father cannot do that [help take care of a baby] [laughs] – 17P, Father, 66-75

Fathers were also more likely to report involvement in caregiving for older children, rather than for infants, with an age-related trend whereby infants were more likely to be held by fathers and other caregivers after the newborn period:

Maybe every day, I would think around 2 hours or something; 30 minutes here and then 20 later and 5 later, you add them up - because I don't have breasts or anything! When the baby starts crying we have to give the child to the mother. When they start crawling, I would say they spend most of their time with me rather than the mothers, except when they want to feed or wash them. One is sleeping down there. When he wakes up he will come to me. I will not even call the mother. When they get to 7 months or so, I like them! I like them. Before that, no. – 11N, Father, 56-65

Given the report from some mothers that their husbands helped them take care of their infants, and the self-report from some fathers that they helped their wives care for their infants, it can be inferred that although the burden of childcare does fall primarily on the mothers in this sample, fathers were expected to be involved at least by providing for the family, with some fathers also participating in proximal care to varying degrees.

4.4.1.3 Parents' daily experiences (theme 4)

The interview schedule prompted discussion of parents' experiences beyond caregiving by asking "What other things do you do, in addition to looking after your children?" and, to community members, "What problems do parents commonly experience?" These questions, as well as responses to questions throughout the schedule, provided a 'snapshot' of some of these parents' daily life outside childcare.

Mothers and fathers all reported work responsibilities in addition to childcare, with work outside the home described along gendered lines, and work inside the home ascribed primarily or exclusively to mothers. While a few fathers noted organised leisure activities, most described spending time at home as their way of resting:

"Usually" [English] Fridays and Saturdays I will take off and stay home. During that period I will stay with the family, brew attaya, and be chatting. When I close from work, we also stay together and chat, so that I will be able to know their problems. – 23W, Father, 36-45

Mothers in particular must manage an intensive workload including childcare, cleaning, laundry, preparing food, collecting water, and attending crops according to season.

I will be resting not more than 2 minutes! [laughing] Because I have a lot of work to do, so this is why I don't rest much! – 07Z, Mother, 36-45

Cooking – when there is enough firewood I cook. Then I will sweep, and I will finish cooking by 2 o'clock if there is enough firewood. After I sweep, then I will take the baby and breastfeed him, then I will play with the baby. Then I will start washing. If the baby cries then I will take the baby again and breastfeed the baby. After breastfeeding then I will lie the baby down. When I finish washing then I will breastfeed the baby again before I start to cook the lunch. – 12U, Mother, 26-35

This long list of responsibilities appears largely unchanged since 1968, except for water collection in Keneba, which has been altered by the installation of public taps that are much easier to use than manually drawing buckets from 60-foot wells (Thomson et al., 1968). These descriptions were also congruent with field observation of women constantly busy with children and household chores, and reports of mothers' responsibilities in other studies (see Mark Blackden & Wodon, 2006 for a review; also Mwangome, Prentice, Plugge, & Nweneka, 2010).

Between them, community members reported common problems for parents, including: health problems of parents or their children; family responsibilities such as feeding and caring for children as well as immediate and extended family; and financial worries such as sending children to school and paying for medical treatment.

A few community members also referred to difficult experiences such as infertility and maternal and infant death.

And then unlike people who are unable to have a child. They're not happy. That esteem... because the tradition looks upon them as people who are not doing well, maybe the man has a problem or the woman has a problem, so that context surrounding them doesn't give you a good feeling at all. – 20D, Community Member, 36-45

If you are unable to have anything which you can use to finance the education of your child, that is a problem for parents. – 27F, Community Member, 66-75

However, being a parent was considered 'worth it' in this sample, because of the understanding that there is personal and social value in having children. Without being explicitly prompted, parents and community members described many ways in which becoming a parent was of value, and many ways in which not becoming a parent would mean missing out on these benefits. Participants reported that having

a child provides social standing and esteem; joy in family resemblances; an interesting, important, and amazing experience; blessings from *Allah* (the name for God as understood in Islam); securing a better future for oneself; the passing on of one's compound and life achievements; and development of characteristics such as patience, responsibility, and love.

I think it's very kind to be a parent because you learn to have sympathy, patience. You learn to love and care for humanity. If you don't have children, you wouldn't know responsibility. In Islamic belief, you get blessings from Allah when you have children legally [when married]. – 10W, Father, 26-35

It's an amazing thing, it's difficult [...] Because I think every parent is happy to be a parent. You know if a family, if a man and a woman have a child, they feel proud of that, so that tells you that esteem is very important. (...) But generally I think being a parent boosts up your morale, it boosts up your esteem. – 20D, Community Member, 36-45

Despite the hard work of caregiving there was a sense overall that parenting in Keneba is often supported by the immediate and extended family, community figures, and even the MRCGU. Mothers listed the infant's father, elder siblings or grandmother, and the mother's relatives as sources of support. Fathers listed the infant's elder siblings or grandparents, the father's other wife/wives, and the father's relatives. Fathers reported more sources of support in childcare than did the mothers, depicting a family system of care. Co-wives were mentioned infrequently as a source of support, perhaps reflecting a caregiving system in which each mother is responsible for her 'own' children as a requirement, although she may opt to help with other wives' children as well.

Sometimes the baby will be with the elder siblings, and sometimes my sister will help me to take care of the baby. – 03B, Mother, 26-35

I and the baby's mother, and the grandmother, we help each other to take care of the baby, and the elder brothers and sisters. – 15V, Father, 56-65

The MRCGU KFS clinic and Traditional Birth Attendants (TBAs) were also noted by some community members as sources of support, though no parents cited TBAs.

Several community members described mothers' experience of presence or absence of support as dependant on the mother's family circumstance.

If the baby is not somebody who is agitated, and the mother is staying with people with whom she is on good terms. Because if the mother is on good terms with other people, the time that the baby will spend with other people is more than the time it will spend in her arms. But still if the mother is staying with people she is not on good terms with, the baby will always be with the mother. – 30R, Community Member, 66-75

A mother who is not staying with anybody will have to take care of the baby and housework, fetching water, sweeping, and cooking, and if you have something to pound you have to pound it yourself. If at all you don't have a child who can help you or a neighbour who can help you, you have to do all this by yourself. – 24Q, Community Member, 66-75

All mothers and fathers in this sample indicated at least one instance of support, and several participants indicated that this support was enough to dispel depression.

Q: Do they [parents] ever feel stressed? A: Not like UK honestly, because they have the family members around them. Depression is hardly ever here, definitely. – 19E, Community Member, 46-55

I don't think I have ever experienced that [feeling helpless, depressed, or not sure what to do]. No, because always when I get up, I have people to help me, I have plenty of people around me. – 11N, Father, 56-65

To say that social support for parents in The Gambia is universal or that no parents lack support, however, would not be accurate. Despite all mothers and fathers describing a presence of support on at least one occasion, just over half of the sample also described an absence of support. Responses contained a fair amount of variation in whether and to what extent parents felt they had or lacked a support network, and this variation fell largely along gendered lines.

In terms of actual numbers, while only three references indicated fathers experiencing an absence of support, a lack of support was described by six mothers across 29 references. This might suggest an absence of support may be more salient to mothers than fathers, if not an indication that more mothers experienced a lack of support in caregiving than fathers.

In addition to this basic frequency count, mothers and fathers also defined an absence of support differently. When mothers discussed an absence of support, it was often expressed as a total absence of help from anyone at all, whereas two of the three fathers who discussed an absence of support expressed this lack as an absence of support to the family overall from sources outside of the family, rather than as a complete absence of support.

I'm alone. I always take care of the baby. – 16B, Mother, 36-45

My baby is usually with us, simply because our compound is in an isolated area, so we are not staying with people, so my baby doesn't go out much. – 09K, Father, 46-55

None of the mothers in this sample explicitly linked an absence of support with distress or unhappiness. However, one community member did explicitly frame motherhood as an enjoyable experience when mothers have their husband's support, perhaps implying that the reverse could be true – a less enjoyable experience when that support is lacking.

Q: What is it like to be a parent? A: Like... you mean the burden? Or... well I think it is really enjoyable, because some people definitely like it, especially when they have support from the husband. – 19E, Community Member, 46-55

Another community member linked an absence of support with distress in parents of a baby who cries excessively:

And if you don't have – with some other children you may have people supporting you, it could help a lot, but for some situations for example, where it's just the couples at the place where they don't have that family support, they don't have that neighborly support, it [excessive crying] could also be very distressful for them. – 20D, Community Member, Senior Midwife, 36-45

However, even where support is not perceived, some parents professed a confidence in their ability to manage on their own. Despite the intensive requirements for childcare and household duty placed on parents, some mothers and fathers expressed confidence in their parenting abilities, whether or not they experienced support. Interestingly, this confidence was most often expressed in response to a question about whether they ever felt helpless or depressed or were not sure what to do with their children, thereby raising the question as to whether these expressions of confidence were defensive statements.

No, I usually take care of the family and I don't have assistance from anyone. At the same time, I don't have any difficulty controlling [managing] the situation. – 04D, Mother, 36-45

Taking into account all of these views, the experience of being a parent in Keneba could be summarised in the following way: 'it's hard, especially for mothers, but it's also worth it and valuable; mostly you will get some support from others, but whether you get support or not, you just get on with life.'

4.4.2 Question 2: What contextual factors influence parents in Keneba?

Parenting does not occur in isolation, but in a wider context including other people and environmental influences (e.g. Bronfenbrenner, 1999). According to respondents in this sample, cultural distinctions and traditions play a role in caregiving arrangements, how parents care for their children, and in terms of rules and norms for aspects of life such as pregnancy and marriage.

Nine respondents explicitly identified 27 aspects of their culture or tradition in relation to their discussions about caregiving. Distinctions were made with regard to medical or health-related beliefs and practices; stigma or shame; who cares for infants, and how; beliefs about infants' sight and hearing ability; and rules or norms governing a variety of other aspects of life.

These other aspects included play, where babies sit, talking to infants before birth, romantic non-marriage relationships, what parents do to care for children, and mothers spending the first postpartum week secluded with their infants.

But for the traditional people I think the common belief is that the baby would see around, within the first month. (...) that is just the traditional way of thinking. – 20D, Community Member, 36-45

I want to protect them as well as possible so they will no go astray and will not give me shame in the future; like getting pregnant before getting married, that is a big shame in this community. (...) Having a boyfriend or girlfriend is against our religion, against our culture. – 10W, Father, 26-35

Although organised as conceptually related under a shared topic, references to ‘cultural distinctions’ did not fall into a select few categories, suggesting that traditions and cultural beliefs, practices or norms may play a role in many aspects of life in Keneba, at least in the perspective of these nine respondents.

Another contextual influence was the MRCGU KFS clinic. KFS was established permanently in 1974, remaining a visible presence in Keneba for 45 years, but research has had a presence in the community since 1950 (Hennig et al., 2015). Nearly two thirds of the respondents in this sample contributed to the 37 references made to KFS or MRCGU during these interviews, despite neither being mentioned nor asked about, suggesting that KFS is not merely a salient presence in the community, but a potential source of influence.

KFS provides free clinic care to residents of KW, as well as conducting research, and it appeared to exert influence in this sample through these interrelated avenues. KFS was referenced in a number of ways, most often in terms of taking infants to the clinic when ill or for vaccination (17 references), followed by getting advice on caregiving or infant health (seven references), and the MRCGU’s history of research and clinical care, or attending the clinic as part of a study (five references). Five references were also given to the influence of KFS in terms of changes to health practice in the community, such as exclusive breastfeeding and decreasing family size.

So the first milk, breastmilk, the mother will give that baby, because in those days when a baby is newly born they will chew kola nut, put it in

the baby's mouth to brush the baby's gums, and under the tongue, because they said that then the baby would be able to talk. But now, the nurses stopped that completely. They said that it's not good. When the nurses said this is not good, that's the time that we also stopped it. Now when the baby is born (...) they will tell the mother to put the breast in the mouth, even if there is no milk, just the small water that is coming out of the breast, it is important and good for the baby, more than any other thing at that time. – 25W, Community Member, 66-75

For older community members, KFS was referenced in a positive or transformative way, whereas (younger) mothers' and fathers' references to KFS, although positive, seemed routine, and were primarily related to taking the infant to the clinic when sick or receiving advice.

Our first people didn't have this, our elder-elder people never had this. In those days we had to take care of the child for 3 weeks and the child cannot to anything. But now the child, 1 year 9 months, if you meet that child in the street, if they tell you this child was born last year you would not believe it. So I think that this is all because of the treatments they are getting from the clinics. – 28P, Community Member, 56-65

(...) if the baby is supposed to have an injection, the father will remind me that it is time to take the baby to the clinic for that injection. – 13B, Mother, 26-35

Perhaps older community members could remember or had been told of a time before KFS, and in comparison, KFS had made a noticeable, positive difference, whereas for younger parents, KFS had been a constant presence throughout their lives, the influence of which was as an aspect of daily life that could be accessed when needed. As more comprehensively addressed within theme 5 (not included in this report), although infants' physical health was a salient topic, and despite living in a

setting of relative deprivation, there was much consideration but little fear regarding theories of and responses to children's physical health, perhaps due to the presence of KFS.

A third contextual influence emerging in the interviews was religion. Social organisation and tradition in The Gambia has been described as broadly "patriarchal and gerontocratic" (Chant & Touray, 2012, p. 3) with influence from the cultural and societal implications of conservative Islam as a "powerful factor" (Touray, 2006, p. 78). Islam is the predominant religion of The Gambia, and virtually the sole religion of KW. Two mosques in Keneba make five daily calls to prayer. Many men and women observe varying degrees of *hijab*, or manners of dress prescribed for women and encouraged for men in the Qur'an. Most women wear some form of head covering outside of their compound, and cover their legs, though very few women wear burqas or cover their faces. Polygamy is commonly practiced (Hennig et al., 2015), with men allowed up to four wives according to the teachings of the Qur'an.

In this sample, 23 out of 30 respondents made references to *Allah* or to the religion of Islam. Many of these references were made when discussing the goals and concerns parents had for themselves and their children, suggesting a belief that much of what they hope for is dependent on Allah's will or provision, echoing an early finding by Thomson and colleagues (Thomson et al., 1968) that residents of Keneba "attributed everything ultimately to the will of Allah" (p. 337).

Respondents referenced getting advice, children, help, judgement, long life, good health, success, avoidance of illness or contracting illness, and true belief from Allah. Some respondents thanked or worshipped Allah during their interviews, often with regard to good health or protection from illness. Beyond people's individual faith in Allah, respondents also referenced the collective religion of Islam, with particular regard to the teachings of the religion on aspects of family life.

I pray for my family, that all of them can have long life and apart from that, I pray that they can be good people. – 13B, Mother, 26-35

Our religion always advises people to take care of the baby. And our religion also says you have to try very hard so that you can take care of your family, under the Islamic religion. – 05C, Father, 36-45

This is my aim: to see my family to be in a religious way, because I am a Muslim. I prefer them to be Muslim also so that the children will understand what my mother and father were telling me, about 'let me do that so that it will benefit me'. – 30R, Community Member, 66-75

Some respondents referenced Allah or religion consistently throughout their interviews, while others referenced it either once or a few times, and others did not reference Allah or religion at all, reflecting a varied salience of faith and religion.

Finally, seasonal changes provided a physical source of environmental influence in parents' experiences. Farming practices in KW, a region based primarily on subsistence agriculture, are governed by the annual transition between two seasons – the rainy season, from July to November, and the dry season, from mid-November to June (see Rayco-Solon, Fulford, & Prentice, 2005). No fathers mentioned seasonality, but based on the discussion of seven mothers and community members, the rainy season influences certain aspects of mothers' caregiving practices.

Respondents describing how mothers managed farming and care of a newborn or young infant cited practices such as taking the infant to the farm with them, or going to the farm but leaving the infant in the care of others, either returning periodically to breastfeed or leaving behind expressed milk or porridge.

My children's food, when I'm going to the farm in the rainy season, I take it to the grandmother. When I cook the food already, I'll cut part

of the food and give it to the baby, and give the remaining one to the grandmother so that the grandmother will give it to the baby in my absence. – 12U, Mother, 26-35

If it is during the rainy season, if you have an older daughter you can leave the baby with her at home and you can go to the bush to do your other works. If not, if there is a grandma, you can leave the child with the grandma while you go to do your other works. If you don't have all these, the grandma or older daughter, you have to put the baby on the back and you take one of the younger siblings; when you arrive at the rice field you make the baby to sit in a baby pan so that the sibling can look after it and the mother can continue her work in the field. – 24Q, Community Member, 66-75

One community member explained that mothers who work in fields close to the compound may leave the infant in the compound and come back to breastfeed them periodically, whereas mothers whose fields are further may take their infant with them. This respondent associated leaving an infant in the compound while the mother farms during the rainy season with disruption of Exclusive Breastfeeding (EBF) and early introduction of weaning foods, unintended by the mother.

We always emphasise this exclusive breastfeeding, but, like during the rainy season sometimes mothers go to the field to work and when they go to the field some of them will leave their babies behind, and then it is other people in the compound or you know, grandparents, or sometimes someone who is identified to take care of the baby in the absence of the mother, who feeds the baby in the mother's absence, apart from the breastmilk. (...) Although a lot of mothers would take the children along with them to the fields. But still you have a good number of women who would leave the baby behind, go to the field, and then periodically come back to feed them if their fields are not very

far away from the houses, from the village. When the fields are very far they usually go with the babies to the field and I think that's a situation where a lot of times the babies are introduced to foods apart from the breastmilk, because I've seen in situations where the mother will try as much as possible to exclusively breastfeed the baby, but when they leave the babies home, the other people who are caring for the baby, each time the baby cries they associate it to the baby feeling hungry, so they will give it water or something to keep – just to calm the baby.

– 20D, Community Member, 36-45

As described in the first set of quotations related to the influence of the rainy season on mothers' caregiving practices, mothers' responsibilities appeared to increase during the rainy season, when they must manage their farming work as well as domestic work and childcare. Some quotations suggested that risk of early discontinuation of EBF was more likely when an infant is born during the rainy season to a mother whose farm is close enough to the compound to leave the infant at home while farming, during which time a grandparent may introduce supplemental feeding.

4.4.3 *Question 3: How do parents perceive and respond to their infants' behaviour?*

The second section of the interview schedule was dedicated to questions about newborn and infant crying, behaviour, and mental states. The questions were developed to explore parents' understanding of their infants and what meaning they ascribed to infant crying. For example, these questions sought to reveal whether all crying in newborns was understood to indicate only physical causes (e.g. hunger) or whether parents attributed psychological or relational causes (e.g. boredom, loneliness) to crying; whether they thought newborn infants could see or hear; whether they attributed mental states to infants; and whether they used infant behaviour to guide their caregiving responses. Results from questions about infant

mental states were categorised most appropriately within theme 2 (mental states and emotions) and will be discussed in answering Question 4.

4.4.3.1 Parents interpret and respond to infant crying in primarily physical ways

Infant crying is universal (Newman, 2007), serving as a young baby's primary form of communication. Due to its universal nature and prominence in the caregiving experience, much attention has been given to crying in psychological and anthropological literature. Previous research suggests that infant crying is acknowledged, at least physiologically, by both men and women, and caregivers of one child, more than one child, and those without children (Boukydis & Burgess, 1982). While noticing infant crying and making an attempt to soothe the infant appears to be a "universal" response to infant distress, the particular way in which a caregiver responds may depend on a myriad of factors, including cultural beliefs about the meaning of crying, and therefore what constitutes an appropriate response (Murray, 2014; Toselli, Agostini, & Bukaci, 2011).

4.4.3.1.1 The primary interpretation of infant crying is hunger

The interpretation of infant crying was considered to give insight into parents' perceptions of their infants' inner worlds – for example, whether cries were attributed primarily to physical causes, or whether interpersonal or emotional interpretations were also given. Questions regarding interpretation of newborn crying were asked first, and then crying in older infants. Respondents seemed to interpret the question about newborn crying as specifically relating to the very first cries of an infant, which according to Wasz-Hockert and colleagues (Wasz-Hockert, Lind, Vuorenkoski, Partanen, & Valanne, 1968) are distinct from the other three 'types' of cry – hunger,

pain, and attention bid – in terms of their auditory qualities, rather than the cries of an infant in the newborn period¹².

Some respondents ascribed religious meaning, some discussed meaning related to entering the world or having life, while others ascribed ‘newly-born’ crying to hunger or other physical causes such as tiredness, temperature, or pain. Other than quotations relating specifically to the first cries of a newly born infant, respondents overwhelmingly described overlapping interpretations of crying in newborns and non-newborns. This is shown in Table 6, with shaded cells indicating interpretations specific to newborn or non-newborn crying.

Although the vast majority of respondents interpreted infant crying in light of physical causes, three respondents referred explicitly to infant crying as a form of communication in the absence of speech.

Sometimes when the baby cries, maybe it's sick, and you as a parent, maybe you don't know what is wrong with the baby, because the baby cannot talk and tell you, you know, this is what is paining me. Sometimes when the baby is hungry, it will cry. – 12U, Mother, 26-35

¹² This is likely due to a translation error, as the Mandinka phrase “malaika merengo” or ‘angel’ was selected by those originally supporting the translation, which later emerged as a phrase referring to a *newly born*, rather than a newborn, infant. The phrase “deenaano kuto” more accurately refers to an infant in the first weeks and months of life, later selected for use in the NBAS pilots.

Table 6. Interpretations of newborn and infant crying

Interpretation of newborn crying (but not newly-born crying)	Interpretation of non-newborn crying
Too hot or cold	Too hot or cold
Hunger	Hunger
Sickness	Sickness
Wanting or needing something (non-specific)	Needing something (non-specific)
Agitated or fussy	Agitated
Pain	Pain
Needing a nappy change or urinated on cloth	Just urinated
Dirty	Dirty
Something is wrong (non-specific)	Something is wrong (non-specific)
Does not recognise someone	Recognises mother so does not want to be with someone else
“A form of communication”	Cannot talk (communication)
Tired or wants to sleep	Wants to sleep
Attention	Attention
Bite or sting	Alerting to danger
Bad handling	Crying even though nothing is wrong
“Manhood”	Did not get something it wanted
Strange/unfamiliar environment	Parents’ feeling
Not wanting to be put down	Protesting
	Scared
	Thirsty
	Something happened but you don’t know what it is

Overwhelmingly, respondents listed hunger as a reason for both newborns and older infants crying, with other physical sources such as pain, temperature, and sickness salient. How parents reported responding to infant crying largely corresponded to these interpretations.

4.4.3.1.2 The primary response to infant crying is breastfeeding

Responses consisting of routine, physical caregiving behaviours characterised the 24 answers given about responding to infant crying. Breastfeeding was the most common and often the first response, followed by other physical responses such as checking or changing the baby's wrapper (nappy), giving food, picking up the infant, taking the baby to the clinic, telling the mother to breastfeed or giving the baby to the mother to breastfeed, and washing the baby. Responses outside of routine caregiving ("*topa to*"), such as playing with the baby and 'figuring out' what the baby needs, were referenced infrequently.

*Whenever [the baby] starts crying I usually give him a breast" – 04D,
Mother, 36-45*

The importance of breastfeeding in this sample was further emphasised by two community members who state that even if a baby is not crying, a mother will still breastfeed the child.

When the baby is in your arms, or the baby is lying down not crying and not sleeping, some parents will just come and breastfeed the baby. Maybe the baby is hungry but because they cannot talk, mothers think in that way. – 28P, Community Member, 56-65

Respondents in this sample also noted that prolonged crying after breastfeeding was interpreted differently to initial crying, with parents responding to prolonged crying by taking the infant to the clinic. Just as prolonged crying was a cause for concern, two community members said silence in a young infant could be interpreted as an indication that 'something is wrong'.

If the baby is lying down calmly and it's not sleeping and it's not playing, sometimes we think something is wrong with the baby. Maybe something is paining the baby. Sometimes we even think this baby is

very calm and quiet; maybe we think it's going to be somebody who cannot talk, dumb. – 28P, Community Member, 56-65

Other responses to crying cited by three or fewer participants included applying lotion, asking or advising the mother about the baby, bringing the baby back to the family, checking if the baby is hot, dressing the baby, giving the baby what it wants, making sure the baby's environment is safe, preparing food, and putting the baby on a bed or wearing the baby on one's back.

Seven respondents, mostly fathers, gave more nuanced considerations of crying, and implied that responding to crying involves searching for its meaning, or that a response to crying would meet the infant's need only if it matched the meaning.

She has a problem. It's an unspoken problem, an unidentified problem. You may look and find an option which will please her, then she will keep quiet. – 10W, Father, 26-35

When the baby cries, many times we may say that the baby is hungry; if not hungry, sometimes if you wrap the baby in clothes and the baby happens to urinate on those wrappings, and you don't know that, you know that the baby will be very uncomfortable and keep on crying. Or sometimes if the weather condition is also very hot, and if the baby feels very hot, if you wash the baby you will see the baby stop crying, you will know that the baby is feeling hot. And if you did all these things and the baby did not stop crying, you should still keep on observing, what is wrong with the baby? – 15V, Father, 56-65

While respondents indicated breastfeeding as the first response to infant crying, these more nuanced responses indicated that some parents consider a wider range of possible meanings and 'solutions' to infant crying, and perhaps that some parents view their infants as having individual inner worlds.

4.4.3.2 *Parents use infants' behaviour to understand them*

Three questions explored how parents understand aspects of their babies' experiences that are not verbally accessible during infancy: how do you know what your newborn baby is thinking or feeling; wants or needs; and likes or doesn't like?¹³

When answering these questions, respondents referred to infant behaviour as a way of understanding infants' inner worlds. Crying was the most commonly cited behaviour discussed in terms of understanding what infants like or want, as has been discussed in detail in the previous sub-theme.

Most respondents named specific behaviours as cues for certain desires, or as evidence of thinking or feeling, including: high activity levels, sleeplessness, sleeping patterns, not wanting to lie down, refusing the breast, silence, making sounds, grunting, screaming, laughing, making actions, making sucking movements, sitting calmly, crawling, playing, and smiling. These observed behaviours were frequently interpreted as signals of desires related to basic needs, such as wanting to breastfeed or eat, being full, wanting to pass urine or stool, or wanting to be picked up, in addition to being taken as evidence that an infant was thinking or feeling.

A baby will cry or sometimes will make signs that he needs something. Sometimes a baby will put a finger in his mouth to suck the finger. You will know that the baby is hungry. – 25W, Community Member, 66-75

¹³ Perhaps due to issues with translating the nuances of wanting and liking versus not wanting and not liking in Mandinka (both use the same root word, such that for example 'alaafitala' could mean he/she wants or he/she likes it), the responses for those two questions garnered similar responses.

The predominance of physical cues may have been due to a translation challenge¹⁴, so it is not clear whether more parents would have ascribed emotions to their infants when prompted with different wording. One mother did use ‘happiness’ as a way of understanding what her infant liked. One father listed behaviours which are associated with his infant being happy or sad.

*I observe the baby; when it's happy I know that he likes something. –
01A, Mother, 36-45*

*I don't know what she was thinking. I don't know but I feel that
sometimes she is happy, or very sad. She will start crying and then stop
all the sudden. But when she was sleeping you would see her smiling. –
10W, Father, 26-35*

One community member said that they did not think parents in Keneba were aware that babies could think or have feelings, but that they had an independent awareness of it through reading.

*They always are concerned about the baby to see when it cries and
whether she needs anything. [CB: Let me ask it this way...do you think
parents in Keneba think their baby is thinking or feeling?] I don't think
they have the knowledge that the baby is thinking or feeling. [CB: What
do you think?] Of course! [CB: looks up sharply] Yes, they are thinking
and feeling. [CB: So for you, how do you tell?] Well, I have never seen it
but by reading through the books. [CB: So you know but haven't
observed it?] Of course you do observe, you see them just being quiet so
you think maybe they are thinking. –19E, Community Member, 46-55*

¹⁴ It was not discovered until translating the MHQs a year later that the Mandinka word for ‘feeling’ indicates a physical feeling, such as feeling a feather on one’s skin, rather than an emotional state.

Overall, respondents were able to describe a range of infant behaviours that they used as cues to help them understand their infants, with crying the most prominent behaviour noted.

4.4.3.3 *Many parents believe newborns cannot see or hear*

After being told by KFS staff that many people in the area believed newborn infants could not see or hear, related questions were added to the interview schedule. There was a clear difference in range of responses for seeing versus hearing, with a small range for sight, and wide range for hearing. Most respondents said that infants could see from 2 or 3 months after birth, although a few respondents said infants could see from birth or at 4 months, one said 6 or 7 months, and one participant said that the age of sight onset depends on the particular infant as “people’s brains are faster and slower than each other” (09K, Father, 46-55).

Two community members and a mother described the belief that infants can see from 2 to 3 months as a “traditional” belief or the belief of “others,” but cited either research or personal experience to explain why they believed that infants could see much earlier.

A new baby, or...? Mandinkas used to say that a baby cannot see, but when you stand beside a baby you will see that the baby looks at you. If you make any movement, the baby will look at you. From my own understanding, the babies see the moment they are born, because when the baby is born, at the end of the one month if you stand beside the baby you will notice that the baby looks at you, and any movement that you do, the baby will look at you. – 12U, Mother, 26-35

Traditionally? I don't know. But I know that a baby can see right from that day one. The baby can see – they might not be able to interpret that information that they see but that faculty begins to mature and then with time they begin to differentiate faces, they begin to

differentiate objects, they begin to differentiate colours, but that seeing process is right from day one, right. But for the traditional people I think the common belief is that the baby would see around, within the first month. (...) But that is just the traditional way of thinking. I know from my experience, from my professional experience, I know that babies see from that day one. – 21Y, Community Member, 46-55

The significance of when an infant becomes able to recognise people was salient in discussions of sight in infancy, reportedly developing after the onset of sight.

You will know that the baby can see in that two months. In 3 months, a baby will differentiate you with other people. – 07Z, Mother, 36-45

4 months. 3-4 months. The baby will start to see people. At 5 months the baby will recognise people. (...) – 25W, Community Member, 66-75

Unlike sight, for which most participants gave an onset in the range of 2 to 3 months with only a minority of responses outside this range, responses for hearing onset varied widely, ranging from before birth to age one, with no ‘majority’ answer.

The moment the baby is born he will start to hear. – 03B, Mother, 26-35

They start hearing at the age of 2 months, but they will not understand what you are saying. – 22W, Father, 26-35

Before the baby will be able to hear, very close to 8 months, up to 9 months, until 11 months. – 30R, Community Member, 66-75

No explanation for this wide range of answers was identified. No traditional beliefs about the onset of hearing were referenced, as there had been for sight, so

perhaps without a 'template' available, respondents relied more on their own experiences to answer the question about hearing.

Without prompting, respondents provided examples of how to determine whether an infant could see or hear, including: visual tracking of objects or people; reacting to sound with bodily movement; waking up because of a noise; and looking at objects or people after a sound is made.

When the baby is asleep and something drops and the baby wakes up and panics, then you know they can hear. And when the baby looks at you moving around in the house, then you know they can see. – 11N, Father, 56-65

While many participants either labelled a given age of onset of sight or hearing as a "traditional belief" or did not provide further explanation beyond the proposed age of onset, most respondents gave some kind of evidence, whether based on personal experience or research, to justify their answer, suggesting that although a traditional belief about age of onset, specifically regarding sight, may be prevalent, parents in Keneba also 'test' whether their infant can see or hear, over time.

4.4.3.4 Infants' needs are viewed as primarily physical

Two questions, "What does a baby need during the first 2 months, and how do you provide your baby with this/these things?" and "What is important for a baby to do during the first 2 months?" explored parents' understanding of their infants' needs in the first 2 months. The question "what is important for a baby to do during the first year?" also invited discussion of what infants need.

All respondents noted at least one physical need, with a sub-set of respondents also discussing psychosocial needs. Perhaps unsurprisingly, given their

prevalence throughout other themes in the interviews, physical needs related to breastfeeding and eating were repeated by most respondents.

In the first 2 months, the baby needs only breastmilk. I give the baby the breast every time. – 07Z, Mother, 36-45

Other physical needs, usually following a mention of breastfeeding or food as the primary need, included a non-specific need “to be cared for,” “good health,” and needs related to hygiene, including: soap, clean clothes, being clean, food hygiene, a clean place to sleep, the mother being clean, and washing.

To take care of the baby. Feed the baby very very well, make the place very neat where the baby is going to stay; you as a mother you have to take care of yourself also because if you are dirty as a mother your child will also be very dirty. This is what I think. – 25W, Community Member, 66-75

Less frequently discussed physical needs included medical or health needs, stretching, massage, holding, safety, survival, and provision. One community member jokingly noted crying and making noise as a need for infants in the first 2 months.

Q: What is important for a baby to do in the first 2 months? A: Apart from lying down making noise? [laughs] I don't think other than that they have anything. Crying, always crying, and looking for food! – 19E, Community Member, 46-55

In addition to physical needs, four male respondents discussed psychological or social needs, geared toward future development. Three of these respondents noted good character as a need for an infant in the first year, though not in the first 2 months. These respondents also noted that infants, in the first year, should accomplish other aspects of pro-social development, such as learning socially

acceptable behaviours, learning to communicate (including their needs), becoming responsive to situations, and understanding the parents' way of life.

Q: What is important for a baby to do in the first 2 months? A: A baby to do... (laughs) Okay, I think babies should be responsive to situations. I mean, to... cry when it needs, when it is uncomfortable... to alert, to make – to try to communicate its needs, you know, one way or the other. – 21Y, Community Member, 46-55

It's very important for the baby to learn in the first year. You will teach the baby good character, by pointing at certain things so that he will understand. Sometimes if you tell the child, "bring me this," [English] even if he cannot talk, by showing that sign, he will bring it for you. If you tell him "sit down" [English] he will sit down. If you tell him "come" [English], by doing your hand like this, he will come. (...) All this is part of learning, although he cannot talk and cannot say these things, but if you tell him "don't cry" by showing him signs, he will understand you within one year. – 22W, Father, 26-35

The majority of respondents did not discuss such non-primary physical needs for their infants. Although it was not the only need mentioned, breastfeeding was the most prominent need perceived by parents, and most respondents discussed breastfeeding or food first before listing other needs. Most respondents did not discuss psychosocial caregiving needs (e.g. comfort or attention).

4.4.4 Question 4: How do parents describe their own and their infants' emotions

Participants were asked explicitly whether they (or whether "parents," for community members) ever felt helpless, depressed, or that they did not know what to do with their children. Some parents also referenced their own and other adults' emotions during responses to other questions.

More references were made to negative (e.g. distress, anger) than to positive emotions (e.g. love, happiness). The variety of emotions described (Table 7) indicated that at least some parents felt able to name and reflect on their emotions in relation to their caregiving experiences, despite the limited number of emotion words in Mandinka (field observation; MHQ translation process), and the narrow number of emotion words used in standard greeting conversation (field observation).

Table 7: Adult emotions listed during caregiver interviews

Afraid	Aggressive	Agitated	Crying
Depressed	Distressed	Frustrated or fed up	Happy
Jealous	Laughter	Lonely	Love
Not happy	Proud	Sad	Steady mind or peace of mind
Worry			

As might be expected, many parents described causes of happiness and sadness as directly related to their children’s well-being, and their ability to provide for their children’s needs.

(...) Sometimes I might want to buy something for the family but if I am not in the position of getting money, that makes me sad. – 23W, Father, 36-45

The most important thing for the baby in the first 2 months is to have good health. When he has good health then I can have peace of mind. – 18T, Mother, 26-35

As discussed in chapter 2, women in LMICs may experience Common Mental Disorder (CMD) symptoms after giving birth, including ‘morbid’ distress and unhappiness (Oates et al., 2004). Although only two parents made a direct reference to feeling depressed, others referenced emotions related to depression, including aggression, agitation, crying, distress, frustration, unhappiness, sadness, and loneliness, with worry cited frequently.

One community member made a reference to depression in parents and the effect this can have on the parent-child relationship and on infant feeding. Another described the negative emotional impact of excessive crying in a newborn.

Especially with ill, sick children or malnourished children, they are already depressed themselves – the parents are already depressed, and if they show it, and if the child picks it, he too stops eating, you know, and it affects the relation. – 21Y, Community Member, 46-55

I got my last child, you know – even when you try to do all the best care that you could, this child has a particular time of the day that the child would start crying very excessively, and then I remember at some point my wife was crying, because she just doesn't know what to do with the child. – 20D, Community Member, 36-45

Reference both to negative emotions and direct labelling of depression are contrary to the assertion by staff members during field observation, and by a community member in this sample, that 'depression does not happen here'.

Q: Do they [parents] ever feel stressed?) A: Not like UK honestly, because they have the family members around them. Depression is hardly ever here, definitely. – 19E, Community Member, 46-55

Although no participant cried or displayed any other 'negative' emotion visibly during the interviews, many laughed aloud as they answered questions.

If I want to tell you that, I cannot; the baby cries, but what the baby is crying for, I don't know that! [laughs] – 01A, Mother, 36-45

The frequent laughter during interviews was congruent with field observation of laughter as a major feature of communication in Keneba.

Respondents also discussed emotions and mental states in their infants, often in response to questions about how parents can know what a newborn likes, dislikes, wants, or needs, or what they are thinking or feeling, as has already been discussed. Respondents also spontaneously labeled a range of infant mental states and emotions which included both negative emotions (e.g. distressed, not happy, panic, protesting, sad, and scared) and positive states (e.g. happy, laughter), though the range was smaller than for adult emotions.

When the baby is happy, I know it. When the baby is sad, I know that also. – 06Q, Mother, 36-45

*(...) I don't know but I feel that sometimes she is happy, or very sad. [...]
I know that she's unhappy when she's crying. – 10W, Father, 26-35*

The term agitated was used to describe infants in several cases, and while coded as an emotional state, parents seemed to use this term to describe the behaviour of a restless or 'fussy' infant, similar to the concept of irritability, which may or may not be perceived as relating to emotions.

Some babies are very agitated, so they will keep on crying, even if they are not hungry. – 06Q, Mother, 36-45

Statements indicating consideration of infant mental states included infants being familiar or unfamiliar with someone, recognising people (occurring exclusively in responses to questions about onset of sight), seeking attention, wanting or not wanting something, and learning about the environment.

(...) if she recognises the mother then she will not allow anyone else to hold her. Even when the mother takes the baby and gives it to other people, the baby will refuse, because she has already recognised the mother. – 07Z, Mother, 35-45

Consideration of infant mental states most often occurred either in the context of questions about what an infant's cry means, or questions explicitly asking about how to gain information about infant mental states, suggesting that although parents in this sample were aware of emotional needs and states, these were not necessarily salient when discussing daily caregiving activities or routines.

4.5 Discussion

These interviews helped give an understanding of what it is like to be a mother or father in Keneba, including some of the contextual influences at play, how infants are perceived in this setting, and how parents talk about their own and their infants' emotions. The current study was unique in approaching parents in Keneba directly to ask about their perceptions of newborn behaviour and abilities, and about their hopes and concerns for their children, although previous research has been conducted in similar areas.

A much earlier study in Keneba, in 1962, involved daily 'flash observations' of three compounds to provide information about "women's activities, arrangements for childcare, (...) [the] general condition of survey children and (...) feeding arrangements" (cited in Thomson et al., 1968, p. 335). The author of that study, a sociologist, also wrote descriptions of Keneba in other publications, including parents' activities, division of labour, and seasonality (e.g. Thompson, 1966; Thompson & Rahman, 1967). These descriptions indicate that mothers have maintained an intense workload of caregiving, domestic, and agricultural responsibilities, and that seasonality continues to influence caregiving arrangements.

Another early study in 1989 was conducted with a group of Mandinka families in the neighbouring country of Senegal (Whittemore & Beverly, 1989). This study explored aspects of child caregiving activities and socialisation, but focused on those provided by other children.

A more recent study asked Gambian mothers directly about their experiences in the postnatal period. Mothers in Mwangome and colleagues' study (2010) in three KW villages (Keneba, Manduar and Kantong Kunda) reported similar experiences in several domains. The mothers in Mwangome's sample (2010) identified similar formal and informal social support networks to those identified in the current sample, with sources of support including their child's siblings and grandmother, other relatives, and from the MRCGU itself (p. 170). They also reportedly described instances of "absence of support" although these were not listed in the article (Mwangome, Prentice, Plugge, & Nweneka, 2010, p. 170). Other experiences cited in the present study and in Mwangome's sample included leaving infants in the care of others during the rainy season due to farming work; and intense gender inequality in decision-making and division of labour.

Unlike Mwangome's sample, in which mothers reported little to no support in caregiving from their husbands, respondents in these interviews presented a more nuanced view of fathers' involvement in caregiving, with some fathers reporting routine caregiving involvement, and the majority reporting distal involvement through financial provision, playing with the infant, or instructing older children.

The perception of lacking support in childcare, shared by some mothers in the current sample and in Mwangome's study, has also been reported and previously linked to depression in a third qualitative study. Many of the mothers in Sawyer and colleagues' (2011) study of 55 women in an urban, coastal region of The Gambia reported that absence of support from the husband in particular was a reason they felt "distressed and unhappy" during pregnancy and the first year after birth (p. 535). As described in the literature review, this association between lack of support and maternal postnatal unhappiness has been found in numerous previous studies in HIC and LMIC settings (see Oates et al., 2004; Sawyer, Ayers, & Smith, 2010).

Most recently, a study published in 2018 (Nabwera et al., 2018) presented results from interviews with 16 mothers and three fathers in KW, as well as four research staff at KFS, to explore, amongst other topics, experiences of child malnutrition and mothers' psycho-social stressors. These interviews revealed very similar results to the present study, including the perception of a father's role as that of a provider; a more nuanced view of fathers' support in childcare; and the necessity of maintaining good social rapport if one is to receive social support.

The following discussion considers the results of the current interviews in light of previous research, and implications for interpreting the results of the main study.

4.5.1 Parenting in the context of Keneba

The findings from these interviews suggest that beliefs and traditions play an important role in caregiving arrangements and activities, and in norms for pregnancy and marriage. The MRCGU KFS is a significant presence in Keneba and changes have been made to local health practices because of it. Families engage with KFS to seek treatment, participate in research, and get advice about caregiving (although some advice appeared unsolicited). Religion is also a salient influence, with many respondents referring to a dependence on Allah for provision, and other respondents praying to or thanking Allah even during their interviews.

Furthermore, seasonal agricultural patterns in KW influence mothers' responsibilities and infant feeding practices. During the rainy season women must either take their infant with them to the farm or leave them in the care of others. Infants whose mothers cannot bring them to the farm may have weaning foods introduced at an earlier age by relatives in the mothers' absence. An early study in Keneba reported variations in weight gain dependent on this seasonality (McGregor, Rahman, Thompson, Billewicz, & Thomson, 1968), a finding that may or may not be related in part to early weaning.

Although this sample was recruited solely from Keneba and therefore findings are not generalisable to the wider region of KW, respondents' descriptions of the influence of local customs and Islam are likely to be relevant to other villages in KW. The influence of seasonality is presumably stable across the region, but the direct influence of KFS may decrease in villages further away. Respondents in Nabwera's sample in KW also reported reliance on Islamic beliefs in order to cope with daily circumstances (Nabwera et al., 2018). Certainly, this setting, as described by respondents, is influenced by similar contextual features to parents in the KW sample of the main study.

These interviews were concordant with previous research in detailing the time-intensive nature of mothers' involvement in caregiving, especially compared to fathers, and the heavy burden not only of childcare but also of domestic work and farming or gardening. This burden has been previously reported in a Gambian household survey (GBOS & UNICEF, 2011).

The reports in this sample of fathers' support was similar to a previous set of interviews with mothers and fathers in KW (Nabwera et al., 2018), with fathers described as having the role of a provider rather than as a proximal caregiver, although at least one of the fathers in Nabwera's sample reported involvement in physical caregiving. Despite mostly indicating that the father's role was to provide financial support, this support was crucial to mothers' experiences of caregiving.

One crucial difference was that although only a few references were made in the present interviews to parents facing infant mortality, a third of the mothers in Nabwera's wider quantitative study (N=280) had experienced the death of a child, serving as a reminder that certain aspects of parents' experiences in the present sample may not be generalisable to other parents.

4.5.2 *Newborn social behaviour and mother-infant interaction in the context of primarily physical caregiving and the belief that newborns cannot see or hear*

The questions utilised for theme 7 were developed after gaining the impression that some people in Keneba believed that newborn infants were only capable of eating, sleeping, crying, and passing digestive material, with little consideration of psychological or social processes (personal observation¹⁵).

Previous research evidences visual orientation in infants as young as 10 minutes old (Goren et al., 1975), with newborns able to show a preference for their mother's face from 2 days (Walton et al., 1992), and for their mother's voice from birth (Freeman & Spence, 1996). Despite the universal potential for these abilities during the newborn period, and contrary to research describing newborn infants as competent persons predisposed to social engagement with caregivers from moments after birth (e.g. Stone, Smith, & Murphy, 1973), the majority of respondents in this sample – though, importantly, not all – stated that infants could not see until approximately 2 months after birth, hear until potentially much later, and that they could not recognise or distinguish between individuals until a month or longer after the perceived 'onset' of sight. The degree of consistency across respondents suggested a shared cultural belief about delayed onset of sight in newborns.

A previous study in an Efe community in the Republic of the Congo noted that infants were perceived to 'become socially aware' at the age of 4 to 5 months, at which time they are viewed as capable of social interaction (Winn, Tronick, & Morelli, 1989). Similar to the caregivers in the present interviews, the Efe infants in Winn, Tronick and Morelli's study were "fed often, (...) comforted quickly following a fuss or cry, and (...) rarely engaged socially" during the first months after birth (pp. 94-95),

¹⁵ On multiple occasions during the initial trip women laughed when I spoke to newborn infants; and two KFS staff asked why I was interacting with a newborn, given that he could not see or hear me.

which is contingent with the present findings. Similar reports of perception of limited social capacity in newborns have been given of American mothers, who report an increase in enjoyment toward their infants around 3 months, due to a shift in social behaviour, and in Kipsigis mothers in northern Kenya, who begin to refer to infants as 'children' around 3 to 4 months after birth, having previously referred to them as 'monkeys' (Super & Harkness, 1982, p. 5).

In terms of the broader aims of this thesis and future research, such beliefs may impact on parents' interactions with their infants at various time points. For example, one might expect a marked increase in talking and engagement between 1 and 5 months, as most respondents believed infants had developed sight and hearing abilities by this time, arguably increasing their motivation to interact verbally and visually with their infants and to view them as interactive partners.

Furthermore, few parents in this sample indicated playing with an infant as part of their daily caregiving activities. Based on field observation, engagement with newborn infants was limited to routine, physical caregiving, and stereotyped engagement including: covering the infant's mouth when yawning, placing a thread on the infant's head when hiccupping, and sounds and comments (e.g. "hey!" or "you are hungry") seeming more for the benefit of other listeners than for the infant.

Additionally, newborns were typically fully swaddled and asleep during the day in several layers of cloth, carried by their mothers when going to the clinic or at a naming ceremony, or asleep on a bed at home during the day when not being breastfed or held by others (field observation), rather than being engaged in interaction. Newborns may sleep up to 16 hours a day and only be socially available for 10% of their waking hours in the first few weeks after birth (Nugent et al., 2007). If, during this period when waking hours are few, the infant is kept asleep via

breastfeeding¹⁶ and swaddling, and given the intensive workload that mothers must manage alongside infant care with little time for resting, it seems probable that mothers in Keneba have few opportunities to take advantage of these short windows for interaction with their newborns, especially if they are not looking for these windows due to beliefs that the infant cannot see, hear or recognise them.

Bearing in mind that differences in caregiving practices between culturally distinct groups have been associated with variations in newborn behaviour as early as 2 days after birth (Keefer et al., 1978), these practices and beliefs have implications for interpreting the results of the NBAS scores in the main study. Social orientation scores may differ in the KW infants as a result of early caregiving practices (e.g. breastfeeding upon waking; daytime swaddling), as these are based on beliefs about newborns not being socially available, and may initiate a cycle in which caregiving practices influence infant behaviours, which then reinforce the shared beliefs about non-competence that influenced the caregiving practices.

Also potentially related to the main study measure of MII, respondents primarily discussed physical caregiving needs and desires in their infants. As with Omer-Salim and colleagues' (Omer-Salim, Persson, & Olsson, 2007) interviews with Tanzanian mothers, the most common reason given for infant crying was hunger, and breastfeeding or feeding the most common response. In the present sample, breastfeeding was reportedly also offered when the infant was awake but not crying. Infants were perceived to have mental states, but mostly related to physical desires or discomfort, such as hunger, being wet, or wanting to be picked up. Few participants cited psycho-social (e.g. attention) needs, desires, or reasons or responses to crying.

¹⁶ Recall also some respondents' view that something is wrong if an infant is in the quiet, alert state, and reports that mothers will breastfeed the infant in this state even if the infant is not crying

While a small group of respondents in the present sample discussed psychological, social, and behavioural development, these respondents were non-representative, the majority being fathers in roles providing proximity to urban (e.g. teaching) or 'Western' ideas (e.g. KFS non-clinical staff), or male community members trained in 'the West' before working as KFS clinical staff. Respondents' descriptions of caregiving routines, as well as understanding of infant needs, were primarily physical; infant behaviour was understood as communication of physical rather than psychosocial needs; 'play' was not described as part of routine caregiving; and newborns were believed not necessarily to be able to see or hear. Given these views, and taken alongside field observation of infant swaddling and daytime sleeping, it seems likely that MII in the first few weeks may be characterised less by social or verbal, turn-taking style engagement, and more by non-verbal, physical interaction or the 'stereotyped' engagement seen during field observation.

Although variation might be expected in MII quality in the main study, with some mothers engaging socially and emotionally with their infants, less evidence of consideration of infant's social or psychological lives might be expected in KW than in a setting where beliefs about newborn competency are more commonly held, especially in the early postpartum period.

This is not to say that mothers in KW would be expected to be un-responsive, but that their responses may or may not be contingent to infant cues, given that mothers and fathers in this sample typically interpreted all infant behavioural cues, including crying, as indicators of physical needs such as hunger, and responded accordingly. In fact, these interviews suggest that caregivers in Keneba respond immediately to infant crying – no respondent stated that they ignored their infant or allowed them to continue crying – and, unlike the Western belief that it can be "fake" or "manipulative" (Zeifman, 2001), all but two respondents consistently referred to physical or desire-based reasons for infant crying, and noted immediate responses to

distress. Such a view of infant crying as having a genuine underlying cause and requiring a physical caregiving reaction is congruent with the immediate responding to crying described of parents in other 'non-Western' cultures (Ainsworth, 1977; Brazelton, Robey, & Collier, 1969; Konner, 1976).

In this way, although parents in this sample reported responding immediately and consistently to infant distress, the range of responses noted included few non-physical responses, and due to the lack of resting time and beliefs about newborn non-competency, it may be that mothers respond less frequently or non-contingently to behavioural cues such as non-distress vocalisations during MII, at least at 1 month.

Equally, however, it should be noted that at least some of the male respondents reported that their infants, even at 2 months, had psychological and social needs beyond basic caregiving. Some mothers in the main study may also hold these views and demonstrate them during MII; it may be that the interviews did not make the infant's non-routine needs as salient as a period of time alone with the infant and away from other responsibilities.

4.5.3 Parental mental health in the context of fewer discussions of emotions and variable support

Despite one community members' assertion that 'depression does not happen here,' two parents made a direct reference to feeling depressed, others referenced related emotions including aggression, agitation, crying, distress, frustration, unhappiness, loneliness and worry. A recent study reported the prevalence of depression in a sample of Gambian women as 10.3% overall and 6.6% during the perinatal period (Coleman et al., 2006). A prevalence of 13% was subsequently reported in a group of women of reproductive age in KW (Nabwera et al., 2018). Both previous reports are incongruent with an absence of depression in KW.

Additionally, half of the mothers in the sample reported on at least one occasion that they lacked support, with six mothers reporting a complete absence of support in caregiving. As previously noted, lacking support is a well-known risk factor for depression across cultures (see Oates et al., 2004), suggesting that at least some mothers in the main sample will report depressive symptoms.

Between them, respondents mentioned a range of positive and negative emotions experienced by themselves or other adults, the majority of which were not prompted by interview questions. This spontaneous labelling and discussion suggests that, despite a dearth of emotion words in Mandinka compared to English and relatively little reference to these in daily life (field observation; Momodou Darboe, personal communication), some respondents recognised and reflected on their own or others' feelings. Negative emotions in parents were cited more frequently than positive emotions, with references to 'worry' being the most common, perhaps indicating the strain of caregiving, at least for some parents.

Respondents also identified positive and negative emotions in their infants, and mental states such as desires and recognition of certain individuals, both spontaneously and during answers to questions specifically about infant mental states, indicating a degree of reflective functioning. As discussed in chapter 2, the ability of parents to recognise their child as having an individual mind and their efforts to represent the child's feelings and mental states has been implicated in both parent and child outcomes (see Katznelson, 2014).

One of the infant emotions discussed was agitation, similar to the concept of irritability. A few respondents described their infants as "agitated," suggesting that parents in this sample noticed their newborn's temperament and had a word to describe an irritable infant, perhaps similar to the English word "fussy." Irritability has been studied as an influence on parents' caregiving experiences, and whether NBAS

scores in The Gambia mirror degrees of irritability in other settings, including Cambridge, will be of interest in future BRIGHT research output.

In addition to labelling emotions related to depression, mothers' variable descriptions of support may provide context for the EPDS in the main study. As described in this report, mothers in KW work hard, have little time for leisure, sometimes lack support, and report worries about financial issues, family responsibilities and health concerns. The primacy of the mother as caregiver is universally described (Samman, Presler-Marshall, & Jones, 2016), was indicated in another recent set of interviews in KW (Nabwera et al., 2018), and fitted the present findings. Gender inequality, with women responsible either solely or for the majority of parenting, chores, and farming was reported in the present sample, and even more directly in a previous KW sample of 68 mothers in Keneba and two neighbouring villages in 2001 (Mwangome et al., 2010).

With regard to implications for the main study, family support was experienced by some mothers and noted as absent by others, with a general sense that when it comes to caregiving, one must 'get on with it,' whether or not support is available. This might suggest that high EPDS scores (denoting more depressive symptoms) may be more common than expected given the typical extended family arrangement, as not all mothers felt they had access to support from this.

4.6 Limitations

The quality of these exploratory interviews was high in terms of depth of analysis, but several methodological limitations are noted in this "cross-language research" (Temple, 2002, p. 844).

Transcription from English recordings was conducted in a semi-naturalist manner (e.g. pauses, laughter, etc. recorded), while transcriptions from Mandinka

recordings could be more accurately described as denaturalist (e.g. pauses omitted, etc.) due to the filter of the translator. There was certainly room for improvement via a formal notation system for capturing non-verbal utterances and other elements of participants' responses during transcription (Oliver, Serovich, & Mason, 2005).

A further practical constraint in the transcription process was that Mandinka is an oral rather than a written language. Interviews recorded in Mandinka were not first transcribed, but were simultaneously translated and transcribed into English, resulting in a potential loss of data during translation, and greater difficulty in 'going back' to the original content to clarify meaning.

Additionally, due to limited staff and financial resources, these interviews were translated from Mandinka (Alhagie Darboe) or transcribed from the recorded or translated English (the author) by a single person. To achieve the highest data quality, a bilingual translator with formal training in translation and transcription processes would have been employed, and a second person may have translated a sub-set of the interviews for comparison. By assessing the agreement between two translations, a higher level of confidence could be placed on the extent to which transcripts accurately reflected respondents' speech, and provide opportunities for clarifying phrasing and meaning of responses for which there is no direct translation (conceptual equivalence; Squires, 2009).

Finally, the author was the sole person analysing transcripts, and feedback on agreement or disagreement with proposed themes from additional persons would have improved reliability of the results.

Further confidence could be granted for the interview results were participants consulted for their feedback on the themes, as respondent validation

might reveal additional assumptions and biases and improve the degree of “trustworthiness” (Lincoln & Guba, 1985) of the results (S. Cooper & Endacott, 2007). Such feedback was not feasible at the time of analysis, since the author had returned to the UK and email communication to closely-involved KFS staff members or respondents with access to the internet understandably did not elicit feedback due to intensive workloads.

However, despite these limitations, there were also strengths. The author maintained a clear audit trail including detailed analytic memo’s (facilitating reflexivity throughout coding and analysing data), records of conceptual frameworks, and iterative revisions to the structure of themes and sub-themes (including definitions) after coding each transcript, thereby improving the trustworthiness of the analytic process (S. Cooper & Endacott, 2007).

Additionally, the translator (AD) was fluent and articulate in English and highly experienced in translation, including translation and interpretation of topics beyond the physical health care research typical of KFS, due to his extensive translation work in a previous study of depression and child stunting (Nabwera et al., 2018). He was also receptive to requests for verbatim translation, including non-speech noises, and offered insight and options when translating words and phrases for which there was underlying cultural information or multiple options in English. This degree of fluency and experience likely reduced errors in the translation process (Jandt, 2013) over a translator and interpreter less fluent in the shared language or less familiar with psycho-social topics.

Alongside the methodological limitations, my positionality as a student, a Christian, an outsider, a female, someone without children, and someone from a different setting influenced how I perceived participants, and presumably how they perceived me. These factors indicate the likelihood that un-checked assumptions

about an 'other' culture influenced the way I analysed and interpreted data, and drew conclusions. My positionality was potentially made worse or better by close relationships with families in Keneba and some degree of familiarity with the context after living there one year. My positionality as a novice researcher with little experience of qualitative methodology also influenced the way data was collected. All conclusions must therefore be held lightly due to my 'outsider' position and methodological choices.

Overall, despite these methodological weaknesses, the interviews were conducted at all stages as rigorously as possible given practical constraints, and facilitated this initial exploration of topics previously unexplored in the region (e.g. newborn abilities) from informants (e.g fathers) not previously included in the conversation. In future qualitative research in this area, the need for multiple coders and translators is emphasised for improved validity of findings. Additionally, participant feedback on the results would be valuable, to confirm whether the interpretations presented here accurately reflect respondents' experiences.

4.7 Conclusion

Through talking to parents and community members living in KW, the context in which the main study took place can be better understood. The inclusion of fathers' perspectives, in addition to mothers' and community members', provided a more complete 'picture' of parents' day-to-day experiences compared to earlier research with mothers alone.

It should be noted, however, that the sample of respondents who participated in the interviews were living or working in Keneba only, as opposed to throughout the region as in the main study, and these parents are not the same parents who will be participating in the main study. As such, these interviews may have limited applicability. However, parenting happens in a context and not in isolation, and having

an awareness of this context in the region in which main study participants are living, growing, and parenting, is valuable.

Having briefly considered some of the contextual factors influencing the experience and daily activities of parents in Keneba, as well as the way parents perceive and respond to their infant's needs and behaviours, the next chapter presents the results of the pilot study conducted to adapt the main study measure of newborn social behaviour (NBAS) for use in a novel setting.

5 Results for adapting the NBAS for use in Kiang West

5.1 Introduction

Before using a measure in a new location, it is necessary to determine whether adaptations are required. The Keneba Field Station (KFS) has hosted researchers for more than 60 years and staff are well-accustomed to conducting medical research. However, only a minority of KFS studies have employed psycho-social or behavioural measures; in fact, of the measures of interest in this study, only the Edinburgh Postnatal Depression Scale (EPDS) has been used in previous research at KFS. Therefore, before the main study commenced, there was a period of preparation for piloting and assessment of any needs for adaptation, as well as extensive translation of the Mental Health Questionnaires (MHQs) including the EPDS, and training staff.

This chapter provides the results of the Neonatal Behavioural Assessment Scale (NBAS) acceptability pilot, which was undertaken to determine whether all NBAS items were acceptable to parents in the region, and therefore, whether it would likely be an acceptable measure for participants in the main study. The term 'acceptable' is used here to mean: perceived as appropriate by parents and elders; not causing distress to the observers or to the infant; and avoiding actions deemed negative by culturally held beliefs (e.g. regarding infant handling).

The following question, therefore, underpins this chapter: is the NBAS acceptable to parents in Kiang West (KW), or does it require modification?

5.2 NBAS acceptability pilot results

5.2.1 *Participants*

A target of 15 NBAS sessions was set with the aim of conducting each item several times across these infants. Fourteen infants and their respective caregivers or elders were recruited. All families who were approached joined the pilot study. Ten

family groups comprised of a mother and at least a father or an elder, four mothers without additional responding family members, and one elder without additional responding family members, were recruited; they observed their infants (N=14) receiving an NBAS and gave feedback.

All NBAS sessions and feedback interviews took place in the participants' homes. The author (CB) introduced and conducted all NBAS sessions with translation support from Mustapha Minteh (MM) or Malang Jammeh (MJ). All but one infant did a single NBAS, with participating respondents all observing and then interviewed individually. One infant's parents were not available at the same time, so two sessions were conducted, with the mother and father observing separately.

Fourteen mothers between the ages of 18 and 39 years (*Mdn* = 28.5) took part, as well as eight fathers between the ages of 30 and 80 years (*Mdn* = 44), and five elders – as with mothers and fathers, defined by their position in the family rather than age – between age 52 and 90 years (*Mdn* = 70). Overall, respondents ranged in age from 18 to 90 years, with a median age of 34 (30 for women; 52 for men).

All respondents in these feedback interviews lived in one of three KW villages – Keneba, Tankular, and Kulli Kunda – and all but one respondent, originally from Senegal (P19, Mother, age 38), were born in The Gambia. All were Muslim and spoke fluent Mandinka. Four respondents reported no formal education; three reported formal education in an English school; and the rest reported education at an Arabic school, four of whom had reached senior secondary school (grades 10-12). Three of the younger mothers were still students at the time of interview. Just over half (N=15 out of 27) of respondents reported agricultural activities as their occupation, mostly farming, with gardening and cattle herding also cited. Other reported occupations included driving, carpentry, electrician work, non-specified “business,” student, child-care, and housework, with one respondent listing her occupation as “housewife”.

5.2.2 *Analysis summary*

The interview contained 33 questions. All respondents, including elders, answered the first 10 questions. Although the questions inviting item-by-item feedback (Q11-32) were re-coded and considered first, in this report, responses to selected questions within the first nine questions will be explored first, followed by an overview of the responses to item-by-item questions, for sake of organisation and to condense the report. Finally, the discussion examines several emergent themes and considers how the NBAS was adapted as a result of these findings.

Throughout, participants are identified by the letter “P” followed by their anonymised participant number, their relationship to the infant receiving the NBAS, their age in years, and in the case of quotations, the relevant question number.

5.2.3 *Qualitative questions*

For sake of brevity, only the summaries for responses to questions 5 and 6 (whether anything in the session was considered negative) and 7 (whether other parents would be likely to find a session acceptable) are given.

The behaviours and items seen in the NBAS were new for some observers, and were considered acceptable by all but two respondents. Only five respondents said that an item made them uncomfortable or was strange, and no respondents said that any items were disagreeable. The two respondents who noted an objectionable item during question 5 (whether anything had made them upset or uncomfortable), cited the light (habituation item) and undressing the infant. The three who responded in question 6 that something was strange did not seem to use this word to indicate something negative, but merely novel or unfamiliar.

Seven respondents who said nothing was strange or upsetting further explained their reasons, including that it was because they had allowed the session in

the first place, that they in fact liked what they saw, and that they had either seen the behaviours before or that the elicitation of items involved actions that were ‘normal’ for infants or infant handling. One mother’s response provided evidence that explaining the rationale of the session and what would happen, before beginning, is a crucial way of ensuring the parents feel happy with the session, as will be further discussed in this chapter. Another respondent’s seemingly irrelevant comment about provision of toys emphasised the importance of including the parents as participants in the research by explaining the purpose of the session and what it was measuring.

Sixteen of the 26 respondents for Q7 believed other mothers and fathers would find the NBAS acceptable. The remaining 10 respondents, rather than thinking other parents would find it unacceptable, said that they could not “speak for” other parents, some of whom might accept such a session and others of whom might not. This served as a reminder for examiners not to assume a given parent finds all NBAS items acceptable, and trainees were instructed to: explain the content of the session to parents beforehand; ‘talk through’ certain items; watch for any signs of discomfort in the parent; and invite comments and questions after the session. The ever-salient theme of research was mentioned by a father who was of the opinion that parents may be interested in taking part in the study if they know it is research, because a non-specified “result” or benefit may come of their taking part. Although the meaning of that statement it is not clear, it highlighted the importance of clearly stating the purpose of the NBAS, as will be further discussed.

5.2.4 Item by item feedback: Questions 11-32

Elders were thanked for their time after question 10. Mothers and fathers continued the interview by providing feedback on specific items. Respondents were instructed to evaluate each item or set of items as positive (good/interesting), neutral (acceptable/okay/fine), or negative (not acceptable/made you uncomfortable/you did not agree). Respondents gave these evaluations in words, which were later re-

coded into categories representing a negative (0), neutral (1), or positive (2) response. Table 8 provides examples indicating these 3 values.

Table 8. Examples of negative, neutral, and positive phrasing during NBAS feedback

Negative	<ul style="list-style-type: none"> • <i>Amangbeteata</i> (it's not good) • Statement about behaviour, indicating pain, even though not clearly saying the item is negative – “[She] feels some pain, that’s why she moved.” – Q20, P22, Mother, age 18 • “There is no problem except for that of [baby], his umbilical cord is big, so for him that is the only problem when it comes to placing him on his tummy.” – Q23, P15, Father, age 55
Neutral	<ul style="list-style-type: none"> • It’s fine • It was okay • No problem • That is nothing • I have no problem with that • That one is not good, but also not bad • I accept it • Statement about behaviour, neither positive or negative. E.g. “She’s feeling something, that’s why she moved.” – Q17, P22, Mother, age 18.
Positive	<ul style="list-style-type: none"> • <i>Abeteatale</i> (it’s good) [most frequent] • Yes, it’s not bad. It’s good • I like that • Very good • I appreciate it • Positive though not evaluative: “That shows her hands are strong, and her toes. It seems she is healthy.” – Q16, P22, Mother, age 18 • Yes, I accept it and I like it

Item-by-item analysis was more quantitative than for the first nine questions and questions 10 and 33, and were re-coded according to the afore-mentioned

system with comments only retained for negative appraisals, or when the quotation yielded unique information.

Summaries of the 22 parents' feedback to item-by-item questions about the NBAS administration are presented below, organised according to the following groupings: items administered during sleep states (Habituation Items), items administered in awake states relating primarily to muscle tone, motor tone and reflexes (Motor and Reflex Items), and items administered either in the alert or crying state (Orientation Items and Consoling). Where relevant, supplementary information from the more qualitative questions (Q1-10;33) is included.

5.2.4.1 Habituation items: Rattle (Q11), Bell (Q11), Light (Q12) and Foot (Q13)

Habituation items were rated as positive or neutral by most parents. One rated the rattle or bell as negative and three parents rated the light as negative. No parent said that the foot probe was negative, despite the sharp-looking shape of the probe¹⁷.

During the qualitative questions, two participants commented on the foot probe. One father (P8, age 32) said he did not know what "the thing on the foot" was, while a male elder (P24, age 70) described the probe in a positive light, saying that "... when you used the probe on the foot, he moved, so that shows that the baby is well and very strong ...". These two comments taken together give further evidence that the foot probe was mostly viewed as acceptable, but that parents may benefit from an explanation of the item before it is administered, or at least a demonstration that the probe is not painful. Trainees are typically instructed to demonstrate the probe on their own and the parent's hand, to show that it is not painful, as well as to ask

¹⁷ This may have been ameliorated because, as trained, the author always used the probe first on her own hand and then the parent's.

parents about any questions or comments they might have at the end of the session. These protocols were reportedly followed in both Keneba and Cambridge.

One parent gave negative feedback to the rattle or bell (Q11), at first stating that it did not surprise them, then, after taking a phone call, saying that it was not good. No further rationale was given so it is not possible to determine precisely the issue this parent had with the bell or rattle. Given that four respondents listed the bell or rattle during sleep as their favourite item during the qualitative questions, and that the other 14 parents who saw this item gave positive (N=12) or neutral (N=2) feedback, no adjustment was recommended.

Three parents stated during the item-by-item questions that they did not like the light item. Two young mothers (P16 and P21; ages 18 and 20) said that they did not like the light being shone on the infant's face or that it was "not good" (non-specific), and a father (P20, age 33) said that while he personally understood that the item was being done in the name of research observations and that he therefore accepted it, "elderly ones don't want the light to be put on the face," seeming to point to a non-directly referenced cultural belief. Interestingly, the oldest parents to see the light item (P17 and P12, age 68 and 80) did not report any problem with this item, with the older father giving positive feedback.

In fact, the only respondent to profess negative feedback about the light item during the qualitative questions was a less-than-middle-age mother (Q5, P3, Mother age 39), who answered 'yes' and cited the light in the question of whether anything had made her upset or uncomfortable. Considering other feedback from the qualitative questions, in which two respondents listed the light during sleep as their favourite item; the fact that most of the 15 parents who saw this item gave either positive (N=9) or neutral (N=3) feedback; and given the variation in feedback from parents with two giving negative feedback without rationale and another saying he

personally did not mind but that elderly persons would not like it (while the two eldest parents, age 68 and 80, gave neutral and positive feedback respectively), it was decided that this item did not require adjustment or removal. Rather, the importance of asking parents whether they had any questions or comments, and paying attention to any signs of discomfort during the session, was emphasised during training.

5.2.4.2 Motor/reflex items: Pull-to-sit (Q19), Defensive (Q26), Cuddliness (Q25), Undressing (Q18) and Reflexes (Q14-17; 20-24; 27-28)

Based on parents' feedback to the item-by-item questions, reflex and motor items were rated by most parents as being positive or neutral. Of the 15 questions related to the motor system and reflexes (including cuddling), 11 received only positive and neutral responses: passive tone in arms and legs; rooting and sucking; palmer, plantar, babinski and ankle clonus; glabella; undressing; pull-to-sit; placing; standing and walking; incurvation; crawl; tonic deviation ("spin"); cuddliness; defensive; tonic neck reflex; and Moro.

In one instance, a father described the rooting and sucking reflexes as "not a problem as long as you did not put anything on your finger to put it in his mouth. (...) Yes, there is no problem if there is nothing on your finger that will harm the baby." (Q14, P15, Father, age 55). Coupled with the fact that this particular participant frequently wanted to know the rationale behind the items, such a statement indicated some level of suspicion that the whole purpose of the visit had not been revealed.

This emphasised the importance of open and detailed information for participants not only about "what" will happen in a study, but "why" the study is being done, and also of providing a space for parents to ask any questions or make comments. Partly because of this participant, and due to the curiosity of several other parents, the local colleagues being trained in the NBAS were encouraged to always ask the parents at the end of the session if they had any question or comment.

It was surprising in the case of pull-to-sit and Moro that parents gave no negative feedback, given that the necessity of supporting a newborn's head seems to be an integral belief in many cultures (Joanna Hawthorne, personal communication).

Regardless of feedback, an alteration was made to the protocol for pull-to-sit following this pilot: since waist-height surfaces were rarely available, trainees were explicitly instructed, including formally in the written protocol, that pull-to-sit was *not* to be administered on the ground, as this carries greater risk of discomfort to the infant and administration errors. Rather, pull-to-sit should only be administered if the infant could be placed on a raised bed on a frame (e.g. not just a mattress on the ground) or a table, and that the examiner must get down to the infant's height where the surface is less than waist-high, in order to minimise risk of infant discomfort and to improve administration.

It was also surprising that none of the seven parents who observed the Tonic Neck Reflex (TNR) evaluated it negatively, as this is an aversive (though not painful) item that involves positioning the infant's head fully to the left and then to the right side while they are lying in supine, often causing fussing.

Few parents could comment on the cuddliness item, as it was only administered in front of three parents. This item simply involves holding the infant close to the body in a calm state, first horizontally in one's arm across the chest, and then vertically over the shoulder. It is possible that this item could have been received negatively by someone if more observers had seen it, but there is no reason to suspect this would be the case as it is a non-aversive item and a 'normal' way to interact with an infant in this setting (field observation).

The questions for the following four items had at least one negative response, further detailed below: undressing, placing, crawling, and defensive.

Only one parent gave negative feedback to the placing reflex and the crawling reflex. In the case of crawling, the negative feedback was specific to the individual infant, whose umbilical cord was not fully healed: “There is no problem except for that of [baby], his umbilical cord is big, so for him that is the only problem when it comes to placing him on his tummy (Q23, P15, Father, age 55)”. Therefore, advice was given to the trainees to be aware of the umbilical stump when deciding whether to administer the crawling reflex, possibly skipping it and doing so very gently if proceeding, taking special care to pay attention to the infant and parents’ cues.

Four parents saw the placing reflex, one of whom gave negative feedback. As with cuddliness, therefore, one must be wary of drawing a conclusion from such a small sample. Three of the parents gave positive feedback, one of whom qualified his response by saying that it was positive because of its rationale, perhaps indicating that while he accepted it as part of the research, there was something about it that he was not quite comfortable with: “Yes, it’s good, because you are trying to look at something. (Q20, P8, Father, age 32)”. The parent who gave negative feedback indicated that the placing reflex had caused her infant pain: “[She] feels some pain, that’s why she moved. (Q20, P22, Mother, age 18)”.

The reason this item was not administered in front of more parents in this pilot was that it requires a raised, flat surface, which is without any uneven edges, and under which the infant’s feet can be swiped to elicit the reflex to the top of the foot. As part of training, examiners are repeatedly warned to swipe the surface with their own fingers to check for rough edges, every time. Often there was no such suitable ledge in the compounds, so for this pilot it was simply omitted in the majority of cases. Following the pilot, the placing reflex was conducted by holding up the NBAS manual to use as a hard, even surface with no possibility of splintering or causing pain.

Undressing and the defensive item seemed to be the most controversial items in this set, with three parents giving negative feedback to each in the item-by-item questions. In the case of undressing, three of the 18 parents who saw the item responded negatively. Two young mothers said that it was “not good” (P16, Mother, age 18) or made them uncomfortable (P22, Mother, age 18). Another young mother gave a response that was neutral overall but still contained a partly negative evaluation: “That one is not good, but also not bad” (P21, Mother, age 21). One father gave neutral feedback, indicating that it was acceptable because it was part of research, saying “there is no problem because it is part of the observation – if you don’t do that you cannot see what you want to observe” (P8, Father, age 32).

One father, however, was explicit in his evaluation of the undressing as negative, explaining:

“(…) that one is not good because a newly born baby who is at this stage, not all the air is good for him so that is why we wrap babies in 2 or 3 clothes to prevent the air from reaching them. That’s why to remove all the clothes is not good. It’s just because it’s part of your work that I allowed you to do that.” – Q18, P20, Father, age 33

This father explained that he allowed the infant to be undressed because it was part of research, even though he believed it was not a good thing to do. This comment, taken together with other parents’ references to the research setting, largely informed the decision to emphasise that the NBAS trainees at both sites needed to prioritise sensitivity to parents’ reactions and respond to any signs of discomfort by asking the parent if they are feeling worried about anything or have any questions, and if they are, to reassure them that the item can be skipped, respecting the participant’s right to stop at any time. This kind of adaptation to examiner-observer communication is further described in the discussion.

Only one of the three respondents (P22, Mother, age 18), who had given negative feedback during the item-by-item questions had initially cited undressing as a negative action during the qualitative questions, citing it during Q5 as something that made her upset or uncomfortable. Even then, she had first laughed before making her comment, perhaps suggesting that it was uncomfortable for her to mention that she did not approve of the item. In addition to this negative feedback, two further answers conflicted, one seeming to say that it was good because the infant woke up when undressed (P14, Mother, age 30) while another said it was “not a problem, since you see he is not sleeping” (P15, Father, age 55) thereby seeming to imply that if the infant was sleeping during the item it would not be preferable.

Nevertheless, because only three parents found the item disagreeable, and because it is an important component of the NBAS in that it enables the examiner to correctly assess colour changes as well as letting all infants start at the same ‘baseline,’ NBAS trainees prior to the main study were instructed to undress the baby at least to a vest if wearing one, and to undress the infant completely at least for necessary items such as reflexes, and then to re-dress the baby for orientation items or if showing signs of autonomic stress, paying particular attention to the comfort of the parent in addition to the infant’s reactions.

The defensive item also received negative feedback from three of the 10 parents who saw it, and notably, the two parents who gave neutral feedback requested an explanation for the item before giving their feedback, perhaps indicating they were not sure whether they approved (Table 9).

Table 9. Requests for further information during defensive item feedback

<p>“That one, I don’t understand, why did you do that? [CB: <i>Explains</i>] It’s good [<i>Abeteata</i>].”</p>	<p>Q26, P19 Mother, age 38</p>
<p>“Why did you do that? [CB: To see his reaction – when the cloth is covering his eyes, what will he do? All babies are different, so it’s to observe, for your child, if the cloth is placed there, what does he do?] There is no problem with that also.”</p>	<p>Q26, P21 Mother, age 20</p>
<p>“Putting the cloth on his face, that is to make the child to be curious, so when you put the cloth on his eyes, do you see any action? [CB: What I observed is that when I put the cloth on the face, he shook his head.] Ok, there is no problem with that.”</p>	<p>Q26, P15 Father, age 55</p>

Of the three parents who gave negative feedback, one did not provide additional rationale¹⁸, saying simply, “That one is not good” (P20, Father age 33). Another explained that her infant felt uncomfortable during the item, and that she also felt uncomfortable: “[She] doesn’t feel comfortable because she showed the signs that she wants to remove it. Turning sideways. (CB: Did you feel uncomfortable?) Yes.” (P22, Mother, age 18). The third parent giving negative feedback stated explicitly that an infant’s eyes should not be covered: “He feels that. That’s why you see him shaking because the eyes should not be covered with something.” (P8, Father age 32). Interestingly, this same father cited the defensive in his answer to the first qualitative question (Q1), describing it both as something that “disturbed” the infant and that was “interesting” because of the infant’s response (Q1, P8, Father age 32).

To put the blanket on his eyes, because when you put the blanket on his eyes, you see him shaking, because his eyes are disturbed, so it’s interesting. - Q1, P8, Father age 32

¹⁸ One limitation to this pilot study was the lack of consistent translation *in situ*, which would have allowed clarification of such statements.

The defensive manoeuvre was retained, because two thirds of the parents who saw it gave positive or neutral feedback; however, this item was the most controversial within the reflex or motor items, and because of this feedback, examiners were trained to explain this item to parents before administering it. No parent stopped the exam to say that they did not feel comfortable with this item, perhaps indicating that they did not feel they could do so, so examiners were trained to watch for signs of discomfort in the parents and to respect their right to stop the assessment or skip the item where relevant. This 'explain and observe' approach was also indicated for the foot probe and Moro items.

5.2.4.3 Orientation items and consoling: Ball (Q29), Rattle and Rattle to Side (Q30), Face, Face plus Voice, and Voice to Side (Q31), and Consoling Manoeuvres (Q32)

Parents were receptive to the orientation items and to the consoling manoeuvres, with no negative feedback given.

Fewer parents saw the orientation items than the reflex, motor and habituation items, presumably because infants were less often in the required alert, available state than in sleep states or fussing and crying states. Based on experience from the caregiver interviews, the six orientation items were grouped into three questions (ball-based, rattle-based, and voice/face-based) to shorten the interview schedule. Most parents who saw the orientation items reacted positively (16 out of 22 responses; 73%), and none reacted negatively. Five of the six neutral responses (three from the same respondent) were comments on the infant's behaviour during the item, without an explicitly negative or positive conclusion (Table 10).

Table 10. Examples of neutral comments about orientation items

<p>“It shows that she started seeing.”</p>	<p>Q29 (Ball-based items) P22, Mother, age 18</p>
<p>“Yes, he can hear but his hearing is not that much because his maturity is not there yet.”</p>	<p>Q30 (Rattle-based items) P15, Father, age 55</p>
<p>“That shows that she can see.”</p>	<p>Q31 (Voice/Face items) P16, Mother, age 18</p>

Although these orientation items were consistently rated positively or at least neutrally and did not require any adjustment to administration, the fact that a number of parents described these items as assessing sight and hearing ability meant that trainees were taught to clarify that the NBAS is not a test of sight or hearing, and to describe the NBAS as an exploration of *what* the infant is doing and how they do it at a given moment, rather than a measure of *whether* they can do something. For this reason, it is critical for examiners to avoid prospective comments (e.g. “Now we are going to shake the rattle so that she will look at it,” etc.). Partly as a result of this pilot, and partly because of the NBAS training I received, this aspect was heavily emphasised to trainees at both sites, and written into the protocol.

Consoling was seen by seven parents, six of whom made positive remarks. The seventh made a neutral comment on the infant’s behaviour, saying “Yes, when she’s crying and you picked her up she is quiet, but if you don’t pick her up, she cries” (Q32, P16, Mother, age 18). There was no expectation that this item would be rated negatively, but there was some uncertainty as to how parents would tolerate and perceive their infants being allowed to cry for 15 seconds before any visible reaction from the examiner. Trainees are told to inform the parents about the consoling procedure when introducing the NBAS. It is the author’s personal habit to state this when introducing an NBAS, so it is likely these seven parents were prepared. It is unclear whether the same absence of negativity would be found if the examiner did

not make such a statement at the beginning. This kind of introduction was written into the NBAS delivery protocol for Cambridge¹⁹, and trained verbally in Keneba.

5.2.5 *The research setting of KW*

In addition to information provided directly about the acceptability of the NBAS, comments by respondents across the interviews contributed to an emergent theme: the unique situation of conducting NBAS's as a research measure in KW.

When giving feedback, respondents frequently referred to the fact that the NBAS was being done as part of research, with the underlying assumption – and sometimes explicit statement – that because the items were part of a study, they must be good, or at least not be harmful to the infant. This raises the question of whether this assumption, indicated by a significant number of respondents, might have influenced their answers. Namely, did respondents genuinely find the item acceptable, or did they say it was acceptable whether or not they had any reservations, because it was part of research and therefore must be acceptable? Table 11 provides example quotations that contributed to this emerging theme.

¹⁹ “Nothing I do in this session will cause your baby pain, but some of the things are stressful so I do expect that at some point in the session he/she may start crying. When that happens, I will lie the baby down and wait for 15 seconds, before I then try some things to see what helps him/her to calm down.”

Table 11. Example quotations about acceptability of the NBAS as research

<p>“That’s what I’m saying, it’s you who observed it, it’s because of your work you use that method, but if it was not part you would not do it. So I have no problem with it.”</p>	<p>Q16, P2, Father, age 47</p>
<p>“That one is not good because a newly born baby who is at this stage, not all the air is good for him so that is why we wrap babies in two or three clothes to prevent the air from reaching them. That’s why to remove all the clothes is not good. It’s just because it’s part of your work that I allowed you to do that.”</p>	<p>Q18, P20, Father, age 33</p>
<p>“That one also, it’s good because it’s all part of her job.”</p>	<p>Q24, P18, Mother, age 33</p>

Perhaps because KW residents are accustomed to participating in research, some participants seemed to express a high level of trust in the measure and in me as a researcher, as indicated in the quotations above. Also implied by some of the quotations is the sense that some items may have been permitted *only* because they were perceived as part of a study and therefore as safe. This level of trust promotes collaboration between residents and researchers, making it all the more important to ensure that the trust is warranted by relating to participants as collaborators; for example, by working to ensure participants are fully informed and able to ask questions at any point to receive further information.

Conversely, one participant seemed to express a degree of distrust that the author’s intentions had not been fully disclosed, in his comment that the sucking reflex, during which a gloved finger is inserted into the infant’s mouth, was acceptable “as long as you did not put anything on your finger to put it in his mouth” (Q14, P15, Father, age 55).

In large part because of this pilot and the author's experiences of being perceived as a researcher in KW, trainees were instructed to include parents in the observations and invite questions and comments, as well as explaining the purpose and process of the NBAS before beginning.

Additionally, respondents frequently speculated about the rationale for the items, and while many guesses were essentially correct, others were beyond what the NBAS claims to measure. For example, in response to Q4, one elder explained:

"Now what I observed, sometimes you see somebody who goes up to 10 years you begin to feel some pain with the joint and the head and the muscles. That's what I think she is trying to observe, whether when the child grow up whether the muscles and the joints will be strong enough to do whatever he is wanting to do." – P25, Male Elder, age 80

Another respondent (P4, Father, 41), though certainly not the only one to make this assumption, surmised regarding the habituation items that "the reason why you make it is for you to notice whether he can hear, and you can see that." As discussed previously and as will be discussed further in the section about adaptations, the NBAS is not a test of hearing, sight, or future strength. Rather, it is an observation of the neuro-behavioural profile of a given infant in a given moment, and is in no way medical or diagnostic. Respondents' speculations about the purpose of using the measure in research served as further encouragement to provide a full explanation of the NBAS before beginning.

Finally, as previously described in discussion of the defensive item, the fact that several parents withheld their judgement until the item's rationale was given supported the overall theme of the unique context of conducting research in KW. Requests for an explanation suggested that, for at least some respondents, merely observing the items was inadequate when deciding whether the item was acceptable,

and further information about *why* it was conducted was required. In part because all NBAS and Newborn Behavioural Observations system (NBO) trainees are encouraged to collaborate with parents, share observations, and invite comments and questions, and in part because of some highly engaged and curious respondents during this pilot, trainees were encouraged to relate to parents as participants in, rather than passive observers of, their infant's assessment.

Such a combination of respondents who required further information, respondents who through incorrectly guessing the rationale revealed that they did not understand the purpose of the session, and respondents who seemed to accept the session primarily because they trusted it as part of a research study, all contributed to the sense that KW is a very particular context in which researchers are afforded a high degree of trust. The benefit may be a rapport or ease in working with participants, but the danger may be that parents make assumptions about the rationale or safety of a study based on this trust. In such a context, ensuring that participants are fully informed of both process and purpose of a given study is vital, even if a particular participant is content to trust the researcher without it.

5.3 Discussion

5.3.1 *Summary of results*

Conducting pilot NBAS sessions and seeking feedback from the parents and elders observing them yielded useful information about the NBAS's overall acceptability, and, largely through item-by-item feedback, informed modifications to the NBAS training for the main study.

The majority of respondents viewed the NBAS as an acceptable tool. Of the 22 item-by-item questions covering 32 NBAS items, only six received any negative feedback from the 22 parents interviewed at item-by-item level. Shaking a rattle and bell during sleep, the placing reflex, and the crawling reflex each garnered a single

negative comment. Undressing the infant, shining a light across the infant's eyes while asleep, and covering the infant's eyes while awake each received three negative appraisals. Some practical modifications were made as a result of this feedback and of conducting the NBAS items in a new environment, including, for example, the observation that homes did not tend to have a flat, smooth, raised surface on which to conduct placing, standing, and walking and pull-to-sit reflexes. These adaptations will be further explored under the next heading.

The main 'adaptation' suggested by this pilot, due to the unique research-oriented setting of KW, was the importance of maintaining a collaborative partnership with the observing parents. Encouraged during training in both sites was that examiners should:

(a) give a full explanation of the rationale and process of the NBAS before beginning, including the purpose of the session; what it is and is not (e.g. that it is not diagnostic, or a sight or hearing test); the kinds of items that will be observed; that nothing causes pain but that the infant will likely cry during the assessment and what will happen when they do,

(b) state the purpose and process of specific items during the session that may be considered more aversive (e.g. the foot probe, pull-to-sit, defensive, and Moro),

(c) make observations out loud as they conduct the assessment, avoiding prospective comments, and pay attention to any signs of discomfort or concern in observing parents; and

(d) invite and encourage the parents to ask questions or make comments at the end of the session.

In other words, training emphasised relating to the parents as co-observers in the NBAS, respecting their right to be fully informed and involved, and acknowledging their status as collaborators rather than passive recipients in the research.

5.3.2 Adaptations

Adaptations were largely restricted to minor practical adaptations and increased emphasis on assessor-observer communication during training.

Because the negative feedback to the crawling reflex was simply a statement by one father that although there was no problem in general, he was concerned due to his baby's protruding umbilical cord, it was decided that no major adjustment was required, and trainees were told to be aware of any infants whose umbilical cord had not yet fallen off and to perhaps skip this item in such cases.

Objection to shaking a rattle and bell during sleep was comprised of a single negative comment which was not expounded upon; given that all other 14 parents to see the item gave positive or neutral feedback, with four respondents listing one of these as their favourite part of the session, this item was not adapted.

The placing reflex was only demonstrated to four parents, one of whom said it caused her infant pain. It is likely that this item was only administered in front of four parents due to a lack of raised, even surfaces; following this pilot, the NBAS manual was used for training and study NBAS's in KW as a surface known to be safe and not to cause pain.

Although rated as neutral or positive by the majority of respondents who saw them, shining a light across the infant's eyes while sleeping, undressing the infant, and the defensive manoeuvre (covering the infant's eyes with a cloth) were comparatively more controversial as they received three negative comments each. Due to the low proportion of negative appraisals, these items were not removed from the session. Rather, they received special attention during training in terms of communication with the observing parents and the importance of monitoring parents for any signs of discomfort.

5.3.2.1 *Light (Habituation)*

Given that the majority of the 15 parents who saw the light item gave positive or neutral feedback, and given the variation in feedback, this item did not require adjustment or removal. Rather, the importance of asking parents whether they had any questions or comments, and paying attention to whether they showed any signs of discomfort during the session, was emphasised during NBAS training at both sites.

5.3.2.2 *Undressing*

In the case of undressing, a cultural belief seemed to be the reason for one of the respondent's statement that newborns should stay wrapped in several layers. The two young mothers giving negative feedback did not further qualify their responses, but the father explained that "not all the air is good for him so that is why we wrap babies in two or three clothes to prevent the air from reaching them. That's why to remove all the clothes is not good" (Q18, P20, Father, age 33)". Another father (P8, Father, age 32) indicated that it was acceptable because it was part of research, but was not necessarily positive about it.

Indications of allowing the item to be done only because it was part of research emphasised the importance of sensitivity to parents' reactions. Because only three parents found the item disagreeable, and because it is an important component of the NBAS that facilitates all infants starting at the same 'baseline', NBAS trainees in the main study were instructed to undress the baby at least to a vest if wearing one, or to undress the infant for necessary items and then to re-cover the baby for orientation items if needed, with special attention to the comfort of the parent as well as to cues of stress in the infant.

5.3.2.3 *Defensive*

For the defensive item a higher proportion of parents gave negative feedback (3 of 10) and the two parents who gave neutral feedback requested an explanation

for the item before giving their feedback, perhaps indicating they were not sure whether they approved. Of the three parents who gave negative feedback, one did not provide any additional rationale, another explained that she and her infant felt uncomfortable during the item, and the third stated explicitly that an infant's eyes should not be covered, seeming to allude to a cultural belief. The defensive item was retained, as two thirds of the parents who saw it were positive or neutral, but this item was the most controversial and based on the feedback, examiners were trained to explain this item in particular to parents before administering it, to be aware of discomfort in the parents, and to respect the parents' right to stop the assessment or skip the item. Such an approach of explaining before administering was trained especially for this item as well as for foot probe, pull-to-sit, and Moro as this took place during the author's own training in the UK for these potentially more aversive-looking items.

5.3.2.4 Other minor practical adjustments

The pull-to-sit and placing reflex also benefitted from some physical adaptation based on experience during this pilot. After noticing that waist-height surfaces were rarely available in the respondents' homes, trainees in both sites were explicitly instructed *not* to administer pull-to-sit on the ground, as this carries greater risk of discomfort to the infant. Rather, pull-to-sit should only be administered when a raised surface is available, and only with the examiner eliciting the response at the infant's height. For a similar reason – the absence of flat surfaces with smooth edges – trainees were instructed to use the NBAS manual as the surface against which to elicit the placing reflex, as it is always taken to NBAS visits and should not cause the infant pain.

Negative feedback given in the case of sucking and the crawling reflex provided insights that, while not requiring direct adaptation to the items themselves, were incorporated into training. In the case of crawling, trainees were advised to be

aware of an infant's umbilical cord where relevant, paying attention to infant and parent cues.

One father said that the rooting and sucking reflexes were “not a problem,” as long as I had not placed any substance on my finger without his knowledge that would harm the infant. As was discussed above, this emphasised the importance of open and detailed information for participants not only about “what” will happen in a study, but “why” the study is being done, and also of providing a space for parents to ask questions and make comments.

Finally, although the orientation items did not receive any negative feedback and did not require any adjustment to administration, a number of parents seemed to perceive them as tests for vision and hearing. One respondent seemed to think the same for the habituation items. Therefore, it was emphasised during training that the NBAS is *not* a sight or hearing test. Partly as a result of this pilot, the importance of explaining to parents that the NBAS is not a test of what the infant can do, but an observation of what the infant is doing at a particular moment in response to the assessment, was emphasised during training at both sites.

In short, a total of 11 months' training was required to train and certify the two KFS staff administering the NBAS in KW, including these adaptations. Aside from the author, who had been previously certified, a total of 9 months was required for training and certifying the four members of staff based in the UK, largely due to staff turnover.

5.3.3 Low level of negative feedback

The NBAS is intended to be culturally flexible and none of the items cause the infant pain; the rationale for this pilot was the possibility of any items making parents

uncomfortable due to cultural variations in caregiving practices and newborn handling.

There was a surprisingly low degree of negative feedback. This suggests that the parents and elders in these interviews largely found the NBAS items acceptable and positive. However, consideration of the comments made regarding acceptability of some items in the context of a research study indicated that at least for some respondents, the items were rated as acceptable or positive simply because they were presented as part of research. For example, when asked, three parents objected to their newborn being undressed, and one father explained the rationale of a shared belief that infants in the newborn stage should remain covered to protect their bodies from the air. None of these parents, however, gave signs of distress during the session – at least none visible to the examiner – or asked for their infant to be re-covered.

Similarly, although three parents each, when asked, were also critical of the light and the defensive, none of these parents requested the items to be stopped or skipped. Such a pattern suggests that at least some handling or interaction with the infant during the NBAS, for at least some parents, might typically be considered inappropriate, but that for whatever reason, no objections were raised until invited.

This may suggest that some respondents did not feel that they could request an item to be stopped or skipped. It may be that these parents are accustomed to participating in studies and trust researchers not to do anything that will harm their infant. Perhaps there was some degree of perceived power differential such that a parent might not have felt able to request omission of an item. Or perhaps the items were not perceived as negative enough to interrupt the session but nonetheless were undesirable to the respondents who gave a negative evaluation when prompted.

The trust between researchers (including NBAS examiners) and participants is predicated upon full disclosure of information and rationale, as well as the duty of the researcher/examiner to respect the right of the parent/participant to stop at any point, as well as making observations of parental comfort as he/she proceeds, and inviting questions and comments. With the importance of this trust in mind, the KFS trainees were instructed using a protocol involving all of the above means of communicating respect and collaboration.

5.3.4 *Usefulness of asking for item-by-item feedback*

Asking in-depth questions about the items specifically, rather than just asking the initial, broad questions, was useful in that it revealed several respondents' perceptions not stated during their answers to 'overall' questions. For example, P16 (Mother, age 18) said in Questions 5 and 6 that nothing had upset her or bothered her, and in fact said she thought other parents would enjoy the session, but in item-by-item Q12 she admitted that she did not like the light item – “putting the light on the face, I don't like that” – and in item-by-item Q18 explained with regard to undressing, “that one is not good (*amangbetzata*)”. Likewise, neither P22 (Mother, age 18) or P20 (Father, age 33) mentioned the defensive in the qualitative questions, but when asked directly in Q26, they rated this item negatively, P22 saying it made her uncomfortable and P20 saying it was “not good”.

Another participant (P21, Mother, age 20) seemed to find all items acceptable given her responses during the first 10 questions, but in the item-by-item feedback she identified two items she did not like. Her answer to Q1, her favourite part of the session, was “all of them”. She identified the light as something that made her surprised or interested in Q2, as well as her baby's reaction to the light being something new that she had learned about her baby. In Q5 and Q6 she said she was not angry or upset, and that nothing made her uncomfortable. Furthermore, she said in Q7 she thought other parents would find the session acceptable; however, in

response to item-by-item Q12 (light), she said that the light item was not good. Although they seemed to find all items acceptable during the open questions, these three respondents rated at least one item negatively when asked to give their opinion about the items specifically.

These respondents omitted mentioning undesirable items when asked about the session as a whole, but seemed more comfortable expressing their opinion when asked about the items in detail. Perhaps asking a question of researchers unless prompted directly is not typical in this setting. A previous report regarding mothers and health care workers is congruent with this possibility. In Anya, Hydera and Jaiteh's study (Anya et al., 2008) in an urban area of The Gambia, only 12.8% of the 457 pregnant women who filled out questionnaires in 2004 in the three urban districts of Banjul, Brikama, and Kanifing had reported asking any questions to their antenatal healthcare provider during appointments, and 70.6% reported that they had spent 3 minutes or less with their provider. Perhaps asking questions of 'professionals' or spending time discussing and asking questions or giving feedback to a health care provider is not culturally normative in that coastal district; or perhaps, in a setting perceived to be related to a health care setting, little time was expected and asking questions or giving their own opinions was not anticipated. Of those who did ask questions, 94.8% said that they understood the answers given, indicating that discussion is largely conducive to knowledge transfer when it does happen.

Relating to the current study, when the session with the health care practitioners is not "rushed," the dynamic may change, as Anya and colleagues presume. Asking and re-asking questions, as well as leaving a space for each participant to ask questions or make comments generally, may have indicated that the author was not in a hurry and wanted to elicit their genuine opinion. Of course, these findings may be less relevant in rural KW than in an urban area, so no direct conclusion can be drawn. However, 192 women in the aforementioned study were from 'urban' areas, and 192 from 'rural' areas, lending some possibility for relevance.

Regardless, requesting feedback item by item in the present study may have merely been a prompt for recalling all they had seen so that they could recall what they did or did not like, but equally, asking for feedback for each NBAS item specifically may have clarified to respondents that their honest opinion was invited.

5.3.5 *How do these findings compare with other studies?*

'Acceptability' is measured in a variety of research areas, especially when trialling a new medication or therapy, or when preparing a standard measure for a new population. Such acceptability studies tend to report that measuring acceptability is a crucial component of piloting, but few give a clear definition of what is meant by acceptability, and many seek perceptions from professionals or researchers who are familiar with a given setting, population or issue, rather than from members of the population, or those who would be using the new measure, drug, or therapy themselves. For example, one study in South Africa (Pascoe & McLeod, 2016), consulted speech and language therapists to determine acceptability of a translated parent-report scale of children's speech, and another group in the US (Auerswald, Sugano, Ellen, & Klausner, 2006) assumed 'acceptability' based on how many participants completed a treatment protocol.

In terms of research specifically on the NBAS or NBO, there have not been any formal pilot assessments of the scales' acceptability to parents in other contexts, although these tools have been used in a wide range of contexts beyond their original setting in the US. Though no acceptability studies *per se* were available, informal observations of NBAS and NBO practitioners in other contexts²⁰ indicated a similarly high degree of receptiveness to the sessions by parents, as reported in this sample.

²⁰ Following an unsuccessful literature search, the author contacted the heads of both the Brazelton Centre in the UK, and the original Brazelton Institute in the US, as well as clinicians and researchers utilising the NBO or NBAS in cultures outside the US where the scales were developed

The Ububele Centre in Johannesburg, South Africa, did not find any “major resistance” to items in the NBO, although there were initial concerns by the trainees about how the pull-to-sit item and undressing would be perceived (Nicki Dawson, 2017, personal communication). The only hesitancy reported during Ububele NBAS sessions was the reluctance of some mothers regarding their infant being woken up, presumably during habituation items, and the single occasion of a “strong negative reaction” to the rattle during habituation, as it may have been perceived as spell-casting (Dawson, 2017, personal communication.)

According to Yvette Blanchard (2017, personal communication), resistance to certain items by parents from given cultures is purely “anecdotal,” though as with the lone participant in this sample who was suspicious of the motives behind the sucking reflex, she found that Haitian parents did not want their infants to suck on a finger. Unlike the present sample, however, she also noted that Haitian parents did not approve of their infants sucking on a pacifier, a finding not noted in this sample. Consistent with the adaptations made during training in KW, despite not conducting any formal assessment of acceptability, Blanchard takes the approach of maintaining a dialogue with parents during an NBAS, asking questions and inviting feedback, because “even within the same ethnic/cultural group, you will find differences between individuals” (2017, personal communication).

Other assessments of newborn behaviour, in large part practically and theoretically resembling the NBAS, likewise lack published appraisals of acceptability. Neither the Einstein Neonatal Neurobehavioral Scale (e.g. Majnemer, Rosenblatt, & Riley, 1994), Neurobehavioral Assessment of the Pre-term Infant (e.g. Korner et al., 1994), Assessment of Pre-term Infant Behavior (Als, Butler, Kosta, & McAnulty, 2005), Alberta Infant Motor Scale (Darrah, Piper, & Watt, 1998), Test of Infant Motor Performance (e.g. Campbell, Kolobe, Wright, & Linacre, 2002), Infant Behavioral Assessment and Intervention Program (e.g. Koldewijn et al., 2005), nor the Mothers’

Assessment of the Behavior of her Infant (e.g. Field, Dempsey, Hallock, & Shuman, 1978) have published information on the reaction of stakeholders in original or subsequent contexts.

Similar assessments considering infant behaviour outside of the newborn period have likewise not undergone formal piloting to assess cultural acceptability or need for adaptation in other populations based on parent feedback, or at least such research has not been widely published. For example, the Bayley Scales of Infant Development, despite being piloted in Ethiopia for validity and reliability, and in Nigeria for deriving a normative data set for that setting, was not assessed for acceptability in these populations (Aina & Morakinyo, 2005; Hanlon et al., 2016).

Perhaps such pilot work is conducted in an informal way (e.g. chatting with clinicians and volunteers, and 'trying out' variations, rather than piloting or consulting), or is not documented, or perhaps the *manner in which* the adaptations are selected is not considered to warrant dissemination in the same way as is the resulting 'version' of the measure. Especially in under-staffed small projects, work occurring within a strict timeline that has not accounted for it, or in contexts where the focus is on clinical care or other 'urgent' output, it may be that measures, whether questionnaires or behavioural assessments, are not routinely subjected to a formal procedure for cultural adaptation; or, at least, these procedures are not published.

A final possibility explaining a lack of formal, published adaptation, at least tools assessing newborns, is that authors may adopt an evolutionary perspective – as with the Assessment of Pre-term Infant Behaviour, for example – which presumably would reduce considerations of contextual or environmental influences, and therefore reduce perceived need for acceptability testing. Alternatively, perhaps for those assessments conducted in a clinical or hospital environment primarily for medical or research purposes, consideration of parents' perspectives are less salient topics for research than the ability of the items to elicit measurable information.

In any case, Hambleton and De Jong's (2003) call for documentation of questionnaire translation, and the dissemination of such work, is applicable to assessing the receptivity and subsequent adaptation of psychological and behavioural assessments as well, including the NBAS. Such research would allow for a preliminary cross-cultural comparison of newborn handling beliefs, and assessment of newborn behaviour that is more appropriately tailored to the widely varying settings in which infants are developing.

5.4 Conclusion

This pilot proved a useful way to explore parents' receptiveness to the NBAS in a country in which it had not previously been used, and to consider any need for contextual adaptation. The majority of parents were positive to most of the items, and the few items with negative feedback produced a small number of negative responses, indicating that the NBAS was, overall, an acceptable and culturally appropriate tool in its original format.

Taking on board the feedback from this pilot led to several minor adjustments in order to adapt the tool for KW: namely, emphasising certain aspects of examiner-parent communication during training and in the protocols (e.g. avoiding prospective comments, informing parents about the defensive and pull-to-sit items before doing them, looking for any signs of parental discomfort, inviting questions and comments, stating that the NBAS is not a vision or hearing test, and giving information about crying and consoling before starting the session), as well as three physical adjustments (using the NBAS manual to conduct the placing reflex, checking for an umbilical cord before doing the crawling reflex, and only doing the pull-to-sit on a raised surface from the infant's height). Other than the need for these slight adjustments, respondents overall found the handling and engagement comprising the NBAS to be an acceptable way of observing newborn behaviour in KW.

Having now described the results of the preparation phase, the following chapter presents the demographic features of the main study sample in KW. Next, chapter 7 presents the prevalence rates and descriptive statistics of each of the measures of interest, including whether scores stay stable or change over time. The final results chapter then assesses how these measures of interest inter-relate.

6 Main study core sample characteristics

6.1 Introduction

This first quantitative results chapter provides a description of the selection of the core sample in KW, its key demographic features, and any differences with the full, potential sample. A comparison follows of core sample demographic features with previous groups of participants in KW and other samples in The Gambia.

6.2 Selecting the core sample from Kiang West

After a final request for data, the information from all mother-infant dyads who had participated in BRIGHT by providing data by the 5th of October 2017 (N=165) was sent to the author, from which the final set of dyads for the present study was selected.

The core sample was comprised of dyads who provided data for at least three of the four key visits relevant to this study: antenatal, 7-14 days, 1 month, and 5 months. Data from the birth visit was utilised in the analyses but having data available from the birth visit was not an inclusion criterion, as this data was not initially collected consistently from the KW participants due to communication errors between VA's and midwives that were subsequently rectified.

From the 165 dyads with data at one visit or more as of 5th October 2017, 42 had been subsequently withdrawn from the BRIGHT study at an early stage, primarily due to the mother moving away from KW. Of these 42 available infants withdrawn from BRIGHT, 36 were also excluded from the core sample of this thesis because they had been withdrawn from the study at or before the 7-14-day visit, primarily due to the mother moving away from KW but also including 12 infants who were stillborn or passed away during the neonatal period. The remaining six infants who had been withdrawn from BRIGHT but retained in this thesis included five infants who were not

withdrawn until after the 1-month (N=2) or 5-month (N=3) visit, either on medical grounds or due to moving away, and one infant who passed away after the 5-month visit. These six infants were retained for analysis in the core sample as they had attended three or more visits before being withdrawn. Ten ‘pilot’ participants were also excluded because they only provided data for the 1-month visit, and a further 13 participants were excluded as they had missed three or more visits out of the four visits most relevant for this study.

The core sample, therefore, was comprised of 106 dyads, 67 of whom provided data for all key visits. The remainder provided data for three of the four visits, as detailed in Table 12 below. The exception was a participant who had missed three visits but was retained because their 1-month mother-infant interaction (MII) video had already been coded and MII data was available for a limited proportion of the sample.

Table 12. Participants in the core sample for the four key visits, and birth visit

Visit	Antenatal	Birth	7-14 days	1 Month	5 Months
N	90	85	97	101	96

Note: Total participants in final set = 106. 67 of these sets have at least partial data from 4/4 visits; the rest (with one exception) have at least partial data for 3/4 visits

These numbers indicate the total number of dyads who provided data on at least one measure at that time point; however, some participants provided, for example, anthropometric data but not mental health questionnaires. The number of participants providing data for each measure is provided in Table 13 below.

Table 13. Core sample participants with data for each visit and measure

	34-36 wk	Birth		7-14 days		1 month		5 months	
Measure	EPDS	BW	GA	NBAS	SES/demog.	EPDS	GRSMII	EPDS	GRSMII
N	88	79	79	93	97	94	49	91	43

When core sample participants had missing data for a visit, the primary reason was that the family had travelled away from KW temporarily and did not return in time for the measures to be taken²¹. A series of chi-square, Mann-Whitney U, and independent samples t-tests were used to compare participants with missing data (as represented by EPDS or NBAS data as appropriate) to those without missing data at each visit, on the following demographic variables: infant gender, maternal occupation, family arrangement, SES, maternal parity, maternal education, maternal age, and infant BW and GA. With little exception, infants and mothers with missing data were similar overall with regard to these key demographic characteristics to those who did not have missing data, at each of the four key visits.

Families living in 16 of the 36 villages in KW were invited to join the study, with families from 15 of these villages represented in the core sample, as outlined in Table 14. The majority of participants in the core sample (N=106) were recruited from Keneba (20.8%) itself, with higher proportions from geographically proximal villages such as Manduar, Kuli Kunda, Kantong Kunda, Jali and Jiffarong (see map on Figure 1 in chapter 3).

The villages remained roughly proportionately represented in the core sample, with the exception of 10 participants lost from Kuli Kunda, reducing the representation from 11.5% in the available sample to 8.5% in the core sample; the proportion from Jiffarong rising from 9.1% in the available sample to 12.3% in the core sample; and the lack of representation in Dumbuto, where the only participant recruited was later excluded from the core sample.

²¹ With the exception of the 7-14-day visit in the earliest months of BRIGHT, when miscommunication with VA's also resulted in missing data.

Table 14. Recruitment villages

Village	Available participants (N=165)	Participants in core sample (N=106)
Keneba	34 (20.6%)	22 (20.8%)
Kuli Kunda	19 (11.5%)	9 (8.5%)
Kantong Kunda	18 (10.9%)	10 (9.4%)
Jiffarong	15 (9.1%)	13 (12.3%)
Jali	14 (8.5%)	9 (8.5%)
Manduar	12 (7.3%)	10 (9.4%)
Jattaba	12 (7.3%)	9 (8.5%)
Karantaba	8 (4.8%)	4 (3.8%)
Bajana	8 (4.7%)	5 (4.7%)
Sankandi	7 (4.2%)	3 (2.8%)
Janneh Kunda	5 (3%)	2 (1.9%)
Tankular	4 (2.4%)	4 (3.8%)
Kemoto	4 (2.4%)	2 (1.9%)
Joli	3 (1.8%)	3 (2.8%)
Dumbuto	1 (0.6%)	0 (0%)
Gissay	1 (0.6%)	1 (0.9%)

6.3 Descriptive statistics – core sample in KW

Birth and delivery information such as delivery mode, infant BW, gender, and gestational age (GA) was recorded by a KFS midwife within 72 hours after birth.

At the 7-14-day visit, participants orally completed a questionnaire to provide demographic information and details about their socio-economic situation (SES). These questionnaires were based on measures developed for a previous study on growth and nutrition in KW (Watson et al., under review). Demographic items included parents' date of birth (DOB), education level, parity and place of birth.

Socio-economic items included parental primary occupation, animal ownership, family income, and details about home utilities such as water sources, electricity, and cooking fuel, among other items. Using the methodology of the questionnaire's developers (Watson et al., under review), the three questions regarding materials used in the wall, floor, and roof of the mothers' living quarters were weighted and summed to create a ranking for the infant's socio-economic environment. SES data was not obtained for five of the 106 core families, and information relevant to the SES coding schema as per Watson and colleagues was not available for a further five participants, meaning SES ranking was not possible for 10 of the 106 core families in total. The use of this ranking protocol had some limitations, as will be discussed at the end of this chapter. Key sample characteristics are outlined in Tables 15-18, below.

Table 15. Key sample characteristics – Mothers

		N (cumulative %)
Born in The Gambia		
	8 missing	96 (90.6%), valid % = 98
Age when study infant born		
	20-24 years	29 (27.4%)
	25-34 years	41 (38.7%)
	35-44 years	23 (21.7%)
	Missing data	13 (12.3%)
		<i>Mdn</i> = 29 years (IQR = 24, 34.5) <i>M</i> = 29.47 years (<i>SD</i> = 6.374)
Primary occupation		
	Agricultural: Farming	63 (59.4%)
	Trade or other paid work: Tradesman, “Employed”	3 (3.7%)
	Not in paid work: “Housewife”	34 (32.1%)
	Missing data	6 (5.7%)
Parity		
	Primiparous	15 (14.2%)
	Multiparous	89 (84%)
	Missing data	2 (1.9%)
		Median (IQR) and Mean (SD)^a
Years of schooling		
	5 missing	<i>Mdn</i> = 0 years (IQR = 0, 6) <i>M</i> = 3.02 years (<i>SD</i> = 4.135)
Number of children		
	5 missing	<i>Mdn</i> = 5 children (IQR = 2, 6) <i>M</i> = 4.29 children (<i>SD</i> = 2.426)

Note a: Median and mean both reported for variables with non-normal distributions to allow for comparison with other studies

Table 16. Key sample characteristics – Fathers

		N (cumulative %)
Born in The Gambia		
	9 missing	94 (88.7%), valid % = 96.9
Paternal age when study infant born		
	25-34	10 (9.4%)
	35-44	22 (20.8%)
	45-54	5 (4.7%)
	55-64	6 (5.7%)
	65-74	1 (0.9%)
	Missing data	62 (58.5%)
		<i>Mdn</i> = 39.5 years (IQR = 35, 45) <i>M</i> = 42.18 years (<i>SD</i> = 9.881)
Paternal primary occupation		
	Agricultural: Farming, fishing, herding	44 (41.5%)
	Trade or other paid work	54 (50.9%)
	Not in paid work: Student, “Not working”, Retired	3 (2.8%)
	Missing data	5 (4.7%)
		Median (IQR) and Mean (<i>SD</i>)^a
Paternal schooling (years)		
	6 missing	<i>Mdn</i> = 4 years (IQR = 0, 12) <i>M</i> = 5.06 (<i>SD</i> = 5.295)
Paternal number of children		
	5 missing	<i>Mdn</i> = 6 children (IQR = 2, 10) <i>M</i> = 7.00 children (<i>SD</i> = 5.675)

Note a: Median and mean both reported for variables with non-normal distributions to allow for comparison with other studies

Table 17. Key sample characteristics – Families

		N (cumulative %) [valid %]
Socioeconomic ranking		
	Lowest Extremes	9 (8.5%) [9.4%]
	Lower-to-Middle Minority	20 (18.9%) [20%]
	Middle-to-High Majority	58 (54.7%) [60.4%]
	Highest Extremes	9 (8.4%) [9.3%]
	10 missing	10 (9.4%)
Family arrangement		
	Not married	1 (0.9%)
	Monogamy	65 (61.3%)
	Polygamy	35 (33%)
	Missing data	5 (4.7%)

Table 18. Key sample characteristics – Infants

		N (cumulative %)
Gender		
	Boys	51 (48.1%)
	Girls	55 (51.9%)
Delivery Mode		
	Vaginal delivery	98 (92.5%)
	C-section	1 (0.9%)
	Missing data	7 (6.6%)
Term classification at birth		
	Pre- and early term (< 38.9 weeks)	35 (38.5%)
	Full- and post-term (> 39 weeks)	34 (37.4%)
	Missing data	22 (24.2%)
		Mean (SD)
Birth weight (Kg)		
	27 missing	3.07 (0.347)
Gestational age at birth (weeks)		
	27 missing	38.9 (1.185)

Parental place of birth was missing for eight mothers and nine fathers; 98% of the mothers and 97% of the fathers for whom demographic data was available were from The Gambia. The five parents not born in The Gambia were born in neighbouring West African countries: Ivory Coast (one mother), Senegal (two fathers; one mother), and Guinea (one father).

Parental ethnic group (e.g. Mandinka, Fula, Wolof, etc.) was not measured in this KW sample; however, being a fluent Mandinka speaker was a requirement for inclusion.

Mothers' ages in the core sample ranged from 20 to 44 years ($M = 30$ years), and fathers ranged from 28 to 70 years ($M = 42$ years). Parental ages were not queried directly, but were calculated by hand from the target parent's year of birth and their infant's year of birth. Where infant DOB was missing, the year 2016 was used for the first 69 IDs (where only two infants were born in 2017) and the year 2017 was used for infants after the 70th ID (where only one infant was born in 2016). Thirteen mothers did not know the year of their birth so it was not possible to calculate this information. The DOB for 62 fathers was unknown, likely because the father was not present at the 7-14-day visit when demographic details were taken, so fathers' age at infant birth was unknown for over half of the sample.

Education level for the purpose of this thesis was quantified as the number of years of schooling. The range was 0 to 12 years of schooling for both mothers and fathers, but mothers reported a median of 0 years of schooling (IQR = 0, 6) and fathers reported a median of 4 years (IQR = 0, 12).

In terms of SES, dyads providing this data ($N=96$) could be fit into four groups. The possible scores ranged from 2.6 to 3.9. Of those with SES data, over half (60.4%) had the same higher-middle score of 3.7. There were only nine dyads (9.3%) with a

higher score than 3.7. Twenty dyads (20%) had a score between 3.1 and 3.6, falling in the truly low-middle to middle range. No dyads had scores between 2.7 and 3. The same number of participants had the highest SES scores – nine dyads (9.4%) – as the lowest SES score of 2.6.

Parental occupations differed for mothers and fathers. The majority of mothers (59.4%; 65% for those with demographic data [valid %]) reported their primary occupation as agricultural work, with a third (32.1%; valid % = 34) self-identifying as “housewives.” Only three mothers reported a trade or other form of paid employment (1.9%; valid % = 2). A higher percentage of fathers were in some form of paid work (50.9%; valid % = 53.5%), and reported a wider range of occupations, including agricultural work (41.5%; valid % = 43.6%) such as farming, herding, and fishing, and other forms of paid work including tradesman, craftsman, tailor, driver, contractor, “Marabout” (folk medicine / witch doctor), construction, carpenter, “business,” painter, and those who travelled, presumably to seek employment. Only 2.8% of fathers (valid % = 3) did not report any form of work, about the same percentage as mothers who reported being in paid employment. This is concordant with the qualitative results in chapter 4 indicating a tendency for mothers to work inside or near the home in unpaid work such as domestic care and gardening, and for fathers to work outside the home in paid employment.

Despite reports of the common household arrangement of polygamy (for example, Hennig and colleagues' [2015] report of the region found over half of households had a polygamous arrangement), in this sample, only a third of participants had fathers reporting a polygamous arrangement, with 61% reporting a monogamous arrangement, and only one participant's father reported being single.

Perhaps due to the disparity in age, mothers' and fathers' parity differed, with mothers reporting between one and 10 children (*Mdn* = 5, *IQR* = 2, 6) and fathers

reporting between one and 23 children ($Mdn = 6$, $IQR = 2, 10$). Mothers' average parity in this sample is similar to Hennig's (2015) report of an average parity of 5.5 children in KW. Relevant to the time-intensive nature of childcare and other domestic responsibilities, the majority of mothers in this sample (84%) had children in addition to the study infant, with only 15 first-time mothers represented (14.2% of the sample).

Four infants were born before 37 weeks' estimated GA, below the BRIGHT study's proposed cut-off for inclusion; however, due to the imprecise nature of the GA measurements in KW, these infants were retained for analysis. Of the core sample, GA at birth ranged from 36.2 to 41.8 weeks ($M = 38.9$ weeks, $SD = 1.185$). GA was also re-coded into a categorical variable which classified infants as pre- or early term (under 38.9 weeks) or full- or post-term (over 39 weeks) according to Fleischman's classification of 'early' term GA (37-38.9 weeks) to acknowledge the increased likelihood of medical and developmental challenges more likely in infants under 39 weeks (Fleischman, Oinuma, & Clark, 2010). Of infants with GA data available, approximately half ($N=35$, 50.7%) were born before 38.9 weeks, and approximately half ($N=34$, 49.3%) after.

Across the sample, infants were born at a mean of 3.07 kg ($SD = 0.347$), ranging from 2.19 to 4.04kg. In this sample, boys were slightly, but non-significantly (independent samples t-test: $t(77) = 0.562$, $p = 0.576$, two-tailed) heavier at birth ($M = 3.09$ kg, $SD = .377$) than girls ($M = 3.04$ kg, $SD = .313$). Of the 106 infants included in the core sample, 51 were boys and 55 were girls, such that gender was evenly spread.

Due primarily to issues such as miscommunication or lack of communication with VA's regarding when or whether infants had been born, at least part of the birth data was missed in over half of participants in the core sample. For example, data about the mode of delivery was missing for 73 out of 106 mothers.

Information about the location of birth was more often available. Because in KW C-sections are only performed at two of the possible nine locations (Bwiam Hospital, and Edward Francis Small Teaching Hospital [EFSTH]), vaginal delivery could be assumed for non-hospital births. Therefore, 48 of the 61 infants missing delivery data were assumed to have been delivered vaginally. Additionally, the KFS senior midwife was able to verify the delivery mode of a further six infants with missing delivery data, as they had been born in hospital. Only one woman in the core sample had a C-section; the rest of mothers in the core sample with obstetric data available (N=98) were reported (N=50) or presumed (N=48) to have delivered vaginally; the remaining core sample infants (N=7) were left with missing delivery data.

Of the non-core, available sample (N=59), 13 infants had been born in hospital, delivered either by C-section (N=3) or vaginally (N=10); all other available-sample infants not born in hospital were assumed to have been delivered vaginally (N=46).

6.4 Distribution of demographic data in core sample

After calculating basic descriptive features of the demographic variables of interest, a histogram of each continuous demographic variable in Tables 13-16 (above) was visually inspected as a preliminary assessment of the shape of distribution. The one-sample Kolmogorov-Smirnov (KS) goodness-of-fit test was used to confirm statistical probability of approximately normal distribution in the sample, in order to select parametric or non-parametric tests for each variable, as appropriate.

Distribution deviated from normality for all but two continuous demographic factors – infant BW (KS = 0.200) and infant GA at birth (KS = 0.095). Parental age at infant birth, parental years of schooling, and number of children of each parent were not approximately normally distributed.

6.5 How did participants in the core sample differ from the available sample?

After assessing normality of the continuous demographic variables, participants in the core sample (N=106) were compared with excluded infants (N=59) from the wider available sample (N=165) on all key demographic variables. Mann-Whitney U tests were used to compare the ranked means of continuous variables with non-normal distributions. Chi-square tests for independence were used for comparison of categorical variables. Independent samples t-tests would have been used for comparison of continuous variables where the distribution had been assessed as normal, but the only normally distributed variables were infant BW and GA, and these data were unavailable for the non-core sample.

The null hypothesis was retained for all non-parametric continuous variables, suggesting that the core sample did not differ significantly from the non-core sample on any of the following variables: parental age, parental years in school, or parents' number of children.

With the exceptions of infant gender, BW, and GA – which could not be assessed because this data was missing in the non-core sample – and the recruitment village, chi-square tests were used to assess whether the differences of frequencies in the core and non-core samples, on categorical demographic data, were significant. The result for Fisher's exact test was also inspected using 2x2 tables, to compensate for the violation of the assumption that frequency counts will exceed 5 in at least 80% of cells (Pallant, 2016).

Using these two tests as appropriate (see Table 19 and 20 for results), the differences between the available and core sample groups on parental age, parents' years of schooling, maternal and paternal parity, parental country of birth (whether in The Gambia or outside of The Gambia), occupation (whether in primarily

agricultural work, other paid work, or not in paid work), delivery mode, whether the mother was primi- or multiparous, and SES, were not significantly different.

The only variable with statistically significant variation between the two groups was household arrangement – whether parents were unmarried, or had a monogamous or polygamous arrangement – with a nearly medium effect size (Pallant, 2016): $X^2(2, N=111) = 7.435, p = 0.024, \text{Cramer's } V = .026$. A higher percentage of polygamous households, a lower percentage of monogamous households, and a higher percentage of unmarried households were represented in the available group compared to the core sample.

In all cases, however, the frequency count assumption was violated and only 10 or fewer non-core parents had the relevant data available, so these results serve only as an indication that the core sample was likely not significantly different to the non-core sample, with the possible exception of household arrangement, in which monogamy was reported in a higher percentage and polygamy in a lower percentage of the core-sample compared to the non-core sample.

Table 19. Assessing differences between median values of non-parametric continuous demographic variables in available versus core sample

	Mann-Whitney U	Z	<i>p</i> (Asymptotic, 2-Sided)	N	<i>r</i> ^a
Maternal age	309.500	0.448	.654	99	.05
Paternal age	3.000	-1.465	.178	45	.22
Mother's schooling	486.000	-0.219	.827	111	.02
Father's schooling	390.500	-1.222	.222	110	.12
Mother's parity	616.000	1.154	.248	111	.11
Father's parity	599.000	0.973	.331	111	.09
SES	580.000	1.261	.207	106	.12

Note a: Effect size must be interpreted with caution, as on a Mann-Whitney U test, *r* reflects the effect size of the difference in ranked means rather than the actual data

Table 20. Differences between frequency counts of categorical demographic variables in available versus core sample

	χ^2	<i>df</i>	<i>p</i>	<i>N</i>	<i>Effect size</i>
Mother's country of birth 2x2 Gambia vs. Outside of Gambia	.000	1	1.000	105	<i>Phi</i> = -.037
Father's country of birth 2x2 Gambia vs. Outside of Gambia	.000	1	1.000	105	<i>Phi</i> = -.049
Family arrangement 2x3 Monogamous vs. Polygamous vs. Unmarried	7.435	2	.024	111	Cramer's <i>V</i> = .259
Maternal occupation 2x3 Agricultural vs. Trade/Paid Employment vs. Unpaid domestic work	.413	2	.813	110	Cramer's <i>V</i> = .061
Paternal occupation 2x3 Agricultural vs. Trade/Paid Employment vs. Retired/Student/Not-in-Paid-Employment	2.769	2	.158	111	Cramer's <i>V</i> = .158
Infant delivery mode 2x2 Vaginal vs. Caesarean	1.110	1	.292	158	<i>Phi</i> = .125
Mother Primiparous or Multiparous 2x2	0.000	1	1.000	110	<i>Phi</i> = .014

Though the results of these comparisons are presented for consideration, they cannot be taken as evidence that the core and non-core samples were not significantly different (or, in the case of household arrangement, significantly different), as a maximum of 11 of the 59 non-core infants had key demographic information available for each variable. The other 48 had been withdrawn before or missed the 7-14-day visit. Therefore, comparison of the core sample to the more widely available possible sample on basic demographic feature is indicative only.

6.6 Differences between BRIGHT sample and KW residents with non-consent outcomes

As detailed in chapter 3, in the majority of cases, the reason for a non-consent outcome for mothers approached as potential participants was that the mother was temporarily or permanently living away from KW. As of 5 October 2017, only nine non-consent outcomes were due to actual refusal by those approached for the BRIGHT study, again implicating the research-accustomed context of KW (chapter 5). It was not possible to assess whether families who were approached to enrol but had a non-consent outcome differed significantly (in terms of demographic features) from families enrolled in the core sample, as the families with a non-consent outcome were not formally recruited and therefore access to their demographic information was not covered by the ethics approval for the study.

6.7 Discussion

Participants in the core sample did not differ significantly from the available pool of BRIGHT participants on any variable except family arrangement, with a greater proportion of monogamous arrangements (and lower percentage of polygamous groups) reported in the core sample. As will be discussed, the percentage of monogamous family arrangements in the core sample also differed from previous reports of arrangements in KW and other rural areas, although it mirrored almost exactly a previous report of an urban sample.

The demographic features of this sample bear similarities to previous studies in The Gambia on most variables, as well as marked differences in family arrangement, paternal occupation and parental education levels.

No data was collected in this study on participants' ethnicity, but it is likely that the majority were Mandinka, as one of the inclusion criteria was Mandinka

fluency, and a previous report (Hennig et al., 2015) indicated that the majority of residents of KW (79.9%) are Mandinka.

There were no mothers under 20 years in the present sample, which differs from previous reports. Coleman's study of women in Farafenni (Coleman et al., 2006), for example, included women of reproductive potential who were as young as 15. Of course, this is partly due to eligibility criteria, as the BRIGHT study only enrolled women who were 18 years or older, and Coleman's study was interested in females of reproductive age rather than mothers, *per se*. Similarly, Coleman's study included women up to 54 years old. As with a study of mothers in urban Old Jeshwang (Sawyer et al., 2011) that included mothers between 18 and 46 years old, there were no mothers in the present sample older than 44 years.

Two previous studies with mothers in The Gambia reported inclusion of mothers under 20 years old. One study based at two regional hospitals near Bansang reported a high percentage (36%) of mothers under 20 years old, with the youngest mother age 13 (Jammeh, Sundby, & Vangen, 2011b). The proportion of mothers under age 20 (17.7%) was also relatively high in a large study in the urban Western Health Division (Anya et al., 2008). Beyond the inclusion criterion of 18 years, the reason for the discrepancy in representation of mothers younger than 20 (e.g. 18 and 19 years old) between the present and previous samples is unclear.

Unlike range in age, mothers in the present study had a median age (29 years) in the mid-range of means reported in previous studies. Mwangome and colleagues' (2010) KW sample of mothers with children younger than 3 years had a mean age of 32, older than the current sample; Nabwera and colleagues' (2018) study of mothers in KW reported a mean age of 34, also older than the present sample. However, mothers in Nabwera's sample had given birth to the target infant within the previous

4 years, so had the mother's age at the target infant's birth been reported – as in the present study – the difference might not have been so marked.

Conversely, a small study in the urban coastal district of Old Jeshwang reported a mean age of 27.7 years amongst mothers in the first postnatal year (Sawyer et al., 2011), slightly younger than the present sample. A small study with 20 mothers delivering in rural Bansang Hospital (Jammeh et al., 2011a) reported the same mean age (29 years) as the mothers in the present study.

In addition to these samples with similar or slightly older maternal ages, mothers in the present sample were much older than a previous study with chronically undernourished women in KW who had given birth between 1989 and 1994 (Ceesay et al., 1997). These mothers had a mean age of 23.7 years ($SD = 6.4$) in a control group and 24 years ($SD = 6.2$ years) in an intervention group. The distinct difference in age between Ceesay's sample and the present sample may be related to Owolabi and colleagues' statement (Owolabi et al., 2015, p. 3):

We observed that the average maternal age at delivery increased over the period of study [4 years, between 2007 and 2010]. This trend might be explained by increasing female education with time in the population (which) will lead to relatively late marriages and increased use of family planning methods for child spacing.

That 13 mothers did not know their birth year was concordant with an earlier study in the Lower River Region, which reported that nearly a quarter (23.5%) of mothers in their sample did not know their precise age (Semega-Janneh et al., 2001).

The fertility rate in KW as a region is 5.5 infants per woman in 2013 (Hennig et al., 2015), compared to 3.73 for The Gambia as a whole. The mothers in this sample had a slightly lower median parity ($Mdn = 5$, $IQR = 2, 6$; $M = 4.29$, $SD = 2.426$) than the

regional report, but this might be explained by the fact that point parity is likely to be lower than lifetime fertility. Parity in other Gambian samples has varied. Some studies in rural regions such as Bansang and KW have reported a lower maternal parity of four children (Jammeh et al., 2011a; Nabwera et al., 2018), while another in KW reported the same maternal parity as the present sample (five children; Mwangome et al., 2010). Two studies in Farafenni (Ratcliffe et al., 2002 [using data from 1993-1997]; Ratcliffe, Hill, & Walraven, 2000), meanwhile, reported consistently higher maternal parity than the present sample: 6.8 and 7.5, respectively. Paternal parity in Farafenni (Ratcliffe et al., 2002) was also higher in 1993-1997 than in the present sample, at 12 children compared to seven in the present sample.

Previous studies in The Gambia have consistently reported higher representations of first-time mothers compared to the present sample, with the sole exception having been conducted in KW. The percentage of primiparous mothers was higher (23.9 % in Western Health Division; 38.2% in Old Jeshwang) in two urban samples (Anyah et al., 2008; Sawyer et al., 2011) as well as in a rural sample (32.8% in Bansang; Jammeh et al., 2011b) than in the present study (14.2% first-time mothers in the core sample). Only one older study conducted in KW (Ceesay et al., 1997) reported a similar percentage of first-time mothers to the present sample: 14.4% and 15.1% in a control and intervention group, respectively. Though it is not possible to speculate on underlying factors, the similar proportion of first-time mothers in KW compared to higher proportions in neighbouring regions suggests that women in KW may be more likely to have a first infant at a younger age, such that it is less likely to find women in KW who are giving birth for the first time than in other regions, despite the lack of young mothers in this study.

Hennig's demographic report on the KW region found a low level of education amongst adults, despite high enrolment rates for the present generation in lower (88%) as well as upper (66%) basic school (comprising ages 7 to 15), with more and

more girls enrolled. More than half of the mothers in this sample (57.4%), and just under half of fathers (46%) did not have any formal education, but 14 mothers (14.4%) and eight fathers (8%) had completed some secondary school. The divide between men and women widened at the highest levels of education: though one mother had qualifications higher than secondary school, only five mothers had completed secondary school (4.2%) compared to 28 fathers (28%). This is concordant with a previous study in the three 'core' villages of KW (Mwangome et al., 2010), which found that only 11 of the 68 participating mothers (16.2%) had any formal education.

The percentage of mothers and fathers in the present sample, as well as mothers in Mwangome's study, who had any formal education, was higher than in the Farafenni region (Ratcliffe et al., 2002), where only 3% of mothers and 10% of fathers had formal education. Two other studies in rural Gambian regions reported similarly low rates of formal education amongst mothers, at 0% in Bansang (Jammeh et al., 2011a) and 4% in the Lower River Region (Semega-Janneh et al., 2001). Despite higher rates of formal education amongst mothers in KW compared to other rural regions, markedly higher rates were reported in the urban Old Jeshwang district at the coast (Sawyer et al., 2011), where 38.2% of mothers had secondary education, and 25.5% had reached tertiary education.

This sample had a nearly inverse representation of women in monogamous (61.3%) and polygamous (33%) family arrangements compared to Coleman's sample in Farafenni, which had 60.7% polygamous and 30.8% monogamous arrangements. Another study in Farafenni (Ratcliffe et al., 2002) reported a slightly lower percentage of 54% of women in a polygamous arrangement. The representation of family arrangement in the present sample was more similar to a small study (N=55) in an urban municipality (Sawyer et al., 2011), which reported 57.4% of mothers in monogamous arrangements, compared to 25.9% in polygamous. It is not clear why the percentage of polygamous relationships in this sample was so much lower than

previously reported in other rural areas, but given that the core sample had significantly more monogamous family arrangements than the available pool, it may be that the core sample was not representative of KW more widely on this feature.

Fewer reports of studies with Gambian parents (e.g. O'Neill et al., 2015) provided detailed details about paternal age, parental occupation, mode of delivery, and infant gender, BW, and GA, so less comparative information is available for these variables than for maternal demographic factors. However, the demographic makeup of the core sample is discussed below with regard to the data available.

In terms of paternal age and occupation, a recent study in KW (Nabwera et al., 2018) reported a markedly older mean paternal age of 48.7 ($SD = 12.1$), compared to the median of 39.5 years ($M = 42.2$) in the present sample. A study in another rural region (Ratcliffe et al., 2000), Farafenni, reported the age and occupation of fathers (but not the occupation of mothers); the mean age was 43 years for Mandinka men, closer to the median in the present sample. The majority of fathers in Ratcliffe's (2000) sample were farmers (89.3% of the Mandinka fathers surveyed) or shepherds (13%), but traders (11.9%), craftsmen or tradesmen (7.4%), fishermen (7.5%), Marabouts (witch doctors; 5.4%), retirees (5.4%), professionals (1.6%), village heads (*Alkalos*, 1.2%) and students (0.2%) were also counted. This list of occupations was nearly identical to present sample, though a lower percentage of men in the present sample reported primary occupations in agriculture (e.g. farming, fishing, or herding; 41.5% of those reporting this data), and a higher percentage reported trade or other forms of paid employment (50.9% of those reporting this data) than in Farafenni.

Regarding maternal occupation, one study in an urban district (Sawyer et al., 2011), reported that 67.3% of new mothers were unemployed, while the remaining 32.7% were in paid employment. Conversely, only 3.7% of mothers in the present sample were in paid employment, but this difference may be expected given the

wider range of occupations available at the coast compared to rural KW. Concerning mode of delivery, Sawyer and colleagues (2011) also reported that 94.5% of their mothers had an unassisted vaginal birth, which was only slightly lower than the percentage in this study (99%).

As for infant gender, the percentage of male and female infants in the present sample (48.1% males) approached 50% as expected, mirroring a previous study in KW (50.4% male in the control group and 49.5% in the intervention group; Ceesay et al., 1997). A higher percentage of males was found in Bansang (55.9% male; Jammeh et al., 2011b), and a longer-term report of all births at Fajikunda Health Centre (an urban clinic) from 2007 to 2010 (Owolabi et al., 2015) found consistently higher percentages of males (50.1% to 52.7%) than females (47.3% to 49.9%), though it was unclear why.

Infant BW in this sample ($M = 3.07\text{kg}$, $SD = 0.347$) was as expected given previous findings in other rural regions. A large review (Nabwera, Fulford, Moore, & Prentice, 2017) of 1300 infants in three KW villages reported a slightly higher average BW than the present sample ($M = 3.1\text{kg}$; $SD = .4$), while Jammeh, Sundby and Vangen (2011) reported a slightly lower average ($M = 3.02\text{kg}$; $SD = 0.541$) in Bansang. Conversely, a higher average BW ($M = 3.31\text{ kg}$; $SD = .508$) was reported for infants born in the semi-urban municipality of Fajikunda (Owolabi et al., 2015). The mean BW for male infants in the core sample ($M = 3.09\text{ kg}$, $SD = .377$) was slightly heavier than female infants ($M = 3.04\text{ kg}$, $SD = .313$). Although non-significant, this finding was corroborated by Jammeh, Sundby and Vangen's (2011) study in Bansang, which reported a lower mean BW for female infants of 2.95kg ($SD = 0.533$) than for male infants ($M = 3.06\text{kg}$; $SD = 0.542$).

Only one infant could be classified as LBW (<2500g), lower than previous reports from urban (5%; Owolabi et al., 2015) and rural (10.5%; Jammeh et al., 2011b) settings. Only one infant could be classified as macrosomic (>4000g), again much

lower than the 10.3% cited in Owolabi's study. However, BW data was missing for 27 infants in this sample (25.5%) so the distribution should be taken tentatively.

Infant GA in the core sample ranged from pre- and early term to term and post-term, with nearly half of infants born at 39 weeks or later, and half between 36 and 38.9 weeks. A study of 1,579 deliveries in two rural hospitals near Bansang (Jammeh et al., 2011b) found only 11% of infants born before 37 weeks, which would seem to indicate a higher rate of pre-term birth in the core sample; however, these percentages are not directly comparable, as the cut-off points used differ by 2.5 weeks, and infants born before 36 weeks were not eligible for the present study.

Finally, direct comparison of SES with previous studies was not possible, as no other published study has assessed SES in the same manner (though Watson et al. is under review). Although the authors of the protocol recommended splitting the sample into tertiles based on SES (e.g. low, middle, and high), the core sample did not clearly divide into thirds. The use of other items on the SES form (e.g. ownership of a motorbike, ownership of cattle, ownership of horses, maternal income, paternal income, etc.) likewise did not clearly or consistently differentiate families into tertiles. Rather, after visual inspection of proportions, the use of quartiles based on mothers' housing materials (according to Watson and colleagues' protocol) was preferred.

The majority of families received the same SES score (3.7; 60.4%) and the remainder were evenly split between much lower scores and slightly higher scores. In addition to some of the culture-specific factors complicating the calculation of family assets, the SES scores as calculated in this study suggested a majority of participants in the same SES group and little distinction except for a minority lowest-scoring group. This was concordant with field observation that most families utilised the same housing materials, and had similar food, possessions, and clothing, with a minority of

families having visibly greater wealth and possessions, or living with fewer or lower-quality possessions, food or clothing.

Proxy variables, for example parental occupation, may have given a better indication of parental assets and use of time, but even these would need to be interpreted with caution because other factors within the culture mean that objective or traditional measures of SES are not necessarily reliable in this setting. As an example, it is not clear how paternal income relates to infant SES, as this may vary depending on the number of wives the father has aside from the infant's mother, the number of children each of those wives has, and the way paternal income is shared between the wives.

A recent study in KW (Nabwera et al., 2018) administered the same SES questionnaire, but used two Principal Component Analyses (PCA) to develop quintiles for ranking participants. In the first PCA, mothers in the control group were divided as follows: 31% poorest, 27% low, 4% middle, 20% higher, and 18% wealthiest. This division is quite different from the present sample, with a higher percentage of mothers in the wealthiest and poorest groups, but still shows the majority (58%) of participants in KW as having similarly-low SES. Nabwera's SES findings utilised more items in the questionnaire than the present study, and although they are therefore not directly comparable, this yields further evidence to the difficulty of assessing SES in this setting.

6.8 Conclusion

Overall, the demographic features of participants in this sample were not markedly different to previous reports in The Gambia, with a few exceptions. There was a slight difference in representation of male and female infants, but all studies had an approximately even split. Maternal age was similar to previous studies with a few years' difference depending on the comparison sample, but a marked difference

of lacking mothers under the age of 20. Paternal age was also similar to a previous study. The majority of women in the core sample had an unassisted vaginal delivery, with a slightly higher but similar percentage compared to women in an urban sample. The percentage of primiparous mothers represented was nearly identical to a previous sample in KW, but much lower than other urban or semi-urban samples. Maternal parity in the core sample was also similar to maternal parity reported for KW as a region. Infant BW and GA also appeared similar to previous reports.

There were four main differences with previous research. The smaller percentage of mothers in paid employment in the present sample compared to an urban population was expected. The markedly lower percentage of fathers reporting agricultural work as their primary occupation, and greater percentage reporting trade or other paid employment, compared to another rural sample, was not expected. There was a higher percentage of mothers and fathers with formal education as well, compared to other rural areas, though the majority of mothers did not have any formal schooling and therefore the median education level was low. One of the biggest differences was the percentage of monogamous compared to polygamous family arrangements, which was similar to urban samples but far higher (more monogamous arrangements) than other rural samples, as well as significantly different to the pool of available participants not included in the core sample.

Having described the core sample of participants in the main study, the next chapter will provide descriptive results of the measures of interest in KW, including mean social scores for infants during the NBAS; mean infant social and behavioural scores during MII at 1 and 5 months; and the prevalence of depressive symptoms during pregnancy and at 1 and 5 months after birth.

7 Description of infant social behaviour and prevalence of maternal depression in KW

7.1 Introduction

The key variables of interest to the present study are infant social behaviour and maternal depressive symptoms. This chapter presents the mean scores of infant social behaviour at 2 weeks, 1 month and 5 months, and the prevalence of depressive symptoms at 34-36 weeks of pregnancy, and at 1 and 5 months postpartum. Infant weight and SES are of secondary interest and will be included in the next chapter. As with the demographic factors, before calculating the descriptive features of the key variables, histograms and Q-Q plots were visually inspected to assess the shape of distribution; one-sample Kolmogorov-Smirnov (KS) goodness-of-fit tests were likewise consulted, as were Shapiro-Wilk (SW) tests when sample size fell below 50 (in line with Pallant, 2016).

Part 1: Infant Social Behaviour

7.2 Infant social behaviour in the newborn period: NBAS

Infants were visited in their homes for a behavioural assessment (NBAS) at the 7-14-day visit, including observation of orientation behaviour. Of the core sample, 93 infants (87.7%) were assessed using the NBAS. Due to mothers' clinic appointments, three NBAS's were conducted at KFS, closer to 'ideal' conditions for light, temperature, and noise level as outlined in the manual (Brazelton & Nugent, 2011).

Infants were meant to be assessed within 7-14 days, in order to compare infants within a similar developmental window, and prior to extensive environmental influence. In order to respect the cultural norm for family seclusion before the naming ceremony on the 7th day, an earlier window was not feasible. In 20.8% (N=22) of cases, the infant was older than 14 days (range 15-25 days), primarily due to communication

delays amongst the field team, though sometimes due to trained staff unavailability or a mother's delayed return after delivery at a coastal hospital. Only one infant was less than 7 days old, necessitated by availability of trained staff. To ensure that the age of assessment was consistent across the group, NBAS data from the two infants assessed after 21 days postpartum was excluded from analyses. Therefore, NBAS data from 91 infants was assessed (*Mdn* age = 12 days; *M* = 12.33; *SD* = 3.03; range 6-19 days).

Consistent with study protocol, parents were invited to observe the NBAS. The invitation may not have been consistently extended to fathers, especially early in the study when NBAS trainees were concentrating on administration procedures. Due to the extended family system, a variety of caregivers observed. Most commonly, only the mother attended (73% of available data). In two instances, no parents or caregivers attended (Table 21).

Table 21. Who observed the NBAS

	N	%	Valid %
Mother only	54	59.3	73
Mother and father	13	14.3	17.6
Mother and another caregiver (not the father)	3	3.3	4.1
No parents or caregivers	2	2.2	2.7
Another caregiver only (not the parents)	1	1.1	1.4
Both parents plus another caregiver	1	1.1	1.4
Missing data	17	18.7	
Total	91	100	100

Four trained assessors conducted the NBAS sessions, with the majority conducted by KFS staff members Fabakary Njie (FN) and Tijan Fadera (TF) (Table 22).

Table 22. NBAS Examiners

	N	%
FN	40	44
TF	34	37.4
CB (author)	16	17.6
SB (BRIGHT research assistant)	1	1.1

NBAS's took place between 8:30 and 18:30 (Table 23), though most began before noon due to the heat, and to accommodate family work and rest patterns. Of those beginning in the afternoon, only six started after 15:00. The latest NBAS's began at 18:00 and 18:30 due to exceptional circumstances regarding staff and family availability.

Table 23. Time of NBAS session

	N	%
Started between 8:30 and 11:59	65	71.4
Started between 12:00 and 18:30	26	28.6

7.2.1 Selection of NBAS items for analysis

The following NBAS items were the focus of the first set of analyses:

Individual social and non-social orientation items

- a) Response to Face Only (FO)
- b) Response to Face and Voice (FV)
- c) Response to Voice to the Side (VS)
- d) Response to Ball (B)
- e) Response to Rattle (R)
- f) Response to Rattle to the Side (RS)

Summary variables

- g) Social items average score (SAv): $(FO + FV + VS)/3$
- h) Non-social items average score (NSAv): $(B + R + RS)/3$
- i) Summary of Alertness during Orientation Cluster items (SumA)
- j) Orientation Cluster mean score (OC): $(FO + FV + VS + B + R + RS + SumA)/7$

Differentials

- k) Visual social and non-social differential score (VDif): $(FO - B)$
- l) Visual-auditory social and non-social differential score (VADif): $(FV - R)$
- m) Auditory social and non-social differential score (ADif): $(VS - RS)$

Mean performance

- n) Mean visual item performance (MV): $(FO + B)/2$
- o) Mean visual-auditory item performance (MVA): $(FV + R)/2$
- p) Mean auditory item performance (MA): $(VS + RS)/2$

The mean score of the orientation cluster (OC) was calculated because although this thesis is interested primarily in engagement with human stimuli, the full OC has known psychometric properties based on other samples (Costa et al., 2010; Jacobson, Fein, Jacobson, & Schwartz, 1984; McCollam, Embretson, Horowitz, &

Mitchell, 1996), and its inclusion allows comparison with previous studies, which typically have not reported individual orientation item scores.

The summary score of alert behaviour during the orientation items (SumA) is included to consider whether the median scores of social items alone are broadly equivalent to examiners' subjective assessment of overall performance on orientation items (including responses to inanimate objects).

Following Bedford and colleagues (2014), the difference between performance on the social and non-social orientation item for each stimulus category (e.g. visual only [VDif], visual and auditory together [VADif], or auditory only [ADif]), are included in order to assess whether infants in this sample tended to perform differentially to social versus non-social orientation items.

7.2.2 *Descriptive results for orientation behaviour*

To adjust for the differences in scale between the "to Side" orientation items (VS and RS) compared to the orientation items administered *en face* (FO, FV, B and R), in addition to reporting the median score for each item, individual item scores were also reviewed in four categories. The most extreme scores (1-2; 8-9) comprised the lowest and highest categories, and the five more moderate scores were split conceptually according to performance required. For sake of conciseness, only the criteria for the median score of each item is fully described; a complete description of scoring for original NBAS items included in this thesis can be found in Appendix H.

7.2.2.1 *Social orientation items*

7.2.2.1.1 Orientation to Face Only

Most infants (N=69; 78.3% valid percent) scored between 3 and 7 for FO (see Table 24). The median FO score was 4, indicating an infant who is able to focus on and follow the face for a minimum of one 30-degree horizontal arc with jerky movements.

7.2.2.1.2 Orientation to Face plus Voice

The median score for FV was slightly higher than for FO, at 5, denoting an infant who focused and followed for a 30-degree horizontal arc with smooth movement. Similar to FO, the majority of scores fell between 3 and 7 (76.2%; Table 24), with 14.3% of infants not fixing or following at all (score of 1).

7.2.2.1.3 Orientation to Voice to the Side

The median VS score was 5, denoting an infant who “brightens” to the sound of the voice, stills her body movements, and moves her eyes but not her head in the direction of the voice (Brazelton & Nugent, 2011, pg. 54). This item arguably involves more effortful coordination than orientation items in which the stimulus begins in the infant’s line of sight. Nine infants were assessed as having no reaction to VS (10.5%). Most of the infants scored between 3 and 7 (82.6%; Table 24).

7.2.2.1.4 Social items average score

The average score across the three social items (SAv) was approximately normally distributed ($KS = .091$, $df = 80$, $p = 0.096$), but because it was only marginally normally distributed, and to facilitate direct comparison with the individual items, the median and mean are both reported. The median SAv score was 4.67 ($M = 4.58$, $SD = 1.68$), just within the lower mid-range. Most infants ($N=68$, 86.8%) scored in the mid-range of 3-7 (Table 24).

Table 24. Median scores of the individual social orientation items

Item	Median	IQR	Lowest scores (1-2) N (%)	Lower-Middle scores (3-4) N (%)	Higher-Middle scores (5-7) N (%)	Highest scores (8-9) N %
FO	4	3, 6	17 (19.3%)	29 (32.9%)	40 (45.4%)	2 (2.2%)
FV	5	3, 6.75	15 (17.9%)	25 (29.8%)	39 (46.4%)	5 (6%)
VS	5	3, 7	12 (14%)	28 (32.6%)	43 (50%)	3 (3.5%)
SAv	4.67 <i>M</i> =4.58	3.33, 5.67 <i>SD</i> = 1.68	11 (13.9%)	32 (41.4%)	36 (45.4%)	0

Note: Scale: 1-9; FO = Face Only (human visual); FV = Face plus Voice (human visual and auditory); VS = Voice to the Side (human auditory); SAv = Social items average

7.2.2.2 Non-social orientation items

As will be reported, the median summary alertness score (SumA; *Mdn* = 5) was concordant with the individual social items (FO *Mdn* = 4; FV *Mdn* = 5; VS *Mdn* = 5). This suggests that infant performance on the three individual non-social items did not differ enough from performance on the explicitly social items to alter examiners' summary perception of infants' alert behaviour during orientation. To provide a comparison for infants' orientation behaviour toward human, social stimuli, the three orientation items related to inanimate objects is provided.

7.2.2.2.1 Orientation to Ball

The median score for orientation to a red ball (B) was 5, denoting an infant who focused and followed for a 30-degree horizontal arc with smooth movement. Fifty infants (61.7%) scored in the mid-range between 3 and 7 (Table 25).

7.2.2.2.2 Orientation to Rattle

As with B, the median score for orientation to a rattle (R) was 5. Half of the infants (50.6%) achieved a higher mid-range score (Table 25), with 55 infants (67.9%) scoring in the mid-range.

7.2.2.2.3 Orientation to Rattle to the Side

The median score for orientation to a rattle outside of the infant's line of sight (RS) was 6, indicating an infant who turns his head toward the source of the sound in addition to becoming alert and shifting his eyes toward the sound. A quarter of infants (N=22) scored 7, meaning that they looked at the rattle once or twice out of the four attempts. Over two thirds of the infants (N=66, 77.6%) scored in the mid-range of 3-7 for RS, a higher proportion than the other non-social items.

7.2.2.2.4 Non-social items average score

The distribution of scores for the average of non-social items (NSAv) was non-normally distributed ($KS = .103$, $df = 75$, $p = .047$) but because it was only marginally below significance, the median and mean are both reported. The median average score across the three non-social items was 5.33 ($M = 5.23$), with the majority (N=64, 85.4%) in the mid-range.

Table 25. Median scores of the individual non-social orientation items

Item	Median	IQR	Lowest scores (1-2) N (%)	Lower-Middle scores (3-4) N (%)	Higher-Middle scores (5-7) N (%)	Highest scores (8-9) N (%)
B	5	3, 7	16 (19.7%)	18 (22.2%)	32 (39.5%)	15 (18.5%)
R	5	3, 7	13 (16%)	14 (17.3%)	41 (50.6%)	13 (16.1%)
RS	6	3, 7	11 (13%)	21 (24.7%)	45 (52.9%)	8 (9.4%)
NSAv	5.33 ($M=5.23$)	4, 6.67 ($SD=1.83$)	9 (12%)	21 (28%)	43 (57.4%)	2 (2.6%)

Note: Scale: 1-9; B = Ball (inanimate visual); R = Rattle (inanimate visual and auditory); RS = Rattle to the Side (inanimate auditory); NSAv = Non-social items average

7.2.2.3 Summary measurements across social and non-social orientation items

7.2.2.3.1 Summary of Alertness

The median score for SumA was 5 ($M = 4.88$, $SD = 1.845$), denoting an infant who the examiner rates as having displayed moderate periods of responsiveness, which may have taken time to elicit, during the orientation items.

7.2.2.3.2 Mean score of orientation items

The full OC mean score, typically reported, is the mean of the seven orientation items, including SumA, where infants had completed the three social and three non-social items (to control for variation in score by number of items completed). The median OC score was 5, with nearly all ($N=67$, 94.4%) infants scoring in the mid-range (Table 26).

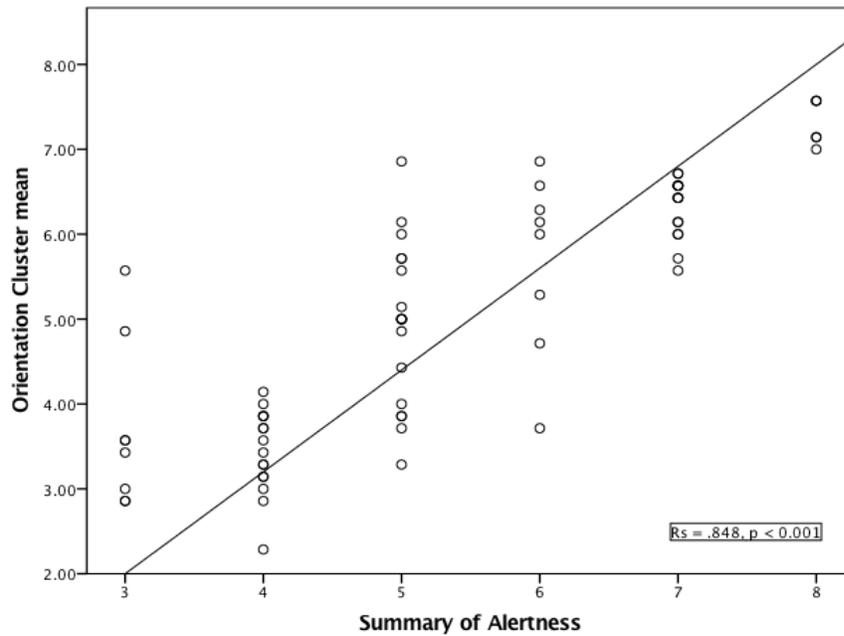
Table 26. Median scores for orientation behaviour on the NBAS summary items

Item	<i>Mdn</i>	IQR	Lowest scores (1-2) N (%)	Lower-Middle scores (3-4) N (%)	Higher-Middle scores (5-7) N (%)	Highest scores (8-9) N (%)
SumA	5	4, 6	8 (9%)	29 (32.6%)	46 (51.7%)	6 (6.7%)
OC	5	3.71, 6.43	4 (5.6%)	28 (39.5%)	39 (54.9%)	0

Note: Scale: 1-9 (only 1-8 reached); SumA = Alertness (summary score of alert behaviour during 6 orientation items); OC = Orientation Cluster (average of all 7 items on the orientation cluster)

As expected, examiners' summary assessment of infant alertness during orientation items (SumA) correlated strongly and positively with the mean score of the orientation items (OC), as shown in Figure 12 ($R_s = .848$, $N=71$, $p < .001$), evidencing the high agreement between examiners' recalled summary of performance and the actual item scores.

Figure 12: Relationship between SumA and OC



7.2.2.4 *Comparison of visual, visual-auditory and auditory orientation in social and non-social domains*

Differential scores were calculated for:

- a) VDif = Visual only social item (FO) – visual only non-social item (B)
- b) VADif = Visual/auditory social item (FV) – visual/auditory non-social item (R)
- c) ADif = Auditory only social item (VS) – auditory only non-social item (RS)

Differential scores could theoretically range from -8 to +8. Infants scoring -8 to -1 had higher performance on the non-social item. Infants scoring 0 had the same score on each item. Infants scoring from +1 to +8 had higher performance on the social item.

7.2.2.4.1 Visual differential

VDif scores were normally distributed ($KS = .091$ (80), $p = .159$). The mean VDif score was -0.38 (see Table 27), indicating that on average infants performed marginally better on the non-social visual item (B) than the social visual item (FO).

7.2.2.4.2 Visual-auditory differential

The distribution of the VADif scores was non-normal ($KS = .132$ (76), $p = 0.002$). The median score for VADif was -0.5 , indicating that on average infants performed marginally better on R than FV. There were two infants with outlying positive scores, scoring very highly on FV and low on R (VADif = $+6$, $+7$). Removing these scores did not markedly alter the mean ($M = -0.58$; 5% trimmed $M = -0.64$) so they were retained for analysis.

7.2.2.4.3 Auditory differential

The distribution of ADif scores was non-normal ($KS = .177$ (83), $p < .001$). The median score for ADif was 0 (Table 27), indicating that on average infants performed equally well on VS and RS. There were two infants with outlying positive scores, scoring very highly on VS and low on RS (ADif = $+6$). These were not the same infants with outlying VADif scores. Removing these scores did not markedly alter the mean score ($M = -.3$; 5% trimmed $M = -.36$) so they were retained.

Table 27. Difference between social and non-social orientation items

Differential	N	Median (IQR)	Mean (SD)	N (%) Scoring -	N (%) Scoring 0	N (%) Scoring +
VDif	80	-	-0.38 (2.53)	39 (48.9%)	13 (16.3%)	27 (35.2%)
VADif	76	-0.5 (-2, +1)	-	38 (50%)	17 (22.4%)	21 (37.5%)
ADif	83	0 (-2, +1)	-	35 (42.2%)	26 (31.3%)	22 (26.4%)

Note: VDif = difference between visual item scores (FO – B); VADif = difference between visual-auditory item scores (FV – R); ADif = difference between auditory item scores (VS – RS)

7.2.2.5 Mean performance on visual, visual-auditory, and auditory items

The mean performance for each pair of social and non-social items was also calculated (Table 28). This provided a control for general ability to orient to a stimulus (Bedford et al., 2014).

Table 28. Mean performance on social and non-social orientation items

Mean	N	Median (IQR)	Mean (SD)	Scores 1-2 N (%)	Scores 3-4 N (%)	Scores 5-7 N (%)	Scores 8-9 N (%)
MV	78	5 (3, 6)	-	15 (19.1%)	22 (28.1%)	39 (50%)	2 (2.6%)
MVA	76	-	4.99 (1.84)	8 (10.4%)	25 (32.8%)	39 (51.2%)	4 (5.3%)
MA	83	5 (3.5, 6.5)	-	10 (12%)	22 (26.4%)	50 (60%)	1 (1.2%)

Note: MV = mean performance on visual items $([FO + B]/2)$; MVA = mean performance on visual-auditory $([FV + R]/2)$; MA = mean performance on auditory items $([VS + RS]/2)$

The following NBAS items will be carried forward to the next chapter for comparison with other measures: FO, FV, visual and visual-auditory social/non-social differentials (VDif and VADif), MV and MVA (to control for the effect of general ability to alert to the visual, and visual-auditory items, respectively).

7.3 Infant social behaviour at 1 and 5 months: infant GRSMII

Infant behaviour during MII was rated on two GRSMII dimensions. The first dimension is included in this thesis, and assessed infant behaviour in terms of visual attentiveness toward the mother, communicative efforts, and positive vocalising. These three scales are assessed individually and then averaged to form a composite score, as per the manual (Gunning et al., 1999). For the full description of scores, see Appendix F.

7.3.1 *Infant social behaviour at 1 month*

7.3.1.1 *Infant attentiveness at 1 month*

The mean score for infant attentiveness at 1 month (ATN-1; the extent of infants' visual engagement towards their mothers) was 3, indicating an infant who looks at the mother for approximately half of the session. Nine infants (18.4%) were rated a 3. At the extremes, five infants (10.2%) were rated the lowest score, and three infants (6.1%) were rated the highest (Table 30).

7.3.1.2 *Infant active (positive) communication at 1 month*

Active (but not negative, e.g. fussing or crying) communicative efforts at 1 month (AC-1) were considered next, including "pre-speech (wide-open mouthings, active tonguing movements), movement of limbs in response to mother's actions, vocalisations, smiles, etc." (Gunning et al., 1999, p. 28). The median AC-1 score was 2, denoting only brief periods of active communication during the session. The majority of infants (N=34, 69.4%) were uncommunicative for most of the session (Table 30). There were eight outlying scores, four above the median and four below, which were retained as they did not greatly alter the mean ($M = 2.87$; 5% trimmed $M = 2.86$).

7.3.1.3 Infant positive vocalisation at 1 month

The frequency count of positive vocalisations at 1 month (PV-1) included audible sounds rated as happy or excited. The median score for PV-1 was the lowest score of 1, with nearly all infants (N=41, 87.8%) rated as making no positive vocalisations at all, and a further five (10.2%) making between one and four brief positive vocalisations. Five infants had outlying scores; all were higher than the median score, and two also had outlying AC-1 scores. These were retained as they did not greatly alter the mean ($M = 1.19$; 5% trimmed $M = 1.09$).

7.3.1.4 Infant social behaviour composite at 1 month

The median score was 2 for the composite of the three infant social behaviour scales at 1 month (CD1-1), with 51% of infants (N=25) in this category (Table 29).

Table 29. Median scores on GRSMII Infant Dimension 1 at 1 month

Item	Total (Scale)	N	Median	IQR	Minimum	Maximum
ATN-1	1-5	49	3	2, 4	1	5
AC-1	1-5	49	2	2, 2	1	4
PV-1	1-5	49	1	1	1	5
CD1-1	1-5	49	2	1.67, 2.33	1	4

Note: ATN-1 = Infant Attentiveness at 1 month; AC-1 = Infant Active Communication at 1 month; PV-1 = Infant Positive Vocalisations at 1 month; CD1-1 = Infant Composite Dimension 1 at 1 month

Table 30. Proportion of infants rated in each GRSMII scoring category at 1 month

Item	N	1	2	3	4	5
ATN-1	49	5 (10.2%)	17 (34.7%)	9 (18.4%)	15 (30.6%)	3 (6.1%)
AC-1	49	10 (20.4%)	34 (69.4%)	4 (8.2%)	1 (2%)	0
PV-1	49	43 (87.8%)	5 (10.2%)	0	0	1 (2%)
CD1-1	49	21 (42.9%)	25 (51%)	2 (4.1%)	1 (2%)	0

Note: ATN-1 = Infant Attentiveness at 1 month; AC-1 = Infant Active Communication at 1 month; PV-1 = Infant Positive Vocalisations at 1 month; CD1-1 = Infant Composite Dimension 1 at 1 month

7.3.2 *Infant social behaviour at 5 months*

7.3.2.1 *Infant attentiveness at 5 months*

Similar to 1 month, the median ATN score at 5 months (ATN-5) was 3, denoting infants who visually attentive to their mothers for approximately half of the session (Table 31). The proportion of infants rated in this category was higher (N=12, 27.9%) than at 1 month (N=9, 18.4%) despite a decrease in sample size (Table 32). Just under a third of infants (N=14; 32.6%) were attentive 75% of the time. In contrast to 1 month, fewer infants were rated as completely inattentive (N=1, 2.3% at 5 months; N=5, 10.2% at 1 month).

7.3.2.2 *Infant active communication at 5 months*

The median AC score at 5 months (AC-5) was 2, denoting only a few brief positive vocalisations throughout the session. Just over half of the infants (N=22, 51.2%) were rated in this category, compared to 69.4% at 1 month. Eight infants were rated as communicative during 75% of the session (N=6, 14%) and two infants (4.7%) communicated actively throughout the session. Both these infants in the highest scoring category were outliers, but were retained as excluding them did not significantly alter the mean ($M = 2.72$; 5% trimmed $M = 2.64$).

7.3.2.3 *Infant positive vocalisation at 5 months*

The median PV score at 5 months (PV-5) was 2, denoting an infant who makes only a few brief vocalisations during the session. Just under a quarter of infants (N=10, 23.3%) received this score (Table 32). A further 12 infants (27.9%) were rated as making no positive vocalisations during the session whatsoever. Seventeen infants made five or more short vocalisations (or two or more long vocalisations).

7.3.2.4 Composite infant social behaviour at 5 months

The mean score for the average of these three scales at 5 months (CD1-5) was 2.85, with just under 40% of infants (N=17, 39.6%) having a composite score of 3 and nearly the same number (N=16, 37.2%) having a composite score of 2 (Table 32).

Table 31. Median scores on Infant Dimension 1 at 5 months

Item	Scale	N	Median (Mean, if normally distributed)	IQR (SD, if normally distributed)	Min.	Max.
ATN-5	1-5	43	3	2, 4	1	5
AC-5	1-5	43	2	2, 3	2	5
PV-5	1-5	43	2	1, 4	1	5
CD1-5	1-5	43	3 (2.85)	2.33, 3.33 (.821)	1.33	4.67

Note: ATN-5 = Infant Attentiveness at 5 months; AC-5 = Infant Active Communication at 5 months; PV-5 = Infant Positive Vocalisations at 5 months; CD1-5 = Infant Composite Dimension 1 at 5 months

Table 32. Proportion of infants rated in each GRSMII scoring category at 5 months

Item	N	1	2	3	4	5
ATN-5	43	1 (2.3%)	12 (27.9%)	12 (27.9%)	14 (32.6%)	4 (9.3%)
AC-5	43	0	22 (51.2%)	13 (30.2%)	6 (14%)	2 (4.7%)
PV-5	43	12 (27.9%)	10 (23.3%)	7 (16.3%)	10 (23.3%)	4 (9.3%)
CD1-5	43	5 (11.6%)	16 (37.2%)	17 (39.6%)	5 (11.7%)	0

Note: ATN-5 = Infant Attentiveness at 5 months; AC-5 = Infant Active Communication at 5 months; PV-5 = Infant Positive Vocalisations at 5 months; CD1-5 = Infant Composite Dimension 1 at 5 months

7.3.3 Stability versus change: infant social behaviour between 1 and 5 months

The median scores for ATN and AC were consistent over time, but increased for PV. The change in PV was striking: while 87.8% (N=43) of infants made no PVs at 1 month, only 27.9% (12 infants) did not vocalise at 5 months. Additionally, while only one infant received a score of 3 or more at 1 month, 17 infants received such scores at 5 months.

Wilcoxin Signed Rank Tests (WSRTs) were used to assess whether the changes in scores over time were significant.

There was no significant difference in the median ATN scores at 1 and 5 months ($Mdn = 3$ at both visits; $z = -1.387$, $N=92$, $p = .166$). Median AC scores were significantly different ($Mdn = 2$ at both visits; $z = -3.928$, $N=92$, $p < .001$), with a medium effect size ($r = 0.42$) as per Cohen's (1988) criteria. This is likely due to the shift in AC score distribution between 1 and 5 months, with a notable decrease in the percentage of infants rated the lowest scores of 1 and 2 ($N=0$ for score of 1; $N=22$, 51.2%, for score of 2) at 5 months compared to 1 month ($N=10$, 20.4% for score of 1; $N=34$, 69.4% for score of 2). The increase in median PV scores between 1 month ($Mdn = 1$) and 5 months ($Mdn = 2$) was also significant ($z = -4.275$, $N=92$, $p < .001$), with a medium effect size ($r = 0.45$).

Finally, the increase in median CD1 score between 1 month ($Mdn = 2$) and 5 months ($Mdn = 3$) was also confirmed as significant by an WSRT ($z = -4.292$, $N=92$, $p < .001$), with a medium effect size ($r = 0.45$). Because CD1 scores were normally distributed at 5 months ($KS = .129$ (43), $p = 0.071$; $SW = .969$ (43), $p = .294$), the difference in scores at 1 and 5 months was also assessed using a paired samples t-test, which confirmed a significant increase in mean score (t (43) = -5.242 , $p < .001$) from 1 month ($M = 1.9683$) to 5 months ($M = 2.8413$).

Part 2: Maternal depression

7.4 Maternal depressive symptoms self-reported by EPDS questionnaire

7.4.1 Median EPDS score

Median EPDS scores were low across participants and visits. The distribution of scores was clustered toward lower scores (e.g. skewness = 1.137, SE = .249 at 1 month), with the majority of participants reporting low incidence of symptoms and only a few participants reporting higher values. Participants did not use the upper half of the available range of EPDS scores, with median scores barely exceeding the lowest possible score (Table 33).

Table 33. Descriptive data for EPDS total score as a continuous variable

Visit	Total (Scale)	N	Median	IQR	Minimum	Maximum
Antenatal	0 to 30	88	4	2, 6	0	15
1 month	0 to 30	94	3	0, 4	0	13
5 months	0 to 30	91	1	0, 3.5	0	9

The median EPDS total score at 34-36 weeks was 4 (IQR: 2, 6). Although the antenatal median score was higher for multi-parous mothers, a Mann-Whitney U test did not indicate that this difference in ranked means was significant at the 34-36 week visit ($Mdn = 2.5$ for first-time; $Mdn = 4$ for multiparous mothers; $U = 447.000$, $z = .908$, $N=86$, $p = .364$, $r = .10$). Four mothers scored above the cut-off of 10 at this visit.

At 1 month, the median EPDS total score was 3 (IQR: 0, 4). First-time mothers had a higher median score ($Mdn = 3$) than multiparous mothers ($Mdn = 2$) but this difference was not significant ($U = 433.5$, $z = -0.909$, $N=92$, $p = .363$, $r = -.09$). Three mothers scored above the cut-off at 1 month.

By 5 months, no mothers had scored at or over the cut-off point of 10 and the median score for mothers overall decreased to 1 out of 30, with no significant difference between the median scores of primiparous (*Mdn* = 3) and multiparous (*Mdn* = 1) women ($U = 349, p = .085, N=89, z = -1.724, r = -.18$).

7.4.2 Stability versus change in EPDS scores

The median EPDS total score decreased over the three visits (Table 34). The EPDS data, being non-normally distributed and containing several outliers, violated two of the five assumptions for repeated-measures ANOVA; therefore, the non-parametric alternative, Friedman's test, was used to assess the significance of change in EPDS scores over time while adjusting for comparing the means multiple times. The results of this test (Table 34) showed a statistically significant difference in EPDS scores across the antenatal, 1- and 5-month visits, $X^2 (2, N=66) = 34.211, p < .001$.

A WSRT confirmed that the decrease in EPDS median score between pregnancy and 1 month was significant, $z = -4.242, p < .001, N=77$, with a moderate effect size ($r = 0.48$). Another WSRT confirmed that the decrease in EPDS scores between 1 month and 5 months was also significant ($z = -6.773, p < .001, N=81$), with a large effect size ($r = 0.75$).

Table 34. Stability of EPDS total scores across visits

	Ant. <i>Mdn</i>	1M <i>Mdn</i>	5M <i>Mdn</i>	Friedman Test	WSRT, Antenatal to 1M	WSRT, 1M to 5M
EPDS total	4	3	1	$X^2 (2, N=66) = 34.211^{**}$	$z = -4.242^{**}$ $r = 0.48$	$z = -6.773^{**}$ $r = 0.75$

* $p < .05$; ** $p < .025$

Although not statistically significant, the median score decreased across the three visits for multiparous women. Conversely, there was a very slight increase for first-time mothers between late pregnancy and 1 and 5 months.

7.4.3 Responses to EPDS Question 10

In the original version, EPDS Question 10 (Q10) asks about thoughts of self-harm or suicidal ideation. Due to previous work (Tesfaye et al., 2010) indicating that asking about these topics in a non-clinical setting would be inappropriate, a previous study had modified Q10 to ask about any desire to be isolated from others, believed to indicate depression in a Gambian community (Coleman et al., 2006). Across visits, only one mother reported wanting to be alone often. The response translated as “sometimes” was selected more often. At the antenatal visit 10.2% of mothers reported wanting to be alone sometimes, 3.4% at 1 month, and 3.3% at 5 months (Table 35). Of those with EPDS data at all three visits, 21.2% responded affirmatively to Q10 at least once: 13.6% at 34-36 weeks, 10.7% at 1 month, and 7.7% at 5 months.

Table 35. Responses to EPDS Q10: “In the last 7 days, have you wanted to be alone?”

	Antenatal (N = 88)	1 Month (N = 94)	5 Months (N = 91)
No	76 (86.4%)	84 (89.4%)	84 (92.3%)
Not very often	3 (3.4%)	6 (6.4%)	4 (4.4%)
Sometimes	9 (10.2%)	3 (3.4%)	3 (3.3%)
A lot	0	1 (0.9%)	0

7.4.4 Demographic features of those scoring above 10 on the EPDS

Seven participants reported total EPDS scores over the clinical referral cut-off of 10 used in a previous study in a neighbouring region (Coleman et al., 2006). Four above-cut-off scores were reported at the 34-36 week visit, three at the 1-month visit, and none at the 5-month visit (Table 36). No mothers scored over 10 at multiple visits.

Table 36. EPDS total score presented as a categorical variable

Visit	N (%) scoring ≥ 10: score	N (%) scoring < 10	N (%) missing data
Antenatal (N = 88)	4 (4.6%): 15, 14, 11, 11	84 (79.2%)	18 (17%)
1 month (N = 94)	3 (3.2%): 13, 11, 11	93 (87.7%)	10 (9.4%)
5 months (N = 91)	0	89 (83.9%)	17 (16%)

Upon closer inspection of those mothers who scored above versus below cut-off, there seemed to be some demographic differences (Table 37).

Table 37. Characteristics of mothers with EPDS total scores above cut-off²²

Variable	Full sample <i>M (SD) [N]</i>	Participants with EPDS scores < 10 <i>M (SD) [N]</i>	Participants with EPDS scores ≥ 10 <i>M (SD) [N]</i>
Age	29.47 years (6.374) [93]	29.61 years (6.442) [87]	27.5 years (5.357) [6]
Schooling	3.02 years (4.135) [101]	2.96 years (4.101) [94]	3.86 years (4.845) [7]
Parity	4.29 children (2.426) [93]	4.44 children (2.371) [87]	3.33 children (2.582) [6]
H's age	42.18 years (9.881) [44]	42.15 years (9.794) [41]	42.67 years (13.429) [3]
H's school	5.06 years (5.295) [100]	4.95 years (5.311) [93]	6.57 years (5.224) [7]
H's parity	7 children (5.675) [101]	7.19 children (5.785) [94]	4.43 children (3.101) [7]
Infant's BW	3.07 kg (0.347) [79]	3.09 kg (0.345) [74]	2.74 kg (0.199) [5]
Infant's GA	38.9 weeks (1.185) [79]	38.9 weeks (1.209) [74]	39.1 weeks (0.805) [5]

Note: H's Age = Husband's age; H's School = Husband's years in school; H's Parity = number of children of the husband

BW appeared lower for infants whose mothers scored above 10 ($M = 2.74$ kg, $SD = 0.199$) than for those who scored below 10 ($M = 3.09$ kg, $SD = 0.345$). This difference may have resulted from the difference in group size ($N=74$ scoring under 10 compared to $N=7$ scoring 10 or more) and therefore invites only preliminary consideration. Nevertheless, an independent samples t-test confirmed that infants of mothers who scored below 10 at all visits were significantly heavier at birth than infants of mothers who scored above cut-off at any visit, $t(77) = 2.263$, $p = .026$, two-tailed, equal variances assumed. The magnitude of the differences in the means (mean difference = 0.35332, 95% CI: 0.04243 to 0.64422) was moderate (eta squared = 0.062) according to Cohen's (1988) classification. In other words, 6.2% of the

²² Differences in parental occupation between those scoring above and below EPDS cut-off could not be assessed; more than 20% of the cells had fewer than 5 counts so a Chi-square test was not possible.

variance in BW in this sample could be explained by whether mothers scored below or above a cut-off of 10 on the EPDS at any point.

Due to the small sample size, a Mann-Whitney U-test was also run, to account for the possibility that the over-10 group violated the assumption of normal distribution; this test also rejected the null hypothesis that median BW was the same across groups, $U = 68.5$, $p = .015$ (2-sided), $Z = -2.346$, $N=79$, $r = 0.26$, with a small effect size using Cohen's criteria²³.

A series of independent samples t-tests confirmed that none of the other differences (e.g. paternal occupation, parental education, parental parity, parental age, and infant GA) between those scoring below and above cut-off on the EPDS were statistically significant (Table 38). Mann-Whitney U-tests also retained the null hypothesis of no difference on all accounts.

Table 38. Results of t-tests for demographic variables by EPDS cut-off group

Variable	Group								
	EPDS under 10			EPDS ≥ 10					
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	95% CI for Mean Difference	<i>t</i> (<i>df</i>)	Sig.
Mat. age	9.61	.442	87	7.50	5.357	6	-3.246 to 7.464	.782 (91)	.436
Pat. age	2.15	.794	41	2.67	13.43	3	-12.587 to 11.457	-.087 (42)	.931
Mat. School	.96	.101	94	.86	4.845	7	-4.126 to 2.326	-.553 (99)	.581
Pat. School	.95	.311	93	.57	5.224	7	-6.477 to 3.226	-7.82 (98)	.436
Mat. parity	.44	.371	87	.33	2.582	6	-.894 to 3.101	1.1 (91)	.276
Pat. parity	.19	.785	94	.43	3.101	7	-1.636 to 7.162	1.25 (99)	.216
Infant GA	8.89	.209	74	9.06	.8050	5	-1.258 to .9352	-.293 (77)	.770
Infant BW	.089	.3438	74	.736	.1992	5	.0424 to .6642	2.26 (77)	.026

* $p < .05$.

²³ Effect size based on results from a Mann-Whitney U test must be interpreted with caution, as it reflects the effect size of the difference in ranked means rather than in the actual data.

7.5 Maternal depressive behaviour during mother-infant interaction, as indicated by mood and energy

Interactions between mothers and infants were assessed in a sub-group of dyads (N=43 at 1 month, N=49 at 5 months), and rated according to a coding schema of maternal behaviour during interaction with her infant, the Global Rating Scales of Mother-Infant Interaction (GRSMII).

One of the four GRSMII dimensions for maternal behaviour, ‘Signs of Depression,’ assessed mothers on outward expressions and behaviours considered to relate to depression. Four scales comprised this dimension in the original tool; maternal mood, energy, and focus of attention were retained for BRIGHT *a priori* at the discretion of the coder (see chapter 3). As will be explained, maternal focus of attention was not an appropriate sub-scale in this setting due to the novelty of the large mirror, and was subsequently removed; however, the 1-month scores are provided to illustrate the rationale for removal.

7.5.1 Depressive behaviour at 1 month

7.5.1.1 Maternal mood at 1 month

The median score for maternal mood at 1 month (MM-1) was 3 (Table 39), denoting both mothers who had a neutral affect (“not overtly happy or sad”) or who had a mixed though only mildly positive and negative affect (Gunning et al., 1999, p. 18). The majority of mothers (N=29, 59.2%) received this rating, with similarly sized groups of mothers rated as either displaying some smiles though mostly depressive mood (score of 2; N=10, 20.4%) or happy but without an animated interaction style (score of 4; N=9, 18.4%). In this way, MM-1 scores were centred in the mid-range.

7.5.1.2 Maternal energy at 1 month

The median score for maternal energy at 1 month (ME-1) was the middle score of 3, with 15 mothers who typically waited for the infant to initiate interaction, and missed more than three engagement opportunities. A sub-set of mothers (N=9, 18.4%) showed little effort in starting or continuing an engagement (score of 2). At the extremes, two mothers showed markedly little effort, if any (score of 1), while 11 mothers (22.4%) were rated as lively, energetic, and effortful (Table 40).

7.5.1.3 Maternal focus of attention at 1 month

The median score for focus of attention at 1 month (FOA-1) was 2, indicating a mother who either looks at herself in the mirror five or six times or does not seem to 'see' the infant while looking at him or her. Seventeen mothers (34.7%) were rated in this category. A further 15 mothers (30.6%) received the lowest possible score, indicating that they looked at the mirror more than five or six times, possibly looking at the infant without responding to him or her, or possibly talking while looking in the mirror. Only five (10.2%) mothers were rated as generally focused on the infant and the interaction, though still taking at least one "obvious" look in the mirror (score of 4; Gunning, Fiori-Cowley, & Murray, 1999, p. 20).

Given the novelty for this group of women of having a large mirror to themselves, in a room with no older children or other adults, and typically when wearing more formal clothes to come to KFS (field observation), the FOA scale was not considered to provide an accurate indication in this setting of whether mothers would typically focus their attention on their infant or on their surroundings, and was removed. FOA scores at 1 month are provided alongside the other maternal scales in Tables 39 and 40 to show the difference in proportion of mothers in the lowest and highest scoring categories.

Table 39. Median scores on GRSMII Maternal Dimension 3 at 1 month

Item	Total (Scale)	N	Median	IQR	Minimum	Maximum
MM-1	1-5	49	3	3, 3	2	5
ME-1	1-5	49	3	3, 4	1	5
FOA-1	1-5	49	2	1, 3	1	4

Note: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; FOA-1 = Maternal focus of attention at 1 month

Table 40. Proportion of mothers rated in each GRSMII scoring category at 1 month

Item	N	1	2	3	4	5
MM-1	49	0	10 (20.4%)	29 (59.2%)	9 (18.4%)	1 (2%)
ME-1	49	2 (4.1%)	9 (18.4%)	15 (30.6%)	12 (24.5%)	11 (22.4%)
FOA-1	49	15 (30.6%)	17 (34.7%)	12 (24.5%)	5 (10.2%)	0

Note: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; FOA-1 = Maternal focus of attention at 1 month

7.5.2 Depressive behaviour at 5 months

7.5.2.1 Maternal mood at 5 months

The median maternal mood score at 5 months (MM-5) was 4 (Table 41), indicating a mother who smiles and laughs a lot during interaction but is not necessarily active and animated. Over half of the mothers (N=24, 55.8%) were rated as mostly happy at 5 months (Table 42). No mothers were rated as clearly depressed or quite depressed at 5 months.

7.5.2.2 Maternal energy at 5 months

The distribution of scores for mothers' energy at 5 months (ME-5) was negatively skewed (skewness = $-.923$, SE = $.361$), with higher scores predominant. The median ME-5 score was 4, indicating a mother who is generally effortful in interaction and only misses one or two opportunities for engagement. Thirteen mothers (30.2%) received this score, and a further 18 mothers (41.9%) were rated as highly energetic in their interactions (score of 5; Table 42).

Table 41. Median Maternal GRSMII scores at 5 months

Item	Total (Scale)	N	Median	IQR	Minimum	Maximum
MM-5	1-5	43	4	3, 4	3	5
ME-5	1-5	43	4	3, 5	1	5

Note: MM-5 = Maternal Mood at 5 months; ME-5 = Maternal Energy at 5 months

Table 42. Proportion of mothers rated in each GRSMII scoring category at 5 months

Item	N	1	2	3	4	5
MM-5	43	0	0	15 (34.9%)	24 (55.8%)	4 (9.3%)
ME-5	43	1 (2.3%)	4 (9.3%)	7 (16.3%)	13 (30.2%)	18 (41.9%)

Note: MM-5 = Maternal Mood at 5 months; ME-5 = Maternal Energy at 5 months

7.5.3 Stability versus change in maternal depressive behaviour from 1 to 5 months

The percentage of mothers rated as generally or clearly happy (scores of 4 and 5) rose between 1 and 5 months, with fewer mothers classified as clearly or generally depressed (scores 1 and 2) and the majority of mothers shifting from a neutral or mixed/mild mood score of 3 at 1 month (59.2%), to a generally happy mood score of 4 at 5 months (55.8%). This pattern was repeated for a percentage of mothers in the highest and lowest energy scores, with noticeably more mothers rated as highly energetic (score of 5) at 5 months (41.9%) compared to 1 month (9.3%). Another notable change was the decrease in proportion of mothers rated as having generally low mood (score of 2) at 1 month (20.4%) compared to 5 months (0%).

The median scores for MM and ME increased by one scoring category each between 1 and 5 months. A series of WSRTs confirmed that these increases were significant (Table 43). The increase in MM had a medium effect size ($r = 0.42$).

Table 43. Stability versus change: Maternal GRSMII

	1-Month <i>Mdn</i>	5-Month <i>Mdn</i>	Wilcoxin Signed Rank Test z, p	Effect size
Mood	3	4	-3.985, <.001	0.42
Energy	3	4	-2.652, .008	0.28

7.6 Discrepancy between self-report of depressive symptoms and observation of depressive mood and energy

There was a stark contrast between the percentage of mothers identified as likely to be depressed using the EPDS (N=3, 3.2% at 1 month), and the percentage of mothers identified as showing marked ‘signs of depression’ in the form of low energy (N=11, 22.5%) and low mood (N=10, 20.4%) at 1 month (Table 44).

Table 44. Percentage of mothers with lowest mood and energy scores

Month	Energy				Mood			
	1 month		5 months		1 month		5 months	
Score	1	2	1	2	1	2	1	2
N (%)	2 (4.1%)	9 (18.4%)	1 (2.3%)	4 (9.3%)	0	10 (20.4%)	0	0

7.7 Discussion of infant social behaviour and maternal depression

7.7.1 Infant social behaviour

7.7.1.1 Newborn social behaviour at the 7-14-day visit – NBAS

Moderate scores predominated across social and non-social orientation NBAS items, with approximately half of the infants obtaining mid-range scores of 3-7. Dominance of moderate scores was also evidenced in median scores of 5 on both the summary description of infants’ alert behaviour (SumA) and the mean of all orientation item scores (OC). The strong positive correlation between SumA and OC lends credibility to SumA as an accurate assessment of infant orientation ability.

The results of chapter 4 suggested the possibility for lower orientation scores in KW compared to other samples due to the potential early effects on newborn behaviour of caregiving practices influenced by shared cultural beliefs that newborns cannot see, hear, or engage socially. Similarly, across other samples in China and Japan (Loo et al., 2005), Spain (Canals, Fernandez-Ballart, & Esparo, 2003), Portugal (Costa et al., 2010), and Kenya and the United States (Keefer, Tronick, Dixon, &

Brazelton, 1982), OC mean scores ranged from 5.85 to 6.4, higher than the present sample ($Mdn = 5$).

The lower performance in the present sample cannot be simply explained by age. Older infants are expected to be better able to engage with these stimuli (Canals et al., 2003), but with the sole exception of the Kenyan and American infants, who were assessed between 9 and 12 days, infants in the present sample were older than infants in the other samples (Japan = 4 days; China and Spain = 3 days; Portugal = 7 days) and yet had lower median OC scores.

Studies reporting more similar NBAS performance to the present sample were conducted with newborns of depressed mothers. One study in the USA (Hernandez-Reif, Field, Diego, & Ruddock, 2006) included depressed and non-depressed mothers and their newborns ($M = 12$ days). The infants of the depressed mothers had individual social item and OC mean scores ranging from 4.5 ($SD = 2.7$) to 4.9 ($SD = 1.6$), lower than the infants of non-depressed mothers, whose scores ranged from 5.5 ($SD = 3.1$) to 6.5 ($SD = 2.4$). Infants in the present sample had median individual social item and OC scores that more closely resembled the infants of the clinically depressed mothers in Hernandez-Reif's study, than the infants of non-depressed mothers in that study or in the 'non-clinical' samples cited previously²⁴.

Lower OC scores for newborns of depressed mothers were identified earlier in a study by Abrams and colleagues (1995), in which American newborns of low-SES depressed mothers had lower OC scores ($M = 4.8$, $SD = 2.6$) than newborns of low-SES non-depressed mothers ($M = 5.6$, $SD = 1.5$), within a day of birth. In addition, although only the differences in FV and VS scores were significant in that sample, the infants of the depressed mothers in Abrams' study performed consistently lower on the

²⁴ The one exception to this pattern was the Voice to the Side item; the median score in KW ($Mdn=5$) was lower than either the depressed or non-depressed mothers in Hernandez-Reif's sample.

individual orientation items than infants of the non-depressed mothers. This pattern of lower OC scores in infants of depressed mothers was repeated the following year in another low-SES American sample with 2-3 day-old newborns (Lundy et al., 1996), with a mean OC score of 4 ($SD = 1$) for infants of depressed mothers compared to a mean score of 5.2 ($SD = 1$) for infants of non-depressed mothers.

This pattern has been reported in newborns whose mothers had antenatal depression as well: a more recent study in South London (Fantini, 2014) similarly found that infants whose mothers had been diagnosed with Major Depressive Disorder (MDD) during pregnancy had lower OC scores ($M = 6$ to 6.1) than the infants whose mothers had not ($M = 7.1$ to 7.6). Again, though still higher than the present sample, the mean scores of the infants of antenatally depressed mothers in Fantini's study were closer to the median scores of the present sample, compared to the infants whose mothers had not been depressed.

There was one study that reported lower OC scores than the present sample, though still consistent with a pattern of lower OC scores in the presence of maternal depression. Field and colleagues' (2004) study with day-old newborns of young, low-SES American mothers, 37% of whom were single and nearly half of whom were of ethnic minority, reported lower OC scores than the present sample, whether their mothers were depressed ($M = 3.8$, $SD = 1.3$) or not ($M = 4.7$, $SD = 1.6$). Given the higher scores of Abrams' 1-day-old newborns, these lower scores cannot be solely attributed to the infants' younger age. Alongside the lower OC scores in the present sample, these previous findings implicate an association in the following chapter between EPDS scores in pregnancy²⁵ and newborn behaviour during the NBAS.

²⁵ The antenatal visit is indicated because depression is not measured at the NBAS visit and therefore no concurrent EPDS score is available.

Despite steady median scores of 5 on four out of the six orientation items, between 42 and 50% of the infants in the present sample scored marginally better on the non-social items, and a further 16.3 to 31.3% performed equally well across social and non-social items. This differs from Bedford and colleagues' (2014) study, which reported marginally better performance overall on the social item FO compared to the equivalent non-social item (B; mean difference = $+0.5$, $SD = 0.97$). Conversely, infants in the present sample performed marginally better overall on B compared to FO (VDif $M = -0.38$, $SD = 2.53$), as well as marginally better on R than FV (VADif $Mdn = -0.5$, $IQR = -2, 1$). Median average scores corroborated marginally better performance on the three non-social (NSAv $Mdn = 5.33$) than the three social items (SAv $Mdn = 4.67$).

As a caveat when interpreting these results, it is not possible to determine from NBAS performance whether an infant or sample of infants have differing orientation abilities from birth (e.g. whether the intrauterine environment or infant physical health has influenced attention and engagement capacity from birth or even during prenatal development) or whether early influence from caregivers has affected infant behaviour within the first few days.

However, the latter possibility of the influence of early exposure to the extra-uterine caregiving environment is in line with a previous study that identified a significant correlation between newborn age in *hours* during the first 4 days after birth, and the strength of the association between the infants' neural activation and orientation performance to a social stimulus (Farroni et al., 2013). Though necessarily speculative, the better performance to non-social items in the present sample may suggest a lesser degree of experience of explicitly social stimulation – or, conversely, a greater degree of experience with non-social stimulation – prior to the NBAS. Further research measuring the extent of social engagement with newborns in the context of routine caregiving in the home environment would be required to investigate this line of enquiry.

7.7.1.2 *Infant social behaviour at 1 and 5 months – GRSMII*

There was greater infant contribution to interaction at 5 months compared to 1 month, which was expected given the developmental agenda in early infancy (e.g. pre-/post- 2-month shift). At 1 month, infants had a moderate median visual attentiveness score, with a low level of active communication efforts and very few positive vocalisations. The median composite score of this dimension at 1 month was low, at 2. Active communication efforts and positive vocalisations increased significantly by 5 months, as did the composite score, but the high degree of visual attentiveness to the mother did not change significantly over time. At 5 months, 76.8% of infants had a low to moderate composite score of 2 or 3, with a median score of 3 across the sample.

Given the theorised impact of the 2-month shift on infant contribution to MII, including reported increases in infant gazing and vocalisation behaviour between 1 and 3 months (Henning, Striano, & Lieven, 2005), a trend in increasing median scores over time would be expected. This was the case for AC and PV but not visual attentiveness toward the mother, perhaps because a third of infants in this sample already had a high median ATN score by 1 month.

However, despite this trend toward higher social behaviour scores in older infants, cultural factors are likely to play a role in the degree of infant contribution to MII, in addition to age. This is indicated by results from Gunning and colleagues' (2004) cross-cultural study of MII in European dyads, in which a sample of 3-month-old infants from Porto had higher CD1 scores ($M = 3.67, SD = 0.81$) than a sample of 4-month-old infants from Zurich ($M = 3, SD = 1$). Likewise, 4-month-old infants from Zurich and 6-month-old infants in Vienna had nearly equivalent ATN scores (Zurich $M = 3.17, SD = 1.14$; Vienna $M = 3, SD = 0.86$).

With regard to the present sample, median composite scores (CD1-1 *Mdn* = 2; CD1-5 *Mdn* = 3) were comparable to both younger and older infants in the European samples, including 6-month-olds in Bordeaux ($M = 3.58, SD = 0.93$) and 3-month-olds in Porto ($M = 2.62, SD = 1.14$). Further indicating that infant age alone does not determine contribution to MII, 1- and 5-month-old infants in the present sample had only slightly lower AC scores (*Mdn* = 2 at 1 and 5 months) than a sample of much older infants ($M = 17$ months) in Ethiopia ($M = 2.93, SD = 0.27$) (Knight, 2016).

As indicated by these findings, while age-related trends *within* samples are expected due to developmental processes, infant age is not the sole variable related to differences in infant social behaviour observed *across* settings, thereby implicating other environmental factors, such as caregiving, on the development of early infant social behaviour in a given context.

7.7.2 *Maternal depressive symptoms and behaviour*

7.7.2.1 *Self-reported depressive symptoms on the EPDS questionnaire*

Though technically congruent with the supposition based on chapter 4 results that at least some mothers in the main sample would have high EPDS scores, mothers in this sample had low median EPDS scores across the three visits. Median scores were close to the minimum possible score of 0 on a 30-point scale. When defined as the percentage of mothers who scored at or above 10, the point prevalence of depression was 4.6% at the 34-36-week visit, 3.2% at the 1-month visit, and 0% at the 5-month visit. The period prevalence of depression in this sample between late pregnancy and 5 months after birth, for those with data at all three visits, was 7.5%. A low prevalence, with few mothers reporting scores much higher than the bare minimum, may be expected for a measure of mental health (Counsell, Cortina-Borja, Lehtonen, & Stein, 2011); however, the point prevalence of depression in this sample was much lower than the majority of previous research in Sub-Saharan Africa, and even the period prevalence was less than the 10-15% global average (Halbreich & Karkun, 2006).

A higher percentage of mothers responded positively to EPDS Question 10 (Q10) in particular – querying desire for isolation, previously identified as a key marker of depression in The Gambia (Coleman et al., 2006) – than might have been expected given the low prevalence calculated from the total score. At all three visits, Q10 indicated a low level (below 0.9%) of more severe depressiveness, as defined by wanting to be alone “often,” but 10.2% of mothers at the antenatal visit reported wanting to be isolated “sometimes”. At 1 and 5 months this percentage decreased to 3.3-3.4%. Although considered to be highly related to depressive symptoms in this setting in general, it was specifically during the antenatal visit that Q10 indicated a higher point prevalence compared to the EPDS as a whole. However, when considering any degree of desire for isolation, 13.6% of mothers responded affirmatively at 34-36 weeks, 10.7% at 1 month, and 7.7% at 5 months, and the period prevalence overall (21.2%) was much higher than the 6.9% based on total score.

Depression has been measured in The Gambia in two other published studies (Coleman et al., 2006; Nabwera et al., 2018). Coleman and colleagues found a similar period prevalence of depression in a neighbouring region: 6.6% in women within 12 months of giving birth, and 10.3% in women of reproductive age. These reported prevalence rates were based on diagnosis by clinical interview rather than by the EPDS questionnaire, so although their findings appear to corroborate a low prevalence of depressive symptoms in the perinatal period, they are not directly comparable to the results of the present study.

However, the period prevalence of above-cut-off EPDS scores in Coleman’s sample overall²⁶ – comprised of women of reproductive age, rather than just within the first year postpartum – was 16.3%, much higher than in the present sample or in Coleman’s sample as assessed by clinical interview, but was closer to the prevalence reported in Nabwera and colleagues’ study published this year (Nabwera et al., 2018).

²⁶ Calculated here for the purpose of this thesis; not directly reported in Coleman et al., 2006

Using a cut-off score of 12 in a sample of 280 KW mothers within 4 years of giving birth to a target infant, Nabwera and colleagues (2018) found a period prevalence of approximately 13%, again higher than the present sample (7.5%), and closer to Coleman's sample based on the EPDS. The additional 3% in Coleman's sample may have come from the wider age range or lower cut-off score.

Unlike the EPDS total score, the percentage of women responding positively to Q10 at each visit approached the prevalence reported by Coleman and Nabwera. Although exploratory given the improbability that a single question could accurately indicate likelihood of depression, the fact that prevalence based on Q10 more closely matches previous reports than prevalence based on the total score – while still displaying the expected decreasing trajectory over time – may suggest a unique contribution of Q10 to understanding maternal depression in this setting, despite potential flaws in the measure overall.

It is not clear why the prevalence based on EPDS total score was lower in this sample than expected, but the previously posited reason that the postnatal period is protective against depression in this setting due to the social importance of child-bearing (Coleman et al., 2006) was not simply accepted, especially given the higher prevalence based on responses to context-specific Q10. Alternative theories are explored in the discussion chapter of this study (chapter 9), including translation and administration issues, differences in chronological proximity to birth, and cultural influences on expression of emotional states as related to the measure utilised to assess depression. Notably, differences in prevalence are not immediately assumed to relate to a cultural difference, in recognition of the possibility that “error along the translation path” may most accurately account for deviation from prevalence rates resulting from use of the original EPDS (Van Widenfelt, Treffers, De Beurs, Siebelink, & Koudijs, 2005, p. 145).

A final finding of note was that infants of mothers who consistently scored below 10 on the EPDS were significantly heavier at birth than infants whose mothers scored above 10 at *any* visit. Previous studies have reported associations between BW and maternal antenatal anxiety, but have failed to find such an association with depression (see Evans et al., 2012; Husain, Cruickshank, Tomenson, Khan, & Rahman, 2012). The relationship between depression and infant weight in this sample will be further explored in the next chapter. No other demographic factors were significantly different between mothers who scored above or below cut-off.

7.7.2.2 Maternal depressive mood and energy on the GRSMII

Overall, mothers in this sample were characterised by moderate to higher energy during MII at 1 month, though nearly a quarter showed little effort toward engagement. Maternal mood at 1 month was lower to moderate, with over half of mothers displaying neutral or mixed-mild affect throughout the session. Notably, 10 mothers (20.4%) were rated as having a depressive mood for most of the interaction.

At 5 months, interactions were characterised by high maternal energy and moderate mood. Mothers had generally high energy at 5 months when engaging their infants, with just over 10% of mothers showing little to no effort and energy. Over half of mothers in this sample had a positive mood, and laughed and smiled as they interacted with their infants at 5 months, although just over a third were rated as mildly happy with some signs of mild depression, or as neutral. Between 1 and 5 months, there was a significant increase in both mood and energy scores, concordant with previous research describing a decrease in depressive symptoms, for example low energy and mood, between 1 and 5 months (e.g. Gaynes et al., 2005).

The increase in maternal engagement efforts is congruent not only with the universal influence of the 2-month-shift, but with chapter 4 findings specific to this setting, providing a concurrent explanation for increased engagement effort between

1 and 5 months alongside a reduction in depressive symptoms. A majority of interview respondents reported an onset of infant sight and hearing after 2 months postpartum. One might therefore expect mothers to expend less energy in engaging infants at 1 month, if they believe that their infants cannot see or hear them.

Although maternal depressive behaviour in this sample is not directly comparable²⁷ to Gunning and colleagues' (2004) European study, as a preliminary consideration, the mood and energy median scores in the present sample at 1 month (*Mdn* = 3) and 5 months (*Mdn* = 4) were similar to the mean composite dimensions of mothers of young infants across a range of settings including Bordeaux (*M* = 3.92, *SD* = 0.56; 6 months), Vienna (*M* = 4.21, *SD* = 0.55; 6 months), Zurich (*M* = 3.71, *SD* = 0.91; 4 months), and Porto (*M* = 3.58, *SD* = 0.78; 3 months). Beyond European countries, the mothers in the present sample had similar mood and energy scores to mothers of older infants (*M* = 17 months; *M* mood = 3.01, *SD* = 1.10; *M* energy = 3.23, *SD* = 1.41) in Ethiopia (Knight, 2016). Taken together, these findings indicate the presence of 'signs of depression' in mothers, including mood and energy, to a moderate degree during infancy, across a variety of HIC and LMIC contexts.

One potential limitation was identified relating to the GRSMII in the present study. Mothers in this sample were rated as highly self-absorbed due to looking in the mirror often. Similarly, mothers in Southern Ethiopia (Knight, 2016) had been rated as moderately self-absorbed during MII (*M* = 3.3, *SD* = 1.28), including "excessive engagement" with the camera, mirror, or their own attire (p. 150); therefore, due to the novelty in these settings of a large mirror and free time in a quiet room, the Focus of Attention (FOA) scale was not considered to reflect true self-absorption in the present study and was removed.

²⁷ Because the composite score in that publication includes four scales, only two of which were used to calculate the composite score for Maternal Dimension 3 in this sample

Therefore, because a third scale ('Relaxed to Tense') had been excluded prior to coding as LB felt it was more directly related to anxiety rather than depression, removing the FOA scale during analysis reduced the original Signs of Depression dimension to half its original content. Such limitations will be further discussed in the final chapter.

7.7.2.3 Discrepancy in maternal depression prevalence by measure

The difference between the percentage of mothers flagged as depressive in this sample at 1 month using a self-report measure requiring discussion of negative emotions (EPDS total; N=4, 3.2%), compared to an observational measure of behaviour not requiring language or discussion of negative emotions (GRSMII; N=10, 20.4% with a generally low mood) is marked. When also taking into account mothers who had neutral affect or both mild happiness and mild depressive mood (N=29), the discrepancy widens.

Even when considering the proportion of women scoring at or above 10 on the EPDS at any point (N=5 out of 72 with data at all 3 visits = 6.94%; N=7 of women with data at any time point = 6.6%), the percentage of women showing signs of depression on the GRSMII during most of their interaction with their infants at each visit (N=10; 20.4%) was still greater. Scores on these two measures of depression will be compared in the next chapter. Along with the higher proportion of mothers reporting a desire to be alone on Q10 – not requiring direct discussion of negative emotions – compared to the total EPDS score, these differences may either indicate varying sensitivity to depression amongst these three ways of measuring prevalence, or variation in the underlying factors measured, whether directly related to depression or not.

7.8 Conclusion

The low prevalence of depressive symptoms by EPDS total in this sample may be taken as a genuine reflection of low depression, or as an indication that the particular version of the self-report measure used to assess depression was not optimally appropriate. Two previous studies found higher prevalence of depression – 16.3% in a neighbouring region amongst women of reproductive age; 13% in KW amongst women who had delivered within 4 years – using EPDS translations; a higher percentage of women in the present study reported the setting-specific symptom of wanting to be alone (7.7–13.6% across visits; 21.2% period prevalence); and 20.4% of mothers in this sample showed depressive mood for most or all of the MII session at 1 month. Taken together, these findings lend further explanatory weight to the idea that, rather than a genuinely low prevalence rate, the EPDS version used in this sample may have failed to fully identify existing depressive symptoms.

The mid-range social and non-social orientation scores amongst newborns in this sample, which were lower than other samples surveyed, was unexpected. Their similarity to samples of clinically depressed mothers similarly provided theoretical weight to the view that there may be more experiences of depression in this sample than assessed by the EPDS used in this study. As will be discussed in chapter 9, further research on the understanding, experience, and reporting of depressive symptoms in this region is recommended.

Having reported the prevalence of infant social behaviour and maternal depressive symptoms, as well as changes over time, the next chapter will assess relationships between these variables, with particular emphasis on the relationship between earlier measures and infant social behaviour, and the role of potential moderating demographic variables such as infant BW, SES, and maternal age.

8 Associations within and between infant social behaviour and maternal depression in KW

8.1 Introduction

As described in chapter 1, the fourth objective of this thesis was to assess the relationship between infant social behaviour and maternal depression measures in this sample.

This chapter first presents results for associations between infant social behaviour scores on the NBAS and on the GRSMII, and then maternal depression scores on the EPDS and maternal mood and energy scores on the GRSMII, before addressing the overall question, how are infant social behaviour and maternal depression related in this sample? The role of potential moderating variables such as infant weight and SES is then assessed. Finally, tentative models for relationships between infant social behaviour and a selection of significantly associated variables are presented based on linear regression analyses.

Only a sub-set of variables measured in the present study are included in this report. Exclusions, necessitated by the word limit, took place prior to analysing data for this chapter in order to reduce likelihood of 'data dredging' (Amrhein, Chen, Korner-Nievergelt, & Roth, 2017). The selection of measures for these associations was theory-driven based on previous research, as outlined in chapter 2, and in some cases, conceptual or practical rationale (e.g. removal of maternal focus of attention due to a lack of 'fit' in the novel setting). The set of included variables was large primarily due to measurement across multiple visits, and the inclusion of sub-scales for conceptual accuracy, rather than reporting only composites. No variables were added or subtracted *post hoc* based on the results of this chapter, and the full available sample size was used in each set of analyses.

Due to the small sample with GRSMII coding, and non-normally distributed data that was resistant to correction by statistical transformation, the regression models are purely exploratory and the emphasis of this chapter rests necessarily on the results from correlation analyses.

8.2 Associations

The overall question of how infant social behaviour and maternal depression are related in this sample was addressed via four smaller questions, each of which was assessed in turn by a series of correlations. Spearman's Rho was selected over Pearson's r because most variables had non-normally distributed scores. All data in this section met the following assumptions: continuous level of measurement, related pairs (data from the same subject), and independent observations (Pallant, 2016). Scatterplots were used at intervals to assess linearity, homoscedasticity, and outliers.

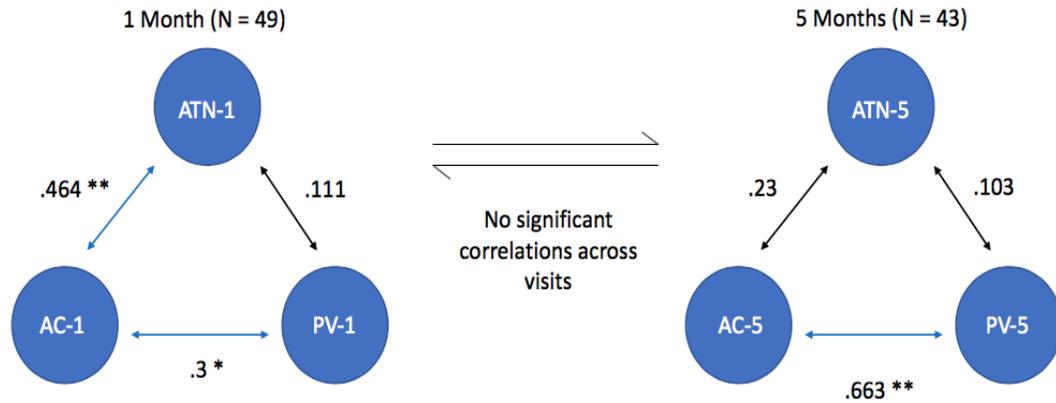
8.2.1 How do scores relate on the infant social behaviour measures?

First, Spearman's rank-order correlations were used to assess (a) relationships amongst the infant GRSMII items, and continuity between infant behaviour at 1 and 5 months, (b) relationships amongst the selected NBAS items, and (c) the relationship between newborn (NBAS) and infant (GRSMII) social behaviour. Throughout the tables provided in this chapter, significant associations (green) and trends (blue) are highlighted for ease of reference.

8.2.1.1 Infant social behaviour 1 and 5 months (GRSMII)

As shown in Figure 13, some infant GRSMII scales were significantly correlated within each visit, but there were no significant correlations across the two visits. Within each visit, the composite dimension (CD1) was significantly correlated with each of the individual scales at that visit, but neither the individual scales nor the composite scores were significantly correlated over time (Tables 45 and 46).

Figure 13. Rho values for Spearman’s rank-order correlations for infant GRSMII scores at and between 1 and 5 months



ATN = Infant visual attentiveness to mother

AC = Infant active positive communication efforts

PV = Infant positive vocalisations

* $p < .05$

** $p < .001$

Table 45. Spearman’s rank-order correlations between composite dimension 1 scores at 1 month, individual scales at 1 month, and composite score at 5 months

		ATN-1	AC-1	PV-1	CD1-5
Spearman’s Rho	CD1-1	.918**	.745**	.363**	.083
Sig. (2-tailed)		< .001	< .001	.012	.607
N		47	47	47	41

Note: ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month; CD5-5 = Composite Dimension 1 at 5 months; ** $p < .001$

Table 46. Spearman's rank-order correlations between composite dimension 1 scores at 5 months and individual scales at 5 months, and composite score at 1 month

		ATN-5	AC-5	PV-5	CD1-1
Spearman's Rho	CD-5	.556**	.809**	.843**	.083
Sig. (2-tailed)		< .001	< .001	< .001	.607
N		42	42	42	41

Note: ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months; CD1-1 = Composite Dimension 1 at 1 month; ** $p < .001$

Therefore, whilst it was reported in chapter 7 that infant AC and PV both increased significantly over time in the sample overall, these scores were not significantly correlated at the level of the infant over time.

8.2.1.2 Infant social behaviour on the NBAS – relationship between the selected items

Next, the relationships between the NBAS items carried forward from chapter 7 – Face Only (FO), Face plus Voice (FV), Visual Differential: FO – Ball (VDif), Visual-Auditory Differential: FV – Rattle (VADif), Mean Visual performance: FO, Ball (MV) and Mean Visual-Auditory performance: FV, Rattle (MVA) – were assessed. As expected, the two individual social orientation items (FO; FV) were significantly positively correlated ($r_s = .611, p < .001, N=83$), and each individual social item was significantly positively correlated with the relevant differential (Table 47). Mean performance scores (MV; MVA) were highly inter-correlated, not only with one another ($r_s = .814, p < .001, N=73$) and with the relevant individual item (e.g. MV and FO), but also with the alternate individual item (e.g. MV and FV; Table 47), presumably due to sharing the visual modality.

The visual mean (MV) was also significantly negatively correlated with the visual differential (VDif; $R_s = -.473, p < .001, N=73$), such that higher MV scores were associated with higher scores on the non-social visual item (Ball) compared to the

social visual item (FO). There was a trend in association between MV and VADif (Table 47), with higher MV scores associated with lower scores on the non-social visual-auditory item (Rattle) compared to the social visual-auditory item (FV).

Table 47. Spearman’s rank-order correlations within selected NBAS items

		FV	VDif	VADif	MV	MVA
Spearman’s Rho	FO	.611**	.349**	.115	.559**	.561**
Sig. (2-tailed)		< .001	.002	.321	< .001	< .001
N		83	80	76	78	76
	FV		-.065 .571 78	.457** < .001 76	.83** < .001 78	.806** < .001 76
	VDif			.131 .268 73	-.473** < .001 78	-.181 .125 73
	VADif				.212 .072 73	-.111 .338 76
	MV					.814** < .001 73

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = Mean score of FO and Ball; MVA = Mean score of FV and Rattle; ** $p < .01$

8.2.1.3 Newborn social behaviour (NBAS) and infant social behaviour at 1 month (GRSMII)

NBAS differential scores (VDif; VADif) were not significantly correlated with infant behaviour at 1 month (Table 48). Only infant response to the individual FV item was significantly, positively correlated with infant ATN at 1 month ($r_s = 0.331$, $p = .028$, $N=44$) with a medium magnitude of association. FV was also marginally significantly correlated with the composite social behaviour score at 1 month ($r_s = 0.301$, $p = .047$,

N=44). There was a positive trend between FV scores and AC at 1 month, and a negative trend between FV scores and PV at 1 month, but these were not significant.

MV score correlated with ATN-1 at a borderline significance level ($r_s = .317$, $p = .049$, N=39) and had a trend toward association with PV-1. MVA score was significantly correlated with ATN-1 ($r_s = .39$, $p = .016$, N=38), AC-1 ($r_s = .328$, $p = .044$, N=38) and marginally with CD-1 ($r_s = .301$, $p = .047$, N=44), but not PV-1 (Table 48).

Table 48. Spearman’s rank-order correlations between selected NBAS social scores and infant social behaviour GRSMII scores at 1 month

		ATN-1	AC-1	PV-1	CD1-1
Spearman’s Rho	FO	.138	.161	-0.06	.167
Sig. (2-tailed)		.367	.289	.697	.274
N		45	45	45	45
	FV	.331*	.274	-.268	.301*
		.028	.072	.078	.047
		44	44	44	44
	VDif	-.154	.142	.239	-.006
		.336	.337	.133	.969
		41	41	41	41
	VADif	-.125	-.172	-.185	-.151
		.454	.3	.267	.367
		38	38	38	38
	MV	.317*	.119	-.315	.216
		.049	.469	.051	.186
		39	39	39	39
	MVA	.39*	.328*	-.199	.357*
		.016	.044	.23	.028
		38	38	38	38

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = Mean score of FO and Ball; MVA = Mean score of FV and Rattle; ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month; * $p < .05$

To account for the effect of general ability to respond to a stimulus, a partial correlation was run between the significantly correlated individual NBAS item and infant GRSMII items at 1 month (FV, ATN-1, and CD1-1) while controlling for the mean visual-auditory item (MVA). After controlling for MVA, correlations between FV and ATN-1 ($r = -.067, p = .684, df = 35$) and CD1-1 ($r = -.126, p = .456, df = 35$) were no longer significant. This partial correlation indicates that the association between newborn and 1-month social behaviour is driven by attentional (orientation) abilities overall rather than the ability to orient to a social stimulus in particular. Because partial correlations use the parametric Pearson product-moment correlation²⁸, whereas FV and ATN-1 scores were non-normally distributed, these results must be interpreted with caution.

8.2.1.4 Newborn social behaviour (NBAS) and infant social behaviour at 5 months (GRSMII)

None of the selected NBAS items were significantly correlated with infant ATN, AC, PV, or the composite, at 5 months (Table 49), although an association between MV and AC-5 approached significance, with a higher mean visual score associated with a lower AC-5 score ($r_s = -.327, p = .059, N=34$). There was also a trend between MVA and PV-5, with a higher mean visual-auditory score associated with a lower PV-5 score, but this was likewise non-significant ($r_s = -.29, p = .096, N=34$).

²⁸ Syntax (Top Tip Bio, 2017) was used to attempt a partial non-parametric correlation; however, only four cases were available for the FV and ATN-1 by MVA correlation, and the FV and CD1-1 by MVA correlation could not be run due to syntax errors, so this ultimately did not yield useful information.

Table 49. Spearman's rank-order correlations between selected NBAS social scores and infant social behaviour GRSMII scores at 5 months

		ATN-5	AC-5	PV-5	CD1-5
Spearman's Rho	FO	.186	-.168	-.05	-.001
Sig. (2-tailed)		.259	.299	.757	.996
N		40	40	40	40
	FV	.173	-.257	-.258	-.181
		.29139	.114	.113	.269
			39	39	39
	VDif	.051	.225	.208	.223
		.769	.187	.223	.191
		36	36	36	36
	VADif	-.076	.078	.119	.022
		.668	.660	.501	.903
		34	34	34	34
	MV	.049	-.327	-.253	-.253
		.783	.059	.149	.148
		34	34	34	34
	MVA	.165	-.279	-.29	-.206
		.351	.11	.096	.244
		34	34	34	34

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = Mean score of FO and Ball; MVA = Mean score of FV and Rattle; ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months

Taken together with the fact that (1) the associations between FV and ATN-1, and FV and CD1-1, become non-significant when controlling for MVA, (2) the FV score is no longer significantly correlated with any infant social behaviour at 5 months and (3) that a trend between MVA and PV and between MV and AC persists at 5 months, these findings indicate that infants' ability to orient to social cues in particular may be tightly bound to their general ability to direct their attention. Therefore, mean visual and visual-auditory scores (MV and MVA; indicating infants' general ability to respond

to potentially-social *en face* stimuli) may be the best neonatal indicators in this sample of later social orienting behaviour at 1 and 5 months during MII, as well as indicators of later, more general, attentional control mechanisms.

8.2.2 How do scores relate on the maternal depression measures?

8.2.2.1 Scores within the EPDS

In terms of the EPDS, total scores were significantly correlated across all visits, while Q10 (the question about desiring isolation) was significantly correlated between the antenatal and 1-month visits, and between the 1- and 5-month visits, but not between the antenatal and 5-month visits (Table 50).

Table 50. Spearman's rank-order correlations between EPDS scores over time

		Antenatal EPDS Q10	1 Month EPDS total	1 Month EPDS Q10	5 Month EPDS total	5 Month EPDS Q10
Spearman's Rho	Antenatal	.47**	.352**	.024	.314**	-.009
Sig. (2-tailed)	EPDS total	.000	.002	.836	.006	.936
N		88	77	77	76	76
	Antenatal		.221	.276*	.119	.066
	EPDS Q10		.054	.015	.305	.57
			77	77	76	76
	1 Month			.279**	.375**	.35**
	EPDS total			.006	.001	.001
				94	81	81
	1 Month				-.051	.25*
	EPDS Q10				.654	.024
					81	81
	5 Month					.313**
	EPDS total					.002
						91

** $p < .001$; * $p < .05$

As expected, there was a strong positive correlation at 1 month between the EPDS total score and EPDS Q10 ($r_s = .279$, $p = .006$, $N=94$, 7.8% shared variance). Similar to 1 month, there was a strong positive correlation between EPDS total score and EPDS Q10 at 5 months ($r_s = .313$, $p = .002$, $N=91$, 9.8% shared variance). The EPDS total and EPDS Q10 were even more strongly associated at the antenatal visit ($r_s = .47$, $p < .001$, $N=88$, 22% shared variance) than at 1 and 5 months.

8.2.2.2 Scores within the maternal GRSMII

In terms of the maternal GRSMII, mood and energy scores were significantly correlated within each visit, but not between visits (Table 51).

Table 51. Spearman's rank-order correlations between maternal GRSMII scores at 1 and 5 months

		ME-1	MM-5	ME-5
Spearman's Rho	MM-1	.691**	.089	.049
Sig. (2-tailed)		<.001	.576	.758
N		49	42	42
	ME-1		.169	.168
			.283	.287
			42	42
	MM-5			.578**
				<.001
				43

Note: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; MM-5 = Maternal mood at 5 months; ME-5 = Maternal energy at 5 months; ** $p < .001$

The relationship between MM-1 and ME-1 was significant, with higher mood associated with higher energy, and with 47.7% shared variance ($r_s = .691$, $p < .001$, $N=49$). This strong positive correlation between MM-1 and ME-1 was expected, given that mood and energy were both measured as part of the same GRSMII dimension,

'Signs of Depression'. The two behavioural ratings of maternal depression remained significantly correlated at 5 months ($r_s = .578, p < .001, N=43$; 33.4% shared variance), but with a lower degree of shared variance than at 1 month.

8.2.2.3 Scores between the EPDS and maternal GRSMII

Next, the relationship between the self-report and observational measures of maternal depression was assessed using Spearman's rank-order correlations, first within the 1 and 5 months visits, and then across the three visits (including 34-36 weeks). At 1 month, total EPDS scores were not significantly correlated with maternal mood (MM-1) or energy (ME-1) ratings, and nor was 1-month Q10, $p = .215 - .960$.

Similarly, at 5 months, total EPDS scores were not significantly correlated with maternal mood (MM-5) or energy (ME-5), and nor was 5-month Q10, $p = .481 - .932$.

Because the highest prevalence of depressive symptoms was identified during pregnancy, antenatal EPDS scores were also entered into a correlation matrix with the GRSMII maternal mood and energy scales at 1 and 5 months. The antenatal EPDS total score was significantly, negatively correlated with ME-1 ($r_s = -.407, p = .012, N=37$), such that higher antenatal EPDS scores were associated with lower maternal energy at 1 month, with a medium magnitude of association and 16.6% shared variance. Antenatal EPDS total scores were not significantly correlated with 1-month mood, 5-month mood, or 5-month energy scores ($p = .116 - .992$). However, there was a trend toward association between antenatal Q10 and ME-1 ($r_s = -.227, p = .097, N=37$).

There were no significant correlations between the 1-month EPDS total scores or 1-month Q10 scores and maternal mood or energy at 5 months ($p = .109 - .893$), or between 5-month EPDS total scores and 1-month maternal mood scores ($p = .343$). Total EPDS scores at 5 months, however, were significantly, negatively associated with maternal energy at 1 month ($r_s = -.362, p = .016, N = 44$), such that lower energy at 1

month was associated with higher EPDS scores at 5 months, with a medium magnitude of association and 13.1% shared variance. There was also a trend between MM-1 and 5-month Q10 ($r_s = .277, p = .069, N = 44$), counter-intuitively implicating higher mood at 1 month and a higher desire for isolation at 5 months, but this was non-significant.

When considering both measures of depression in this sample, the only significant correlations between EPDS and maternal GRSMII scores were between ME-1 and antenatal EPDS total score, and between ME-1 and 5-month EPDS total score. These correlations were inverse, with higher EPDS scores (more depressive symptoms) in pregnancy and at 5 months associated with lower maternal energy at 1 month (though not at 5 months).

Though these measures of depression are not consistently highly correlated, both are retained for further analysis in this chapter. The rationale for retaining the EPDS total score is that the EPDS has been previously validated as an assessment of depressive symptoms in numerous settings, including in this region of The Gambia, despite differences in translation.

The GRSMII is retained because, as discussed in chapter 7, it may better represent the genuine prevalence of depression in this sample, and it allows comparison of maternal depression and infant social behaviour collected during the same experimental MII paradigm. Although mood and energy were highly correlated, both are retained as they did not share all the same associations with other variables.

8.2.3 How do infant social behaviour scores and maternal depression scores relate?

Next, correlations between maternal depression and newborn and infant social behaviour scores were assessed.

8.2.3.1 Newborn behaviour (NBAS) and maternal depression scores (EPDS and GRSMII)

There were no significant correlations between NBAS items and EPDS scores – total or Q10 – at 1 and 5 months (Table 52). The single trend in association was between VDif and the 5-month EPDS Q10 score, with a higher performance on the social FO item compared to the non-social Ball associated with mothers’ greater desire for isolation at 5 months.

Table 52. Spearman’s rank-order correlations between NBAS and EPDS scores at 1 and 5 months

		FO	FV	VDif	VADif	MV	MVA
Spearman’s Rho	1M EPDS total	-.12	-.149	-.023	-.067	-.161	-.151
Sig. (2-tailed)		.293	.201	.851	.588	.187	.218
N		79	75	71	67	69	68
	1M EPDS Q10	.1	.032	.123	-.109	-.084	-.015
		.383	.768	.309	.375	.492	.903
		79	75	71	68	69	68
	5M EPDS total	.021	.099	.12	.199	-.163	-.095
		.858	.413	.334	.116	.194	.456
		74	71	67	64	65	64
	5M EPDS Q10	.123	.131	.205	.119	-.054	-.011
		.298	.276	.096	.347	.67	.93
		74	71	67	64	65	64

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = (FO + Ball)/2; MVA = (FV + Rattle)/2

Likewise, there were no significant correlations between NBAS items and observations of maternal mood or energy during MII at 1 or 5 months (Table 53); however, there was a positive trend between VDif and MM-1 ($r_s = .278$, $p = .079$, $N=41$), with greater performance on FO compared to Ball associated with higher maternal mood at 1 month.

Table 53. Spearman's rank-order correlations between NBAS and maternal GRSMII

		FO	FV	VDif	VADif	MV	MVA
Spearman's Rho	MM-1	.214	.076	.278	.195	-.004	.076
Sig. (2-tailed)		.158	.626	.079	.241	.98	.652
N		45	44	41	38	39	38
	ME-1	.243	.068	.24	.079	-.016	.043
		.108	.663	.13	.635	.925	.799
		45	44	41	38	39	38
	MM-5	-.039	-.1	.259	.03	-.236	-.153
		.813	.547	.127	.864	.179	.387
		40	39	36	34	34	34
	ME-5	.086	.116	.153	.191	-.066	-.013
		.597	.481	.372	.28	.711	.941
		50	39	36	34	34	34

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = (FO + Ball)/2; MVA = (FV + Rattle)/2; MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; MM-5 = Maternal mood at 5 months; ME-5 = Maternal energy at 5 months

8.2.3.2 Infant social behaviour (GRSMII) and maternal EPDS scores

There was no significant correlation between 1-month EPDS scores and infant social behaviour scores on the GRSMII at 1 month (Table 54).

Table 54. Spearman's rank-order correlations between EPDS and infant GRSMII: 1 month

		ATN-1	AC-1	PV-1	CD1-1
Spearman's Rho	1 Month EPDS total	-.212	-.083	-.031	-.172
Sig. (2-tailed)		.148	.577	.836	.243
N		48	48	48	48
	1 Month EPDS Q10	-.1	-.049	-.129	-.108
		.5	.742	.384	.465
		48	48	48	48

Note: ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active positive communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month

In contrast, EPDS total score at 5 months was significantly positively correlated with PV-5 ($r_s = .32, p = .041, N=41$), with medium strength. EPDS 5-month total score also had a trend toward significant correlation with AC-5 and CD1-5 (Table 55). EPDS Q10 was not significantly correlated with infant social behaviour at 5 months (Table 55). These findings suggest that a higher EPDS total score at 5 months is associated with greater infant efforts to vocalise and/or actively communicate with their mothers at 5 months after birth.

Table 55. Spearman’s rank-order correlations between EPDS and infant GRSMII: 5 months

		ATN-5	AC-5	PV-5	CD1-5
Spearman’s Rho	5 Month EPDS total	-.031	.273	.32*	.268
Sig. (2-tailed)		.848	.085	.041	.09
N		41	41	41	41
	5 Month EPDS Q10	.06	.118	-.056	.039
		.708	.464	.727	.809
		41	41	41	41

Note: ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months; * $p < .05$

8.2.3.3 Infant and maternal GRSMII scores

Next, maternal depressive behaviour and infant social behaviour as measured by the GRSMII were entered into a correlation matrix, to assess whether measurements of maternal and infant behaviour from the same assessment conditions may reveal a stronger correlation; however, there were no significant correlations between maternal depressive behaviour and infant social behaviour at 1 month (Table 56) or at 5 months (Table 57). There was a single trend between maternal energy and infant positive vocalising at 5 months, with a higher ME-5 score associated with lower PV-5.

Table 56. Spearman's rank-order correlations within 1-month GRSMII scores

		ATN-1	AC-1	PV-1	CD1-1
Spearman's Rho	MM-1	.037	.061	-.088	.042
Sig. (2-tailed)		.800	.675	.545	.776
N		49	49	49	49
	ME-1	.062	.077	.079	.1
		.673	.599	.587	.494
		49	49	49	49

Note: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active positive communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month

Table 57. Spearman's rank-order correlations within 5-month GRSMII scores

		ATN-5	AC-5	PV-5	CD1-5
Spearman's Rho	MM-5	-.069	-.035	-.017	-.076
Sig. (2-tailed)		.659	.822	.915	.630
N		43	43	43	43
	ME-5	-.01	-.188	-.285	-.245
		.943	.228	.064	.114
		43	43	43	43

Note: MM-5 = Maternal mood at 5 months; ME-5 = Maternal energy at 5 months; ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active positive communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months

Likewise, there was no significant correlation, or trend, between maternal mood or energy and infant social behaviour across visits (Tables 58 and 59).

Table 58. Spearman's rank-order correlations between maternal GRSMII at 1 month and infant GRSMII at 5 months

		ATN-5	AC-5	PV-5	CD1-5
Spearman's Rho	MM-1	-.236	-.026	-.035	-.117
Sig. (2-tailed)		.133	.871	.826	.459
N		42	42	42	42
	ME-1	-.002	-.059	-.221	-.15
		.989	.713	.159	.342
		42	42	42	42

Note: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months

Table 59. Spearman's rank-order correlations between infant GRSMII at 1 month and maternal GRSMII at 5 months

		ATN-1	AC-1	PV-1	CD1-1
Spearman's Rho	MM-5	.014	-.072	.091	.004
Sig. (2-tailed)		.93	.65	.566	.977
N		42	42	42	42
	ME-5	-.053	-.084	-.109	-.103
		.737	.598	.494	.515
		42	42	42	42

Note: MM-5 = Maternal mood at 5 months; ME-5 = Maternal energy at 5 months; ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month

8.2.3.4 Antenatal maternal EPDS scores and infant social behaviour (NBAS and GRSMII)

Finally, the relationship between EPDS scores in the third trimester and later infant social behaviour scores was assessed, since previous research has indicated a salient effect of antenatal depression on infant physiology (e.g. Field, Diego, & Hernandez-Reif, 2006) and behaviour (e.g. Davis et al., 2004).

Antenatal EPDS Q10 scores ($r_s = -.273$, $p < .026$, $N=66$) were significantly correlated with newborns' mean performance on visual items (MV), with higher Q10 scores associated with lower MV scores. There was a similar trend between antenatal EPDS Q10 and mean performance on visual-auditory items (MVA) (Table 60).

Table 60. Spearman's rank-order correlations between antenatal EPDS and NBAS

		FO	FV	VDif	VADif	MV	MVA
Spearman's Rho	Antenatal	-.007	-.091	.066	.153	-.113	-.163
Sig. (2-tailed)	EPDS	.955	.462	.594	.222	.366	.192
N	total	73	68	68	66	66	66
	Antenatal	-.06	-.188	.171	-.082	-.273*	-.238
	EPDS Q10	.614	.124	.163	.51	.026	.054
		73	68	68	66	66	66

Note: FO = Face Only; FV = Face plus Voice; VDif = FO – Ball; VADif = FV – Rattle; MV = (FO + Ball)/2; MVA = (FV + Rattle)/2; * $p < .05$

There were no significant correlations between antenatal EPDS total or Q10 scores and infant social behaviour at 1 month (Table 61).

Table 61. Spearman's rank-order correlations between antenatal EPDS and infant GRSMII at 1 month

		ATN-1	AC-1	PV-1	CD1-1
Spearman's Rho	Antenatal EPDS total	-.067	.059	.207	.023
Sig. (2-tailed)		.701	.736	.234	.895
N		35	35	35	35
	Antenatal EPDS Q10	.017	-.107	.06	.008
		.923	.541	.733	.962
		35	35	35	35

Note: ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active communication at 1 month; PV-1 = Infant positive vocalisation at 1 month; CD1-1 = Composite Dimension 1 at 1 month

At 5 months, antenatal EPDS total scores were significantly correlated with both PV-5 ($r_s = .409, p = .018, N=33$) and CD1-5 ($r_s = .388, p = .026, N=33$), but not with ATN-5 or AC-5 (Table 62), although there was a trend toward association between antenatal EPDS total score and infant AC-5 (Table 62). Higher EPDS total scores in pregnancy were associated with higher infant PV and CD1 at 5 months, with 16.7% and 15.1% shared variance respectively, but not at 1 month or with NBAS orientation behaviours. At 5 months, EPDS Q10 scores during pregnancy were associated significantly only with infant PV-5 ($r_s = .352, p = .045, N=33$; shared variance 12.3%).

Table 62. Spearman’s rank-order correlations between antenatal EPDS and infant GRSMII at 5 months

		ATN-5	AC-5	PV-5	CD1-5
Spearman’s Rho	Antenatal EPDS	.055	.328	.409*	.388*
Sig. (2-tailed)	total	.761	.062	.018	.026
N		33	33	33	33
	Antenatal EPDS	-.051	.204	.352*	.278
	Q10	.779	.254	.045	.118
		33	33	33	33

Note: ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months; * $p < .05$

8.2.4 Is ‘chronic’ depression more associated with infant social behaviour than depression at a single visit?

Because of previous findings as outlined in chapter 2 (e.g. Sutter-Dallay et al., 2011; Wojcicki et al., 2011), further analyses were intended to explore whether ‘chronic’ depression (e.g. an EPDS score above cut-off at multiple visits) was more strongly associated with infant social behaviour scores than having an above-cut-off EPDS score at only one visit; however, such a comparison was not measurable in this sample because no mothers scored above cut-off at more than one visit.

Maternal GRSMII scores were consulted to give an exploratory indication of stability. Of those with a mood score at both visits (N=42), eight mothers (19%) had low mood for the majority or all of the session at 1 month, but no mothers had this score at the 5-month visit. Of those mothers with an energy score at both visits (N=42), nine mothers (21.4%) had low energy at only 1 month; three mothers (7.1%) had low energy scores at 5 months only; and two mothers (4.8%) had low energy at both visits.

8.3 Associations between infant social behaviour and demographic factors

After exploring the relationship between infant social behaviour and maternal depression, potential demographic influences on infant social behaviour were assessed, again using Spearman's rank-order correlations. The demographic variables of interest were infant gender, BW, GA at birth, and weight at each visit; maternal parity and age; and SES. Associations between demographic factors and newborn social behaviour (NBAS) are considered first, with infant age on the day of assessment as an additional demographic variable of interest.

8.3.1 Newborn social behaviour and demographic factors

Infant sex was significantly correlated with FO scores ($r_s = .216, p = .043, N=88$) and VDif scores ($r_s = .276, p = .013, N=80$), with females having higher mean scores than males, but with a small magnitude of association, and only 4.7% and 7.6% shared variance, respectively.

Maternal parity significantly, was inversely correlated with VADif scores ($r_s = -.255, p = .027, N=75$). Therefore, better performance tracking the social FV item compared to the non-social Rattle was associated with lower maternal parity.

There were three other trends approaching significance between NBAS performance and demographic factors (Table 63): VADif score and infant weight on the day of the NBAS, with better performance on the social item associated with a heavier weight; FV score and infant age on the day of the NBAS; and VDif score and infant age on the day of the NBAS, with better FV and VDif scores associated with older infant age on the day of assessment.

Table 63. Spearman's rank-order correlations between NBAS scores and selected demographic factors

		Sex	BW	GA	Visit weight	Mat. parity	Mat. age	SES	Infant visit age
Spearman's Rho	FO	.216*	-.023	-.148	-.045	.066	.023	.127	.125
Sig. (2-tailed)		.043	.853	.228	.678	.546	.844	.261	.245
N		88	58	68	87	87	79	80	88
	FV	.084	.063	-.053	.058	-.177	-.103	.036	.203
		.449	.618	.678	.603	.109	.380	.758	.064
		84	64	64	83	83	75	76	84
	VDif	.276*	-.138	.095	-.161	.116	.074	.097	.199
		.013	.276	.454	.155	.309	.533	.416	.077
		80	64	64	79	79	73	72	80
	VADif	.108	-.189	.041	-.216	-.255*	-.164	-.004	.117
		.354	.276	.749	.063	.027	.175	.974	.315
		76	64	63	75	75	70	69	76
	MV	-.072	.139	-.165	.158	-.1	-.063	.058	.113
		.534	.281	.199	.17	.387	.599	.632	.326
		78	62	62	77	77	71	70	78
	MVA	-.027	.158	-.137	.123	-.1.2	-.087	.03	.098
		.82	.217	.284	.294	.306	.473	.805	.401
		76	63	63	75	75	70	69	76

Note: FO = Face Only; FV = Face plus Voice; VDif = Face Only – Ball ; VADif = Face Plus Voice – Rattle; MV = (Face Only + Ball)/2; MVA = (Face plus Voice + Rattle)/2; * $p < .05$

8.3.2 Infant social behaviour at 1 and 5 months and demographic factors

Next, individual infant GRSMII scales and the composite score were assessed alongside demographic factors, first at 1 and then at 5 months. At 1 month, the only significant correlation between infant social behaviour and demographic variables was between infant BW and AC-1 ($r_s = .389, p = .021, N=35$), with a medium magnitude of association, 15% shared variance, and a higher BW associated with higher AC-1. There were no other significant associations with demographic variables at 1 month, including infant visit weight (Table 64).

Table 64. Spearman's rank-order correlations between infant GRSMII at 1 month and selected demographic factors

		Sex	BW	GA	Visit weight	Mat. parity	Mat. age	SES
Spearman's Rho	ATN-1	-.214	.134	-.125	.138	-.159	.003	-.071
Sig. (2-tailed)		.14	.442	.473	.348	.281	.986	.645
N		49	35	35	48	48	42	44
	AC-1	.209	.389*	-.22	.051	.016	.228	-.119
		.15	.021	.205	.73	.916	.147	.442
		49	35	35	48	48	42	44
	PV-1	-.031	-.098	-.034	.1	-.009	-.042	.133
		.835	.577	.845	.501	.949	.789	.389
		49	35	35	48	48	42	44
	CD1-1	-.074	.197	-.161	.122	-.126	.059	-.078
		.614	.257	.354	.408	.393	.713	.614
		49	35	35	48	48	42	44

Note: ATN-1 = Infant visual attentiveness at 1 month; AC-1 = Infant active communication at 1 month; PV-1 = Infant positive vocalisations at 1 month; CD1-1 = Composite Dimension 1 at 1 month; * $p < .05$

Similarly, there were no significant associations between the demographic variables and infant social behaviour at 5 months (Table 65). There was, however, a

trend between infant weight at 5 months and PV-5 ($r_s = .273, p = .08, N=42$), with a higher infant visit weight associated with a higher frequency of vocalising.

Table 65. Spearman’s rank-order correlations between infant GRSMII at 5 months and selected demographic factors

		Sex	BW	GA	Visit weight	Mat. parity	Mat. age	SES
Spearman’s Rho	ATN-5	-.108	-.009	-.057	.037	.254	.237	.194
Sig. (2-tailed)		.49	.961	.722	.817	.325	.159	.236
N		43	30	42	42	43	37	39
	AC-5	-.184	-.212	.169	.255	.086	-.263	.016
		.238	.26	.373	.104	.582	.115	.925
		43	30	30	42	43	37	39
	PV-5	-.112	-.127	-.072	.273	.109	.014	.041
		.473	.502	.705	.080	.485	.934	.803
		43	30	30	42	43	37	39
	CD1-5	-.167	-.161	-.005	.242	.175	.038	.1
		.284	.397	.979	.123	.261	.824	.546
		43	30	30	42	43	37	39

Note: ATN-5 = Infant visual attentiveness at 5 months; AC-5 = Infant active communication at 5 months; PV-5 = Infant positive vocalisations at 5 months; CD1-5 = Composite Dimension 1 at 5 months; * $p < .05$

8.3.3 Maternal depression and demographic factors

Finally, given that infant BW and GA, infant weight, SES, maternal parity and maternal age are thought to influence maternal depression, mothers’ EPDS scores, and then mood and energy (GRSMII), were correlated with demographic factors.

8.3.3.1 EPDS and demographic factors

EPDS Q10 at the antenatal visit was significantly, negatively correlated with SES ($r_s = -.290, p = .009, N=81$), and infant BW ($r_s = -.256, p = .028, N=74$), with higher antenatal EPDS Q10 scores associated with lower SES and lower infant BW. EPDS total

score at 1 month was significantly, negatively associated with maternal age ($r_s = -.292$, $p = .008$, $N=82$) and parity ($r_s = -.231$, $p = .036$, $N=82$), with higher 1-month EPDS total scores associated with lower maternal parity and age. Similarly, EPDS Q10 at 5 months was significantly, negatively correlated with maternal parity ($r_s = -.269$, $p = .017$, $N=79$) and age ($r_s = -.325$, $p = .003$, $N=81$), with higher EPDS Q10 scores at 5 months associated with lower maternal parity and age. There were also trends between EPDS total score at 5 months and maternal parity, and between antenatal EPDS total and infant BW, but these were non-significant (Table 66).

Table 66. Spearman’s rank-order correlations between EPDS and demographic variables

		GA	BW	1M weight	5M weight	SES	Mat. Parity	Mat. Age
Spearman’s Rho Sig. (2-tailed) N	Antenatal EPDS total	-.011 .926 74	-.214 .067 74	-.057 .612 81	.133 .252 76	-.067 .555 81	-.011 .927 76	.067 .555 80
	Antenatal EPDS Q10	.004 .974 74	-.256* .028 74	-.11 .326 81	-.045 .697 76	-.290* .009 81	.145 .212 76	.075 .51 80
	1 Month EPDS total	-.026 .829 71	-.085 .483 71	-.113 .283 93	-.078 .484 83	-.154 .158 86	-.231* .036 82	-.292** .008 82
	1 Month EPDS Q10	-.035 .772 71	-.172 .151 71	-.107 .308 93	-.035 .757 83	-.051 .639 86	-.102 .36 82	-.114 .307 82
	5 Month EPDS total	-.157 .197 69	-.091 .459 69	-.007 .950 85	.097 .367 88	-.136 .218 84	-.202 .074 79	-.011 .925 81
	5 Month EPDS Q10	-.081 .508 69	-.154 .206 69	.048 .663 85	.037 .73 88	-.119 .279 84	-.269* .017 79	-.325** .003 81

** $p < .01$; * $p < .05$

8.3.3.2 Maternal GRSMII scores and demographic factors

Maternal mood and energy at 1 month (as rated by the GRSMII) were not significantly correlated with any demographic variables (Table 67). At 5 months, maternal mood was significantly, inversely correlated with maternal parity ($r_s = -.356$, $p = .019$, $N=43$) and age ($r_s = -.46$, $p = .004$, $N=37$), such that a lower mood at 5 months was associated with a *higher* maternal parity and age (the opposite direction of effect to correlations between the EPDS and maternal age and parity), with a medium strength of association. Maternal energy at 5 months was significantly associated with maternal parity ($r_s = -.407$, $p = .007$, $N=43$). Neither SES, nor infant BW, GA or visit weights were significantly correlated with maternal GRSMII scores at either 1 or 5 months, though there was a trend between ME-5 and maternal age (Table 67).

Table 67. Spearman’s rank-order correlations between maternal GRSMII at 1 and 5 months and demographic variables

		GA	BW	1M weight	5M weight	SES	Mat. Parity	Mat. Age
Spearman’s Rho	MM-1	.162	.188	.1	-.093	.076	-.003	-.073
Sig. (2-tailed)		.353	.278	.499	.543	.626	.985	.644
N		35	35	48	45	44	48	42
	ME-1	-.011	.223	-.083	-.077	.115	.016	-.098
		.949	.198	.574	.616	.458	.913	.535
		35	35	48	45	44	48	42
	MM-5	-.032	-.036	-.097	.153	-.004	-.356*	-.46**
		.866	.849	.541	.335	.982	.019	.004
		30	30	42	42	39	43	37
	ME-5	.144	.23	.036	-.079	.121	-.407**	-.28
		.449	.221	.821	.618	.462	.007	.093
		30	30	42	42	39	43	37

Notes: MM-1 = Maternal mood at 1 month; ME-1 = Maternal energy at 1 month; MM-5 = Maternal mood at 5 months; ME-5 = Maternal energy at 5 months ** $p < .01$; * $p < .05$

8.4 Predictors of infant social behaviour

To assess whether any demographic or earlier infant behaviour scores were predictive of later social behaviour, linear regressions were planned with maternal and infant variables identified in the previous sections of this chapter as highly and significantly correlated with infant social behaviour at 1 and 5 months, and during the newborn period. Due to the limited sample size of infants with social behaviour data coded at 1 and 5 months, linear regressions were exploratory only.

8.4.1 *Predictors of infant social behaviour at 1 month: infant BW and NBAS performance (FV, MV, MVA)*

The first simple linear regression was calculated using infant BW to predict infant active communication at 1 month. The histogram and normal P-P plot of the standardised residuals displayed approximately normal distribution. The normal P-P plot also indicated approximate linearity with some deviation in the middle portion. A scatterplot of the predicted values against standardised residuals indicated heteroscedasticity with a single outlier, but the standardised residual values fell between -2.215 and 2.081, within the guideline of -3 to +3, and Cook's distance was less than 1 (.291), indicating that this outlier was unlikely to have greatly impacted the model. This process of inspecting the model for assumption violations was conducted for each regression. For sake of conciseness, the full process is not detailed for subsequent regressions; only violations of assumptions are indicated.

A significant regression equation was found using BW as a predictor of infant active communication efforts at 1 month ($F(1, 33) = 4.869, p = .034$; Beta = .383, $t(3) = 2.207, p = .034$; adjusted $R^2 = .102$), and explained 10.2% of the variance. Infants' predicted AC-1 score was $-.139 + .687$ points when BW is measured in kg. In other words, infants' predicted AC-1 scores increased by .687 for each kg of BW.

Another simple linear regression was calculated to predict ATN-1, using infant performance on the NBAS item FV. A significant regression equation was found ($F(1, 42) = 4.608, p = .038$). From this model we can conclude that FV was a significant predictor of ATN-1 in this sample (Beta = .314, $t(3) = 2.147, p = .038$; adjusted $R^2 = .077$). Infants' ATN-1 score was $2.134 + .166$ points when FV is scored on a scale of 1 to 9. Infants' predicted ATN-1 score increased .166 points for each point increase in FV score. Regressions using FV to predict PV-1 and AC-1 were not significant.

As a comparison, an equation using MVA as a predictor of ATN-1 was also significant ($F(1, 35) = 8.22, p = .007$) and could explain more variance (16.7%; Beta = .436, $t(3) = 2.867, p = .007$, adjusted $R^2 = .167$) than the model using FV (7.7%). An equation using MV as a predictor of ATN-1 was not significant but only marginally so ($F(1, 37) = 3.985, p = .053$; Beta = .312, $t(3) = 1.996, p = .053$; adjusted $R^2 = .073$). This indicates that infant visual attention to the mother was predicted better by general ability to orient than orientation to a social stimulus in particular.

A multiple regression with both FV and MVA as predictors of ATN-1 could not be run with confidence as there were too few cases available and these items were strongly inter-correlated and collinear; however, in line with the results of the simple regressions using FV and MVA independently (higher variance for MVA than FV), this multiple regression indicated that MVA contributed more of the variance in ATN-1 score (Part = .342; 11.6% variance) than FV (Part = .029; .08% variance) in the model.

Finally, after removing an outlier to adhere to required assumptions, a simple linear regression equation using MVA as a predictor of the infant social behaviour composite at 1 month was significant ($F(1, 35) = 7.021, p = .012$). From this model we can conclude that MVA was a significant predictor of CD1-1 (Beta = .409, $t(3) = 2.65, p = .012$; adjusted $R^2 = .143$). Infant's CD1-1 score was $1.506 + .110$ points with MVA

scored on a scale of 1 to 9. Infants' predicted CD1-1 scores increased by .409 for each point increase on MVA score.

8.4.2 *Predictors of infant social behaviour at 5 months: NBAS performance (MV; MVA) and antenatal and 5-month EPDS scores*

Although associations between NBAS performance according to MV and AC-5 had been identified, and between MVA and PV-5, linear regressions using these NBAS items as predictors of 5-month social behaviour were non-significant. The equation using MV as a predictor of AC-5, though non-significant, did suggest an inverse trend ($F(1, 32) = 3.076, p = .089$; $\text{Beta} = -.296, t(3) = -1.754$; adjusted $R^2 = .059$). The equation using MVA as a predictor of PV-5 was likewise inverse and non-significant ($F(1, 32) = 2.528, p = .122$; $\text{Beta} = -.271, t(3) = -1.59$; adjusted $R^2 = .044$).

Unlike using NBAS as predictors of 5-month behaviour, a simple regression equation using antenatal EPDS total scores to predict PV-5 was significant and explained 13.6% of the variance ($F(1, 31) = 6.038, p = .02$; $\text{Beta} = .404, t(3) = 2.457, p = .02$, adjusted $R^2 = .136$). With one standard unit increase in antenatal EPDS total score, infants' predicted PV-5 score increased by .404.

EPDS total score at 5 months was a slightly better predictor of infant PV-5 than EPDS total score in the third trimester, and a model utilising 5-month EPDS total scores as a predictor for PV-5 was significant ($F(1, 39) = 8.809, p = .007$; $\text{Beta} = .414, t(3) = 2.843, p = .007$, adjusted $R^2 = .15$) and explained 15% of the variance. With each standard unit increase in 5-month EPDS total score, the predicted PV-5 scores increased by .414.

A multiple regression model remained significant when using both antenatal and 5-month total EPDS total scores as predictors of PV-5 ($F(2, 30) = 5.445, p = .01$), but revealed that 5-month EPDS total score was a unique predictor of infant PV-5

score over and above antenatal EPDS total score, $Beta_1 = .333$, $t(7) = 2.055$, $p = .049$, $sr^2 = .103$. With one standard unit increase in 5-month EPDS score, the predicted PV-5 increased .333 units and the contribution of the antenatal depression score was no longer significant in this model ($Beta_2 = .318$, $t(7) = 1.968$, $p = .058$, $sr^2 = .095$). Additionally, while the assumptions of multicollinearity, heteroscedasticity and normality were upheld, there were fewer than the required 40 cases for two predictors, so the previous simple regression model using 5-month EPDS scores only was more appropriate than a multiple regression equation for predicting PV-5, though antenatal EPDS scores were a similarly good predictor using data from an earlier visit.

8.4.3 Predictors of newborn social behaviour (NBAS): maternal parity and antenatal EPDS Q10

Finally, maternal parity and antenatal EPDS Q10 were assessed as predictors of newborn social behaviour. First, after removing an outlier to avoid violating the assumption of heteroscedasticity, a regression equation in which maternal parity predicted the difference in response to the social FV item compared to a Rattle (VADif) was significant ($F(1, 72) = 5.52$, $p = .022$; $Beta = -.267$, $t(3) = -2.349$, $p = .022$, $R^2 = .071$), explaining 7.1% of the variance. With one standard unit increase in parity, VADif score decreased .267 units.

A second regression equation in which mothers' antenatal EPDS Q10 score predicted newborn mean performance on the visual NBAS items (MV) was significant, ($F(1, 61) = 6.1$, $p = .016$; $Beta = -.302$, $t(3) = -2.47$, $p = .016$, $R^2 = .092$), explaining 9.2% of the variance. With one standard unit increase in antenatal EPDS Q10, MV score decreased .302 units.

8.5 Discussion

8.5.1 *Summary of associations within measures of infant social behaviour and maternal depression*

8.5.1.1 *NBAS*

The items measuring infant social behaviour at the 7-14-day visit were largely inter-correlated, which is expected given that the sets of selected items (individual items, differentials, and means) were essentially assessing the same features (orientation to social and non-social stimuli) from differing angles, and calculated using the same basic scores (FO, FV, Ball and Rattle). A significant, inverse correlation between MV and VDif emphasised the better performance on non-social compared to social items in this sample, especially between FO and Ball.

8.5.1.2 *GRSMII – infants*

Infant GRSMII scales were associated to some extent within each visit, with two significant correlations amongst the individual scales at 1 month and one significant correlation at 5 months, but there were no significant correlations at all amongst infant social scales between 1 month and 5 months. Although, in terms of active communication and positive vocalising, infants became more interactive between 1 and 5 months (chapter 7) as could be expected given the 2-month shift, these behaviours were not significantly associated over time within infants.

Therefore, in this sample, individual infant behaviour at 1 month does not necessarily predict this behaviour at 5 months, such that an infant who is highly vocal at one visit may not be highly vocal at another. This lack of significant correlation over time may suggest that other environmental factors – for example, parental behaviour or other unmeasured parent-, context- or infant-specific factors – are influencing individual infant behaviour.

8.5.1.3 EPDS

Within the EPDS, the total scores and answers to the culturally-specific item (Q10) were significantly, positively correlated together at all visits, suggesting good agreement, with the strongest correlation at the antenatal visit; however, as will be discussed, EPDS Q10 and EPDS total score did not always correlate in a shared way with other variables, so there was reason to think that Q10 may have accessed a distinct underlying feature of depression to some degree. Total EPDS scores were also significantly correlated within mothers over time, such that mothers who reported low total depressive symptoms at one visit were likely to do so at the others, and vice versa. EPDS Q10 was significantly correlated within mothers between the antenatal and 1-month visits, and between the 1-month and 5-month visits, but not between the antenatal and 5-month visits, indicating a lack of coherence in this culturally-specific aspect of depression between the earliest and latest points of assessment.

8.5.1.4 GRSMII – mothers

Similar to the infant social behaviour ratings on the GRSMII at 1 and 5 months, maternal mood and energy scores were significantly correlated within each visit, but not across visits. This lack of coherence between 1 and 5 months for both infant and maternal behaviour might be accounted for by a number of possibilities. For example, perhaps normal developmental changes between 1 and 5 months preclude, or at least reduce, the usefulness of direct comparison of behaviour at these visits. Additionally, the GRSMII was developed for use with 2- and 4-month-old infants rather than 1- and 5-month-olds, perhaps to control for marked developmental changes between 1 and 3 months. Due to behavioural differences preceding and following the 2-month shift, the GRSMII may not measure identical features of MII behaviour at 1 and 5 months, which may help to account for the lack of correlation between the visits.

8.5.2 Associations across measures of infant social behaviour: NBAS and infant GRSMII

Newborn behaviour on the NBAS was not consistently related to infant behaviour on the GRSMII, which might have been expected given that these measures assess infant behaviour in different ways. As previously noted, both measures assess visual pursuit of the interactive partner; however, during the NBAS, the interactive partner is a skilled examiner who purposely attempts to draw out the infant's optimal orientation behaviour, whereas the interactive partner in the GRSMII is the infant's mother, who, due to a likely intensive caregiving and domestic load as well as possible shared beliefs about newborns lacking sight and hearing abilities, may or may not be experienced in eliciting social and orientation behaviour at 1 month.

The items based on visual-auditory modalities (e.g. FV, MVA), were the most significantly correlated with later infant social behaviour, while the individual item based on the visual modality only (FO), was not correlated with any later behaviour. MVA scores had the greatest number of significant correlations with infant social variables at 1 month (ATN-1, AC-1, and CD1-1), though the individual FV item had two significant correlations (ATN-1 and CD1-1) as well as having trends in association with the remaining 1-month variables (AC-1 and PV-1). MV was significantly correlated with ATN at 1 month, and there was a trend between MV and PV-1.

Interestingly, the Rho values between MVA and PV-1, and between FV and PV-1, were negative, indicating that any potential relationship between these variables would signify decreasing positive vocalising at 1 month alongside increasing performance to visual-auditory NBAS items. Although speculative because of a lack of significance and also because correlations do not imply causation, it is nevertheless interesting that a high performance in visual tracking (e.g. *en face* engagement with a social stimulus) would coincide with a low frequency of audible contributions to an *en face* social interaction at 1 month. Perhaps this is due to the low frequency of positive

vocalising in the sample at 1 month overall. However, there were also negative trends between MV performance and PV-1 and between FV score and PV-1, such that there may be reason to posit that higher visual and visual-auditory engagement during the NBAS is related to lower vocalising behaviours at 1 month.

By 5 months, there were no significant correlations between NBAS items and infant social behaviour on the GRSMII, but there was a trend toward negative association between MVA and PV-5, such that higher engagement during the NBAS continued to coincide with lower frequency of positive vocalising at 5 months. This enduring trend between multiple facets of newborn orientation behaviour and later vocalising frequency in this sample may be worth further investigation.

Interestingly, the direction of association between the individual NBAS items and AC, and between the mean scores and AC, was positive at 1 month, but was negative at 5 months, whereas associations between NBAS items and PV remained negative at both visits, and associations between NBAS items and ATN remained positive at both visits. Although preliminary, these patterns may indicate unique relationships over time between newborns' orientation performance and the three types of infant social behaviour measured, and potentially implicate other factors in the environment. This may also warrant further investigation with a larger sample.

8.5.3 Associations across measures of depression: EPDS and maternal GRSMII

There was little agreement between the EPDS total scores at 1 and 5 months and the observational ratings of maternal mood and energy (maternal GRSMII), suggesting that these measures may have been accessing different underlying factors. However, there were two significant negative correlations, both related to maternal energy at 1 month: between antenatal EPDS total score and maternal energy at 1 month (though not at 5 months), and between maternal energy at 1 month and EPDS total score at 5 months. These results suggest a stronger relationship between

mothers' higher self-reported depression (in the third trimester and at 5 months), and their observed lower *energy* at 1 month, than between antenatal or 5-month depressive symptoms and observed lower *mood* at 1 month. Notably, however, there was also a conflicting, negative trend in association between 1-month maternal mood and 5-month Q10 score (implicating a higher mood at 1 month and a higher desire for isolation at 5 months) which would contradict this pattern.

It is possible that the EPDS and the GRSMII are measuring different underlying variables, but the fact that the antenatal and 5-month EPDS total scores are significantly negatively associated with maternal energy raises the possibility that the EPDS total score and GRSMII ME scale do overlap in terms of aspect of depression assessed, with the salience of energy-related facets of depression (e.g. struggling to cope with daily tasks, etc.) more highly relevant than mood-related facets (e.g. crying, laughing or panicking), especially at the antenatal visit just prior to birth and at the 5-month visit, by which time mothers will have resumed a more typical workload following the first few weeks with their newborn (field observation). The fact that observed maternal mood had no significant relationship with the EPDS total score gives weight to the possibility that the translated EPDS used in this study did not access as much information about mothers' *mood* in particular as it did information about facets of depression not strictly related to emotions (e.g. low energy, struggling with daily tasks, etc.).

8.5.4 Associations between measures of infant social behaviour and maternal depression

In this sample, the degree of correlation between measures of maternal depression across visits and infant social behaviour at the 7-14 day or 1-month visit was lower than the degree of correlation between maternal antenatal and 5-month depression and later infant behaviour at the 5-month visit.

Newborn social behaviour as measured by the NBAS was not correlated significantly with maternal mood or energy at either 1 or 5 months, or with EPDS scores at 1 or 5 months, which may be expected given the chronology of assessment. However, there was a positive trend between VDif and maternal mood at 1 month, with higher performance on FO compared to Ball associated with higher maternal mood, suggesting a potential relationship between more socially-interested newborns and higher maternal mood at 1 month, but this was non-significant. Counterintuitively, there was also a positive trend between VDif and the 5-month EPDS Q10 score, such that higher performance on FO compared to Ball (more engagement with the social stimulus) was associated with a greater desire for isolation at 5 months, but this was also non-significant.

As expected given previous findings as detailed in chapter 7, there was a significant association between depression during pregnancy and one aspect of newborn behaviour, but this was restricted to the culture-specific EPDS Q10 rather than the total score. Antenatal EPDS Q10 scores were correlated significantly and negatively with mean performance on the FO and Ball items (MV), such that a higher desire for isolation during pregnancy was associated with lower mean performance on the visual NBAS items. There was a similar trend between antenatal Q10 and mean performance on the visual-auditory items (MVA). Both of these trends are in line with previous findings that depression during pregnancy can negatively influence newborn orientation behaviour (e.g. Field et al., 2004; Lundy et al., 1999).

Unlike infant social behaviour at the NBAS or 5-month visit, there were no significant correlations or trends between infant social behaviour at 1 month and maternal depression at any visit. This absence of correlation at 1 month could simply be due to the small sample size, or taken to mean that maternal depression is not correlated with infant social behaviour at 1 month in this setting, but given that significant correlations between maternal depression and infant social behaviour

were identified at the other visits, a more likely explanation for the lack of association is the timing of the visit. During an NBAS, a trained examiner purposely attempts to engage the infant in social orientation behaviour and patiently facilitates the infant's best performance. Similarly, as described in chapter 4, by the 5-month visit the adult interactive partner (mother) likely believes that the infant can see and hear, and the infant is more developmentally mature and experienced in interaction than at 1 month. The 1-month interaction protocol, however, represents a point at which the dyad may be immature in their interaction experience, as it involves infants who have not yet reached the 2-month-shift, and mothers who may or may not believe their infants lack the capacity to interact with them.

Given that other studies have shown significant influence of maternal depression on infant behaviour in the newborn period (e.g. Hernandez-Reif et al., 2006), it is likely that the combination of the shared belief about delayed onset of sight and hearing, and the universal infant developmental agenda, interact in this setting to produce the observed 'gap' in influence of maternal depression on infant social behaviour at 1 month. The majority of studies on infant behaviour and maternal depression during MII have involved infants between 3 and 6 months of age (Field, 2010), which does not allow for direct comparison with the present study. Future research conducted with slightly older infants, at 2 or 3 months could help to determine whether this 'gap' persists into later infancy.

Unlike at 1 month, infant social behaviour at 5 months was highly correlated with antenatal and 5-month EPDS total scores, at least in terms of positive vocalising, though the association was not in the expected direction. A previous review of postpartum depression and child outcomes – albeit comprised of studies conducted with older infants in HIC settings – found that infants of depressed and withdrawn mothers tend to “develop passivity [and] withdrawal” (Canadian Paediatric Society, 2004, p. 576). In the present sample, however, rather than the inverse relationship –

higher maternal depression, lower infant social behaviour (withdrawal) – that might be expected based on these previous findings, there was a significant positive relationship between higher maternal antenatal and 5-month depression scores and higher infant positive vocalising (engagement) during MII at 5 months.

This unexpected association could be due to the small sample size, or the possibility that the EPDS was not measuring depression itself (given the lack of agreement between the EPDS total score and observed maternal mood or energy), but an alternative explanation rests in Murray and Cooper's observation that one of the "most direct" pathways of influence between maternal depression and infant outcomes is "the child's exposure to the mother's depressive symptoms" (Murray & Cooper, 1997, p. 100).

In KW, newborns are cared for almost exclusively by the mother (chapter 4), but by 5 months, infants are likely interacting with other family members such as older siblings for sustained periods during the day. One possibility for the apparent emergence of a negative association between maternal depression and infant positive vocalising in this sample is that by 5 months these infants have routinely experienced interactions with others, such that even if the mother is depressed, the infant has learned how to contribute vocally to interactions, and can apply this skill to bid for attention. Perhaps these slightly older infants, in the presence of higher maternal depression, are more effortful in engaging the social attention they are accustomed to across other interactive partners.

Supporting this theory is the finding in a sample of American infants that moderate to prolonged time with a non-depressed, warm father during infancy moderated the adverse influence of maternal depression, at least in terms of reduced internalising problems in kindergarten (Mezulis, Hyde, & Clark, 2004). Importantly, however, there was no such association in the present sample with observed

maternal mood and infant social behaviour, and it is unclear why in this sample there were associations with one purported measure of maternal depression and not the other. As will be discussed in the following chapter, further research is needed to develop and confirm a contextually-specific measure of depression in this setting.

The final, unexpected, finding in terms of the relationship between infant social behaviour and maternal depression in this sample was a negative trend between maternal energy and infant positive vocalising at 5 months, such that higher maternal energy at 5 months was associated with less infant positive vocalising at 5 months. This trend was not found at 1 month, possibly due to the low level of positive vocalising in that age group overall. Although speculative, it could also possibly be related to the coding scheme, since according to the GRSMII manual, higher maternal energy can indicate intrusiveness, such that an infant may not 'need' to make attempts to engage a highly energetic mother via vocalising.

8.5.5 Associations with demographic factors

A small number of significant associations were found between infant social behaviour and demographic factors, with a greater number of associations related to NBAS compared to infant GRSMII scales at 1 or 5 months.

8.5.5.1 Demographic factors and the NBAS

There was an expected trend between FV and VADif with infant age, such that older infants had better scores on the visual-auditory item (FV), but the fact that these associations were not significant may indicate that the range of 6 to 19 days after birth was narrow enough that infant age did not significantly influence NBAS performance, at least in the selected domains. There was also a trend between VADif and infant weight on the day of the NBAS, with heavier infants performing better on the non-social Rattle item than the FV item. Although non-significant, this trend may indicate a greater 'robustness' or 'tolerance' of the heavier infants to the intense

stimulation of the Rattle, congruent with the idea based on previous research reported in chapter 2 (Moore, 2016) that heavier infants may have greater energetic resources available for engagement. There were no trends or significant associations between NBAS items and infant BW, nor other associations between NBAS performance and visit weight aside from VADif.

The least expected association between an NBAS item and a demographic factor was the significant, negative association between VADif and maternal parity, such that lower maternal parity was associated with better performance on the social FV item compared to the non-social Rattle item. One speculative explanation is that mothers with lower parity may have more time to engage socially and face-to-face with their newborns, such that infants with fewer older siblings have had greater experience with *en face* tracking of a face and voice by the time of the NBAS.

8.5.5.2 Demographic factors and infant GRSMII at 1 and 5 months

Regarding demographic factors and infant social behaviour at 1 month, the only significant association was between AC-1 and infant BW, with infants who were heavier at birth having higher active communication scores at 1 month. As with the trend between infant visit weight and VADif, this is concordant with the aforementioned idea that heavier infants may be more 'robust' during interaction. Even given the absence of association with the infants' weight on the day of the 1-month visit, if higher BW allows infants to engage in more interaction from birth, this could lead to better communication by 1 month, regardless of their current weight (Sarah Lloyd-Fox, 2018, personal communication).

By 5 months, there were no significant associations between infant social behaviour and demographic factors, though the single trend between visit weight and positive vocalising (with heavier infants vocalising more), was again congruent with the idea that heavier infants may have greater resources available for interaction.

8.5.5.3 *Demographic factors and maternal depression*

8.5.5.3.1 Demographic factors and the EPDS

Compared to infant social behaviour, there were far more associations that reached significance between maternal depression and demographic factors. The culturally-specific EPDS Q10 at the antenatal visit was significantly correlated with infant BW and SES, such that higher desire for isolation during pregnancy was associated with lower infant BW as well as lower SES. These findings echo previous research that implicated maternal antenatal depression as a correlate of low infant BW (e.g. Grote et al., 2010). As described in chapter 2, however, associations between antenatal depression and low infant BW are uncommon, whereas associations either between postnatal depression and infant concurrent weight, or between antenatal anxiety and infant BW, have been more consistently reported. The findings of the present study – that only the culturally-specific antenatal EPDS item was significantly associated with infant BW – may indicate the utility of context-specific measures for assessing the influence of PMH on infant development in a particular setting.

The association between maternal antenatal depression and SES partly contradicts the conclusions of a previous review of studies in Nigeria, Uganda and South Africa (Wittkowski et al., 2014). This review did not identify any associations between maternal postnatal depression (PND) and SES, and the authors assumed that the lack of association was because “many African women are exposed to high levels of prolonged social adversity” (p. 120). The results of the present study in one way are concordant with Wittkowski and colleagues’ findings in that there was not an association between maternal *postnatal* depression (at 1 or 5 months) and SES, but given the significant association with a depressive measure in the third trimester, it is unlikely that their explanation is generalisable across ‘African women’; or at the very least there may be an aspect of late pregnancy that makes any underlying relevance of SES for depressive symptoms more salient.

Notably, SES as measured in this study was not significantly associated with antenatal EPDS *total* score, only Q10 score, again indicating the importance of developing and using a context-specific measure if we are to properly assess and understand the relationship between depression and other factors in this setting.

Higher self-reported depression at 1 month (EPDS total) and 5 months (EPDS Q10) was significantly associated with lower maternal parity and age. Lower maternal age has been previously identified as a risk factor for maternal PND in The Gambia (Sawyer et al., 2011), but the association with lower parity was unexpected, under the assumption that a greater number of children would require more intensive domestic labour and child-care responsibilities for mothers in this setting (given the gendered caregiving workload reported in chapter 4). However, mothers with fewer children are also likely to be younger, and perhaps age, and experience in the mothering role, is more salient to depression in this setting than parity itself. Again potentially implicating the importance of context-specific measurement to understanding depression in this setting, it is unclear from this data why the EPDS total score was significantly associated with maternal age and parity at 1 month, while the culturally-specific Q10 was significantly associated at 5 months.

8.5.5.3.2 Demographic factors and maternal GRSMII

Maternal depressive behaviour (mood and energy) on the GRSMII at 1 month was not significantly associated with any demographic variables; but at 5 months, higher (more positive) maternal mood was associated with lower maternal age and parity, and between higher (more active) maternal energy and lower maternal parity, with a trend between higher maternal energy and lower age. The interaction between younger age and higher energy makes sense at an intuitive level, but the relationship between higher mood and younger age and parity warrants further exploration, especially given this finding opposes the significant associations between these variables and higher depression scores on the EPDS.

Although speculative, the opposite relationship with maternal parity and age for the two measures of depression could be related to the fact that GRSMII mood and energy scales may primarily assess mothers' energy. For example, the behaviours coded as part of the mood scale (i.e. smiling, joking, and actively playing with an infant) might be more expected in a mother with adequate energy available, and less likely in a physically exhausted mother. However, as noted, depression has been previously associated with younger maternal age, but the GRSMII found associations between lower mood/energy and older maternal age. Such discrepancies further strengthen the case that the EPDS and the maternal GRSMII scales do not measure the same facet of maternal depression. It is also possible that depression in this setting, especially amongst younger mothers, may be simultaneously experienced and self-reported on the EPDS in a manner that may or may not be contingent with observed mood or energy during MII in particular. Further research would be required to determine whether these measures access distinct underlying features of depression, or perhaps whether one or more of these measures accesses experiences not directly related to depression.

The lack of association between maternal mood or energy and demographic factors at 1 month, in light of the presence of such associations at 5 months, mirrored the lack of associations at 1 month between maternal depression and infant social behaviour. In this sample, the 1-month visit data for both mothers and infants was uniquely less correlated with other data, compared to the other visits. This lack of association at 1 month, compared to the third trimester, 7-14 days and 5 months, could be due in part to the measures selected, or as previously discussed, due to the particular combination of dyadic interaction experience and maternal beliefs about infant social ability at 1 month compared to 5 months.

8.5.6 *Exploratory models of predictive value*

Based on the strongest significant associations found between infant social behaviour and demographic or maternal depression variables, a few significant preliminary models were identified. Higher desire for isolation during pregnancy (Q10) was a significant predictor of lower NBAS performance, explaining 9.2% of the variance in MV. Maternal parity likewise explained a small amount of variance in newborn behaviour as measured by VADif (7.1%), with increasing parity predicting decreasing performance on the social FV item compared to the Rattle.

Due to a lack of significant correlation, maternal depressive symptoms and behaviour were not tested for predictive value of infant social behaviour at 1 month. However, infant BW and NBAS performance were predictors of 1-month social behaviour in this sample. Higher infant BW was a significant predictor of greater infant active communication efforts at 1 month, explaining 10.2% of the variance.

Considering NBAS items that had been significantly associated with infant social behaviour at 1 month, although measuring similar constructs (visual pursuit of a human face and voice versus visually attending to the mother), NBAS item FV was not a strong predictor of infant attentiveness at 1 month, explaining 7.7% of the variance. Mean performance on both visual-auditory NBAS items (MVA) was a better predictor of infant attentiveness, explaining 16.7% at 1 month, as well as 14.3% of the variance in the composite social behaviour dimension. These findings suggest that general orientation ability (as measured by MVA) underlie later infant attentiveness, rather than the ability to orient toward a social stimulus in particular.

Regarding predictors of infant social behaviour at 5 months, antenatal and 5-month EPDS Q10 scores were strong predictors of infant social behaviour as measured by positive vocalisations, and explained 13.6% and 15% of the variance in PV-5, respectively. NBAS performance as measured by MVA and MV were no longer significantly predictive of infant social behaviour at 5 months.

As noted at the outset, ability to assess predictive value of variables related to infant social behaviour in this sample was limited due to the small number of infants with MII data coded, and the predominance of non-normally distributed data. However, these preliminary models confirmed the predictive value of some of the maternal, demographic, and earlier infant social behaviour variables that were highly correlated with infant social behaviour at each visit, and also raised some interesting questions for future work, including why antenatal EPDS Q10 scores were a significant predictor of positive vocalisation at 5 months, but not at 1 month, and why higher antenatal Q10 scores predicted *greater* positive vocalisation in this setting.

8.5.7 Limitations

There were several methodological limitations in this chapter. First, applying Bonferroni's correction for multiple comparisons was not feasible in a sample of this size, so results that reached the significance threshold during correlation analyses must be accepted cautiously.

Second, the majority of the sets of variables assessed for correlation were visually inspected for further information about the relationships between them, such as the distribution of data points, outliers, and the 'shape' of the relationship (e.g. linear versus curvilinear, and 'cigar'- versus wedge-shaped; Pallant, 2016). However, due to the discrete nature of the measures, especially on the GRSMII (containing only five points on each scale), it was difficult to confirm from scatterplots whether assumptions were truly met, and therefore results must be interpreted with caution.

Third, as noted, the small sample size and non-normal distribution restricted the utility of linear regression models. The BRIGHT study can take forward these preliminary analyses in a larger sample.

8.6 Summary

This chapter assessed the relationship between infant social behaviour and maternal depression in this sample, and between these variables and potential demographic influences, as well as briefly exploring the predictive value of some of the variables for later infant social behaviour that can be assessed in future research.

Some of the key findings were the predictive utility of antenatal EPDS Q10 scores for infant positive vocalisation at 5 months (though not at 1 month); a curious dearth of associations between infant social behaviour or maternal depression at 1 month and other variables (compared to associations found at the antenatal, 7-14-day and 5-month visits); the low correlation between each set of measures (NBAS and infant GRSMII; and EPDS and maternal GRSMII); the low correlation within the GRSMII (maternal and infant) between 1 and 5 months; and that NBAS performance ceased to be significantly correlated with infant social behaviour at 5 months. There were also several indications of the need for further work on a culturally-specific measure of depression in KW, such as the lack of agreement between the measures purportedly both assessing maternal depression.

The final chapter provides a discussion of the results of the present study as a whole, in light of previous findings and suggestions for continuing work.

9 Discussion

9.1 Introduction

This thesis involved the use of qualitative methods to explore caregivers' daily experiences in Keneba and to adapt the NBAS for use in a novel setting, and quantitative methods to assess data on infant social behaviour and maternal depression from an existing longitudinal study. This final chapter begins with a brief reflection on the relationship between the author's positionality and her interpretation of the data, and then summarises the hypotheses and key findings, before providing a critical appraisal of the prevalence of maternal depression reported in this sample, and the relationship between maternal depression and infant social behaviour, in view of the existing literature. Methodological strengths and weaknesses are then outlined, followed by directions for future research output.

9.2 Further reflection on positionality

The following paragraphs summarise my reflections on positionality with regard to drawing conclusions about data collected for this thesis. These statements were written following data analysis, and this error is noted as a limitation. Reflexivity is a critical component of the research process, especially for qualitative work, and in addition, "research is a process, not just a product" (England, 1994, p. 82); or, as Bourke remarks, "research continues as we reflect" (2014, p. 1). Therefore, despite a time delay, consideration of my own influence on this data improves the 'credibility' of the output (Cutcliffe, 2003).

Positionality is made up not only of one's own identity but the ways others perceive one's identity, especially in qualitative research, where the "self [acts as the] research instrument (Bourke, 2014, p. 2). When I first arrived in Keneba, I was visibly a complete outsider: a "*tubab*" ('foreigner') and "*luntango*" ('stranger'). As a Caucasian, American, young, female at KFS, I was assumed to be a student,

researcher, nurse, or doctor. I had few language skills apart from basic greetings, and was naïve to social relationships or any other facet of culture that might relate to me, except for a few practical expectations I had been told before arriving, including the norm of women covering legs and shoulders due to the dominance of Islam.

During data collection for the interviews, I asked about religion as part of the demographic questions. This often resulted in laughter and many people returned the question. Therefore, I was labelled a “Christian” shortly after arrival.

As an American, I was perceived as wealthy and from a powerful country. As a female, but also an American, I had the struggle and choice about whether and to what extent to enter into KW norms for dress and for interaction with men. Power structures in Keneba, more obviously than in the UK or in America, favour men over women and particularly elder men over younger women (Touray, 2006), and daily interactions include both serious and joking references to these. At first, I resisted any semblance of these structures, being an egalitarian. However, I later willingly entered the joking and accepted some of the more serious references (e.g. with tasks expected of a subordinate, such as walking over to someone when called) as symbols of genuine respect. I also complied with norms for ‘modest’ dress out of respect for the community and to avoid unnecessary boundaries with others in daily life.

As of my last visit in April 2018, I am still an outsider and a *tubab*, but I believe I would no longer be considered a *luntango* at KFS. I am known by name, and know many by name, with adequate language skills to greet, joke, and understand requests. I perceived the process of learning as much Mandinka as I could, in conjunction with spending time visiting compounds, playing with children, and chatting, as making a difference to my acceptance in Keneba. The power structures and perceptions obviously remain. However, I was understood at last visit as a student (rather than a higher-status nurse or doctor), as having made the effort to integrate where possible

for the sake of friendship, and as someone still naïve to the culture but with a year of familiarity with individual persons.

Finally, and importantly in a setting where religion and faith are prominent status markers and social requirements, I was known by the end as a “pure” Christian – as someone devoted to God, and who prayed with and for people, a less clearly outsider position than when I arrived as merely a ‘non-Muslim’.

My positionality likely influenced the way I analysed and interpreted both qualitative and quantitative findings. One notable example is that I was conducting research with mothers and their infants, yet I am not a parent, so any assumptions I might have about caregiving were not founded in personal experience. This could have influenced my research in both positive (e.g. not interpreting participants’ answers in light of personal experience) and negative (e.g. not understanding participants’ answers fully due to lacking personal experience). In addition, I have been deeply immersed in the Brazelton tradition of exploring newborn behaviour and interaction, so I also have assumptions about newborn behaviour that may have biased my interpretation of participants’ responses and experiences.

Positionality is not in itself a negative component of the researchers’ repertoire, however, as certain experiences may at times be drawn upon to more closely relate to participants’ reports. For example, my positionality and known “field persona” (Damsa & Ugelvik, 2017, p.1) as a person of faith may have influenced participants’ likelihood of discussing their own faith during the interviews, and allowed me to relate to participants’ considerations of Allah and references to religion. Although the Christian and Muslim faiths are certainly distinct, my vantage point may have promoted greater understanding of the role of religious belief than the positionality of a non-theistic researcher.

Additionally, my positionality as someone who enjoyed spending time with families outside of KFS and outside of working hours may have also promoted an improved (though still subjective and biased) perspective of some aspects of the data, such as typical interactions between mothers and infants during routine activities, and who the infant might spend time with while the mother is working, compared to the positionality of a researcher who primarily socialises within KFS.

As stated in chapter 4, the conclusions drawn in this thesis were necessarily influenced by my positionality, and therefore must be held lightly. Research is never completely objective (Strauss & Corbin, 1998), but researchers' reflexivity can assist readers in more correctly appraising the researcher's role and influence throughout the process of data collection, analysis, and reporting. The aim of this selection of reflections was to provide an insight to the reader of my particular experiential lens.

9.3 Summary of key findings

9.3.1 *Chapter 4: Caregiver interviews – context of caregiving in Keneba*

The 30 interviews with parents and community members in Keneba highlighted the time- and labour-intensive nature of caregiving, specifically for mothers, who must also manage agricultural and domestic responsibilities. While some mothers reported receiving much support in these tasks, others reported none. Respondents listed common worries and problems of parents in Keneba, including financial struggles, illness, and, more rarely, infant and maternal mortality.

A shared belief amongst most respondents was that infants could not see until 2 months after birth, or hear until much later. Respondents on the whole did not report playing with their infants as part of their daily caregiving routines, which consisted almost exclusively of physical tasks. Similarly, respondents viewed infant needs as primarily physical; for example, hunger was seen as the primary reason for infant crying, and therefore breastfeeding or feeding was the first response.

Contrary to claims by some that there was no depression in KW, respondents listed a range of positive and negative emotions in their interviews, including direct references to depression as well as associated emotions such as distress, worry, and loneliness. Notably, respondents listed a much smaller range of emotions with regard to their infants and children. Finally, caregiving in Keneba was influenced by seasonal changes determining mothers' caregiving and farming patterns in the rainy season, as well as the presence of KFS, the religion of Islam, and self-identified cultural traditions.

As the caregiver interviews were explicitly exploratory, no hypotheses were made. Overall, respondents' day-to-day caregiving was time-intensive and primarily physical, especially for mothers, with variable experience of support from others.

9.3.2 Chapter 5: NBAS acceptability – adapting the NBAS for a novel setting

Prior to this study, the NBAS had not been used in a West African setting, but due to its design was hypothesised to be acceptable to KW parents and elders. Piloting the NBAS with 14 families revealed that, overall, the NBAS was an acceptable tool for measuring newborn behaviour in this novel setting. Three items – habituation to a light, undressing the infant, and covering the infant's eyes with a cloth – elicited three or more negative comments. These items were retained, but the protocol was adapted according to respondents' feedback; for example, rather than keeping infants undressed for most of the session, the expressed belief about inhibition of newborn growth due to contact with air was respected by instructing examiners to undress infants to a vest, and to leave them partially covered if parents seemed concerned.

Other practical adjustments resulting from the pilot included instructing examiners to administer the pull-to-sit only where a bed or table provided an appropriately raised surface, and to clarify that the orientation items were not vision or hearing tests. The low level of negative feedback may have been because the

observing caregivers approved of the items, which are designed to be culturally flexible. However, because a few respondents only indicated disapproval when asked directly about each item, and due to an assumption apparent in some comments that any task for the purpose of research must be acceptable, the low level of negative feedback may have stemmed at least partly from the particular, research-saturated context of KW.

Due to high levels of trust in research amongst respondents, the primary adaptation was more intensive training with the local examiners, emphasising the importance of (a) fully explaining the purpose of the NBAS before beginning, (b) keeping open engagement with observers, (c) being conscious of signs of discomfort, and (d) inviting questions and discussion following the session.

9.3.3 Chapter 6: Main study sample characteristics

The core sample included 106 mother-infant dyads participating in BRIGHT. Fifteen of the targeted 16 KW villages were represented, with the highest proportion from Keneba. Core sample dyads only differed significantly from excluded dyads in terms of family arrangement, with lesser representation of polygamous arrangement and greater representation of monogamous arrangement in the core sample.

Overall, demographic characteristics were as expected given previous rural Gambian samples, with the exceptions of family arrangement (higher proportion of monogamy), fathers' occupation (higher proportion of paid employment compared to agricultural work), parents' higher education level, and the absence of mothers under the age of 20.

9.3.4 Chapter 7: Prevalence and stability of infant social behaviour and maternal depression

Newborns in this KW sample had mid-range median orientation scores at the 7-14-day visit, with at least marginally better orientation to non-social items than social items, depending on the comparison. The median NBAS scores in this sample were lower than previous samples surveyed, with the exception of infants of mothers with depression. Therefore, the hypothesis that scores would not markedly differ from previous research was partially correct, but not fully accurate, in that scores were consistently slightly lower than previous research (rather than slightly higher or lower depending on the sample); and additionally, the greater similarity to samples with infants of depressed mothers was not foreseen.

At 1 month, infants overall were moderately visually attentive to their mothers, and made little active communication efforts or positive vocalisations. At 5 months, they remained moderately visually attentive, but made significantly more active communication efforts and positive vocalisations, as expected given the 2-month shift and in line with the hypothesis that infants would display more optimal social behaviour at 5 months than at 1 month. With regard to previous research, median infant GRSMII scores were slightly lower than, but comparable to, four European samples, and lower than a sample of older infants in Ethiopia.

The period prevalence of maternal depression in this sample was low, at 6.9% based on a cut-off score of 10 on the EPDS. In terms of stability, at the antenatal visit the median EPDS total score was 4 out of 30, with four mothers (4.6%) scoring 10 or more. At 1 month, the median score was 3, with three mothers (3.2%) scoring 10 or more. At 5 months, the median score was 1, and no mothers scored above cut-off. Mothers who scored below cut-off had infants with significantly higher BWs than mothers who scored above cut-off at any point. The period prevalence based on EPDS total was similar to the 6.6% of clinical depression reported in a neighbouring region,

but lower than the 13% reported this year in KW using the EPDS with a cut-off score of 12. It was also lower than the hypothesised prevalence (10-15%, based on previous reviews). However, the possibility of a slightly lower or higher rate had been foreseen, due to the potential influence of translation effects and less familiarity discussing emotions in KW. Several possible explanations for the variance are explored later in this chapter.

The 10th EPDS question, about desire for isolation, indicated a higher period prevalence than the total, with 10.2% of mothers desiring isolation sometimes during pregnancy (13.6% including mothers who wanted to be alone on occasion), and 3.3-3.4% at 1 and 5 months (10.7% and 7.7% including mothers wanting to be alone on occasion). The reduction in prevalence between pregnancy and the early postpartum period, based on total score as well as Q10 independently, was inconsistent with a previous meta-analysis of 28 studies of perinatal depression in HICs (Gaynes et al., 2005), which found the highest point prevalence in the third month after birth, and a higher point prevalence in postpartum months 4 to 7 than during pregnancy. It was consistent, however, with the hypothesised reduction in symptoms at 5 months in this sample compared to the last antenatal and first postnatal month.

During interaction with their infants at 1 month (GRSMII), mothers' median mood and energy scores were mid-range, but 20.4% of mothers displayed mostly depressive mood and 18.4% showed little energy in initiating or sustaining engagement. In terms of stability, maternal mood and energy increased significantly at 5 months, at which point no mothers displayed mostly depressive mood, and half the 1-month proportion showed little energy. These median scores were similar to, though not directly comparable with, previous samples in Europe and in Ethiopia.

9.3.5 Chapter 8: Relationship between infant social behaviour and maternal depression

Analyses of the relationship between infant social behaviour and maternal depression in KW were necessarily exploratory, though a few preliminary hypotheses were made in line with findings from previous research.

One prediction was made regarding agreement within measures of infant social behaviour: that NBAS orientation scores would be associated with later infant social behaviour at 1 and 5 months. This hypothesis was only partly supported; while significant associations between multiple NBAS items and infant GRSMII scores at 1 month were identified (e.g. FV, MV, MVA and ATN-1; MVA and AC-1), as well as several trends, no NBAS items were significantly correlated with infant GRSMII scores at 5 months, and the two trends (MV and AC-5; MVA and PV-5) unexpectedly described inverse relationships. However, infant GRSMII scores were not themselves significantly correlated between 1 and 5 months, suggesting a marked change in the measured behaviours over time. As discussed in chapter 8, the lack of sustained association between newborn and later infant social behaviour in this sample may be partly explained by contextual factors (e.g. caregiver beliefs about infant abilities), universal developmental features (e.g. the 2-month shift), and the use of disparate assessment paradigms (e.g. intentional elicitation versus unstructured interaction).

There was comparatively little agreement between the measures of maternal depression (EPDS and maternal GRSMII) measures. Mothers' EPDS total scores were not associated with their observed depressive mood (GRSMII), although mothers' lower energy at 1 month was associated with higher total EPDS score at the antenatal visit and 5 months. The culturally-specific EPDS Q10 antenatal score was significantly negatively correlated with maternal energy at 1 month (higher Q10 score, lower energy), but this association was not found at 5 months. The hypothesis that antenatal and 1-month EPDS scores would be associated with 5-month EPDS scores

was largely supported. Mothers' antenatal and 1-month EPDS total scores were both significantly associated with total scores at 5 months; however, this consistency did not extend to EPDS Q10 in particular. Mothers' 1- and 5-month Q10 scores were significantly associated, but their antenatal and 5-month Q10 scores were not.

Across measures (infant social behaviour versus maternal depression), significant correlations were found at the 7-14-day and 5-month visits, but not at 1 month. The one hypothesis made with regard to the relationship between infant social behaviour and maternal depression was that antenatal EPDS scores would be inversely associated with newborn orientation scores and 1-month infant GRSMII scores, though not necessarily with 5-month infant GRSMII scores. This hypothesis was only partially supported. Antenatal EPDS total scores were not associated with newborn behaviour, although, as implicated by the discussion of findings in chapter 7, antenatal EPDS Q10 scores were significantly, negatively correlated with infant mean performance on the visual NBAS items (MV). Unexpectedly, and contradictory to the hypothesis, antenatal EPDS total and Q10 scores were not associated with infant social behaviour at 1 month, but were both significantly correlated with infant positive vocalising behaviour at 5 months, such that higher total antenatal depression scores and greater desire for isolation at 34-36 weeks were associated with more positive vocalising by infants at 5 months.

The single formal hypothesis involving a demographic factor (that SES would be associated with 5-month EPDS scores) was not supported. Antenatal EPDS Q10 scores were significantly, inversely correlated with SES, as well as infant BW, such that greater desire for isolation before birth was associated with a lower SES, and lower BW. No such associations were found with the overall EPDS scores at any visit, highlighting the importance of culture-specific assessment tools.

With regard to associations between infant social behaviour and other demographic factors, infant BW was significantly associated with infant active communication at 1 month, and maternal parity was significantly inversely associated with greater orientation to the visual-auditory social item compared to the non-social item (VADif). A greater number of associations were found between demographic factors and maternal depression. Higher maternal depression scores at 1 (EPDS total score) and 5 (Q10 score) months were significantly associated with lower maternal age and parity. There were also trends between maternal mood and energy (GRSMII) at 1 and 5 months, and maternal age and parity, but in the opposite direction (lower mood and energy associated with higher age and parity).

No hypotheses were made regarding the linear regressions which were run to examine the predictive value of demographic and maternal depression measures for later infant social behaviour. Although purely exploratory due to methodological limitations, these models indicated the predictive utility of some demographic factors, such as maternal parity for NBAS performance (VADif) and infant BW for infant active communication at 1 month, and of some aspects of newborn social behaviour for 1-month infant social behaviour. For example, a higher NBAS MVA score predicted greater infant attentiveness to the mother at 1 month. While no 1-month EPDS or maternal GRSMII scores were predictive of infant social behaviour at 1 month, antenatal EPDS scores significantly predicted infant positive vocalisation scores at 5 months.

In the thesis overall, hypotheses were partly supported by results that broadly aligned with previous research while including several unexpected findings. As such, the present study confirmed a low but significant relationship between infant social behaviour and maternal depression in this novel setting, as well as some associations between these variables and demographic factors. Most significant for future work, the lack of association within the measures of maternal depression indicated a need for further research on depressive symptom expression and measurement in KW.

9.4 Prevalence and stability of maternal perinatal depression in KW

9.4.1 *Prevalence of MPD*

The period prevalence of maternal perinatal depression (MPD) in this sample – 7.5% according to EPDS total score – was similar to the period prevalence of 6.6% reported in a neighbouring region of The Gambia as measured by clinical interview (Coleman et al., 2006). However, it was approximately half of the 13% prevalence according to the EPDS reported in a recent study within KW (Nabwera et al., 2018).

As described in the literature review (chapter 2), MPD prevalence rates vary widely across context and cultural setting. For example, one review of postnatal depression in LMICS (Parsons et al., 2012) found prevalence rates ranging from 4.9% in Nepal to 50% in Guyana. Even within The Gambia, prevalence rates have ranged from 0.4% amongst transgender women in the coastal region (Poteat et al., 2017) to 85.5% amongst Sierra Leonian refugees (Peterson et al., 2012). There are numerous possible explanations for this variation, including differences within the population, and in the measures used (Uriyo et al., 2013). If taken at face value, the results of the present study may be interpreted as indicating a lower prevalence of maternal depression in KW than reported in another study in the same region, also using the EPDS. However, three alternative possibilities are considered in this discussion: time frame, the measure and translation used, and contextual influences.

One apparent difference between this study and the previous study of depression in KW is the chronological window of inclusion. The mothers in Nabwera's study reported depressive symptoms using the EPDS up to 4 years after the target infant was born, whereas mothers in the present study reported symptoms within a 6-month period. It is possible that the difference in prevalence may be due to this shorter timeframe, as only the early perinatal period was considered. The BRIGHT study follows families until the child is 2 years old, such that the prevalence of depression across this longer period may be more congruent with Nabwera's findings.

Coleman's study in another region of The Gambia also found a higher prevalence based on EPDS total score (16.3%). This higher rate was amongst women of reproductive age, encompassing an even wider window of inclusion. Coleman interpreted the difference in prevalence between her full sample (10.3% by clinical interview) and women in the first year after a birth (6.6% by clinical interview) as an indication that the postnatal period was protective against depression in that setting. However, an alternative explanation may be simply that the timeframe for reporting symptoms was smaller in the perinatal group. Additionally, even within the same sample, Coleman reported different prevalence rates based on the measure used, a reminder that rather than objectively revealing a given phenomenon, prevalence rates may be influenced by the chosen assessment.

Even across studies of depression using the same assessment, differences in cut-off score may influence prevalence estimates. A wide variety of EPDS cut-off scores have been utilised in research across Africa (see Sawyer, Ayers, & Smith, 2010, Table 2, p. 21). Such differences presumably contribute in part to the range of prevalence rates reported, although interestingly, studies using higher cut-off scores than the present study have still reported higher prevalence rates. For example, Owoeye, Aima and Morakinyo (2006) reported that 23% of Nigerian mothers in their sample were depressed at 4-6 weeks after birth, using a cut-off score of 12. The fact that Owoeye's cut-off score and prevalence rate were both higher than the three studies of depression in The Gambia (including the present study) could be interpreted as indicating a genuine difference in prevalence in the Nigerian sample compared to previous Gambian samples; however, it could also indicate differences in norms for understanding or reporting mental health symptoms, possibilities that are further discussed at the end of this section.

Furthermore, even studies that use the EPDS with the same cut-off score in the same setting are not directly comparable if different translations are used, or if

the method of administration differs. All three studies of depression in The Gambia have used different translation procedures to arrive at the final script, and this may have influenced the way participants understood and responded to the questions.

The translation process in the present study involved 6 months of intensive consultation and field testing, and endeavoured to select specific words and phrases for standardised use across participants and between administrators. The final questionnaire, therefore, had high *linguistic* accuracy and consistency, but the result may have been that, in a culture unfamiliar with discussing negative emotions, participants may have felt less comfortable engaging with the topics using unfamiliar phrasing, especially in such a rote and literal manner (decreased *cultural* accuracy).

In Nabwera's study, on the other hand, a single person translated the EPDS and then administered it across nearly 300 participants, and was able to stray from the strict wording of questions in order to draw out participants' responses. Although accurate translation and consistent administration may be desirable in quantitative research, the hyper-literal translation and formal administration in the present study may have resulted in under-reporting of symptoms due to participant discomfort or unfamiliarity. In this setting in particular, a more 'approachable' administration protocol may better facilitate assessment of participants' experiences of depression – a phenomenon that may be unusual to discuss (Helen Nabwera, 2018, personal communication).

Finally, as previously indicated, the degree to which participants are familiar with the topic of depression, and comfortable with discussing it in a research setting, may affect their responses and therefore the calculated prevalence. A person's comfort and familiarity, in turn, may be influenced by cultural or social processes, such as pressure to be 'stoical' versus 'passionate', for example, or conversational norms encouraging or prohibiting discussion of feelings. Halbreich and Karkun (2006) note that, due to stigma around mental health, women may underestimate their

symptoms, and as noted in chapter 4, KW appears to be a setting in which feelings – while not wholly avoided – are not typically spontaneously discussed.

In this way, there could be genuinely lower prevalence in the perinatal period that accurately reflects women’s experiences, due to protective cultural influence, as Coleman surmises; but equally, the lower prevalence could be due to a lack of reporting. As posited, this lack could be due to unfamiliarity with discussing emotions in this setting. Congruent with this possibility, even at the same time point, using the same measure in the same setting, a lower percentage of mothers in the present sample scored above cut-off on a questionnaire that required discussion of negative emotions (3.2% at 1 month), than mothers who reported a desire for isolation on EPDS Q10, a context-specific item not requiring explicit discussion of negative emotions (10.7% affirming at least some desire for isolation at 1 month). Furthermore, compared to the prevalence based on EPDS total score, an approximately 10-fold greater percentage of mothers (20.4% at 1 month) were rated as having a depressive mood during an observational measure (MII) that required no self-report of negative emotions at all.

In a similar manner, Nabwera noted that “mothers [in KW] rarely reported feelings of low mood or inability to cope with their daily lives, even in the context of adverse events,” and posited that not reporting negative emotions could be “a coping strategy in the context of societal expectations for mothers to demonstrate resilience even in the face of adversity” (Nabwera et al., 2018, p. 16). These conclusions were drawn from Nabwera’s interviews with parents and KFS research staff, during which respondents conveyed that mothers’ social support is contingent on their ability to maintain good rapport with others, a sentiment also noted in the present study (chapter 4).

Contrary to settings in which saying one is struggling to cope is a validated form of support-seeking, Nabwera's findings underline the difficulty of accurately measuring mothers' experiences of depression in a setting that discourages discussing it. In the face of both the reported strong cultural requirement for being seen to be coping and not complaining, and the reported relationship between maintaining a good reputation or rapport with others and receiving social support, omitting discussion of negative emotions may be advantageous if not necessary. In other words, if being perceived as struggling to cope can damage a mother's reputation, which then results in a loss of social support, reduced reporting of negative emotions may be expected. Future qualitative investigation could explore whether the emotions and experiences comprising the EPDS items are perceived to incur such negative social consequences. Whether desire for isolation is viewed as more 'socially acceptable' than the other items would be of particular interest for understanding the results of the present study.

With regard to the social norms around negative emotions, there is an alternative, albeit speculative, interpretation of present and previous findings that is contrary to Coleman's theory that the postpartum period protects against depression in The Gambia due to the social significance of childbearing. If the postpartum period is regarded as socially significant, and if mothers face social pressure to "demonstrate resilience" in general (as in Nabwera et al., 2018, p. 16), mothers may report fewer depressive symptoms in the perinatal period – not necessarily because it is genuinely protective, but, precisely because of the social value of child-bearing, as a result of believing that they *should* be happy about the event and pressure not to complain. In the previous studies, mothers were asked about their depressive symptoms up to 12 months (Coleman's perinatal sample) or 4 years (Nabwera's sample) after the birth of the target infant. As indicated previously, measurement of depressive symptoms is not an isolated or purely objective task, but is influenced by contextual and subjective factors. Perhaps these mothers, who were more chronologically distant from a

socially highly-prized event, were more willing than mothers in the current study to report on negative emotions.

That social pressure against reporting negative emotional experiences may be particularly salient in the early perinatal period is in line with the higher incidence in the present study of observed depressive mood at 1 month compared to self-reported depressive symptoms at 1 month. Mothers were not told that their mood, specifically, was being assessed, and no other adults were present. Without reminders of social norms or direct questions about negative emotions, perhaps any existing depressive symptoms were conveyed more accurately through behaviour than self-reporting.

Finally, the influence of contextual factors in the experience and reporting of depression was highlighted by the unique relationship of the context-specific EPDS question (Q10) to other variables, compared to the total score. For example, a high antenatal Q10 score was significantly associated with a lower BW, lower SES, and lower mean performance on the NBAS visual orientation items. The antenatal *total* EPDS score, however, was not significantly associated with any of these factors, despite a similar trend with BW. Although there could be alternative explanations for this unique relationship, that Q10 avoids discussion of explicitly negative emotions, whereas the EPDS includes nine other questions that are contingent upon such disclosure for an accurate representation of depressive symptoms in the total score, may implicate the influence of a culture that discourages discussion of negative emotions. As will be further discussed, context-specific measures are required if the prevalence of MPD is to be accurately assessed and its relationship with other factors properly understood.

9.4.2 *Stability of MPD*

The stability of depressive symptoms could not be compared to previous findings in The Gambia, as Coleman and Nabwera's studies were not longitudinal. A

true comparison of stability versus change would not be appropriate given that no mothers in the present study scored above cut-off on the EPDS at more than one visit. However, as a preliminary consideration, a recent study with Iranian mothers who had scored above a cut-off of 12 in the third trimester found a high degree of stability compared to the present study (in which no mothers scoring above cut-off during pregnancy continued to do so after birth): two-thirds (66.3%) of the Iranian mothers (who had scored above 12 during pregnancy) continued to score above 12 at 2 weeks postpartum, and 52.9% at 3 months (Abdollahi, Zarghami, Sazlina, & Lye, 2017).

Stability of depression over time may be expected given previous reports of the strong association between antenatal and postnatal depression (e.g. Robertson et al., 2004; Zerkowicz et al., 2008). Many studies have reported changes in the point prevalence of a sample over time. For example, the point prevalence of depression according to the EPDS in a sample of Portuguese mothers decreased from 17.4% in the third trimester to 11.1% at 3 months (Figueiredo & Conde, 2011). However, relative stability of depressive symptoms within individuals has been reported, such as in Nakić Radoš, Tadinac and Herman's (2013) study in Croatia, which found that mothers' EPDS scores were moderately correlated ($r = .46$ to $.58$, $p < .0001$) between the third trimester and 2 days and 6 weeks after birth.

Interestingly, Nakić Radoš and colleagues found that a decrease in depressive symptoms across the perinatal period was specific to mothers who were not subsequently diagnosed by clinical interview with Postpartum Depression at 6 weeks. Of those who were diagnosed, depressive symptoms *increased* between late pregnancy and 6 weeks postpartum, indicating that the degree of stability and direction of change in perinatal depression may be particularly influenced by the severity of the symptoms.

The variation in reports of stability versus change in the literature may be in part attributable to differences in measures, assessment points, cut-off scores used, and whether stability was calculated (or just differences in point prevalence), as well as potentially implicating culture-specific aspects of depression. Although prevalence was measured, future BRIGTH publications with a larger sample over a longer period may be in a better position to assess stability of depressive symptoms and to compare this with other samples.

9.5 Relationship between maternal depression and infant social behaviour

Previous research has shown that a parent's mental health can strongly influence the quality of the parent-infant relationship (Parfitt et al., 2013), with the presence or absence of symptoms of a variety of CMDs including depression (see Field, 2010 for a review), anxiety (see Glasheen, Richardson, & Fabio, 2010 for a review; and Pawlby, Hay, Sharp, Waters, & Pariante, 2011) and stress (e.g. Tarullo, St. John, & Meyer, 2017), both before and after birth, acting as notable influences on MII and infant behaviour.

As described in chapter 2, maternal depression has been associated with negative outcomes in physical (e.g. weight), physiological (e.g. reactivity), behavioural (e.g. motor development) and interactional (e.g. MII) domains. In this study, a significant association was identified between antenatal depression and infant positive vocalisation at 5 months, with antenatal EPDS total score confirmed as predictive. There was also a trend between higher antenatal EPDS total scores and more infant active communication at 5 months. Additionally, the setting-specific EPDS Q10 was significantly, negatively correlated with newborns' mean performance on the visual NBAS items.

Despite varying degrees of relationship between maternal depression and infant social behaviour at the 7-14-day visit and at 5 months, infant social behaviour at 1 month was not associated with maternal depression on either the EPDS or maternal GRSMII, at any visit. Given that significant relationships between depression and early infant development have been found previously, there are a number of possible explanations for the smaller number of associations identified in this study, especially at 1 month, some of which represent methodological limitations.

First, the limited number of dyads filmed during interaction at 1 (N=47) and 5 (N=43) months constrained the available sample size; thus this study may have been unable to detect a significant relationship between maternal depressive mood or energy and infant social behaviour where one may have been present.

Second, this study was conducted in a novel setting and used a MII coding schema that had not undergone formal adaptation for KW. Similarly, the EPDS translation had not been psychometrically evaluated. It is possible that pertinent aspects of maternal and infant behaviour specific to KW, or maternal experiences of depression, were not optimally captured using these measures.

Third, given the significant relationship between antenatal depression and infant social behaviour at 5 months, maternal depression may be more influential for infant social behaviour later in infancy. The present study could only assess dyads up to 5 months after birth, potentially when parents are just beginning to see infants as capable of social engagement. Whether the BRIGHT study will find an association when the infants are 1 or 2 years old will be a question for future analysis.

Fourth, a previous study using the NBAS noted that its predictive value was best when the infant was assessed the day after birth and again 1 week later. Ohgi and colleagues (2003, cited in Arnett, 2012) found that infants who scored in the

normal/higher range at both visits, and those who scored in the lower range at day 1 but moved to the normal/higher range at day 8, had better outcomes than infants who remained in the lower range at both assessments or scored in the normal/higher range at day 1 and moved to the lower range at day 8. Using such a 'recovery curve' may provide a more reliable measure of newborn behaviour than a single 'snapshot.'

Another possible explanation of the low level of relationship between maternal depression and early infant behaviour in the present sample is that the infant variables selected may not be those most influenced by maternal depression. Newborn reactivity, and infant affect and activity level at 1 and 5 months, for example, may have been more appropriate choices for comparison with maternal depression, given that an earlier study showed infant motor behaviour and irritability to be predictive of onset of maternal depression by 8 weeks (Murray, Stanley, Hooper, King, & Fiori-Cowley, 1996), and another showed that maternal antenatal depression was associated with lower motor, reflex, and irritability scores on the NBAS (Goodman, Rouse, Long, Ji, & Brand, 2011).

Similarly, a review of effects of maternal antenatal depression, for which the point prevalence was higher in the present study than after birth, on newborn and infant behaviour (Field et al., 2006), emphasised physiological effects over social or interactive outcomes. More recently, a number of studies have found associations between maternal depression and newborn irritability, reactivity, regulation, and motor behaviour, in addition to orientation behaviour (Abrams et al., 1995; Hernandez-Reif et al., 2006; Lundy et al., 1999). It is possible that in this sample, the effect of depression may have been more pronounced in physiological domains than in social behaviour, especially at 1 month, and future publications can explore this possibility.

Finally, maternal depression itself, even when using a measure known to be valid in a particular setting, may not be the best indicator of the effects of depression on infant behaviour. Parental depression has been associated with parenting styles or behaviours which are in turn associated with adverse developmental outcomes (see National Research Council [US] and Institute of Medicine [US] Committee on Depression, 2009 for a succinct review). Maternal behaviours that may be influenced by presence and severity of depression, such as responsiveness (e.g. Pearson et al., 2012), may be more closely or directly associated with infant social behaviour. As outlined in the first chapter, maternal behaviours such as sensitivity have been identified as mediators of the relationship between maternal depression and infant outcomes. In fact, a study of infant socio-emotional development in Vietnam found no significant associations with maternal depression during pregnancy or after birth, but rather with mothers' early caregiving practices (Tran et al., 2014).

In other words, depressive symptoms may be more of an indirect or proxy measure of the direct effects of maternal behaviour on infant development. Minimally, depressed mothers' behaviour during caregiving has been identified as a "component of the risk" of exposure to maternal depression (Lovejoy, Graczyk, O'Hare, & Neuman, 2000, p. 588). Maternal depressive behaviour was selected for this thesis due to perceived theoretical coherence with the primary maternal variable of interest, but future BRIGTH publications can use available data to explore the relationship between maternal responsiveness, sensitivity, warmth, remoteness and intrusiveness at 1 and 5 months with infant social behaviour in KW.

9.6 Strengths and limitations

9.6.1 *Strengths*

The present study had a number of strengths. The piloting and preparation phases included stringent translation of the EPDS, formally adapting the NBAS for a novel setting, and intensive staff training and supervision. Contextualising interviews

sought descriptions of caregivers' and infants' daily experiences directly from parents and community members, providing a detailed account of the physical and social environment of the participants. Although the main study focused on mothers and infants, the pilot studies sought the input of fathers, recognising their key roles in infant development.

The main study data was collected as part of a prospective, longitudinal project, which allows a developmental perspective and improves the ability to make inferences about causality since the "sequence of exposure and outcome is known" (Stein et al., 2014, p. 1800). Although this thesis used a smaller sub-sample, the BRIGTH study overall was well-powered. In addition, compared to urban teaching hospitals, which "over-represent relatively advantaged women" (Fisher et al., 2012, p. 140), the BRIGTH study likely achieved even sampling, due to recruiting from a rural region with high antenatal coverage and access to health care at KFS.

Data quality in the main study was high in that field staff were trained explicitly on all new measures, and had refresher training for measures they were well-accustomed to using, such as infant anthropometry. All data was double-entered from the field forms by the data office team, with discrepancies resolved in consultation with the relevant staff member and the hard copy of the form. All NBAS sessions were filmed to allow consultation during scoring where the examiner and observer disagreed, and the author watched the recordings of all sessions conducted by examiners prior to full certification with any scoring errors corrected and fed back as part of continuous training. Most of the MII videos used in this thesis were professionally coded, with the small remainder coded by a BRIGTH affiliate under the professional coder's supervision.

The combination of qualitative exploration and quantitative investigation promoted a more comprehensive understanding of the setting in which the study

took place and of underlying possible narratives within the main study results. While quantitative data is rightly utilised to answer questions about what has happened, qualitative work is required if researchers wish to move beyond the descriptive and consider the numerous, complex, and sometimes un-quantifiable contextual factors, and *why* results might have come about as they did (Daniels et al., 2016).

9.6.2 Limitations

Alongside these strengths, the results of the present study must be understood within the context of its limitations. First, one must not assume universality from a “thin slice of humanity” (Henrich et al., 2010, p. 63), and results from this sample may not be generalisable to other regions of The Gambia, especially due to the influence of KFS. Unlike other regions, health care is free at point of access for KW residents, which may influence infant development and parental health; for example, the mortality rate in KW is lower than the Gambian national average (Hennig et al., 2015). Limited generalisability is applicable to nearly all studies, as findings in one setting are not inherently relevant to another (Tomlinson & Morgan, 2015).

Additionally, KW residents are well-accustomed to the health research that has been conducted around Keneba for over 60 years, and this familiarity may impact their engagement with research measures. The relatively small population compared to the density of research contributes to what Hennig and colleagues, with reference to medical research, noted as a “risk of ‘over-studying’” (Hennig et al., 2015, p. 10).

With regard to the literature review, a narrative, scoping-style approach was used to describe the extant literature on the key topics relevant to this thesis. Although meeting its aims of providing a broad overview of historical and recent literature on early infant social behaviour, PMH, and parent-infant interaction, the review was subject to selection bias and cannot be considered a comprehensive account (Pae, 2015). In future research, a more structured and objective approach to

synthesising literature would be preferable, including a narrower set of review objectives. Although systematic review is not the only valid approach (e.g. formal methodologies for rapid, targeted, and focused reviews can be employed depending on review aims), selecting a clearly defined, rigorous, transparent, and comprehensive approach allows a review process to begin with a “focused research question” and arrive at an “empirically derived answer” (Mallett, Hagen-Zanker, Slater, & Duvendack, 2012, p. 446).

Another area of limitation was the methodology selected for the caregiver interviews (chapter 4). The aim of this first qualitative stage was to test personal and anecdotal assumptions about caregiving and perceptions of newborn behaviour in KW, hence using field observation and directly approaching parents regarding their own experiences. At the time of initial decision-making, however, my previous methodological experience and training had been quantitative. Unfamiliarity with qualitative approaches was in itself an aspect of my positionality and resulted in methodological limitations as described in chapters 3 and 4.

In retrospect, methodological choices could have been improved by narrowing the interviews’ scope to a more focused set of topics (e.g. about parents’ daily experiences, or perceptions of newborn behaviour, or goals and concerns, but not all three). Had pilot interviews been conducted, this might have encouraged reducing the number of questions. Due to being a primarily quantitative researcher, I was unaware at the outset that an interview schedule could be altered during the course of a study. Iterative adaptation of the schedule based on topics raised by participants and desired areas of future investigation would likely have resulted in a more streamlined schedule after the first respondents, by removing less informative questions and condensing others into broader topics.

In a future exploratory study, were a longer period available, a more open-ended approach with saturation-checking to determine completion would be preferred over a structured schedule, to promote flexible investigation of individuals' experiences. Even if a semi-structured schedule was preferred, an alternative methodological choice to improve the 'flow' of the interview would be a flexible administration protocol allowing the interviewer to select the next question based on participants' responses rather than having to move through the items sequentially.

With greater time and staff availability, more extensive preparation and training with the interviewer and translator would have been preferable, to ensure familiarity with study aims, how to conduct interviews to invite information on concepts of interest (e.g. knowing when to probe), and the purpose and level of detail desired in the translation process. Having a second bilingual staff member translate a sub-set of interviews would provide an indication of the reliability of the translation (Squires, 2009). In a similar manner, having a sub-set of participants – or at least by persons with an 'insider' positionality such as other KW residents – give feedback on the analysis of the interviews would allow for confirmation or rejection of conclusions drawn and improve confidence in whether the analysis yielded a fair or reliable representation of caregivers' experiences in KW.

With regard to the main phase of the study, a significant limitation was the lack of an *a priori* power calculation to determine the sample size required for avoiding the likelihood of type-I and type-II error in the results. This omission occurred due to the practical constraint of the sample size necessarily being determined solely by the recruitment rate of participants enrolled in an existing study within the available timeframe prior to submission. The critical importance of power is acknowledged, however, and would be a priority in the planning stages of any future quantitative research.

Another consideration is that, despite sampling designed to invite a wide range of participants, the sample might not have been representative, in that mothers who were struggling more to cope – and who perhaps would have had higher EPDS scores – may have decided not to enrol in the study due to the time and effort required. This possibility is in line with findings from a review of qualitative research with depressed participants during clinical trials, which found that the decision about “whether to participate (...) is filtered through consideration [of] the patient’s health state” (Hughes-Morley, Young, Waheed, Small, & Bower, 2014, p. 280).

However, the recruitment process for the BRIGHT study was inclusive across the key KW villages, as pregnant mothers were identified using a database comprised of records for all residents, rather than by approaching a selection of compounds. In addition, KW residents are well-accustomed to participating in research studies (chapter 5). Out of 272 women approached for the BRIGHT study as of 5 October 2017, only nine declined to participate. This recruitment strategy, with all residents meeting the inclusion criteria having a fair chance of being approached, and the research-saturated context, with those approached being accustomed to the concept and routine of engaging with research studies, would suggest that the recruited sample likely reflected the community as a whole.

Furthermore, participation in BRIGHT, as with most KFS studies, includes free transportation on testing days (and when the participant is ill) to the KFS clinic, a welcome incentive for most families in KW. Therefore, despite the possible aforementioned limitation of refusal by mothers who were already struggling to cope, these recruitment protocols mean that the results and prevalence figures of this study – had the tools been reliable and validated – are more likely to reflect the community as a whole compared to random sampling.

Importantly, however, the tools used in this thesis had not been validated in KW. Despite the rigorous preparation phase, there was no psychometric evaluation or sensitivity analysis of the newly translated EPDS compared, for example, to a clinical or diagnostic interview, limiting the amount of confidence in its ability to detect depressive symptoms. Additionally, seeking a high degree of linguistic accuracy during translation may have inadvertently reduced the likelihood of participants' reporting of depressive symptoms, given the formal and unfamiliar language.

As noted in chapter 7, the filmed MII situation was not a naturalistic observation in a representative setting. The laboratory-style conditions, with unfamiliar distractions such as a large mirror and lack of common background features such as other family members and responsibilities, may not have captured the typical interaction qualities or behaviours of either social partner. Conversely, this focused engagement setting may have amplified certain aspects of interaction quality due to removing common distractions (Bremner & Fogel, 2001). In either case, the GRSMII coding schema is designed for use with 2- and 4-month-old infants, presenting another limitation in its use with slightly younger and older infants in a period of rapid social development.

Additionally, the scoring system developed by the original study for the SES form had only been used once before (Watson et al., under review), and had not been psychometrically evaluated. Despite creating scores as instructed by the authors, this protocol did not clearly differentiate families into tertiles (e.g. low, middle, and high). Given the low variance, SES as calculated by mothers' housing materials may ultimately not have been the optimal demographic comparison variable. Future BRIGTH publications using the full data set could use qualitative probing within the community, or Principal Component Analysis, to determine which SES questionnaire items are most relevant for identifying families of lower, mid-range, and higher

relative SES in the region. Differential susceptibility to SES would then become a desirable potential avenue for further research (Tomlinson & Morgan, 2015).

A related limitation was the lack of reliability measurement for administrators or coders on these measures. For example, despite the two KFS NBAS examiners being trained to certification standard, their inter-rater reliability both prior to and post-certification was not formally measured; nor was their agreement with the author's scoring choices. The limitations of using pre-certified examiners was somewhat ameliorated by implementing an intensive protocol that required each NBAS session to be attended and independently double-scored by both examiners, as well as each pre-certification session being watched and re-coded by the author for accuracy. However, despite these strengths, the author could only code what was shown on the video, and at times the limitations of pre-certification administration were marked. In addition, reliability was not formally calculated, and studies should ideally report the reliability of their administrators and coders, so readers may make an informed decision about the data's trustworthiness (Lombard, Snyder-Duch, & Campanella Bracken, 2002)."

In the same way, there was no formal reliability calculation for the two GRSMII coders (Laura Bozicevik [LB] and June Pastor [JP]). LB is a highly experienced coder, and her training process for JP was extensive, taking place across several months. In addition, quality control for the MII protocol was high due to the simple instructions for set-up and filming, and adherence to these protocols was confirmed on MII recordings. However, despite this high level of quality control, no inter-coder agreement statistic was calculated, and this remains a limitation.

The first MHQ administrators (LS, FN and TF) received intensive training in the underlying concepts, word choice, and practical and inter-personal considerations of administration over several months, with close supervision and feedback until the

author was confident in administration and scoring quality. Later administrators were trained by TF and FN, but the author was unable to observe MHQs by later administrators until after the submission of this thesis, at which point a high degree of feedback over three sessions was required to reach required administration quality. Other than such supervision and feedback sessions, there was no formal quality control process for the MHQs, and this was also a limitation, particularly for later MHQs conducted by administrators who not directly supervised for administration quality.

Furthermore, no inter-rater calculations were made for the MHQs. Despite high likelihood that the administration was practically uniform across participants (due to administrators reading from a set script), due to wide variation in personal interest in mental health and formal training in sensitivity and rapport, the apparent differences in interpersonal aspects of administration was a limitation in reliability between administrators as well as quality control.

Fathers were invited to participate in BRIGHT, but the lack of uptake was a limiting factor, since fathers are a key influence in their infants' development (Barker, Iles, & Ramchandani, 2017) and on mothers' experiences of caregiving support (chapter 4). Furthermore, other studies have found high rates of depression amongst fathers. The prevalence of paternal depression in the first 3 months after birth was 17% in one Japanese sample (Suto et al., 2016). A review of 20 studies (Goodman, 2004) reported widely ranging paternal depression prevalence in the first year after birth, from 1% to 25% in community samples and much higher in fathers with a depressed partner (24% to 50%).

Therefore, the lack of fathers in this sample may have omitted an important link between PMH and infant social behaviour. However, a meta-analysis revealed that postnatal depression in mothers and fathers affected children's behavioural

outcomes in a similar way (Stein et al., 2014). Fathers' exclusion in this sample was purely pragmatic, since lack of participation would have made the sample underpowered to assess their influence. In addition, the absence of fathers in the main study may have been most influenced by a form of self-selection bias (e.g. Costigan & Cox, 2001) based in cultural norms for participation in KFS research (KFS staff, 2015, personal communication). A study of infant development in KW recruiting fathers in particular, with a larger sample size, would be desirable, and would require concerted recruitment efforts due to the prevailing research bias and participation culture.

Finally, a primary limitation in this study was the use of a subjective measure of newborn behaviour (NBAS), especially given the lack of a consistent, certified examiner. The KFS staff who conducted the NBAS's, TF and FN, had no prior training in newborn behaviour or development. After the NBAS-certified staff member had to leave BRIGHT at short notice, both were trained to certification standard by the head of the UK NBAS training centre, and practiced administration and scoring under the supervision of the author for several months prior to the author's return home.

The lack of a certified NBAS examiner at every session was mitigated by an administration protocol requiring one trainee to be the examiner while the other takes notes and prompts the examiner as needed, as well as a scoring protocol that required both trainees to complete their scoring forms independently and then consult their notes or video to resolve disagreements. Prior to their certification, the author also watched the video of each session and adjusted scores as necessary. Although all possible precautions were taken to ensure the highest data quality under the circumstances, the fact that most NBAS sessions included in this thesis were conducted by pre-certified examiners was a limitation, especially given the NBAS's reliance on examiner facilitation of infants' best performance.

Therefore, the lower median orientation scores across infants in this sample compared to previous groups may have been influenced by variations in the examiners' ability to elicit best performance, as much as by features of their particular cultural or environmental setting or unmeasured factors within the infants themselves (e.g. cortisol), and it is not possible to determine which of these possible variables may have contributed to the lower scores.

Despite the many opportunities afforded through collaboration with BRIGHT, several limitations were due in large part to the pragmatic constraints of entering a pre-existing study. The aim of BRIGHT was to develop brain-function-for-age curves; therefore, the neuro-cognitive measures (e.g. fNIRS and EEG) were prioritised. Although included as valuable supplementary measures, the psycho-social tools (e.g. NBAS, MHQs and MII) were nonetheless secondary, and therefore, pragmatically speaking, could not be allocated the same degree of cost or time for formal adaptation and piloting. Similarly, the visit schedule was designed to optimise neuro-imaging data, and, with the exception of the NBAS, the psycho-social measures were slated within these pre-defined visits.

Some examples of these limitations included conducting a single NBAS and using the data as a 'snapshot' rather than creating a 'recovery curve' over two sessions; being unable, due to the ethics approval timeline, to formally validate the MHQs; and being unable to wait for KFS staff to achieve NBAS certification before conducting sessions, as the infants were already enrolled and born when the NBAS-trained staff member needed to leave. In addition, in such a large project with a limited number of supervisory staff, it is not possible to conduct detailed quality control inspections on every measure for all staff administering them. Although the data collection had high quality control in terms of following study protocols for accurate administration and data entry, certain aspects of data collection, such as interpersonal sensitivity during MHQs, could not be regularly inspected.

Such limitations are part of the nature of large research projects, especially in resource-limited areas. The BRIGHT collaboration is aware of these limitations. The benefit of BRIGHT is that the inclusion of so many measures allows for future research directions to be determined based on inter-disciplinary findings. As the relative importance of the various measures for infant development in KW begins to be clarified, future projects will likely employ a narrower set of measures, thereby enabling higher standards of reliability and quality control.

9.7 Directions for future research

9.7.1 Selected methodological considerations

As outlined in the methods chapter, practical as well as theoretical considerations informed the selection of tools and methods used in BRIGHT. After 2 years of data collection and reflection on the preliminary analyses comprising this thesis, limitations resulting from specific methodological choices would suggest the following recommendations for future research in infant social behaviour and mental health in KW.

Firstly, the EPDS was selected because it was brief, widely used in LMIC settings, and had been recently used in The Gambia; however, while the EPDS was the most appropriate choice at point of selection, given timeframe and resource limitations (e.g. used as a supplementary measure within a larger study not dedicated to mental health measurement), it was ultimately not the ideal tool due to the cultural context in KW around discussing mental health. As has been raised in chapter 7, a better choice in a future study dedicated to mental health measurement in KW would be to develop a culturally informed measure, or at least to select an existing measure better suited to a context unfamiliar with the concept of depression, such as a discussion-based assessment or diagnostic-style interview.

In addition, even if a future study does not have the time or resources to develop a new measure, more intensive sensitisation and supervision of all staff administering the EPDS is recommended. Those administering MHQs should have an informed understanding of mental health problems and the importance of interpersonal sensitivity for collecting accurate data, as well as ongoing observation and feedback to maintain the required degree administration technique. Helen Nabwera may have facilitated such an understanding with her EPDS administrator by selecting as the administrator the same person who translated it, thereby ensuring a working knowledge of the meaning behind each item, and by allowing the questionnaire to be administered in a fluid manner as opposed to an entirely scripted process, thereby achieving a less rigid and more conversational interview. She and the administrator also engaged in a continuous supervisory process throughout the study (personal communication).

Similarly, the GRSMII, while the best choice at the time of selection, may not have been the ideal tool for measuring MII in this novel setting; at least not without a greater degree of qualitative pilot work to understand MII in this context. In a future study focusing on MII in KW, infants would ideally be observed in their everyday caregiving contexts (e.g. within the compound), to understand typical interaction patterns between infants and their caregivers, at different ages. Even if the study required the use of video recordings in a laboratory-style setting, this kind of exploratory groundwork would promote a more comprehensive understanding of MII in a setting where this has not been previously closely studied, and may reduce the need for comparison of KW infants' MII to infants in other contexts when considering coding schemas. As with the use of MHQs, future studies may wish to focus on developing a setting-specific measure of MII rather than transposing a European schema.

Finally, the NBAS was found to be an appropriate tool for measuring neonatal behaviour in this setting, in that there was a low degree of modification required (chapter 5). It was selected for BRIGHT due to previous use across numerous settings and its relevance to other measures within the study. Due to staff constraints, only one NBAS per infant was feasible. Ideally, a recovery curve approach, using the difference in performance on the various items between two NBAS sessions, rather than the performance in a single session, should be used for future studies intending to consider the predictive value of neonatal behaviour for later outcomes (Brazelton and Nugent, 2011). In addition, the NBAS relies on the skill of the examiner to elicit best performance on each item in a particular moment and to correctly administer items in a sequence tailored to the infant's state. Future studies should, where possible, ensure that examiners have achieved certification status in the NBAS prior to collecting data, and calculate inter-rater reliability if appropriate.

As stated, these methodological decisions were influenced by pragmatic requirements related to the timeline and resources of a large collaborative project, and were the best decisions at the time. Future researchers may face similar constraints, but these recommendations are provided as suggestions 'from the field' to benefit forthcoming studies on neonatal behaviour, MII and mental health in KW.

9.7.2 Studying depression in KW and developing an appropriate measure

Although global mental health has grown as a discipline, a significant knowledge and provision gap remains (Patel & Prince, 2010), with far less known about PMH and infant psychological development in LMICs than in HICs such as the United States and European nations (World Health Organization, 2004). Nearly 15 years ago, Mark Tomlinson and colleagues called for an increase in developmental research in LMIC settings (Tomlinson & Swartz, 2003), but as of 2014 they report that "too little progress" has been made toward this end (Tomlinson, Bornstein, Marlow,

& Swartz, 2014, p. 624), and in 2015 they issued a specific call for infant mental health (IMH) research within Africa (Tomlinson & Morgan, 2015).

Based on the premise that IMH research includes the study of caregivers' psychological well-being, further research on mothers' and fathers' experiences of mental health problems in KW should be prioritised to enable the development of a comprehensive understanding of psycho-social as well as physical influences on infant development in that setting. Without accurate measurement and evidence of the nature and extent of these key developmental influences, mental health in KW may remain in the category of "no data, no problem, no action" (Tinajero, Cohen, & Ametorwo, 2016, p. 117).

The results of the present study, compared with previous research, indicate that to have confidence about the 'real' prevalence of depression, further research is needed on the experience and expression of depression and other mental health problems in KW. As noted, a key limitation was the use of a translated version of the EPDS, a tool developed for use in the 'West', to measure depressive symptoms in a rural region of The Gambia.

Importantly, measures developed for use in one setting need to be adapted for optimal use in another (Tinajero et al., 2016; World Health Organization, 2004). Sweetland and colleagues note that merely translating a 'Western' measure of mental health focuses on achieving a "valid enough" adaptation (Sweetland, Belkin, & Verdelli, 2014, p. 9), when a more optimal approach would involve assessment rooted in local conceptualisations of mental health. Even though the EPDS has been validated in multiple settings worldwide (Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009), and while linguistic accuracy was achieved during EPDS translation in the present study, the resulting measure was still a transported assessment of a Western concept of depression, rather than a tool based on depression as experienced in KW.

As detailed in section 9.3, measuring depression is not an objective science removed from environmental influence, but is culturally experienced and expressed. This is outlined clearly in Oates and colleagues' (2004) multi-site study of the perinatal period, based on interviews with parents, grandparents, and health professionals in 11 countries, including Japan, Uganda, and Italy. Although certain experiences were country-specific, an experience the authors termed 'postpartum morbid unhappiness' was described across sites in a manner similar to the 'Western' concept of postnatal depression. This common experience was understood as primarily in the domain of relationships and emotions, and in some settings was not understood to require professional support, or did not have a consistent name.

That something akin to depression was recognised in 11 countries, with variation in how the experience was understood and what kind of support should be sought, indicates that while it may not coincide completely with the 'Western' definition or experience of depression, this kind of 'postpartum morbid unhappiness' likely exists across a range of other settings. Precisely because experiences of this unhappiness or depression were reported to be culturally variant, exploratory research must be conducted to understand experiences of depression in a given setting. Following this groundwork, a pre-existing measure could be more optimally adapted. Practical adaptations, including use of conversation-style interviews in which respondents are invited to ask questions about the meaning of items, could also improve accuracy (Sweetland et al., 2014).

Alternatively, a new measure of depression specific to KW could be developed. In a discussion of respective findings, the author of the present study and the author of the previous study of depression in KW (Nabwera, 2018, personal communication) concurred that the logical and crucial priorities for future research in KW are: first, an understanding of the way in which mental health problems are described and

experienced (including any influences or restrictions on reporting), and second, the development and validation of a KW-specific measure of depression and other mental health problems.

The form and content of such a measure would necessarily be based on exploratory research, but might be best conducted as an informal conversational assessment, an observational measure, or a questionnaire focused on aspects of behaviour or daily life most connected with morbid unhappiness in KW. In any case, researchers and clinicians in KW should now move away from Western models of depression and instead develop a new tool that captures the way mental health problems and distress are experienced and expressed in KW in particular (Nabwera, 2018, personal communication). The authors of a recent systematic and meta-analytic review of tools for measuring perinatal depression in African settings (Tsai et al., 2013) came to the same conclusion, stating that “more qualitative research is needed to adequately characterize local understandings of perinatal depression-like syndromes in different African contexts” (p. 1).

Having a reliable measure of depression available would help to bridge the IMH and global mental health research gaps between HICs and LMICs, and could have clinical implications. To borrow Tinajero’s expression again, a context-specific tool can produce reliable prevalence data; with reliable data, a problem may be identified with confidence; and with evidence of a problem, action may be taken.

9.7.3 Further investigation of maternal and infant behaviour

In addition to further research on MPD, future publications may utilise data available within the BRIGHT study to investigate other aspects of maternal and infant behaviour. The present study was necessarily narrow in scope – assessing maternal depression and infant social behaviour in a small sub-set of mother-infant dyads between pregnancy and 5 months postpartum – due to the practical constraints of

doctoral research. The BRIGHT study as a whole, however, is multi-site, with a larger sample of dyads (N=200 in KW; N=60 in Cambridge) followed to 2 years of age, and assesses participants on a wider range of measures.

As mentioned previously, infants do not develop in isolation, but in the context of a given parent-infant system and environmental constellation encompassing not only physical or material attributes but also social, religious, political, and other aspects of the milieu often referred to by the term 'culture'. Studying infants in multiple cultural contexts yields a better framework than single settings for assessing the wide range of infant behaviour both within cultures – in terms of individual differences and what other variables these may correlate with in a given setting – and across cultures, in terms of behaviours that may be observed in common in multiple settings. In fact, it may be that what appear to be differences in patterns between cultures simply indicate the different ways in which “common processes are expressed and shaped by a culture” (Lester & Brazelton, 1982, p. 49).

When measuring infant behaviour in a single setting, one might be tempted to make claims about such behaviour universally, rather than recognising the limited generalisability of findings. The benefit of measuring infant behaviour in settings with differing characteristics is that it permits the identification of patterns not only within each group individually but also between the settings. Future publications by the BRIGHT team will also be able to consider variations on each measure not only within each site but cross-culturally.

One aspect of interest for future research is infant social behaviour and MII in infants older than 5 months. As noted in chapter 4, caregiver beliefs about newborn sight and hearing ability may impact how parents in KW interact with their infants at various ages. For example, there may be an increase in caregiver speech during interaction between the early months and later infancy, once caregivers believe their

infants can see and hear and once they are viewed as potential interactive partners. The key relevance of infant age for caregiver and infant behaviour during interaction has been reported in both HIC and LMIC samples. As one HIC example, Henning, Striano and Lieven (2005), reported an increase in German mothers' speech between 1 and 3 months, noting that this occurred alongside increases in infant positive vocalising, gazing, and smiling.

The salience of infant age (and, presumably, beliefs held about infant abilities at different ages) for MII was demonstrated more clearly by Lewis and Lusk (1972), who found in their small study of 10 Senegalese families that "the pattern of caregiver-infant interaction was related more strongly to the age of the infant than to any other variable investigated," including developmental assessments and demographic data (p. 1). Of course, it is also possible that verbal engagement might decrease in later infancy (Martini & Kirkpatrick, 1981). Future analysis of MII data from older infants and toddlers in BRIGHT will be able to elucidate the presence of any age-related trends in maternal or infant behaviour, though qualitative work would be required to explore whether any such trends are related to beliefs about infant social capacity.

In addition to assessing MII in infants of different ages, future analysis of BRIGHT data will allow assessment of features of maternal and infant interactive behaviour not included in the present study. It is possible that aspects of caregiving behaviour, such as sensitivity or intrusiveness, may better explain differences in early infant social behaviour than maternal mood or energy. Conversely, differences in maternal mood and energy may be more related to infant behaviours not measured in the present study. In future publications, the BRIGHT team can assess relationships between other key variables during MII, including: maternal remoteness, intrusion, responsiveness, and warmth; infant affect, activity level, and engagement with self as opposed to the environment; and more objective assessment of infant attentiveness and maternal focus of attention, such as measuring looking time.

Finally, numerous other variables of interest to the study of IMH in LMICs may be assessed using the data available through BRIGHT. Data on maternal anxiety, positive and negative affect, and perceived stress was also collected, as was data on newborn irritability, habituation, motor behaviour, and reflexes. Documentation of these variables in a novel, LMIC setting and investigation of the relationships between them would be desirable in reducing the IMH knowledge gap between HIC and LMIC contexts (Tomlinson & Morgan, 2015).

9.8 Conclusion

As described in chapter 1, infant development occurs not in a void, but in contexts saturated with sources of influence. During the newborn period and in early infancy, caregivers shape the most salient features of their infants' developmental contexts primarily via the numerous daily interactions that form the basis of the attachment relationship. One of the factors that has been most studied in relation to the quality of these interactions has been parental mental health (PMH), specifically in terms of the implications for infants' physical, physiological, social and emotional outcomes.

In recent years, infant mental health researchers have sought to assess the effects of PMH and parent-infant interaction quality on infants in settings beyond 'the west,' with a view to bridging the gap in mental health research and provision that persists between High- and Lower-Middle Income Countries (HICs and LMICs). Importantly, due to the influence of unique environmental factors, the relationship between PMH and infant development in a given setting cannot be assumed to mirror previous research from other contexts.

The present study contributed to an improved understanding of the relationship between infants' early social behaviour and PMH in a novel LMIC setting. Within The Gambia, this study represents the first attempt to measure newborn and

infant social behaviour; the first to measure maternal depression in the context of a longitudinal study, including antenatally; and the first to assess the relationship between infant social behaviour and maternal depression.

As outlined in this final chapter, the NBAS was successfully adapted for use in KW, and a number of interesting results were found; however, as discussed, the key outcome of this study was the indication of a need for improved understanding of how depression, and mental health more broadly, is experienced and expressed within this setting. This level of understanding is necessary to facilitate the development of tools that can assess the presence and expression of depression in KW with optimal accuracy. Once such measures are available, they can be used to construct a more detailed and accurate picture of the effect of depression on infant development in this setting.

As conveyed by Tinajero and colleagues' critique of "no data, no problem, no action" for PMH and infant social-emotional development in LMICs, the collection of setting-specific data using valid and reliable assessments is foundational for developing and providing tailored support to parents and infants in non-HIC settings. As such, the present study represents an important first step in instigating research on parent and infant mental health in The Gambia.

10 References

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11 Appendices

11.1 Appendix A: Caregiver interview questions for Mothers and Fathers

Section 1: Daily Experiences in the First Two Months

1. What do you do each day to care for your baby?
2. What is it like to be a parent?
3. What does it mean to be a 'good' parent?
4. How much time do you spend taking care of your baby and other children each day?
5. How much time do you spend doing other things?
6. How much time do you spend talking or playing with your baby each day?
7. What other things do you do, in addition to looking after your children?
8. What does a baby need during the first two months, and how do you provide your baby with this/these things?
9. Who feeds your baby during the first two months (including breastfeeding)?
10. Who helps you to take care of your baby?
11. Who gives you advice about your baby?
12. Who makes decisions or influences your decisions about how you take care of your baby?
13. How much time does your baby spend physically with you each day *during the first 2 months?*
14. How much time does your baby spend physically with you each day *after the initial 2 months?*
15. Where does your baby sleep for naps, and at night, *during the first two months?*
16. Where does your baby sleep for naps, and at night, *after the first two months?*
17. How much time does your baby spend with others each day, *during the first two months?*

18. How much time does your baby spend with others each day, *after the first 2 months*?

19. Which other people does your baby spend time with?

20. When your baby *is with you*, is *your baby* usually:

Near you on the ground/bed

On your body in the back

In your arms,

Or somewhere else?

21. When your baby *is with you*, are *you* usually:

Working in the home,

Working away from the home,

Resting,

Or doing something else?

22. When your baby *is with someone else*, are *you* usually:

Working in the home,

Working away from the home,

Resting,

Or doing something else?

23. When your baby *is with someone else*, is *your baby* usually:

Near them on the ground/bed,

On their body in the back,

In their arms,

Or somewhere else?

24. When your baby *is with someone else*, is the *other person* usually:

Working in the home,

Working away from the home,

Resting,

Or doing something else?

Section 2: Understanding Newborns

1. What does it mean when a newborn baby cries?
2. What does it mean when an older baby cries?
3. What do you do when your baby cries?
4. How do you know what your newborn baby is thinking or feeling?
5. How do you know what your newborn baby wants or needs?
6. How do you know what your newborn baby likes or doesn't like?

7. At what age could your baby see?
8. At what age could your baby hear?

Section 3: Goals

1. What goals do you have for yourself, personally? (E.g., is it important to you that you have a job, live in a safe house, have friends, good standing in the community, pray?)
2. What goals do you have for your family?
3. What goals do you have for your baby, for now and in the future?
4. What is important for a baby to do during the first two months?
5. What is important for a baby to do during the first year?

Section 4: Concerns

1. What concerns or worries do you have with regard to yourself?
2. What concerns do you have about your family?
3. What concerns do you have about your children?
4. What concerns do you have for your baby during the first 2 months? (For examples, concerns about eating, sleeping, getting sick, being lonely, getting bored, crying, being hungry, thirsty, too hot or too cold?)
5. What concerns do you have for your baby right now?
6. What concerns do you have for your baby for the future?
7. In your daily experiences of looking after children, do you ever feel helpless, or depressed, or that you just don't know what to do about your children?
8. Is there anything else you would like to add about being a parent in Kiang West?

11.2 Appendix B: Pilot NBAS session feedback questions for Mothers and Fathers

A. Open-Ended – Overall Feedback

1. What was your favourite part of the session?
2. Was there anything you saw that surprised you or made you interested?
3. Did you learn anything new about your baby's abilities or behaviours?
4. Was there anything you saw that you had already noticed with your baby?
5. Was there anything that upset you or made you uncomfortable?
6. Do you think there was anything strange about the session, or anything you did not agree with?
7. Do you think other mothers and fathers in Kiang West would find acceptable such a session with their babies?
8. Do you think your baby can see? Why?
9. Do you think your baby can hear? Why?
10. Is there anything else you would like to ask about or add before I focus on the specific questions about the session?

B. Item-specific feedback (skipping an items not administered)

For each item I describe (...) please choose one of the following three categories: was it (good/interesting), (acceptable/fine), or (not acceptable/made you uncomfortable/ you did not agree).

Habituation Package

11. When your baby was sleeping, and we shook the rattle and rang the bell?
12. When your baby was sleeping, and we shined the light across his/her eyes?
13. When your baby was sleeping, and we undressed him/her and touched his/her foot with the probe?

Motor-Oral Package + palmer grasp

14. When we looked at your baby's muscle tone in the arms and legs?
15. When I stroked your baby's cheek and placed my gloved finger in his/her mouth to look at the sucking response?
16. When I looked at your baby's hand grasp, and touched his/her feet with my finger, and pushed back on the foot toward the leg?
17. When I tapped your baby's forehead?

Truncal Package

18. When I undressed your baby?
19. When I pulled your baby up to sit from a lying position?
20. When I placed your baby's feet against the table one by one?
21. When we looked at your baby 'standing' and 'walking'?
22. When I ran my finger down his/her spine and we watched the hips swing?
23. When I placed your baby on his/her tummy?
24. When I held your baby facing me and spun to the left and right?
25. When I held your baby close to me?

Vestibular Package

26. When I placed the cloth over your baby's eyes and we watched his/her response?
27. When I placed your baby's head to the left and to the right?
28. When I let your baby experience a short drop into my arms?

Social Interactive Package

29. When we watched your baby's response to the ball?
30. When we shook the rattle on the side of your baby's head, and when we watched his/her response to the rattle being held and shaken in front of him/her?

31. When we watched your baby's response to my face and voice, and when we talked to the baby on his/her left and right?

Other

32. When we observed your baby crying for a few moments before I went through a series of attempts to soothe him/her?

33. Is there anything else you would like to ask about or add?

11.3 Appendix C: BRIGHT Participants Information Leaflet and Consent Form

Identification code: DOP-CTS-001 F/CTS-003 (Adult)
Version: 6.0 – 30th August 2017



PARTICIPANT INFORMATION SHEET

Version 06 Date 30th August 2017

Study Title: Developing brain function-for-age curves using novel biomarkers of neurocognitive development from birth in Gambian infants.

SCC:	451	Protocol:	03
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Sponsor & Funder: MRC

What is informed consent?

You and your infants are invited to take part in a research study. Participating in a research study is not the same as getting regular medical care. The purpose of regular medical care is to improve one's health. The purpose of a research study is to gather information. It is your choice to take part and you can stop any time. Before you decide you need to understand all information about this study and what it will involve. Please take time to read the following information or get the information explained to you in your language. Listen carefully and feel free to ask if there is anything that you do not understand. Ask for it to be explained until you are satisfied. You may also wish to consult your spouse, family members or others before deciding to take part in the study.

If you decide for yourself and your child to join the study, you will need to sign or thumbprint a consent form saying you agree to be in the study.

Why is this study being done?

This study in The Gambia is part of a two-country study, enrolling mothers and infants from The Gambia and the UK. The main purpose of the study is to help us understand how to measure brain development and also to begin to understand what factors – such as different environments – influence brain development.

The results of the study will be made available to your community.

What does this study involve?

You are being asked to take part because you are a healthy pregnant woman. If you take part in this study then during your pregnancy you will be asked questions regarding your health and family situation and we would also like to take a small volume of blood (5mL, equivalent to 1 teaspoon) and urine from you. At this visit you will also be offered Voluntary Counselling and Testing (VCT) for HIV-infection.

Once your infant is born, we would like to see you and your infant at the MRC Keneba field station on 7 occasions across the first two years of their life. At each of these visits we will ask you a number of questions about you and your infant, measure their growth, and we will also make some measures of your infant's brain development. The first visit will occur at your home, shortly after the birth of your infant where we will perform a number of simple and harmless tests on your infant (such as testing their ability to grip, and simple actions directed at them). These tests are specifically designed to test behaviour in the early neonatal period. This session may be video-recorded.

When your infant is aged 1, 5, 8, 12, 18 and 24 months of age we will then ask to see you and your infant at the field station in Keneba. At each of these visits we will test your infant's brain development using a special hat that contains light sensors linked to a computer. These light sensors are like tiny torches and are completely harmless to your child. Putting the hat on will only take a few minutes, after which your child will be shown a collection of pictures and hear a range of sounds. The light sensors will record how he/she responds to the pictures and sounds. The session will be videotaped and recorded using a small camera (called an eye-tracker) so that staff can record your child's behavioural responses, as well as the brain signals we measure from the light sensors.

When your infant is aged 1, 5 and 18 months of age we will also test their brain using another method (called electroencephalogram). Our brain communicates using faint electric signals. We can test this communication by placing an array of sensors of the head that can pick up the natural activity of the person's brain. The equipment we use is known as the Enobio, specifically designed for babies. This technique is completely safe and has been used for studying how the brain works for many years without using expensive equipment.

At each visit we will also ask your infant to perform some simple tasks (such as responding to toys) in order to assess their development. These will also be videoed. Finally, we would also like to make a short recording of you talking to your infant, which will be recorded. This helps us to understand how you are both communicating with each other. We may also ask if we can conduct these assessments in your home environment, so we can record you interacting with your infant at home. If the infant's father is available, we may also request to record him interacting with your infant also. We would also like to ask the infant's father some of the same questions we have asked you throughout the course of the study.

At each visit we will collect a finger prick blood sample from your infant, to measure the amount of iron in your child's blood. When they are aged 5, 12 and 24 months, instead of the finger prick, we would like to collect a small quantity of blood from their vein (3mL, < 1 teaspoon) and also a small amount of their urine. These samples will be used to measure the amount of different markers (such as nutrients) in your infant's body that may be associated to neurocognitive development.

In between these clinic visits to MRC Keneba, we will make regular visits to you in your home to ask simple questions regarding your infant feeding (fortnightly) and to measure your infant's growth (monthly).

When your child is aged 12, 18 and 24 months we will also visit your home to conduct some additional assessments. The first assessment involves a 1 – 2 day recording of language and environmental sounds of the child. Your child will wear an audio recording device within a t-shirt provided by the study team. We will not be assessing specific words used by you or the child's other relatives but rather the type of interactions the child has with others and the words that they can say. In addition to the recording device we will also conduct a home observation and/or interview to record who interacts with your child during this period. The second assessment involves your child wearing a monitor to record sleep quantity and quality. This monitor will be worn on the leg or wrist for 3 – 5 days to record daytime and night-time sleep during this period. We would also like to ask you some questions about the words that your child knows and can say, and what they play with while at home.

If you need to leave the clinic visits early before everything can be completed, we are also happy to arrange a further visit to the clinic, or to you at home to complete questionnaires at a time that is convenient.

In case the investigator discovers you or your child is sick and decides that you or he/she cannot participate in the study because of that, you or he/she will receive immediate care at the MRC Keneba clinic. If the research study needs to be stopped, you will be informed and your child will have the normal medical care.

What will happen to the samples taken in this study?

The samples collected in this study will firstly be processed and stored at the MRC laboratories, and then shipped overseas for analysis by the research team implementing the study.

What harm or discomfort can you expect in the study?

Collecting blood samples will cause a minor, temporary discomfort to yourself and your infant. However, we do not anticipate any other harm or discomfort from this study.

What benefits can you expect in the study?

The close contact your child and the family will have with our field staff will provide you with an immediate opportunity to address any health care concerns you have during the contact period.

Will you be compensated for participating in the study?

You will not get paid for participation of you or your child in the study. We will either visit you in your home, or bring you to the field station in Keneba for measurements, so there will be no transportation costs.

What happens if you refuse to participate in the study or change your mind later?

You are free to participate or not in the study and you have the right to stop participating at anytime without giving a reason. This will not affect the medical care that you would normally receive.

In case you decide to withdraw your participation during the study, any information already generated from the samples until the time of withdrawal will be used and samples already collected, for which you have given consent, will

also be analysed and data used. The study doctor may also ask for tests for your safety.

Should any new information become available during the study that may affect your participation, you will be informed as soon as possible.

If you are injured in the study what compensation will be available?

We will be responsible to provide for treatment caused by procedures of the research study.

If medical treatment is required as an emergency, please refer to your health centre or clinic and contact the field worker who gave his/her telephone number to you or contact the Keneba research nurse, Mr Edrissa Sinjanka, on 7160857.

How will personal records remain confidential and who will have access to it?

All information that is collected about you or your child in the course of the study will be kept strictly confidential. Your personal information will only be available to the study team members and might be seen by some rightful persons from the Ethics Committee, Government authorities and sponsor.

Who should you contact if you have questions?

If you have any queries or concerns you can contact Dr Dr Momodou Darboe on 9904248 and you can always call the personal numbers of the study staff given to you.

Please feel free to ask any question you might have about the research study.

Who has reviewed this study?

This study has been reviewed and approved by a panel of scientists at the Medical Research Council and the Gambia Government/MRC Joint Ethics Committee, which consists of scientists and lay persons to protect your rights and wellbeing.

11.4 Appendix D: BRIGHT study NBAS scoring form

BRIGHT NBAS SCORING FORM

Infant Study ID.....Visit Date..... Examiner.....Observer.....

Visit status: (1) Seen (2) Not seen (3) Travelled (4) Refused (5) Other. Other comment:.....

Infant Sex..... Infant DOBMother Parity..... Others present?:.....

Infant Behaviour

Habituation	9	8	7	6	5	4	3	2	1	DD	NR	CS	Comments
Light													
Rattle													
Bell													
Foot probe													

Social-Interactive	9	8	7	6	5	4	3	2	1	DD	NR	CS	Comments
Face													
Face + voice:													
Ball													
Rattle													
Rattle side													
Voice side													
Alertness													

Motor System		8	7	6	5	4	3	2	1	DD	NR	CS	Comments
General tone													
Motor maturity													
Pull- to-sit													
Defensive (cloth)													
Activity level													

State Organisation	9	8	7	6	5	4	3	2	1	DD	NR	CS	Comments
Peak of excitement													
Rapidity of build- up													
Irritability													
Lability of states													

State Regulation	9	8	7	6	5	4	3	2	1	DD	NR	CS	Comments
Cuddliness													
Consolability													
Self-quieting													
Hand-to-mouth													

Autonomic System	9	8	7	6	5	4	3	2	1	DD	NR	CS	Comments
Tremulousness													
Startles													
Lability of skin colour													

Smiles

BRIGHT NBAS scoring form page 2

Supplementary Items	9	8	7	6	5	4	3	2	1	Comments
Quality of alertness										
Cost of attention										
Examiner facilitation										
General irritability										
Robustness & endurance										
State regulation										
E's emotional response										

Reflexes	0	1	2	3	Asym	DD	CS	Comments
Plantar								
Babinski								
Ankle clonus								
Rooting								
Sucking								
Glabella (blink)								
Passive resist - legs								
Passive resist - arms								
Palmar (hand grasp)								
Placing								
Standing								
Walking								
Crawling								
Incurvation (hip swing)								
Tonic dev. – head & eyes (spin)								
Nystagmus								
TNR								
Moro								

Key:

DD = Didn't do (please provide reason)

NR = No response

CS = Couldn't see (please provide reason)

Comments (any concerns about infant to be followed up):

11.5 Appendix E: BRIGHT study EPDS questionnaire in English

1. These past 7 days, have you been able to laugh when you saw something (plural) that could make you laugh? Your answer could be:

- 0 - Yes, as normal
- 1 - Yes, but less than normal
- 2 - No, not much
- 3 - No, not at all

2. These past 7 days, have you been expecting things related to fun to come in the future? *(Same scale as Q1)*

3. (...) have you been unnecessarily blaming yourself if things went very badly? Your answer could be:

- 3 -Yes, a lot of the time
- 2 -Yes, some of the time
- 1 -No, it didn't happen much
- 0 - No, it never happened

4. (...) have you been uncomfortable or worried without any genuine reason? *(Q4-10 same scale as Q3)*

5. (...) have you been scared or did you panic without any genuine reason?

6. (...) have you been able to control your daily routine?

7. (...) were you having difficulties in terms of your sleep, because you were not happy?

8. (...) have you been sad?

9. (...) have you had so much unhappiness which caused you to cry?

10. (...) have you been wanting to be secluded on your own?

11.6 Appendix F: Definitions and scoring for relevant Global Rating Scales

Adaptations to the original maternal scales by Laura Bozicevic

Original infant scale text from GRSMII manual (Melanie Gunning et al., 1999)

Maternal Dimension 3: Signs of Depression (excluding Focus of Attention and Relaxed to Tense)

Happy (5)

Sad (1)

DEFINITION: (...) captures the outward impression of the mother's affective state and the level of her enjoyment in interacting with her infant. (...)

SCORING:

5. A very happy mother smiles, laughs and plays with her infant, makes jokes or happily joins in with the infant's games.
4. The mother is happy but behaves less excitedly than in rating no. 5. She smiles and laughs but is not as active and animated in her interaction style.
3. The mother displays a rather neutral affect. Not overtly happy and not sad. Or, she may display a mixture of both mild happiness and mild sadness or depression.
2. There are some smiles from the mother, though some may appear to reveal tension rather than enjoyment, but for most of the interaction her facial expression and/or tone of voice seem sad and depressed.
1. Throughout the interaction the mother appears depressed or sad through both her facial expression and tone of voice. She very rarely smiles and if she does, it looks more like a forced or sad smile.

Much Energy (5)

Low Energy (1)

DEFINITION: (...) related to the depressive's experience of low energy, psychomotor retardation, or flaccidity. (...)

SCORING:

5. The mother appears motivated to engage with the infant; she is ready to act to get or maintain contact with her infant. She responds promptly to the infant's physical needs (e.g. supporting him when he slips). She looks lively and energetic. She may be intrusive. If the infant is avoidant, she makes a consistent effort to gain his attention.
4. The mother appears motivated to engage with her infant; however, she is not particularly lively or excited at all times. On 1 or 2 occasions, she may miss the opportunity for responding promptly. If the infant is avoidant, she generally makes an effort to engage him; however, she does little on occasion.
3. Generally the mother is motivated to interact with her infant, however, on 3 or 4 occasions she may miss the opportunity to respond promptly to the infant's needs. If the infant is avoidant, she may make a little effort to engage the infant, however, she generally waits for the infant to start any contact.
2. The mother shows little effort in gaining or maintaining engagement with her infant. She is slow in responding to his needs and may take some time to help him when he slips down the chair. In the face of an avoidant infant, the mother attempts to engage him 2 or 3 times, and these seem unenthusiastic.
1. The mother makes minimal, if any, effort to engage with her infant and is markedly slow to do so. If he slips she may not help him, or may take an uncomfortably long time to do so. She may look helpless and at a loss for what to do. If the infant is avoidant, she does not attempt to gain his attention, simply waiting for.

Infant Dimension 1: "Good to Poor"

Attentive (1)

Avoidant (5)

DEFINITION: (...) rates the amount of visual attentiveness (...) ranging from an infant who constantly looks at his mother to an infant who never regards his mother.

SCORING:

5. The infant spends all, or very nearly all, of the interaction in visual contact with his mother. He may look away briefly a few times to regulate high peaks of arousal
4. The infant looks at the mother a great deal during the interaction. Roughly three quarters of the time) with 2 or 3 brief periods of avoidance, or 1 longer period
3. The infant spends about half the interaction looking at his mother, either continuously or in more brief periods totalling about half the time
2. The infant is avoidant for most of the interaction and looks towards his mother 3 or 4 times. Or, he may make many very quick glances at her.
1. The infant makes no visual contact at all with his mother, or only for a very brief period.

Active positive communication (5)**No active positive communication (1)**

DEFINITION: Any type of [positive] communicative effort directed towards the mother (...). Pre-speech (...), movement of limbs in response to mother's actions, vocalisations, smiles etc., are all included. (...)

SCORING:

5. The infant is actively communicative towards her mother throughout the interaction. He may vocalise, make pre=speech movements, gestures with limbs, and smiles, either separately or contemporaneously, and all directed towards the mother

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 one 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.

Positive vocalisations (5)

No positive vocalisations (1)

DEFINITION: A [frequency count of] any high pitched, happy, communicative sounding vocalisation the infant produces.

SCORING:

5. The infant makes many clearly positive vocalisations throughout the interaction.

4. The infant several positive vocalisations either with quite long pauses between episodes or he vocalises for half the session with no vocalisations in the other half.

3. Either 2 or 3 long vocal phrases of 5 or 6 short vocalisations.

2. Just 1-4 brief vocalisations are uttered throughout the interaction.

1. No positive vocalisations are made.

11.8 Appendix H: NBAS item scores relevant to this thesis

From NBAS manual (Brazelton & Nugent, 2011); author notes in parentheses

Orientation to Face Only, Face plus Voice, Ball and Rattle

1. Does not focus on or follow stimulus (or looks away; shuts out).
2. Stills with stimulus and brightens.
3. Stills, focuses on stimulus when presented, little spontaneous interest, brief following.
4. Stills, focuses on stimulus, follows for a 30-degree arc, jerky movements.
5. Focuses and follows with eyes horizontally for at least a 30-degree arc. Smooth movement, loses stimulus but finds it again.
6. Follows for two 30-degree arcs with eyes and head. Eye movements are smooth.
7. Follows with eyes and head at least 60 degrees horizontally, maybe briefly vertically, partly continuous movement, loses stimulus occasionally, head turns to follow.
8. Follows with eyes and head 60 degrees horizontally and 30 degrees vertically.
9. Focuses on stimulus and follows with smooth continuous head movement horizontally and vertically, and follows in a circular path for a 180-degree arc.

Orientation to Voice and Rattle to Side

1. No reaction (or looks away).
2. Respiratory change or blink only.
3. General quieting as well as blinking, and respiratory changes.
4. Stills, brightens, no attempt to search for source.
5. Shifting of eyes to sound, stills and brightens.
6. Alerting and shifting of eyes, head turns to source.

7. Alerting, head turns to source, searches for, finds and looks at stimulus at least once.
8. Alerting, head turns, eyes search for and find stimulus repeatedly, 3 out of 4 times.
9. Alerting prolonged and consistent, head turns, eyes search for and find stimulus every time, 4 times out of 4.

Alertness

1. Inattentive – rarely or never responds to stimulation.
2. When alert, responsiveness very brief and always delayed. Not specific to stimuli.
3. When alert, responsiveness brief and often delayed and quality of alertness variable. Responsiveness specific to stimuli.
4. When alert, responsiveness brief but not delayed. Quality of alertness variable.
5. When alert, responsiveness of moderate duration. Responsiveness may be delayed and variable and it may take considerable time to engage the infant's alertness.
6. When alert, responsiveness of moderate duration, not delayed and not variable, and can be achieved with minimal examiner effort.
7. When alert, responsiveness of generally sustained duration. Still some delay and variability. Examiner support may be necessary to elicit this level of responsiveness.
8. When alert, responsiveness is sustained. No delay or variability, and minimal examiner support necessary to initiate Orientation responses.
9. Always alert for most of the examination (of Orientation items and stimulation). Orientation cues are clear and alertness predictable. No examiner facilitation necessary.