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The Influence of Maternal Childbirth Experience on Early Infant Behavioural Style

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Submitted to Swansea University in fulfilment of the requirements for the Degree of Doctor of Philosophy

College of Human and Health Sciences

2020

Declaration

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I declare that my thesis, including tables and figures, consists of 96,837 words.

Carmen Power

for Jasmine and Sophie

ACKNOWLEDGEMENTS

I am greatly indebted to all the people without whom this thesis could not have been written. First, to my supervisors Professors Amy Brown and Claire Williams for their steady direction and guidance throughout – Amy for her insight, clarity and expertise, for readily answering all my questions, and for always managing to simplify things whenever I over complicated them. Huge gratitude to Claire for all of the above, her in-depth knowledge, advice and rigorous checking of all-things-statistical, and for that great knack of knowing how to offer just the right words of encouragement when they were needed most.

A heartfelt thank you to all the wonderful and insightful mothers, health professionals and doulas who took part in this research. I am extremely grateful to you for generously donating your time, sharing your experiences so openly and honestly, and trusting me with your words and your wisdom. I hope I have done them justice.

A great deal of gratitude goes to my family. First and foremost, to my parents who have always supported my dreams and ideas, whether or not they understood the driving force behind them. Also to my sisters, 'bonus parents' and extended family, especially John Hills, Jeany Ecklund and Judy O'Mahony, for their ongoing faith in me, even in moments when my own belief wavered. A very special thank you to Professor Sir John Hills for his mentoring and practical support throughout, for reading and providing useful feedback on early versions of the thesis, and for his invaluable advice regarding the sociodemographic data. It was John's active and generous support that enabled me to complete the thesis on schedule.

Thank you to my amazing daughters Jasmine and Sophie who were with me during the final few months of thesis-writing lockdown, which coincided with the first global pandemic lockdown – for willingly taking on far more than their share of cooking, cleaning and dog walking. Special thanks to Jasmine for her endless enthusiasm and encouragement, and to Sophie for proof reading more words than she had bargained for. You are both my constant source of joy and inspiration and I feel immensely proud of you and grateful that you were born. My greatest appreciation must be acknowledged to my partner Mike for his extreme patience, kindness and nobility, for

remaining solidly by my side for the long haul, and for being my anchor amidst the sometimes turbulent waters of balancing challenging work alongside a PhD.

I am very grateful to Professor Phil Reed (and Dr Janet!) for teaching me statistics in a way that I could finally understand. Also to Eleanor Gregory in the Psychology department for her welcoming friendliness and for willingly linking me up with the Research Methods in Psychology MSc timetable for three consecutive years; and to the amazing Human and Health Sciences department secretaries, especially Katie Retallick for her constant support, and Maria Davies for her open-door ethos and for being so warm, kind, helpful and compassionate throughout my PhD journey.

Massive thanks to my very dear friends Mark and Deryl Robinson for all their kindness – for having me to stay whenever I was in Swansea and always pampering me with delicious homemade food, roaring fires, lively conversations and a comfy bed. Gratitude also to my girlfriends, especially Kate, Sophie, Inga, Thelma, Annie and midwife Becci, for gladly cheering me on, their willingness to discuss ideas, and for being there over the years for tea breaks, walks, talks and wild swims. Special thanks to Kate Hawkins for reading and commenting on the thesis in its final stages.

A huge thank you to my developmental psychology professor at Lancaster University, Gavin Bremner for first inspiring me to learn about the incredible intelligence of babies. Also to the SRIP and UCLAN conference organisers for their ongoing interest in my topic – enabling me to regularly present, receive feedback and discuss my findings at their annual conferences. Fond memories and gratitude go to Berry Brazelton who I was privileged to meet before he died – at the international conference of the World Association of Infant Mental Health in Edinburgh (June 2014), which he travelled all the way from America to attend, aged 96 and against his doctor's orders. I am grateful for the opportunity to speak with him in the exciting earliest stages of the PhD about my two favourite topics: Babies and Birth. Like my own dear parents, Brazelton was an inspiration to just keep on doing what you love.

ABSTRACT

The use of interventions during childbirth is increasing (WHO, 2018) and, while such interventions can be life-saving, they may have a negative impact on the mother's experience of birth and her psychological wellbeing post birth. They may also adversely affect the newborn infant's physiology and behaviour (Taylor, Swift & Glover, 2000; Gitau et al., 2001; Douglas & Hill, 2013). However, little is known about whether the birth and early postnatal experiences influence infant behavioural style (known as temperament) (Thomas & Chess, 1977) beyond the initial postnatal period. Employing an exploratory mixed methods approach, the overarching aim of this thesis was to explore how any potential impacts of birth experience on newborn infant behaviours may occur, and if so, whether they persist beyond the neonatal period; as well, to explore how the mother's response to her birth experience might mediate such effects.

Part One involved a qualitative exploration of the experiences and beliefs of eighteen health professionals and twenty-two mothers in relation to childbirth and early infant behavioural style. Health professionals interviewed in Study One believed that the birth experience could have a direct impact on newborn wellbeing and behaviour as well as influencing it indirectly via the mother's response to the birth and her subsequent perceptions of and interactions with her baby. In contrast, most of the mothers interviewed in Study Two did not perceive any association between their birth experience and their baby's early behavioural style. However, a simple content analysis highlighted strong patterns in the data between reported maternal physical and emotional birth experiences and perceived infant temperament during the first year.

Part Two (Study Three) involved a detailed online survey of approximately a thousand mothers, employing quantitative methods of analysis. Although physical birth factors contributed to the newborn baby's response (e.g. alert-content or cry-fuss behaviours), it was subjective and psychological birth factors that predicted ongoing infant behavioural style (0-6 months), for example alert-responsive or unsettled, irritable infant behaviours. Taken together, the data suggest that subjective and psychological factors could be as important as objective physical factors in post-birth mother-infant wellbeing and developing infant temperament. These findings may have important implications for future maternity and perinatal care of mothers and their infants.

PUBLICATIONS AND CONFERENCE PRESENTATIONS

An adapted version of Study One (Chapter Four) is published at:

Power, C., Williams, C., & Brown, A. (2019). Does childbirth experience affect infant behaviour? Exploring the perceptions of maternity care providers. *Midwifery, 78*, 131-139.

Findings from Studies One and Two (Chapters Four – Five) were presented together at:

International Normal Labour and Birth Conference, Lancashire, 2nd – 4th October 2017

Brazelton Centre UK Conference, Cambridge, 21st September 2017

Society of Reproductive and Infant Psychology (SRIP) Conference, York, 12th–13th September 2017

Findings from Study Three (Chapter Six) were presented at:

Normal Labour and Birth Conference, Lancashire, 17th – 19th June 2019

Society of Reproductive and Infant Psychology Conference, London, 5th – 6th September 2019

Maternity and Midwifery Festival, Cardiff, 18th September 2019

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TERMS and ABBREVIATIONS

Terms used in thesis

Infant temperament has been defined as the 'behavioural style' of the infant (Thomas & Chess, 1977; Carey & McDevitt, 2016). When referring to studies that examine infant temperament, the term 'infant temperament' is used. Maternal perceptions or reports of their infant's temperament are referred to as 'infant behaviour', 'behavioural style' or 'behavioural patterns'. The words woman, mother and maternal or infant and baby are also used interchangeably throughout the thesis.

Mother and Baby Scales – abbreviations

MABS	Mother and Baby Scales
A-R	Alert-Responsive
U-I	Unsettled-Irregular
LCC	Lack of Confidence in Caretaking
Easy	Easiness
GC	Global Confidence
ADF	Alert during Feeds
IDF	Irritable during Feeds
LCBF	Lack of Confidence in Breastfeeding

Other acronyms and abbreviations

ADHD	Attention deficit hyperactivity disorder
ARM	Artificial rupture of membranes
BE	Birth emotions
BF	Breastfed/breastfeeding
BPS	British Psychological Society
CS/C section	Caesarean section
CT	Caretaking

EFM	Continuous electronic foetal monitoring
FSE	Foetal scalp electrode
FBS	Foetal blood sample
Gov.uk/wales	UK/Wales government statistics
HB	Hypnobirth/ing
HE	Higher education
HPA	Hypothalamic-pituitary-adrenal (axis)
M	Mean
MANOVA	Multivariate Analysis of Variance
MANCOVA	Multivariate Analysis of Covariance
MCP	Maternity care provider
N/n	Number of participants
Neonate	Newborn infant aged 0-4 weeks
NICE	National Institute for Health and Care Excellence
NICU	Neonatal Intensive Care Unit
NMPA	National Maternity and Perinatal Audit
ONS	Office for National Statistics
PN	Postnatal / postpartum
PPD	Postpartum depression
PTSD	Posttraumatic stress disorder
RCM	Royal College of Midwives
RCOG	Royal College of Obstetricians and Gynaecologists
SD	Standard deviation
UNICEF	United Nations Children's Fund
UNPF	United Nations Population Fund
WHO	World Health Organisation
WMA	World Medical Association

The Influence of Maternal Childbirth Experiences on Early Infant Behavioural Style

Chapter One

Introduction

Medical interventions during childbirth are steadily rising across the world (World Health Organisation, 2018). While these can be life saving, the World Health Organisation (WHO, 2018) and the latest National Maternity Review, *Better Births* (NHS England, 2016), have both stated that the current overuse of interventions is not always conducive to safer or more satisfying births for mothers and their infants. Although obstetric interventions are necessary in times of emergency, they are not without consequence and may have a negative impact on maternal and infant wellbeing post birth (Dahlen, 2014; NHS England National Maternity Review, 2016; NHS Care Quality Comission, 2018, 2020; WHO, 2018).

There could be a number of reasons behind these impacts on the mother-infant dyad. Unnecessary interventions may disturb the progression of normal physiological labour and birth (Uvnäs-Moberg et al., 2019) as well as instinctive neonatal behaviours that make it easier for mother and infant to bond and breastfeed post birth (Widström et al., 2019). Evidence also shows that obstetric interventions may adversely affect child health outcomes up to five years of age (Peters et al., 2018) and, arguably, this would negatively impact their overall wellbeing. Although relatively little is known about the possible continuing consequences of a medicalised birth on developing temperament, it has been suggested that certain high impact obstetric interventions such as assisted birth (using forceps or ventouse) could potentially have longer term effects on infant behaviour and functioning (Douglas & Hill, 2013; Dahlen et al., 2013).

While essential interventions can save the neonate from serious negative outcomes (such as hypoxia or cerebral palsy), the potential for more subtle effects on crying, feeding, and other newborn infant behaviours may go relatively unoticed. However, neonates (infants aged 0-4 weeks) can experience a heightened stress response to a medicalised birth, as evidenced by increased crying and cortisol levels after assisted delivery (Taylor, Fisk & Gover, 2000; Gitau et al., 2001). Other perinatal factors that may contribute to unsettled neonatal behaviour include

pharmacological pain relief medications (Mellon, Simone & Rappaport, 2007) and induction by synthetic oxytocin, especially when combined with epidural analgesia (Brimdyr, Cadwell, Widström, Svensson & Phillips, 2019).

Another potential issue for the mother-infant dyad is that women are at increased risk of experiencing post-traumatic stress and depression (PPD) after unexpected obstetric complications or interventions (Ayers, Bond, Bertullies, & Wijma, 2016; Horsch & Garthus-Niegel, 2019). Maternal PPD is known to adversely affect mother-infant interactions (Murray, 1992; Matthies et al., 2017; Murray, Halligan, & Cooper, 2018), disrupting the development of an enduring positive relationship (Feldman, 2017). In turn, this may impact on the infant's future mental health (Halligan, Murray, Martins, & Cooper, 2007). Looking beyond the birth to how the infant should be expected to thrive emotionally, behaviourally and developmentally (Murray, Cooper, & Fearon, 2014), both the birth itself and the mother's response to the birth could therefore potentially have consequences for the infant's future healthy development.

Consequently, there is an increasing awareness that maternal psychological wellbeing around the perinatal period (before and after childbirth) should also be considered. As overall physical safety during pregnancy and childbirth is often prioritised at the expense of inter-related mother-infant physiological and psychological wellbeing, these seemingly opposing needs of physical and psychological safety somehow need to be reconciled (WHO, 2018).

In short, much of the evidence around childbirth impacts on the mother-infant dyad focuses on very early neonatal behaviours (e.g. Douglas & Hill, 2013); or it explores maternal perceptions and feelings around the birth in relation to postnatal mood outcomes, sometimes touching upon her relationship with her partner and infant (Ayers et al., 2016). The impact that postnatal depression and other mood disorders can have on maternal behaviour, mother-infant interactions and subsequent infant behaviour has been examined (e.g. Murray, 1992; Ayers, Eagle & Waring, 2006; Murray et al., 2014). However, while it has previously been suggested that infant behavioural outcomes might be connected to the mother's subjective birth experience (Taylor et al., 2000, p120), this research has not yet been conducted. It is possible that the mother's individual response to childbirth could mediate any potential impacts of the physical birth on her baby's behaviour. The aims of the thesis are set out within this context.

1.1 Aims of thesis

The overarching aim of the thesis is to explore how the birth experience might influence early infant behavioural style. Although obstetric interventions can lead to rising maternal and neonatal blood cortisol levels, with associated behaviours such as increased crying (Taylor et al., 2000; Douglas & Hill, 2013), little is known about direct or indirect links between the wider birth experience and developing temperament. The possibility of a relationship between the mother's birth experience and her baby's behaviour therefore requires further exploration. The present thesis aims to contribute to a body of work which is helping to bridge that gap.

Consequently, the studies within this thesis seek to improve understanding of the ways in which birth may positively or negatively impact early infant behavioural patterns (such as crying or fussing), which in turn may influence the sociable mother-infant interactions so important for healthy infant development (Thomas & chess, 1977; Murray & Andrews, 2005). As described above, most of the existing research around the impacts of childbirth relate either to the physical safety of mother and infant (e.g. Fenwick, Staff, Gamble, Creedy, & Bayes, 2010) or to maternal psychological wellbeing (e.g. Garthus-Niegel, von Soest, Vollrath, & Eberhard-Gran, 2013). However, while the birth experience can affect postpartum maternal mood (Ayers et al., 2016), maternal mood may influence the mother's perceptions of her baby's behaviour (McGrath, Records & Rice, 2008). Likewise, a distressed or unsettled infant could negatively impact their mother's psychological wellbeing (Britton, 2011). This thesis therefore also aims to examine the psychological impacts of childbirth on mother and infant wellbeing and early infant behaviour – which in itself might be considered as an expression of the infant's overall physiological and neurobiological wellbeing (Brazelton & Nugent, 1995).

1.2 Research questions

The overarching research question stemming from these aims is:
Does childbirth experience influence maternal perceptions of infant behaviour?

Within this principal research question are three sub-questions:

1. Can differences in perceived early infant behaviours be identified depending on birth experience?
2. If so, can they be explained by the physical birth experience or do maternal perceptions of the birth matter too?
3. Which are the most significant perinatal factors in early infant behavioural patterns?

1.3 Outline of thesis

To address these research questions, the thesis is organised as follows:

Chapter One: An outline of core concepts relevant to childbirth and early infant behaviour

Chapter Two: A narrative literature review setting the overarching research question and sub-questions within the existing evidence on the maternal and infant responses to childbirth

Chapter Three: A methodology chapter explaining the rationale for adopting a mixed methods approach to the research problem

Chapter Four: Study One – a qualitative study exploring the experiences and beliefs of maternity care providers in relation to childbirth and post birth mother and infant behaviours

Chapter Five: Study Two – a second qualitative study exploring maternal experiences of childbirth and the mother's perceptions and interpretations of her infant's behaviour post birth

Chapter Six: Study Three – a quantitative study designed to examine multiple physical and psychological perinatal variables and their potential influence on maternal confidence and infant behavioural patterns during the first 30 weeks, with a specific focus on childbirth itself

Chapter Seven: A general discussion chapter, bringing the findings from all three studies together. The chapter includes: conclusions, limitations, implications for practice and suggestions for future research around the subject of childbirth experiences and early infant behavioural style.

Chapter Two

Literature Review

This chapter contains a narrative review of the literature (Green, Johnson & Adams, 2006) to explore the potential impacts of childbirth on developing young infant behavioural style, known as temperament. In contrast to a meta-analysis or systemcatic review, this is achieved without any quantitative analysis. A narrative review was chosen as it synthesises the literature in the chosen area by describing the issues and developments that have occurred over a period of time (Bourhis, 2017). This approach was deemed suitable as there is little previous literature on the subject of how childbirth may impact infant behaviour; therefore a review of the literature was needed to determine whether the concept of a potential link between these two mostly separate topics was plausible. Indeed, it was necessary to cast a wide net to capture all possible perinatal explanations for infant behavioural outcomes. The history of infant temperament also needed to be discussed as, both in the past and currently, it has been the subject of much dispute (Thomas & Chess, 1977; Goldsmith et al., 1987). Equally, previous researchers have have explored potential relationships between numerous aspects of childbirth and infant behaviour (Lester, Als & Brazelton, 1982; James-Roberts & Wolke, 1987; Brazelton & Nugent, 1995), and have largely considered that many impacts of childbirth are transient, or quickly over-shadowed by other enviromental or sociodemographic factors (James-Roberts & Conroy, 2005; Carey & McDewitt, 2016).

Thus, a narrative review of the literature allowed the overraching research questions to be explored, charting the journey in this line of research from the 1970s to the present (Bourhis, 2017). It offered the flexibility to pursue various lines of enquiry and from different perspectives (e.g. considering both physiological and psychological perspectives of childbirth), and to speculate theoretically about potential pathways between key variables of interest that began to emerge from within the literature. While a limitation of this style of review is that it does not employ empirical methods or quantititve anaysis of outcomes (Bourhis, 2017), it relies instead upon high quality studies and quantitative reviews to enable the research history of childbirth impacts on infant temperament to unfold. However, rather than reaching a conclusion, as is the case in most systematic reviews or meta-analyses, instead it reopens an historical enquiry into potential links between childbirth experiences and infant temperament.

Infant mental health is an increasingly recognised concept known to be influenced by the earliest experiences (Zeanah, 2018). However, research exploring how the infant's behaviour could be affected by the birth is sparse. Moreover, the literature that does exist is often contradictory, highlighting major discrepancies and disagreements about whether and how childbirth might influence early and ongoing infant behaviours, and what the mechanisms behind any impacting factors might be (James-Roberts & Conroy, 2005).

The effects of modern medicalised childbirth culture upon maternal and infant physical safety and wellbeing have received considerable interest over recent decades (Lyberg, Dahl, Haruna, Takegata, & Severinsson, 2019). Although normal birth is associated with an increased likelihood of optimal physical outcomes for both mother and infant, obstetric intervention rates are still rising (McIntyre et al., 2013; NHS England National Maternity Review, 2016; WHO, 2018). Attention has turned to considering how the mother's psychological wellbeing might be affected by her birth experience, and the impacts this may have on the mother-infant relationship, breastfeeding success, and infant cognitive, socio-emotional, language and physical development (Horsch & Ayers, 2016).

Previously established influences on infant temperament include general physical and mental health passed genetically from parent to child and common factors such as prematurity (Hughes, Shults, McGrath, & Medoff-Cooper, 2002). There are environmental contributions such as the mother's diet, exercise and lifestyle including alcohol, smoking, drugs, or exposure to environmental toxins (Carey & McDevitt, 2016). Maternal depression (Murray et al., 2014) and poor mother-infant nutritional status (Wachs, 2009) – iron deficiency in particular (Wachs, Pollitt, Cueto, Jacoby, & Creed-Kanashiro, 2005) – may play a part, as can sociodemographic background, family structure and parenting style (Murray, Cooper & Fearon, 2014).

However, each of these factors is in itself a major topic. Consequently, the focus of this literature review is to explore the potential influences of maternal experiences of childbirth on early infant temperament. It discusses major perinatal factors that could affect infant behaviour. Thus, in aiming for an unbiased and comprehensive review of the literature (Wright et al., 2007), this chapter presents a philosophical and historical narrative of developments in the specialised and sparsely researched field of childbirth and infant behavioural style.

To do this, a literature search was first conducted around the central theme of potential impacts of childbirth on infant behaviour or temperament. The initial research question was formed, as defined in Chapter One: *'Does childbirth experience influence maternal perceptions of infant behaviour?'*. A comprehensive list of keywords and search terms were developed, and terms relating directly to the research question were inputted to find relevant peer reviewed papers published in reputable English language journals. These terms were also used in searches intermittently throughout the research to identify any new emerging evidence.

University librarians specialising in human and health sciences advised on the electronic search strategy, and databases containing the widest range of medical and academic outputs relating to the research question were purposefully selected (Aveyard, 2014). The following research databases were searched: MEDLINE and PubMed, CINAHL via EBSCO, SCOPUS, Web of Science, Science Direct, including JSTOR, SpringerLink, the American Psychological Association's (APA) database, Cochrane Library of Cochrane Reviews, SAGE Publications, Health Management Information Consortium (Ovid) and Google Scholar. PsycINFO and PsycARTICLES were also included for containing papers on psychology, social and behavioural sciences including developmental psychology and the psychological impacts of childbirth on the mother.

To focus the search, initial key terms included both full and truncated versions of words and phrases, such as: childbirth; childbirth interventions; effects of childbirth medication/ pain relief/ obstetric complications/ interventions/ Caesarean section/ assisted delivery/ induction on infant behaviour/ temperament; (child)birth and baby/ infant/ neonatal/ newborn behaviour; impacts/ influences of childbirth on infant behaviour/ temperament; childbirth and maternal mood; maternal perceptions of neonatal/ infant behaviour/ temperament post birth.

Ideas relating to childbirth experiences and infant behaviour were fully explored, with one paper often leading to another. For example, examining early studies by James-Roberts and Wolke (1983-1989) led to also exploring their later work concerning infant crying (James-Roberts & Conroy, 2005) and ongoing regulatory problems (Wolke, Schmid, Schreier, & Meyer, 2009). Similarly, a paper on the neurobiological infant response to childbirth (Douglas & Hill, 2013) led to exploring the wider and potentially longer lasting impacts of childbirth factors on the infant's hypothalamic-pituitary-adrenal (HPA) axis, microbiome and epigenome, in turn possibly affecting temperament.

Consequently, more specific search terms began to be entered, such as epidural/ pethidine/ induction/ synthetic oxytocin/ forceps/ ventouse/ caesarean section/ skin to skin/ breastfeeding/ social/ professional support and infant crying/ bonding, breastfeeding and regulatory problems/ behaviour/ temperament/ HPA axis/ microbiome/ epigenome. Thus, the search began with a wide net and broad search terms, which then became more specific. As connected topics arose during the search, they were followed up with further searches, such as assisted/ caesarean birth and autism/ ADHD/ adolescent depression. Likewise, protective factors, such as skin to skin or social support, that emerged as preventative to a traumatic response were specified in future searches. This method helped to gain a wider picture around the possible impacts of the birth experience on future infant, child and adolescent wellbeing and how such impacts might be lessened.

A further area of relevance became apparent during the search for relevant literature – the impacts of childbirth on postpartum maternal psychological wellbeing. Similarly, maternal mental health emerged as a strong and known predictor of young infant temperament. Therefore, maternal pre- and post-natal mental health, how they might relate to the birth experience, and their impacts on infant behaviour and developing temperament were also included in the literature search.

The search for relevant papers approximately followed CASP best-practice principles (2013). However, as this literature review followed a narrative rather than systematic review format, CASP was used to guide rather than dictate the search and assembling of relevant articles. Academic papers and reviews were first searched for their relevance to the subject before reading and critically assessing the effectiveness of their approach. Study methods, research questions and outcomes were reviewed as part of the process of determining their relevance to the search criteria. Peer reviewed papers which revealed different viewpoints to the mainstream were also sought. Furthermore, relevant references were used to search for other related, well-cited papers published in well-established, reputable journals. Thus, useful and appropriate practices were adopted and a rigorous approach to the literature review was employed. Certain texts in the grey literature were also sought where they applied directly to the subject matter, for example the WHO recommendations (2018): ‘Intrapartum care for a positive childbirth experience’, and the NHS England document (2016): ‘Better Births’.

However, despite efforts to capture all related research outputs, a level of bias can remain in any review. Although this is a narrative review, Sandelowski (2008, p105) has argued that even

systematic reviews involve a certain 'idiosyncratic' bias in the framing of the research question, the methods used to search for relevant papers, and in their subsequent analyses. Therefore, while assuming an unbiased pose and searching wherever possible for evidence to the contrary, it is inevitable that on some level the research question itself would dictate a natural leaning towards papers that support the thesis. Nevertheless, both sides of the argument are presented wherever they were found to exist, and the literature review does not attempt a definitive or conclusive statement but rather leads on to the methods of enquiry employed in this thesis.

The literature review provides a detailed discussion of some of the diverse range of perinatal factors that might affect mother and infant during their joint journey from pregnancy through to the postnatal period, with a specific focus on childbirth and related issues. Section 2.1 outlines the current status of childbirth, with a particular focus on the UK, including potential physical and psychological outcomes of medicalised interventions for mother and infant. Section 2.2 follows this with a definition and historical overview of early infant behaviour and ongoing temperament development (Thomas & Chess, 1977), while making reference to widely-used and validated measures of infant temperament throughout (e.g. Brazelton & Nugent, 1995; Rothbart, Chew & Gartstein, 2001). The literature review then explores research findings specifically relating to the infant's potential neurobiological and behavioural response to physiological events, complications and interventions that may occur during childbirth (Taylor et al., 2000; Gitau et al, 2001; James-Roberts & Conroy, 2005; Douglas & Hill, 2013).

To explore the possibility that infants might also be affected by their mother's response to birth, research which indicates the significance of a mother's perceptions of her birth experience to her own postnatal psychological wellbeing is examined (e.g. Olde et al, 2006; Ayers, Bond, Bertullies & Wijma, 2016). Furthermore, studies that demonstrate the potential impacts of the mother's psychological prenatal and postnatal states on infant behaviour (Feldman et al., 2009) and on the mother-infant relationship (Murray, 1992; Murray et al., 1997; Feldman, 2017) are critically reviewed and summarised. As well, the literature review explores evidence converging around the possibility originally suggested by Taylor et al. (2000) – that a mother's subjective experience of birth might mediate any physical impacts upon her baby's behaviour.

2.1 Impacts of childbirth on the mother-infant dyad: an overview

2.1.1 *Childbirth intervention rates in the UK*

Interventions rates in the UK and elsewhere are rising steadily, despite warnings from the World Health Organisation (WHO, 2018) that this may have negative repercussions for mother and infant physical and psychological wellbeing. Perhaps most significantly, the induction rate is rising sharply (Gov.wales Maternity Statistics Wales, 2017-18; Gov.uk NHS Maternity Statistics England, 2016-17); NMPA Project Team National Maternity and Perinatal Audit: Clinical Report, 2017). Consequently, in England there has been a decrease in the spontaneous onset of labour from approximately 69% in 2006-7 to 55% in 2016-17 (Gov.uk NHS Maternity Statistics England, 2016-17).

Similar trends are reported to have occurred in Wales. Recent figures show 51% for spontaneous onset of labour, with 34% of labours being induced, 23% of women using epidural anaesthesia, and 27% experiencing either a planned or emergency Caesarean section birth (C section or CS) (Gov.uk Maternity Statistics Wales, 2017-18). Some of these figures overlap (e.g. the same mother could have an induction, epidural and C section). Consequently, according to Maternity Statistics Wales (2017-18), just 28% of Welsh births are now classed as 'healthy births' – defined as spontaneous onset of labour and unassisted vaginal birth without medical interventions or use of epidural, and a five minute Apgar score (Apgar, 1952) of seven or above. The 'Statement on caesarean section rates' by WHO (Betrán et al., 2016) clearly outlines the increased morbidity and mortality risks posed by these still rising CS rate across the modern world, above the recommended life-saving maximum of 10-15% (Ye et al., 2016) to over 40% in some areas (Betrán et al., 2014). Concerns have been raised regarding both short and long-term risks to mother and child by this increased rate of non-medically indicated C sections (Brownlee et al., 2017).

There may be less chance of experiencing medical interventions during a homebirth. However, births that begin at home come with their own set of risks, including a higher chance of an in-labour transfer and a small, though significant, increased risk of adverse outcome for the infant (NICE, 2017). However, this increased risk is thought to apply only to high-risk mothers who choose to give birth at home without a suitable health professional attending (Dahlen, 2019). A recent meta-analysis of 14 studies conducted in 'well-resourced' countries confirmed no significant differences in perinatal or neonatal mortality between low obstetrical risk mothers

who intended to give birth in hospital versus those who intended to have a homebirth with an attending midwife who was 'well-integrated' within the health services (Hutton, Reitsma, Simioni, Brunton, & Kaufman, 2019).

2.1.2 *Physical impacts of childbirth on mother and infant*

Despite potential negative repercussions for mother and infant physical and psychological wellbeing, medical interventions during childbirth can also be life-saving, with overall infant and maternal mortality at an all-time low. For example, in England, the maternal mortality rate fell from 14 to 9 deaths per 100,000 women giving birth between 2003-5 and 2011-13 (NHS England National Maternity Review, 2016). Similarly, there was a reported decrease of more than 20% in stillbirth and neonatal mortality rates over the same period. Nevertheless, steadily rising rates of childbirth interventions, including CS and induction or augmentation of labour, are considered a growing problem in the UK and elsewhere, although the exact level of unnecessary interventions and what is driving them has proven difficult to measure globally (WHO, 2018). The National Maternity Review *Better Births* also highlighted that quality of care and outcomes can vary hugely across the country (NHS England, 2016), and it has been estimated that over half of UK maternal deaths may be preventable with better care (MBRRACE-UK Perinatal Confidential Enquiry Report, 2018).

Evidence suggests that mothers experience more satisfaction and less trauma after a normal birth (WHO, 2018); and experience a better birth when they have woman-centred care, are presented with unbiased information, and are given the opportunity to make their own informed choices (NHS England National Maternity Review, 2016). In contrast, traumatic births where the mother feels out of control during her labour and birth have been associated with maternal mood disorders, which could potentially have negative repercussions for the mother-infant relationship (Ayers et al., 2016). This possibility will be fully discussed in Section 2.7: Psychological impacts of childbirth on mother and infant.

Physical impacts of medical childbirth interventions

A childbirth intervention is any medical process that is used during pregnancy, labour and birth to trigger or augment labour, to relieve pain, or to expedite the birth by artificial means (Chapman & Charles, 2009). As briefly outlined in Chapter One, increasing medicalisation of childbirth may have unwanted negative effects on mother and infant wellbeing post birth

(WHO, 2018). The main interventions and their possible outcomes are discussed across the next sub-sections: induction of labour, foetal monitoring, assisted birth, Caesarean sections, and medical forms of pain relief.

1. Induction of Labour

Induction of labour (IOL) has become an increasingly used method of initiating a woman's labour before spontaneous physiological onset (Baker & Kenny, 2011). Recent figures demonstrate that it is now the most common form of intervention in the UK birth room (Gov.wales, 2018: NHS Maternity Statistics Wales 2017-18; Gov.uk (2018). NHS Maternity Statistics England, 2016-17; NMPA Project Team National Maternity and Perinatal Audit: Clinical Report, 2017). Induction starts labour by one of a variety of means, including artificial rupture of membranes (ARM) or use of synthetic hormones such as prostaglandins or oxytocin. In some cases, such as pre-eclampsia or intrauterine growth restriction, an IOL may be life-saving (Baker & Kenny, 2011). Women who are more likely to require an IOL are those with a high body mass index, multiple pregnancies, diabetes or high blood pressure. Women over the age of forty or who smoke may be at a higher risk of having a stillbirth or other complications and are therefore generally offered an early induction. Induction may also be life-saving where a pregnancy continues past the expected due date (e.g. prolonged pregnancy) given that the placenta may begin to work less efficiently by 42 weeks (Baker & Kenny, 2011).

A Danish national cohort study covering a twelve-year period found that, while induction rates had more than doubled in that time, the stillbirth rate had fallen by one per thousand newborns (Hedegaard et al., 2014). Notably however, the number of women smoking in pregnancy, which also increases the risk of stillbirth, had halved during this period and more high-risk women were being induced. Overall, for prolonged pregnancies, in hoping to prevent the increased risk for stillbirth, foetal compromise during labour, foetal aspiration of meconium or problems in infants born after 42 weeks, numerous births must be induced for one life to be saved (Baker & Kenny, 2011). Nevertheless, in our increasingly risk-averse culture, and supported by the above findings, women are now often offered an induction after 40-41 weeks.

It is therefore worth noting that induction itself entails certain risks, including a possible increase of maternal anxiety, which may interfere with the normal physiology of childbirth (Chapman & Charles, 2009). Medical risks of IOL include umbilical cord prolapse or hyper-stimulation of the uterus, potentially causing foetal bradycardia (a sustained low heartrate),

both of which could result in emergency CS (Baker & Kenny, 2011). While the question of whether IOL rates are driving up emergency CS rates is hotly debated (Danilack et al., 2016), inductions have been linked to instrumental births (Ryan & McCarthy, 2016; NHS Direct Wales, 2019). Consequently, assisted deliveries using forceps or ventouse extraction now account for approximately 10-15% of UK births (Horan & Murphy, 2016).

These associations between induction and assisted birth may occur due to several related factors. Routine induction procedures, such as early rupture of membranes, raise the rate of foetal heart abnormalities and therefore increase the chances of needing assistance (NHS England National Maternity Review, 2016). Moreover, inductions often lead to a higher use of regional or local analgesics and anaesthetics such as pethidine or epidural to manage the increased pain (NHS England National Maternity Review, 2016), which may further drive up intervention rates (Vayssière et al, 2011). According to the WHO (2018, p1), this 'increasing medicalisation' of childbirth is 'undermining' women's natural capacity to give birth without interventions, which is considered to have a negative impact on the overall birthing experience. Furthermore, it does not always signify better physical outcomes for mother and infant and may lead to decreased maternal satisfaction and potential trauma for the dyad (RCOG, 2020).

2. Foetal monitoring

One side effect of IOL is the need for constant rather than intermittent foetal monitoring (Baker & Kenny, 2011). Once an induction begins, the woman must be carefully monitored for signs of foetal distress caused by the induction process. This would normally occur via continuous electronic foetal monitoring (EFM), using cardiotocography to record changes in the foetal heart rate in relation to the mother's uterine contractions (Baker & Kenny, 2011). However, this process can hinder the woman's freedom of movement during her labour. Moreover, a recent Cochrane review concluded that EFM did not improve the overall perinatal mortality rate or cerebral palsy rates compared to more traditional intermittent auscultation methods (Alfirevic et al., 2017). According to the review, CS and assisted birth rates rose after continuous EFM although, despite potential increases in pain due to decreased mobility, there was no reported rise in use of pharmacological pain relief methods. Foetal blood sampling (FBS) taken from a scrape on the unborn infant's scalp may occur during EFM if there is any doubt concerning cardiotocography readings. As with EFM, however, FBS was not found to influence differences in neonatal seizures or other forms of neonatal morbidity or mortality.

3. Operative vaginal (assisted) birth

While potentially life-saving when required, for example in cases of malposition or foetal distress, an assisted birth – which uses forceps or ventouse to remove the infant from the birth canal – also involves physical risks to mother and infant wellbeing (RCOG, 2020). Risks for the mother include a higher chance of experiencing vaginal, perineal or uterine trauma, potentially leading to bladder or anal incontinence or, at the extreme end, pelvic organ prolapse (Vayssière et al, 2011; Handa et al., 2012; Lim et al., 2018).

Risks of serious physical complications for the infant include facial or cranial injury (RCOG, 2020). Although it is recommended that clinicians conducting a complicated assisted delivery such as rotational forceps avoid excessive compression of the baby's skull (Horan & Murphy, 2016), if the pressure becomes too forceful, the infant's safety can be compromised. Consequently, assisted birth in full-term infants is moderately associated with neonatal intracranial haemorrhage (Ekeus, Hogberg & Norman, 2014; Horan & Murphy, 2016) and cranial brain injury (Pollina, Dias, Li, Kachurek & Arbesman, 2001), with both posing negative consequences for long-term quality of life.

4. Caesarean sections

Increasing rates of CS – an abdominal surgical procedure to birth the infant – while thought to be caused by both a more risk-averse obstetric culture and increased rates of maternal request, may also involve multiple risk factors for mother and infant, including infection, uterine rupture and respiratory disease (Mylonas & Friese, 2015). Although C sections are continually becoming safer, they are still associated with increased maternal morbidity, including a higher risk of postpartum haemorrhage or infection (Horan & Murphy, 2016). Moreover, the increasing use of CS over the past two decades has been associated with a negative impact on the infant's developing immune system (Cho & Norman, 2013) and an 'epidemic' of atopic disorders such as asthma (Bager, Wohlfahrt & Westergaard, 2008).

Results of a large-scale Finnish study of over 21,000 infants with matched controls indicated that the link between Caesarean birth and childhood asthma is more evident in diagnoses made before the age of three (Metsälä et al., 2008). It has been suggested that this effect could operate via alterations to the infant microbiome during an operative delivery (Dominguez-Bello et al., 2010), which might be exacerbated by recommendations concerning the frequent use of antibiotics to help prevent infection after a CS (Horan & Murphy, 2016). However, it remains

unclear whether early impacts of CS on the infant's developing immune system also exert longer term effects on their future immune response (Cho & Norman, 2013). Planned or unplanned CS can also have a negative impact on breastfeeding initiation and duration (Hobbs et al., 2016). Despite these drawbacks, some women request a CS when not medically indicated, sometimes due to a fear of childbirth (Lavender et al., 2012).

5. Pain Relief

Sensations of pain are common during labour and the medical profession have consistently tried to alleviate physical maternal pain in various ways. Interventions such as acceleration or induction of labour or lack of mobility due to EFM can lead to increased pain and are commonly accompanied by the use of pharmacological pain relief, such as pethidine or epidural analgesia (Baker & Kenny, 2011). However, pain relief used during labour is known to affect the newborn infant immediately post birth (Brimdyr, Cadwell, Widström, Svensson, & Phillips, 2019). It may also interfere with the normal hormonal balance of mother and infant during physiological labour and birth (Uvnäs-Moberg et al., 2019). These potential obstetric medication and hormonal disruptions to mother and infant wellbeing are further described in sections 2.6.1: *Neonatal pain and distress during and after birth* and 2.6.2: *Birth hormones and infant behaviour.*

2.1.3 *Psychological impacts of birth on maternal mood and wellbeing*

The type of birth a mother has may affect her psychological wellbeing (Ayers et al., 2016). Obstetric complications and interventions have been found to play a role in the mother's subjective experience of childbirth, and how she responds post birth (Andersen, Melvaer, Videbech, Lamont, & Joergensen, 2012). Mothers who experience a difficult birth, particularly those with a history of mental health issues, are at increased risk of developing anxiety, depression, or psychological birth trauma (Olde et al, 2006; Alcorn et al., 2010; Ayers et al, 2016). Post-traumatic stress disorder (PTSD) after childbirth can have detrimental effects on maternal mental wellbeing and family relationships (Ayers, 2004; Olde, van der Hart, Kleber, & Van Son, 2006). However, understanding the pathways between a traumatic birth experience and maternal mood is complex. Development of PTSD is associated with maternal perceptions and interpretations of events during the birth (Ayers et al., 2016). These may include feeling fear or a lack of control during birth, mentally dissociated from the birth and unsupported during labour or in the postnatal period (Ayers, Joseph, McKenzie-McHarg, Slade, & Wijma,

2008; Ford & Ayers, 2009; Harris & Ayers, 2012). This potential for a challenging birth experience to have a negative impact on maternal mood and the mother's subsequent relationship with her newborn infant will be discussed in greater detail across Sections 2.7.3: *Postnatal maternal mood disorders – anxiety and depression,* and 2.7.4: *Post-traumatic stress disorder after childbirth.*

Potentially, interventions and pain relief medications could affect early maternal experiences as a mother and caretaker of her new baby, particularly if she is trying to breastfeed (Brown & Jordan, 2013, 2014). For example, a mother who has had a CS will have had some form of anaesthetic which might affect her infant's behaviour, she may be in pain or exhausted, and may also be more likely to be deprived of immediate skin to skin contact with her infant – the instinctive maternal and infant behaviour after a normal birth known to promote bonding and breastfeeding (Widström et al., 2011). Rowe-Murray and Fisher (2001) explored childbirth interventions and bonding, finding that the timing and duration of initial mother-infant skin to skin contact could affect how the mother felt later. An assisted birth or CS, either of which may delay first contact, were believed to have a negative impact on these early interactions, maternal mood, and mother-infant bonding. Similarly, Redshaw, Hennegan and Kruske, (2014) found significant benefits for maternal physical and psychological wellbeing when holding her baby immediately after a normal birth – including reduced likelihood of reporting feeling depressed or anxious – although this effect did not apply after CS births. However, mothers who held their baby within five minutes of an emergency CS were more likely to be breastfeeding at three months than those who held their baby later. Evidence also highlights that this opportunity to bond post birth is important for the infant's early social, emotional and cognitive development and their future physical and mental wellbeing (Johnson, 2013).

The next sections will outline popular definitions of infant temperament and normal newborn behaviours before discussing the multiple influencing factors on behaviour and temperament development, and the many mechanisms through which positive or negative childbirth experiences could be related to infant behavioural outcomes.

2.2 An overview of infant temperament

Temperament has been defined as *"a quality that varies among individuals, is moderately stable over time and situation, is under some genetic influence, and appears early in life – a coherent profile of behavior, affect (emotional state), and physiology (neurochemistry of the brain)"* (Kagan, 2018, p38). It is also "*the behavioral style of the individual, the characteristic pattern of experiencing and reacting to the external and internal environment*." (Carey & McDevitt, 2016, p26).

This widely accepted idea specifies that temperament is an interaction between genes and the environment, and is therefore based on a combination of biological and psychological or experiential substrates. However, this general opinion was not always clear, as highlighted in the discussion held by a group of prominent infant temperament researchers at 'The Roundtable' Goldsmith et al., 1987). Despite the overall agreement that temperament consisted, not of one clear personality type, but of an individual mix of character traits such as irritability, fearfulness and activity level, views differed on exactly which traits constituted temperament. The two areas of temperament agreed upon were activity level and emotionality.

However, 'The Roundtable' debated the proportion of behaviour that is governed by temperament (Goldsmith et al., 1987). There was also wide disagreement – the classic 'nature-nurture' debate – concerning whether temperament was inherently genetic or emerged in response to the infant's environment. Only Thomas and Chess believed that infant temperament may be bi-directional, adapting to the environmental context as the parents also adapted to their child (Goldsmith et al., 1987). The current consensus is to view infant temperament as a behavioural style which regulates the infant's developing social behaviour, with both genetic and environmental components (Carey & McDewitt, 2016). This understanding is built on over half a century of research, as outlined below.

The ideas of neonatal states of conscious awareness and individual differences in newborn infant temperament as valid concepts were first generated by the minute and detailed observations of newborn infants carried out by Peter Wolff (Wolff, 1959). Wolff was a medical doctor and psychiatrist who pioneered a method of researching the infant psyche by collecting lengthy observational data (up to 12 hours at a time) of the neonate's behaviour in their home environment, gradually introducing the new concept of neuropsychology: the study of how the brain may affect behaviour. During this period, a general interest in the seemingly inborn

behavioural differences between infants was emerging amongst eminent developmental psychologists. For the first time, in contrast to the infant-as-a-blank-slate philosophy, infants were seen to possess unique differences in their physiological and emotional states from birth (Carey, 1973).

2.2.1 *Where it all began: the New York Longitudinal Study on infant temperament*

At the forefront of the newfound interest in young infant temperament was the landmark New York Longitudinal Study (NYLS) which began in 1956, monitoring behavioural differences between infants from the age of three months (Thomas, Chess, Birch, Hertzig & Korn, 1963). The NYLS was designed to show the significance of temperament as a factor in child development as infants began to interact with their social and physical environment. Nine temperament items were defined based on numerous observations of infants and children, and on interviews with their caregivers (Thomas & Chess, 1977). As later summarised by Carey and McDevitt (2016), these were:

1. Activity – amount of physical motion, e.g. during sleeping, feeding, bathing
2. Rhythmicity – regularity of sleeping, feeding and elimination routines
3. Approach/withdrawal – the infant's initial response to new people or stimuli
4. Adaptability – flexibility in adapting to new people or situations
5. Intensity – energy level of response to stimuli
6. Mood – pleasant/unpleasant overt behaviour, generally and specific to setting
7. Persistence/attention span – amount of time spent on any given activity
8. Distractibility – how easily distracted the infant is by external stimuli
9. Sensory threshold – amount of sensory input, e.g. light/noise, required to elicit response

While NYLS' methods initially involved interview questions, the study was later conducted by means of a parental report questionnaire based on the original NYLS interview. This incorporated detailed and specific questions regarding the infant's behavioural habits in relation to routines of feeding, sleeping and elimination (soiling and wetting), and infant responses to communication, socialising, play and known or new places or experiences (Carey, 1973, 1996). Individuality of temperament was not considered fixed but rather a complex, interactive unfolding process between the child, its parents or caregivers and the environment, whereby the child learns and develops their personality and intellect (Thomas & Chess, 1977).

Following the NYLS, as mentioned earlier, early temperament came to be defined simply as the infant's 'behavioural style'. Five specific dimensions of the nine temperament definitions listed above were originally found to predict subsequent behavioural and future psychiatric problems (Thomas & Chess, 1977). These were low rhythmicity (irregular feeding, sleeping and elimination routines), negative mood (regular crying or fussing), low approach (withdrawal from stimuli), low adaptability (to new people or situations) and high intensity (intense moods including loud laughter and tantrums). Similarly, definitions of 'difficult' infant temperament began alongside these other temperament definitions, and comprised qualities such as negative mood, inconsolability when distressed, irregularity of routines, inadaptability, high activity and intensity, and a lack of self-regulation (Thomas & Chess, 1977).

Therefore, temperamental differences were defined in terms of difficult or easier behaviours, and the 'goodness of fit' between parents and infants was assessed in a newly non-judgemental manner (Thomas & Chess, 1977, pp 186-7). Temperament was perceived as essentially innate rather than merely shaped by the environment, and parents were regarded as participants in a reciprocal relationship instead of being perceived as solely responsible for their infant's behaviour. However, the infant's presentation of specific qualities or difficulties of temperament were believed to require differential parental responses as considered appropriate for each behavioural style. It was suggested that stress or tension in the mutual relationship deriving from a lack of understanding of a child's natural disposition might lead to developmental delays and future behavioural problems (Thomas & Chess, 1977). Expanding on the theory regarding how the child's temperament contributes to the parent-child relationship, other researchers in the field considered that the nature of the infant's temperament may define the way the primary caregiver is able to care socially for their child (Goldsmith & Campos, 1982), in turn affecting bonding and attachment and the infant's adaptive behaviours in relation to their environment.

2.2.2 *Neonatal Behavioural Assessment Scale*

Running parallel to the famed twenty-year NYLS, and directly inspired by Wolff's newborn observations (1959), a paediatric doctor named Berry Brazelton conducted his own intensive 'Neonatal Observations' (Brazelton, 1962). These detailed observations included rigorous monitoring of the typical neonate's six-day period of 'recovery' from birth, as well as the frequent delay in normal breastfeeding behaviours following pain relief or other medications administered to the mother during labour. With accredited echoes of an original idea by

Greenacre (1945), Brazelton stated his shared belief that the infant reacts to and physiologically recovers from their birth in a way that may set a 'prototype' for their future stress and anxiety.

Based upon continuing observations, Brazelton developed the Neonatal Behavioural Assessment Scale or 'NBAS' (Brazelton, 1973), which has become a widely used method for testing physiological, neurobiological and behavioural differences in newborn infants, particularly those with a difficult obstetric background or preterm birth. The NBAS was designed to measure neonatal recuperation post birth, and this detailed examination of the newborn contained measures of the infant's physiological range and regulation of state. Neonates assessed by the NBAS are also found to be affected on the temperament-arousal factor by their five-minute Apgar score (Lester et al., 1976), demonstrating a relationship between the two measures.

Corresponding with Thomas and Chess, Brazelton argued that each infant responds differently to its environment and caregivers, stemming in part from inborn differences in temperament. Therefore, infant temperament items were later added to the original scale, including behavioural sub-items such as 'crying or fussing', 'irritability', 'consolability' or 'self-quieting', 'cuddliness', 'smiles', 'quality of alertness', 'low adaptability' and 'high intensity' (Brazelton & Nugent, 1995). The neonate was considered a social being, born equipped to communicate and interact with its caregivers, which Brazelton demonstrated through the two-way interactive process of the NBAS administration as it documented behavioural characteristics including the neonate's response to social interactions, stimuli or stress. Akin to the NYLS, Brazelton's presumed innate, individual character differences were believed to affect the course of the relationship between parent and child, and consequently, the direction of personality development throughout infancy and early childhood (Brazelton & Nugent, 1995).

Many subsequent infant temperament measures stemmed directly from these first two figureheads (Brazelton, 1973; Thomas & Chess, 1977). However, while some of these measures are mentioned in passing and the one chosen for use in Study Three (Chapter Six) will be discussed, it is not within the scope of this thesis to describe them all in comprehensive detail.

2.3 Infant temperament in relation to childhood temperament

Infant temperament is considered to affect both normal and abnormal aspects of social and emotional development (Zenter & Bates, 2008), particularly when combined with relevant environmental factors. The most important of these, as previously mentioned, was originally considered to be the parental response to a child's temperament, known as the 'goodness of fit' between parent and child (Thomas & Chess, 1977). One large scale study, which followed a French cohort of 1184 mother-child pairs from 24-28 weeks' pregnancy through to their fifth birthday, found that an infant's high emotionality at 12 months predicted their behavioural scores, emotional difficulties, conduct problems and activity and attention levels at five years; while an infant's high activity levels predicted later conduct problems (Abulizi et al., 2017).

The notion of early infant temperament as 'easy' or 'difficult' was based largely on a somewhat dated western notion of 'normal' infant routines, especially in the controversial areas of breastfeeding and sleeping patterns (Brown, 2016; Gopnik, Meltzoff & Kuhl, 1999). Although there is a widely held view that breastfeeding may affect infant sleeping habits due to the increased frequency of feeds needed to supply adequate nutrition to the infant, this possibility is thought to be countered by fewer feeding regulatory problems in addition to improved physical health and cognitive and behavioural development (Wolke et al., 2009).

Nevertheless, variability of routines in infancy could be perceived as problematic for parents where they occur alongside crying, fussing and poor soothability. Importantly, infants who fret frequently may be less able to regulate their behavioural states, including feeding, sleeping and elimination routines (James-Roberts & Wolke, 1988). In a follow-up study however, only persistent regulatory problems during pre-school years were found to predict future cognitive and motor impairment, behavioural problems, and increased likelihood of attention deficit hyperactivity disorder (ADHD) diagnosis (Schmid & Wolke, 2014). Therefore, while high stability has been demonstrated between multiple regulatory problems at five months and pre-school age (Wolke, 2002), transient regulatory problems in infancy are not considered predictive of hyperactivity at school age (Schmid & Wolke, 2014).

2.4 Which factors influence infant temperament?

Whereas the history of infant temperament definitions has been polarised by the nature-nurture debate, it is now well established that genetic makeup is just one of many influential factors, with the number of potential variables that may affect infant temperament steadily increasing (Carey & McDewitt, 2016). Known contributors include maternal factors such as the mother's diet, toxins, and emotions (Wachs & Bates, 2001; Wachs, 2009). Moreover, premature infants can be initially fussier and less regular in their routines than full term infants (measured at 6 weeks), and may be considered as more 'difficult' by their parents during the first year as a result (Hughes et al., 2002). Previous research has found that premature and underweight infants can also exhibit more negative emotionality in the longer term, potentially hindering their early social development and altering the perceptions and behaviour of their parents (Chapieski, & Evankovich, 1997). Such parents may become more anxious and protective, which can result in unhelpful behaviours including over-stimulating their hyper-sensitive preterm infant (Hughes et al., 2002).

Another major factor to consider is neonatal anaemia, which can influence early infant temperament ratings. In one laboratory comparison study, newborns exhibited more negative emotionality and less soothability where cord blood haemoglobin and serum iron levels were low (Wachs, Pollitt, Cueto, Jacoby, & Creed-Kanashiro, 2005). These results were unaffected by sociodemographic factors, low birth weight, and maternal diet or diabetes.

2.4.1 *Perinatal factors and infant temperament*

Research literature around the subject of childbirth and infant temperament is scarce. The NBAS (Brazelton & Nugent, 1995), and the Mother and Baby Scales known as MABS (Wolke & James-Roberts, 1987) – which were designed to measure neonatal behaviours alongside Brazelton's original more medical, neurobiological measure (Brazelton, 1973) – both operated on the principle that adaptive changes would take place in response to the extrauterine environment. Therefore, early temperament in normal, healthy infants was considered unstable and variable (James-Roberts, 1987; Brazelton & Nugent, 1995). This lack of stability in neonatal behaviour was thought to be a measure of the infant's innate flexibility, reflecting 'the ability of the neonate to reorganize after the stress of labor and delivery' (Brazelton & Nugent, 1995, p82). In some cases, the NBAS could also signify problems such as low birthweight,

preterm delivery and genetic disorders (Brazelton & Nugent, 1995) or maternal substance use (Dixon, 1994).

Furthermore, early infant behavioural style was felt to be influenced by factors which might have been indirectly impacted by the mother's birth experience, such as her 'quality of caregiving' and 'self-efficacy' post birth (Bandura, 1994). It was also considered to be affected by the mother's ability to cope with her newborn (Wolke & James-Roberts, 1987; James-Roberts & Wolke, 1988). Consequently, the infant may recover from their birth experience given the appropriate support and positive interactions with their caregivers (Brazelton & Nugent, 1995). However, as Brazelton noted in his earlier neonatal observations (1962), a new mother can easily be overwhelmed by difficult newborn behaviours and struggle to cope, which was considered to set up a potentially damaging pattern of behaviours between mother and infant. The mother may become anxious and depressed and her 'hypersensitive' infant could then withdraw from such negative environmental stimuli and shut down behaviourally or physiologically (e.g. increased sleeping), possibly leading to developmental delays.

Later definitions of neonatal temperament were similarly inclined towards combined explanations of hereditary factors and neonatal adjustments to the extrauterine environment, while also claiming that temperament remains quite stable across time, from infancy through to childhood (Gartstein & Rothbart, 2003; Prokasky et al., 2017). However, there are certain exceptions to this idea, as illustrated by a continuing gap in understanding of the extreme infant distress condition widely known as 'colic'. Colic is defined by excessive crying and is common in infants from six weeks to three months of age. The causes of colic are unknown and, despite some evidence to suggest that colic can sometimes be treatable by reducing allergens for breastfeeding mothers (Johnson, Cocker & Chang, 2015), its symptoms often have a sudden onset and an equally rapid disappearance (Lam, Chan & Goh, 2019). Consequently, colic is not generally classed as a permanent marker of early infant temperament (James-Roberts & Conroy, 2005).

2.4.2 *Potential impacts of childbirth on newborn and ongoing behavioural style*

The idea that childbirth experience could potentially affect neonatal behaviour is not new, and it has been argued that the stress of being born may exceed the stress of any subsequent life event (e.g. Schlinzig et al., 2009). Indeed, in earlier studies, newborn fretfulness and reduced alertness have been associated with obstetric complications (James-Roberts & Wolke, 1984,

1989) and linked to disruptions in early infant temperament development (James-Roberts, 1987). As mentioned earlier, when regulatory problems are ongoing, they could also relate to cognitive and behavioural problems in later childhood, including hyperactivity and ADHD (Amor et al., 2005; Schmid & Wolke, 2014). However, in a large Swedish cohort of nearly two million children born between 1990 and 2008, Curran et al. (2016; 2016b) concluded that, given there were no associations between planned CS and ADHD, the associations found between emergency Caesarean sections and children with ADHD may have been due to confounding by the indication for the Caesarean. Nevertheless, it is possible that there could be other differences occurring between planned and emergency Caesareans, including genetic and environmental differences (Curran et al., 2016b). As well, the mother's better psychological preparedness for a planned CS compared to an emergency CS might conceivably contribute.

Prior research has highlighted potential relationships between obstetric conditions and psychiatric disorders as far ranging as autistic spectrum disorder (Larsson et al., 2005; Kolevson, Gross & Reichenberg, 2007; Gardener, Speigelman & Buka, 2009), schizophrenia (Preti et al., 2000; Clarke et al., 2011; Forsyth et al., 2013), anorexia nervosa in girls (Cnattingius, Hultman, Dahl, & Sparén, 1999), and severe depression leading to suicide (Mittendorfer-Rutz, Rasmussen & Wasserman, 2014). However, these are all complex conditions and their aetiology remains unclear, with some research also failing to find a significant impact of mode of delivery on child behavioural and psychological disorders (Curran et al., 2016). Therefore, the following sections will focus on the potential impacts of childbirth on early infant temperament development in reference to normal infant behaviour.

2.5 Defining normal newborn infant behaviour

Newborn infant behaviour is routinely assessed by health professionals at birth to establish the infant's physical wellbeing. An integral part of this is the measurement of normal neonatal physiology at one and five minutes post birth by the Apgar score (Apgar, 1952). The Apgar scale (with ratings of 1-10 on each item) evaluates the newborn's heart rate, respiratory effort, skin coloration, muscle tone and response to stimulation on a ten-point scale, with a score of seven or above at five minutes indicating a normal, healthy newborn infant (Baker & Kenny, 2011). Apgar scores are generally considered to be a good indicator of the neonate's

physiological and neurobiological state, which will affect neonatal behaviour in the period following birth (Apgar, 1952). A low Apgar score has been associated with neurological and psychiatric disorders such as cerebral palsy or intellectual disability, and more recently, autism (Modabbernia et al., 2019). In contrast, infants with healthy Apgar scores (7-10 at five minutes post birth) are expected first to cry, then to have a period of being quiet and alert, and finally to settle.

Apgar scores may be adversely affected by obstetric complications (Haddad, Mercer, Livingston, Talati, & Sibai, 2000), and perhaps even more so for complications that lead to mother and infant separation post birth, normally for the intensive care of either party. There are thought to be some inter-rater discrepancies between Apgar observations, and consequently, more precise and objective measures of the newborn condition have been called for (O'Donnell, Kamlin, Davis, Carlin, & Morley, 2006). Nevertheless, in a large cohort study involving over 150,000 newborn infants, Apgar scores were affirmed as an accurate predictor of infant survival and wellbeing (Casey, McIntire, & Leveno, 2001).

2.6 Physiological impacts of childbirth on neonatal behaviours

Neonatal behaviours encompass the first month post birth, which is generally found to be the most sensitive period for exhibiting signs of stress from the physical birth (Brazelton & Nugent, 1995). As mentioned, newborn infants with childbirth complications can be more irritable and tend to cry more than those with an easier obstetric history (James-Roberts & Wolke, 1984; Douglas & Hill, 2013). One emerging theory around potential neurobiological impacts of childbirth concerns adaptive changes to the infant epigenome (e.g. Dahlen et al., 2013; Almgren et al., 2014), which in turn may affect behaviour (Burns et al., 2018). Another relates to physiological changes to the neonate's gut microbiota, which influence future risk of obesity, diabetes, and immunity to disease (Sandall et al., 2018) as well as susceptibility to stress-related disorders via the gut-brain axis (Foster, Rinaman, & Cryan, 2017; Rea, Dinan, & Cryan, 2016). This section aims to outline the main physiological childbirth factors that could be related to infant temperament outcomes. Three possible and overlapping routes for changes to infant temperament development – the epigenome, microbiome and HPA axis – are discussed across sections 2.6.5 – 2.6.7.

2.6.1 *Neonatal pain and distress during and after birth*

It is recognised that birth can be both a stressful and painful event for the emerging infant (Lagercrantz & Slotkin, 1986), and evidence shows that stress linked to elevated cortisol levels may cause a behavioural response in the neonate (Gitau et al., 2001). However, while pain is always experienced as stressful for the neonate, stress is not necessarily painful (Craig et al., 1993). Therefore, it becomes important to differentiate between pain and stress experienced by the neonate during childbirth, and a simple cry may signify hunger, coldness, or fatigue rather than pain. In contrast to previously well-established medical beliefs (Anand, 2001), we now know that both preterm and full-term infants are capable of experiencing pain-related distress (Anand & Hickey, 1987; Grunau, Johnston & Craig, 1990; Grunau et al., 1998).

Before this surprisingly recent period in neonatal pain research, preterm infants were routinely operated on without analgesia, as it was not yet widely believed by the medical profession that newborns could either experience or remember pain (Gopnik, Meltzoff & Kuhl, 1999). It has since been surmised that such 'outdated professional attitudes' could be due to critically ill or preterm neonates being less able to mount a strong vocal or behavioural response to their pain (Anand, 2001, p177), potentially leading to undiagnosed and unnecessary suffering, increased morbidity and altered neurodevelopment (Shapiro, 1991). Through extensive and meticulous research leading to the development of the Neonatal Facial Coding System (Grunau & Craig, 1987), and later the Infant Body Coding System (Craig et al., 1993), these authors established that pain is experienced acutely by the preterm neonate, who might respond with subtle changes in facial expression and motor activity rather than more widely recognised signals such as the pain or distress cry of older, healthier full-term infants. The Neonatal Facial Coding System has since become the supporting evidence used to assess pain caused by invasive and repetitive procedures commonly carried out in neonatal intensive care units (NICU) on sick or preterm infants (Porter, Grunau & Anand, 1999; Anand, 2001).

Another contributory issue is that neonates undergoing surgery may have greater hormonal, metabolic and cardiovascular responses than older infants (Anand et al., 1985; Anand, 1998). Indeed, Axia and Bonichini (2008) demonstrated that the infant's adrenocortical response to pain diminished with increasing infant age (3-18 months). This indicates that younger infants with immature nervous systems are in fact more vulnerable to pain and distress than older infants, and consequently may be less able to regulate their own stress response to pain. Following a randomised control trial of 84 neonates with respiratory distress and hypoxemia, Pokela (1994) concluded that routine intensive care to assist breathing could be more effective

when the newborn is also administered a low dose analgesic, in contrast to the saline solution used for the control group.

It has been suggested that a neonate enduring untreated pain might find it more difficult to adapt to the postnatal environment, which could potentially affect their future psychological development (Anand & Hickey, 1987) including heightened behavioural responses to pain (Taddio & Katz, 2005). Notably, Bergqvist et al. (2008) found that infants born spontaneously rather than by CS showed reduced physiological and behavioural responses to immediate postnatal pain (such as the heel prick). This effect was considered to be influenced by the production of pain-relieving hormones such as oxytocin and beta-endorphins during a normal birth. (See section 2.6.2 for details on birthing hormones and infant behaviour.)

As well as the possibility of heightened neonatal stress responsivity during childbirth complications having longer term consequences, evidence points towards neonatal pain and distress causing negative changes to the central nervous system, neuroendocrine and immune systems, potentially affecting the infant's temperament and future susceptibility to pain, stress and illness (Page, 2004). These effects, which include higher internalising behaviours in infants and children up to seven years of age, are accentuated for preterm infants enduring a combination of skin breaking hospital procedures and parenting stress (Ranger, Synnes, Vinall, & Grunau, 2014). Preterm infants are also known to be more sensitive to their environment than full-term infants, explaining this contribution of parenting stress to neonatal cortisol levels and subsequent behaviour (Tu et al., 2007).

However, there are now established methods for pain reduction in neonates, and their response to pain may be mediated by use of topical anaesthesia or by soothing maternal behaviours during a painful postnatal procedure such as heel lancing (Miller et al., 2005). Therefore, neonates may require higher doses of analgesic or anaesthetic relative to their size than older infants during routine invasive procedures such as oxygen administration or when experiencing surgery (Anand, 2001). However, Anand also highlights how commonly used analgesics during labour may cause respiratory depression in the newborn, and consequently, their long-term use should be limited. Alternatively, skin to skin contact or breastfeeding could be safer methods of soothing neonatal pain and distress during painful procedures post birth (Carter, 2014).

Neonatal pain research raises the question of whether the application of foetal scalp electrodes during childbirth could cause pain and stress for the unborn foetus. While it has been claimed

that this practice may reduce further interventions by providing reassurance that all is well, it is also possible that an 'abnormal' foetal heartrate, which does not always signify a problem, could lead to further tests and the decision to err on the side of caution by performing an operative birth (American College of Obstetricians and Gynecologists, 2018). Following this idea, in addition to other risks such as infection, non-invasive methods are being developed which instead use external abdominal sensors (Behar, Oster & Clifford, 2014). However, these methods are still in their early development stage due to difficulties in differentiating the foetal heartbeat from background internal maternal noise (Behar et al., 2016).

Overall, pain may be a factor in relation to the neonate's response to birth and their developing temperament (Page, 2004). However, it also appears that observed reactions to pain and distress might be offset by a moderate and careful use of analgesics during labour (Miller et al., 2005) and non-pharmacological forms of pain relief in the postnatal period (Carter, 2014).

2.6.2 *Birth hormones and infant behaviour*

The perinatal period is a hormonally sensitive time for mother and infant that requires a series of complex interactions between the hormonal systems and their accompanying hormones, including oxytocin, prolactin, beta-endorphins, and stress hormones such as adrenaline, noradrenaline and cortisol (Buckley, 2015). The efficient functionality of these systems requires a delicate balance of circumstances and environment that may be easily disrupted by obstetric procedures. Oxytocin is perhaps the best known of the hormones exchanged by mother and infant during the perinatal period. It is manufactured in the body and the brain and has a dual purpose, first as an essential hormone for the reproductive processes of birth and breastfeeding; and second, as a neurotransmitter affecting a wide range of behaviours that include maternal love and bonding and, when combined with dopamine, stimulates maternal motivation for these affiliative behaviours (Love, 2014). Accordingly, the human body is full of oxytocin receptors. The mother is said to be the focal point for her newborn infant, and throughout history, her care has been biologically essential for the infant's survival. The flow of endogenous oxytocin between mother and infant is believed to encourage a smoother birth and breastfeeding transition, helping to ensure effective maternal caregiving behaviours post birth and promoting mother-infant bonding and attachment (Feldman et al., 2007 & 2012; Carter, 2014; Uvnäs-Moberg, 2014). These normal hormonal and physiological behaviours by

the mother, including simple touch and gaze, coupled with the infant's mirrored response, have been named 'biobehavioural synchrony' between a mother and her baby (Feldman, 2012, p42).

In research developed and led by Feldman (2015), the first hours and days are a sensitive period for developing this mother-infant synchrony; and once established, bio-behavioural synchrony between mother and infant may continue throughout childhood and adolescence into early adulthood. Feldman also demonstrated that infants given kangaroo care (KC) – defined as frequent and prolonged skin to skin contact with their mother – during the neonatal period showed better cognitive control at five and ten years, lower response to stressors, more synchronous interactions with their mother, and better sleep. The mechanisms behind these findings were thought to be the oxytocin and cortisol hormonal response systems. Neonates receiving KC released more oxytocin after close maternal contact, including breastfeeding, and these oxytocin levels continued throughout the first year of biobehavioural synchrony between mother and infant. On measuring the stress response in preterm neonates, cortisol levels in newborns receiving KC returned to baseline levels sooner than infants in the control group.

These enduring oxytocin levels and synchrony between mother and child developed during infancy – when brain plasticity may be at its highest – are said to be important factors in the child's growing resilience, also possibly affecting their brain development, behaviour and future risk of psychopathology (Feldman, 2015). Fathers were found to release equally high amounts of oxytocin during social interactions with their infants, although their patterns of biobehavioural synchrony may be different, with more peaks of excitement and less stability than those of healthy mothers. Furthermore, close involvement of fathers enhances family relationships, reduce behaviour problems, and possibly contribute to a child's resilience, especially where the mother is depressed (Vakrat, Apter-Levy & Feldman, 2017).

The oxytocin exchange between the new dyad may also moderate their autonomic nervous systems, consequently mediating the mother's stress response (Uvnäs-Moberg & Petersson, 2005) and thereby helping to protect against maternal anxiety and postnatal depression (Stuebe, Grewen & Meltzer-Brody, 2013). In turn, postnatal maternal mood and associated behaviours are known as principal factors for infant temperament that may have long-term consequences for the infant's cognitive, neurobehavioural and social-emotional development (Feldman et al., 2009). Cortisol and associated feelings of anxiety in the mother may reduce normal postpartum

maternal behaviours that lead to effective bonding between mother and infant, although this relationship is acknowledged to be highly complex and multifaceted (Feldman et al., 2007).

The hormonal physiology of mother and infant therefore appears to be intricately inter-connected throughout the perinatal period (Davis et al., 2008). High levels of endogenous oxytocin, prolactin and beta-endorphins during labour help to promote a physiological birth and may also protect mother and infant against the physiological and behavioural impacts of pain (Bergqvist et al., 2008; Mazzuca et al., 2011). Moreover, skin to skin contact and breastfeeding following a normal birth are thought to help regulate maternal and infant oxytocin systems and lessen HPA axis activity (Carter, 2014). This may benefit the newborn's neurobiological state, enable positive epigenetic programming and modulate infant stress reactivity, with potentially far-reaching benefits to emotional and cognitive development, including healthy development of the nervous system (Carter, 2014). Therefore, the act of breastfeeding, particularly where possible after a difficult or distressing birth experience, may benefit mother-infant bonding and behaviour by encouraging the flow of endogenous oxytocin.

Despite these potential benefits, when a fearful, painful or difficult labour and birth has activated the mother's stress hormones, the biological production of oxytocin and beta-endorphins and a normal birth and breastfeeding process might be impeded, along with the positive birth hormones' analgesic properties and other benefits to early mother and infant behaviour and attachment (Buckley, 2015). Consequently, concerns have been raised that obstetric procedures affecting the oxytocin system should be carefully considered prior to administration (Carter, 2014). Notably however, Figueiredo, Costa, Pacheco and Pais (2008) found that associations between birth mode, pain relief and mother-infant bonding and attachment were no longer significant after accounting for sociodemographic variables. Therefore, the postnatal environment may be just as important as the birthing environment.

Nevertheless, modern maternity care may also disturb other functions of the hormonal system (Buckley, 2015), and both mode of delivery and the pharmacological pain relief often used during labour and birth are associated with differential hormonal outcomes (Vogl et al., 2006). For example, pre-labour elective Caeasrean sections are known to prevent the final surge of catecholamines necessary for the infant's respiratory system to operate after birth (Sotiriadis, Makrydimas, Papatheodorou, Ioannidis & McGoldrick, 2018). The following section will

discuss how obstetric medications may interfere with the mother-infant dyad's innate hormonal programming for optimal birth, breastfeeding, and bonding.

2.6.3 *Obstetric pain relief and other medication impacts on newborn behaviour*

Obstetric pain relief has a chequered history, with many early forms of analgesia and anaesthesia – such as 'twilight sleep' and chloroform – often leaving the mother either unconscious or semi-conscious with no real memory of her birth (Goodson & Martis, 2014). These initial versions of pain relief for labouring women were later found to be harmful to both mother and newborn infant (Lim et al., 2018). A wide body of research has demonstrated the subtle adverse effects of medical forms of pain relief often used in labour. Moreover, morphine used for preterm neonatal pain relief may increase internalising infant behaviours (Ranger et al., 2014). However, the potential psychological impacts of acute labour pains on the mother are also considered an important public health issue, especially when combined with adverse maternal or foetal outcomes (Mobaraki, Yousefian, Seifi, & Sakaki, 2016).

a) Epidural anaesthesia/ analgesia

Early studies demonstrated the additive effects of certain pharmacological substances used during labour, including those contained in epidural anaesthesia (Lester, Als & Brazelton, 1982). The depressive effects of these treatments on the neonate's central nervous system and subsequent behaviour are considered cumulative when combined with other factors, such as length of labour and mode of birth (Brazelton & Nugent, 1995). Lester et al. (1982) also suggested that a mother may be in a less than optimal position for caring for her newborn if she has undergone abdominal surgery combined with anaesthetic, as she may be in pain and recovering from the medication administered to her during the birth.

Equally, it might take her infant a few days to become alert following a medicated birth, and this could mean a period of mutual adjustment for mother and infant while they attempt to synchronise their communication (Lester, et al., 1982). Nevertheless, while preterm and small-for-dates infants responded more significantly on the NBAS measurements, the effects of minimal amounts of obstetric medications were generally felt to be short-term, and not to have too much impact on the neurobiological state of a healthy full-term newborn of normal birth weight. Furthermore, while the previous concern that epidural anaesthesia used during C sections could cause long-term learning disabilities, this is disputed by some (e.g. Sprung et

al., 2009). Despite certain disparities in beliefs, however, research has shown anaesthesia during labour to be neurotoxic for the foetus, possibly altering the structure and function of the central nervous system (Mellon et al., 2007). There is accumulating evidence that such neurotoxicity produced by anaesthesia, unless administered using low dose strategies, might contribute to neurodevelopmental abnormalities (McCann, Matthes & Greco, 2018). For instance, an epidural was formerly found to affect more disorganised neonatal behaviours (Sepkoski, 1992).

Furthermore, epidurals could increase the risk of assisted delivery (Sepkoski, 1992), although more recent evidence does not support such a connection (McKenzie et al., 2016). These later findings may be due to refinements in both the drug dosage and administration process (McCann, Matthes & Greco, 2018), consequently making it safer to use than previously.

As mentioned earlier, there is also disagreement concerning whether epidural analgesia increases the risk of a CS, which in turn may then increase the risk of maternal morbidity (Lim et al., 2018). However, the evidence base does not appear to support this connection between epidurals and C sections (Apfelbaum, 2016). Nevertheless, an epidural can slow down uterine activity in some women, potentially prolonging labour by interfering with endogenous oxytocin production (Cheng et al., 2014). This may then lead to a frequent need for epidural to be combined with exogenous oxytocin augmentation (Rahm, 2002) which is likely to have an adverse effect on the body's ability to produce its own oxytocin.

b) Combinations of epidural analgesia and synthetic oxytocin

Thus, the impact of epidural analgesia on the neonate's nervous system may be even more pronounced when used in combination with other medications. A recent prospective US/Swedish study of 63 low income American mothers found that normal neonatal behaviours, including the breast crawl and suckling (Widström et al., 2011), were adversely affected by a combination of fentanyl (used in epidural analgesia) and synthetic oxytocin (Brimdyr, Cadwell, Widström, Svensson & Phillips, 2019).

Interventions such as epidural administration and synthetic oxytocin augmentation may therefore inhibit oxytocin production in the mother (Wiklund et al., 2009; Jonas et al., 2009), and lack of endogenous oxytocin can interfere with the spontaneous process of birth and breastfeeding (French, Cong & Chung, 2016; Erickson & Emeis, 2017). It could potentially

also have an adverse effect on mother and infant bonding behaviours (Nissen et al., 1995; Feldman et al., 2007). Notably, a deficit of endogenous oxytocin has also been implicated in non-sociable or 'aloof' autistic children (Modohl et al., 1998), and could possibly have other adverse developmental and behavioural impacts on the infant (Buckley, 2015). Therefore, it is conceivable that epidural analgesia in labour might also interfere, albeit indirectly, with infant temperament development via its associations with synthetic oxytocin.

c) Analgesics

Analgesic opioids readily cross the placenta and may consequently depress the neonatal respiratory system, negatively impact Apgar and neurobehavioural scores, and adversely affect the infant's muscle tone, suckling and social responsiveness (Sprung et al., 2009; Reynolds, 2011). Pethidine, the most widely used analgesic in the UK for the relief of pain during labour, may also increase newborn crying and adversely affect early breastfeeding behaviours (Ransjö-Arvidson, Matthiesen, Lilja & Nissen, 2001; Brown & Jordan, 2013). In a Swedish study involving thirteen infants, Nissen et al. (1997) found that pethidine negatively impacted normal breastfeeding behaviours only after short dose delivery time intervals. However, pethidine is known to stay in the blood stream for two-three days, and Belsey et al. (1981) previously found that higher doses of the drug might continue to reduce the infant's ability to self-quiet at six weeks although, when compared to a control group, these effects were found to be negligible. More recently, a Brazilian systematic review of international studies concluded that pethidine was safe for the infant when administered at a dose of 50mg or less (Nunes, Colares & Montenegro, 2017).

Nevertheless, whilst originally known for its sedative, anxiety reducing properties, the presumed analgesic efficacy of pethidine has now been disputed (Goodson & Martis, 2014). Notably, a small Iranian randomised control trial suggested that, while pethidine might be beneficial to anxious and fearful mothers during labour, acupuncture could be equally effective in reducing labour time and pain and without side effects (Allameh, Tehrani & Ghasemi, 2015). In a survey of all consultant-led obstetric units in the UK, over half the units reported to have no protocols in place for sleepy 'narcotized' infants who were drowsy or failed to feed (Tuckey, Prout & Wee, 2008). Infants with respiratory depression after pethidine administration during labour are therefore more likely to be taken to NICU and consequently separated from their

mother immediately post birth (Moe-Byrne, Brown & McGuire, 2018). This separation could interfere with the newborn's early breastfeeding behaviours and social responsiveness.

d) Entonox or nitrous oxide ('gas and air')

In contrast, nitrous oxide (commonly known as gas and air) is widely believed to be a safe and effective form of pain relief for maternal use in labour (NHS, 2020). In a double-blind clinical randomised control trial, while causing nausea, sickness, drowsiness and dizziness in 25% of cases, Entonox was also found to reduce pain severity and subsequent pethidine usage (Attar, Feizabadi, Jarahi, Feizabadi, & Sheybani, 2016). Another randomised control trial presented evidence that Entonox could work more effectively than pethidine in the early stages of labour, while finding no differences in pain severity 60 minutes after usage (Mobaraki et al., 2016). Nevertheless, although women who use gas and air are found to appreciate the self-administration benefits during their labour (Lim et al., 2018), its possible impacts on infant and child development have been questioned and require more research (Markley & Rollins, 2017).

Summary of the physiological impacts of childbirth

Overall, neonatal crying and fussing behaviours may occur more frequently after use of in-labour medications, including Syntocinon (synthetic oxytocin), pethidine or epidural (pharmacological analgesia/ anaesthesia), the second (or 'pushing') stage exceeding one hour, and foetal distress during labour (James-Roberts & Conroy, 2005). These factors are thought to be associated, for example a longer second stage may increase – or equally stem from – the type or amount of pain relief used; and pain relief such as the bupivicaine used in epidurals might contribute to foetal distress, particularly during labour acceleration.

A Spanish pilot study of twenty infants (Olza Fernandez et al., 2012) and its follow up study of approximately 100 infants (Marin Gabriel et al., 2015) also found that the primitive neonatal reflexes associated with early breastfeeding behaviours – such as suckling, swallowing and gazing – were adversely affected by non-dose-dependent synthetic oxytocin used during inductions and accelerations of labour. However, alongside their initial findings concerning neonatal crying, James-Roberts and Conroy (2005) warn against making predictions of difficult infant temperament based on perinatal adversities without accounting for possible confounding variables (e.g. maternal smoking, drinking, nutritional state, or state and trait anxiety).

Nevertheless, the evidence reviewed above suggests that certain types of pain relief and other medications widely used during childbirth have the potential to negatively impact the mother and infant's delicate neuro-hormonal balance, their stress responses during labour and birth, mother-infant bonding, and subsequent infant behaviour (Buckley, 2015).

2.6.4 *The importance of skin to skin care post birth*

Early mother-infant skin to skin contact is based on an instinctive behaviour between a mother and her baby. It encourages a normal newborn neurobiological response as it helps the metabolic, respiratory and regulatory systems to settle after birth and may reduce crying when compared to infants placed in a cot (Christensson et al., 1992). Indeed, an observational randomised control trial found that a newborn infant may fiercely protest if separated from their mother immediately post birth, although the crying generally stopped after reunion, possibly suggesting a strong genetic mammalian programming in the newborn to ensure survival (Christensson et al., 1995). Similar findings were recorded in a small follow-up randomised trial which used sound spectrography to establish that the group of infants placed in a cot during the first 90 minutes post birth cried approximately ten times more than those who were kept in close proximity with their mothers (Michelsson, Christensson, Rothgänger & Winberg, 1996). A later study found that fathers could stand in for mothers after a CS and have a similarly effective soothing impact on their newborn infant's early post birth behaviours (Erlandsson, Dsilna, Fagerberg & Christensson, 2007).

Maternal skin to skin care may also encourage breastfeeding. During skin to skin time immediately post birth, an alert and healthy newborn infant has been found to follow a set of instinctive steps towards their first feed (Widström et al., 2011; Widström, Brimdyr, Svensson, Cadwell, & Nissen, 2020), although they may do this more effectively after normal birth than after a CS delivery (Heldarzadeh et al., 2016). A Cochrane review of 34 randomised control trials concluded that early skin to skin contact between mother and newborn may also have a positive effect on breastfeeding duration (Moore, Bergman, Anderson & Medley, 2016).

Despite all these evidenced benefits however, only 45% of infants worldwide are reported to have immediate skin to skin contact with their mothers after birth (Unicef, 2016). Medical birth interventions may interfere with the mother's ability to have immediate and prolonged skin to skin contact with her baby, which could disrupt the healthy newborn's instinctive behaviours that would normally follow birth (Widström et al., 2020).

2.6.5 *Does childbirth affect the infant microbiome?*

The human microbiome or 'microbiota' refers to the microorganisms that live on and inside our bodies, influencing health and wellbeing by affecting pathways to the immune, endocrine, and neural networks within the body (Yang et al., 2016). These pathways, known as the gut-brain axis, connect the brain to the gut bi-directionally. The microbiota that exist within our gut are believed to be plentiful and diverse as well as influential to our physical and psychological wellbeing. Mode of birth, exposure to antibiotics and infant feeding style (breast or formula) are all believed to affect the young infant microbiome (Yang et al., 2016).

The infant's gut gets colonised at birth, the neonate collecting microbiota from the mother as they pass down through the birth canal; also during post birth events involving close contact with the mother's microbiome (e.g. breastfeeding); and this balance of infant gut microbes will affect their digestion, food metabolism, immune system, cognition and behaviour (Clarke, O'Mahony, Dinan, & Cryan, 2014). Therefore, being born by Caesarean section could deprive the newborn of the first step of the gut colonisation believed to be so vital for future health (Dominguez-Bello et al., 2010; Harman & Wakeford, 2016). This might depend on the type of Caesarean, as only elective CS neonates do not enter the birth canal at all (Dahlen et al., 2013).

In recent years, it has begun to be understood how the human microbiome may affect behaviour from early infancy. Aatsinki et al. (2019) found that infant gut microbiota at 2.5 months was associated with infant and toddler temperament traits such as positive emotionality, with greater gut diversity linked to reduced negative emotionality and fear reactivity at six months, and to increased extroversion at 18-27 months (Christian et al., 2015). As with gut-brain pathways, the association between the infant's microbiome and their behavioural style is believed to be bi-directional (Schmidt, 2015), with early interventions to improve gut flora diversity considered potentially helpful for preventing future physical and mental health problems (Christian et al., 2015).

Initial research suggests that breastfeeding might help to restore the infant's microbiome and healthy immunity (Guaraldi & Salvatori, 2012; Khodayar-Pardo et al., 2014; Mueller, Bakacs, Combellick, Grigoryan, & Dominguez-Bello, 2015). However, these findings are in their infancy and are far from conclusive. Nevertheless, they are of interest given the association of gut microbiota with mental health (Kaplan et al. 2015) alongside a reported steady increase in

mental disorders and neurological diseases in the general population (Global Burden of Disease (GBD), 2015; Neurological Disorders Collaborator Group, 2017; Kelly et al., 2017). Another possibility, however, as highlighted by a meta-analysis by Polanczyk et al. (2014), is that rising rates of mental health conditions such as anxiety and depression, autism, ADHD and schizophrenia may be an artefact of methodological differences between studies and increasing awareness and diagnosis rather than an actual rise in figures. Moreover, there is a strong genetic component in susceptibility to many common psychiatric disorders (Larsson, Chang, D'Onofrio & Lichtenstein, 2014).

2.6.6 *Does childbirth affect the infant epigenome?*

Perinatal epigenetics, the study of changes in genetic expression which can occur independently of the underlying DNA, is a relatively new and expanding branch of biomedicine (Dahlen et al., 2013). Epigenetic changes are now believed to be heritable. Thus, if the expression of a specific gene is triggered by the environment, causing changes to DNA methylation, these changes can then be passed down through generations. The neonate's epigenome is open and vulnerable to its environment and from the earliest stages is thought to be affected by maternal diet, stress and toxins (Odom & Taylor, 2010). It might also be related to the microbiome via early nutrition and the gut microbiota's production of metabolites, the 'epigenetically active' end products of metabolism (Mischke, & Plösch, 2013, p.1065). Furthermore, both the microbiome and epigenetics may affect the immune, endocrine and neural pathways, with potential overlaps in their indirect influences on the function of the HPA axis, consequently also affecting temperament development (Dahlen et al., 2013). However, as research in this area is still in its early stages, there remain many uncertainties.

Nevertheless, alongside research on the potential significance of the infant microbiome, there is also increasing evidence that early stressors, including childbirth interventions such as CS, could potentially and permanently alter the neonatal epigenome, with negative consequences for long-term health and wellbeing (Dahlen et al., 2013; Almgren et al., 2014). These epigenetic adaptations may cause changes in global DNA methylation, and act by silencing gene expression (Meaney, 2010). Not all research, however, supports this idea. A large American study assessing epigenetic adaptations of umbilical cord blood found no statistically significant differences between vaginal births and emergency or elective C sections once figures were adjusted for strong covariates such as maternal age and smoking (Virani et al., 2012). While this study did acknowledge that gene specific (rather than global) differences

could be taking place, another much smaller Swedish study found that epigenetic changes to neonatal DNA methylation in the white blood cells important for future healthy immune system functioning only lasted 3-5 days (Schlinzig et al., 2009). Taken together, these studies help to illustrate the complexity and uncertainty concerning the combined perinatal factors potentially involved in changes to the infant epigenome (Beijers, Buitelaar & de Weerth, 2014).

2.6.7 *Disruption of HPA axis functioning*

Whilst complex factors such as alterations to the infant's epigenome or microbiome could be involved, on a simpler level, it is believed that heightened levels of maternal cortisol during childbirth and in the early postnatal period may dysregulate the infant's HPA axis, potentially increasing the child's and future adult's stress reactivity (Douglas & Hill, 2013; Barry et al., 2015). This possible disturbance of HPA axis functioning caused by elevated cortisol levels in a distressed neonate could alter the way the infant subsequently responds to stressors (Gitau et al., 2001), potentially leading to behavioural problems, including ADHD in later childhood (Wolke et al., 2009; Schmid et al., 2010). Disturbances to the HPA axis in infancy may also render the future adult more susceptible to depressive illness (Checkley, 1996; Schuller et al., 2012) and post-traumatic stress disorder (Yehuda, 2002). Yet despite this possible pathway between childbirth and behaviour, Schmid et al. (2010) concluded that family adversity and psychosocial stress factors (such as problems in the parents' relationship or financial stress) are more significant contributors to multiple regulatory problems in infancy than birth mode.

As discussed above, the epigenetic argument, involving a potentially permanent dysregulation of normal HPA axis functioning, runs alongside an increasing body of research regarding transformations of the infant microbiome during childbirth (Dahlen, Downe, Kennedy, Foureur, 2014). In theory, there is a place for both ways of examining neurobiological disruptions to normal neonatal behaviours following obstetric complications and interventions. However, while they have been briefly covered here, their full details are beyond the remit of this thesis.

Factors that might affect the newborn's stress response

Although such stress responses in the mother-infant dyad may be successfully reduced by adequate obstetric medication during a painful or distressing birth (Miller et al., 2005), a positive association of neonatal cortisol with stress responsivity, in turn related to infant temperament measures (Gunnar et al., 1995), highlights the possibility that birth complications

and interventions may influence early temperament development. However, whilst excessive cortisol in the perinatal period could potentially alter the HPA axis setting in the long-term, the precise levels of cortisol required for such changes is thought to vary between infants depending on genetic factors, brain malleability known as 'plasticity', and resilience or susceptibility to environmental stressors at the moment of birth (Belsky & Pleuss, 2009; Belsky et al., 2009). In temperament studies, some children have been found to be more susceptible to adverse traumatic responses than others (Carey & McDevitt, 2016). Theoretically, these differences in individual infants' sensitivity to their environment could in themselves be driven by epigenetic interactions between the genes and the environment (Meaney, 2010).

Do neonates recover physiologically after birth?

Most infants are believed to recover during the neonatal period (Brazelton & Nugent, 1995). However, as outlined above, in infants who still appear distressed after a few months, it may be possible that acute foetal or neonatal stress has triggered a hyper-arousal of their sympathetic nervous system at birth (Douglas & Hill, 2013). If the infant does not manage to recover from their birth experience, their ability to self-regulate and temperament factors such as arousal, attention, and emotional processing could be affected (Wolke et al., 2009; Schmid et al., 2010).

These disruptive impacts on the infant's epigenome are speculated to be caused by maternal catecholamine release during labour interfering with the oxytocin production present during a normal birth (Douglas & Hill, 2013). It is now established that the stress hormone cortisol passes readily through the placenta, and maternal cortisol levels are therefore highly correlated with infant cortisol levels, although the infant's are generally found to be lower (Gitau, Cameron, Fisk & Glover, 1998). Excessive crying, salivary and umbilical cortisol measured at birth, and a subsequent heightened infant stress response to inoculations at eight weeks, have all been associated with birth mode, with the greatest stress response after assisted vaginal births (forceps or ventouse), and the least found in infants born by planned CS (Taylor et al., 2000; Gitau et al., 2001).

Conversely, a Swedish study involving 37 infants suggested that epigenetic increases in DNA methylation interfering with gene expression may also occur because of interventions such as CS (Schlinzig et al., 2009). Only elective C sections and normal vaginal births were compared in this study, however, and therefore the differences between planned or emergency C sections and spontaneous or assisted vaginal births were not cross-examined. A further notable point is

that potentially damaging epigenetic changes to DNA methylation are considered reversible with sensitive and responsive caregiving in the post birth environment (Meaney, 2010).

Overall, however, there is limited research examining how infants may recover from their birth experience, or whether this could be affected by the mother's emotional and behavioural response to birth and her subsequent relationship with her infant. Therefore, the potentially deeper, more psychological effects of childbirth on mother and infant wellbeing, and their subsequent reciprocal behaviours (Feldman, 2017), are fully discussed in the next section.

2.7 Psychological impacts of childbirth on mother and infant

As outlined in the introduction (Chapter One), in addition to the physiological aspects of childbirth considered so far, a mother's subjective experience may also have consequences for her own and her infant's wellbeing. Indeed, the flow of endogenous oxytocin and endorphins after a normal birth, which enable a more positive maternal mood, are also essential for sensitive maternal caregiving and subsequent optimal infant development (Dahlen et al., 2013). In contrast, a negative experience of childbirth could potentially create a cascade of negative emotions for the mother (Murray & Cartwright, 1993; Blom et al., 2010; Ayers et al., 2016).

The mother's disordered emotional state post birth may affect her social interactions with her baby, which could then influence the infant's cognitive and emotional development (Tronick & Reck, 2009). Negative maternal perceptions of her birth experience and the care and support she has received, could also create a fear of giving birth which may alter her desired mode of delivery for subsequent births (Pang et al., 2008). In turn, the development of fear of birth is associated with anxiety and depression (Rouhe et al., 2011), although professional support to allay these fears can be successful and may even reduce the incidence of postpartum mood disorders. However, untreated maternal psychiatric conditions can have adverse impacts for mother and infant, including problems within their mutual relationship (Anderson et al., 2004).

Prenatal and postpartum maternal mood disorders are considered to affect infant behaviour (Brummelte & Galea, 2016). They may also relate to one another and to the birth experience. This section will therefore attempt to unravel the complex mechanisms that could be involved in any effects of perinatal maternal stress on developing infant temperament before exploring

how childbirth itself might adversely impact the infant via stress, depression and other perinatal psychological disorders in the mother.

2.7.1 *Maternal characteristics*

Birth outcomes may be affected by maternal and paternal personality. For example, a large Japanese cohort study found differences in preterm birth rates, gestational age, and foetal growth according to certain personality traits in both parents (Morisaki, Fujiwara, & Horikawa, 2016). Evidence also shows that negative maternal characteristics such as neuroticism can influence the mother's fear of childbirth, which in turn can adversely affect outcomes, including increased likelihood of a longer labour resulting in assisted birth or emergency CS (Handelzalts et al., 2015).

Similarly, Johnston and Brown (2013) found that childbirth complications and interventions could be associated with maternal trait anxiety, giving rise to the possibility of an indirect link between maternal personality and neonatal behaviour via the shared birth experience. Childbirth complications in the higher trait anxiety group included C section, assisted delivery, and foetal distress. Conversely, women who rated themselves as emotionally stable and more extroverted were more likely to experience a normal birth with less foetal distress. However, as the same mother may experience differing birth modes in successive births, other contributory factors also need to be considered.

2.7.2 *Prenatal maternal stress*

Maternal mood disorders are common during pregnancy, with approximately 12% and 13% of women experiencing prenatal depression and anxiety respectively (NICE, 2014). These conditions have been linked to maternal stress hormones disrupting hormonal regulation in both mother and foetus (Brummelte & Galea, 2016). In a prospective study of 163 newborn infants, Hernández-Martínez et al. (2008) found that infants of emotionally stable mothers were more alert and less irritable, while even moderate anxiety during pregnancy was associated with lower self-regulation and orientation scores on the NBAS (Brazelton & Nugent, 1995). In terms of ongoing infant behaviour, high prenatal maternal state anxiety predicts infant crying at twelve weeks (James-Roberts & Conroy, 2005). A prospective study of 86 pregnant women also found that life stresses and emotional problems during pregnancy predicted excessive infant crying during the first 6 months (Wurmser et al., 2006). In turn, persistent sleeping and

feeding regulatory problems in crying infants are associated with fewer social and adaptive behaviours in the pre-school child (Wolke et al., 2009; Schmid et al., 2010).

The mechanisms behind these potential impacts of prenatal stress on infant temperament, coined the 'foetal programming hypothesis', are increasingly coming to light (Sandman et al., 2011; Buss et al., 2012; Glover, O'Donnell, O'Connor, & Fisher, 2018). The foetal programming mechanism, affecting the unborn child's neurodevelopment and subsequent behaviour, is believed to involve the neonate's developing nervous system, including the limbic system, prefrontal cortex, and HPA axis. As discussed in section 2.6.7, increased blood cortisol reaching the foetus via the placenta may dysregulate the HPA axis, epigenetically programming it to be more stress responsive (Oberlander et al., 2008). This can lead to higher levels of negative reactivity and fearfulness in the infant (Davis et al., 2007; Bergman et al., 2007; Ostlund et al., 2016), increasing their risk for neurodevelopmental disorders and emotional problems (Van den Bergh, Dahnke, & Mennes, 2018) and adversely affecting their future cognitive ability and regulatory emotional and behavioural outcomes (Feldman, 2017).

These effects are thought to occur via the hormonal system, with evidence suggesting that excess stress during pregnancy increases basal cortisol levels for both mother and foetus (Weinstock, 2008), which may then disrupt the neurobiological state and behaviour of the infant and future child (Huizink et al., 2002; Hernández-Martínez et al., 2008; Glover, O'Connor & O'Donnell, 2010). Specifically, research by Glynn et al. (2018) showed that negative maternal mood during pregnancy increases infant and child 'negative affectivity' scores. In turn, these negative emotionality scores were related to later internalising problems measured at 6, 12 and 24 months and 7 years, in addition to potentially damaging impacts on adolescent mental health in children of 10-13 years.

Equally, a longitudinal study by O'Connor et al. (2005) found that prenatal stress led to higher cortisol levels in young adolescents, potentially affecting their longer term behaviours and vulnerability to psychopathological conditions. Indeed, a large prospective longitudinal study examining effects of acute stress during pregnancy found that it could predispose children and adolescents aged 10-19 years to depression (Kingsbury et al., 2016). Young people whose mothers were distressed during pregnancy may therefore be more susceptible to a range of psychological disorders including anxiety, depression, and ADHD (Van den Bergh et al., 2005; Glover et al., 2010).

A systematic review of both prospective and retrospective longitudinal clinical studies (Van den Bergh et al., 2017) further corroborated the belief that the adverse effects of prenatal maternal psychological stress on infant neurodevelopment, self-regulation and temperament may be implicated in numerous future physical and mental health problems of the child and adult. Moreover, a meta-analysis of 64 studies by Gardener, Spiegleman and Buka (2009) concluded that prenatal stress, pregnancy complications and medications during pregnancy may be part of multiple components contributing to the development of autism, the complex disorder believed to involve interactions between the genes and intrauterine or extrauterine environments. However, caution should be exercised when interpreting these results as autism still has an incomplete aetiology, and therefore no definitive inferences can be drawn. Similarly, Thapar and Rutter (2009) advised cautiousness when assuming causality between prenatal stress, child temperament and future mental disorders such as depression, ADHD or schizophrenia due to the possibility of unmeasured 'residual' confounders. Nevertheless, if it is possible that perinatal factors might contribute to disorders such as autism, it is also conceivable that the birth experience could affect infant behaviour in milder ways.

A further to point to consider is the one made by DiPietro, Novak, Costigan, Atella and Reusing (2006) – that not all prenatal stress is damaging to the infant. In their longitudinal study of a group of healthy mothers and infants with uncomplicated pregnancies, they found that reported mild to moderate amounts of stress, anxiety and depression during mid-pregnancy could in fact enhance the two-year-old infant's mental and psychomotor development, speculating that this may occur via the stimulation provided to the foetus (DiPietro et al., 2006). However, although these effects were 5.5-6.8% of the total variance, the study was of a specific group of well-educated, financially stable women who experienced no major distress or trauma during their pregnancy and therefore the findings may not generalise to the wider mother-infant population.

2.7.3 *Postnatal maternal mood disorders – anxiety and depression*

Approximately 15-20% of women are thought to experience some level of anxiety and depression during the first year after childbirth (NICE, 2014), with rates potentially higher depending on the measurement criteria used (Brummelte & Galea, 2016). Indeed, around half of all cases experiencing anxiety or depression are believed to go undetected, a finding supported by the fact that 40% of women in England alone are believed to lack access to perinatal mental health services (NHS England: National Maternity Review, 2016). There is

mounting evidence to suggest that postpartum maternal stress also affects infant temperament and behaviour (Oyetunji & Chandra, 2020). Indeed, research summarised in a narrative review by Field (2018) shows that postpartum maternal stress can have a significant and ongoing negative impact on infant outcomes, including physical and cognitive development, health, mother-infant interactions, bonding, temperament and mental wellbeing. A longitudinal study by Reck and colleagues (2018) showed that the extent of these impacts on the infant depended more on the severity and duration of maternal postpartum anxiety than on the timing of exposure. Moreover, maternal avoidance behaviours reinforced negative effects by creating a less stimulating environment for the infant.

Postnatal mood disorders may have certain attributes in common with prenatal mood disorders and, while postnatal mood affects the extrauterine rather than the intrauterine environment, these two discrete states are often comorbid and may also present alongside post-traumatic stress after childbirth (Ayers et al., 2016). Anxious mothers may experience a more difficult birth (Johnston & Brown, 2013), and mothers who experience a difficult birth are at increased risk of developing anxiety, depression, or psychological birth trauma (Olde et al, 2006; Alcorn et al., 2010; Ayers et al, 2016). Notably, while maternal experience of childbirth and whether the mother develops post-traumatic stress disorder (PTSD) appears to be partly objective (due to obstetric complications), it is also a somewhat subjective process (Andersen et al., 2012; Ayers et al., 2016).

Could childbirth influence infant temperament via postpartum maternal mood?

We now know that early life stressors can negatively impact on the future psychological wellbeing of the infant (Lupien, McEwen, Gunnar, & Heim, 2009). As neonatal stress may occur via maternal stress, it seems inevitable that maternal postpartum mood would affect infant behaviour and development to some extent (Murray, Halligan, & Cooper, 2018).

A large scale, prospective, multi-ethnic Dutch survey, with multiple contact points from pregnancy through to the first two months post-birth, found that perinatal complications – including an interventionist birth mode – might precipitate disturbances in maternal mood, especially in more vulnerable women (Blom et al., 2010). Additionally, Field (2017) found that mode of delivery, fear of birth and fear during birth, loss of control, low confidence, the treatment received from staff during labour and birth, a lack of social support, and negative perceptions of the birth experience all contributed significantly to maternal postpartum anxiety.

In relation to infant behaviour, a study by Matthies et al. (2017) found that both maternal trait anxiety and confidence measured at various time points from pregnancy to four months postpartum predicted regulatory problems in the four-month old infant, although maternal confidence had stronger interactions with infant crying, feeding and sleeping problems. These associations may occur via adverse impacts of maternal anxiety and depression on the mother's confidence and self-efficacy (Reck, Noe, Gerstenlauer & Stehle, 2017), and the subsequent effect of low maternal confidence and self-efficacy on the mother-infant relationship and parenting style – both of which are well-established factors in infant temperament development (Murray et al., 2014). However, these effects could be mediated by increased social support, which in turn improves maternal caregiving confidence (Jover et al., 2014).

Clout and Brown (2015) also linked persistent perinatal maternal anxiety to infant health problems at 4-6 months, while infant and maternal sleep problems were found to predict the onset of maternal postnatal depression. In this study, stressful life events were predictive of high postpartum stress levels, and a continuum in stress levels was observed from the third pregnancy trimester to 4-6 months postpartum. Notably, stressed mothers were also more likely to have a Caesarean section; and mothers who experience interventions are at increased risk of developing postpartum mood disorders (Ayers et al., 2016). Prenatal anxiety or depression may therefore accentuate the possibility of negative postnatal mood via the birth experience, adding to stress on the mother-infant relationship. Furthermore, perceived stress in relation to infant care predicts higher levels of anxiety and depression post birth (Falah-Hassani, Shiri, & Dennis, 2016). However, Glasheen, Richardson and Fabio (2010) questioned the general consistency and validity in assessment methods, also cautioning that study methods can be variable and that confounders are not always adequately accounted for. Therefore, the possible link between postpartum anxiety and infant temperament factors may in fact be inconclusive.

Another potential issue is that maternal ratings of infant temperament could be affected by her mood (McGrath et al., 2008). Consequently, there is the pertinent question of how accurate maternal reports of infant behaviour can be. Mothers with postpartum depression (PPD) may also experience feelings of stress, anxiety, guilt and isolation, with these emotions potentially affecting ratings of their baby's temperament. More specifically, McGrath and colleagues (2008) found that depressed mothers reported their infants as more difficult at 2 and 6 months than their non-depressive counterparts, or than objective ratings, although actual differences

were small. Equally, Pauli-Pott, Mertesacker and Beckman (2004) found that mothers with PPD rated their infants as having higher negative emotionality including fear, withdrawal and irritability at 4, 8 and 12 months.

Therefore, although maternal ratings of infant temperament have generally been found to correlate well with professional observer ratings (Rothbart et al., 2001; Henderson & Wachs, 2007, Zenter & Bates, 2008), an exception may exist for mothers with postnatal mood disorders. Consistent with this, Pauli-Pott and colleagues (2000) found no relationship between the ratings of mothers with depressive symptoms and trained observer ratings of infant positive or negative emotionality, suggesting that the supposed relationship between maternal mood and infant temperament may have more to do with biased maternal ratings than the infant's behavioural characteristics.

Nevertheless, maternal postpartum anxiety or depression during the first year have been found to correlate with temperament factors empirically measured by The Early Infancy Temperament Questionnaire (Medoff-Cooper, Carey & McDevitt, 1993) during the first month. These include activity, adaptability, distractibility, intensity, and an overall more difficult temperament (Britton, 2011). Hence, research examining the impacts of maternal mood on infant behaviour might be best conducted through trained professional observations, as is the case with the NBAS (Brazelton & Nugent, 1995); or alternatively via thorough and detailed questioning regarding very specific elements of infant behaviours which relate to everyday life for a new mother, as in Wolke and James-Roberts' MABS (1987).

More recently, concordance has been established between maternal and observer ratings (Van den Bergh et al., 2017). Additionally, depressed mothers have been observed to behave differently during interactions with their infants, adversely affecting mother-infant outcomes including a reduced ability in the nine-month-old infant to regulate negative emotions (Feldman et al., 2009). In this study, mothers with depression and their infants were found to have higher baseline cortisol levels with a steeper response and slower recovery to external stressors. These mothers and infants also showed less biobehavioural synchrony in their mutual relationship than matched controls where the mother had no depression. Therefore, it is potentially a combination of somewhat distorted perceptions of her infant and actual disturbances in mother-infant interactions and behaviours that lead to the recognised association between maternal depressive symptoms and young infant temperament.

Britton (2011) suggested that maternal mood and infant temperament, while seemingly connected, could possibly be bi-directional, with the newborn's early behavioural patterns affecting the mother's ability to cope with her infant. Therefore, neonatal behaviour can be innately difficult, or be perceived by the new mother as challenging, which might further exacerbate her depressive symptoms (Mertesacker et al., 2004; McGrath et al., 2008; Britton, 2011). Aligning with this concept, Murray (1996), after accounting for initial postnatal maternal mood, found that poor motor skills and excessive irritability in the newborn infant predicted the onset of maternal depression and less positive mother-infant interactions at eight weeks postpartum. On examining the interactive relationship between mother and infant at each monthly point from birth to six months, Van de Bloom and Hoeksma (1994) also found that mothers responded more positively to non-irritable infants. This occurrence could influence maternal caretaking behaviours, mother-infant interactions, and subsequent bonding and attachment, potentially further affecting future infant behaviour (Murray et al., 2014).

Although the aetiology of perinatal mood disorders is still not fully understood (Dennis & Dowswell, 2013), hormonal fluctuations during reproduction are believed to play a significant role (Brummelte & Galea, 2016), and particularly in more hormonally sensitive women (Schiller, Meltzer-Brody & Rubinow, 2015). The mother's high secretion of cortisol as a symptom of PPD could potentially dysregulate her own HPA axis functioning (Glynn, Davis & Sandman, 2013), in addition to being implicated in young infant temperament in healthy breastfed infants (Glynn et al., 2007). As previously discussed, Clout and Brown (2015) found that prenatal anxiety was associated with C section delivery, which in itself may predict higher levels of postpartum stress, anxiety and depression. Accordingly, there is a widely acknowledged continuum between pre- and postpartum mood disorders (Ayers et al., 2016).

However, although prenatal anxiety or depression were the greatest risk factors for PPD in a large study involving 10,000 new mothers, approximately 40% of mothers with PPD suffer their first ever depressive episode post birth (Wisner et al., 2013). Therefore, while some women appear more predisposed to suffering postpartum mood disorders, a large proportion of depressed mothers may not have experienced psychiatric problems before the birth. Importantly, mothers with PPD are at increased risk of further depressive episodes, and this could still affect child behaviour at four years (Josefsson & Sydsjo, 2007). Moreover, PPD may

have an adverse effect on maternal caregiving and infant safety practices (Field, 2010), highlighting the importance of early diagnosis and treatment for this disorder.

Impacts of postpartum depression on the mother-infant relationship

As mentioned above, maternal anxiety or depression during the perinatal period are associated with negative influences on the mother-infant relationship, with diminished maternal responsiveness, sensitivity or emotional availability widely considered to interfere with mutual interactional synchrony between the dyad (Murray, 1992; Beck, 1995; Brummelte & Galea, 2016; Field, 2017). Consequently, PPD may cause difficulties in mother-infant bonding, in some cases leading to indifference to their newborn infant (Ohoka et al., 2014), lack of affection, and even abuse or neglect (Kumar, 1997). Mothers with postpartum depression may also be more likely to struggle with breastfeeding and to stop sooner (Dennis & McQueen, 2007, 2009), possibly adding further pressure to mother-infant interactions.

Such impairments in the mother-infant relationship are known to have a long-term impact on infant cognitive development (Murray et al., 2014; Priel, Djalovski, Zagoory-Sharon & Feldman, 2019). Furthermore, maternal postpartum anxiety and depression are found to contribute to social, emotional, and behavioural problems in the child (Field, 2010, 2017). Withdrawn maternal behaviour due to depressed mood may be one of the mechanisms behind this effect, as depressed mothers are less responsive to their infants, who in turn may become more withdrawn (Stein et al., 2012). Conversely, infants who are emotionally connected to their mothers, with secure attachments at six months, have been found to exhibit fewer behavioural problems during the first three years (Frosch et al., 2019). Consequently, positive mutual interactions between the mother-infant dyad are generally considered a key factor in an infant's healthy trajectory of social, emotional, and cognitive development.

Parallel evidence can be found in research utilising both trained professional observations and online facial coding systems (Feldman et al., 2012). This study demonstrated that postnatally depressed mothers show less emotional availability to their infants, and maternal depression was related both to reduced vagal tone – affecting emotional regulation – and to her oxytocin levels. As detailed previously, oxytocin is the hormone and neuropeptide involved in mother-infant bonding behaviours (Feldman et al., 2007). Lack of oxytocin could have long-term consequences for temperament development as depressed mothers show reduced maternal

sensitivity, which in turn is linked to lower child oxytocin levels and reduced ongoing mother-infant synchrony (Feldman et al., 2012).

In their meta-analysis, Bernard et al. (2018) provided further support for the relationship between higher maternal depression scores and reduced maternal sensitivity during the first year, while Goldstein, Diener and Mangelsdorf (1996) found associations between maternal stress, reduced sensitivity in caregiving behaviours and more insecure attachment. Indeed, evidence over several decades has highlighted the importance of maternal sensitivity for secure infant-mother attachment (Ainsworth & Bell, 1970; Ainsworth, Bell & Stayton, 1974) and longer term associations with the child's future emotional and cognitive development (Belsky & Fearon, 2002; Fraley, Roisman & Haltigan, 2013). In further support of this concept, emotional deprivation resulting from postpartum maternal stress has been associated with reduced emotional regulation in the infant and young child (Feldman, 2012; 2015) and subsequently more externalising and internalising problems and lower resilience in the older child (Priel et al., 2019).

Further to this, a prospective longitudinal study conducted at three time points over the first two years, where mothers and infants were given time to be together and bond at birth, found that mutual positive interactions between mother and infant led to increases in infant brain power as measured by an electroencephalogram (EEG) placed over the frontal cortex (Bernier, Calkins & Bell, 2017). This type of reading is thought to be a general indicator of electrical brain activity, and supports previous suggestions that an infant's neurodevelopment – in terms of cognition and emotions – is strongly connected to early mother-infant interactions (Murray, Fiori-Cowley, Hooper & Cooper, 1996; Cooper & Murray, 1998).

Welch's 'calming cycle' theory (2016) suggests that this link between the infant's emotional connection to their mother and their externalised behaviour stems from the two-way regulatory process of the autonomic nervous systems of mother and infant. This mutual regulation may involve physiological and psychological responses of the mother-infant dyad to one another post birth (Hane et al., 2015). Therefore, regular skin to skin contact is considered to benefit the infant's neurodevelopment and behaviour, as well as maternal anxiety and depressive symptoms (Carter, 2014). Notably, when skin to skin care was tested in a randomised controlled trial, it was also found to significantly reduce the risk of autism spectrum disorder diagnosis in preterm infants (Welch et al., 2015). It therefore appears that the wellbeing of mother and infant are intricately connected via their joint hormonal physiology during the

perinatal period (Davis et al. 2008) and their subsequent behavioural and emotional synchrony and exchange post birth. Ostensibly, these mutual exchanges may be bi-directional in nature.

Overall, the evidence points towards an indirect link between childbirth experience and infant temperament via postpartum maternal mood, a concept that is further discussed in the next section.

2.7.4 *Post-traumatic stress disorder after childbirth*

Another potential risk for mothers who have experienced a difficult birth is post-traumatic stress disorder or PTSD (Ayers & Pickering, 2001), with up to 10% of women considered to have this severe traumatic response to birth (Ayers, 2004). However, more recent figures show that between 20-45% of women may rate their birth experience as traumatic, and between 1% and 6% of women who felt they had a traumatic birth develop symptoms of PTSD (Harris & Ayers, 2012; Dikmen-Yildiz, Ayers, & Phillips, 2018). This response is not always on a direct pathway from birth mode, although the objective birth experience (including birth mode) may be a factor. Although one study of Israeli women found no direct associations between obstetric complications and postpartum mood (Polachek et al., 2014), a randomised control trial in the same year established that emergency Caesarean section was the birth mode most strongly related to perceptions of trauma, with first time mothers the most susceptible (Boorman et al., 2014). As well, subjective maternal negative perceptions of her birth experience are a significant factor, combined with her previous social and psychological history and whether she received adequate emotional support during the birth (Ayers, 2004; Ayers et al., 2014).

Garthus-Niegel and colleagues' (2013) findings highlighted how a mother's subjective experience of childbirth might mediate two potentially predisposing factors: a previous psychiatric history, and the objective birth experience. This supports the findings of a Scandinavian systematic review which revealed obstetric emergencies and maternal perceptions of distress during labour as the most significant risk factors for PTSD after childbirth (Andersen et al., 2012). Furthermore, a UK meta-analysis established the two major predictors of maternal postnatal distress developing into PTSD after childbirth as: (1) having an assisted vaginal birth or CS; and (2) the mother's subjective perceptions of her birth experience (Ayers et al., 2016). Consequently, although PTSD after childbirth may be partially initiated by obstetric complications, maternal psychological states (such as feelings of fear, loss of control or emotional detachment) appear to play a significant role (Polachek et al., 2014). In

addition, perceptions of high levels of pain experienced during and post birth contribute to a woman's perceptions of her overall birth experience (Larsson et al., 2011).

A prospective Israeli study comparing differences between Arabic and Jewish women's experiences of birth, suggested that a mother's negative relationship with maternity caregivers during their birth might also be a relevant factor in her perceived traumatic experience (Halperin, Sarid & Cwikel, 2015). In support of this, a Flemish prospective cohort study found that women felt less distressed by childbirth complications if they had felt able to ask questions of their midwife (de Schepper et al., 2016). As mentioned above, PTSD could also be more likely to develop in individuals with prior mental health problems (Koenen et al., 2008), although Parfitt and Ayers (2009) originally found no evidence for this. However, Ayers and colleagues (2016) later concluded that a diagnosis of PTSD was moderately associated with a previous episode of PTSD. Therefore, some individuals may be more susceptible to perceiving their birth as traumatic than others, suggesting that maternal resilience could be important. Dikmen-Yildiz and colleagues (2018) found that perceptions of inadequate support during and after childbirth predicted symptoms of PTSD, as highlighted above. Therefore, emotional support is likely to mediate the relationship between childbirth interventions and postpartum PTSD (Ford & Ayers, 2009; Ayers et al., 2014).

How might PTSD and other postnatal mood disorders affect the infant?

Notably, children of mothers with PTSD during pregnancy may be more prone to suffering PTSD or other mood disturbances themselves in future life. Yehuda, Bell, Bierer and Schmeidler (2008) compared 211 holocaust survivors with a smaller Jewish control group (n = 73), finding that children of the survivors were more likely to inherit these effects from their mother than their father. Therefore, the influence of the mother's PTSD on the infant's own stress response system and future susceptibility to mood disorders was speculated to operate via transmission of the maternal state to the intrauterine infant epigenome. It is conceivable that similar epigenetic transformations in the infant could potentially occur during a traumatic birth. Furthermore, maternal mood disorders are frequently comorbid, and PTSD is strongly associated with postnatal depression (Ayers et al., 2016; Dekel, Ein-Dor, Dishy, & Mayopoulos, 2019), indicating that these infants may be affected in similar ways to those whose mothers have PPD.

Like other perinatal mood disorders, PTSD has the potential to adversely impact mother-infant interactions, possibly reducing maternal sensitivity or responsiveness towards her baby (Figueiredo et al., 2008; Parfitt & Ayers, 2009). Again, this could have negative consequences for the infant's social-emotional, and cognitive development (Garthus-Niegel et al., 2017), including their ability to form a secure attachment with their mother (Murray et al., 2014). As with the tainted outlook of depressed mothers, maternal perceptions of trauma during labour and birth could colour her perceptions of her infant, leading to problems in the mother-infant relationship (Davies, Slade, Wright, & Stewart, 2008). Given all the above evidence on PPD and infant development and behaviour, these complex perceptive difficulties might compound impairments to infant development, potentially affecting cognitive and emotional growth.

Incidentally, following a traumatic birth experience, the father may suffer his own set of symptoms, which could have a similarly negative impact on his relationships with his partner and newborn infant (Parfitt & Ayers, 2009). Severe maternal mood disorders may therefore have poorer outcomes for family relationships and parent-infant bonding. They also significantly affect maternal wellbeing, including an increased risk of maternal mortality by suicide (National Maternity Review, 2016) which is the main cause of death during the first year after birth, with a mortality rate of 2.8 per 100,000 maternities (95% CI 2.2-3.5) (MBRRACE-UK, 2018).

An important factor in subjective maternal perceptions of trauma during childbirth appears to be the quality of care and support received by a mother during birth and the immediate postnatal period (Harris & Ayers, 2012), which would conceivably include her early breastfeeding experiences. Indeed, whilst a mother's experience of PTSD may adversely affect her ability to breastfeed her infant (Halperin, Sarid & Cwikel, 2015), positive breastfeeding support and experiences help to promote mother-infant bonding and attachment (Ayers et al., 2008), in turn benefitting infant behaviour and development (Murray et al., 1996). Both postpartum maternal mood and infant temperament itself may affect mother-infant bonding (Nolvi et al., 2016), once again demonstrating the bi-directional and possibly cyclical nature of the many factors discussed here. Heritable differences are also important. Due to genetic make-up and different natural resilience to stressors, some infants are more affected by their caregiving environments than others (Drury et al., 2012) and therefore some infants could also be more susceptible to positive or negative effects of their mother's postpartum mood and associated caregiving style.

Overall, it appears that maternal mood and infant temperament, while seemingly inter-related, are flexible variables that are highly sensitive to their perinatal environments. Conceivably, they could be directly or indirectly influenced by a mother's experience of pregnancy, childbirth and the immediate postnatal period, and how well she felt supported during these momentous life events. In an early predictive study, Cooper (1996) found that the risk of developing postpartum depression was halved in women who received social support. Moreover, 'at risk' mothers targeted with interventions that encourage the release of oxytocin, such as music or infant massage, may experience a reduction in their symptoms (Field, 2017), although whether these positive impacts are passed on to the infant remains uncertain.

Nevertheless, interventions to improve the mother's emotional state and enhance her coping abilities may positively affect her perceptions of her infant, mother-infant interactions, subsequent mother and infant wellbeing, and infant temperament development (Britton, 2011). Sensitive maternal caregiving appears to be a critical factor in the infant's learned ability to regulate their emotions (Thomas, Letourneau, Campbell, Tomfohr-Madsen, & Giesbrecht, 2017). Consequently, it has also been suggested that this could be encouraged through extra support given to vulnerable mothers, alongside professional monitoring of their parenting styles, to enable parenting approaches that encourage optimal mother-infant interactions and early infant development (Murray et al., 2014, 2018).

2.8 Bringing the literature together

To summarise, the literature surrounding childbirth complications, perinatal mood disorders, and the potential impacts of both on infant temperament appears to show four main trends. First, childbirth complications or interventions may have a direct or indirect impact on the neurobehavioural state of the newborn, with several overlapping routes possible, including dysregulation of the HPA axis (Douglas & Hill, 2013) and disruption to the neonatal epigenome (Dahlen et al., 2013; Almgren et al., 2014) and microbiome (Christian et al., 2015; Schmidt, 2015; Aatsinki et al., 2019). Neonates may also be affected by maternal hormonal states both during and post childbirth (Brummelte & Galea, 2016). Furthermore, certain childbirth interventions have been linked to possible longer term negative outcomes for personality and mental health, such as depression (Mittendorfer-Rutz, Rasmussen, &

Wasserman, 2014), autism (Kolevson, Gross, & Reichenberg, 2007; Gardener, Speigelman, & Buka, 2009) and schizophrenia (Preti et al., 2000; Clarke et al., 2011; Forsyth et al., 2013).

Second, subjective perceptions of a difficult birth experience may have an adverse impact on postpartum maternal mood, regardless of any previous experiences of mood disorders, although some women appear less resilient and therefore more susceptible than others (Ayers et al., 2016). Third, maternal mood disorders have been linked to disruptions to maternal-infant interactions and bonding (Ayers, Eagle, & Waring, 2006) and may increase the infant's future susceptibility to psychopathology (Priel, Djalovski, Zagoory-Sharon, & Feldman, 2019). Finally, dysregulations of mother-infant communications and mother-infant bonding and attachment are widely considered to have a negative impact on infant temperament and development – cognitively, socio-emotionally, and behaviourally (Murray et al., 2014).

Previous research has examined the separate issues of birth mode, medication, foetal stress response, maternal emotional states, and infant temperament. However, a detailed exploration of the potential link between the mother's physical and psychological response to birth and neonatal and young infant behavioural outcomes does not yet appear to exist. While we know that childbirth can affect the newborn in the initial hours and days post birth, very little is known about any longer term impacts on infant behaviour. Previous attempts have been made to discover whether the type of birth an infant experiences (traumatic or gentle) could influence their temperament (e.g. Maziade, Boudreault, Côté, & Thivierge, 1986). We also know from epidemiological studies that adverse neonatal experiences such as pain and distress may alter subsequent brain development and behaviour (e.g. Anand & Scalzo, 2000). However, a recent review, while acknowledging some evidence on birth mode affecting breastfeeding and infant sleep, concluded that the research literature on potential impacts of childbirth on infant behaviour and temperament development is limited and inconclusive (Burke-Aaronson, 2017).

Given the already established associations between birth experience and postnatal mood and between postnatal mood and infant temperament, a direct pathway between subjective maternal experience of childbirth and young infant behavioural patterns is plausible. Prior evidence also suggests that physical birth factors (such as birth mode) may influence neonatal behaviours. However, the potential ongoing impacts of physical and psychological perinatal influences on infant temperament development have not yet been fully investigated. To recap, this thesis will

therefore explore the overarching question: *Does childbirth experience influence maternal perceptions of infant behaviour?* Within this, it will examine the following sub-questions:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?
3. Which are the most significant perinatal factors in early infant behavioural patterns?

Chapter Three

Methodology

Chapter Three outlines the methodological approach adopted for the research and the rationale underpinning methodological choices for each study. First, philosophical approaches to conducting this style of research are discussed, followed by a description of the specific qualitative or quantitative methods employed in each study. Next, the rationale for choosing a mixed methods design is explored, including an evaluation of these choices and the strengths and challenges involved in this approach. Finally, there is a section on motivation and reflexivity, including a sub-section on the use of public and patient involvement (PPI) to inform the work. This covers the background to the research from a personal point of view to assess whether it could have potentially influenced the aims and findings of the research.

3.1 An overview of the research methodology

The research adopted an exploratory mixed methods approach, with a convergent (otherwise known as concurrent) parallel design (Fetters, Curry & Creswell, 2013). The exploratory mixed methods approach was chosen to achieve a broader picture of any impacts of childbirth on infant behaviour and the possible mechanisms behind this. Thus, both personal and numerical information could be gathered (Creswell, 2013), including rich in-depth data from personal experiences of the sample populations and numerical data to describe statistical relationships between specific perinatal factors and early infant behavioural style. The two methods contributed equally to addressing the overarching research question by offering various perspectives via an assorted sample of interviewees (health professionals and mothers) and different types of data (qualitative and quantitative). This approach is considered more rigorous than using either qualitative or quantitative methods alone (Creswell & Hirose, 2019).

Consistent with this, mixed method designs are increasingly used to explore complex issues within public health (Fetters, Curry, & Creswell, 2013). They were developed following a realisation that a creative combination of qualitative and quantitative methods may successfully add to the quality of social, behavioural and health science research (Creswell & Hirose, 2019). According to these authors, qualitative research may explore the phenomenon while specific

research questions can be answered through quantitative methods. However, new insights may occur in the comparison of the two types of data. Consequently, a 'staged approach' is used in this thesis – where the results are analysed and reported in stages, beginning with the two qualitative data sets and progressing to the quantitative data (Fetters et al., 2013). This leads to a comparison of all three study results in the discussion chapter (Chapter Seven), providing a wider understanding than each stand-alone method could without the other's contribution (Creswell & Hirose, 2019).

Thus, this research was designed to include both qualitative and quantitative methods, via semi-structured individual interviews with mothers and health professionals and a detailed survey. Interview and survey data were collected in parallel, although the survey ran on either side of interview data collection and analysis (see Table 1 and Figure 1). Forty exploratory interviews of health professionals and mothers were fully analysed, interpreted and written up before any survey data was downloaded. The thesis progresses accordingly, presenting each study chapter in the order they were analysed and interpreted. Interview data are used to gain an initial understanding of unique individual perspectives, while the survey adds empirical value to the findings, extending and standardising them via a series of fixed questions and responses (Fetters et al., 2013). Thus, the quantitative data builds on and helps to further explain the qualitative findings; and how the three sets of results converge with or diverge from one another is also discussed (see Figure 2) (Creswell, 2013).

Table 1 Timeline for data collection, analysis and interpretation of the three studies

Activity	**Date/duration**
A Ethical approval for Study 3 survey	28th May 2014
B Study 3 survey data collection	June 2014 - March 2017
C Ethical approval for interview studies 1 and 2	15th December 2014
D Data collection for interview studies 1 and 2	January - October 2015
E Analysing and interpreting the interview studies	October 2015 - October 2016
F Analysing and interpreting Study 3 survey data	March 2017 - October 2018

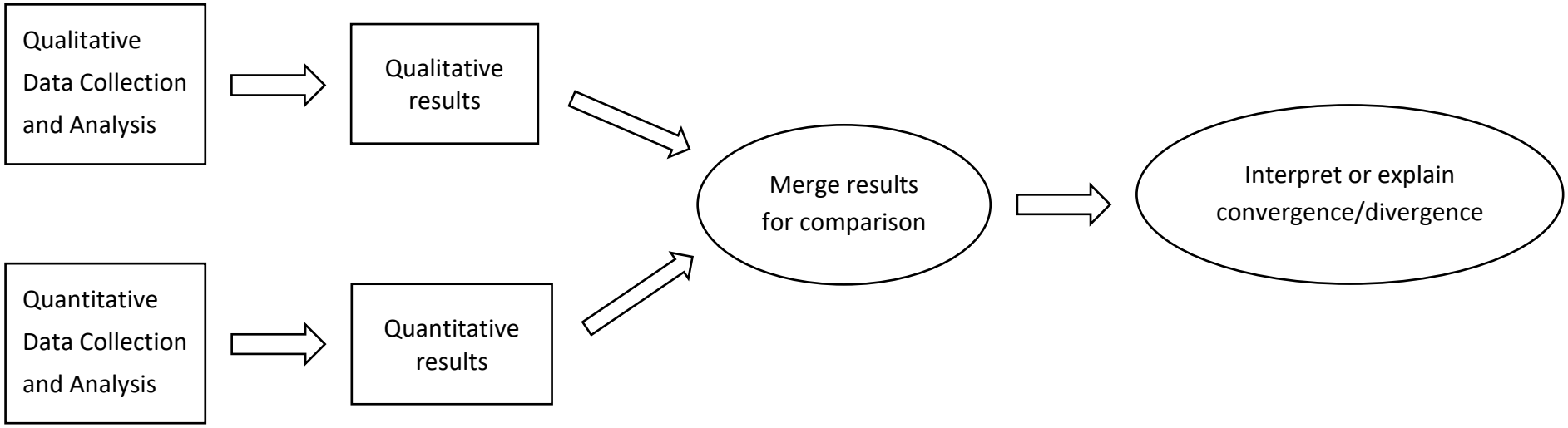
Note: the phrase 'analysing and interpreting' includes writing up the studies

Figure 1 Gantt chart illustrating approximate timeline of data collection, analysis/interpretation and reporting of the 3 studies

Activity: Table 1	Duration: months	May 2014	June 2014	Sept 2014	Dec 2014	Jan 2015	April 2015	July 2015	Oct 2015	Jan 2016	April 2016	July 2016	Oct 2016	Jan 2017	April 2017	July 2017	Oct 2017	Jan 2018	April 2018	July 2018
A	1																			
B	33																			
C	1																			
D	10																			
E	11																			
F	18																			

Note: each block represents approximately 1-3 months

Figure 2 Exploratory mixed methods approach, using a convergent parallel design (Creswell, 2013)



3.2 Philosophical assumptions

The choices regarding how best to conduct the research were based on certain philosophical assumptions. On a fundamental level, there are essential differences in qualitative and quantitative approaches to research involving first ontology – philosophies about the nature of reality – and second epistemology – how we develop truth and knowledge about that reality (Bryman, 2008). These overarching concepts contain within them two basic paradigms or ideological positions – constructivism and positivism – which have been part of an ongoing debate about the contrasting merits of 'subjective' and 'interpretivist' qualitative or alternatively 'objective' quantitative research methods (Morgan, 2007; Feilzer, 2010).

Although positivism with its quantitative measurement of data has been the dominant research paradigm in the past, constructivist qualitative research has increasingly gained attention and respect since the 1970s when it first began to be recognised as a discipline in its own right. Guba and Lincoln (1986) first labelled constructivist or interpretivist research as 'naturalistic enquiry' (Morgan, 2007). While positivism and post-positivism theories claim to uphold the 'purity' of objective science, constructivism acknowledges that any involvement of the human mind will interact with and affect the experience and knowledge of 'reality' (Feilzer, 2010). Hence, the human mind will always tend to interpret reality subjectively to some extent, no matter how objective are the original and ongoing aims of the research (Sandelowski, 2010).

Therefore, while qualitative research takes a constructivist, interpretivist approach, exploring the context and meanings of specified social phenomena, quantitative research takes on a more positivist, objectivist approach, measuring results through the statistical analysis of numerical data relating to the phenomena. Although 'wars' have reigned between these two methodological and epistemological disciplines for decades (Feilzer, 2010), constructivism and positivism have more recently been united through pragmatism. Pragmatism is a newer research philosophy that builds upon older research styles, and may overcome some of the tensions within previously dichotomous perceptions of qualitative or quantitative methodologies (Morgan, 2007; Creswell, 2009a).

According to Teddlie and Tashakkori (2009), pragmatism commits to a degree of uncertainty by acknowledging that knowledge is unpredictable, transient, and produced by the researcher rather than being thought of as a definitive and unchanging absolute reality. It accepts that there

are multiple realities open to empirical investigation, focusing instead on finding practical solutions to real world problems without holding the researcher rigidly to one paradigm (Feilzer, 2010). Pragmatism therefore draws upon the benefits of ontological and epistemological ideologies, reconstructing them and building a bridge across the previous boundaries between constructivism and positivism (Shannon-Baker, 2016).

In opposing the longstanding dichotomy of positivism versus constructivism, pragmatic research bases itself upon the joint worlds of subjective and objective human experience with all their various layers and ambiguities. In so doing, pragmatism acknowledges that all approaches or paradigms are in fact in search of the truth (Feilzer, 2010). A pragmatic approach may reinforce the transferability and generalisability of the findings by increasing the breadth and depth of inter-connecting data, guided by the researcher's wish to produce socially useful information (Morgan, 2007). Pragmatism therefore focuses upon the research question that requires answering, as well as the social implications of the research (Feilzer, 2010). Consequently, inductive qualitative and deductive quantitative methods may be harmoniously united to measure the different layers of the research problem and to create more comprehensive answers.

Although pragmatism also permits the researcher to move back and forth between the two different types of data, for the purposes of this thesis each study was analysed separately, and they were presented as three independent though connected studies (Bryman, 2007). Transferability of the findings was enhanced through merging the trustworthiness and confirmability of the stand-alone qualitative data with the strength of cause and effect findings in the quantitative data (Morgan, 2007; Shannon-Baker, 2016). The context and meaning of the two qualitative studies were brought together and interpreted alongside the increased generalisability of the quantitative study's findings in the final chapter (Chapter Seven), forming a connection whilst finding meaning in both.

Qualitative themes arose inductively from interview data in the first part of the research (Studies One and Two – Chapters Four and Five respectively), and these observations contributed to theories generated by subsequent analysis of the quantitative study (Study Three – Chapter Six). However, the interview questions for the first two studies and the survey statements had to be formed from somewhere, and as Morgan notes (2007, p70), data-driven

inductive and theory-driven deductive methods are not two completely distinct entities as the actual process of moving between theory and data is never solely in one direction.

The pragmatic approach meanwhile takes observations – albeit general ones observed in everyday life or from previous research – and converts them into theories which can be assessed through action. The pragmatic research strategy searches for connecting ideas between qualitative and quantitative methods without completely separating subjective from objective ideals (Morgan, 2007). Pragmatism therefore appeared to fit the challenges posed by the research questions.

Consequently, despite the potential difficulties involved in conducting two different types of research simultaneously, it was decided that involving both qualitative and quantitative approaches to the design and analysis of the three studies would be the most suitable way to fulfil the diverse requirements of the research. In this way, different elements of the research question could be answered. The aim was to qualitatively explore whether childbirth experience might influence infant behaviour, and if so, to identify any possible underlying mechanisms. Furthermore, data collection needed to happen on a larger scale, with detailed and rigorous questioning and analysis, to highlight the impacts of perinatal factors in specified areas of infant behavioural response, such as alert, responsive, settled or unsettled.

Therefore, the three interconnected studies within this thesis were conducted and analysed in a way that would enable a pragmatic approach while ultimately striving towards rigour and subsequent triangulation of the findings (Creswell & Hirose, 2019). Each study is self-contained in its own chapter with introduction, method, results and discussion sections, and describes in full the specific methods of conducting the research and the forms of data analysis that were employed.

3.3 Design

Three separate studies were conducted to address the research questions. The aims of the studies were first to find out whether mothers, midwives and other maternity care providers believed experiences of childbirth to be associated with infant behaviour, and second to discover which perinatal variables make the most difference to infant behavioural outcomes.

Although data for the three studies were collected in parallel (see Figures 1 and 2), the studies are presented in the order of their analysis, interpretation and conference presentations. In this way, the quantitative data were used to further explain and develop findings from the two exploratory qualitative studies (Creswell et al., 2013; Creswell & Hirose, 2019).

The two first studies (Part One of the thesis) were linked, exploring first the broader perspectives from health professionals who see hundreds of women and infants, and second, personal in-depth maternal perspectives of their own lived-in birth experience and their baby's behaviour. These qualitative studies aimed to answer the first two sub-questions of the thesis:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?

The third study (Part Two of the thesis) aimed to answer the following third sub-question by investigating which specific physical and psychological factors of maternal experience from pregnancy through to the postnatal period contribute most to early infant temperament:

3. Which are the most significant perinatal factors in early infant behavioural patterns?

Maternal outcomes of self-confidence and self-efficacy were also considered, given that how the mother feels relates to her transition into motherhood and the quality of care she is able to give to her baby (Loto et al., 2010), and therefore to infant behavioural and developmental outcomes – as voiced at a meeting of the World Health Organization and United Nations Population Fund (WHO & UNPF, 2008). While the three studies are outlined here, as each is a self-contained stand-alone study with its own chapter, the individual method details will be covered more fully in Chapters 4-6. The studies explore direct and indirect pathways between maternal experiences of childbirth and infant behavioural patterns during the first year by conducting a detailed investigation of the possible underlying mechanisms of these pathways.

Study One (Chapter Four)

The first study was designed to find out whether maternity care providers perceived an association between maternal experiences of childbirth and early infant behaviours. It is a

qualitative study, employing interviews with thematic analysis to explore the experiences and beliefs of maternity care providers around childbirth and early infant behavioural style. More specifically, it aimed to examine whether maternity care providers felt that maternal birth experience might influence the mother's perceptions of and interactions with her baby, and if so, what impact this could have on the infant. It also aimed to explore whether maternity care providers perceived childbirth to affect the infant directly.

The study used semi-structured interviews with 18 maternity care providers working in areas of South West Wales and England. Qualitative research methods enable a descriptive depth and detail in the data which is suited to investigating interpretations, meanings and relationships occurring within the social world. The researcher can interpret these through a process of rigorous and systematic transcribing and analysing of themes that allows for complex understandings of complex situations (Anderson, 2010). Thematic analysis was chosen as the most appropriate method for analysis due to its highly flexible approach which identifies, examines and reports patterns observed in the data in a rich and detailed manner (Braun & Clarke, 2006). According to Boyatzis (1998), thematic analysis also speaks in a language which allows for communication between qualitative and quantitative aspects of research, and for conversations between researchers specialising in either of these fields. This analysis was combined with Sandelowski's philosophy of qualitative description, interpreting the words as they were spoken to capture the interviewees' intentions while simultaneously aiming to minimise the risk of projecting the researcher's own viewpoints onto the analysis (Sandelowski 2000, 2010).

Study Two (Chapter Five)

The second qualitative study was designed to explore maternal perceptions of childbirth and their own baby's behaviour. Semi-structured interviews were conducted with 22 mothers living in South West Wales and England to explore their personal birth experiences and their babies' behaviour post birth – specifically, to investigate whether there was a link between maternal birth stories and mother-reported infant behaviour both post birth and during the first year, and if so, whether mothers perceived an association between the birth and their baby's behaviour.

Face to face interviews were deemed the most effective way to capture mothers' open and honest birth stories and perceptions of infant behaviour (DeJonckheere & Vaughn, 2019). As with Study One, thematic analysis was considered the best way to analyse in-depth data –

maternal birth stories and infant behavioural patterns in the weeks and months after birth. Thematic analysis was therefore used to investigate maternal interpretations of events and the meanings they gave to them through a detailed process of transcribing and analysing identified themes that arose in the data, while enabling new insights and awareness of themes that were not immediately evident (Nowell, et al. 2017). In addition, a simple content analysis was conducted to observe patterns between maternal birth themes and infant behavioural themes.

Study Three (Chapter Six)

The third study was designed to answer the third research sub-question: *Which are the most significant perinatal factors in early infant behavioural patterns?* It collected data via an online survey of over a thousand mothers giving birth in the UK. Following on from the two exploratory qualitative studies, patterns emerging in the data were further explored through quantitative methods. Theories generated in the qualitative data could therefore be examined and tested. Given the restraints of time and cost for the thesis, a survey was chosen as the design best suited to providing a detailed examination of multiple perinatal factors that might contribute to any impacts of childbirth experience on infant behavioural style (see Chapter Six for details). Quantitative statistical methods of analysis were employed to help summarise the data and describe any patterns or relationships. Each physical and psychological factor was first analysed separately in relation to infant and maternal outcomes before reducing relevant factors to those continuing to affect outcomes when all other variables were held constant.

3.4 Mixed methods approach – strengths and challenges

This use of an exploratory mixed methods design (Creswell & Hirose, 2019) seemed the most effective way to investigate the potential influences of childbirth on infant temperament. Qualitative elements may first explore the research question through the collection and analysis of rich in-depth data. The quantitative section can then provide numerical measurements of cause and effect, examining associations and differences between variables and which variables predict infant behavioural patterns. Thus, qualitative methods may be used to explain unexpected findings in the quantitative data, or alternatively, as in this thesis, quantitative methods can be used to expand on previously analysed findings, testing theories arising in the qualitative data, with neither method taking priority over the other (Morse & Niehaus, 2016).

A mixed methods approach to social science research has become an increasingly popular way to conduct two or more scientifically rigorous research studies, particularly if the research question involves a complex phenomenon (Morse & Niehaus, 2016). Mixed methods can also be employed if more than one aspect of a research problem requires exploring: in this instance, maternal experience of childbirth and the perceived behavioural response of mothers and their babies. Thus, mixed methods allow for more than one goal - assessing associations and risk factors for a phenomenon while potentially also uncovering the mechanisms behind its existence (Morse & Niehaus, 2016). Exploring a social phenomenon from different perspectives may enhance the overall quality of information, whilst each method aims to compensate for any shortfalls in the other. For example, while qualitative methods may collect and analyse rich in-depth data, exploring potential mechanisms behind a concept, quantitative methods can be used to assess their statistical significance. Mixed methods research therefore has several strengths, including the possibilities of cross-comparing, synthesising and triangulating the findings (Creswell & Clark, 2007). Consequently, it can be considered the most appropriate way to address the research problem in some instances (Creswell, 2009), with its use increasing in the context of public health research (Kaur, 2016).

However, mixed methods research also poses certain challenges. These may include the researcher needing to invest extra time in becoming fully acquainted, versatile and adept at conducting studies using two very different though complementary research methods (Creswell & Hirose, 2019). Additionally, the researcher must learn how standards and principles of research rigour are adhered to in their chosen methods, with the two approaches of qualitative and quantitative research using different criteria to assess overall consistency, reliability and validity (Jones & Sumner, 2009). Although the qualitative research presented here seeks to explore concepts whilst maintaining Lincoln and Guba's (1985) standards of trustworthiness, including credibility, dependability, neutrality and transferability (Morrow, 2005; Thomas & Magilvy, 2011), and the quantitative research adheres to strict rules governing statistical analysis of data (Field, 2009), the methods may converge in their joint emphasis on research quality and validity of findings.

Consequently, although many researchers including Lincoln and Guba (1985, 1986, 1994) and Bryman (2007) have argued that qualitative and quantitative research strategies are fundamentally based on an opposing and consequently incompatible 'set of beliefs and practices' known as 'paradigms' (Morgan, 2007, p49), others have found a way to successfully

merge and integrate the two. These once divergent methods may join to make a study more comprehensive, with the findings of one method corroborated by the findings of the other (Creswell & Hirose, 2019). This success may depend upon the two different research methods being conducted mostly apart, rather than together, whilst adhering strictly to their own sets of rules and guiding principles. On following these rules methodically, the result can be an increased depth and breadth of the overall research (Morse & Niehaus, 2016).

3.5 Research motivation and reflexivity

My motivation for exploring this topic stemmed from a number of experiences. As a mother and educational practitioner – including teaching Early Years Education courses and tutoring undergraduate and postgraduate university students in Psychology, Education and Public Health – I have long held an interest in the potential impacts of childbirth on infant and child behaviours. I discussed this issue over many years with mothers and midwives I knew, and those I met at mother and baby groups or later in educational settings. Responses were always interesting and diverse. I came across individuals who agreed – and many who disagreed – with the possibility that childbirth might affect the infant's temperament or behavioural style.

As an on-call part-time early years and primary education teacher for much of the duration of this research, I was also privileged to experience working closely with different children from a diverse range of nurseries and schools, and to witness staffroom conversations about how socio-emotional and behavioural problems in children have increased over the past decade. There may be multiple factors contributing to this supposed increase in behavioural problems, including rising child poverty and increased disparity between the social classes along with fewer long-term parent partnerships. Furthermore, nurseries are now widespread, and young infants are separated from their parents from as early as six weeks, in contrast to countries like Sweden where nurseries only cater for infants aged one-five. However, it is perhaps possible that the rise in birth interventions plays a part. I also worked for several years at a school for children with special educational needs (SEN), with physical and behavioural disorders as diverse as cerebral palsy, ADHD and autism. Interestingly, a disproportionately high ratio of the children were reported to have experienced a challenging birth with obstetric complications. While disorders such as cerebral palsy have obvious links to their circumstances of birth (e.g. foetal hypoxia), others are less immediately obvious.

My initial interest however was sparked by the easy hospital waterbirth of my second baby after a brief, tranquil and supported labour. This was in stark contrast to a long and complicated first birth which had included neglectful care, a cascade of interventions, fear for all involved, an ambulance journey from a small rural midwife led unit (MLU) to the nearest hospital, and a rotatory forceps delivery, by which stage my partner was convinced that either the baby or I were going to die. Our daughter was born with a large bulbous red bump on her head, understandably cried for the first few days, and became a fairly demanding and unsettled infant. As a new mother, I was immensely grateful to the doctors and kind, helpful midwife who had eventually 'saved me', although I also felt in pain, disempowered and somewhat disappointed.

In contrast, after her relatively easy and straightforward waterbirth, my second child smiled within moments of being born, breastfed instantly, and soon became settled and easy to care for. I felt empowered and euphoric for several months following my positive experience and began to question how the two births could have been so dissimilar, with such different outcomes for myself, our new family and the babies. I felt that my second birth had benefitted from a highly supportive atmosphere with actively encouraging midwives and the availability of a birth pool; and also, that my postnatal mood had been affected by each birth experience.

After the second birth, my curiosity about what I had experienced the first time around inspired me to begin researching childbirth and the factors that may influence a mother's experience including: experiencing lack of control (Ayers et al., 2016; Philbin & Schiller, 2019); 'Valsalva' pushing techniques (Sandström et al., 2017), although the evidence on these is inconclusive (Lemos et al., 2017); routine interventions such as artificial rupture of membranes (ARM) or episiotomies (Handa et al., 2012); and continuity of carer, which had been highlighted as a major future aim by the controversial government white paper Changing Childbirth (Department of Health, 1993). This research fuelled my interest further as I discovered that many of the difficulties I had experienced during my births, such as continuous electronic foetal monitoring (EFM), being offered ARM to 'speed up' labour or encouraged to accept commonly used pain relief medications such as pethidine, had often had their effectiveness called into question (NHS England National Maternity Review, 2016; WHO, 2018). It was clear that research evidence could take a long time to filter through to practice.

My own experiences of childbirth had undoubtedly played a role in directing my preliminary investigations in this field as I was drawn to reading papers that resonated with both my positive

and negative birth experiences. Consequently, when the opportunity arose to begin this thesis, I did so with an increased awareness of the way in which personal interests can affect the way research is conducted (Chenail, 2011). Nevertheless, the sharp contrast between my two very different experiences, combined with my understanding of the diversity of others' birth experiences, had taught me that birth can be either an uplifting or traumatic experience, at once empowering and disempowering as the woman embarks upon her new journey into motherhood. This thought enabled me to conduct the interviews with an open and curious mind.

However, I recognised that my keen interest in the subject may have increased my bias. Therefore, I took steps to mitigate this effect. Semi-structured interviews and thematic analysis appeared to be the most appropriate tools for carrying out exploratory qualitative studies, as they would allow the free flow of thoughts, beliefs and opinions while ensuring the credibility of the findings through checking interpretations directly with the participants (Lincoln & Guba, 1985). The nature of the open-ended questions such as *'Tell me about your birth'* or *'Tell me about your baby's behaviour'* meant that mothers and maternity care providers could talk for extended periods of time without much external input other than words or nods of encouragement, with follow-up questions utilised where needed to understand the interviewee's point of view more fully. Closed questions and transmitting personal opinions were avoided (Chenail, 2011). In this way, the risk of researcher bias was reduced.

The analytical process was described in detail to increase the credibility and confirmability of the first two qualitative studies. A second coder (first supervisor AB) examined and discussed the interview transcripts and data analysis, and a consensus was reached. Lincoln and Guba's (1985) standards of 'trustworthiness' were met through following their criteria of credibility, transferability, dependability and confirmability, as detailed further in Chapter Four.

Similarly, in planning the survey, care was taken to ask no leading questions. Instead, options were given for an array of responses. When analysing the data, the aim was to fulfil the quantitative criteria of reliability and validity by meticulously checking all data against the appropriate methods of analysis along with their assumptions of validity (Howell, 2008; Field, 2009). This empirical quantitative approach is viewed as scientific, objective and rational (Carr, 1994; Denscombe, 2010). It ensures validity and reliability through rigorous clarification of aims and statistical methods of analysis (Ochieng, 2009). It is potentially less open to ambiguities and therefore the most appropriate way to validate previously constructed theories. Once again, a second analyst (second supervisor CW) examined the procedures and results.

Public and Patient Involvement

Public and patient involvement (PPI) is increasingly used in health and social research (Boivin et al., 2018; Wicks Richards, Denegri, & Godlee, 2018) as it can improve the quality and relevance of a study through consultation with pertinent members of the public and patients. Given the exploratory nature of the three studies in this thesis, as mentioned, the inductive and deductive questioning had to originate from somewhere (Morgan, 2007). Most of the objective physical and psychological research questions and statements concerning childbirth, maternal mental health and infant temperament were based on pre-existing literature. However, subjective statements – such as those concerning maternal thoughts and feelings during childbirth and the wider perinatal period – had their origin in earlier conversations between the researcher, mothers and health professionals. For example, in informal discussions that took place over several years, the researcher asked many other mothers how they had felt during and after childbirth and whether they believed their baby had been affected in any way by the birth. As well, midwives and health visitors were questioned whenever the opportunity arose to discover whether they perceived any connection between childbirth and infant behaviour. In this way, PPI stimulated and enhanced initial research ideas and, in combination with personal experiences, generated the concept that the birth experience may influence infant temperament.

To conclude, while personal experiences might have influenced this thesis in some way, efforts were made not to guide participants in any particular direction. Moreover, all qualitative and quantitative analytic procedures were carried out with the utmost care and concern for their accuracy. This was to ensure a genuine contribution to the existing evidence concerning the potential impacts of childbirth experience on young infant temperament or behavioural style.

The three studies incorporated in this thesis are presented across Chapters Four – Six.

Chapter Four: Study One: Does childbirth experience affect infant temperament? Exploring the attitudes of maternity care providers

An adapted version of this chapter is published at:
Power, C., Williams, C., & Brown, A. (2019). Does childbirth experience affect infant behaviour? Exploring the perceptions of maternity care providers. *Midwifery*, *78*, 131-139.

Findings from Studies One and Two (Chapters Four – Five) were presented together at:
International Normal Labour and Birth Conference, Lancashire, 2nd – 4th October 2017
Brazelton Centre UK Conference, Cambridge, 21st September 2017
Society of Reproductive and Infant Psychology Conference, York, 12th – 13th September 2017

Chapter Four presents the first study in Part One of the thesis: the initial exploratory section. Study One is a qualitative semi-structured interview study using thematic analysis to explore maternity care providers' perceptions of whether childbirth might influence infant behaviour (e.g. how calm or unsettled an infant is); and if so, what the potential mechanisms behind this could be. It therefore explores the experiences and perceptions of midwives, health visitors and doulas, who all work closely with women during labour and childbirth.

4.1 Background

In the UK, the number of women experiencing 'normal' birth is debated, with the Royal College of Midwives (RCM) quoting figures ranging from 19.9 to 40% (RCM, 2016). As detailed in the literature review, the physical impacts of a clinical birth on mother and infant are well documented (Hansen, Wisborg, Uldbjerg & Henriksen, 2008; McIntyre et al., 2013). While sometimes lifesaving, procedures such as induction and caesarean sections are occurring at a much higher rate than a decade or two ago (Gov.wales, 2018; Gov.uk, 2018; NMPA, 2017).

These interventions entail risk, and normal birth is therefore associated with better physical health outcomes for both mother and infant (Lydon-Rochelle, Holt, Martin, & Easterling, 2000; Hansen, Wisborg, Uldbjerg, & Henriksen, 2008; McIntyre et al., 2013; WHO, 2018). Furthermore, a complicated pregnancy or birth experience can increase the risk of developing postnatal depression (Fisher, Hammarberg, & Baker, 2005) or post-traumatic stress disorder

(Ryding, Wijma, & Wijma, 1997, 1998; Ayers, 2004; Ayers et al., 2016), which may disrupt mother-infant bonding (Rowe-Murray & Fisher, 2001; Stein et al., 2012; Cooper, De Pascalis, Woolgar, Romaniuk, & Murray, 2015). In turn, this could lead to the formation of insecure attachments and impaired cognitive and emotional development (Cooper and Murray, 1998; Murray et al., 2014; Feldman, 2017).

Limited research has explored whether childbirth could influence infant behaviour, highlighting how obstetric complications are associated with unsettled behaviour in the days after birth (e.g. James-Roberts & Conroy, 2005; Douglas & Hill, 2013). There are several reasons why this is believed to occur, including possible residual pain or distress in the infant from procedures such as forceps or medications used during labour (Taylor et al., 2000; Ransjö-Arvidson et al., 2001; Brown & Jordan, 2013). High cortisol levels circulating during labour might also overstimulate an infant's hypothalamic–pituitary–adrenocortical (HPA) axis, leaving them in a state of arousal and potentially altering their future stress response (Douglas & Hill, 2013).

However, how the subjective maternal experience of childbirth might indirectly affect her baby's behaviour has yet to be fully considered. We know more broadly that a difficult birth can affect maternal mood (Ford & Ayers, 2009), and maternal mood may alter perceptions of infant behaviour (McGrath et al., 2008); depressed mothers can struggle to bond with their infants (Figueiredo et al., 2008), and infants may sense negative maternal mood, becoming more unsettled (McMahon, Barnett, Kowalenko, Tennant, & Don, 2001). Wider factors such as the birthing environment and support (Horsch & Garthus-Niegel, 2019) or the mother's personality (Johnston & Brown, 2013) may also play a part in birth outcomes.

Consequently, although childbirth experience may have a physiological impact on the newborn, and there appear to be psychological pathways via which it could also affect infant development, little research has directly explored whether or how ongoing infant temperament and behaviour might be affected. Therefore, the first step in the research was to explore whether those who observe women in childbirth and their infants on a daily basis perceive any connection between the birth experience and early mother or infant behaviour.

Hence, the aims of Study One were to discover whether, and if so how, maternity care providers perceived birth to affect infant behaviour or influence maternal perceptions of and interactions

with her infant. Study One therefore sought to begin informing the main research question – *Does childbirth experience influence maternal perceptions of infant behaviour?* – in addition to the first two sub-questions:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?

4.2 Methods

Design

Semi-structured interviews with open-ended research questions were chosen as the most appropriate, flexible tool to explore and identify topics for subsequent quantitative anaysis (Breakwell, 2006; Breakwell & Rose, 2006; Wilkinson, Joffe & Yardley, 2004). This approach was favoured for initial exploration as, while questionnaires are sometimes used to gather open-ended responses (Fife-Shaw, 2006), they are predominantly a tool for more closed questioning of participants (Wilkinson, Joffe & Yardley, 2004, p42). Hence, semi-structured interviews may help to identify topics for subsequent detailed examination and develop further research questions to test in a larger sample (Breakwell, 2006; Wilkinson, Joffe & Yardley, 2004).

This method of open-ended questioning aimed to encourage the free flow of thoughts, feelings, and beliefs without constraining or leading the participant (Breakwell, 2006; Wilkinson, Joffe & Yardley, 2004). Face-to-face implementation of the interview schedule enabled the use of unobtrusive visual cues such as eye contact and nodding (Breakwell, 2006); and for the interviewer to prompt for extended information on points of specific interest relating to prior research, such as obstetric complications and interventions or methods of pain relief.

Participants

Study One was designed and conducted in accordance with the principles of the 1964 Declaration of Helsinki (World Medical Association (WMA), 2013) and the standards set out in Codes of Ethics and Conduct guidelines by the British Psychological Society (BPS, 2018).

Swansea University Department of Psychology Ethics Committee granted ethical permission for the study on 15th December, 2014 (Appendix 1A).

Eighteen maternity care providers were recruited from Bristol, Swansea and West Wales, UK (see Appendix 1B for advertisement). Three types of care provider were chosen based on the extensive time they spend with mothers before, during and post birth, and according to the range of infants they oversee. These included eleven Midwives, who care for women and infants during labour, birth and postnatally (six hospital based and five community), four Health Visitors (who care for mothers and their infants after birth), and three Doulas (who provide emotional support to mother and baby during pregnancy, birth and beyond). Average years spent in professional practice were 14.94 (SD: 8.56) (range 1–36). Obstetricians and paediatricians were not included in this study as they are normally involved only in clinical births or births with complications.

Measures

A qualitative semi-structured interview schedule was designed to explore maternity care providers' perceptions of how the birth experience might affect infant behaviour. Briefing information was given alongside the consent form (Appendix 1C). This specified that there were minimal research preconceptions (Breakwell, 2006; Wilkinson et al., 2004) and asked participants for their honest experiences and opinions.

Maternity care providers also gave background information regarding their role in maternity care and the place and length of practice. The interview schedule asked two main research questions concerning the impact of birth on: (a) infant behaviour, and (b) maternal feelings and behaviour towards her baby (see Table 2). These were designed to be broad and to illicit discussion around the potential mechanisms for any impacts of childbirth upon maternal and infant behaviours. However, on the whole participants needed very few prompts as they spoke freely about possible pathways between childbirth experiences and mother-infant outcomes.

Table 2 Semi-structured interview schedule

Background questions:

1. How long have you been a practicing midwife / health visitor / doula?
2. What setting do you currently/have you previously worked in?

Research questions:

1. In your opinion, how if at all do you think a baby's behaviour may be influenced by his or her experience of being born?
2. In your opinion, how if at all do you think the experience of childbirth affects the mother's feelings and behaviour towards her baby?

Example prompts:

1. How common do you think that is?
2. Is it at all affected by the postnatal environment?

Procedure

Data collection took place between January – September 2015. Participants were recruited via adverts placed in health centres, the Human and Health Sciences Department of Swansea University, and in mother and baby clinics in South West Wales and England. Interested participants contacted the researcher for further information and, if interested, a convenient time and location was arranged to conduct the interview. Prior to interview, all participants read a study information sheet and provided their informed consent (Appendix 1C). As interviews would be audio recorded in addition to note taking, this included granting permission to use a Dictaphone.

Participants were requested to speak as much as they wished. The open-ended questions allowed midwives, health visitors and doulas to fully explore their experiences, attitudes and beliefs around the topic of childbirth and infant behaviour. To obtain varied and genuine responses to the questions, participants were asked to base their answers on personal experience rather than on any current research. All participants were thanked and debriefed after the interview, and any questions they had regarding the purpose of the study were answered.

Data analysis

All interviews were transcribed in full and any identifying information was removed. Confidentiality and anonymity of participants were ensured by allocation of a number in place of their name, together with their working title (midwife, health visitor or doula). Scripts were explored in detail and thematic analysis was performed on each script, documenting themes and subthemes where they arose (Braun & Clarke, 2006; Fereday & Muir-Cochrane, 2006).

Qualitative description techniques were used to summarise the data, extracting facts and meaning where they were given clearly by the participant (Sandelowski, 2000, 2010). This was chosen for its straightforward simplicity and to keep as close to the raw data as possible. In addition, an inductive content analysis, often used alongside qualitative analysis in public health research, was conducted to examine the number of health professionals raising each specific theme or subtheme (Elo & Kyngäs, 2008) (see Tables 4 & 5 in results section).

Thematic analysis

Braun and Clarke (2006) define thematic analysis as a flexible method for identifying, analysing and reporting themes within qualitative data, which can provide a detailed and complex record of that data. According to these authors, the researcher always plays an active role in selecting, analysing and reporting themes. Braun and Clarke's (2006) six phases of thematic analysis were followed systematically:

1. Familiarising self with the data – transcribing, re-reading and noting initial ideas
2. Generating initial codes – coding interesting features across data set and collecting data relevant to each code
3. Searching for themes – collating codes into potential themes and gathering data relevant to each theme
4. Reviewing themes – checking if themes work in relation to coded extracts and the whole data set; reviewing data for additional themes, and drawing up a thematic map or table
5. Defining and naming themes – refining the process by further analysing each theme, generating clear names and definitions
6. Producing a report – selecting extracts from data for each theme; final analysis of each theme; and finally, relating analysis back to the research question and the literature

In this study, a mix of researcher theories and observations were used to extract the dominant themes. Repeated horizontal and vertical progressions were made through the data. Themes were constantly refined and divided into subthemes, coded, and recoded during each data reading until every theme was adequately coded and reported. Supporting passages were quoted to highlight the findings. The thematic analysis was carried out and written up using qualitative description, reporting participants' own reality and experiences as they were told (Sandelowski, 2000, 2010). The themes were chosen for three reasons: their connection to the research question, their importance to the participant, and their prevalence throughout the corpus data (Braun & Clarke, 2006). In this way, both inductive and deductive approaches to the data were used (Fereday & Muir-Cochrane, 2008).

To summarise, the raw interview data were systematically examined for emerging themes (Breakwell, 2006) which were identified, organised into codes, collapsed into broad codes and sub-codes, checked against the data, analysed, and finally reported (Braun & Clarke, 2006).

Coding

A code manual was developed following the coding principles of Fereday and Muir-Cochrane (2006). The initial template included two broad categories based on the research questions, followed by overarching themes that recurred throughout the data, for example ‘Relationships’. These were then divided into subthemes such as ‘with Partner’ and ‘with Midwife’. The themes, and subthemes were drawn up into tables for clarity (see example in Table 3). Credibility of themes and inter-rater reliability of coding were established through confirmation by a second coder (supervisor AB).

Table 3 Example of subtheme coding for the theme 'Relationships'

Code 1	
Label	Relationship with Partner
Definition	Partner's role in birth process
Description	How MCP considers the partner's role, e.g. present/absent; supportive/unsupportive.
Code 2	
Label	Relationship with Midwife
Definition	Midwife's role in birth process
Description	How MCPs consider midwife's role, e.g. present/absent; supportive/unsupportive.

Note: MCP = maternity care provider

The data that arose deductively from the two main interview questions were given headings:

1. **Infant response**: Impact of birth on infant behaviour
2. **Maternal response**: Impact of birth on maternal perceptions of and interactions with her infant

Themes and subthemes were placed beneath these two overarching headings in the initial coding tables. A definition was written for each coded theme and subtheme plus a brief description of how to recognise when it occurred. Key words and phrases used by maternity care providers were also noted and categorised. Where possible, participants' exact words were used as theme or subtheme headings and descriptions, for example 'Baby Mirrors Mother'. Relevant coded extracts of data were matched with specific themes, with some codes fitting more than one particular theme (Braun & Clarke, 2006).

To summarise, the raw data were transcribed, coded into themes and subthemes, and then thematically analysed using qualitative descriptive techniques (Sandelowski, 2000, 2010). Participants rather than the researcher interpreted the outcome of events in terms of their perceptions regarding influences of childbirth experiences on maternal and infant behaviour. The process of analysis stopped only when the data were fully understood, as recommended by Breakwell (2006). While recognising the limitations of a small sample, themes and subthemes were also counted to gain a picture of dominant themes that occurred across participants.

Trustworthiness

The four measures of Lincoln and Guba's evaluative criteria (1986) were adhered to as closely as possible in a qualitative research study of this sample size to help ensure the trustworthiness of the research findings. Credibility in the truth of the findings was established by using a meticulous and systematic approach to recording the data (Lorelli, Norris, White, & Moules, 2017) and by continuing the research until similar observations, beliefs and opinions began to appear. The results were considered dependable and insightful due to a rigorous data analysis process using logical, clearly documented and validated methods of coding and description (Braun & Clarke, 2006; Sandelowski, 2000, 2010; Lorelli et al., 2017). They were confirmed as trustworthy by the involvement of a second analytic coder, and fully disclosed for readers to make their own judgement. This detailed analysis meets Lincoln and Guba's criteria of 'thick description' (1986) – therefore transferability could apply to similar contexts. Thus, the results were confirmed as being clearly derived directly from the data by strict adherence to Lincoln and Guba's definitions of credibility, transferability and dependability (1986), and by following the 'Means of Establishing Trustworthiness' by Lorelli et al. (2017).

4.3 Results

Eighteen health professionals and childbirth supporters (maternity care providers) completed interviews, including eleven midwives, four health visitors and three doulas, as detailed above under 'Participants'. Due to the semi-structured nature of the interview, discussions lasted from twenty minutes to approximately one hour. A total of six overarching themes with seventeen

subthemes were established (Tables 4 and 5). Themes and subthemes are reported and highlighted by relevant extracts under questions asked of the data. The terms 'maternity care providers' and 'health professionals' are used interchangeably throughout.

Table 4 Thematic analysis of birth impacts on infant behaviour

Theme	**N**	**%**	**Sub-theme**	**N**	**%**
Physical Birth Process	17	94	Normal birth	6	33
			Interventions	15	83
			Hormones	3	17
			Pain relief	8	44
Early Postnatal Moments	16	89	Baby mirrors mother	9	50
			Environment	8	44
			Events: *skin-to-skin, bonding, separation*	12	67

Table 5 Thematic analysis of birth impacts on maternal interactions with and perceptions of her infant

Theme	N	%	Subtheme	N	%
Birth Experience	18	100	Physical experience of birth	13	72
			Psychological experience of birth	15	83
Expectations and Postnatal Perceptions	8	44	Birth process	7	39
			Breastfeeding	1	6
			Mothering	6	33
Relationships	16	89	Birth: partner/midwife	7	39
			Postnatal support	9	50
			Relationship with baby	6	33
Postnatal Maternal Wellbeing	13	72	Impact on baby	11	61
			Opportunity to talk	5	28

Note: Perceived impacts are in expected direction with one exception – one midwife believed that a difficult birth could make a mother more conscientious regarding bonding with her baby

The findings were considered under two key questions:

Question One. Do maternity care providers believe infant behaviour to be directly affected by their birth?

Maternity care providers' beliefs regarding the possible impacts of childbirth on infant behaviour were explored by the first open-ended question: *In your opinion how if at all do you think a baby's behaviour may be influenced by his or her experience of being born?*

Almost all (94%) participants believed that the physical birth experience could influence infant behaviour (Table 4 above), although maternity care providers differed in opinion on the level of impact on infant behaviour they believed to be initiated by the physical process of birth. A straightforward birth was widely perceived to precede infants who were 'easy, predictable, settled and soothable', whilst a challenging birth was more often associated with infants who were 'difficult, tense, needy, fussy, unsettled, irritable, fractious and demanding'. Midwives remarked on the distinctive differences in early behavioural style of infants born calmly into water.

Furthermore, many maternity care providers appeared to believe the infant to be as receptive to the mother's feelings post birth as to any pain or medication that might be affecting them more directly. However, it was recognised that this effect was complex. Physiological processes during the birth could impact the infant, but infant behaviour may in turn affect how parents perceived and interacted with their baby.

> *"The birth does affect the baby and then of course it does have, you know, an effect on the physical and mental wellbeing and the stability of the family as well so that affects how the baby's being cared for and how, you know, they generally attach and bond with that newborn."* (Health Visitor 4)

Birth, although important, was considered one of many influential factors.

> *"I think it's easy to assume that the birth experience a baby goes through has a huge impact on its temperament or its behaviour after that point or its feelings when actually it's one of many elements I think."* (Midwife 7)

Two broad themes were established relating to potential mechanisms by which it was considered that birth might affect infant behaviour: (1) the physical birth process and (2) early postnatal experience (Table 4).

Theme One: ***Physical Birth Process***

The physical experience of being born and the occurrence of complications and interventions were widely recognised as factors that may affect neonatal behaviour. According to some health professionals, however, birth could be a 'traumatic' time for the infant regardless of whether it was a spontaneous or induced labour and whether it was a normal physiological, Caesarean section or assisted birth (by forceps or ventouse).

> *"The actual preparation and nature of the labour really is its head has been used as a battering ram, so the babies are quite traumatised by what we would perceive as a quite normal delivery."* (Health Visitor 4)

a) Normal birth

Health professionals perceived physical events during childbirth to potentially affect neonatal behaviours. 'Normal' spontaneous physiological labour and birth were considered more predictable and less traumatic for the baby, and infants were said to be more 'settled' and less likely to cry or fuss after a normal birth without any interventions or medication. A normal birth was therefore felt to be protective, allowing the infant a calmer entry into the world.

> *"I think there's something about the natural experience of the progression of labour I think which is somehow a bit more predictable for a baby than sudden onslaught of induction."* (Health Visitor 1)

Waterbirths were also frequently perceived as being calm and gentle for the baby, exerting a positive effect on newborn behaviour.

> *"Yeah, I mean a lot of the time you do see babies that are born, particularly in water, they do seem very settled. It's almost like they haven't realised that they've been born..."* (Midwife 11)

A midwife of thirty-six years of professional experience also noted how a positive birth experience could benefit the whole family.

> *"A lot of women that have nice normal uncomplicated births or waterbirths, quite often that relaxed atmosphere does have a relation to how settled the baby is afterwards. It has a massive effect on the parent's ability to bond with the baby as well. So, outcome of delivery and birth experience I think cannot be underestimated really."* (Midwife 1)

Another factor raised within normal physiological birth was how quickly the birth occurred. Although long, complicated births with high levels of intervention were felt to lead to a more demanding infant in greater need of 'comfort' or 'containment', the concept of a shorter birth being problematic was also raised. According to some, a newborn infant could be shocked not only after a long, 'drawn out' or difficult delivery, but also after one that was too fast, whether spontaneous or medically induced.

> *"It seems to be more of the quick delivery ones that seem to sort of arrive in a state of shock… because they sometimes perhaps are a little bit more fretful, and sometimes perhaps a little bit more difficult to feed."* (Health Visitor 3)

b) Interventions and other factors influencing infant behaviour

Interventions during labour – particularly instrumental deliveries – were commonly seen as having a noticeably negative impact on the infant's physical and behavioural wellbeing.

> *"There are obvious cases where if the baby's been pulled out by forceps and had a shoulder dystocia on the way, and come out with literally birth trauma, you know, a massive bruise on its face and a palsy and a broken clavicle, then clearly that baby is going to be uncomfortable and probably fractious and probably not feed well, and of course a baby that is born prematurely and needs to be put into an incubator rather than to be put on its mum, is clearly going to have a very different experience to a baby that's born naturally and has uninterrupted skin to skin and breastfeeds, you know, for the first six hours. In those cases, clearly the birth experience that a baby goes through affects what it then goes on to experience and how it then behaves."* (Midwife 7)

Some health professionals considered negative birth effects to diminish within a few days, whereas others thought it may take longer and could be facilitated by sensitive care. Plenty of skin to skin contact, ideally between the mother and baby, was believed to mitigate the impact of a traumatic birth.

> *"Some effects will continue for a long time afterwards, I think, in terms of trauma… Holding them, picking them up and touching them when they have a headache or they've been pulled out and they've got obvious bruising – they can find that very painful. They don't want to be handled or feed but actually sometimes they just need to be with their mum or their dad skin to skin and that can be in itself very soothing."* (Midwife 6)

One midwife spoke of pain and potentially long-term damage caused by forceps or ventouse deliveries, including *'stretching nerves'* and *'affecting other systems in the body'*. Another spoke of infants who were *'very difficult to settle and crying and in quite a bit of distress'.*

> *"I do feel that they don't often take the baby into account in the birth process, even though the doctors will say, you know, 'Your baby's at risk if we don't take you to theatre or we don't induce you,' or whatever. And I see babies, you know, with broken clavicles, and humorous, and when they do all those interventions it's sort of said that it's the best for the baby but actually I don't know. As I say, I don't think they'd do a lot of those things if the baby was out of the uterus… Babies that have had really difficult births can be really, really hard to settle and grizzly."* (Midwife 6)

Some health professionals considered babies born by Caesarean section (CS) to be calmer and more settled, while others believed that the shock of being 'whipped out' could pose adjustment difficulties in addition to the respiratory problems that can occur after a planned CS. An emergency CS occurring after a long and difficult labour was considered traumatic for both mother and infant, while several participants regarded this trauma as a more temporary state if the right postnatal care was given – Sensitive and supportive care were believed to help mother and infant overcome any birth trauma.

> *"When you're looking at complications, interventions such as ventouse delivery, forceps delivery, um you know, babies presenting with low Apgars and cords round their neck, and Caesarean sections, heart dips and so forth, you know, trauma in the*

last couple of minutes of the delivery, obviously that is going to have some sort of impact on the way the baby is." (Health Visitor 4)

The position of the baby in the womb was also felt to play a role, especially if they were lying in an awkward position for some time or if the waters had broken. Malpositioned infants may be more likely to experience a long labour or an assisted delivery leading to pain.

"So, whether, you know, even if the baby's not had an instrumental delivery it can perhaps, you know, it can be in a slightly awkward position in pregnancy or birth. It means it comes out and has a bit of a neck ache and a bit of a headache." (Midwife 7)

c) Hormones

Hormones such as oxytocin are known to play a vital part in the birthing process and afterwards, and health professionals considered them to affect mother and infant in equal measure through their influence on bonding and attachment and feeding behaviours. Some health professionals mentioned the possibility of a missed opportunity to 'build up' the positive birthing hormones during a complicated or very quick delivery, such as a Caesarean section.

"It's like a dance between the mums and babies, both of them, but if the baby hasn't had any of that, you know the hormones or any of the adrenaline, any of the head moulding or anything else that happens in the process of birth and it's just whipped out, then I think it could affect them." (Midwife 6)

Maternal stress hormones such as adrenaline and cortisol were considered to disrupt the newborn's ability to respond socially to its parents and to initiate and continue breastfeeding.

"We know that cortisol then is passed through into the bloodstream of the baby, because obviously the baby's still inside, and whatever birth experience if there's been a trauma of sorts then the adults will be experiencing stress, and babies are very much in tune with stress and stressors." (Health Visitor 4)

d) Pain relief

Pethidine and bupivicaine (used in epidurals or spinal blocks) were the types of pain relief most often mentioned by Health professionals. Pethidine in particular was said to depress the infant's respiratory system while making the newborn sleepy, fretful and uninterested in interacting with its parents.

> *"Things like pethidine for pain control, you know, they're quite strong opiates… those babies can be quite difficult to attach onto the breast for instance, they're quite sluggish, you know, because of the effects of the drugs, so there are definite physical effects that can affect a baby's attachment and behaviour."* (Health Visitor 4)

Pain medication was also felt to impact negatively on infant feeding, leading to feelings of guilt and inadequacy in the mother if breastfeeding then proved problematic.

> *"The baby's sleepy and uninterested or just irritable after the birth… Nowadays everyone ends up expressing and syringe feeding the babies which is disempowering for the mothers and their ability to breastfeed… The mothers may get really distressed if they feel they can't feed their baby, and the baby picks up on their distress and so the baby gets distressed."* (Midwife 10)

Conversely, infants born without medication were thought to exhibit more calm and alert behaviours immediately after birth, rendering them easier to feed and to bond with.

> *"Mothers who have calm relaxed births without drugs tend to report back that they have calm babies. Pethidine goes directly through the placenta barrier to the baby."* (Midwife 10)

These responses were fairly consistent and indicated the general consensus that birth can have a direct physiological impact on the neonate's behavioural style.

Theme Two: *Early postnatal moments*

The second theme identified events immediately after childbirth, such as the mother's response to birth, skin to skin contact and the postnatal environment, as potentially also affecting newborn behaviour. Many maternity care providers highlighted the importance of adequate

professional and social care to facilitate maternal-infant wellbeing, bonding, breastfeeding and social adjustment to motherhood.

a) Baby mirrors mother

Participants discussed how infant awareness of maternal emotions appeared to be reflected in their behaviour. If mothers were stressed, the infant may become unsettled, possibly affecting bonding and attachment between mother and baby.

> *"You can see the baby mirroring how the mother's feeling, and we see it often, so there's this baby that's basically living on his nerves – very twitched, very insecure, hates being put down, very rarely settles, almost on alert, you know, not quite sure what's gonna come next. And even in the mums who haven't had a hugely traumatic birth, if their anxiety levels are high after, and they've just got general worries, concerns, anxieties, even that you can see in a baby's behaviour."* (Health Visitor 3)

Newborn infants were considered social creatures, seeking out contact and interaction with their mother. If mothers struggled to engage and respond to this, some participants believed that infants could also become withdrawn, mirroring their mother's behaviour.

> *"Mums who are, you know, postnatally depressed, and not able to give the non-verbal contact to the baby, we know that those babies shut down quite quickly… A lot of people are oblivious to the fact that babies are very attentive to communication and stimulation in the early months. People can be very naïve as regards to the fact that, you know, they kind of think that the baby just eats and sleeps…"* (Health Visitor 4)

Equally, infants were thought to respond well to positive maternal states.

> *"Laid back mothers do tend to have easier deliveries and more laid back babies."* (Midwife 11)

b) Environment

Many participants also felt that the infant responds to its birthing and postnatal environments. If the birthing atmosphere was tense, they observed the infant to react accordingly.

"If the baby's expecting a calm environment and entering real panic and anxiety you can understand why they get stressed." (Health Visitor 3)

"I think we underestimate how much they pick up on atmosphere, you know, and how raised voices and the environment generally raised, bright lights and, you know, stressful environment; I think they clearly, very clearly respond incredibly to a calmer environment, dimmed lights, not too much noise." (Midwife 7)

c) Events

Postnatal events such as skin to skin time, bonding or separation of the new family were often believed to affect mother and infant almost as much as the birth itself.

i) Skin to skin

'Skin to skin' contact between mother and infant was perceived as a calming, soothing influence, supporting both infant and maternal wellbeing after a difficult birth. Skin to skin time between mother and baby immediately post birth was also seen as the ideal transition for the newborn, irrespective of whether the mother intended to breastfeed.

"I still think we've got a long way to go because I think that skin to skin is linked too much to feeding, and actually all babies benefit from skin to skin whether they are gonna breastfeed or not, because… it's more about easing that transition, and, you know, exposing the baby to all the good bacteria, calming it…" (Midwife 7)

ii) Bonding

Some health professionals mentioned that skin to skin might aid the mother's recovery as much as the infant's after a challenging birth. This was thought to extend through the postnatal period, helping the mother to process her birth, enabling her to bond with her baby while soothing her nervous system after a difficult time.

"The mothers who are battling with postnatal depression, with detachment, distance from babies, I always make sure with them, you know, I'm saying, 'You do skin to skin as often as you can' because in my head I think if I can get some oxytocin going somewhere, you know, maybe that mothering instinct to want to hold, to nurture, love,

care for, protect, will kick in and override all of that cortisol and whatever else is swimming around her brain." (Health Visitor 3)

Similarly, 'skin to skin' was seen to help the infant bond with their mother – bonding and attachment were said to be two-way processes. Moreover, allowing infants skin to skin access to use their senses to get to know their mother was felt to be both calming and healing. If a mother was temporarily incapacitated by the birth or medication, paternal skin to skin was raised as a positive alternative to relax the infant and encourage infant-father bonding.

"Bonding is a two-way process – we always talk about mothers bonding with babies. What we don't talk about is that babies bond with their mothers. They need to be able to use their instincts, which at birth are primarily touch and smell. And if those have been dampened by drugs, they're not going to be able to bond with their mothers." (Doula 3)

iii) Separation

However, mothers and infants were said to be frequently separated in the early hours due to maternal exhaustion or the hospital environment. Separation could also be for quick physical checks or a visit to the neonatal intensive care unit (NICU). Health professionals considered separation sometimes unnecessary and avoidable, and potentially damaging to the new dyad.

"The idea is that babies always stay in the same place as the mothers while they're in hospital, but again if, maybe not because of the trauma, maybe not because of the birth itself, I think because of the hospital environment which is quite a sort of noisy, disruptive environment, you find a lot of mums do end up having babies taken away at night. So sometimes babies will come out and stay with the midwives over night for one or two hours which does give the mother time to sleep but it's still a separation." (Midwife 3)

It was acknowledged that infants wanted to be close to their mother, and separation could make them fractious or distressed.

"The baby hasn't read the book (laughs)… so they're going to want to sleep with you and want to feed every hour and a half and they're not going to want to be put down." (Health Visitor 3)

One midwife claimed sadness at seeing a newborn in hospital *'in a fish-bowl'* across the room from its mother (Midwife 5). As well, a doula quoted a mother saying after the birth, *'Everyone held my baby before me.'* (Doula 3).

Question Two Do maternity care providers believe that a mother's experience of childbirth might indirectly affect her infant?

Maternal emotional and behavioural response to childbirth was explored by the second open-ended question: *In your opinion how if at all do you think a mother's experience of childbirth affects her feelings and behaviour towards her baby?* Here, the concept of maternal birth experience as affecting her behaviour towards her baby, and subsequent observations regarding infant response and behavior, were explored.

Theme Three: *Birth experience*

Every participant believed that the mother's experience of childbirth could influence her perceptions of, and interactions with, her infant. Within this, 72% (n = 13) considered the physical impact of a difficult birth to be significant and 83% (n = 15) discussed potential emotional consequences (see Tables 4-5).

a) Physical experience of birth

Maternal feelings and behaviour towards her baby were thought to depend in part upon the physiological nature of her birth experience. Whether the birth was spontaneous or complicated was felt to contribute to maternal outcome, which could then affect aspects of infant care. Midwives suggested that maternal pain and exhaustion, often increased by physical interventions, may affect her interactions with her baby, including her feeding decisions. This could therefore have a negative impact on early breastfeeding and bonding behaviours.

> *"If birth does involve a lot of intervention or has been a very long or exhausting process, I think women will often find themselves too physically exhausted to interact with the baby as much as they would have liked to and I witness that a lot, especially after a Caesarean section, the physical exhaustion can be quite sort of detrimental*

and they can be much more likely to want the midwife to take the baby, or more likely to bottlefeed as well rather than breastfeed." (Midwife 3)

Hormones were also felt to play a role. Oxytocin, which was associated with a normal, straightforward birth, was considered particularly important in supporting the bonding process, enabling the mother to care sensitively for her baby.

"Oxytocin is probably far more important than we really think… It's actually extremely important for the fourth trimester (after birth) where oxytocin is needed for mother and child bonding, promoting breastfeeding, promoting motherly love, which is ultimately a survival mechanism for the baby." (Doula 3)

b) Psychological experience of birth

Psychological factors after birth were also felt to adversely affect breastfeeding and bonding, potentially leading to self-blame and guilt, and possibly postpartum depression (PPD) or post-traumatic stress disorder (PTSD). Maternal emotional states were generally assumed to be negative if the birth was difficult, although some midwives also mentioned the potential shock of a spontaneous birth. As well, participants believed that the mother's psychological experience could affect her baby. Health professionals used emotive words such as 'resentment, grief, battling, trying to cope, isolation, desperation, sadness, and self-blame' to describe how a traumatic birth might affect the mother. Many felt that such negative emotional states highlight the vulnerability of the new mother and could adversely affect mother-infant interactions. Nevertheless, the mother's psychological response to her birth was thought to depend on many factors including her character and the emotional support she is given during and after childbirth. Participants also felt that complications might reduce maternal confidence in her body and herself, consequently affecting her feeding and care behaviours.

I think if they've had a difficult birth then it might knock their confidence, inevitably, so their faith in their body, their ability to maybe breastfeed, and their ability to care for the baby." (Midwife 6)

In contrast, a positive birth experience was felt to empower the mother, allowing her to feel more in control during and after birth. A mother who felt fully informed, and who was

consulted before any birthing decisions were made, was thought to fare better emotionally, enabling her to feel confident in her ability to care for her baby, thus facilitating attachment.

> *"I think if women have a positive birth experience then they're more likely to feel really good and empowered so I think they'll probably feel more confident about their ability as a mother to start with."* (Midwife 6)

> *"If she's felt involved and empowered in her birth, she takes the baby into her life."* (Doula 2)

However, some participants emphasised that the birth experience did not always affect maternal behaviours. Maternal resilience was believed to override complications in some instances, with mothers able to birth and care for their infant regardless. Words such as 'stoicism' and 'ability to cope' were used to describe a mother's natural resilience influencing her response to birth, regardless of birth mode.

> *"I always think that women who seem to do really well, and carry on doing really well, are just like the ones who just accept everything they have to do. They have to give birth to their child and so they feel confident in their ability and they just do it, and it just seems to flow. They seem to deal with everything quite well really."* (Midwife 5)

Theme Four: ***Maternal expectations and postnatal perceptions***

An important element of a mother's perceptions of and interactions with her baby was felt to be her expectations of the birth and postnatal experience. Many participants spoke of the frequent disparity between maternal expectations and experiences, which they believed could cause a mother to feel '*disappointment, guilt, grief*' or even '*traumatised*', potentially impacting negatively on the new mother-infant relationship.

> *"There are times when women can be quite taken by surprise by the trauma of birth and can find themselves in a bit of a place they didn't expect to be"* (Midwife 3)

Maternal expectations were believed to be linked to the birth, feeding, and more broadly to being a mother. Many health professionals considered modern cultural entities such as social

media to play a large part in forming maternal expectations of birth, feeding and mothering. These expectations prior to birth and motherhood could affect maternal perceptions post birth.

a) Birth process expectations

Maternal expectations of birth were considered to strongly affect how she felt post birth. While a positive experience matching her expectations could be empowering, a mismatch could leave her feeling demoralised, which may then affect her ability to care for her infant.

> *"I often think the preconceived ideas about how birth will go … heavily influence the experience … that also then has a huge influence on the parenting journey – how that is shaped and formed at the very early stages."* (Health Visitor 3)

b) Breastfeeding expectations

Expectations around infant feeding also mattered. One participant highlighted how mothers could sometimes feel like a failure if they struggled with breastfeeding, particularly when following their own or others' high expectations. This might influence how a mother felt about her baby and result in loss of confidence, which could be exacerbated by pressure from hospital protocols to breastfeed quickly or to persevere through problems.

> *"They used to be allowed to go 24 hours before feeding and now they say 6 hours, but if the baby's drugged up for the first 6 hours and not interested there's pressure on the mum to feed and then she gets upset with her baby."* (Midwife 10)

c) Mothering expectations

Mothering expectations were believed to arise via family, friends, culture and the media.

> *"I think (mothers) expect everything to be easy. I often call this the 'Next Baby Syndrome' – that's the way I look at it – you know, they flick through the 'Next' directory and see them all sitting there beautifully in their little clothes and peacefully and … It ain't like that!"* (Health Visitor 3)

Maternal expectations of motherhood were said to include a belief that she will feel 'instant love' for her newborn. Health professionals – namely health visitors and doulas who see more of mother and infant post birth – believed that this internal pressure could also lead to feelings of failure when it did not occur immediately, particularly when mother or infant were experiencing pain or medication effects after a more challenging birth.

> *"A lot of mums will say they expected to instantly fall in love with their babies and they didn't and they feel really guilty about that… but generally it's a relationship that builds and develops over time."* (Health Visitor 2)

In addition, participants discussed mothers' high expectations and subsequent disappointments regarding other aspects of mothering.

> *"In the real world having a baby can be one of the most traumatic experiences. I think, you know with modern life, people expect it to be happy and, you know, the most fantastic thing that's ever going to happen to them, and the reality sometimes can be very, very far from that."* (Health Visitor 4)

Theme Five: ***Influence of maternal relationships on mother and infant wellbeing***

Participants perceived the role of supporting a mother during childbirth as pivotal to her overall experience of birth, regardless of birth mode, and that maternal perceptions of this experience centre around how well she felt cared for during childbirth and postnatally. Maternal relationships during and after birth were also perceived to affect her feelings about herself and her baby. If she felt supported, informed, and cared for by those around her, including her partner, family and healthcare professionals, she would be empowered to care for her baby. Conversely a lack of support could leave her feeling detached and disempowered.

> *"She will be more traumatised by her experience if she feels unsupported or ill-informed."* (Midwife 10)

It was also felt that more 'individualised and sensitive care' would be ideal rather than the standard 'one-rule-suits-all' practiced on large maternity wards. Postnatal psychological care, both professional and social, was considered necessary to help mothers overcome birth trauma.

a) During the birth with partner and midwife

One key time point for such support was felt to be during the birth, from both her partner and midwife. Support could enable a better birth experience, which in turn would benefit the infant. Participants disagreed only on which relationship during birth was the most important – with partner or with midwife. One midwife specified good partner support: *'They approached it like a team.'* Others considered continuous professional support imperative.

> *"Without the support, it's very hard for women to have a really good experience. I do think it's a really pivotal thing to feeling confident as a parent… A birth isn't just creating a baby but creating a mother as well."* (Midwife 5)

b) Postnatally

Social and emotional support of the mother from healthcare professionals and family during the postnatal period were believed to be as crucial to the mother's emotional state as the birthing experience itself.

> *"Support that she gets postnatally from her partner, from her family, can all have a massive influence."* (Midwife 1)

However, while postnatal support from midwives was considered the ideal, it was not always available on busy postnatal wards. 'Essential' early support could therefore sometimes get deferred until mother and infant were home and able to have regular meetings with their health visitor. Professional support on the ward was defined as a protected space, practical guidance, or simply being present.

> *"If there was some way that women were, I don't know, allowed to have more peace on the ward, or there were more midwives at the bedside to make sure babies are feeding and settling properly."* (Midwife 3)

c) Relationship with her baby

Participants also discussed the importance of a mother's relationship with her infant. The birth experience was believed to sometimes affect how a mother felt about her baby – consciously

or subconsciously. A positive experience was felt to promote bonding and attachment, while pain and complications could potentially damage this. How well the mother and infant responded to one another after the birth was taken by many as a measure of successful outcome, and this two way process between parent and child was considered to be of paramount importance to infant wellbeing and development.

> *"Birth experience is vital, absolutely vital, pivotal, to that transition then into parenthood, you know getting that secure attachment early on."* (Midwife 6)

A difficult birth was mostly considered a negative influence on this process. The transition into motherhood was perceived to be more difficult if a mother was in pain, for example after a Caesarean section, episiotomy or medication.

> *"How can you feel connected to a baby that's caused you lots of pain and that's brought up issues for you… if you just feel disempowered, abused, mistreated?"* (Midwife 5)

Equally, a distressed infant in pain after a ventouse or forceps delivery was considered to have potentially negative consequences for bonding and attachment as the new mother may struggle to deal with her baby's distress. However, one midwife considered the possibility of a difficult birth aiding rather than deterring the bonding process. When mothers had felt scared for the wellbeing of their infant, the relief of them being here could possibly promote bonding behaviour.

> *"I'm just wondering maybe does a traumatic birth sometimes make the mother more – a bigger attachment because – I think it can make them sort of more keen to bond with the baby, more tactile and more attentive."* (Midwife 3)

Nevertheless, some maternity care providers mentioned that, given the right support, mother-infant bonding could take place regardless of the physical birth experience.

> *"I don't think it's necessarily that if she has a bad experience she doesn't bond with her baby, but it's about the care and support she receives during her birth and afterwards that actually affects her. If she's supported well, then there's no reason that she shouldn't bond with her baby properly."* (Doula 1)

Theme Six: ***Impact of postnatal maternal wellbeing on infant***

Overall maternal physical and emotional wellbeing during the postnatal period was felt to affect how well she coped with her new role as mother. As already discussed (see Baby Mirrors Mother above), while many maternity care providers believed that the infant's wellbeing and subsequent behaviour may be directly affected by interventions or medication, others considered the infant to be more affected by their mother's emotional state. They perceived stress or distress as contagious, the neonate experiencing life through its mother's lens, reflecting her physiological and emotional state of calm or anxiety postnatally.

> *"Babies are looking to mum for safety and security and then if she's not that safety net babies will think, 'If they're stressed I need to be stressed'."* (Health Visitor 3)

a) Impact on baby

Many participants also debated the potential direct and indirect consequences of childbirth affecting a mother's ability to care intuitively for her infant.

> *"Yeah if it's been a difficult birth you often see the mothers… it maybe takes a while to become in tune with the baby."* (Health Visitor 1)

Some believed this could affect the mother-infant relationship and subsequent infant wellbeing.

> *"I do worry about this idea that… her pain, her discomfort, her thoughts, her feelings about this whole process that's just gone on, and (she) is then handed this little baby who's completely dependent on her, and can just struggle with tuning in to what that baby needs because all of her wants and needs are all consuming almost. So, I do feel that it does impact hugely on that early days' relationship."* (Health Visitor 3)

b) Opportunity to talk

Participants, especially health visitors, often mentioned the benefits of postnatal debriefing. They felt that mothers should be able to discuss what happened during the birth and why certain decisions were made, particularly after a difficult experience. The chance to debrief was

considered vital to postnatal maternal wellbeing and a mother's ability to cope with her newborn. One health visitor spoke regretfully about an abolished debriefing service in her area.

> *"It was a way of getting rid of all this negative emotion."* (Health Visitor 2)

Another mentioned the usefulness of debriefing to mitigate future problems.

> *"I do worry about how we diagnose postnatal depression as the answer is, 'Let's use some pills to sort you out' whereas sometimes I think almost debriefing, and allowing mothers to just talk about the experience, and allow them to grieve the experience they didn't have…"* (Heath Visitor 3)

Sometimes, however, rather than being encouraged to process their emotions and experiences through sharing and discussing, one participant mentioned that mothers could be 'silenced' by professional, social and cultural pressure to be grateful for a live 'healthy baby', regardless of their experience. This was also felt to have a negative impact on the mother-infant relationship.

> *"I would say that it's actually very difficult to know exactly how mothers feel because they're not going to tell you for fear of being branded a bad mother… 'But you've got a healthy baby, you should be grateful'… I think that when you hold all of that inside it becomes inevitable that it will change your relationship with your child."* (Doula 3)

4.4 Summary

The findings presented in this chapter are the perceptions of 18 maternity care providers (including midwives, health visitors and doulas) around the potential impacts of childbirth experience on maternal and infant behaviour and wellbeing. The main findings were:

- Maternity care providers felt that the birth experience could affect infant behaviour
- Birth interventions were often perceived to negatively affect neonatal behaviours
- A calm birth and postnatal experience were believed to promote calm, settled behaviour
- Maternal perceptions of the birth were viewed as indirectly affecting infant behaviour

- A calm, nurturing postnatal environment might also enable normal newborn behaviours and facilitate bonding, attachment, and mother-infant wellbeing in the postnatal period

Consequently, it was widely believed that childbirth could affect the infant, both directly via the impacts of birth interventions and medications, and indirectly via the mother's personal experience of birth and the effect this may have on her perceptions of and interactions with her baby. Physical and emotional stress were associated with more challenging infant behaviours such as crying and being unsettled, while a calmer birth and calmer mother led to a more content and settled baby. However, it was felt that the potential impacts of the birth experience could be mediated by postnatal factors such as skin to skin and emotional support of the mother.

4.5 Discussion

This first study was intended as an initial exploration of this thesis topic - childbirth and infant behavioural style - and was designed to begin investigating whether the birth experience may affect infant behaviour, and if so, how. It presents the views of a self-selecting sample of UK health and childbirth practitioners caring for mothers during labour, birth, and the postnatal period, specifically exploring their perceptions of how the birth experience might impact early infant behaviours, temperament development, and maternal perceptions of her baby.

The qualitative nature of the study allowed a full and rich exploration of the observations, beliefs and experiences of those who work closely with women and their infants during the perinatal period. Building on previous findings that physical interventions can increase unsettled neonatal behaviours (e.g. Miller et al., 2005; Berqvist et al., 2009), it highlighted a fairly consistent view that different elements of the birth experience including the physical process, social and professional support and the postnatal environment may interact to influence infant behaviour. It was a widely held belief that this process may happen directly through physiological impact on the infant, and also through subsequent mother-infant interactions affected by the mother's subjective birth experience. Overall, childbirth was considered to have a complex effect on both mother and infant and their mutual relationship.

A major finding was that participants perceived a calm, normal birth to promote more settled infant behaviours while, consistent with previous research, interventions and complications, particularly when combined with medication, were associated with more unsettled behaviours

(Ransjö-Arvidson et al., 2001) and reduced ability to breastfeed (Brown & Jordan, 2013). However, the birth environment, and notably stress, were thought to affect these outcomes. If a Caesarean section was calm, or the birthing room relaxed, mother and infant were considered to be less affected by their experience.

This relationship between mother, infant and their mutual experience of birth was perceived as multifaceted. It was suggested that infants could be hormonally affected by a stressful birth. Oxytocin is known to have a positive influence on infant temperament development from birth (Carter, 2014; Feldman, 2015), yet endogenous levels are lower during interventions such as induction or epidural analgesia (Jonas et al., 2009; Jordan, 2010). Conversely, its natural antagonist, the stress hormone cortisol, may disrupt endogenous oxytocin, potentially increasing the infant's future sensitivity and response to stressors (Douglas & Hill, 2013; Dahlen et al., 2013). Participants therefore discussed the importance of trying to create a calm, quiet birthing and postnatal haven: a significant challenge in a busy hospital.

Furthermore, maternal physiological and emotional responses to childbirth were perceived to influence a mother's developing relationship with her infant, who might subsequently respond to this in addition to their own physical birth experience. A traumatic experience of childbirth may increase the risk of postnatal depression (Alcorn et al., 2010) which can affect mother-infant interactions (Edhborg, Matthiesen, Lundh & Widstrom, 2005), in turn increasing infant stress reactivity (Feldman et al., 2009; Feldman, 2015). Participant beliefs around this process included their observations of how birth experience might indirectly affect the infant by influencing maternal mood, subsequently affecting mother-infant bonding. This aligns with previous research highlighting how postnatal depression may impact on relationships between parents and their baby (Ayers et al., 2006; Murray et al., 2014), adversely influencing both family synchrony and infant stress reactivity (Feldman et al., 2009; Feldman, 2015).

Therefore, although the physical process of birth was perceived as an important influence on infant behaviour, maternal emotional experience during the birth and her interpretation of events was viewed as central to how she interacted with her baby and the infant’s subsequent behaviour. This is supported by previous research associating negative maternal perceptions of childbirth with postnatal mood disorders (Ayers et al., 2016); and maternal mood with mother-infant bonding (Edhborg et al., 2005); and infant behavioural style (McMahon et al., 2001).

Participants also emphasised how postnatal experience matters and, dependent on experience, can be restorative for the mother after a difficult birth, enabling her to be more responsive to her infant. 'Skin to skin' was highlighted as a potential soother for both infants and mothers who had been distressed by birth, and as an aid to bonding and breastfeeding. Skin to skin care is associated with numerous positive outcomes for the infant, including increased cardio-respiratory stability, reduced infant crying, and enhanced ability to breastfeed (Erlandsson et al., 2007; Feldman, Rosenthal & Eidelman, 2014; Moore et al., 2016).

Moreover, skin to skin can reduce cortisol levels in mother and infant (Mörelius et al., 2015), therefore lessening anxiety while increasing attachment behaviours in the mother, improving cognitive control in the future child and improving mother-child relations (Feldman et al., 2014). Early contact between mother and infant may therefore enhance maternal mood and mother-infant interactions (Rowe-Murray & Fisher, 2001); and improved maternal mood benefits infant temperament (Britton, 2011). This positive influence on infant temperament occurs in the areas of self-regulation, attention and emotionality at three months (Feldman, Weller, Sirota & Eidelman, 2002). In addition, participants mentioned that skin to skin could also happen with the father if the mother was receiving care (Erlandsson et al., 2007).

'Skin to skin' has now been widely adopted in UK hospitals, with 82% of mothers of infants born at 37 weeks having skin to skin within the first hours (NHS Maternity Statistics England, 2018-2019). However, some participants expressed regret that not all women are granted the opportunity for immediate and extended skin to skin contact, especially after obstetric complications, if an infant is premature or delivered by Caesarean section, or if they have chosen to bottle feed. Also, consistent with previous research (e.g. Bystrova et al., 2009), if the newborn infant is taken to NICU, it was believed this may have a negative impact on early infant behaviour and mother-infant wellbeing.

Midwives especially also spoke about the importance of having time and peace on the ward to enable mothers to successfully breastfeed their babies. However, typically due to a lack of staffing and investment, midwives often have little time to sit with and nurture new mothers post birth (Hunter et al., 2015). These findings may therefore help to justify investment in more extensive support of positive early mother-interactions, as recommended by Murray et al. (2014), emphasising the importance of adequate postnatal support which enables mothers to adapt to caring for their newborn infant.

Other more complex factors were also felt to affect postnatal maternal mood and subsequent interactions with her infant, such as whether maternal expectations of her birth and postnatal experience were met. Although positive birth expectations can be associated with positive outcomes (Ayers & Pickering, 2005), often there is disparity between a mother's expectations and her actual experience (Ayers et al., 2008; Lally et al., 2008). Brown (2016) highlights how mothers themselves frequently recognise this postnatally, particularly in relation to infant feeding. This study may therefore further emphasise the importance of antenatal education and postnatal support that helps mothers adjust to their birthing experience. The results presented here further emphasise the need for maternal expectations to be well founded. However, an overburdening of facts could be counter-productive as fear, pain and use of epidural anaesthesia are mutually associated (Alehagen, Wijma, Lundberg & Wijma, 2005).

The significance of social and professional support and relationships was also raised. Participants perceived such support to affect both the birth process and maternal perceptions of her infant. We know that support during childbirth matters, and continuous emotional support during labour is associated with several factors including decreased maternal anxiety (Ford & Ayers, 2009), fewer obstetric interventions (Scott, Berkowitz & Klaus, 1999), reduced requirement for pain relief, shorter labour and normal birth with associated improvements in infant Apgar scores and breastfeeding rates (Hodnett, Gates, Hofmeyr, & Sakala, 2012).

If mothers felt well supported by health professionals during childbirth, their overall perceptions were thought to be more positive, potentially benefitting the mother-infant relationship. It follows that supporting the mother may extend to benefitting infant behaviour. Mothers are more receptive to their infant if they have received good emotional care themselves (Olde, van der Hart, Kleber & Van Son, 2006; O'Hara, 2009), and infants with positive maternal-infant relationships develop better emotional self-regulation (Frick et al., 2018), an important feature of temperament development.

Maternity care providers also emphasised the importance of enabling partner support during labour and birth (Johansson et al., 2015). Given that fathers can suffer from postnatal depression too (Philpott & Corcoran, 2018), perhaps partners could be further supported in their role. However, in the current climate, finding the extra resources needed to additionally support fathers may prove difficult.

Finally, the interacting factor of maternal personality was felt to play a role, particularly around concepts of resilience. Participants noted that some mothers appeared less affected by the birth, were able to engage positively with their infants regardless of their experience, and tended to have easier infants. This resonates with previous findings that maternal personality, particularly anxiety, can affect birth outcomes (Johnston & Brown, 2013) and is associated with more 'difficult' infant temperament (Austin, Hadzi-Pavlovic, Leader, Saint & Parker, 2005). While acknowledging that resources are scarce, health professionals advocated a more 'sensitive and individualised' form of maternity care to cater for these differences in maternal character.

Taken as a whole, the current findings may help to emphasise the importance of investing in supporting maternal birth experience. If an infant is adversely affected by their birth, or a distressed mother feels inadequately supported, in turn affecting her postnatal mood and her baby's behaviour, participants were concerned that this could have long-term consequences for them both. The quality of aftercare which a distressed or traumatised mother receives was felt to influence her ability to care for and feed her infant. In alignment with this, prior evidence has suggested that positive breastfeeding support and experiences may aid the building of a strong mother-infant bond, whereas a lack of support or negative experiences of breastfeeding could potentially exacerbate a mother's symptoms of distress (Ayers et al., 2008; Brown et al., 2016). A sensitive and responsive parenting approach is associated with a range of positive social and emotional outcomes for the child (Landry et al., 2006; Murray & Andrews, 2015). Meanwhile, postnatal depression is associated with more difficult infant temperament, and this is speculated to be bi-directional (Britton, 2011). Therefore, difficult infant behaviours may also adversely affect mothers. Early intervention to support positive birth and postnatal experiences could therefore potentially improve longer term outcomes for mother-infant interactions.

Many participants felt that, particularly after a traumatic birth, a widely accessible debriefing service to support maternal emotional wellbeing may benefit the mother-infant dyad. Although the evidence for debriefing and other interventions is mixed (e.g. Lavender & Walkinshaw, 1998; MacArthur et al., 2002), it has been suggested that providing improved emotional care during obstetric interventions could help prevent perceptions of trauma and the onset of PPD or PTSD (Bastos et al., 2015). Conceivably, this might also benefit infant behaviour.

4.6 Limitations

The study had several limitations. First, participants were self-selecting and may have been biased towards the subject matter. However, many maternity care providers emphasised the multiple factors influencing infant behaviour from genetics to intrauterine and extrauterine environments before offering their perceptions regarding the potential implications of childbirth. Consequently, their views overall appeared balanced and consistent. Second, although the number and type of maternity care providers recruited was largely reflective of the workplace, inclusion of paediatricians and obstetricians might have been beneficial to ensuring that all representative views were gathered. Nevertheless, as these medical health professionals tend to manage only clinical births or infants who are in distress or unwell, the decision was taken to explore the perceptions of those healthcare providers who oversee the entire perinatal period for every type of mother and baby.

Third, it is possible that the views of mothers should have been sought before maternity care providers as they have the actual lived experience of birth and their baby's behaviour post birth. Although a mother would have an in-depth experience of her own baby, however, health professionals see multiple mothers and infants and might therefore be more likely to observe a pattern between types of childbirth experience and subsequent infant behaviours. Health professionals were therefore able to present an overall representative view capturing the experience of a wide range of mothers and babies. In this sense, health professional views are likely to be broader, more comprehensive, and reflective of the realities of many mothers rather than a single mother-infant dyad.

Finally, the study simply offers original qualitative insight concerning the opinions and beliefs of maternity care providers regarding childbirth experiences and infant behaviour. While their discerning perceptions add an important element to this issue, the following qualitative study exploring mothers' perceptions of childbirth and their baby's early behaviour could potentially further elucidate the topic (Chapter Five), as would a larger scale, more detailed quantitative study (Chapter Six). As noted previously, while data collection for the three studies overlapped, they were fully analysed, interpreted and written up individually in the order of progression presented here. Thus, quantitative data continued to be collected via the survey during the analysis and interpretation of Studies One and Two.

4.7 Conclusions

This initial study explored the perceptions and beliefs of maternity care providers concerning the potential effects of birth experience on infant behaviour. The study highlights the valuable insights of maternity care providers concerning the promotion of a calm birth environment, reducing stress, and offering emotional support, which they believed might help to counterbalance the possible negative impact of a difficult birth upon neonatal behaviour. According to participants' popular philosophy of 'baby mirrors mother', circumstances affecting the mother can also impact her baby. Preventing trauma for the mother during childbirth may benefit her relationship with her newborn in addition to the infant's ongoing development. Interventions to benefit postpartum mental health may sometimes be effective (Murray et al., 2014), although such interventions do not necessarily enhance maternal-infant relations or infant outcomes (Cooper et al., 2015). Nevertheless, health visitors in particular felt that widely accessible postnatal emotional support including a good debriefing service should be provided, especially in cases where a mother has found birth challenging or difficult.

Although most participants believed that mother and infant behaviours after birth may be affected by their physical experiences of the birth, many believed that maternal perceptions of birth could play an even more significant role. This finding is not yet supported by broader research literature. Studies by Ayers and colleagues, specifically examining the relationship between childbirth and post-traumatic stress disorder, found that maternal perceptions of her experience may strongly influence the outcome of her diagnosis (Ayers et al., 2008, 2016); and maternal mood disorders are believed to affect infant temperament and development (McMahon et al., 2001; Murray et al., 2014; Garthus-Niegel, Ayers, Martini, von Soest, & Eberhard-Gran, 2017). Consequently, it is possible that maternal perceptions of childbirth could have an indirect impact on early infant temperament. Previous research has only hinted at the wider possibilities of a longer term association (Taylor et al., 2000), despite potential pathways being identified in a diverse array of research studies (Douglas & Hill, 2013; Dahlen et al., 2013). The concept of subjective childbirth experiences affecting infant behavioural style therefore requires further and more comprehensive research.

Next steps

Given this early evidence from health professionals and childbirth practitioners working with mothers and infants, the next stage of this thesis will be to analyse and interpret the maternal

interview data, in order to explore childbirth from a maternal perspective, and to further explore how these experiences may affect infant behavioural style. Discovering whether maternal experiences reflect health professionals and doulas' perceptions and beliefs regarding childbirth and infant behaviour may also enhance understanding of the mechanisms that could lie behind this apparent connection.

Chapter Five: Study Two: Does experience of childbirth influence maternal perceptions of infant behavioural style? Exploring maternal attitudes

Findings from Studies One and Two (Chapters Four – Five) were presented together at:
International Normal Labour and Birth Conference, Lancashire, 2nd – 4th October 2017
Brazelton Centre UK Conference, Cambridge, 21st September 2017
Society of Reproductive and Infant Psychology Conference, York, 12th – 13th September 2017

Chapter Five presents Study Two: the second study of Part One of this thesis. The study was designed to explore maternal perceptions of childbirth and infant behavioural style. Like Study One, the study design was a qualitative semi-structured interview study utilising thematic analysis to explore recurrent themes in the data.

5.1 Background

The previous study (Study One: Chapter Four) explored whether maternity care providers observed that childbirth experience may influence infant behaviour, and found that they perceived both a direct physical link between the birth and infant behaviour and an indirect link through maternal interactions with her infant post birth. However, despite their close involvement with mothers and infants, and their expertise in childbirth itself and postnatal mother-infant wellbeing, their beliefs and opinions could still be considered external knowledge. Hence, the next question is whether mothers themselves perceive a connection between their birth experience and their baby's behaviour post birth. In addition, the aim is to observe any visible patterns between maternal birth stories and reported infant behavioural patterns post birth.

Study Two therefore intends to provide more depth and insight into the mechanisms behind any potential associations between birth experience and infant behaviour. Its aims are to explore whether mothers feel that birth affected their infant's behaviour by directly exploring their perceptions, while also examining associations between their descriptions of childbirth and descriptions of their infant's behaviour. In so doing, it aims to add further an understanding of the answers to the central research question – *Does childbirth experience influence maternal*

perceptions of infant behaviour? – while extending Study One's findings in relation to the first two sub-questions of this thesis:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?

The literature review (Chapter Two) examined many elements of childbirth that might negatively impact mother-infant bonding (Stein et al., 2012; Cooper et al., 2015) and contribute to unsettled infant behaviours (Dennis & McQueen, 2009; Brown & Jordan, 2013). Moreover, it became clear through the interviews with maternity care providers that childbirth is a complex physical and psychological issue that may directly or indirectly affect the infant as well as the mother. Many health professionals discussed the potential 'trauma' of childbirth and the effects this may have on the mother-infant dyad. In addition, several suggested that postnatal mother-infant wellbeing may be more attributable to maternal perceptions of her birth experience and the way in which she and her baby felt cared for than to the physical birth itself.

As discussed earlier in this thesis, experiencing birth as traumatic can have a detrimental impact on postnatal maternal psychological wellbeing (Garthus-Niegel et al., 2013; Ayers et al., 2016); and evidence shows that negative maternal mood has a significant influence on infant emotionality and behaviour during the first two years (Granat, Gadassi, Gilboa-Schechtman & Feldman, 2017; Prenoveau et al, 2017; Garthus-Niegel et al., 2017). Therefore, in addition to the more obvious obstetric or neonatal complications, it is conceivable that mothers and infants could also benefit or be adversely affected by psychological factors during the birth.

5.2 Methods

Design

A qualitative approach was chosen for the second exploratory study, again utilizing thematic analysis (Braun & Clarke, 2006) and qualitative description (Sandelowski, 2000, 2010) to identify and present relevant themes from the data that would highlight potentially connected elements of subjective maternal experiences of childbirth and infant behaviour. (See Study

One, Chapter Four, for details regarding design of Part One of this thesis – incorporating Studies One and Two.)

Participants

Ethical approval was obtained from the Department of Psychology Ethics Committee, College of Human and Health Sciences, Swansea University on 15th December, 2014 (Appendix 1A). The research was conducted according to the principles of the 1964 Declaration of Helsinki and the research questions were developed with care towards the physical and psychological welfare of participants (Barrett, 2006; World Medical Association (WMA), 2013; BPS, 2018).

Participants were included in the study if they were healthy mothers over 18 years of age with a healthy singleton infant aged 0–12 months. Mothers were excluded from participation if they were suffering from any major physical and/or mental illness including postpartum depression (PPD), multiple or preterm birth, if they had a medically sick or low birth-weight infant, or an infant with a five-minute Apgar score of less than seven, in accordance with the Welsh Government Maternity Indicator of 'healthy births' (Maternity Statistics Wales 2017-18).

A predominantly convenience sample of mothers were recruited from Southwest and Wales regions of the UK via advertisements placed on health centre notice boards, in mother and baby clinics, breastfeeding support groups, and on social media (Appendix 1B). As the initial sample recruited was biased towards mothers who were breastfeeding their infants, a targeted recruitment campaign was initiated involving specific requests for mothers who were formula feeding via non-specific mother and baby venues.

Measures

A semi-structured interview with open-ended research questions was utilised to explore the relationship between experience of childbirth and infant behaviour, and to gather in-depth data for analysis (Table 6). Given the diversity and complexity of women's birth stories, three broad questions were used to focus on their birth experience, their baby's behaviour, and their perceptions of whether the two were related. Further prompts were used to encourage women to develop aspects of their story and to explore any new concepts that emerged.

Table 6 Semi-Structured Interview Schedule for Mothers

Question 1. Tell me about your birth…

Example prompts:

- How were you induced?
- How long had you been in active labour?
- How did that feel?
- What pain relief did you have?

Question 2. How have you found your baby's behaviour since birth?

Example prompts:

- How was the baby after the birth?
- How is she now?
- Were you with him?

Question 3. Do you think your baby's behaviour was affected by the birth?

Example prompts:

- Do you think that affects them?
- Do you think that makes a difference?
- Did he recover quickly or did it take a while?

Procedure

Data collection took place from January – October, 2015, alongside and slightly beyond the data collection period for Study One (Chapter Four). Potential participants contacted the

researcher for further information and, if interested, a convenient time and location was arranged to discuss the research in greater detail. Interviews were conducted face-to-face in a place chosen or agreed to by the mother, such as her home or a local café (n = 22), or by telephone for the mother's convenience (n = 1). Mothers were offered refreshments in return for their time. Briefing information was included within the consent form and was read by all participants prior to interview (Appendix 2A). All participants provided informed consent and permission to audio record the interview, with the knowledge that they may ask to withdraw their data at any point during the study.

Mothers were first asked to retell their birth story. This was followed by two research questions concerning: (a) their infant's behaviour since birth; and (b) whether they believed the birth to have had any impact on their infant's behaviour (Table 6). Socio-demographic information was obtained, including age, highest level of qualification, occupation before the birth, and intention to return to work, marital status, and number of children (Results section, Table 7).

To ensure there were no negative effects of being interviewed and to give 'comprehensive explanations' for the research (Breakwell, 2006, p239), each participant was thanked for their time and debriefed following appropriate debriefing criteria (Barrett, 2006). Mothers who spoke about a traumatic birth, or who were worried about their baby, were referred to their health visitor or GP and were also offered contact details for the Birth Trauma Association.

Data analysis

Complete transcriptions were made of 23 audio-recorded interviews, with all personal identifying information removed prior to analysis. Data were analysed via two methods: (1) thematic analysis to find themes within the mothers' birth stories and infant behavioural observations, and (2) content analysis to observe connective patterns in the data between different birth modes, subjective maternal experiences, and mother-reported infant behaviour.

Thematic analysis

As in Study One (Chapter Four), responses to interview questions were analysed thematically using qualitative description (Sandelowski, 2000, 2010). Each phenomenon was examined and

described as it arose, with language used by participants and researcher as a conductor of the facts defined and conveyed by both (Sandelowski, 2000).

Within this overall structure, utilising the methods described by Braun and Clarke (2006), two separate thematic analyses were carried out to analyse and arrange the data systematically into themes and subthemes: the first concerning maternal perceptions of childbirth via their birth stories; the second for maternal descriptions of infant behaviour. As in Study One, credibility of themes and inter-rater confirmability of coding were established by a second coder (supervisor AB). (See *Thematic Analysis* section in Chapter Four for full details of how the thematic analysis was conducted.)

Trustworthiness

The four measures of Lincoln and Guba's evaluative criteria (1986) were adhered to as closely as possible to help ensure the trustworthiness of the research findings. Credibility in the truth of the findings was established by continuing the research until similar experiences and patterns in the data began to appear. As the results were specific to mothers' individual experiences of childbirth and their infants' behaviour, the detailed analysis meets Lincoln and Guba's criteria of 'thick description' (1986), with transferability applying to similar contexts. The results were considered dependable due the rigorous data analysis process, and confirmed as trustworthy by the involvement of the second analytic coder.

Content analysis

Content analyses were conducted to perceive trends in four main areas. First, the type of physical birth experienced by mothers, and specifically, whether the birth was 'normal' (spontaneous physiological birth with no major interventions) or clinical (with medical interventions). Second, within the themes and subthemes of maternal birth experience established through thematic analysis, maternal birth stories were assessed and categorised as 'positive', 'mixed', or 'negative' depending on the words and tone of their descriptions. For example, 'My birth was incredible' was categorised as a positive overall experience; and 'then everything I didn't want to happen happened' was considered a negative experience. Third, their self-reported infant temperament, or 'behavioural style' (Thomas & Chess, 1977), was

tabulated according to three categories of ‘easy’, ‘mixed’ or ‘difficult’, again dependant on maternal descriptions. Finally, the number of mothers who believed their infant’s behaviour to be affected by the birth was recorded in tables to compare with their overall perceptions of childbirth (positive, mixed, or negative). A second coder (supervisor AB) also validated the coding process and categorisation of mothers and infants.

Quantitative counts of mothers and infants in each category were performed to perceive patterns in the data concerning relationships between birth type, subjective maternal experience, infant behaviour, and maternal beliefs. Although this study is qualitative and therefore based upon maternal descriptions, it was also considered interesting to observe patterns in the data between these different categories of maternal experiences of childbirth and perceptions of infant behavioural style. Quantifying qualitative data has been previously performed by researchers wishing to further explore data derived from open-ended questioning (e.g. Hickey & Kipping, 1996; Shemmings, 2008). However, it was approached with caution and the limitations of quantifying data in a sample this size were noted.

5.3 Results

Twenty-four mothers expressed an interest in taking part in the research. However, two women were not eligible: one with postpartum depression was excluded prior to interview; another was excluded post-interview as she had previously experienced a stillbirth and was visibly distressed during the interview. Therefore, a total of 22 mothers took part in the study with a mean age of 32 (SD = 4.37, Range 21-37). Fourteen (64%) were first time mothers. Full sociodemographic information is presented in Table 7. Occupations were coded according to the National Statistics Standard Occupational Classification method (National Statistics Socio-economic Classification, 2010).

Table 7 Sample distribution by sociodemographic factors N (%)

Indicator	Group	N	%
Age	20-24	2	9 .09
	25-29	3	13.64
	30-34	9	40.91
	35 >	8	36.36
Education	School	2	9 .09
	College	5	22.73
	Higher	15	68.18
Maternal occupation	Professional	10	45.45
	Skilled	8	36.36
	Unskilled	3	13.64
	Other (student)	1	4.54
Marital status	Married	15	68.18
	Cohabiting	7	31.82
Number of children	One	14	63.64
	Two	7	31.82
	Three	1	4.54

Infant age and physiological stability at birth

At the time of interview, infants were aged between nine days and 9.5 months, with a mean age of 22.5 weeks (SD 13.16). All infants had a five minute Apgar score of seven or above.

5.3.1 Part One: Thematic analysis of mothers' birth stories

First, a thematic analysis was conducted to explore maternal experiences of childbirth. Nine main themes were identified via mothers' descriptions of their births in terms of both physical events (e.g. birth place and mode of birth) and psychological factors (e.g. feeling empowered, frightened, well supported, or neglected). Consequently, maternal birth data were divided into two overarching categories with corresponding themes and subthemes: (1) Physical experience – objective childbirth factors, e.g. birth mode, pain relief, and birth environment; and (2) Psychological experience – subjective maternal perceptions of childbirth (Table 8).

Table 8 Summary of thematic analysis: maternal experiences of childbirth

Category	*Code label of theme/subtheme*	*Definition*
(1) Physical birth experience	(A) Birth Mode	Type of birth experienced (categories: normal or clinical)
	i) Spontaneous	Physiological labour and birth
	ii) Obstetric interventions	Interventions during labour and birth e.g. induction, forceps or ventouse
	ii) Operative	Planned or emergency CS
	(B) Birth Environment	Where mother gave birth
	i) Home	Homebirth – *for normal birth only*
	ii) Midwife led unit	MLU – stand alone or adjacent to hospital – *for normal birth only*
	iii) Hospital	Hospital birth – *by choice/ for births not following a normal trajectory*
	(C) Pain Relief	Pain relieving methods in labour
	i) Pharmacological	Medical, e.g. pethidine or epidural
	ii) Natural methods	Non-medical, e.g. water/ hypnobirth
	Code label	***Definition***
(2) Psychological birth experience	(A) Fear	Mother experiencing fear in labour
	(B) Expectations	Maternal expectations of birth
	(C) Health Professional Authority	A midwife or doctor stipulating or refusing a treatment or intervention
	(D) Support	Social support from birth partner and/or health professional
	(E) Neglect	A mother feeling abandoned or that her needs were not being met
	(F) Separation	Separation of mother from her partner, infant or both

Note: Normal = no medical intervention – physiological birth, waterbirth, homebirth; Clinical = with any medical intervention – e.g. induction, acceleration, forceps or Caesarean section

The themes summarised in Table 8 were the most frequently occurring physical and psychological factors to emerge from the mothers' birth stories that seemed to influence their perceptions of childbirth. They are presented in more detail below under the two key category

headings: Physical birth experience and Psychological birth experience. Quotes are used to represent each theme that arose in the data, with corresponding subthemes where applicable.

5.3.1.1 Physical birth experience

The mother's physical birth experience included the type of birth she had (birth mode), the birthing environment (hospital, MLU or home), and any pain relief she used (e.g. pethidine or bupivicaine contained in epidural). The first major theme in this category was Birth Mode.

a) Birth mode

Whether a birth happened spontaneously or entailed interventions (such as induction, acceleration, electronic foetal monitoring, assisted delivery, or Caesarean (C) section) often appeared to influence a mother's overall experience of childbirth, her postnatal emotional wellbeing, and the physical and behavioural wellbeing of her infant. However, some mothers experienced medical birth interventions, such as induction or C section, with no adverse effects on their sense of wellbeing. In contrast, others who experienced a normal birth could find it distressing, particularly if professional care and support felt intermittent.

i) Spontaneous labour and birth

Several mothers actively enjoyed the physical sensation of a 'normal' spontaneous physiological birth or a birth without interventions. This experience of 'doing it' unaided could also make them feel strong and empowered, both as a woman and a mother.

> *"It was very much my body did it, and like I enjoyed feeling it*." (Mother 11, normal hospital birth)

> *"It sort of burns a bit but it's not pain… 'cause you can feel something happening… It just happened. I couldn't stop it… My birth was incredible! I'm very lucky."*
> (Mother 12, home waterbirth)

> *"I didn't feel any pain so I was just going with it. I was enjoying it, in the moment… I was still screaming and stuff but it was more like an animal instinct like… not in pain… All this bit I remember like it was the best thing I've ever done. It was amazing like. The whole like established labour and actually getting him out was amazing*."
> (Mother 10, normal hospital birth)

ii) Obstetric interventions

Mothers could feel helpless and out of control of their own labour once decisions regarding medical interventions were administered. Interventions sometimes led to increased pain.

> *"I didn't progress at all… then they gave me the top up (synthetic oxytocin) … it just over-stimulated my uterus… absolute agony."* (Mother 22, acceleration)

iii) Operative: planned Caesarean section

Some mothers reported experiencing the interventions as they occurred without difficulties, but reported negative feelings post birth, such as pain, sadness or regret. This was particularly evident for mothers who experienced a planned C section.

> *"It was all very calm. There were a lot of people. I wasn't in any pain… and then they sort of said don't worry if you don't hear her cry, Caesarean babies don't cry very often. I had a really easy and pleasant few hours with her whereas a lot of mums are taken off for stitches or in another room, or in lots of pain. I didn't have that, but then I think the day after when most people start to feel a lot better, I felt so much worse*." (Mother 4, planned C section, internal haemorrhage, postpartum morphine)

b) Birth environment

The birth environment appeared an important element in maternal perceptions of birth. While some mothers found hospital reassuring, it could also induce negative emotions such as fear in others. Birth complications could lead to mothers being transferred from home or midwife led unit (MLU) to hospital.

i) Home

Homebirths by their nature do not involve obstetric interventions and were therefore more likely to be calm and swift and to comprise less use of pharmacological pain relief such as Entonox or pethidine. (Epidurals are not carried out during a home birth.)

> "*Yeah it felt very calm in the house, really calm… I was in bed until pretty much he was coming down… I was very relaxed… it wasn't even too painful."* (Mother 12, home waterbirth)

ii) Midwife led unit

Several mothers who birthed in a midwife led unit enjoyed their experience, valuing both the quality of care and the homely atmosphere.

> *"So, it was a midwife led unit… so it was homely, more homely… more natural."* Mother 10, MLU waterbirth)

> *"It was a fantastic experience really… The midwife care was brilliant and the facilities there are great… (baby) popped out in one go in the end (on birthing stool) which was pretty amazing. It was really nice 'cause S my partner was sat up behind me so we both sort of saw her arrive at the same time from the same angle and that was really lovely… So the midwife caught her and then just passed her over to me (laughs) and then S cut the cord."* (Mother 20, MLU normal birth)

iii) Hospital

Mothers who had made an in-labour transition from home or midwife led unit to hospital could feel unnerved or distraught by their unexpected change in circumstances. Such transfers could therefore be emotionally distressing for the mother, particularly if accompanied by 'Health Professional Authority' and an associated loss of perceived control (see this theme in psychological birth experience below).

> *"I had planned a pool birth in the midwife led (unit) but when I went back they sent me up a floor (to the hospital) … I was absolutely devastated that I couldn't go down to the midwife led… I'd laminated me birth plan!"* (Mother 14, hospital transfer, acceleration, episiotomy, forceps)

> *"(They) asked if I would go into hospital. I was so upset they'd asked me. Pretty devastated. My dream of having her at home was dashed… When we got there the bed wasn't there. I was on all fours at reception… it was 32 degrees that day. The hospital was unbearably hot so they had all the windows open. When they showed me to the delivery suite they had building works going on outside the window. That really distressed me. I was kind of holding myself together until that point but I just started crying."* (Mother 6, hospital transfer, acceleration, epidural)

Conversely, one mother found the care improved after her transfer from MLU to hospital.

> *"I feel I was disappointed in how the midwife led unit treated me, but I can't fault the labour ward if that makes sense… And then I found the postnatal ward, the support there was excellent, really brilliant…"* (Mother 16, normal hospital birth)

Mothers with no obstetric complications who had actively chosen to birth in hospital felt happier with their birth place than mothers who had hoped to give birth at home or in a MLU.

> *"I really felt I needed just to know that people were with me if anything happened… It was brilliant*." (Mother 11, normal hospital birth)

c) Pain relief

The type of pain relief a mother chose – whether pharmacological (synthetic) or natural – and how she and her infant responded to it, affected her overall experience. Some mothers benefitted from using pain relief, while others reported negative effects or felt that it did not have the analgesic effect they had expected.

i) Pharmacological pain relief

Mothers had mixed experiences of pharmacological pain relief. For some, the effects of medication coloured their perceptions of the birth experience. Some mothers enjoyed the mildly analgesic effects of Entonox (commonly known as 'gas and air') or were relieved to be offered an epidural during a difficult labour.

> *"I loved it (gas and air), it was fantastic after 9 months of sobriety (laughs), it was really great*." (Mother 20, hospital waterbirth, gas and air)

> *"Once they'd put the epidural in my back, the rest of the experience was just amazing… for 8 hours I just sat there with M and B and really enjoyed it. Then they said, 'I think you should push,' and I pushed for ten minutes…"* (Mother 6, hospital, acceleration, epidural)

In contrast to the many positive maternal perceptions of Entonox and epidural anaesthesia, mothers' experiences of pethidine were largely negative.

"I didn't really think much of that (pethidine) because it just made me feel like I wasn't there, had no control, but I still had pain." (Mother 5, hospital waterbirth, pethidine)

"I woke up and just screamed like blue murder… you know, like one of those really like… blood curdling screams…" (Mother 10, hospital waterbirth, pethidine)

ii) Natural methods

Alternative coping techniques, such as breathing or water, often helped the mother to cope with her pain without the side effects typically experienced with standard labour medication. Waterbirths appeared to be a calming mind and body experience, relaxing the mother both physically and mentally and encouraging a smooth, calm birth.

"The first contractions in the pool were so blissful, then the novelty wore off… very quickly I needed to push." (Mother 3, home waterbirth)

Some non-medical methods, such as hypnobirthing, could provide relief in unexpected ways, especially when the birth did not go according to plan.

"The only thing I really took away from the hypnobirthing was the breathing. The breathing got me through." (Mother 6, hospital transfer, epidural, acceleration)

5.3.1.2 Psychological birth experience

A mother's psychological experience of childbirth appeared to be equally as important as her physical experience in terms of postnatal impact on her own and her baby's wellbeing. The psychological experience was generally inter-connected with the physical experience, particularly when physical interventions were unexpected (see theme 'Expectations' below). However, her psychological experience, and whether she had enjoyed giving birth or found it distressing, often dominated the overall tone of her birth story.

a) Fear

Mothers who felt that their birth was not progressing in the way they had hoped could become afraid, particularly if there was a risk of unwanted medical interventions.

"So maximum dosage (of synthetic oxytocin) and the surgeon was ready behind the curtain – they were polishing their cutlery…" (Mother 23, acceleration, hospital birth)

One mother claimed to feel calm once labour commenced, despite initial fear and anxiety.

"I phoned my mum and I said, 'I'm so scared I feel really calm.' You know when they tell you to write a birth plan, they tell you to prepare yourself, pack your bags, everything… I suddenly felt like everything was out of my control and it almost relaxed me completely… because I no longer could control it I think, if that makes any sense." (Mother 11, normal hospital birth)

b) Expectations

If a mother felt mentally prepared for a particular experience, such as a planned induction or planned Caesarean section, she was often able to view that experience more positively.

"Well I had to be induced because of my diabetes so we went into hospital on the Saturday… A little cut and the head popped out. It was lovely being able to be with it and just enjoy it rather than being out of it on pethidine (referring to first baby)." (Mother 19, planned induction)

However, even planned interventions could be experienced as difficult, especially if the mother felt she had not been given enough information beforehand, and this could make the procedures and sensations feel unexpected and unpleasant.

"I didn't feel any pain but I feel like I wasn't prepared enough for how much I might feel, 'cause you can feel each layer dragging back… horrible…" (Mother 13, planned C section)

High expectations of a positive birth experience could also lead to acute disappointment.

"*… because I used to be super fit and healthy and run half marathons and I thought, yeah I can do this. I thought I'm the sort of person who's got a body that can deliver a child… Wrong way round!"* (Mother 4, emergency C section)

Mothers who were unexpectedly kept in hospital post birth because they or their baby needed medical treatment could also find this very difficult.

> *"That was the worst week, well 5 days, of my life. It really traumatised me, that stay in hospital, yeah… which is really hard because when you speak to some people they say, 'Oh we loved it, you know, the support we got from the midwives…' I said quite often, 'This is worse than prison. In prison you get an Xbox and you get a TV and you don't have a baby that's waking you up every half an hour*.'" (Mother 10, normal hospital birth, baby in NICU post birth)

Mothers who felt they had experienced an unexpectedly negative birth could then suffer conflicting emotions postnatally.

> *"And I think as a result of that as well I didn't feel I could bond with him at all well… We really struggled with him the first couple of weeks. 'Have I done the right thing having a baby?' All this jazz*." (Mother 14, hospital transfer, acceleration, episiotomy, forceps)

In contrast, mothers appeared to fare better postnatally if their prenatal expectations of childbirth had been met.

> *"I found both births really empowering… quite euphoric. They gave me a sense of achievement."* (Mother 7, normal hospital birth)

c) *Health Professional Authority*

Several women reported agreeing to interventions on account of their baby's safety without feeling they were given sufficient information, time or opportunity to make an informed decision. This could result in mothers feeling out of control, frightened, neglected or abandoned, particularly where there was a sense that their own feelings or opinions had no part in the proceedings.

> *"And then everything I didn't want to happen happened which was, I didn't want to have stirrups or anything like that, and the next thing was they took the gas and air away and said I wasn't pushing hard enough… I think there's a lot they don't tell you… and then I had a student midwife inside me now … I felt their main concern was him and not me, and I kind of get that."* (Mother 2, hospital induction)

> *"And I said, 'Well I'm having a waterbirth' and he (Dr) said, 'Oh no you're not, you've gone over 24 hours now* (since spontaneous membrane rupture) *and I said, 'I wanna go down to the MLU' and he said, 'No you can't, now you're here you stay here', so I lost the plot and burst out crying…*" (Mother 14, hospital transfer, acceleration, Entonox, epidural, episiotomy, forceps)

> *"They broke my waters - they didn't ask – suddenly there was stuff coming out of me. I did not know what was happening… They were telling me, 'Keep your legs open, keep your legs open', though my natural instinct was to curl up in foetal position to protect myself*." (Mother 1, hospital induction)

One mother explained how she felt that she had limited control over her birth experience.

> *"If the doctors decide this is the way they want you to do it it's very hard not to. If something then happened… I'd never forgive myself*." (Mother 15, hospital induction, forceps)

Health professional authority could also occur in lesser ways, though ostensibly be equally significant to the mother's perceived overall experience.

> *"It was like football side-lines. 'Go on, PUSH!' I wish they hadn't 'cause my bottom took a while to recover – three months of piles and bruising."* (Mother 6, hospital transfer, acceleration)

On occasion, a mother's sense of personal privacy was violated, with vaginal examinations (VE) and/or postnatal stitching considered particularly distressing.

> *"I don't think my husband was there yet; the doctor did an examination. It was horrific – really uncomfortable* (VE)*... I just told her to get out."* (Mother 15, hospital induction, forceps)

> "*At one point I did turn round and say, 'You do realise there is a human being at the other end of this don't you?'* (postnatal stitching) *… the doctor was just plain rude*." (Mother 16, normal hospital birth)

When hospital staff had instructed the use of continuous electronic foetal monitoring (EFM), mothers could find this restrictive and uncomfortable.

> *"I kept saying I needed the toilet just so I could get the straps taken off me. It's horrendous pain. I don't understand why they don't just put them on you intermittently to see if the baby's alright… you're trying to move around attached to the ruddy machine."* (Mother 14, hospital transfer, acceleration, forceps)

> *"I wanted to do it on all fours; 'cause I was connected to all the machines I wasn't really allowed to move…"* (Mother 19, planned hospital induction)

Health Professional Authority also occurred in the postnatal ward, with mothers finding it difficult and bewildering if advice was perceived as inconsistent.

> *"He wasn't latching on at all so I was having to syringe feed him which was intolerable… and then I had a different midwife every day telling me something different."* (Mother 14, hospital transfer, acceleration, forceps)

d) Support

Mothers spoke of social and emotional support in labour and during the immediate postnatal period as being of paramount importance to their sense of physical and emotional wellbeing. Mothers who experienced good midwifery care and partner support were aware of the positive contributions this had made to their overall experience of childbirth.

> *"My husband was doing all the things he'd learned… supporting me, rubbing my back, making sure I was drinking. He also did some of the things he wasn't taught to do which was get lots of kidney dishes because I was vomiting a lot* (laughs)." (Mother 16, normal hospital birth)

> *"She (midwife) was brilliant… She really looked after me afterwards… She even washed me… Yeah she was very very special."* (Mother 11, normal hospital birth)

Professional support continued to be impactful, with nursery nurses, midwives and health visitors who encouraged and facilitated breastfeeding highly praised and much appreciated.

> *"I was lying to the midwife, saying she was latching on 'cause I was so desperate to go home… then this lovely Columbian midwife saved the day. She literally grabbed my boob and flung it in her (baby's) mouth (laughs). So that's how it's done! I think I*

hadn't been fully committing… a bit tentative." (Mother 6, hospital transfer, acceleration)

"She's just amazing (health visitor) – I call her the boob whisperer 'cause… She calmed me more than anything… She just chilled me out and I didn't feel like she was judging me because I can't do it." (Mother 14, hospital transfer, acceleration, forceps)

e) Neglect

In contrast to the theme 'support', busy maternity wards often meant that the intended continuous midwifery care could be intermittent and sparse. Mothers could experience this as problematic during labour, with several finding that they were largely alone with their partners until the second stage, by which time some had been deprived of pain relief or the birthing pool through inconsistent professional care or inaccurate observations. One mother experienced an induction without any pain relief, giving birth moments after her partner had managed to summon the midwife.

"Yeah we kept getting left a lot in the room on our own with nobody – it was quite scary… The pain was like getting worse and worse. I was getting really dizzy and sick, but they told me they couldn't give me any pain relief because what would I be like if I was in proper labour, but at this point nobody checked me at all - to see if I was in labour or not… they kept saying they couldn't check because of the pessary and they wouldn't give me any pain relief 'cause they just thought I was really whingey." (Mother 17, hospital induction, third degree tear)

This mother continued to struggle post birth, in pain with a severe tear, when her partner's postnatal access was restricted and she found she could not reach her baby as readily as she needed to.

"They brought me out of theatre and he (father) stayed with us for an hour but then he wasn't allowed down to the ward… I couldn't move in the bed so every time he (baby) cried I'd have to ring the buzzer, it was horrible." (Mother 17, hospital induction, third degree tear)

Lack of adequate or appropriate care could provoke conflicting emotions in mothers, from acceptance and empathy with overrun staff to extreme distress.

"The antenatal care was good but the postnatal care was really… I was left in dirty sheets, I had to shower myself and at times I had to sit on the floor in the shower because I couldn't stand up… One night I was left with a drip in one arm but the baby over the other side… and I wasn't getting any sleep… The baby opposite kept crying… my baby was sleeping through." (Mother 4, planned CS, internal haemorrhage)

f) Separation

Women could be separated from their partners if undergoing a night induction where hospital protocols dictated that fathers be sent home. Pain was experienced as frightening when alone, and mothers separated from their partners in early labour could find this very distressing.

"… really bad pain, agony, and I was on my own as I'd sent my husband home to sleep." (Mother 1, hospital induction)

"I was just on my own, honestly it's horrible… I think your partner should be with you… I was quite lonely… I didn't sleep…" (Mother 15, hospital induction, forceps)

Mothers separated from their infant or partner immediately after birth could feel especially distraught.

"I was taken back to another room to have a shower and he went with his dad to NICU… and they stayed in NICU until that evening… So yeah I had a shower and then completely forgot where he's gone and went a bit crazy. I suddenly panicked – Where's my husband and my baby?" (Mother 10, hospital waterbirth)

"They took her away straight away and I didn't see her – she was in a corner – it was a shame. I wanted to be attached but she was over in the corner with the paediatrician." (Mother 15, hospital induction, forceps)

One woman remarked on the feeling of emptiness when unexpectedly left alone after the birth.

"Then I was left on my own in that room for 2 hours. It was strange after all that, and all the people, suddenly completely alone." (Mother 6, hospital transfer, acceleration)

5.3.1.3 Categorising maternal childbirth experience

The central aim of this chapter was to explore the possible association between subjective maternal experience of childbirth and infant behaviour. While mothers were directly asked the question of whether they perceived any connection, a potential association between maternal birth experience and reported infant behaviour can also be explored indirectly by examining patterns between the two, to allow any unspoken or unrecognised relationship to emerge. Two main questions were asked during the data analysis:

1. Did mothers who had a clinical birth experience describe different infant behaviour to those who had a normal birth?
2. Were mothers' perceptions of birth as positive, mixed or negative associated with their descriptions of their baby's behaviour?

Consequently, the next step was to divide mothers into groups to explore any apparent associations between their birth experience and their infants' behaviour. Maternal birth stories were used to separate them into groups according to two factors: (a) their physical experience of childbirth (normal or clinical); and (b) their psychological experience of childbirth (positive, mixed, negative).

a) Maternal physical experience of childbirth

Based on their reports of the physical details of their birth experience, mothers were split into two groups: normal and clinical births. Consistent with WHO guidelines (2018), and in line with a survey report by the Royal College of Midwives (2016), births with no medical interventions were categorised as 'normal'. Normal births therefore included any spontaneous physiological birth (e.g. a waterbirth or homebirth). In contrast, births involving clinical management (e.g. continuous electronic foetal monitoring) and interventions (e.g. induction, acceleration or assisted delivery) were classed as 'clinical'.

Based on these definitions, nine (41%) participants had 'normal' births with no medical interventions. Eleven (50%) labours were induced or accelerated (via a pessary, 'teabag', artificial membrane rupture, synthetic oxytocin drip, or a combination of methods). Two of these 11 induced or accelerated labours ended with an assisted forceps delivery (9% of total

births). Two births (9%) were planned Caesarean sections. There were no assisted ventouse deliveries or emergency Caesarean sections in this sample. Consequently, mothers were divided into two broadly equal sized groups for further analysis: Normal birth (n = 9) or Clinical birth (n = 13).

b) Maternal psychological experience of childbirth

Next, maternal perceptions of birth were categorised broadly into positive, mixed and negative experiences. A 'positive' experience, while grounded in WHO Intrapartum Guidelines (2018), is defined here according to subjective maternal descriptions of childbirth.

- Mothers who viewed their birth positively were more likely to have experienced a normal physiological birth. They also tended to have given birth in a calm, supportive environment, and felt well supported post birth by their partner and health professionals. These mothers often felt very empowered by their birth experience.

- Mothers with mixed perceptions did not necessarily experience physical problems during childbirth but might have encountered emotional difficulties such as 'Health Professional Authority', feeling emotionally unsupported, separation from their partner, or insufficient midwife assistance and support during labour or postnatally.

- Mothers with negative perceptions of their birth were more likely to have experienced some form of obstetric complication or intervention. In addition, they might have experienced difficulties immediately after childbirth (e.g. postpartum haemorrhaging or infection; newborn baby being taken to NICU). Equally, mothers who perceived their birth negatively might have been separated from their partner during labour or immediately post birth.

Mothers were divided into groups based on their direct stories (e.g. descriptions of how they viewed events during the birth) and the types of words that they used, such as 'incredible' or 'horrific' (Table 9). As well, after retelling their birth story they were asked how they rated their overall birthing experience to ensure a correct interpretation was made of their experience.

Table 9 Maternal Perceptions of Childbirth – examples of the three categories

Category	Number	Mothers' descriptions of their labour and birth experiences
Positive	8	*My birth experience was incredible! I'm very lucky. I put the phone down to my midwife and then had this excruciating contraction… walked downstairs… got in the pool and little K was born fifteen minutes later. No midwife, just my husband… (the) midwife arrived at 8 o'clock.* (Mother 12)
Mixed	8	*I was a little bit shell shocked from the birth 'cause, I don't think I had a traumatic birth, but it was kind of, I think being told nothing was happening and thinking, I can't cope with it if that's the case…* (Mother 8)
Negative	6	*It was traumatic, horrific… first they did an internal examination which was really not pleasant… I felt really uncomfortable… kind of exposed … I spent the whole night in absolute agony… like someone ripping my insides apart…. They broke my waters… I didn't know what was happening…* (Mother 1)

Mothers were therefore split fairly equally into three broad categories to allow examination of infant behaviour in each group: positive, mixed or negative perceptions of childbirth.

5.3.2 Part Two: Maternal descriptions of infant behaviour

Next, mothers were asked to describe their infant's behaviour. Participants gave a variety of responses, though generally described the behaviour itself rather than defining their infant as specifically 'easy' or 'difficult'. They spoke mostly about common topics: sleeping, feeding, and their baby's interactions, such as whether they would let other people hold them or their tendency to smile or cry. Emotive words were frequently employed, such as 'feisty', 'chilled', 'happy' or 'angry'. These descriptions were used to divide infants into three categories: easy, mixed or difficult behaviour. Within these criteria lay a wide array of infant behaviours, as

illustrated by the examples below. Numbers of infants in each group, and examples of infant behaviour in each category, are shown here.

a) Easy infant behaviour – 10 infants

Ten infants were described as having an 'easy' behavioural style. This included infants who appeared calm, settled and sociable, with positive feeding and sleeping behaviours.

> *"Oh he's been so calm & content and he's been very easy… He is generally very happy, smiles a lot, is very good at being passed around… very calm"* (Mother 3, home waterbirth, no pain relief)

> *"Easy. He's been fab at feeding. In general he sleeps really well."* (Mother 12, home waterbirth, no pain relief)

> *"Brilliant. Perfect. He's, the way he is makes me really broody. I just want to eat him… Yeah he's a very chilled out little boy."* (Mother 19, planned hospital induction, Entonox)

b) Mixed infant behaviour – 6 infants

Six infants were classified as behaviourally 'mixed', defined by variable behavioural patterns and with maternal descriptions of both positive and negative infant behaviours.

> *"She's been a good sleeper. She's very easy at the moment. In the early days she had that solemn look and wouldn't let anyone else hold her. I struggled with breastfeeding… She did cry quite a bit in the early days* (until 6 months)." (Mother 6, hospital, epidural)

> *"Well straight after the birth she was very sleepy… She's quite a persistent baby in that she's generally happy but I would say if something displeases her she's got quite a feisty vibe on her… the only thing that will console her when she wakes up at night is breastfeeding… She won't let my partner… she will scream and keep screaming until she gets me."* (Mother 8, MLU waterbirth, Entonox during stitching)

"He was waking a lot in the night to feed. And then probably from about 2 months old he's been a really laid back baby. He's been really calm. (In NICU) they were doing obs. every half hour which was very disruptive for him… he'd scream and cry… He didn't have a very nice start." (Mother 10, MLU waterbirth, pethidine, Entonox)

c) Difficult infant behaviour – 6 infants

Six mothers described their infants as 'unsettled' in terms of crying and fussing or reported more difficult infant behaviours leading to problems (e.g. excessive sleep deprivation).

"Strong… very angry when he's changed or bathed… very nosey, very alert and curious… very hard… he screams his head off. Feeding… was a battle. It feels like the hardest job I've ever had." (Mother 1, hospital, induction, Entonox)

"She's definitely a more clingy baby than my first, she does not like to be put down, she doesn't lie down, she's quite sicky. She won't settle away from me." (Mother 15, hospital, induction, forceps, pethidine, epidural)

"The first few weeks he was just constantly sick, constantly in pain and screaming…. jittery. He does it all the time, it's like he's startled and his hands sort of shake." (Mother 17, hospital, induction, third degree tear)

The largest infant behaviour group was therefore the easier infants, although sufficient numbers were present in each category (easy, difficult, mixed) to explore associations with birth experience.

5.3.3 Part Three: Was infant behaviour associated with birth experience?

The final stage of this chapter was to explore the association between maternal birth experience and descriptions of infant behaviour. This analysis had two key stages:

1. Direct maternal perceptions of the potential association between her birth experience and her infant's behaviour

2. Exploring associations between how a mother described her birth (both physical and psychological) and her description of her baby's behaviour

1. *Did mothers believe their infant's behaviour was linked to their birth experience?*

After asking mothers to retell their birth story and to describe their baby's behavioural style both immediately post birth and recently, the third interview question asked mothers directly whether they felt that the birth had impacted their infant's behaviour. Many mothers gave short answers to this question, often replying with a simple yes or no response. Given this, mothers were prompted to elaborate. However, responses still tended to be short. Mothers who did not feel there was a relationship between the two often gave a simple 'no' rather than explaining why they did not think the two were linked. In contrast, some mothers gave an ambiguous response, saying 'no' or 'I don't know' before continuing to describe a possible association (e.g. Mothers 5 and 6 in Table 10 below).

Table 10 shows the number of mothers who responded yes or no, or who appeared unsure (ambiguous). Example quotes are also presented.

Table 10 Maternal response to Question 3: Was your baby affected by the birth?

Group	Number	Example quotes
Yes	10	*Yes. There was a calm mummy and a calm daddy and a happy atmosphere. No pain, no upset, cuddles straight away, music in background… She didn't have any of the trauma of birth and just immediately she had all my love and attention…* (Mother 4) *I think so yeah – I think his difficulties feeding were affected by the birth… the length of it.* (Mother 10)
No	8	*No, not directly I don't think. If he'd been born naturally premature we may have got a bit more support…* (Mother 2) *No I don't think so, I think 'cause I didn't have a traumatic birth. But I think if I had experienced trauma it may have affected him.* (Mother 7)
Ambiguous	4	*Um, no, the only thing that I was worried about in the beginning was she slept loads and loads and I was worried that it was something to do with the pethidine.* (Mother 5) *I don't think so, but I don't know. How intelligent are they at birth? Do they remember being born?... She had a pretty easy coming into the world. Whether my stress hormones in the earlier part of labour got through I don't know…* (Mother 6)

Mothers who expanded on the relationship commonly made references to infant behaviour in terms of social behaviours or feeding, sleeping, and neurobiological states (e.g. distressed, unsettled, calm or content). Five distinct themes emerged from these responses (Table 11).

Table 11 Thematic analysis of birth impacts on infant behaviour

Code label of theme	Definition
1. Birth mode	Type of birth (e.g. spontaneous, forceps or CS) appearing to influence infant behaviour
2. Environment	Birth environment (e.g. hospital or home) impacts on mother and infant
3. Pain relief	Pharmacological pain relief or natural methods positively or negatively affecting infant behaviour post birth
4. Baby mirrors mother	Infant reflecting its mother's psychological state of relaxed/distressed
5. Maternal caregiving	Infants recovering after a difficult birth with the aid of maternal support

Theme One: ***Birth mode***

Mothers who had experienced a normal labour and birth with no medical interventions could perceive that their straightforward birth had affected their infant positively. They felt that the calm environment and gentle entry into the world enabled their infant to be calm and settled.

> *"Pretty much everything that's around her that has helped her to feel safe and secure and calm. And yeah maybe that started off with having a well and truly sort of straightforward arrival."* (Mother 20, hospital waterbirth)

Conversely, mothers who underwent interventions or complications, such as an induction or forceps delivery, sometimes described their infant as being more unsettled and difficult to feed.

> *"I put it (breastfeeding problems) down to the fact that, because he was forceps… when I was trying to put him on the boob, I was pressing the back of his head and neck, not realising… So I felt really upset that I was really useless and couldn't do it."* (Mother 14, hospital transfer, acceleration, episiotomy, forceps)

Theme Two: *Environment*

As with maternal perceptions of birth, the environment during the birth or postnatally could be perceived as affecting infant behaviour positively or negatively. Several mothers mentioned the positive benefits of a calm and quiet environment.

> *"Yeah it felt very calm in the house, really calm. It was a very calm birth and he was pretty calm coming out… he was very settled."* (Mother 12, homebirth, waterbirth)

Other mothers discussed a cascade of interventions that occurred after their transfer to hospital and their potential impact on their infant:

> *"She's been through the mill poor thing."* (Mother 15, hospital induction, forceps delivery)

Theme Three: *Pain relief*

Mothers observed an association between the pain relief they used in labour and their baby's behaviour. Mothers who did not have medical pain relief – except gas and air – could perceive their infant as being more alert.

> *"Well I know that, I mean 'cause we didn't really have any drugs, so she came out as alert as she was going to be, it was quite nice to know that we could bond straight away and she was a hundred per cent rather than dosed up on pethidine or something*." (Mother 16, normal hospital birth, Entonox)

In contrast, mothers who had been administered pethidine or bupivicaine via epidural often felt that their infants were sleepier – some directly attributing this to the effect of the medication.

> *"The only thing that I was worried about in the beginning was she slept loads and loads and loads and I was worried that it was something to do with the pethidine. She slept like a ridiculous amount in the beginning and they had to say like, have you fed your baby? Wake her up! Probably for about 6 days she was sleeping a lot, an awful lot, and she still sleeps well actually…*" (Mother 5, hospital waterbirth, pethidine, Entonox)

Pharmacological pain relief was also believed to potentially affect the infant's behaviour in terms of how unsettled they were.

> *"She's definitely a more clingy baby than my first. She does not like to be put down, she doesn't lie down, she's quite sicky... My mum thinks it's all the chemicals she had."* (Mother 15, induction, forceps, pethidine, epidural; NICU: infant infection, antibiotics)

Theme Four: ***Baby mirrors mother***

As widely believed by health professionals in Chapter Four, an infant's behaviour could be perceived to be influenced by the mother's own physical, emotional and psychological state. In accordance with this, a few mothers felt their infant could sense their own distress after a difficult birth, becoming more unsettled as a result.

> *"Part of me wonders if her behaviour's been affected by my reaction to the birth if that makes sense. Um, she is very different to the first in terms of her neediness… (she) doesn't easily settle away from a person, usually me…"* (Mother 15, induction, forceps, pethidine, epidural)

This feeling was not restricted solely to those who had a difficult delivery. Mothers who had a normal birth, yet felt unsettled about their experience, also described their infant as sensing their negative mood and exhibiting more difficult early behaviours as a result.

> *"I think I found her quite difficult because I was a little bit shell shocked after the birth… I mean we did have some days in the early days where she was really hard to console for no reason other than maybe feeling a bit colicky…"* (Mother 8, MLU waterbirth, no medication)

> *"I know it definitely affected me (laughs), and that in turn probably affects him as well – and that I was just so tired – but I can't specifically say what… I think his difficulties feeding were affected by the birth... And also he was taken away from me straight away…"* (Mother 10, MLU waterbirth, gas and air, pethidine, NICU).

Conversely, mothers who were feeling positive about their birth experience sometimes believed that their relaxed birth and subsequent relaxed postnatal state contributed to a calmer infant.

"I suppose having a chilled out relaxed-ish birth might help – I wasn't stressed out at all. It helps the baby not feeling any stresses from the mum. Yeah he's a very chilled out little boy." (Mother 19, planned induction, Entonox)

Theme Five: ***Maternal caregiving acting as a mediator***

Finally, some mothers felt that their initially unsettled baby had gradually become calmer when kept close and soothed in the postnatal period. Hence, some infants who had frequently screamed or cried during the early stage were said to settle after the first few weeks or months. Two mothers reported that they made the decision to care for their infant in a particular way following a traumatic birth experience, which differed from the way they cared for their first baby (e.g. co-sleeping or holding and carrying them more).

> *"I don't know whether she was affected or I was affected, but I did just cuddle her and mollycoddle her for a long time… She was contented on me… So yeah, we were quite stuck."* (Mother 23, acceleration, no pain relief)

> *"I co-sleep with this one which I never did with my first, mostly because it's the only way I can get some rest. She won't settle away from me."* (Mother 15, induction, forceps, pethidine, epidural)

As noted above, mothers who believed their infant was affected by the birth gave fuller descriptive responses. In contrast, mothers who were more ambiguous or did not perceive a relationship gave far shorter answers. However, some mothers denied any connection between their birth experience and their infant's behaviour, and yet the depth of their birth and infant behaviour descriptions suggested that a relationship may be occurring, even if they were not consciously aware. An example of this is given here by a mother who did not consciously recognise any relationship between her birth experience and her infant's behaviour.

> *"Looking back there wasn't a time when he wasn't crying… He'd feed little and often 'cause he was so uncomfortable as well… He wasn't sleeping and nor was I…"*
> (Mother 2, hospital induction, third degree tear, postpartum haemorrhage)

Based on these results, the next stage was to explore the potential association between maternal birth experience and infant behaviour.

2. *Was maternal birth experience associated with infant behaviour?*

To undertake this analysis, categories of maternal physical and psychological birth experiences and patterns of infant behaviour were compared (Tables 11 and 12). Although the sample size was too small to allow any formal statistical analysis, a comparison between different birth and behaviour groups allowed patterns in the data to be explored.

First, the association between physical birth experience (normal or clinical) and infant behaviour was examined (Table 12).

Table 12 Birth type (n) and infant behaviour – n (%)

(Total 22 births)	**Infant Behaviour n (%)**		
Normal/Clinical births	Easy	Mixed	Difficult
Normal births (9)	7 (77.78)	2 (22.22)	0
Clinical births (13)	3 (23.08)	4 (30.77)	6 (46.15)

As Table 12 shows, there was preliminary evidence to suggest an association between physical experience of childbirth and perceived infant behaviour. Participants who had normal physiological births were most likely to perceive their infant's behaviour as easy, and no mothers who experienced a normal birth described their infant's behaviour as difficult (see Appendix 2B for examples). In contrast, participants who had clinical births were more divided in their descriptions of infant behaviour, with the largest group describing their infant's behaviour as difficult. The exceptions to this general trend were mothers who had experienced planned interventions such as induction or Caesarean section: these mothers reported their infant as behaviourally easier.

Second, the association between maternal perceptions of birth as positive, negative, or mixed and their self-reported infant's behaviour was explored (Table 13).

Table 13 Maternal perceptions of the birth (n) and infant behaviour – n (%)

(Total 22 births)	**Infant Behaviour – n (%)**		
Birth experience	Easy	Mixed	Difficult
Positive (8)	8 (100)	0	0
Mixed (6)	2 (33)	3 (50)	1 (17)
Negative (8)	0	3 (37.5)	5 (62.5)

As illustrated by Table 13, subjective maternal perceptions of birth were also associated with maternal descriptions of infant behaviour. All mothers who described their birth experience as positive described their infant as easy. Conversely, mothers who described their birth experience as negative, consistently described their infants as mixed or difficult, with more fitting the description of difficult. Finally, for those who described a mixed birth experience, half described their infant's behaviour as mixed, with the remainder split between easy and difficult. Notably, all mothers with negative perceptions had experienced a clinical birth and 75% of mothers with positive perceptions had experienced a normal birth. The remaining 25% of mothers with positive perceptions had experienced a planned intervention such as induction or C section, indicating that mothers and their infants may fare better when expecting obstetric treatment than when experiencing unpredicted interventions.

Given the possibility that positive maternal experiences could be affecting a mother's perceptions of her infant, the association between maternal birth experience and infant behaviour was explored further (Table 14). In contrast to the beliefs and opinions of most maternity professionals in the previous chapter (n = 17, 94%), less than half of all mothers in this study (n = 10, 45%) perceived their baby's behaviour as in any way affected by the birth.

Table 14 Maternal perceptions of birth (n) and response to Question 3 – n (%)

Maternal perceptions of the birth	**Question 3. Was your baby affected by the birth? n (%)**		
(Total 22 births)	Yes	No	Ambiguous
Positive (8)	5 (62.5)	2 (25)	1 (12.5)
Negative (8)	3 (37.5)	4 (50)	1 (12.5)
Mixed (6)	2 (33.33)	2 (33.33)	2 (33.33)

Table 14 suggests that mothers who had positive perceptions of the birth were most likely to believe that their infant had been affected by their birth experience (n = 5, 62.5%). In contrast, 37.5% (n = 3) of mothers who had negative perceptions of the birth felt their infant had been affected. Those with a mixed experience were divided equally across the groups.

5.4 Summary

Exploration of maternal birth stories highlighted distinct associations between mother-reported physical and psychological experiences of birth and perceptions of their infant's behaviour. Notably, mothers often failed to make any association between their birth experiences and their infant's early behavioural style despite these strong patterns appearing to exist. Overall, less than half the mothers believed their infant's behaviour to have been impacted at all by the birth. This could simply mean that mothers had not previously considered that the two factors might be connected and – when presented with a direct question – gave a quick answer without much forethought. Nevertheless, mothers who had a positive birth experience and perceived their baby as calm, settled and easy to care for were more likely to perceive a connection than mothers who had a complicated birth, a more unsettled infant, and who took longer to bond with their baby. This implies that on some level mothers who had a more traumatic birth may have found it difficult to (consciously or subconsciously) accept that their infant might have been affected.

However, while prior research points towards the potential for childbirth to influence infant behaviour (e.g. Douglas & Hill, 2013; Dahlen et al., 2013), the reasons for these patterns in the

data are unknown. Potentially, the infant's physical experience of birth had a physiological impact on their behaviour. Alternatively, subjective maternal perceptions influenced by her psychological experience of birth indirectly affected the infant's behaviour or her interpretation of their behaviour. Possibly it was a combination of all the above.

5.5 Discussion

The second exploratory study investigated maternal perceptions of potential associations between their experience of childbirth and their infant's behaviour. Notably, under half the mothers perceived their infant's behaviour to have been impacted by birth. However, maternal birth stories highlighted that their experiences were affected by both physical and psychological elements of birth and the postnatal environment. Therefore, although mothers might not have been consciously aware of any significant connection between events, they still tended to report information that supported a potential association between birth and infant behaviour. This could be due to psychological factors such as maternal guilt and denial. Women who had a more difficult birth may be at increased risk of feeling guilt or anxiety over how a traumatic delivery could have affected their baby (Thomson & Downe, 2010). These mothers may not have wished to perceive or disclose a potential association between the birth and their infant's behaviour. Consequently, the lack of consistency in maternal responses might be caused by cognitive dissonance stemming from a desire to believe that their baby had experienced a positive start to life regardless of the type of birth they had experienced.

This idea was perhaps evident in how many mothers appeared to contradict themselves when they reported experiencing a difficult birth and unsettled infant behaviours. Several described behavioural disturbances in their newborn after depicting a physically traumatic birth, without attributing their infant's behaviour in any way to the birth. Mothers who had experienced difficulties during birth often stated first how 'good' their infant's behaviour was, then added detailed descriptions of seemingly quite difficult behaviour during the first few weeks after birth, such as not sleeping, constant crying, sickness or feeding problems.

Consequently, detailed exploration of the birth stories and descriptions of both early and more enduring infant behaviours suggested that experiences during birth and the postnatal period could be associated with infant behaviour, or at least with maternal perceptions of infant behaviour. Notably, mothers who experienced a normal birth were more likely to view their

birth experience as positive and perceive their infant as easier; and mothers with a clinical birth experience, particularly if unpredicted (e.g. an emergency Caesarean section), were more likely to view their birth negatively and find their baby's behaviour more difficult or challenging.

Some of these findings are likely to be bi-directional, although the direction of causality could not be established here. For example, mothers in a positive mental state during pregnancy may have had easier births and easier infants due to reduced maternal anxiety positively affecting both the birth (Johnston & Brown, 2013) and her baby's behaviour (Ostlund et al., 2016; Feldman, 2017). Equally, a positive birth experience may lead to better postnatal maternal wellbeing and more positive perceptions of their baby's behaviour. Although the findings are participants' retrospective and subjective perceptions of birth events and infant behaviour post birth, there are a number of possible explanations for these results.

1. *Physical birth experience*

First, there appeared to be a pathway between the infant's physical birth experience (as reported by mothers) and their post birth behavioural patterns. Apparent contributory factors were birth mode, birth environment, and methods of pain relief used during labour.

a) Birth mode

Mode of birth was described by all participating mothers and included: 'normal' physiological birth, induction or acceleration, forceps delivery, and planned or emergency Caesarean section. (There were no ventouse deliveries in this sample.) Although the sample numbers are too small to draw any definitive conclusions, waterbirths (N = 7, 32% of total births) were generally associated with calmer, more settled infants. In contrast, mothers felt that their forceps delivery infants might have residual pain or distress from their birth experience, with more frequent crying, fussing or screaming in the postnatal period. One infant had severe bruising for several weeks, presenting visible signs of distress. This type of birth experience could therefore be particularly stressful for the neonate. Indeed, as detailed in the literature review, previous research has demonstrated higher levels of umbilical cord cortisol in infants experiencing obstetric complications, especially assisted birth (e.g. Taylor et al, 2000; Gitau et al, 2001; Douglas & Hill, 2013).

In addition to the direct impact of potentially painful procedures such as a forceps delivery on the neonate's stress response system, infants could be affected by the mother's own raised cortisol levels during the birth (Gerhardt, 2014). Despite some conflicting evidence around the intrauterine 'foetal programming' hypothesis due to discrepancies in recording cortisol levels and differing methodologies, a meta-analysis found moderate associations between prenatal maternal stress and anxiety and heightened infant cortisol secretion (Pearson, Tarabulsy & Bussieres, 2015).

Also, a review of the multiple complex mechanisms behind the impacts of maternal psychosocial stress on infant behaviour suggested that the mother's cortisol release could potentially alter the development of the infant's HPA axis governing their future production of cortisol (Beijers, Buitelaar & de Weerth, 2014). This may occur alongside changes to placental and immune system functioning, the infant's genome and epigenome, and gut microbiota acquired from the mother during birth. In turn, lower diversity of healthy infant gut microbiota has been related to excessive crying and fussing in infancy (Partty, Kalliomaki, Endo, Salminen & Isolauri, 2012) with negative effects on the infant's future health and behaviour (Foster & McVey Neufeld, 2013).

Furthermore, in a review of research on epigenetic changes in the neonate, Vaiserman (2015) outlines likely environmental triggers during childbirth that might alter the infant's epigenome, affecting their subsequent physical and mental health. Risk factors for these epigenetic changes could include induction by synthetic oxytocin or prostaglandins, instrumental vaginal delivery, or general anaesthetic causing oxidative damage to the infant (Dahlen et al., 2013). Changes to the neonate's epigenome have been hypothesised to alter their future stress responsivity (Glover, O'Connor & O'Donnell, 2010; Douglas & Hill, 2013), potentially leading to increased reactivity and fearfulness in the infant (Ostlund et al., 2016).

Despite the widespread interest generated by this relatively new field of potential epigenetic changes during childbirth, caution needs to be exercised when interpreting such findings, as conclusive research is yet to be established. Nevertheless, it is possible that some of the infants in this study were responding physiologically and behaviourally to their mode of birth.

b) Birth environment

Birth environment was also considered important by mothers in relation to their own and their infant's wellbeing. If the physical environment was brightly lit, noisy and stressful, this could

increase maternal stress. Births taking place at home (N = 2, 9%) or in a MLU (N = 4, 18%) had fewer interventions and were generally reported as more positive experiences. While some women experienced a positive or mixed hospital experience (N = 6, 27%), those who experienced an in-labour transfer from home or MLU to hospital (N = 8, 36%) could find it difficult to acclimatise to their new environment, particularly if the transfer involved interventions which raised their stress levels (such as continuous electronic foetal monitoring or synthetic oxytocin administration). Overall, 10 participants (45%) had a negative hospital birth experience, including the 8 transfers. With frequently associated maternal perceptions of increased anxiety and pain levels, some transferred mothers succumbed to requesting methods of pain relief they had previously wanted to avoid (e.g. epidural anaesthesia). While not all mothers made a conscious connection, these unexpected and potentially stressful circumstances appeared to affect maternal reports of their baby's behaviour post birth.

Moreover, midwifery care often appeared to be stretched in midwife led units and maternity wards, despite NICE recommendations of one to one care for all women in labour (2015, 2017). Inconsistent care during labour and noticeable staff shortages on the postnatal ward could be experienced as distressing for the women involved. Indeed, recent staff shortages on maternity wards have been well-documented and can have a negative impact on quality of care (Kelly & Lee, 2017). Intermittent care could affect how participants felt postnatally about their birth environment, with perinatal maternal distress also appearing to adversely impact their infant's early behaviour. However, few mothers perceived this link. In contrast, women who had successful and supported home, MLU or hospital births were more likely to attribute their baby's calm and settled behaviours to the birth environment. Furthermore, mothers who did not perceive such a correlation, but who had a positive, more supported and less stressful birth experience in any environment, also tended to report more settled infant behaviours.

c) Pain relief

The subject of pain relief was also raised. Mothers were more likely to have required pethidine or an epidural during a prolonged or difficult labour. Pain relief appeared to affect mothers and infants in complex ways, with some mothers praising the positive benefits of nitrous oxide ('gas and air') or epidural anaesthesia. However, several mothers reported feeling no effective pain relief from pethidine, as mentioned in prior literature (e.g. Anderson, 2011). Some also experienced negative effects after pethidine or discussed the possibility of adverse effects on their baby's behaviour. This aligns with previous evidence that opioid derivatives in labour

may affect newborn alertness and contribute to breastfeeding difficulties (Nissen et al., 1995; Ransjö-Arvidson et al., 2001). For example, an Australian randomised control trial found that pethidine usage was associated with breastfeeding problems and an increased risk of neonatal nursery (NICU) admission when compared to self-administered fentanyl, which has a faster clearance time (Fleet et al., 2015).

However, fentanyl contained in epidural analgesia may come with its own set of problems. Here, some mothers reported less success in early attempts to breastfeed their baby after a difficult birth, often including a combination of pethidine, synthetic oxytocin and/or epidural. This increasingly used combination of pharmacological substances during labour is thought to potentially block the mother's endogenous production of oxytocin, which is the essential hormone for an easier birth and breastfeeding transition (French, Cong & Chung, 2016). In a large Australian survey involving nearly 2000 women, the use of epidurals significantly increased the risk of assisted deliveries and infants being admitted to NICU (Adams et al., 2015). Meanwhile breastfeeding was found to continue for significantly longer after the use of breathing or massage techniques compared to either pethidine or epidural.

Another study, using a small convenience sample of US mothers and their newborn infants, found the neurobiological pre-feeding organisation of the neonate exhibited by cues such as hand to mouth sucking was reduced after synthetic oxytocin (Bell, White-Traut & Rankin, 2013). Equally, as mentioned earlier, in a recent prospective observational study of mothers and newborn infants in skin to skin contact, Widström and colleagues found that normal patterns of neonatal alert, resting and suckling behaviours were negatively impacted after their joint exposure to synthetic oxytocin and fentanyl (Brimdyr et al., 2019).

In contrast, many mothers participating here who birthed using only nitrous oxide or natural methods of pain relief such as water noted that their baby seemed alert and well post birth. These mothers also reported to have established and sustained breastfeeding relatively easily compared to mothers who experienced birth complications and hence often a greater use of pharmacological pain relief.

2. *Maternal psychological experience of birth*

The pathway between birth and early infant behaviour might also be explained through maternal psychological experience of birth and her subsequent postnatal state. Maternal psychological experience may incorporate both physiological and emotional impacts and is therefore complex to unravel or to analyse. For example, experiencing fear during childbirth may increase circulating maternal cortisol levels, which pass readily through the placenta and breastmilk, potentially affecting infant behaviours (Nolvi et al., 2018). Fear may also increase perceptions of pain (Alehagen et al., 2005) which could then increase the need for epidural anaesthesia. As discussed earlier, epidurals may affect early infant behaviour, especially when combined with synthetic oxytocin (Brimdyr et al., 2019).

Overall, participants who had a normal birth were more likely to describe their experience as positive, while mothers who had a clinical birth with unexpected interventions more often perceived their experience as negative. Mothers who had 'positive' birth experiences generally described their infant's behaviour as easier than those who had a more 'negative' experience. Notably however, several mothers reported positive or mixed clinical birth experiences, particularly around planned inductions or Caesarean sections (N = 4, 18%). The mothers in this group appeared to experience interventions as predictable and hence calm. Although the sample size was small, most of these mothers reported their infant's behaviour as easier than those who had experienced unplanned interventions such as continuous electronic foetal monitoring, induction, acceleration, emergency CS or forceps delivery. This initially surprising factor might be linked to maternal expectations of birth (see theme 'Expectations' below). Additionally, it could be that planned interventions have less urgency and therefore cause less stress for both mother and infant.

a) Fear

Many mothers reported strong emotions such as joy or fear during their birth. Fear is a complex emotion that may cause the mother to feel deeply distressed, leading to the release of stress hormones during birth, such as norepinephrine, epinephrine and cortisol (Alehagen et al., 2005). Here, mothers often reported feeling distressed or fearful during birth complications or unplanned interventions. These mothers were more likely to report having initial difficulties with their infant's behavioural patterns, adjusting to motherhood and bonding with their baby.

In contrast, mothers who reported no fear or distress during their birth appeared more likely to find their infant's behaviour easier, calmer and more settled by comparison.

These findings highlight the physiological impacts of maternal fear or stress on the newborn, as well as the link between physiological and neurobehavioural responses to stress (Gitau et al., 2001; Douglas & Hill, 2013). Furthermore, circulating maternal cortisol in breastmilk post birth has been found to induce heightened fear reactivity, particularly in female infants (Nolvi et al., 2018), while normal birth is associated with a greater release of neuropeptides, prolactin, and oxytocin, which are all known to have a positive impact on maternal mood and mother-infant attachment behaviours (Feldman, Weller, Zagoory-Sharon & Levine, 2007).

The patterns that arose in this study suggested that maternal perceptions of her birth could play a central role in her interpretations of her baby's behaviour and subsequent mother-infant bonding. In a large prospective study following women from pregnancy through to eight weeks post birth, Garthus-Niegel et al. (2013) found that subjective accounts of the birth were the most significant predictors of PTSD. In line with this, a meta-analysis by Ayers and colleagues (2016) concluded that the development of PTSD after childbirth is strongly and significantly associated with maternal subjective perceptions of experiencing fear and distress during the birth. Consequently, women who perceive their birth experience as negative appear to be more susceptible to developing PTSD. It is therefore possible that these mothers are also more likely to perceive their infant's behaviour as challenging. Thus, it is conceivable that frightening birth events affected mothers' perceptions of their infants, for example in-labour transfers to hospital, subsequent unwanted obstetric interventions (such as continual electronic foetal monitoring or acceleration), and for some, experiencing insufficient emotional support.

b) Expectations

Maternal expectations of childbirth, as mentioned frequently by maternity care providers in Study One (Chapter Four), could be an additional factor (Ayers & Pickering, 2005; Ayers et al., 2008; Lally et al., 2008). Here, mothers who experienced disappointment, regret, sadness or guilt around their birth often appeared to find their newborn's behaviour more difficult. We know that mothers who have unplanned interventions (e.g. emergency CS or assisted delivery) are more likely to experience their birth as traumatic (Ayers et al., 2016). Therefore, mothers

whose birth experience was different to how they expected might also perceive their infant differently to mothers who had a more predictable, positive experience of birth.

c) Perceived health professional authority

The theme of perceived 'health professional authority' was also a significant factor in some births. If a mother felt that she had experienced a loss of control through health professionals exerting their authority in regard to previously unwanted interventions, this could have negative implications for her overall perceptions of the birth. Participants who were not fully informed or felt 'coerced' into consenting to unplanned interventions and procedures often had regrets around their birth. For example, several mothers recalled feelings of despair on being transferred from home or MLU to hospital and their subsequent inability to refuse interventions. Following this experience, some mothers succumbed to stronger pain relief than they had originally intended, which could have contributed further to their negative perceptions of the birth. These maternal feelings of loss of control during childbirth are reflected in the literature. In a large retrospective online survey of over 2000 women by Hollander and colleagues (2017), lack of control was the most frequently occurring factor in maternal experience of trauma during childbirth (54.6%) followed by intense levels of experienced pain (47.4%).

d) Support

Consistent with prior research (e.g. Ford & Ayers, 2009), how well the mother felt supported during and post birth influenced her perceptions of the birth and her postnatal mood. These mothers were grateful for the support, sometimes attributing their positive birth experience and their baby's 'easy' behavioural style to feeling supported. Professional support was an important factor for mothers who struggled with breastfeeding initially, most of them eventually succeeding following care and guidance. Mothers often used breastfeeding to soothe and be close to their baby after a difficult birth. Feeling supported to breastfeed in hospital was of particular importance to mothers who were kept in after the birth, although one mother resented being detained in order to establish breastfeeding after her difficult forceps birth.

e) Neglect

In contrast, mothers could sometimes feel neglected during the birth, and mothers theorised about potential reasons for this absence of professional support: perhaps due to presumed staff shortages in hospital or MLU, the busyness of the health care professionals, or possibly because

the midwives felt the couple were coping well alone. Occasionally a participant was not believed when she was in full labour and had requested pain relief. These mothers reported feeling distressed during labour and postnatally, even after a normal birth. Being refused pain relief when they felt they needed it was interpreted by some mothers as neglectful care. These findings reflect those of a systematic review by Bohren et al. (2015) – that neglectful and disrespectful care of women during childbirth still occurs across the world. Instead, respectful and supportive care help to promote more positive birth experiences (WHO, 2018).

f) Separation

Separation from her partner was another factor that could add to a mother's perceptions of birth trauma. This was common practice during night inductions but it could also happen when the mother wanted a bath during labour. Furthermore, some mothers were separated from their baby immediately post birth, and again this could be experienced as distressing and colour her perceptions of both the birth experience and her baby's early behaviour. Indeed, for mothers to feel emotionally close to their infant post birth, it helps to be spatially close (Flacking et al., 2013). This could be especially pertinent during periods of neonatal intensive care where the basic physical and emotional needs of the mother and her newborn to be together may be supplanted by the infant's need for medical care. One qualitative study of 23 preterm infants found that mothers may require extra support to form a physically and emotionally close relationship with their preterm baby (Flacking, Thomson, & Axelin, 2016). Early separation without due consideration of these factors can result in lack of parent-infant closeness and social interaction, leading to developmental delays and potentially detrimental impacts on the future physical and emotional health of the infant (Gerhardt, 2014). In contrast, in a quantitative study of 70 very preterm infants, Feldman and Eidelman (2003) found that the close contact involved in kangaroo care between a mother and her very preterm baby facilitates mother-infant wellbeing and the future neurobehavioural development of the newborn.

3. *Potential impacts of psychological factors*

Relating to many of these themes, similarly negative participant experiences were highlighted in a systematic review of global mistreatments of women during labour (Bohren et al., 2015). 'Mistreatments' included the woman being aware of staff shortages, feeling inadequately supported or neglected during labour and birth, feeling their birth choices were disrespected

(including having restricted mobility due to continuous foetal monitoring), not being 'allowed' to bring their partner into the bathroom, lack of informed consent, painful vaginal examinations, and health professionals refusing to provide adequate pain relief. In the present study, mothers with negative birth experiences – especially if they perceived them as traumatic – often reported more difficult neonatal behaviours. However, definitive conclusions concerning the directionality of this relationship cannot be made at this stage of the research.

4. *Post birth factors, e.g. skin to skin/separation, breastfeeding and support*

Mothers also felt the significance of early postnatal events for their physical and psychological wellbeing and their subsequent ability to care well for their baby, including ease of breastfeeding. Mothers who had a normal and positive birth experience were more likely to report immediate and prolonged skin to skin contact with their baby and an easier transition into breastfeeding. However, the appropriate breastfeeding support from maternity care providers could sometimes help to heal a negative birth experience, enabling mothers to bond with their newborn baby once breastfeeding was successfully established.

There are recognised mechanisms behind the increasingly common practice of encouraging immediate skin to skin contact in UK maternity wards (NHS Maternity Statistics England, 2016-2017). 'Skin to skin' further encourages endogenous oxytocin release in the mother-infant dyad, enabling the newborn to exhibit instinctive behaviours including the 'breast crawl' to their first feed (Widström et al., 2011). Moreover, a randomised control trial demonstrated increased self-efficacy and breastfeeding confidence in primiparous mothers after skin to skin, in addition to higher breastfeeding success rates over a longer time period (Aghdas, Talat & Sepideh, 2014). While one study found breastfeeding benefits only for the first month (Moore & Anderson, 2007), a systematic review of 34 randomised control trials established that early skin to skin contact could bring multiple benefits to the neonate, including higher blood sugar levels, improved cardio and respiratory stability in preterm infants, decreased neonatal crying, and better enablement and continuation of breastfeeding (Moore et al., 2016).

Skin to skin postnatal care has also been linked to multiple other benefits, including a reduced risk of adverse outcomes such as infectious diseases or infant death syndrome (Stuebe, 2009), improved thermoregulation (Christensson et al., 1992), enhanced mutual attachment via raised

oxytocin levels (Nissen, Lilja, Widström & Uvnäs-Moberg, 1992; Widström et al., 2019) and therefore less risk of abandonment (Widström, Wahlburg & Matthiesen, 1990). Furthermore, early skin to skin contact between the new dyad is now believed to positively affect longer term infant and child self-regulation and self-control behaviours (Widström et al., 2019).

In contrast to this instinctive closeness of mother and infant, some mothers discussed how the instant removal of her baby to complete routine postnatal checks made her feel temporarily estranged or distressed. For the newborn infant, this experience of immediate separation from their mother might also be distressing (Christensson et al., 1995). Indeed, one mother noted how her baby screamed when he was instantly removed and placed on the scales. Several mothers found it difficult to breastfeed after childbirth or postnatal complications, especially if their infant was taken to NICU.

Participants who had been deprived of immediate or prolonged skin to skin contact with their infant could therefore require more support when attempting to commence breastfeeding. Where mothers felt well supported and encouraged to persevere in breastfeeding their baby after a difficult birth, this often had a mutually restorative effect, with unsettled infants perceived as becoming calmer and easier in time. These findings are in line with prior research examining adverse effects of early mother-infant separation on maternal wellbeing and breastfeeding behaviours (e.g. Bystrova et al., 2009; Redshaw, Hennegan & Kruske, 2014).

5. *Postnatal maternal mood*

a) Baby mirrors mother

Postnatal maternal mood is believed to affect infant temperament and development and is influenced by the mother's experience of childbirth (Blom et al., 2010). Moreover, negative maternal mood may adversely impact a mother's interactions with and perceptions of her infant (McGrath et al., 2008; Field, 2010, 2017). Indeed, mothers who reported experiencing a traumatic birth were more likely to perceive their infants as difficult, needy or clingy, especially in the early postnatal period. A few mothers also expressed the belief that their own feelings post birth could have been recognised on some level by their baby. These mothers

acknowledged the possibility that their baby could have been unsettled in the early days because they had sensed their pain or distress. This may have affected bonding.

However, as there were no specific interview questions regarding mother-infant bonding and attachment, this element of post birth interactional experience could not be explored in depth. Nonetheless, mothers who described positive birth experiences were less likely to portray difficulties in bonding with their baby or adjusting to motherhood. In contrast, two mothers reported finding motherhood very difficult, and one confessed to wondering if she had made the right decision to have a baby. Another point therefore is that maternal postpartum mood disorders over the first year may have a harmful impact on mother-infant interactions, which could lead to insecure attachments (Murray, 1992; Teti et al., 1995) and adverse effects on the infant's emotional self-regulation (Granat et al., 2017). Consequently, negative maternal mood post birth is widely considered to adversely impact family relationships including that between the mother and her partner as well as the mother-infant bond (Ayers et al., 2006; Figueiredo et al., 2008; Parfitt & Ayers, 2009).

Nevertheless, it was difficult to differentiate between infants who were behaviourally more difficult post birth and those whose behaviour was perceived as difficult by their mothers. Mothers presented their baby's behaviour as it appeared to them, but this was subjective and the questions regarding infant behaviour were open-ended and non-specific. Furthermore, as this was not an observational study, mother-infant interactions (while noted during the interview) were not part of the study criteria. Therefore, maternal perceptions of infant behaviour may not have been accurate and could have been influenced by postnatal maternal mood after a difficult birth experience. Support for this stems from studies where maternal perceptions of her infant appear to be negatively affected by her postnatal mood disorder (e.g. McGrath et al., 2008). However, as Britton (2011) points out, it is equally likely that difficult neonatal behaviours including feeding and sleeping issues could heighten maternal distress.

While no mothers in the present study disclosed any diagnosed postpartum depression, some reported having struggled during the first weeks and months post birth. Furthermore, mothers who described a 'traumatic' birth experience or an immediate post birth removal of their infant to the special care unit appeared more likely to have found bonding and breastfeeding challenging. These mothers often described their infants as being more unsettled in the first few weeks after birth, reporting behaviours such as crying, fussing or screaming.

Consequently, there appears to be a potential pathway between the mother's subjective birth experience, her postnatal distress, and her infant's early behavioural style. However, in a diverse qualitative study it can be difficult to see a clear picture, and once again there can be no conclusions drawn regarding the cause and effect of any ostensible patterns appearing here.

b) Maternal caregiving

Notably, as mentioned earlier, two participants commented on how they had tried to compensate their babies for a traumatic birth experience by keeping them close postnatally. In both cases, the mothers reported having behaved differently with their previous baby after an easier birth experience. Wolke (1995, p123) highlights how this intensive form of sensitive maternal caregiving may act as a soothing mediator for the infant's 'behavioural organisation', particularly after a difficult birth. Additionally, James-Roberts & Wolke (1987) previously highlighted that a mother's personal attributes, such as her 'confidence in caretaking' and 'self-efficacy', could play a role. Subsequent research has shown that maternal sensitivity to infant distress mediates mother-infant attachments (Letourneau et al., 2015). As well, maternal sensitivity could have positive implications for infants whose mothers report high negative emotionality in their offspring (Leerkes & Zhou, 2018).

5.6 Limitations

This study has several limitations. First, mothers who have had a positive birth might be more likely to attribute their infant's behaviour to their experience, or to convey their baby as easier than they actually are (James-Roberts & Wolke, 1987), although mother reports have been found to contain some level of accuracy regardless of their birth experience (James-Roberts & Wolke, 1984). However, maternal reports of infant temperament might also be influenced by prenatal expectations and preconceptions of their baby (Wolke, 1995, p118). Besides, parents' emotional involvement in their infant precludes the possibility of being entirely objective observers of their infant's temperament (Wolke, 1995).

Despite these potential issues, significantly difficult infant behaviour is found to be objectively reported, regardless of maternal mood or preconceptions (Wolke, Meyer & Gray, 1994). Therefore, there tends to be a high concordance rate between self-report and behavioural measures (Rothbart et al., 2001; Van den Bergh et al., 2017). In the present study, participants

were not questioned about specific recent behaviours but rather overall perceptions of post birth and recent behaviours. Thus, maternal responses relied on memory, judgement and a subjective overview and maternal assessments of infant behaviour could be biased. Nevertheless, the more objective observer viewpoints of maternity care providers interviewed in Study One (Chapter Four), who see multiple women and their infants during and after childbirth, could perhaps be considered external raters, supporting the current findings.

Second, despite efforts to recruit a representative sample, unfortunately there was little sociodemographic diversity. For example, all participants were British Caucasian, and just 7 out of 22 (32%) were not educated to degree level. In addition, a majority of mothers in this study (N=15, 68%) breastfed their infants, a higher proportion of breastfeeders than might be expected in the general population – which is approximately 44% of mothers with infants aged 6-8 weeks (Official Statistics, Public Health England, Gov.UK, 2016).

A further limitation was the relatively small sample size. Larger samples are needed to enable an empirical investigation of the potential relationship between objective birth experience (physical factors such as birth mode), maternal perceptions of birth and early infant behaviours. This would allow for closer examination of the multiple complex factors involved in the postnatal neurobiological wellbeing of the mother-infant dyad. In particular, the assessment of infant behaviour would benefit from detailed and more objective questioning regarding behaviours relating to specific areas (e.g. feeding, sleeping, crying or fussing, responsivity, sociability and soothability).

Consequently, while demonstrating some interesting patterns in maternal perceptions of childbirth and infant behaviours, the qualitative nature of the data means that no empirical conclusions can be drawn. In addition, the semi-structured design of the interview schedule meant that participants diverged in the information they presented for analysis. However, this also meant that the results were rich and varied, and some insightful responses were given that might be further explored through analysis of quantitative data in the next chapter.

5.7 Conclusions

In contrast to health professionals in part one of this study, many mothers appeared not to perceive any connection between their experience of childbirth and their baby's behaviour post birth. However, strong patterns seemed to exist. Perceptions of associations between birth

experience and infant behaviour were more common in mothers who reported positive birth experiences and easier infant behaviours. The findings in this chapter further indicate that both the physical birth and a mother's subjective perceptions of birth could have consequences for infant behaviour in the formative stages of early temperament development. From these diverse data, the overall wellbeing of mother and infant appeared to be mutually determined. Adverse impacts on the mother's physical and psycho-social wellbeing during childbirth and the early postnatal period often had a negative impact on her perceptions of her baby's early behaviours. These in-depth qualitative findings could have wider implications for the future practice of care and support given to women during labour, childbirth and the early postnatal period.

Next steps

The findings covered in this chapter call for a more extensive quantitative study to examine whether the patterns between maternal childbirth experience and reported infant behaviour are observed and statistically significant in a larger sample. As described in Chapter Three (Methodology), survey data collection occurred alongside maternal and health professional interviews, with the online survey continuing to collect data while all interview data were analysed and Part One of the thesis was completed. This exploratory mixed methods approach aims to extend the rich in-depth qualitative findings of the first two studies (Chapters 4 and 5) through numerical measurement of cause and effect as well as allowing predictions to be made regarding birth experience and infant behavioural outcomes. As aforementioned (Chapter 3), quantitative findings will then be able to expand upon the qualitative findings with neither method of data collection or analysis taking precedence (Morse & Niehaus, 2016). Also, potential mechanisms behind patterns in the data can be further explored. Finally, triangulation of findings from the three studies will take place, further enhancing the credibility and confirmability of the different data types for the complex topic of childbirth and infant temperament, while increasing validity across the studies as a whole (Creswell & Clark, 2007).

Chapter Six: Study Three

Maternal experiences of childbirth and infant behaviour – an online survey

Findings from Study Three were presented at:

Normal Labour and Birth Conference, Lancashire, 17th – 19th June 2019
Society of Reproductive and Infant Psychology Conference, London, 5th – 6th September 2019
Maternity and Midwifery Festival, Cardiff, 18th September 2019

Study Three is currently under review.

Chapter Six presents the third and final study in the thesis, Study Three. It is a quantitative examination of themes that also arose within the two qualitative studies, researcher PPI and the wider research literature.

6.1 Background

In the second study (Chapter Five), 22 mothers participated in semi-structured interviews to explore three elements of childbirth and infant behaviour including:
1. Their own personal birth stories;
2. Retrospective maternal reports on their baby's early behaviour (0-12 months); and
3. Whether mothers perceived a relationship between the birth and their baby's behaviour.

The data were explored thematically, with several emerging themes consistent with those found in the health professional sample in Study One (Chapter Four). However, some notable new themes were also identified such as 'Health Professional Authority' – which concerned feeling coerced into previously unwanted interventions. It was also observed that maternal emotions surrounding childbirth often appeared to be associated with the mother's physical experience.

Bringing together the findings from the first two studies, a simple content analysis in Study Two (Chapter Five) revealed that common physical factors such as obstetric complications and interventions could be associated with early infant behavioural patterns, as suggested by health professionals in Study One. It also highlighted that psychological aspects of childbirth might

influence a mother's perceptions of her experience, which may further affect her perceptions of her baby's behaviour. However, due to the small sample size and retrospective design of the study, no definitive conclusions could be drawn regarding causality between physical and psychological experiences of childbirth and infant behavioural style. Also, the semi-structured nature of the interviews meant that, while recurrent themes could be explored, no direct comparisons could be made between participants. The next steps were therefore to further examine any associations between maternal physical and psychological experiences of childbirth and infant behaviour in the quantitative data, and to assess differences in infant behaviour according to differences in specific birth events (such as birth mode) and subjective maternal experiences. Consequently, the 'Maternal Experiences of Childbirth and Infant Behaviour Survey' was conducted and analysed both as a stand-alone study and in reference to the two qualitative studies.

Certain concepts identified in the initial literature review – that were considered relevant to the subject though had not arisen during interviews – were included in the questionnaire. For example, the mother's current state of mental health and utilising doulas for extra maternal support during labour. According to Garthus-Niegel et al. (2013), up to a third of women may view their experience of childbirth as traumatic. The literature on PTSD after childbirth suggests that the objective physical birth experience is mediated by the mother's subjective experience (Ayers et al., 2008), and this subjective experience contributes significantly to PTSD (Garthus-Niegel et al., 2013; Ayers et al., 2016). Qualitative research shows that post-traumatic stress symptoms may be associated with a mother's perceptions of her infant (Ayers et al., 2006); and, as postnatal mood disorders are known to be comorbid, mothers who regard their birth experiences as traumatic are more likely to experience postnatal depression (Alcorn, O'Donovan, Patrick, Creedy, & Devilly, 2010; Ayers et al., 2016). Postnatal mood disorders can have repercussive effects on mother-infant bonding (Boorman, Devilly, Gamble, Creedy, & Fenwick, 2014) and infant temperament (Pauli-Pott, Mertesacker & Beckman, 2004).

Aims and objectives

The overall objective of Study Three was to conduct a detailed examination of maternal experiences of childbirth and reported infant behaviour using a quantitative design. While data collection for this study ran in parallel to collect and analysis of studies One and Two, the analysis and interpretation of Study Three aims to expand upon the rich, in-depth knowledge

gathered in the first two studies that began to answer the central research question – *Does childbirth experience influence maternal perceptions of infant behaviour?* The sub-questions set out in Chapter One will also be further explored, with a final focus on the third question:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?
3. Which are the most significant perinatal factors in early infant behavioural patterns?

Within this framework, the study's main objectives are to investigate the following specific questions regarding maternal experiences of childbirth and the perinatal period and mother-reports of their babies' behaviour – both during the first 24 hours post birth and their baby's most recent behaviour – and to explore whether associations change with increased infant age. Therefore, the objectives of Study Three are to answer the following questions:

a) Are objective and physical factors relating to birth and the perinatal period (such as birth mode and feeding method) associated with patterns of early infant behaviour?
b) Are subjective and psychological perinatal factors associated with infant behaviour?
c) Are maternal characteristics and postpartum mood associated with infant behaviour?
d) Which factors during pregnancy, birth and the postnatal period best predict early infant behaviours and maternal confidence when controlling for all other significant factors?

6.2 Methods

Design

Positivism is a scientific realist approach to research that aims to accurately measure and observe phenomena (Bruce, Pope, & Stanistreet, 2017). It is therefore an empirical approach that studies phenomena through scientific methods involving measurement that is: (a) systematic, (b) rigorous, (c) repeatable by the researcher to check reliability, and (d) reproducible by others (Bruce et al., 2017). Using a positivist approach for Study Three allowed inductive reasoning arising from the qualitative studies to be systematically cross-examined, and for deductive hypotheses to be tested using quantitative statistical methods to gather and analyse the available evidence (Teddlie & Tashakkori, 2003). This approach has

been frequently employed in previous public health research and is increasingly used in conjunction with qualitative methods (Kaur, 2016).

The first two exploratory studies raised some concepts only suggested by the previous literature (e.g. Taylor et al., 2000), or studied with a focus on maternal psychological rather than infant behavioural outcomes (e.g. Ayers et al., 2016). The third study therefore required a quantitative approach that would allow causal explanations of the links between childbirth experience and infant behaviour to be further explored (Navarrete, 2009). Theories generated by the qualitative data analyses and research literature could be further investigated and the results applied to a much wider mother-infant population. Thus, the idea that subjective maternal perceptions of childbirth could also affect the infant's behaviour may be fully examined, enabling a detailed picture of multiple interacting physical and psychological variables to be constructed.

A questionnaire was chosen as the most efficient tool for Study Three as it can collect a large amount of objective data (Boynton & Greenhalgh, 2004). Questionnaires are a cost- and time-effective way to reach a large study sample (Fife-Schaw, 2006), allowing ideas developed in the first two studies and the wider literature to be examined within the wider UK maternal population (Saks & Allsop, 2012) using standardised questions and simple response options such as checkboxes. This practice helps to avoid the distortion of information through researcher bias and interpretation (Munn & Drever, 1990).

Although questionnaires are limited in that detailed explanations are not possible, the efficacy and popularity of using a structured quantitative survey for public health research was an advantage (Ponto, 2015). The essentially closed question design allowed maternal birth experiences to be anonymously examined, quantified, and compared to self-report measures of their infants' behavioural patterns (Marks, 2004; Creswell & Clark, 2007). It also enabled the themes arising from Studies One and Two (Chapters Four – Five) to be cross-compared in a larger sample.

A retrospective internet survey was therefore designed with the aim of building on the research literature to achieve a more precise, in-depth picture of childbirth experiences and infant behaviour. It consisted of several established and validated tools and incorporated a series of questions designed to determine mothers' perceptions of the perinatal period and their infant's state and behaviour post birth. With ethical considerations of mothers and their infants in mind,

no access to personal birth data was requested. Therefore, self-report responses relied upon accurate maternal recall of birth experience and immediate post birth infant behaviour.

However, accounts of infant behaviour (0-6 months) relied much less upon maternal memory. To address concerns about accurate recall in the infant behaviour part of the survey it was necessary to use a detailed infant temperament questionnaire that asked specific questions (as recommended by Rothbart and Goldsmith, 1985) rather than asking parents to make relative judgements about their baby's behaviour. Therefore, an infant temperament questionnaire was required that would ask only about recent events and for details regarding very specific infant behaviours and identifiable maternal feelings. This aimed to increase the study's validity by minimising the bias of more abstract forms of mother-report on infant behaviour. Importantly, Rothbart and Mauro (1990) point out that parents see their child in normal everyday situations, and can therefore provide broader, deeper information than external observations.

Online surveys are now a common method for collecting a large amount of data from the sample population (Fricker & Schonlau, 2012), although participants may develop respondent fatigue if the survey is too long (Jones, 2017). Despite this, the online survey has become a popular way to conduct public health research, reaching a large sample in a relatively short amount of time (Hollander et al., 2017; Hunter, Fenwick, Sidebotham, & Henley, 2019). Online surveys in public health research can also reduce 'social desirability' in comparison to other research methods, making them less prone to this type of bias (Zhang, Kuchinke, Woud, Velten, & Margraf, 2017). Thus, the online survey was chosen as the most appropriate method.

Participants

The study was designed and implemented in accordance with the ethical standards of the 1964 Declaration of Helsinki (WMA, 2013) and the British Psychological Society code of ethics and conduct (BPS, 2018). The Department of Psychology Research Ethics Committee at Swansea University granted approval for the study on 28th May, 2014 (Appendix 3A). All participants completed a briefing and consent form and provided background sociodemographic information prior to taking part.

The sample population was mothers (with no major health problem) living in the UK, over 18 years of age with an infant (with no major health problem) aged 0-6 months (7-month/ 30-week cut-off) from a singleton pregnancy. Exclusion criteria were: any major health problems

in mother or infant (e.g. diabetes / cerebral palsy / very low five minute Apgar score); premature birth (< 37 weeks); multiple birth (> 1 infant); or low birthweight infant (< 5.5lb) (WHO, 2020). Low birthweight or premature infants behaviourally differ to full-term infants with a normal birthweight range (Brazelton & Nugent, 1995) and are more likely to be unsettled and irritable (Gitau et al., 1998).

Measures

A self-report online questionnaire was designed, consisting of six main sections: (1) maternal and infant demographics; (2) physical events during the perinatal period; (3) perceptions of and interactions with newborn infant; (4) Mother and Baby Scales (Wolke & James-Roberts, 1987); (5) subjective and psychological perinatal factors and maternal characteristics. Participants who had more than one child were asked to complete the questionnaire about their most recent birth experience and their current (most recent) infant.

1. *Maternal and infant demographic factors*

To establish potential covariates, participants were asked to provide information regarding their age, ethnicity, highest education level, number of children, monthly household income, UK area of residence, and relationship status. Infant age, gender, gestation and birth weight (if known) were also requested.

2. *Physical events during pregnancy, childbirth, and the postnatal period*

Exploring the physical birth was an important first step to finding out how mothers perceived their birth experience. Information regarding any major physical perinatal factors potentially significant to maternal and infant wellbeing was requested via statements concerning: complications occurring during pregnancy, childbirth or postnatally; place of birth; how labour commenced; birth mode; birth events; labour timings; pain ratings and methods of pain relief. Questions regarding standard hospital procedures in cases of medical concern were included (e.g. continuous electronic foetal monitoring [EFM]), as well as questions about the neurobiological state of infant during and after birth (intrauterine distress, meconium in waters or resuscitation). Mothers were also asked whether they had experienced immediate skin to skin contact with their newborn infant, and if the a) first and b) current feeds were breast, expressed or formula.

3. *24 Hour Baby – maternal perceptions of and interactions with her newborn baby*

Initial maternal perceptions of and interactions with her newborn were considered a potentially important precedent for ongoing infant wellbeing and behaviour. Mothers were therefore asked to rate seven statements on a five-point Likert scale about their infant's appearance, physiological wellbeing, and behaviour during the first 24 hours. For example, *'My baby's head looked bruised and swollen'*, *'My baby appeared calm and relaxed'*, *'My baby seemed very sleepy/irritable or smiled/cried a lot'*; also, *'My baby latched onto the breast easily'*.

4. *Mother and Baby Scales (Wolke & James-Roberts, 1987)*

As a measure of early infant temperament, the survey incorporated the validated Mother and Baby Scales (MABS) (Wolke & James-Roberts, 1987), designed as a maternal rating instrument of the temperament dimensions of the NBAS (Brazelton, 1973). Consequently, MABS has been frequently used in conjunction with the NBAS in both research and clinical practice to compare clinical observations with maternal perceptions of newborn behaviour after 'perinatal adversities' (e.g. James-Roberts & Wolke, 1983, 1984, 1986, 1987). MABS was considered the most appropriate tool for the current research as it was designed specifically as a research instrument of early infant behavioural patterns with obstetric factors in mind. Although now over three decades old, it is still relevant and utilised in research concerning infant behavioural patterns post birth (e.g. Meier, Wolke, Gutbrod, & Rust, 2003).

Whilst originally designed for the neonatal period, in agreement with the authors these early infant behaviour scales were considered fit for purpose for infants aged 0-6 months. MABS asks simple, straightforward questions concerning very specific everyday infant behaviours over the preceding seven days. They focus on the infant's feeding, sleeping and elimination behaviours, alongside general mood, negative emotionality (e.g. unsettled or irritable), alert and responsive behaviours, sociability and soothability. They also contain subscales to capture maternal perspectives, including 'social perceptions' (for example of overall infant Easiness), in addition to important maternal attributes such as 'confidence in caretaking' and 'self-efficacy' (James-Roberts & Wolke, 1987). They cover both specific (e.g. 'My baby has fussed before settling down') and general (e.g. 'Easiness') maternal perceptions of her baby, in addition to maternal feelings (such as 'It makes me insecure when my baby cries').

Although mother-reports are strongly associated with maternal diaries and professional observations (James-Roberts & Wolke, 1988), obstetric factors and their potential impact on maternal confidence and self-efficacy could also affect these reports (James-Roberts & Wolke, 1987, 1989). Therefore, MABS also includes maternal feelings around caring for her baby, viewing the mother-infant dyad as an interconnected unit. This enables MABS to define some of the maternal characteristics which may influence her perceptions and reports of the infant (Wolke, 1995). In this sense, infant temperament is not viewed as an isolated phenomenon but considered in relation to the mother's ability to cope with her baby (Abidin, 1983). MABS infant behavioural items are rated on six-point unidimensional scales ranging from '0' (*not at all*) to '5' (*very much/very often*) (Wolke, 1995). The 'Overall Impressions and Experiences' subscales (e.g. Easiness) are rated on seven-point scales from '-3' to '+3', with -3 signifying 'very difficult' behaviours and +3 'very easy' ones (e.g. -3 = 'very irritable'/ +3 = 'very calm').

As a self-report questionnaire, although MABS is potentially vulnerable to social bias or inaccurate recall, it was considered the best tool to examine a range of early infant behaviours from 0-6 months. Other popular infant temperament questionnaires such as the Infant Behaviour Questionnaire (Rothbart, 1981; Gartsein & Rothbart, 2003) measure behaviour from three months rather than from birth. Previous studies have indicated that, whilst factors such as maternal mood (Murray, 1992) and prenatal preconceptions (Diener et al., 1995) may influence judgement, some level of objectivity does exist between different report methods of infant behaviour (e.g. questionnaires, maternal diaries, and health professional observations) (Bates & Bayles, 1984; James-Roberts & Wolke, 1988; Mebert, 1991).

Thus, parental perceptions of infant characteristics have been found to converge well with more objective methods such as trained observers (Wolk et al., 1992). Despite the inevitably subjective and interpretive nature of a parent-report questionnaire, the precision of questions concerning recent infant behaviours alongside a descriptive overview means that maternal impressions and interpretations of infant behaviours are less likely to be distorted and more likely to represent the facts, even for anxious or depressed mothers (Carey & McDevitt, 2016).

Indeed, James-Roberts & Wolke (1984) highlighted how mothers can sometimes underestimate 'difficult' or unsettled infant behaviours after birth complications when compared to a trained observer. Incorporating contextual factors and noting the influences of

environmental factors and initial social processes upon infant development are thus important factors for consideration (Rothbart & Goldsmith, 1985). Similarly, a mother's emotions concerning her infant combined with her sense of her own caretaking abilities are noteworthy. Maternal perceptions of her baby may therefore be considered of equal significance to more objective methods (James-Roberts & Wolke, 1988). While it is acknowledged that mothers may be too emotionally involved and possess too many preconceptions to be mere 'scientific observers' of their offspring (Wolke, 1995, p118), maternal observations are understood to be objectively based on definitive infant behaviours as well as determined by their own expectations and characteristics. Consequently, maternal observations when responding to detailed enquiries regarding recent infant behaviours were largely considered to be valid.

Other recent research has employed the MABS from birth to 6 months (e.g. Oates, Gervai, Danis, Lakatos, & Davies, 2018). Additionally, it has been used in studies of older infants where maternal confidence ratings signified as much importance as infant behaviours. For instance, Field, Hernandez-Reif and Feijo (2002) explored breastfeeding rates in depressed mothers and their 8-month-old infants using MABS, and it has also been utilised to explore links between infant behaviour, maternal confidence, postpartum depression and low-self-esteem (Denis, Ponsin & Callahan, 2012). In the former study, depressed mothers showed reduced breastfeeding rates, and in the latter, significant relationships were found between early maternal postpartum blues (at 2 days), low self-esteem, lack of confidence in caretaking and breastfeeding, and infant behaviours perceived by the mother as more 'difficult'.

Consequently, with the main focus on infant behaviour, the full MABS was used here. Table 15 outlines the eight MABS areas of interest for both infant behaviour and maternal confidence.

Table 15 Mother and Baby Scales (MABS)

MABS area of interest *(abbreviations)*	**Description of measure**
General	
Alert-Responsive (A-R)	How alert, attentive and communicative the infant appears
Unsettled-Irregular (U-I)	How much the infant cries or fusses or how easy they are to settle
Lack of Confidence in Caretaking (LCC)	How capable mother feels when caring for her baby
Overall Impressions	(Maternal perceptions of her confidence and her baby's behavior)
Easiness (E)	How calm, alert and settled the infant appears overall
Global Confidence (GC)	How confident mother feels about coping; general anxiety level
Feeding	
Alertness during Feeds (ADF)	How alert the infant is during and after feeding
Irritable during Feeds (IDF)	Whether the infant feeds reluctantly, or with difficulty or irritability
Lack of Confidence in Breastfeeding (LCBF)	If breastfeeding, whether this is experienced as problematic in relation to tension, conflicting advice, technique, confidence, or any impacts of birth

Reliability and validity of MABS

Although medically designed scales such as the NBAS (Brazelton, 1973, 1995) may measure newborn infants with difficult obstetric backgrounds more effectively than 'naturalistic observations', which are believed to be influenced by maternal care and the environment, the overall validity of maternal observations has been demonstrated (James-Roberts & Wolke, 1987). Studies conducted during the evolution of MABS – a 63 item questionnaire – showed high levels of internal consistency, face validity, and validity of maternal observations,

although the authors could not confirm 'factorial' validity of maternal ratings due to limited sample sizes (James-Roberts & Wolke, 1983, 1984, 1986, 1987). Mothers were found to be relatively consistent about which infants they rated as difficult, moderate or easy, and maternal observations were found to correlate well with maternal diaries addressing similar aspects and periods of infant behaviour (Wolke, 1995).

Maternal reports on specific infant behaviours (such as feeding and sleeping) were also associated with maternal overall impressions of infant 'Easiness', signifying internal maternal consistency in self-reports of their infant's temperament or behavioural characteristics (James-Roberts & Wolke, 1984; Wolke, 1995). Similarly, this MABS section of 'overall impressions' has been shown to operate well when compared to professional observations of infant behaviour, thus giving MABS the status of a reliable questionnaire (Wolke and James-Roberts, 1987; James-Roberts and Wolke, 1988). MABS has also demonstrated its validity in relation to newer self-report infant behaviour measures assessing maternal perceptions and representations of their baby's temperament (Oates et al., 2018).

5. *Psychological factors and maternal characteristics*

Although physical maternity care has made huge advancements over the last century, the emotional care of mothers during pregnancy, birth and early postnatal days is still considered a relatively neglected area of obstetric care (Glover, 2014). Existing research concerning the psychology of childbirth and infant temperament has mostly focused on the impacts of maternal pre- and post-partum stress, anxiety and depression on the infant (Glover, O'Connor & O'Donnell, 2010). As aforementioned, although a prior study examining birth mode in relation to early infant behaviour concluded with a suggestion that the mother's response to the birth could possibly mediate the infant's stress response (Taylor, Fisk & Glover, 2000), research has not yet wholly explored the potential impact of maternal emotions and perspectives during childbirth on developing infant temperament.

Consequently, Study Three also aimed to examine maternal psychological wellbeing during the perinatal period, including maternal perceptions of her birth experience, and to explore how these factors might contribute to infant behavioural patterns. Therefore, survey questions were included which required participants to think about how they had felt both physically and psychologically during pregnancy, childbirth, and the early postnatal period. These became 'subjective maternal perceptions of birth' and are detailed in the results section.

Given that heritability factors are known to play such an important role in personality development and subsequent behaviour (Caspi, Roberts & Shiner, 2005; McAdams & Olson, 2010), and maternal mood is known to impact on infant behaviour (Glover, O'Connor & O'Donnell, 2010), it was necessary to also consider maternal traits, states and postnatal mood when exploring the potential impacts of childbirth on infant behavioural style. To assess participants' shorter- and longer term emotional states and character traits, the following three validated mood and personality questionnaires were included in the survey. To keep the already large-scale survey within workable limits of maternal time, brief versions of the questionnaires were chosen where feasible, providing they correlated well with the original full instrument.

a) Maternal personality – Ten Item Personality Inventory (TIPI)

The 'Big Five' personality traits (Goldberg, 1992) have previously been associated with birth outcomes for mother and infant. For example, in Johnston and Brown's (2013) study, mothers with higher levels of emotional stability and extroversion were more likely to experience a normal birth. Therefore, personality scores were considered both directly and indirectly significant in terms of infant behaviours: maternal personality affects infant temperament genetically, and potentially also environmentally via the mode of birth a mother is more likely to have given her personality type, in addition to the postnatal environment she helps to create.

The ten-item version (TIPI) of the original 100-item Big Five Inventory (BFI) (Goldberg, 1992) was designed to provide researchers with a shorter instrument to measure personality when personality is not directly related to the research questions and a lengthy questionnaire might lead to participant boredom, frustration or fatigue (Gosling, Rentfrow & Swann, 2003). The TIPI, which takes approximately one minute to complete, converges well with other multi-item personality measures, including the BFI (John & Srivastava, 1999). With one overarching question: 'How much do you see yourself as…', the TIPI offers check box options for ten statements pertaining to the five established personality traits: Extroversion, Conscientiousness, Openness, Agreeableness and Emotional Stability. It employs reverse scoring for negatively worded statements (for example, 'Anxious, easily upset' = inverse of Emotional Stability). Its construct validity and test-retest reliability are well-established (Gosling et al., 2003), and it has been widely used in other public health research (e.g. Johnston & Brown, 2013). Consequently, the TIPI was used in the present study.

b) Maternal anxiety and depression – Edinburgh Postnatal Depression Scale

Maternal mood disorders may encourage more negative maternal perceptions of infant behaviour (Orhon, Ulukol & Soykan, 2007; McGrath et al., 2008) and can affect measurable infant outcomes such as fear regulation, stress reactivity and cortisol levels (Feldman et al., 2009). However, as mentioned earlier, the direction of causation is unclear and may be bi-directional, with infant behaviours also affecting maternal mood (Britton, 2011). Therefore, it was anticipated that the infant behavioural measures employed here might correlate with the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden & Sagovsky, 1987).

The EPDS was designed to assess symptoms of postnatal mood disorder by measuring maternal perceptions of their own emotional state over the previous seven days (Cox et al., 1987). Its original form is short and concise, making it quick and easy to administer and score, with a maximum score of 30. Mothers with scores of 13 or above are considered high risk, requiring a risk assessment and suitable care plan. The EPDS presents ten multiple choice statements (e.g. 'I have been able to laugh and see the funny side of things'), with check box answers on a four-point Likert scale. Its sensitivity, internal consistency, validity, and reliability as an effective screening instrument for postnatal depression are well established and it is widely used in the UK and elsewhere (e.g. Bunevičius, Kusminskas & Bunevičius, 2009; Shrestha, Pradhan, Tran, Gualano, & Fisher, 2016).

c) Maternal 'state' – State and Trait Anxiety Inventory (STAI)

It was unknown whether the mother's emotional state at the time of participation would signify anything new in terms of infant behavioural scores or self-reported confidence levels. The 'State' section of Spielberg's State and Trait Anxiety Inventory (Spielberg, 2010) measures current anxiety levels in the mother. The maternal state could be a further indication of her general mood as reported on the Edinburgh Postnatal Scale, or part of her underlying personality as recorded in the Ten Item Personality Inventory. However, it is possible that state anxiety fluctuates according to a transient situation, whilst trait anxiety remains stable across time (Spielberger, Gonzalez-Reigosa & Martinez-Urrutia, 1971).

The six-item version of the STAI State Anxiety was designed to measure state anxiety as reliably as the original version on a reduced item set. With correlation coefficients greater than 0.9 between the original and briefer versions, the shortened instrument is almost equally sensitive to variations in anxiety, with excellent levels of reliability and validity (Marteau & Bekker, 1992). Thus, at the end of the present survey, mothers were asked to check boxes on a four-point scale from 'not at all' to 'very much' alongside six simple statements relating to anxiety (e.g. *I feel calm/upset, I am tense/relaxed*.) Positive items were scored inversely, with the total score corresponding to current anxiety levels. Thus, higher scores on the items 'upset', 'tense' and 'worried' and lower scores on 'calm', 'relaxed' and 'content' signified higher anxiety levels overall, and the total score was therefore taken as a measure of current anxiety.

Recruitment strategy

Recruitment took place through advertisements placed on UK mother and infant sites (such as netmums.co.uk and bounty.com) who agreed to host the questionnaire. Specific social media sites were also targeted, with a link to the questionnaire on SurveyMonkey™ provided. In addition, the supervisory team used their professional networks to reach mother and baby groups, allowing interested parties to retweet or share. This approach enabled the survey to reach a wide range of potential participants. The process of self-selection meant that the study might be biased towards those with an interest in the topic. Also, due to the self-selecting nature of online participants in contrast to a random sampling design, the findings cannot necessarily be generalised to the wider population of mothers and infants (Sturgis, 2006). However, given the high recruitment rate of the sample population, the study potentially provides an adequate representation of internet-utilising mothers living within the UK.

Thus, the internet was used to recruit a large sample of mother-infant dyads. As discussed above, the internet has become a popular way of collecting large amounts of anonymous data over a relatively short time period, although the overall response rate may be no higher than for conventional surveys (Fricker & Schonlau, 2012). A potential drawback is that it can be harder to follow up potentially interested non-respondents as, if they do not complete the survey within a day, they often fail to submit their form altogether (Tse, 1998). Nonetheless, it may still be quicker and easier to complete a survey online than by paper and postal mail (Schaefer & Dillman, 1998), and particularly for convenience rather than purposive sampling. By neatly storing all participant responses together, online surveys may also conceivably

facilitate the data analysis process. Importantly however, the methodology should be well thought out to ensure the consistency and quality of responses (Schaefer & Dillman, 1998).

Procedure

Data collection took place between June 2014 and March 2017 (see thesis timeline, Figure 1, p. 58). This was to enable a large sample whilst allowing time to fully analyse and write up the qualitative studies. Participating mothers responded to an online invitation to take part in the study (see Appendix 3B). Interested mothers clicked on the survey link for further information about the nature of the study and then, if they chose, clicked another link to access the full survey electronically. They were presented with an information page outlining what the study would involve and the study eligibility criteria. To ensure that vulnerable mothers and infants did not take part, potential participants could only proceed with the questionnaire after agreeing to statements regarding their own and their infant's health, and to the inclusion criteria of recommended gestation periods and birthweights (WHO, 2020). Participants were then asked to provide their informed consent, in line with British Psychological Society ethical guidelines of anonymity, confidentiality and right to withdraw (BPS, 2018). The briefing, consent and debriefing pages loaded automatically as participants progressed through the survey (Appendix 3C). At the end, mothers could decide whether to submit or withhold their responses.

The survey consisted mostly of closed questioning, with participants responding to a series of statements regarding their perinatal physical health, emotional states, birth mode and birth experiences on either five-point Likert scales – from strongly disagree to strongly agree – or check boxes (Fife-Schaw, 2006). Open response boxes were used occasionally where this was the best method to obtain the required information (e.g. 'If you know, what was your baby's weight at birth?'). The survey also gave details of how to contact the researcher and supervisor for further information. Finally, participants were signposted to relevant support groups in case the questionnaire elicited difficult memories, and were advised to contact their GP or health visitor if it had raised any parenting concerns. (See Appendix 3C for full questionnaire).

Data Analysis

Raw data were imported from SurveyMonkey™ into SPSS version 26 (SPSS UK Ltd) for analysis. Each of the four questionnaires utilised within the survey were first scored according to their individual instructions. Multiple statements concerning pregnancy or postnatal complications were counted and included as continuous scores rather than individual items.

Continuous, nominal and ordinal data could then be quantified and interpreted via the associated tools for analysis explained in detail below: correlations and ANOVAs to establish similarities, differences and interactions of infant behaviour in relation to the birth experience and surrounding factors; and multiple linear regressions to make predictions.

To begin, factor analyses were carried out on participant-rated statements concerning their subjective perceptions of the perinatal experience. This technique was applied where multiple statements rated on a five point Likert scale had the potential for reduction to fewer items: first, maternal perceptions of their infant's behaviour and wellbeing during the first 24 hours post birth to produce measures of newborn infant behaviour termed '24 Hour Baby'; second, subjective maternal physiological and psychological experiences of pregnancy, childbirth, and the early postnatal period; and finally, overall maternal perceptions of the physical and psychological birth experience. Mothers had responded to questions and a list of potential answers concerning their subjective perceptions (e.g. *'How did you feel during pregnancy/ your birth?'*). Principal Components analyses (PCA) were conducted using Direct Oblimin rotation methods, as recommended by Field (2009) for inter-correlated socio- or psychological data. Factors with an eigenvalue over one were used; computed factors were saved as regression scores, named, and used in subsequent data analyses.

To determine which potential confounding variables required controlling for in further statistical analyses, bivariate correlations (using two-tailed hypotheses) and Multivariate Analyses of Variance (MANOVAs) were performed on the data to discover initial similarities and differences between the compound factors examined in the study, beginning with potential maternal and infant covariates. Infant characteristics (current infant age, gender, gestational age at birth, and birth weight) and sociodemographic confounders (maternal age, education, ethnicity, household income, relationship status and number of children) were considered.

Dummy coded variables (yes = 1, no = 0) were created in SPSS where required, for either brevity or necessity determined by the type of statistical procedure (e.g. regression). Partial Correlations, controlling for covariates and excluding cases listwise, were conducted where independent variables reflected either ratio or interval data. Multivariate Analyses of Covariance (MANCOVAs) were carried out for categorical independent variable data, using the *a priori* Bonferroni correction method of analysis in SPSS, with all means comparisons chosen in advance (Howell, 2002; 2008). This method of planned comparisons produces equal

or slightly more conservative results to planned post hoc tests, while having the advantage of allowing covariates to remain in the equation. An alpha level of < 0.05 was used to assess the results of all correlations and MANOVAs.

The initial ratio variable 'Infant Age' was recoded into three groups of approximately equal size, to assess results across different age bands. This new factor was named Infant Age Group and was applied as an additional fixed factor within all the MANCOVAs. It enabled a deeper level of analysis of the Mother and Baby Scales (MABS) criteria in relation to three infant age groups: 0-10 weeks (n = 293/ 29.3%), covering the initial period of adjustment to life outside the womb; 11-20 weeks (n = 391/ 39.1%) where infants are becoming more consciously aware and communicative with their caregivers; and 21-30 weeks (n = 301/ 30.1%) when active communication increases and mobility begins (Murray & Andrews, 2005). Breastfeeding confidence ratings were significantly higher between 0-10 weeks and 21-30 weeks, whilst the new factor 'Infant Age Group' also showed significant differences in infant behaviour measures: overall, older infants were reported as more Alert-Responsive and less Unsettled-Irregular or Irritable during Feeds, and perceived by their mothers as 'Easier' overall.

Monthly household income was categorised using the five income brackets taken from the ONS division of quintiles from 2014-2016, corresponding with the survey design and data collection period (ONS, 2017). For the purposes of later multiple linear regression analyses, household incomes were further divided into dichotomous variables – below and above £2700/month – corresponding to the approximate median gross household income of £2700/month in the same period, 2014-2016 (ONS, 2019).

Certain factors had the potential to be bi-directional in causality. However, placing infant behaviour and maternal confidence as the main speculated outcome variables was integral to the overall study hypothesis: that childbirth itself and maternal perceptions of the birth experience may influence mother-reported infant behaviour. Moreover, maternal perceptions of her baby are believed to comprise her own self-reported confidence, coping and caretaking competence. Therefore, the three maternal confidence measures incorporated within the Mother and Baby Scales (MABS) were included, as intended by the authors, to also establish the potential impacts of childbirth experience upon maternal confidence and self-efficacy.

Finally, a predictive form of analysis was chosen to establish the strongest independent variables, and to indicate which factors might explain the greatest proportion of the total variance of infant behavioural scores when all others were held constant. Multiple linear regression was employed, using the forced entry method as recommended by Studenmund and Cassidy (1987) and excluding cases pairwise. By the pairwise method, the data were mostly retained, including cases where a question did not apply to a participant (e.g. feeding method) or when the answer was unknown (e.g. the infant's initial birth weight or Apgar score).

Thus, a series of multiple linear regressions were performed for each of the ten outcome variables: two 24 Hour Baby scales and eight MABS items. Outliers were not generally removed in light of the reasonably large sample size (a total of 999 qualifying mothers were included in the final analysis). Therefore, an outlier was only removed if it had an exceptionally large residual (over 30), a leverage value greater than three times the average, and was considered to significantly influence the regression line (Field, 2009). Finally, Cook's distance was employed as a measure of outlier influence (Field, 2009), and interpreted as satisfactory when < 1 in all remaining cases. The Durbin-Watson test was used to establish independence of residuals (Field, 2009). The large sample size, normal distribution of outcome variable residuals and other assumptions of regression being met would normally enable the R^2 to be interpreted (Howell, 2008). However, as the scatterplots showed an unequal variability of errors (homoscedasticity) in some of the regression models, the adjusted R^2 is reported here.

It is recommended that initial predictors are chosen *a priori* according to their relevance to the study, with redundant predictors then filtered out (Howell, 2008; Field, 2009). Therefore, due to an excessive number of significant variables (> 50 in some instances) only variables originally significant at the more stringent alpha level of $p < .01$ were taken forward into the second regression. Thus, all significant variables were entered into the first regression model, with relationships identified and retained using a conservative alpha level ($p < .01$). This was to prevent spurious results or 'over-fitting' the model, and to safeguard its generalisability beyond the sample population (Babyak, 2004; Harvard Business Review, 2015).

Multicollinearity was also managed in the second regression run to reduce the frequently inherent inter-correlations often found in data concerning psychological factors (Field, 2009). Compound inter-correlations within the multiple linear regression models highlighted the multifactorial nature of maternal childbirth experience and its potential impacts upon infant

behaviour. Inter-correlations over 0.6 and moderate correlations over 0.5 were excluded when belonging to non-significant factors in the initial model, as recommended by Howell (2008), to reduce multicollinearity and meet the stringent regression assumption of independence of variables (Field, 2009). Following management of multicollinearity, the variance inflation factor and tolerance statistic were found to be satisfactory in all regression models, and the third and final trimmed linear regression was run using solely the significant factors at an alpha level of < 0.05 from the previous, second regression model (Field, 2009). This increased the power of the model whilst providing clarity around the significant predictors.

6.3 Results

Initially, 1152 mothers completed the questionnaire on SurveyMonkey™ and a total of 999 mothers of an infant aged 0-6 months qualified for inclusion in the study. Mothers who did not meet the eligibility criteria were those with a non-UK postcode, or an infant older than thirty weeks, born before or after 37-42 weeks' gestation, or weighing less than 5.5 pounds (WHO, 2020). Mothers were also excluded if they did not complete the infant behaviour section of the questionnaire. Mean age of mothers on completing the questionnaire (n = 999) was 32 years (SD = 4.2; range 19-44 years). Mean age of infants was 15.31 weeks (SD = 7.48; range 0-30 weeks). Further information on maternal background is presented in Table 16 below.

Table 16 Sociodemographic composition of the sample

Indicator	Group	N	%
Age	19-24	48	4.8
	25-29	217	21.7
	30-34	454	45.4
	35-39	243	24.3
	40-44	32	3.2
Ethnicity	White (British/Irish/Other)	948	94.9
	Mixed/Multiple ethnic group	20	2.0
	Asian/Asian British	13	1.3
	Black African/Black Caribbean	11	1.1
	Other Ethnic Group	4	0.4
Education	No formal qualifications	2	0.2
(highest level)	GCSE or equivalent	32	3.2
	A level or equivalent	108	10.8
	Degree or equivalent	450	45.0
	Vocational qualification	45	4.5
	Postgraduate or equivalent	361	36.1
Relationship Status	Single	19	1.9
	Partner (not living with)	6	0.6
	Cohabiting	261	26.1
	Married	712	71.3
Number of children	1	544	54.5
	2	346	34.6
	3	81	8.1
	4	21	2.1
	5+	4	0.4
Household Income*	Less than £1000/month	25	2.5
	£1000-£1700/month	103	10.3
	£1701-£2700/month	229	22.9
	£2701-£4200/month	335	33.5
	£4201 or more/month	206	20.6
UK area of residence	England	735	73.6
	Wales	130	13.0
	Scotland	67	6.7
	Northern Ireland	27	2.7

N.B. *Gross household income brackets before tax and after benefits or savings (ONS, 2017) – population groups divided in accordance with ONS definitions into bottom, 2nd, 3rd, 4th and top quintiles.

6.3.1 *Infant Behaviour*

Two main measures were used to assess infant behaviour and wellbeing post birth and during the first six months.

1. *24 Hour Baby*

The 24 Hour Baby Scales, incorporating Cry-Fuss and Alert-Content 24 Hour Baby, were designed to provide a simple measure of newborn infant wellbeing and behaviour. An exploratory Principal Components Analysis (PCA), using Direct Oblimin rotation, was performed on data from seven statements regarding maternal impressions of her infant's appearance and behaviour during the first 24 hour period (as detailed in *Measures* section).

The pattern matrix explained 57.19% of the variance, producing two factors which reflected contrasting newborn infant states. These two factors were saved as regression scores and labelled accordingly: (1) 'Cry-Fuss Baby' – accounting for 38.06% of the variance and based on four items which described the newborn infant crying, appearing irritable, *not* calm or relaxed (inverse score used), and having a bruised and swollen head; and (2) 'Alert-Content Baby' – accounting for 19.12% of the variance and constructed from three items describing the infant as calm, relaxed, alert – *not* sleepy (inverse score used), latching onto the breast easily and smiling. 24 Hour Baby therefore comprised Cry-Fuss Baby and Alert-Content Baby. Higher scores in Cry-Fuss behaviours meant that the infant cried and fussed more often, appearing irritable to their mother; also, their head may have appeared bruised and swollen. Higher scores in Alert-Content behaviours indicated a newborn infant who smiled, appeared calm and relaxed, initiated breastfeeding more easily, and was *not* 'very sleepy' (inverse score used). Current Infant Age was not a significant factor for 24 Hour Baby, indicating that the passage of time did not significantly affect maternal perceptions of her newborn infant.

2. *Mother and Baby Scales*

The Mother and Baby Scales (MABS) were analysed and coded according to instructions (Brazelton & Nugent, 1995). The MABS items are detailed in Table 15 above, and Table 17 presents the Mean (SD) and range of 24 Hour Baby and MABS scores.

Table 17 Distribution of 24 Hour Baby and MABS scores

		Mean	Standard Deviation	Range (min-max)
24 Hour Baby (N = 981) ***Actual scores***	Cry-Fuss	2.56	1.03	4 (1-5)
	Alert-Content	3.12	1.15	4 (1-5)
24 Hour Baby (N = 981) ***Factor scores***	Cry-Fuss	.00	1.00	5.51 (-1.31 to 4.19)
	Alert-Content	.00	1.00	5.68 (-2.66 to 3.02)
MABS (N = 999)	Alert-Responsive	39.27	5.13	30.00 (16-46)
	Unsettled-Irregular	49.63	12.79	69.00 (19-88)
	Lack of Conf. in CT	32.40	9.12	60.00 (10-70)
	Easiness	24.28	2.30	12.00 (16-28)
	Global Confidence	17.74	1.88	8.00 (13-21)
	Alert during Feeds	17.09	4.46	23.00 (6-29)
	Irritable during Feeds	19.18	7.05	39.00 (7-46)
	Lack of Conf. in BF	16.49	6.27	38.00 (7-45)

Note: Scores in all tables are rounded to 2 decimal places; CT – caretaking, BF – breastfeeding

To determine whether there was a stable and consistent pattern of infant behavioural style from birth to six months, bivariate Pearson's correlations were performed between the two infant behaviour measures. Significant associations were found between most 24 Hour Baby and MABS items, all in the expected direction (Table 18).

Table 18 Associations between 24 Hour Baby and MABS

MABS	**24 Hour Baby**	
	Cry-Fuss Baby	**Alert-Content Baby**
Alert-Responsive	-.104***	.139***
Unsettled-Irregular	.323***	-.214***
Lack of Confidence in Caretaking (CT)	.141***	-.134***
Easiness	-.225***	.110***
Global Confidence	-.212***	.171***
Alert during Feeds	-.033	.052
Irritable during Feeds	.184***	-.161***
Lack of Confidence in Breastfeeding (BF)	.139***	-.243***

Pearson's *r*: * $p < 0.05$, ** $p<0.01$, *** $p < 0.001$

Determining potential covariates of fixed infant and maternal factors

To explore associations between potential infant and maternal demographic confounders, a series of correlations were performed on all continuous variables (Table 19).

Table 19 Associations between potential covariates, 24 Hour Baby and MABS

Factor	Infant Age	Gestational Age	Birth Weight	Maternal Age	Household Income	Number of Children
24 Hr Baby	df = 967	df = 979	df = 970	df = 975	df = 970	df = 977
Cry-Fuss	.024	.072*	.007	.010	.047	-.111***
Alert-Content	.040	.035	.059	.092**	-.063*	.238***
MABS	df = 997	df = 997	df = 997	df = 819	df = 819	df = 819
Alert-Responsive	.439***	.029	.052	-.001	-.049	.040
Unsettled-Irreg.	-.179***	-.027	-.081*	-.071*	-.058	-.093**
Lack conf. CT	-.042	.075*	-.025	-.061	-.027	-.215***
Easiness	.180***	.023	.023	-.018	-.015	.030
Global conf.	.045	-.015	.001	.032	.027	.129***
Alert dur feeds	.244***	-.032	-.037	-.015	.057	.010
Irritable dur feeds	-.180***	-.014	-.116***	-.053	-.024	-.118***
Lack conf. BF	-.089**	.105**	-.022	.000	.028	-.214***

Pearson's *r*: * $p < 0.05$, ** $p<0.01$, *** $p < 0.001$

To summarise the continuous variables taken forward, Gestational Age, Maternal Age, Household Income and Number of Children were identified as potential covariates for 24 Hour Baby; whilst Infant Age, Gestational Age, Birth Weight, Maternal Age and Number of Children were identified as potential covariates for MABS. A series of MANOVAs with Bonferroni correction were conducted to establish potential categorical covariates:

a) Infant gender

An initial MANOVA revealed a significant main effect of gender, with females rated as more Alert-Content compared to males: F (2, 959) = 11.49; p = 0.001 (Female: M = .099, SD = 1.0; Male: M = –.116, SD = .96). In contrast, no significant differences were found between genders for Cry-Fuss 24 Hour Baby. However, the MANOVA for MABS showed significant gender differences for Unsettled-Irregular patterns, with male infants rated as more Unsettled-Irregular

than females: F (8, 829) = 6.77, p = 0.009 (Female: M = 48.89, SD = 11.98; Male: M = 50.94, SD = 12.69).

Therefore, infant gender was taken forward as a covariate for both 24 Hour Baby and MABS.

b) Maternal education

Reported maternal education levels were recoded into a dichotomous variable – Higher Education (HE) or No Higher Education (No HE). Higher education was inversely associated with household income of £27,000/year or less, r (992) = -.176, p < 0.001. A MANOVA found significant differences in both 24 Hour Baby and MABS scores according to whether mothers had HE. Newborn infants of mothers with No HE were perceived as more Alert-Content than those of mothers with HE, F (1, 844) = 6.06, p = 0.014 (HE: M = .04, SD = .98; No HE: M = .30, SD = .97).

Similarly, infants aged 0-6 months of mothers with No HE were reported as more Alert-Responsive, F (1, 844) = 7.786, p = 0.005 (HE: M = 39.07, SD = 5.18; No HE: M = 40.60, SD = 4.42); and more Alert during Feeds, F (1, 844) = 10.533, p = 0.001 (HE: M = 16.66, SD = 4.43; No HE: M = 18.19, SD = 4.13). They were also perceived as Easier overall, F (1, 844) = 7.844, p = 0.005 (HE: M = 24.12, SD = 2.29; No HE: M = 24.80, SD = 2.13).

Maternal education level was therefore included as a covariate for 24 Hour Baby and MABS.

c) Ethnicity

Mothers of ethnic minority groups were associated with a household income of £27,000 or less a year, r (993) = .962, p < 0.001, despite also being associated with living with a partner, r (993) = .848, p < 0.001. Neither MABS infant behaviour nor 24 Hour Baby scores differed significantly across ethnic groups although Black African/Caribbean/British mothers reported more confidence in caring for their infants. Also, due to small ethnic minority group sizes in the total sample (n = 48, 4.8%), there was not a sufficient spread of data to provide any meaningful analysis. Given this lack of significant main effects for ethnicity overall and the sample of ethnic minority mothers being too small, ethnicity was not taken forward as a covariate. The issue of lack of ethnic diversity in participant recruitment both here and across many UK studies is covered in more depth in the chapter discussion section.

d) Relationship status

As with ethnicity, some group sizes in Relationship Status were too small to provide any meaningful analysis. Furthermore, Relationship Status (married, cohabiting, single, partner – not living with, divorced, widowed) affected only Lack of Confidence in Caretaking scores, $F(3, 841) = 2.753$, $p = 0.042$. Married mothers felt most confident, reporting the lowest *Lack of Confidence in Caretaking* scores (M = 31.61, SD = 8.49), and single mothers the highest (M = 35.25, SD = 5.77). However, as interpretation of these findings was limited by so few participants categorised as Single (n = 19, 1.9%) or *not* Living with a Partner (n = 6, 0.6%), Relationship Status was also excluded from subsequent analyses.

In addition to the continuous covariates assessed above (Table 19), Infant Gender and Maternal Education were potential categorical confounders for both 24 Hour Baby and MABS. Thus, six covariates were identified for 24 Hour Baby and seven for MABS (Tables 19 and 20).

Table 20 Covariates for 24 Hour Baby and MABS

24 Hour Baby	**MABS**
Gestational Age	Gestational Age
Infant Gender	Infant Gender
Maternal Age	Birth Weight
Maternal Education	Infant Age
Household Income	Maternal Age
Number of Children	Maternal Education
	Number of Children

The results will now be presented under three main question headings:
(1) Is infant behaviour associated with objective physical perinatal factors?
(2) Is infant behaviour associated with subjective and psychological perinatal factors?
(3) Which of these factors best predict infant behaviour?

Question One Is infant behaviour associated with objective physical perinatal factors?

Previous research has found that certain perinatal events or obstetric difficulties may predict more unsettled early infant behaviours (Taylor et al., 2000; Gitau et al., 2001; Douglas & Hill, 2013). Consequently, it was anticipated that physical perinatal factors might affect infant behaviour scores. Controlling for covariates, Pearson's partial correlations and a series of MANCOVAs with Bonferroni correction were employed to establish which of the following physical factors were associated with 24 Hour Baby and MABS.

Pregnancy and Postnatal Complications

The number of complications experienced by mothers during each period were computed. Over 25% of participants experienced at least one pregnancy or postnatal complication (Table 21).

Table 21 Descriptive statistics for pregnancy & postnatal complications

Number of complications	Pregnancy complications		Postnatal complications	
	N	%	N	%
0	629	63%	497	49.7%
1	263	26.3%	270	27%
2	80	8.1%	131	13.1%
3	20	2%	58	5.8%
Mean	.51		.91	
SD	.78		1.20	
Range	0-5.00		0-7.00	

Partial Pearson's correlations were conducted to assess relationships between the number of complications experienced before and after childbirth and infant behaviour. A positive significant relationship was found between the number of Pregnancy and Postnatal (PN) Complications and 24 Hour Baby. In both instances a higher number of complications were associated with more Cry-Fuss and less Alert-Content newborn behaviours. Number of Pregnancy Complications also had positive associations with MABS Unsettled-Irregular and Lack of Confidence in Caretaking and Breastfeeding. Similarly, Number of Postnatal Complications had significant positive relationships with MABS Unsettled-Irregular and Irritable during Feeds, and negative associations with maternal confidence (Table 22).

Table 22 Pregnancy – Postnatal Complications, 24 Hour Baby and MABS: Infant Behaviour and Maternal Confidence

Measure	N	Factor	Pregnancy Complications	Postnatal Complications
24 Hour Baby	981	Cry-Fuss	.119, p = .000**	.198, p = .000**
		Alert-Content	-.125, p = .000**	-.144, p = .000**
MABS	999	Alert-Responsive	-.016, p = .613	.032, p = .322
		Unsettled-Irregular	.103, p = .001*	.066, p = .041*
		Lack of Conf. CT	.140, p = .000**	.082, p = .011*
		Easiness	-.070, p = .030*	-.009, p = .789
		Global Confidence	-.074, p = .021*	-.086, p = .008*
		Alert during Feeds	.010, p = .762	-.009, p = .774
		Irritable during Feeds	.105, p = .001*	.086, p = .008*
		Lack of Conf. BF	.088, p = .011*	.140, p = .000**

Pearson's *r*: * $p < 0.05$, ** $p < 0.001$ Note: CT – caretaking; BF – breastfeeding

Birth place

Mothers were asked where they had given birth (hospital, midwife led unit (MLU) or home). A multivariate analysis of covariance (MANCOVA) was conducted, showing significant differences in 24 Hour Baby behaviours between birth settings. Bonferroni analysis highlighted that hospital born infants were reported as exhibiting the most Cry-Fuss and least Alert-Content behaviours, while home-born infants were perceived as less Cry-Fuss and more Alert-Content (Table 23).

A separate MANCOVA was conducted for MABS criteria, with Infant Age Groups as an additional fixed factor to Birth Place (as outlined in *Methods* section). Birth Place was significant for MABS Alert-Responsive and Unsettled-Irregular infant behaviours, and for Lack of Confidence in Breastfeeding scores (Table 23). While differences in Alert-Responsive behaviours were small, hospital born infants were reported as more Unsettled-Irregular, and home-birthing mothers reported greater breastfeeding confidence. These relationships were then explored for infants in different age groups: no significant interaction effects occurred between Birth Place and Infant Age Groups.

Table 23 Birth Place, 24 Hour Baby and MABS

Measure	Factor	Birth Place – Mean (SD)			
		Hospital n = 727	**Home** n = 110	**MLU** n = 152	**Significance**
24 Hour Baby	Cry-Fuss	.12 (1.04)	-.62 (.72)	-.11 (.84)	F (2, 949) = 23.980, p = .000***
	Alert-Content	-.12 (.99)	.62 (.88)	.08 (.95)	F (2, 949) = 16.824, p = .000***
MABS	Alert-Responsive	39.07 (5.26)	39.83 (4.75)	39.70 (4.70)	F (2, 799) = 3.258, p = .039*
	Unsettled-Irregular	50.58 (12.57)	45.06 (10.13)	50.60 (12.56)	F (2, 799) = 6.788, p = .001**
	Lack of Confidence CT	32.85 (8.60)	29.68 (7.02)	31.16 (8.90)	F (2, 799) = 2.990, p = .051
	Easiness	24.15 (2.29)	24.69 (2.32)	24.13 (2.23)	F (2, 799) = 2.462, p = .086
	Global Confidence	17.66 (1.87)	18.31 (1.74)	17.68 (1.82)	F (2, 799) = 2.891, p = .056
	Alert during Feeds	16.89 (4.47)	16.66 (4.02)	16.44 (4.49)	F (2, 799) = .477, p = .621
	Irritable during Feeds	19.43 (7.09)	17.52 (5.45)	19.52 (6.48)	F (2, 799) = 1.775, p = .170
	Lack of Confidence BF	17.06 (6.61)	13.58 (4.09)	16.43 (5.66)	F (2, 799) = 6.753, p = .001**

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: CT – caretaking; BF – breastfeeding

Duration of Stages of Labour

Pearson's partial correlations, including the established covariates, were conducted to assess associations between the length of each labour stage (latent, active and 2nd stage – measured in hours and minutes) and 24 Hour Baby and MABS scores. No significant relationships emerged between the length of any labour stage and Alert-Content Baby. However, the lengths of all three stages were associated with Cry-Fuss Baby: the longer the stage, the more Cry-Fuss behaviours were exhibited (Table 24).

For MABS, the length of Latent Stage was inversely associated with Alert-Responsive infant behaviour. Also, lengths of Active Stage and Second Stage were positively associated with Unsettled-Irregular and Lack of Confidence in Caretaking and Breastfeeding, indicating that infants could be more unsettled, and mothers less confident, after a longer active or second stage (Table 24).

Table 24 Stages of Labour, 24 Hour Baby and MABS

Measure	N	Factor	Stages of Labour		
			Latent Stage (hrs) n = 687	**Active Stage** (hrs) n = 714	**2nd Stage** (mins) n = 750
24 Hour Baby	981	Cry-Fuss	.094, p = .015*	.170, p = .000***	.157, p = .000***
		Alert-Content	-.040, p = .302	-.059, p = .123	-.058, p = .119
MABS	999	Alert-Responsive	-.101, p = .009**	.022, p = .565	.029, p = .438
		Unsettled-Irregular	.045, p = .240	.113, p = .003**	.099, p = .007**
		Lack of Conf. in CT	.022, p = .561	.127, p = .001**	.104, p = .005**
		Easiness	-.017, p = .662	-.053, p = .162	-.049, p = .188
		Global Confidence	-.044, p = .255	-.032, p = .392	-.068, p = .066
		Alert during Feeds	.033, p = .396	.018, p = .630	-.019, p = .609
		Irritable dur. Feeds	.049, p = .205	.022, p = .562	-.013, p = .717
		Lack of Conf. in BF	-.007, p = .872	.095, p = .019*	.114, p = .004**

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001 *Note:* CT – caretaking; BF – breastfeeding

How did Labour Start?

In a series of MANCOVAs for each start of labour method (e.g. natural, sweep, ARM), there were several significant differences in 24 Hour Baby behaviours. Newborn infants cried and fussed significantly less after a natural start to labour. Specifically, Bonferroni analysis highlighted increases in Cry-Fuss Baby scores after inductions of labour by artificial rupture of membranes (ARM), Drip, or Pessary *and* Drip. Correspondingly, Alert-Content behaviours were higher after Natural Start, and lower after ARM, Induced by Pessary, Induced by Drip, or Induced by Pessary and Drip (Table 25a).

Table 25a Start of Labour Method and 24 Hour Baby

Factor	Start of Labour – Mean (standard deviation) and significance											
	Natural n = 552		**Sweep** n = 202		**ARM** n = 95		**Pessary** n = 117		**Drip** n = 58		**Pessary & Drip** n = 81		**Planned CS** n = 62	
24 Hour Baby	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*
Cry-Fuss	-.13 (.96)	F (1, 951) = 22.03, p = .000***	.11 (.98)	F (1, 951) = 1.28, p = .257	.30 (1.05)	F (1, 951) = 9.49, p = .002**	.18 (1.16)	F (1, 951) = 3.45, p = .063	.39 (1.24)	F (1, 951) = 9.20, p = .002**	.45 (1.17)	F (1, 951) = 15.48, p = .000***	.02 (.92)	F (1, 951) = .83, p = .363
Alert-Content	.14 (.96)	F (1, 951) = 31.00, p = .000***	-.09 (1.02)	F (1, 951) = 2.20, p = .139	-.25 (.96)	F (1, 951) = 7.44, p = .006**	-.27 (.97)	F (1, 951) = 8.76, p = .003*	-.40 (1.07)	F (1, 951) = 9.74, p = .002**	-.36 (1.02)	F (1, 951) = 9.20, p = .003**	.08 (1.02)	F (1, 951) = .00, p = .956

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

A further series of MANCOVAs were conducted for each start of labour method in relation to MABS, using the a priori Bonferroni correction and Infant Age Groups as an additional fixed factor. Infants were significantly less Unsettled-Irregular after a Natural Start, and less Alert-Responsive after a Sweep (Table 25b). Mothers were also more confident in breastfeeding after a Natural start and less confident after a Membrane Sweep or when Induced by Pessary and Drip. There were no interaction effects between any significant Start of Labour factors and Infant Age Groups.

Table 25b Start of Labour Method, Infant Behaviour and Maternal Confidence

Factor	Start of Labour – Mean (standard deviation) and significance											
	Natural n = 488		**Sweep** n = 179		**ARM** n = 81		**Pessary** n = 98		**Drip** n = 45		**Pess & Drip** n = 60		**Planned CS** n = 53	
MABS	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*	M (SD)	*Sig.*
A-R	39.35 (5.16)	F (1, 812) = 3.34, p = .07	38.64 (5.50)	F (1, 812) = 5.77, p = .016**	38.42 (6.04)	F (1, 812) = 1.31, p = .253	39.64 (4.93)	F (1, 812) = .17, p = .676	38.71 (5.64)	F (1, 812) = .05, p = .829	40.18 (4.18)	F (1, 812) = 1.35, p = .245	38.94 (5.58)	F (1, 812) = .66, p = .415
U-I	49.43 (12.67)	F (1, 812) = 3.79, p = .05*	51.19 (12.57)	F (1, 812) = 3.01, p = .08	52.23 (12.77)	F (1, 812) = 2.87, p = .091	49.42 (11.08)	F (1, 812) = .02, p = .897	50.91 (12.33)	F (1, 812) = .02, p = .898	50.62 (11.55)	F (1, 812) = .07, p = .789	52.11 (12.15)	F (1, 812) = 1.68, p = .195
LCC	31.76 (8.63)	F (1, 812) = 1.84, p = .18	32.63 (8.87)	F (1, 812) = .00, p = .95	32.72 (9.03)	F (1, 812) = .14, p = .703	33.05 (8.03)	F (1, 812) = 1.01, p = .315	32.15 (9.50)	F (1, 812) = .04, p = .841	33.32 (7.73)	F (1, 812) = .09, p = .760	32.57 (8.88)	F (1, 812) = 2.17, p = .141
Easy	24.20 (2.31)	F (1, 812) = .31, p = .58	24.14 (2.30)	F (1, 812) = .43, p = .51	24.05 (2.35)	F (1, 812) = .23, p = .631	24.30 (2.28)	F (1, 812) = .00, p = .987	24.18 (2.46)	F (1, 812) = .08, p = .784	24.45 (2.17)	F (1, 812) = .22, p = .637	23.85 (2.23)	F (1, 812) = .78, p = .376
GC	17.77 (1.85)	F (1, 812) = .42, p = .51	17.55 (1.79)	F (1, 812) = 1.70, p = .19	17.74 (1.68)	F (1, 812) = .00, p = .997	17.88 (1.67)	F (1, 812) = 1.09, p = .297	17.55 (1.95)	F (1, 812) = .40, p = .533	17.77 (1.99)	F (1, 812) = .22, p = .642	17.62 (2.00)	F (1, 812) = .58, p = .445
ADF	16.52 (4.14)	F (1, 812) = 2.83, p = .09	16.41 (4.59)	F (1, 812) = 1.48, p = .22	16.38 (4.41)	F (1, 812) = .13, p = .722	17.20 (4.36)	F (1, 812) = .09, p = .759	16.95 (4.06)	F (1, 812) = .12, p = .724	17.37 (3.91)	F (1, 812) = .44, p = .508	17.73 (4.85)	F (1, 812) = 1.77, p = .184
IDF	19.09 (6.73)	F (1, 812) = .87, p = .35	20.00 (7.60)	F (1, 812) = 3.98, p = .046*	19.76 (7.70)	F (1, 812) = .43, p =.511	18.87 (6.86)	F (1, 812) = .06, p = .800	19.31 (7.41)	.08, p = F (1, 812) = .778	19.00 (5.66)	F (1, 812) = .54, p = .462	19.79 (7.41)	F (1, 812) = .334, p = .563
LCBF	15.74 (6.01)	F (1, 812) = 16.87, p = .000***	17.98 (7.00)	F (1, 812) = 5.99, p = .015*	19.76 (6.65)	F (1, 812) = .79, p = .375	17.16 (6.53)	F (1, 812) = 1.29, p = .257	17.60 (5.92)	F (1, 812) = 1.39, p = .239	19.45 (8.01)	F (1, 812) = 11.26, p = .001**	17.02 (5.90)	F (1, 812) = 2.38, p = .123

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.00$

Note for acronyms: A-R – Alert-Responsive; U-I – Unsettled-Irregular; LCC – Lack of Confidence in Caretaking; Easy – Easiness; GC – Global Confidence; ADF – Alert during Feeds; IDF – Irritable during Feeds; LCBF – Lack of Confidence Breastfeeding

Labour Occurrences

As with Start of Labour, participants checked boxes against a list of potential in-Labour Occurrences. There were overlaps between some in-Labour Occurrences and Start of Labour methods (e.g. ARM or Drip for acceleration of labour rather than induction). A series of MANCOVAs were conducted for each in-labour event in relation to 24 Hour Baby.

In-labour ARM, continuous electronic foetal monitoring (EFM), or acceleration of labour by synthetic oxytocin (Syntocinon) administered by a drip all showed significant negative differences in 24 Hour Baby scores, with mothers who experienced these interventions reporting less Alert-Content and more Cry-Fuss newborn behaviours. Infants who had either a Foetal Scalp Electrode (FSE), known as 'trace to baby's head' and used to provide an accurate heartrate, or a Foetal Blood Sample (FBS), where the scalp surface is scraped and tested for oxygenation or hypoxia, were also perceived as showing more Cry-Fuss and less Alert-Content behaviours in this initial period post birth. Notably, mean scores were highest for FBS (Table 26a), suggesting that this could be the most distressing in-labour intervention for the foetus.

Table 26a Labour Occurrences and 24 Hour Baby

Factor	**Labour occurrence – Mean (SD) and significance**														
24 hr B	**ARM** n = 260			**Acceleration** n = 239			**EFM** n = 436			**FSE** n = 198			**FBS** n = 57		
	yes	no	*Significance*	yes	no	*Significance*	yes	no	*Significance*	yes	no	*Significance*	yes	no	*Significance*
Cry-Fuss	.24 (1.18)	-.09 (.92)	F (1, 915) = 20.68, p = .000***	.36 (1.18)	-.13 (.90)	F (1, 924) = 35.97, p = .000***	.26 (1.14)	-.23 (.82)	F (1, 921) = 49.21, p = .000***	.43 (1.18)	-.13 (.92)	F (1, 870) = 43.36, p = .000***	.54 (1.21)	-.07 (.96)	F (1, 855) = 19.61, p = .000***
Alert-Content	-.20 (.97)	.09 (1.00)	F (1, 915) = 17.17, p = .000***	-.35 (1.01)	.13 (.97)	F (1, 924) = 30.50, p = .000***	-.19 (.97)	.19 (.99)	F (1, 921) = 25.99, p = .000***	-.28 (.96)	.12 (.99)	F (1, 870) = 17.61, p = .000***	-.53 (.93)	.08 (.98)	F (1, 855) = 14.40, p = .000***

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

A further succession of MANCOVAs with Infant Age Group as a second fixed factor were conducted to assess MABS outcomes following in-labour events. In-labour ARM yielded significant differences in infant behaviours: infants were more Unsettled-Irregular and Irritable during Feeds after ARM (Table 26b). As well, scores were significantly higher for Lack of Confidence in Caretaking and Breastfeeding, with mothers who experienced ARM during labour reporting lower self-confidence. Similarly, mothers who experienced acceleration of labour or EFM reported more Unsettled-Irregular infant behaviours and less Confidence in Caretaking and Breastfeeding. Infants were also more Unsettled-Irregular after the Foetal Scalp Electrode (FSE). Conversely, there were no significant differences in infant behaviour after Foetal Blood Sample (FBS), although Confidence in Caretaking and Breastfeeding were both significantly lower in this group (Table 26b). There were no significant interaction effects of Labour Occurrences and Infant Age Groups.

Table 26b Labour Occurrences and MABS – Infant Behaviour and Maternal Confidence

Factor	Labour occurrence – Mean (SD) and significance														
	ARM n = 209			**Acceleration** n = 191			**EFM** n = 363			**FSE** n = 159			**FBS** n = 46		
MABS	yes	no	*Sig.*	yes	no	*Sig.*	yes	no	*Sig.*	yes	no	*Sig.*	yes	no	*Sig.*
A-R	38.66 (5.66)	39.47 (4.92)	F (1,779) = 3.11, p = .078	39.08 (5.29)	39.32 (5.10)	F (1, 790) = .38, p = .537	39.23 (5.06)	39.30 (5.22)	F (1,788) = .67, p = .413	39.30 (5.13)	39.30 (5.16)	F (1,740) = .34, p = .562	38.80 (4.89)	39.38 (5.07)	F (1,728) = .14, p = .708
U-I	51.42 (12.90)	49.29 (12.16)	F (1,779) = 4.59, p = .032*	51.62 (12.67)	49.35 (12.32)	F (1, 790) = 4.73, p = .030*	51.66 (12.43)	48.67 (12.34)	F (1,788) = 11.93, p = .001**	52.01 (11.79)	49.45 (12.71)	F (1,740) = 4.74, p = .030*	53.26 (12.87)	49.67 (12.47)	F (1,728) = 2.40, p = .122
LCC	33.49 (9.36)	31.73 (8.30)	F (1,779) = 4.67, p = .031*	34.14 (8.50)	31.56 (8.52)	F (1, 790) = 5.06, p = .025*	33.67 (8.77)	31.04 (8.22)	F (1,788) = 10.16, p = .001**	33.58 (8.79)	31.83 (8.48)	F (1,740) = 1.13, p = .287	35.46 (8.18)	31.90 (8.51)	F (1,728) = 4.23, p = .040*
Easy	24.28 (2.33)	24.17 (2.28)	F (1,779) = .40, p = .532	24.16 (2.25)	24.20 (2.31)	F (1, 790) = .09, p = .761	24.15 (2.17)	24.23 (2.40)	F (1,788) = .50, p = .481	24.22 (2.36)	24.20 (2.30)	F (1,740) = .03, p = .872	24.09 (2.15)	24.18 (2.30)	F (1,728) = .01, p = .927
GC	17.71 (1.85)	17.74 (1.88)	F (1,779) = .00, p = .952	17.54 (1.91)	17.80 (1.84)	F (1, 790) = 1.09, p = .297	17.66 (1.88)	17.81 (1.86)	F (1,788) = .46, p = .496	17.75 (1.79)	17.78 (1.88)	F (1,740) = .20, p = .655	17.22 (2.04)	17.78 (1.87)	F (1,728) = 2.39, p = .122
ADF	16.64 (4.26)	16.90 (4.51)	F (1,779) = .25, p = .618	16.86 (4.23)	16.77 (4.50)	F (1, 790) = .17, p = .680	17.02 (4.36)	16.59 (4.48)	F (1,788) = 1.48, p = .225	16.80 (4.17)	16.86 (4.47)	F (1,740) = .17, p = .679	17.09 (4.49)	16.84 (4.42)	F (1,728) = .273, p = .601
IDF	20.07 (7.25)	18.92 (6.62)	F (1,779) = 4.09, p = .044*	19.09 (6.80)	19.25 (6.82)	F (1, 790) = .48, p = .490	19.43 (7.04)	19.07 (6.70)	F (1,788) = .10, p = .750	19.87 (6.82)	19.10 (6.84)	F (1,740) = 1.06, p = .304	20.19 (6.50)	19.15 (6.83)	F (1,728) = .19, p = .661
LCBF	18.07 (7.00)	15.87 (5.85)	F (1,779) = 12.95, p = .000***	18.43 (6.62)	15.84 (6.02)	F (1, 790) = 12.62, p = .000***	17.86 (7.01)	15.43 (5.34)	F (1,788) = 19.11, p = .000***	17.35 (7.06)	16.15 (5.97)	F (1,740) = 1.90, p = .169	19.00 (7.17)	16.30 (6.17)	F (1,728) = 4.83, p = .028*

Multivariate Analysis of Covariance F ratios: * p < 0.05, ** p < 0.01, ***p < 0.001 *Note:* FSE = foetal scalp electrode FBS = foetal blood sample

Note for acronyms: A-R – Alert-Responsive; U-I – Unsettled-Irregular; LCC – Lack of Confidence in Caretaking; Easy – Easiness; GC – Global Confidence; ADF – Alert during Feeds; IDF – Irritable during Feeds; LCBF – Lack of Confidence Breastfeeding

Birth Mode

MANCOVAs were conducted to assess potential differences in infant behaviour and maternal confidence according to Birth Mode, revealing significant differences between Birth Mode for maternal perceptions of 24 Hour Baby behaviours. Newborns were reported as exhibiting the most Cry-Fuss behaviours after Assisted Birth, with the prime differences between Normal and Assisted births (Table 27).

There was a significant main effect of Birth Mode on reported Unsettled-Irregular infant behaviours. Infants were most likely to be unsettled and irregular in their behaviours after Assisted or Emergency Caesarean births. In contrast to the normal patterns, where differences in Unsettled-Irregular behaviours occur less in older infants, differences were more accentuated in the 21-30 week Infant Age Group. Here, Unsettled-Irregular behaviours were approximately 7 mean points higher after Assisted Birth (M = 52.46, SD = 12.44), than after Planned C Section (M = 45.71, SD = 9.28), despite very small initial differences in the 0-10 week Infant Age Group between Assisted Birth (M = 55.32, SD = 14.65), and Planned CS (M = 55.62, SD = 12.80). These findings suggest that infants may recover sooner after Planned CS than Assisted Birth, although differences in behaviours between infants in the middle age bracket were less pronounced (Assisted Birth – M = 50.56, SD = 12.88; Planned CS – M = 52.00, SD = 12.17). Infants were also reported as more Alert during Feeds after Assisted Birth or Planned CS. Maternal Confidence in Caretaking and Breastfeeding were higher after a Normal Birth (Table 27). There were no significant interaction effects between Birth Mode and Infant Age Groups.

Table 27 Birth Mode, 24 Hour Baby and MABS

Measure	Factor	Mode of Birth – Mean (SD) and significance				
		Normal n = 646	**Assisted** n = 147	**Planned CS** n = 66	**Emerg. CS** n = 136	**Significance**
24 Hour Baby	Cry-Fuss	-.19 (.83)	.62 (1.22)	-.01 (.94)	.28 (1.17)	F (3, 954) = 26.32, p = .000***
	Alert-Content	.14 (.96)	-.52 (1.00)	.07 (1.03)	-.15 (1.01)	F (3, 954) = 10.55, p = .000***
MABS	Alert-Responsive	39. 21 (5.19)	39.68 (4.43)	38.90 (5.55)	39.18 (5.35)	F (3, 802) = .69, p = .559
	Unsettled-Irregular	49.01 (12.14)	52.52 (13.25)	51.43 (12.07)	51.47 (12.61)	F (3, 802) = 3.20, p = .023*
	Lack Conf. Caretaking	31.18 (8.34)	34.96 (8.69)	31.75 (8.78)	34.57 (8.29)	F (3, 802) = 4.352, p = .005**
	Easiness	24.21 (2.31)	24.42 (2.37)	23.79 (2.20)	24.03 (2.09)	F (3, 802) = 1.28, p = .279
	Global Confidence	17.85 (1.79)	17.42 (2.07)	17.51 (1.98)	17.51 (1.87)	F (3, 802) = 1.56, p = .196
	Alert during Feeds	16.56 (4.37)	17.56 (4.34)	17.90 (4.95)	16.67 (4.33)	F (3, 802) = 2.74, p = .042*
	Irritable during Feeds	19.01 (6.45)	20.06 (7.72)	19.53 (7.56)	19.32 (7.48)	F (3, 802) = .31, p = .817
	Lack Conf. Breastfeed	15.8 (5.7)	19.2 (8.3)	17.0 (5.9)	17.5 (6.1)	F (3, 802) = 7.07, p = .000***

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Pain Ratings

Partial correlations found that Pain Levels during labour were positively associated with Cry-Fuss Baby and inversely associated with Alert-Content Baby. In relation to MABS scores, higher Pain ratings were positively associated with Unsettled-Irregular and inversely associated with infant Easiness. Pain ratings were also associated with lower confidence ratings both globally and in relation to caretaking (Table 28).

Pain Relief Medication during Labour

Partial correlations were also conducted to give an overview of relationships between medical methods of pain relief (yes/no), infant behaviours, and maternal confidence. Participants

responded via checkboxes to a list of types of pain relief medications. Some mothers used more than one method of pain relief. 'No Pain Relief' during childbirth had a significant positive association with Alert-Content Baby and inverse association with Cry-Fuss Baby, the newborn rated as more settled after a non-medicated labour. Individual in-labour pharmacological pain relief methods also had significant associations with 24 Hour Baby, highlighting that some forms of pain relief may elicit more cry-fuss behaviours post birth (Table 28). In particular, Entonox, Pethidine and Epidural were all positively associated with Cry-Fuss Baby and inversely associated with Alert-Content Baby.

In terms of MABS, Entonox was positively associated with both Unsettled-Irregular infant behaviours and Lack of Confidence in Breastfeeding. Pethidine was associated with Lack of Confidence in Caretaking and Irritable during Feeds, and inversely associated with Global Confidence. Spinal Block was associated with Lack of Confidence in Breastfeeding, while Epidural was associated with less overall perceived infant Easiness, more Unsettled-Irregular behaviours, and lower maternal Confidence in Caretaking and Breastfeeding (Table 28).

Table 28 Pain Ratings and Pain Relief, 24 Hour Baby and MABS

Measure	Factor	Pain Ratings and Pain Relief						
		Pain level n = 955	No Med. n = 79	G & A n = 696	Pethidine n = 141	Spinal n = 112	Epidural n = 224	Gen.Ans. n = 12
24 Hour Baby	Cry-Fuss	.151, p = .000***	-.066, p = .039*	.115, p = .000***	.140, p = .000***	.017, p = .587	.182, p = .000***	.021, p = .522
	Alert-Content	-.222, p = .000***	.098, p = .002*	-.139, p = .000***	-.112, p = .000***	.010, p = .762	-.125, p = .000***	-.048, p = .133
MABS	A-R	-.049, p = .131	.021, p = .506	-.056, p = .081	-.037, p = .256	-.018, p = .572	-.029, p = .375	-.001, p = .972
	U-I	.142, p = .000***	-.025, p = .430	.073, p = .022*	.056, p = .083	.029, p = .375	.109, p = .001**	.038, p = .238
	LCC	.085, p = .009**	-.035, p = .271	.047, p = .141	.090, p = .005**	.043, p = .185	.156, p = .000***	.057, p = .075
	Easiness	-.070, p = .032*	.044, p = .167	-.049, p = .126	.008, p = .808	.034, p = .292	-.075, p = .020*	-.008, p = .801
	GC	-.073, p = .026*	.003, p = .930	-.033, p = .299	-.072, p = .024*	-.058, p = .070	-.037, p = .249	.046, p = .151
	ADF	-.013, p = .683	.031, p = .328	-.041, p = .197	.014, p = .660	.012, p = .710	-.003, p = .923	.034, p = .294
	IDF	.055, p = .092	-.048, p = .135	.021, p = .505	.068, p = .034*	.021, p = .521	.039, p = .223	.029, p = .374
	LCBF	.016, p = .657	-.012, p = .546	.073, p = .035*	-.020, p = .559	.072, p = .038*	.148, p = .000***	.034, p = .326

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001

Note: No Med – no pain relief; G & A – gas and air; Gen. Ans. – general anaesthetic

Natural Methods of Pain Relief During Labour and Birth

Partial correlations were conducted to establish associations between natural methods of pain control and infant behaviours. Relaxation, Water, Breathing Techniques, Hypnobirthing, and Visualisation were positively associated with Alert-Content 24 Hour Baby, while mothers reported less Cry-Fuss behaviours when they had used Relaxation Techniques, Water, or Hypnobirthing during their labour (Table 29).

Similarly, Hypnobirthing was inversely associated with Unsettled-Irregular, Acupuncture was inversely associated with Alert during Feeds, and Reflexology was positively associated with Easiness; infants were reported as 'easier' or more 'relaxed during feeds' after Reflexology or Acupuncture during labour (Table 29). However, as both Acupuncture (n = 8, .8%) and Reflexology (n = 11, 1.1%) had small sample sizes, they were excluded from further analyses.

Table 29 Pain Relief: Natural Methods, 24 Hour Baby and MABS

Measure	Factor	Pain Relief: Natural Methods									
		Relaxation n = 265	Water n = 328	Breathing n = 447	Acupuncture n = 8	Hypnobirth n = 236	Tens n = 223	Homeopathy n = 25	Reflexology n = 11	Massage n = 118	Visualisation n = 237
24 Hr Baby	Cry-Fuss	-.113, p = .000***	-.114, p = .000***	-.044, p = .174	-.020, p = .538	-.125, p = .000***	-.026, p = .420	-.023, p = .471	-.016, p = .620	-.035, p = .279	-.054, p = .092
	Alert-Content	.121, p = .000***	.066, p = .041*	.073, p = .023*	.048, p = .138	.130, p = .000***	.010, p = .759	.050, p = .122	.021, p = .506	-.028, p = .379	.092, p = .004**
MABS	A-R	.059, p = .065	.021, p = .511	.043, p = .178	-.028, p = .377	.044, p = .174	-.022, p = .488	.057, p = .075	.059, p = .065	.031, p = .335	.058, p = .069
	U-I	-.032, p = .314	-.062, p = .054	-.028, p = .386	-.041, p = .201	-.068, p = .033*	-.005, p = .883	.029, p = .363	.011, p = .722	-.022, p = .493	-.016, p = .617
	LCC	.011, p = .732	-.036, p = .260	-.021, p = .518	-.028, p = .389	.014, p = .666	-.044, p = .169	.029, p = .375	-.030, p = .345	.009, p = .789	.025, p = .438
	Easiness	.054, p = .093	-.010, p = .760	-.020, p = .536	.030, p = .349	.057, p = .076	.024, p = .456	.042, p = .195	.071, p = .026*	.012, p = .716	.060, p = .062
	GC	.062, p = .055	.021, p = .519	-.031, p = .336	.035, p = .274	.034, p = .297	-.023, p = .481	.001, p = .979	.013, p = .683	.025, p = .438	.011, p = .723
	ADF	-.015, p = .642	-.019, p = .564	-.020, p = .538	-.071, p = .026*	-.047, p = .141	-.048, p = .137	-.040, p = .211	-.058, p = .072	-.020, p = .534	.024, p = .452
	IDF	.001, p = .972	-.038, p = .237	.005, p = .888	-.051, p = .107	-.021, p = .509	.003, p = .914	.036, p = .265	.007, p = .828	.001, p = .981	.034, p = .295
	LCBF	-.009, p = .806	-.057, p = .099	.051, p = .140	-.045, p = .192	-.031, p = .364	-.020, p = .558	.000, p = 1.000	-.012, p = .722	.042, p = .228	.026, p = .457

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001

Tearing and Episiotomy

A MANCOVA employing the Bonferroni correction explored differences between mothers who had or had not experienced a tear or episiotomy. Significant differences were seen between 'No Tear' and 'Tear or Episiotomy' (Episiotomy was too small a group to include as a stand-alone item, n = 4, .4%). Tear-Episiotomy affected Cry-Fuss and Alert-Content Baby scores, with newborn infants perceived as happier in cases of no maternal perineal injury (Table 30).

Although MABS infant behaviour scores were unaffected, higher ratings of maternal Global Confidence were seen for No Tear (Table 30). There were no significant interaction effects between Tear-Episiotomy and Infant Age Groups.

Table 30 Tear or Episiotomy, 24 Hour Baby and MABS

Measure	**Factor**	**Tear-Episiotomy – M (SD)**		**Significance**
		No Tear n = 187	Tear/Episiotomy n = 812	
24 Hour Baby	Cry-Fuss	-.24 (.82)	.05 (1.03)	F (1, 960) = 9.786, p = .002**
	Alert-Content	.19 (.98)	-.05 (1.00)	F (1, 960) = 6.274, p = .012*
MABS	Alert-Responsive	39.48 (5.36)	39.20 (5.06)	F (1, 815) = 2.488, p = .115
	Unsettled-Irregular	49.04 (12.37)	50.16 (12.42)	F (1, 815) = 2.805, p = .094
	Lack Conf. in Caretaking	30.94 (8.13)	32.46 (8.61)	F (1, 815) = 3.204, p = .074
	Easiness	24.24 (2.38)	24.19 (2.27)	F (1, 815) = .091, p = .764
	Global Confidence	18.20 (1.76)	17.63 (1.86)	F (1, 815) = 10.351, p = .001**
	Alert during Feeds	16.63 (4.49)	16.83 (4.40)	F (1, 815) = .144, p = .705
	Irritable during Feeds	18.90 (6.24)	19.31 (6.97)	F (1, 815) = 1.242, p = .265
	Lack Conf. Breastfeeding	15.67 (5.31)	16.74 (6.48)	F (1, 815) = 1.759, p = .185

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Foetal and Neonatal Distress

MANCOVAs were conducted to examine differences in 24 Hour Baby scores in relation to foetal and neonatal distress signals. Newborn infants were rated as more Cry-Fuss and less Alert-Content after experiencing Foetal Distress, Meconium in Waters or Resuscitation (Table 31).

MANCOVAs with Infant Age Groups as an additional fixed factor were also conducted between MABS and foetal or neonatal distress signals. Significant increases were seen for Unsettled-Irregular and Irritable during Feeds after Foetal Distress. Outcomes for maternal confidence scores were also poorer after Foetal Distress (Table 31).

No significant differences were seen for any MABS infant behaviour items after Meconium in Waters, although Confidence in Caretaking and Breastfeeding scores were significantly lower (Table 31). Global Confidence was lower after Resuscitation. There were no significant interaction effects between any foetal distress signals and Infant Age Groups.

Table 31 Foetal distress signals, 24 Hour Baby and MABS

Measure	Factor M (SD)	Foetal Distress n = 194			Meconium in Waters n = 173			Resuscitation n = 57		
		Yes	No	Sig.	Yes	No	Sig.	Yes	No	Sig.
24 Hr Baby	Cry-Fuss	.62 (1.28)	-.19 (.84)	F (2, 957) = 51.431, p = .000***	.36 (1.19)	-.08 (.94)	F (2, 951) = 11.054, p = .000***	.49 (1.42)	-.03 (.96)	F (2, 949) = 7.100, p = .001**
	Alert-Content	-.53 (.93)	.15 (.98)	F (2, 957) = 29.426, p = .000***	-.20 (1.03)	.05 (1.00)	F (2, 951) = 3.851, p = .022*	-.51 (1.09)	.04 (.99)	F (2, 949) = 10.942, p = .000***
MABS	A-R	39.56 (4.84)	39.19 (5.18)	F (1, 812) = .835, p = .361	39.39 (4.71)	39.23 (5.20)	F (1, 812) = .041, p = .839	39.32 (5.13)	39.26 (5.12)	F (1, 812) = .027, p = .870
	U-I	54.41 (13.22)	48.97 (12.02)	F (1, 812) = 21.168, p = .000***	51.21 (13.39)	49.68 (12.20)	F (1, 812) = 2.612, p = .106	52.94 (12.35)	49.75 (12.39)	F (1, 812) = 3.811, p = .051
	LCC	34.83 (8.90)	31.58 (8.35)	F (1, 812) = 12.018, p = .001**	34.23 (8.35)	31.74 (8.51)	F (1, 812) = 4.959, p = .026*	32.77 (6.88)	32.12 (8.62)	F (1, 812) = .647, p = .421
	Easy	24.08 (2.32)	24.22 (2.28)	F (1, 812) = .348, p = .555	23.96 (2.19)	24.25 (2.31)	F (1, 812) = 2.903, p = .089	23.55 (2.51)	24.24 (2.27)	F (1, 812) = 4.245, p = .040
	GC	17.19 (1.97)	17.86 (1.81)	F (1, 812) = 13.928, p = .000***	17.59 (1.89)	17.77 (1.85)	F (1, 812) = .849, p = .357	17.19 (2.18)	17.77 (1.83)	F (1, 812) = 4.903, p = .027*
	ADF	16.53 (4.22)	16.85 (4.45)	F (1, 812) = .667, p = .414	16.25 (4.32)	16.90 (4.42)	F (1, 812) = 2.888, p = .090	16.00 (4.03)	16.84 (4.43)	F (1, 812) = 1.362, p = .243
	IDF	20.74 (8.02)	18.91 (6.51)	F (1, 812) = 6.911, p = .009**	19.72 (7.15)	19.13 (6.77)	F (1, 812) = .898, p = .344	19.85 (6.29)	19.19 (6.86)	F (1, 812) = .909, p = .341
	LCBF	19.38 (8.14)	15.92 (5.63)	F (1, 812) = 14.704, p = .000***	18.65 (7.39)	16.11 (5.95)	F (1, 812) = 11.937, p = .001**	17.00 (6.54)	16.50 (6.27)	F (1, 812) = .451, p = .502

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Acronyms: A-R – Alert-Responsive; U-I – Unsettled-Irregular; LCC – Lack of Confidence in Caretaking; Easy – Easiness; GC – Global Confidence; ADF – Alert during Feeds; IDF – Irritable during Feeds; LCBF – Lack of Confidence Breastfeeding

Gentle Birth of Head

Mothers were asked to recall how gently they felt their infant's head had been born on a five point Likert scale. To facilitate further analysis, this factor was transformed into a dichotomous variable: 'Gentle Birth of Head' (strongly agree/agree responses were collapsed) or 'Other',

which included the midpoint of neither agree/disagree and was thus defined as ungentle or unsure. Bonferroni analyses indicated that Alert-Content 24 Hour Baby ratings were higher after a Gentle Birth. Equally, Cry-Fuss Baby behaviours were lower. Notably however, the factor analysis definition of 'Cry-Fuss Baby' included the head appearing 'bruised or swollen', which may have contributed to these significant differences (Table 32). Nevertheless, significant differences also emerged for certain MABS criteria after Gentle Birth of Head. Infants were reported as more Alert-Responsive, less Unsettled-Irregular and Easier overall after a Gentle Birth. Gentle Birth of Head also led to significant increases in Global Confidence and decreases in Lack of Breastfeeding Confidence scores (Table 32). There were no significant interaction effects between Gentle Birth of Head and Infant Age Groups.

Table 32 Gentle Birth of Head, 24 Hour Baby and MABS

Measure	Factor	Gentle Birth of Head Mean (SD)		Significance
		Yes n = 369	Other n = 630	
24 Hour Baby	Cry-Fuss	-.32 (.78)	.19 (1.07)	F (1, 960) = 50.593, p = .000***
	Alert-Content	.26 (.98)	-.15 (.98)	F (1, 960) = 23.305, p = .000***
MABS	Alert-Responsive	39.71 (4.91)	38.98 (5.23)	F (1, 811) = 4.747, p = .030*
	Unsettled-Irregular	47.51 (11.77)	51.44 (12.56)	F (1, 811) = 16.636, p = .000***
	Lack of Confidence CT	30.80 (8.03)	32.99 (8.73)	F (1, 811) = 5.551, p = .019*
	Easiness	24.47 (2.29)	24.03 (2.27)	F (1, 811) = 6.110, p = .014*
	Global Confidence	18.08 (1.71)	17.53 (1.91)	F (1, 811) = 11.706, p = .001**
	Alert during Feeds	16.75 (4.44)	16.82 (4.40)	F (1, 811) = .068, p = .794
	Irritable during Feeds	18.52 (6.01)	19.67 (7.27)	F (1, 811) = 3.033, p = .082
	Lack of Confidence BF	15.18 (5.22)	17.37 (6.72)	F (1, 811) = 13.307, p = .000***

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Skin to Skin Care

MANCOVAs were conducted to differentiate between infants who did or did not have immediate skin to skin contact with their mother post birth. The findings indicated that infants receiving immediate 'skin to skin' contact were perceived as exhibiting less Cry-Fuss behaviours and were rated as more Alert-Content during the first 24 hours. Similar potential benefits were shown for infants aged 0-6 months who were reported as less Unsettled-Irregular in their behaviours and Easier overall, although the difference in mean scores for Easiness was small. Similarly, mothers reported increased Confidence in Caretaking and Breastfeeding if they had experienced immediate skin to skin contact with their baby after birth (Table 33). There were no significant interaction effects between Skin to Skin care and Infant Age Groups.

Table 33 Skin to Skin, 24 Hour Baby and MABS

Measure	**Factor**	**Skin to Skin – M (SD)**		**Significance**
		Yes n = 913	Other n = 86	
24 Hour Baby	Cry-Fuss	-.05 (.97)	.59 (1.19)	F (1, 960) = 28.322, p = .000***
	Alert-Content	.05 (.99)	-.58 (1.02)	F (1, 960) = 30.420, p = .000***
MABS	Alert-Responsive	39.29 (5.09)	38.85 (5.64)	F (1, 812) = 2.955, p = .086
	Unsettled-Irregular	49.63 (12.39)	54.30 (11.88)	F (1, 812) = 11.826, p = .001**
	Lack of Confidence CT	31.96 (8.55)	34.96 (7.72)	F (1, 812) = 4.773, p = .029*
	Easiness	24.25 (2.29)	23.55 (2.12)	F (1, 812) = 6.491, p = .011*
	Global Confidence	17.76 (1.85)	17.38 (1.95)	F (1, 812) = 3.1901, p = .074
	Alert during Feeds	16.79 (4.47)	16.77 (3.50)	F (1, 812) = .138, p = .710
	Irritable during Feeds	19.16 (6.75)	20.32 (7.97)	F (1, 812) = 3.583, p = .059
	Lack of Confidence BF	16.37 (6.16)	18.90 (7.43)	F (1, 812) = 8.493, p = .004**

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Feeding Method – First Feed

The survey was somewhat skewed towards mothers who breastfed for the first feed (n = 882, 88.3%) and were currently breastfeeding either partly or exclusively on completion of the questionnaire (n = 850, 85.1%). To facilitate further analyses, First Feed was dichotomised into two groups: Breastfed ('breastfed') and Other ('expressed', 'formula' or 'other'). In a MANCOVA for First Feed and 24 Hour Baby, Bonferroni analyses showed significant differences between perceived newborn behaviours depending on their First Feed. Infants were rated as more Alert-Content if Breastfed and more Cry-Fuss if 'Other' (Table 34). Notably, *'My baby latched onto the breast easily'* was part of the Alert-Content Baby criteria, potentially contributing to the significance of Breastfed as First Feed for Alert-Content Baby.

In a MANCOVA for First Feed and MABS, more Unsettled-Irregular infant behaviours were reported if the First Feed was 'Other' (Table 34). There was also a significant interaction effect for First Feed between Unsettled-Irregular behaviours and Infant Age Groups, F (2, 812) = 3.051, p = .048. The principal differences between the means of Unsettled-Irregular behaviours occurred in the 0-10 week age group (Breastfed: M = 52.33, SD = 12.74; Other: M = 62.57, SD = 12.39). Differences levelled out in the 11-20 week age group (Breastfed: M = 48.70, SD = 12.23; Other: M = 49.42, SD = 11.24), becoming more pronounced again in the 21-30 week age group, (Breastfed: M = 47.86, SD = 11.36; Other: M = 51.13, SD = 12.73).

Table 34 First Feed, 24 Hour Baby and MABS

Measure	Factor	First Feed Breastfeed M (SD)		Significance
		Yes n = 882	Other n = 117	
24 Hour Baby	Cry-Fuss	-.038 (.98)	.30 (1.16)	F (1, 960) = 9.350, p = .002**
	Alert-Content	.10 (.97)	-.81 (.92)	F (1, 960) = 69.40, p = .000***
MABS	Alert-Responsive	39.31 (5.14)	38.68 (4.96)	F (1, 811) = .492, p = .483
	Unsettled-Irregular	49.56 (12.27)	54.06 (13.26)	F (1, 811) = 5.436, p = .020*
	Lack Confidence Caretaking	31.98 (8.45)	34.09 (9.25)	F (1, 811) = 1.189, p = .276
	Easiness	24.23 (2.28)	23.93 (2.38)	F (1, 811) = .618, p = .432
	Global Confidence	17.77 (1.84)	17.38 (2.02)	F (1, 811) = 1.222, p = .269
	Alert during Feeds	16.79 (4.45)	16.79 (3.97)	F (1, 811) = .044, p = .833
	Irritable during Feeds	19.10 (6.85)	20.65 (6.52)	F (1, 811) = 1.560, p = .212
	Lack Confidence Breastfeeding	16.35 (6.17)	18.53 (7.13)	F (1, 811) = 3.783, p = .052

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Current Feeding Method

'Current Feed' responses were also dichotomised: 'Currently Breastfed' and 'Other'. A MANCOVA was conducted for Current Feeding Method and MABS. Infants were less Alert during Feeds and mothers understandably more Confident in Breastfeeding if currently breastfeeding (Table 35). There were no interaction effects between Current Feeding Method and Infant Age Groups.

Table 35 Current Feeding Method, 24 Hour Baby and MABS

Meas-ure	Factor	Currently Breastfed Mean (SD)		Significance
		Yes n = 850	Other n = 146	
24 Hour Baby	Cry-Fuss	-.03 (.97)	.16 (1.11)	F (1, 958) = 4.260, p = .039*
	Alert-Content	.07 (.98)	-.46 (1.02)	F (1, 958) = 33.575, p = .000***
MABS	Alert-Responsive	39.25 (5.14)	40.22 (3.81)	F (1, 812) = .098, p = .754
	Unsettled-Irregular	49.98 (12.41)	48.33 (12.61)	F (1, 812) = .132, p = .716
	Lack Conf. in Caretaking	32.16 (8.60)	32.00 (5.18)	F (1, 812) = .225, p = .635
	Easiness	24.19 (2.28)	24.83 (2.57)	F (1, 812) = .264, p = .607
	Global Confidence	17.74 (1.85)	17.78 (2.13)	F (1, 812) = .001, p = .973
	Alert during Feeds	16.73 (4.36)	20.05 (5.37)	F (1, 812) = 5.339, p = .021*
	Irritable during Feeds	19.21 (6.82)	20.50 (7.35)	F (1, 812) = 1.230, p = .268
	Lack Conf. in Breastfeeding	16.45 (6.20)	20.33 (8.64)	F (1, 812) = 3.901, p = .049*

Multivariate Analysis of Covariance F ratios: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Question Two Is infant behaviour associated with subjective psychological factors?

This section is presented under sub-headings relating to each stage of the perinatal period.

a) Maternal pregnancy wellbeing

Eleven statements were analysed using PCA with Direct Oblimin rotation methods to establish the factor structure of reported subjective maternal states during pregnancy. These included statements relating to how the mother felt physically and emotionally during her pregnancy (e.g. 'felt happy and excited/anxious and fearful about the birth' or 'had plenty of energy/felt tired and drained'). The rotated pattern matrix explained 63.5% of the variance and produced two factors. The first factor, Positive Emotional Pregnancy, had six items and accounted for 46.88% of the variance. It described the mother's emotional state during pregnancy (e.g. whether she 'felt calm' [positive loading] or 'stressed' [negative loading]). A second factor,

Positive Physical Pregnancy, had five items and accounted for 16.63% of the variance. This described the mother's sense of physical wellbeing (e.g. 'had plenty of energy/coped well with pregnancy'). Negative statements such as 'in pain' had a negative loading. In sum, the pregnancy factors became: Positive Emotional Pregnancy and Positive Physical Pregnancy.

Pearson's partial correlations were conducted, including these two new pregnancy factors and the dependent variables of 24 Hour Baby and MABS. As in the previous analyses of physical factors, the covariates established earlier were included: weeks' gestation, infant gender, maternal age, household income, maternal education level and number of children for 24 Hour Baby; and weeks' gestation, infant gender, infant age, maternal age, maternal education level and number of children for MABS (Table 20). Subjective pregnancy factors were positively associated with Alert-Content Baby and inversely associated with Cry-Fuss Baby (Table 36).

For the 0-6 month old infant, numerous significant correlations were evident between Positive Physical Pregnancy, Positive Emotional Pregnancy and MABS scores. Physical and Emotional Pregnancy states were inter-correlated, r (801) = .442, $p < 0.001$, indicating that physical and emotional experiences are connected and possibly bi-directional. Positive Emotional Pregnancy ('calm', 'happiness, excitement') was positively associated with Alert-Responsive, Easiness, and Global Confidence, and inversely associated with Unsettled-Irregular, Irritable during Feeds, and Lack of Confidence in Caretaking and Breastfeeding (Table 36).

Positive Physical Pregnancy ('full of energy', 'enjoying', 'coping well' with pregnancy) yielded similar results: it was positively associated with Alert-Responsive, Easiness, Global Confidence and Alert during Feeds, and inversely associated with Unsettled-Irregular, Irritable during Feeds, and Lack of Confidence in Caretaking (Table 36).

b) Maternal emotions during childbirth

Twenty statements were analysed using PCA with Direct Oblimin rotation methods to establish the factor structure of maternal emotional states experienced during childbirth. The rotated pattern matrix explained 68.43% of the variance and produced four factors. The first factor, Birth Emotions Positive, accounted for 47.63% of the variance and included nine items describing feelings such as 'strong, happy, energised and focused'. The second factor, Birth Emotions Neglected, accounted for 8.33% of the variance and included four items that described feelings of being 'abandoned' or 'ignored' during the birth. The third factor, Birth

Emotions Aware-Alert, accounted for 6.94% of the variance and included three items that described feeling aware and alert. The fourth factor, Birth Emotions Anxious-Afraid, accounted for 5.53% of the variance and incorporated the remaining four items which described feeling 'anxious, afraid, vulnerable, and overwhelmed'. In sum, these birth emotions factors became Birth Emotions Positive, Neglected, Aware-Alert, and Anxious-Afraid.

Partial Pearson's correlations were performed between the four new 'Birth Emotions' factors and the two infant behaviour measures – 24 Hour Baby and MABS (Table 36). A significant relationship was found between maternal emotional states during childbirth and perceived 24 Hour Baby behaviours. Positive and Aware-Alert Birth Emotions were both associated with more Alert-Content and less Cry-Fuss behaviours. In contrast, Neglected and Anxious-Afraid Birth Emotions were positively associated with Cry-Fuss 24 Hour Baby behaviours and inversely associated with Alert-Content behaviours. Newborn infants therefore appeared more crying and irritable if their mother had felt neglected, anxious or fearful during the birth.

To discover whether these relationships continued beyond the first 24 hours, partial correlations were conducted between the new birth emotion factors and MABS outcome measures. Positive Birth Emotions was positively associated with Alert-Responsive, Easiness, Alert during Feeds and Global Confidence, and inversely associated with Unsettled-Irregular, Irritable during Feeds and Lack of Confidence in Caretaking. Where mothers reported feeling Aware and Alert during labour and birth, they also reported their infant's behaviour as less Unsettled-Irregular or Irritable during Feeds and felt more confident in all spheres (Table 36).

Conversely, if mothers had felt Neglected ('abandoned' and 'ignored') during the birth of their infant, they reported lower scores for Alert-Responsive, higher scores for Unsettled-Irregular, and less overall perceived infant Easiness. Neglected Birth Emotions were also associated with Lack of Confidence in Caretaking and Breastfeeding and less Global Confidence. Equally, Anxious-Afraid Birth Emotions were positively associated with Unsettled-Irregular infant behaviours and Irritable during Feeds, whilst inversely associated with overall infant Easiness. Anxious-Afraid mothers also reported significantly less confidence in all spheres (Table 36).

Table 36 Pregnancy States, Birth Emotions, 24 Hour Baby and MABS

Measure	Factor	Pregnancy States n = 981		Birthing Emotions n = 944			
		Positive Emotions	Positive Physical	Positive	Neglected	Aware Alert	Anxious Afraid
24 Hour Baby	Cry-Fuss	-.255, p = .000***	-.155, p = .000***	-.332, p = .000***	.254, p = .000***	-.130, p = .000***	.303, p = .000***
	Alert-Content	.229, p = .000***	.171, p = .000***	.297, p = .000***	-.163, p = .000***	.086, p = .009**	-.250, p = .000***
MABS	Alert-Responsive	.085, p = .009**	.067, p = .039*	.189, p = .000***	-.126, p = .000***	.064, p = .052	-.078, p = .018
	Unsettled-Irregular	-.241, p = .000***	-.202, p = .000***	-.197, p = .000***	.148, p = .000***	-.094, p = .004**	.297, p = .000***
	Lack Conf. in Caretaking	-.128, p = .000***	-.111, p = .001**	-.100, p = .002**	.136, p = .000***	-.120, p = .000***	.196, p = .000***
	Easiness	.156, p = .000***	.091, p = .005**	.148, p = .000***	-.088, p = .008**	.028, p = .392	-.160, p = .000***
	Global Conf.	.229, p = .000***	.171, p = .000***	.187, p = .000***	-.079, p = .016*	.093, p = .005**	-.205, p = .000***
	Alert during Feeds	.030, p = .354	.071, p = .027*	.068, p = .037*	-.049, p = .137	.019, p = .558	-.040, p = .224
	Irritable during Feeds	-.172, p = .000***	-.180, p = .000***	-.110, p = .001**	.056, p = .091	-.095, p = .004**	.134, p = .000***
	Lack Conf. in Breastfeeding	-.136, p = .000***	-.048, p = .163	-.056, p = .110	.165, p = .000***	-.100, p = .004**	.200, p = .000***

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001

c) Postnatal maternal states

Twenty statements were analysed using PCA with Direct Oblimin rotation methods to establish the factor structure of self-reported subjective postnatal maternal states. Three factors were identified reflecting self-reported physical and psychological maternal states post birth. The rotated pattern matrix explained 62.68% of the variance. The first factor, Postnatal Distress, accounted for 48.24% of the variance and was comprised of nine items describing negative emotions of anger, guilt, confusion, and distress. The second factor, Postnatal Positive Emotions, explained 7.87% of the variance and was based on eight items describing positive postnatal emotions of euphoria and exhilaration, relief, and pride. The third and final factor, Postnatal Physical Wellbeing, accounted for 6.57% of the variance and included the three remaining items – with negative loadings – which described postnatal neuro-physical states

such as feeling ‘exhausted’ and ‘in pain’. This factor also included feeling ‘overwhelmed’, highlighting the connection between physical and mental states. Postnatal maternal states were summed up by three factors: Postnatal Distressed, Postnatal Positive Emotions and Postnatal Physical Wellbeing.

Pearson’s partial correlations were conducted, including covariates and the new maternal postnatal wellbeing variables. Postnatal Distressed was significantly positively associated with Cry-Fuss and negatively associated with Alert-Content 24 Hour Baby behaviours, indicating that newborn infants were perceived as more crying and irritable if their mother felt distressed after the birth. In contrast, Postnatal Positive and Postnatal Physical Wellbeing were significantly positively associated with Alert-Content Baby and inversely associated with Cry-Fuss Baby. That is, newborns were perceived as more alert and content with an easier breast latch if their mother felt emotionally and physically positive and well post birth (Table 37).

Pearson’s partial correlations were also conducted between subjective postnatal states and MABS scores. Postnatal Distress was positively associated with Unsettled-Irregular, Irritable during Feeds, and a lack of confidence in all areas, and inversely associated with Alert-Responsiveness and perceived infant Easiness. In contrast, Postnatal Positive was positively associated with Alert-Responsiveness, infant Easiness, Alert during Feeds and Global Confidence, and inversely associated with Unsettled-Irregular, Irritable during Feeds, and Lack of Confidence in Caretaking and Breastfeeding (Table 37).

Postnatal Physical Wellbeing was positively associated with perceived overall infant Easiness and Global Confidence and inversely associated with Unsettled-Irregular, Irritable during Feeds, and Lack of Confidence in Caretaking and Breastfeeding (Table 37).

Table 37 Associations between Subjective Postnatal States, Overall Maternal Perceptions of Childbirth, 24 Hour Baby and MABS

Measure	Factor	Postnatal States n = 945			Overall Perceptions n = 908		
		Postnatal Distressed	Postnatal Positive	PN Phys. Wellbeing	Experience Positive	Experience Supported	Experience Directed
24 Hour Baby	Cry-Fuss	.413, p = .000***	-.341, p = .000***	-.269, p = .000***	-.383, p = .000***	-.207, p = .000***	.288, p = .000***
	Alert-Content	-.201, p = .000***	.263, p = .000***	.230, p = .000***	.250, p = .000***	.129, p = .000***	-.252, p = .000***
MABS	Alert-Responsive	-.121, p = .000***	.243, p = .000***	.058, p = .079	.123, p = .000***	.165, p = .000***	-.075, p = .026*
	Unsettled-Irregular	.259, p = .000***	-.208, p = .000***	-.256, p = .000***	-.207, p = .000***	-.112, p = .001**	.138, p = .000***
	Lack Conf. in Caretaking	.221, p = .000***	-.110, p = .001**	-.149, p = .000***	-.178, p = .000***	-.104, p = .002**	.126, p = .000***
	Easiness	-.164, p = .000***	.193, p = .000***	.119, p = .000***	.143, p = .000***	.081, p = .015*	-.044, p = .192
	Global Confidence	-.188, p = .000***	.213, p = .000***	.211, p = .000***	.176, p = .000***	.089, p = .008**	-.049, p = .143
	Alert during Feeds	-.041, p = .210	.074, p = .024*	.058, p = .076	.041, p = .217	.051, p = .132	.015, p = .658
	Irritable during Feeds	.136, p = .000***	-.137, p = .000***	-.172, p = .000***	-.092, p = .006**	-.047, p = .160	.034, p = .318
	Lack Conf. in Breastfeeding	.178, p = .000***	-.070, p = .048*	-.206, p = .000***	-.179, p = .000***	-.072, p = .045*	.155, p = .000***

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001

d) Overall maternal perceptions of childbirth

Finally, to explore mothers' overall beliefs and opinions around their experience of childbirth, participants were presented with thirteen statements to rate on a five-point Likert scale (e.g. *'The birth went better than I expected'; 'I felt emotionally supported', and 'The baby's head seemed to ease itself out gently'*). A factor analysis using PCA and Direct Oblimin rotation methods revealed three factors, explaining 68.62% of the variance. The first factor, Experience Positive, explained 44.86% of the variance and was based on six items that described a positive birth experience (e.g. feeling comfortable and in control, and a gentle birth of the infant's head). The second factor, Experience Supported, explained 14.95% of the variance and comprised four items that described experiencing helpful, informative, and emotionally supportive birth

attendants. The final factor, Experience Directed, explained 8.8% of the variance. Experience Directed was based on the three remaining items which described staying mostly on the bed, feeling unable to move about freely during labour – possibly due to the constraints of medical equipment – and experiencing guided or 'Valsalva' pushing (Martin, 2009) during the second stage of labour. In sum, the maternal perceptions of childbirth factors became: (1) Experience Positive, (2) Experience Supported, and (3) Experience Directed.

All three maternal perceptions of childbirth factors were significantly related to initial 24 Hour Baby behaviours (Table 37). Experience Positive and Experience Supported were positively associated with Alert-Content Baby and inversely associated with Cry-Fuss Baby. This suggests that infants could be sensitive to their mother's subjective experience of childbirth, or that mothers perceive their infants as happier after a positive birth experience. Additionally, Experience Directed was positively associated with Cry-Fuss Baby and negatively associated with Alert-Content Baby, indicating how restricted movement during labour and a managed second stage might also affect initial neonatal behaviours, or maternal perceptions of her baby.

Similar associations were found between maternal perceptions of birth and MABS (Table 37). When the mother rated her Experience as Positive, she also reported more infant Alert-Responsiveness, overall perceived Easiness, and less Unsettled-Irregular behaviours or Irritability during Feeds. Moreover, mothers who had a positive birth experience reported higher levels of confidence in all areas. Mothers who rated their experience as more Supported also reported more infant Alert-Responsiveness and overall Easiness, less Unsettled-Irregular behaviours, and higher confidence in all areas. In contrast, Experience Directed was positively associated with Unsettled-Irregular and negatively with Alert-Responsive. Lack of Confidence in Caretaking and Breastfeeding were also associated with a more Directed Experience.

Therefore, postnatal maternal perceptions of the birth experience were significantly associated with several infant behaviour and maternal confidence measures. A further series of MANOVAs were conducted to explore differences in subjective maternal perceptions of childbirth and the postnatal period according to Birth Mode (Table 38). Here, subjective perceptions were significantly different according to Birth Mode. Overall, scores for negative perceptions were higher after Assisted Birth or Emergency CS, and scores for positive perceptions were higher after Spontaneous (normal, physiological) birth or Planned CS. Emergency CS was especially highly correlated with Anxious-Afraid Birth Emotions and Postnatal Distress, highlighting this as the most stressful birth mode for the mother.

Table 38 Differences in reported birth and postnatal states according to birth mode

Factor n = 944	**Spontaneous** Mean (SD)	**Assisted** Mean (SD)	**Planned CS** Mean (SD)	**Emergency CS** Mean (SD)	**Significance**
BE Positive	.215 (.92)	-.450 (1.00)	.149 (.91)	-.639 (1.00)	F (3,936) = 41.22***
BE Neglected	-.140 (.88)	.275 (1.15)	-.033 (.97)	.404 (1.19)	F (3,936) = 15.02***
BE Aware-Alert	.122 (.95)	-.480 (1.06)	.558 (. 64)	-.342 (1.34)	F (3,936) = 27.17***
BE Anxious-Afraid	-.220 (.94)	.414 (1.01)	.092 (.95)	.585 (.93)	F (3,936) = 36.10***
PN Distress	-.259 (.79)	.297 (1.08)	.196 (1.13)	.809 (1.23)	F (3,854) = 46.30***
PN Positive	.196 (.87)	-.189 (1.08)	.127 (1.02)	-.713 (1.06)	F (3,854) = 28.91***
PN Physical Wellbeing	.185 (.96)	-.613 (.95)	.325 (.87)	-.328 (.93)	F (3,854) = 30.62***
Experience Positive	.375 (.82)	-.989 (.79)	.214 (.64)	-1.02 (.75)	F (3,854) = 160.85***
Experience Supported	.058 (.93)	.108 (1.09)	-.443 (1.15)	-.497 (1.19)	F (3,854) = 10.83***
Experience Directed	-.277 (.96)	.629 (.86)	.638 (.57)	.547 (.69)	F (3,854) = 55.44***

Multivariate Analysis of Covariance *F* ratios: * p < 0.05, ** p < 0.01, ***p < 0.001

Note: BE – Birth Emotions; PN – Postnatal

Presence of a birth partner or companion

Participants were asked whether they had a birth partner, a birth companion (e.g. doula, friend or relation), or both birth partner and companion at the birth. A MANCOVA indicated no significant differences between these checkbox options for Cry-Fuss 24 Hour Baby, although infants were perceived as least crying or fussing where the mother had both birth partner and companion. Differences were revealed for Alert-Content Baby, however, with the significant difference occurring between 'yes birth partner' (M = -.03, SD = 1.01), and 'yes birth partner and companion' (M = .21, SD = .99), F (3,957) = 3.733, p = 0.011. Therefore, perceptions of 24 Hour Baby behaviour may benefit from maternal support by both her birth partner – usually the infant's father – and an additional birth companion, such as mother, sister, friend or doula. Similarly, whether the mother had solely a birth partner or both a birth partner *and* companion during birth was significant for perceived infant Easiness (MABS), F (3,811) = 5.699, p =

0.001, with the significant difference between 'yes birth partner' (M = 24.06, SD = 2.30) and 'yes birth partner and companion' (M = 25.00, SD = 1.46). Overall therefore, mothers perceived their infants as Easier if they had a birth partner *and* companion present during their birth. There were no interaction effects of Birth Partner / Companion and Infant Age Groups.

Inclusion of the Validated Questionnaires: TIPI, EPDS and Spielberger's STAI – State

a) Maternal personality (TIPI)

Pearson's partial correlations were conducted between 24 Hour Baby and maternal personality traits measured by the Ten Item Personality Inventory (TIPI) (Gosling et al., 2003). Emotionality Stability, Extroversion and Openness were all positively associated with Alert-Content Baby and inversely associated with Cry-Fuss Baby (Table 39). Agreeableness was positively associated with Alert-Content Baby, while Conscientiousness had an inverse relationship with Cry-Fuss Baby.

The relationships between maternal personality traits and specified MABS infant behaviours (0-6 months) were also examined (Table 39). Extroversion was positively associated with Alert-Responsive, Easiness and Alert during Feeds, and inversely associated with Unsettled-Irregular and Irritable during Feeds. Mothers with higher levels of Extroversion also reported higher levels of Global Confidence and greater Confidence in Caretaking and Breastfeeding. Agreeableness ratings were positively associated with maternal Global Confidence and more Alert-Responsive infants. Mothers with higher levels of Agreeableness also perceived their infants as Easier and less Unsettled-Irregular or Irritable during Feeds. Similarly, Mothers with higher levels of Conscientiousness reported Easier, less Unsettled-Irregular infants who were more Alert during Feeds and less Irritable during Feeds, as well as higher Global Confidence and Confidence in Caretaking ratings.

Mothers with higher Emotional Stability scores also rated their infants as Easier and more Alert-Responsive and Alert during Feeds while less Unsettled-Irregular or Irritable during Feeds. These mothers reported higher levels of Global Confidence and Confidence in Caretaking or Breastfeeding. Finally, the personality trait Openness was positively associated with Alert-Responsive, Alert during Feeds, perceived overall infant Easiness and maternal Global Confidence. It was inversely associated with Unsettled-Irregular and Irritable during Feeds. Overall, these findings indicate that early infant behaviours are affected by their mother's personality, and therefore shaped by both genetic and environmental influences.

Table 39 Associations between personality (TIPI), postnatal states (EPDS and STAI State), 24 Hour Baby and MABS

Measure	Factor	Big 5 personality traits (TIPI) N = 953					EPDS total N = 922	State Anxiety N = 947
		Extroversion	Agreeableness	Conscientious	Emotional Stable	Openness		
24 Hour Baby	Cry-Fuss	-.125, p = .000***	-.057, p = .084	-.101, p = .002**	-.187, p = .000***	-.102, p = .002**	.264, p = .000***	.292, p = .000***
	Alert-Content	.164, p = .000***	.101, p = .002**	.064, p = .053	.171, p = .000***	.174, p = .000***	-.153, p = .000***	-.156, p = .000***
MABS	Alert-Responsive	.075, p = .023*	.095, p = .004**	.043, p = .190	.065, p = .047*	.129, p = .000***	-.123, p = .000***	-.158, p = .000***
	Unsettled-Irregular	-.122, p = .000***	-.134, p = .000***	-.162, p = .000***	-.291, p = .000***	-.150, p = .000***	.412, p = .000***	.396, p = .000***
	Lack Confidence Caretaking	-.084, p = .010*	-.050, p = .128	-.102, p = .002**	-.240, p = .000***	-.008, p = .814	.380, p = .000***	.315, p = .000***
	Easiness	.082, p = .012*	.105, p = .001**	.068, p = .037*	.165, p = .000***	.170, p = .000***	-.172, p = .000***	-.221, p = .000***
	Global Confidence	.133, p = .000***	.116, p = .000***	.149, p = .000***	.303, p = .000***	.141, p = .000***	-.350, p = .000***	-.335, p = .000***
	Alert during Feeds	.084, p = .010*	.004, p = .895	.138, p = .000***	.070, p = .033*	.079, p = .016*	-.088, p = .008**	-.072, p = .028*
	Irritable during Feeds	-.091, p = .005**	-.104, p = .001**	-.082, p = .012*	-.209, p = .000***	-.117, p = .000***	.310, p = .000***	.286, p = .000***
	Lack Confidence Breastfeeding	-.093, p = .008**	-.052, p = .142	-.027, p = .448	-.145, p = .000***	-.013, p = .716	.227, p = .000***	.181, p = .000***

Pearson's *r*: * p < 0.05, ** p < 0.01, ***p < 0.001

b) Postpartum depression (EPDS)

Parenting stress – potentially induced by a combination of infant and maternal characteristics (e.g. infant demandingness and negative emotionality, demographic factors, maternal ill health, sense of competence and lack of support) (Abidin, 1983, 1986) could contribute to postpartum depression (PPD). Likewise, PPD is considered a major predictor of parenting stress (Leigh & Milgrom, 2008). Therefore, it was important to measure postnatal depression alongside infant behaviour and maternal confidence and self-efficacy. First, partial correlations were conducted between the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden, & Sagovsky, 1987) and 24 Hour Baby. EPDS total was positively associated with Cry-Fuss Baby and inversely associated with Alert-Content Baby (Table 39), indicating that a newborn perceived as more distressed was associated with a more depressed mother later on. (Notably, EPDS is only applicable after seven days and just one mother of an infant < 7 days old took part in the study.)

EPDS total scores were also significantly associated with all MABS items. Higher EPDS total scores were negatively associated with Alert-Responsive, perceived infant Easiness and Alert during Feeds, and positively associated with more Unsettled-Irregular behaviours and Irritability during Feeds. Mothers with higher EPDS scores also rated themselves as significantly less confident in all areas (Table 39).

c) Current maternal emotional state (STAI State)

Before examining relationships between STAI State and infant behaviour, it was important to establish whether 'State' was unique or reflected mothers' overall emotional wellbeing. Therefore, an inter-correlation was conducted between the three measures: TIPI, EPDS and STAI State. Emotional Stability was associated with EPDS total, r (914) = -.589, $p < 0.001$, and STAI State scores, r (940) = -.556, $p < 0.001$. EPDS total – designed to detect the mother's mood over the past seven days – was also positively associated with STAI State Anxiety scores, r (912) = .766, p <0.001. This suggests that mothers who felt anxious while participating in the survey were also more likely to be feeling depressed, potentially clouding their perceptions of their infant (McGrath et al., 2008).

In relation to infant behaviour, STAI State Anxiety was positively associated with Cry-Fuss 24 Hour Baby and inversely associated with Alert-Content Baby (Table 39). Therefore, mothers reporting higher levels of State Anxiety also reported more distressed and unsettled newborn behaviours. This pattern continued for MABS scores. Higher levels of STAI State Anxiety

were associated with lower ratings of the infant behaviour categories Easiness, Alert-Responsive and Alert during Feeds and higher ratings of Unsettled-Irregular and Irritable during Feeds. Higher levels of State Anxiety were also associated with less Global Confidence and a Lack of Confidence in Caretaking and Breastfeeding. Overall, these findings highlighted that maternal perceptions of their infant's behaviour, and possibly infant behaviour itself, may be susceptible to influences of their own mood and state (Table 39).

Question Three Which factors best predict infant behaviour?

Numerous physical, psychological and maternal factors were significantly associated with both both the 24 Hour Baby Scales and the Mother and Baby Scales (Wolke & James-Roberts, 1987). Therefore, this question is subdivided into smaller questions concerning what predicts:

(1) perceived 24 Hour Baby behaviours
(2) infant behaviour (0-6 months)
(3) maternal confidence and self-efficacy (MABS)

Multiple linear regressions were performed on ten outcome variables (seven infant behaviour and three maternal confidence measures). All significant factors were entered in the first regression model; only factors significant at a conservative alpha level of < .01 were retained on the second run. Also, multicollinearity was examined and correlating factors removed according to their relevance to the outcome variable, e.g. removing EPDS for 24 Hour Baby (not applicable to first seven days) and removing STAI State for MABS due to its strong relationship with EPDS. The third and final run used only factors significant an alpha level of < .05 in the second run. Regression model 3 results will therefore be reported across the following sections. Standardised beta values were interpreted for all regression results.

1. *24 Hour Baby*

a) Cry-fuss 24 Hour Baby

The first multiple linear regression was conducted to determine the most significant predictors for the outcome variable Cry-Fuss 24 Hour Baby, based on 51 significantly associated factors (see Summary Table, Appendix 3D). The overall regression model was significant, F (4, 891)

= 75.897, p = 0.000, R^2 = .254. Interpreting the adjusted R^2 throughout the regressions, the regression model explained approximately 25.1% of the variance in Cry-fuss behaviours during the first 24 hours post birth (Table 40). Assisted Birth, Birth Emotions Positive (inverse), Postnatal Distress and STAI State Anxiety were all significant unique predictors of Cry-Fuss 24 Hour Baby behaviours. Interpreting the standardised beta value, Postnatal Distress appeared the strongest contributor to Cry-Fuss 24 Hour Baby behaviours (Table 40).

Table 40 Predictors of Cry-fuss 24 Hour Baby behaviours

Variables	*Unstandardised Coefficients*		*Standardised (Std.) Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	-.427	.093		-4.585	.000
Assisted Birth	.522	.083	.185	6.267	.000
BE Positive	-.135	.034	-.135	-3.995	.000
PN Distress	.289	.034	.289	8.497	.000
STAI State	.034	.008	.128	4.009	.000

B = Unstandardised coefficient; SEB = Standard error of unstandardised coefficient; β = Standardised beta
Note: BE – birth emotions; PN – postnatal

Reversed regression model

Although some research shows that mothers experiencing postpartum stress or depression are more likely to perceive their infant as difficult (McGrath et al., 2008; Orhon, Ulukol & Soykan, 2007), it has been suggested that a crying and fussing infant and maternal distress potentially leading to postnatal depression could be bi-directional (Leigh & Milgrom, 2008; Britton, 2011; Radesky et al., 2013). Therefore, Cry-Fuss Baby and Postnatal (maternal) Distress were reversed in a further regression model using the four significant factors in Table 40 above. Thus, Cry-Fuss Baby was placed as a potential predictor variable with Postnatal Distress as the new outcome variable. This new reversed regression model was significant, F (4, 891) = 111.046, p = .000. It also explained approximately 33% of the variance in Postnatal (maternal) Distress, a higher amount of variance than the original model which had Postnatal Distress as predictor and Cry-Fuss as outcome variables. Assisted Birth was no longer a significant unique predictor, but both Cry-Fuss infant (β = .259, t = 8.497, p = .000) and Birth Emotions Positive

(β = -.315, t = -10.345, p = .000) were, with the latter being the strongest (inverse) predictor of Postnatal Distress.

b) Alert-Content 24 Hour Baby

A multiple linear regression based on 54 associated factors was conducted to examine potential predictors for the outcome variable Alert-Content 24 Hour Baby. The overall regression model was significant, F (9, 889) = 33.686, p = 0.000, explaining approximately 24.7% of the variance (R^2 = .254; adjusted R^2 = .247). The factors Number of Children, Infant Gender, Assisted Birth (inverse relationship), Birth Emotions Positive, Postnatal Physical Wellbeing, Extroversion, Openness and Annual Household Income ≤ £27,000 were all significant unique contributors to the model. Interpreting the standardised beta value, the infant's First Feed as Breastfed (β = .241, t = 8.209, p = .000) was the strongest single predictor of Alert-Content Baby (Table 41).

Table 41 Predictors of Alert-Content 24 Hour Baby behaviours

Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	-1.588	.177		-8.986	.000
Number of children	.158	.041	.120	3.852	.000
Female infant	.140	.058	.070	2.395	.017
Income £27,000 or less	.168	.061	.081	2.745	.006
Assisted Birth	-.278	.087	-.099	-3.206	.001
Breastfed for first feed	.749	.091	.241	8.209	.000
Positive Birth Emotions	.189	.033	.189	5.815	.000
PN Physical Wellbeing	.111	.033	.111	3.400	.001
Maternal Extroversion	.054	.020	.085	2.704	.007
Maternal Openness	.071	.027	.083	2.642	.008

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

2. *MABS – infant behaviour*

The Mother and Baby Scales (MABS) were the outcome variables used to assess infant behavioural patterns from 0-6 months. Each of the five behaviour items are presented in turn.

a) Alert-Responsive infant behaviour

A multiple linear regression was conducted to determine the most significant predictors of the outcome variable Alert-Responsive, based on 23 significantly associated factors. The overall regression model was significant, F (5, 855) = 59.807, p = 0.000, R^2 = .259, explaining approximately 25.5% of the total variance in Alert-Responsive behaviours during the first six months. The variables Infant Age, Maternal Higher Education (inverse relationship), Postnatal Positive, Experience Supported and Maternal Openness were all significant unique contributors, with Postnatal Positive the strongest single unique predictor (Table 42).

Table 42 Predictors of Alert-Responsive infant behaviour (0-6 months)

Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	33.941	.825		41.165	.000
Infant Age	.302	.020	.440	14.884	.000
Higher Education	-1.198	.432	-.082	-2.772	.006
Postnatal Positive	.929	.161	.181	5.784	.000
Experience Supported	.409	.159	.080	2.565	.010
Maternal Openness	.348	.132	.079	2.642	.008

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

b) Unsettled-Irregular infant behaviour

A multiple linear regression was conducted to determine the most significant predictors of the outcome variable Unsettled-Irregular, based on 42 significantly associated factors. The model was significant, F (4, 854) = 66.077, p = 0.000, with an R^2 of .236. The adjusted R^2 indicated that the model predictors accounted for approximately 23.3% of the total variance in Unsettled-Irregular infant behaviours (0-6 months). The variables Infant Age (-), Anxious-Afraid Birth Emotions and EPDS total scores were all significant unique contributors to Unsettled-Irregular behaviours. EPDS total was the strongest unique predictor of Unsettled-Irregular (Table 43).

Table 43 Predictors of Unsettled-Irregular infant behaviour (0-6 months)					
Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	48.555	1.040		46.695	.000
Infant age	-.331	.051	-.196	-6.653	.000
BE Anxious-Afraid	2.180	.419	.171	5.204	.000
Number of PN Comps.	-.323	.330	-.031	-.981	.327
EPDS total	.902	.079	.370	11.400	.000

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

c) Easiness

A multiple linear regression was conducted to determine the most significant predictors of the outcome variable perceived overall infant Easiness (MABS General Impressions section) based on 25 significantly associated factors. The model was significant, F (6, 863) = 18.208, p = 0.000, R^2 = .112, explaining approximately 10.6% of the total variance in scores for perceived overall infant Easiness. Infant Age was the most significant unique predictor, followed by the mother having reported feeling in a Positive Postnatal state and the maternal trait of Openness. No maternal Higher Education and experiencing support from both a Birth Partner and Companion during birth were also significant unique contributors to Easiness (Table 44).

Table 44 Predictors of perceived infant Easiness (0-6 months)					
Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	22.958	.434		52.900	.000
Infant Age	.054	.010	.176	5.476	.000
Higher Education	-.547	.213	-.083	-2.576	.010
Postnatal Positive	.306	.078	.133	3.923	.000
Birth Partner & Comp.	.551	.208	.085	2.645	.008
Maternal Openness	.244	.065	.124	3.754	.000
EPDS total	-.046	.015	-.104	-3.054	.002

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

d) Alert during Feeds

A multiple linear regression was conducted to determine the most significant predictors of the outcome variable Alert during Feeds, based on 12 significantly associated factors. The model was significant, F (4, 933) = 28.711, p = 0.000, R^2 = .110. The adjusted R^2 indicated that approximately 10.6% of the variance in scores for Alert during Feeds could be explained by variances in the four significant unique predictors of Infant Age, Higher Education (-), Currently Breastfeeding (-), and maternal Conscientiousness. Interpreting the standardised beta value, Infant Age was the strongest single unique predictor, with older non-breastfed infants overall more Alert during Feeds (Table 45).

Table 45 Predictors of Alert during Feeds (0-6 months)

Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	14.785	.836		17.692	.000***
Infant age	.139	.018	.234	7.566	.000***
Higher education	-1.000	.401	-.078	-2.494	.013*
Breastfed currently	-1.904	.396	-.151	-4.810	.000***
Conscientiousness	.498	.119	.129	4.183	.000***

B = Unstandardised coefficient; SEB = Standard error of unstandardised coefficient; β = Standardised Beta

e) Irritable during Feeds

A final multiple linear regression was conducted for infant behaviour, to determine the most significant predictors of the outcome variable Irritable during Feeds, based on 24 significantly associated factors. The multiple linear regression model for Irritable during Feeds was significant, F (4, 865) = 37.466, p = 0.000, R^2 = .148, adjusted R2 = .114. Four significant unique predictors were identified: Infant Age (inverse relationship), First Weight (-), Postnatal Physical Wellbeing (-), and EPDS total, with EPDS being the strongest single unique contributor to Irritable infant behaviour during Feeds (Table 46).

Table 46	**Predictors of Irritable during Feeds (0-6 months)**				
Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	24.086	1.603		15.026	.000
Infant Age	-.179	.030	-.190	-6.035	.000
Birth Weight	-1.363	.419	-.102	-3.254	.001
PN Physical Wellbeing	-.697	.233	-.099	-2.991	.003
EPDS total	.380	.045	.279	8.443	.000

B = unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

3. *MABS – maternal confidence and self-efficacy items*

As explained in *Measures*, the Mother and Baby Scales (Wolke & James-Roberts, 1987) were designed with maternal perceptions of infant behaviour in mind. Due to their emotional involvement and preconceptions prior to the birth, parents cannot be considered purely scientific observers of their infant, although their observations have been shown to be largely based on objective infant behaviours when detailed, highly specific questions are asked – as in MABS (Wolke, 1995). Three measures of maternal confidence were included within the scales' design and therefore here. Consequently, a further series of multiple linear regression models were conducted to assess whether perinatal physical and psychological birth factors predicted overall (Global) maternal confidence and Confidence in Caretaking or Breastfeeding her infant.

a) Global Confidence

A multiple linear regression was performed to determine how much variance in Global Confidence could be explained by 27 significantly associated variables. The overall model was significant, F (4, 865) = 42.153, p = 0.000, explaining approximately 15.9% of the variance in Global Confidence scores (R^2 = .163; adjusted R2 = .159). Postnatal Positive, Postnatal Physical Wellbeing, Emotional Stability, and EPDS total (inverse relationship) were all identified as significant unique predictors. Interpreting the standardised beta value, EPDS total (inverse score) – and thus *not* scoring highly on the depression scale – was the most significant predictor in the model (Table 47).

Table 47	Predictors of Global Confidence				
Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	17.481	.313		55.887	.000
Postnatal Positive	.215	.063	.114	3.445	.001
PN Physical Wellbeing	.200	.063	.106	3.179	.002
Emotional Stability	.172	.050	.133	3.427	.001
EPDS total	-.075	.015	-.206	-5.116	.000

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

b) Lack of Confidence in Caretaking

Another multiple linear regression was performed to determine how much variance in Lack of Confidence in Caretaking could be explained by 36 significantly associated variables. The overall regression model was significant, F (2, 916) = 97.059, p = 0.000, with an R^2 of .175. The adjusted R^2 explained 17.3% of the total variance in maternal Lack of Confidence in Caretaking. The variables Number of Children and EPDS total remained significant unique contributors, with the latter being the strongest unique individual predictor (Table 48).

Table 48	Predictors of Lack of Confidence in Caretaking				
Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	30.836	.770		40.052	.000
Number of children	-1.987	.361	-.166	-5.503	.000
EPDS total	.650	.053	.369	12.253	.000

B = Unstandardised coefficient; SEB = Standard error of Unstandardised coefficient; β = Standardised Beta

c) Lack of Confidence in Breastfeeding

Only mothers who were still breastfeeding their infants at the time of completing the questionnaire (n = 850) provided responses to the Mother and Baby Scales questions regarding their recent feeding experiences. These mothers had therefore managed to continue to

breastfeed, irrespective of any potential adversities such as obstetric complications, or social factors such as lack of support. A final multiple linear regression was conducted to determine the strongest contributors to the outcome variable Lack of Confidence in Breastfeeding, based on 37 significantly associated factors. The model was significant, F (3, 914) = 69.042, p = 0.000, explaining 18.2% of the total variance (R^2 = .185; adjusted R^2 = .182). Number of Children (inverse), Meconium in Waters, and EPDS total were all identified as significant unique predictors of maternal Lack of Confidence in Breastfeeding (Table 49). Depression (EPDS) scores were the strongest unique predictor in this final model.

Table 49 Predictors for Lack of Confidence in Breastfeeding

Variables	*Unstandardised Coefficients*		*Std. Coefficients*		
	B	**SEB**	**β**	**t**	**Sig.**
Constant	30.293	.775		39.103	.000
Number of Children	-1.824	.359	-.153	-5.081	.000
Meconium in Waters	2.579	.726	.107	3.554	.000
EPDS total	.624	.053	.357	11.828	.000

B = Unstandardised coefficient; SEB = Standard error of unstandardised coefficient; β = Standardised Beta

Table 50 SUMMARY Table of Multiple Linear Regression Results

(See Appendix 3D for a full table of all significant variables in correlations & MANOVAs)

PREDICTORS positive/inverse +/–	**24 Hour Baby**		**Mother and Baby Scales (0-6 months)**							
	Cry-Fuss	Alert-Content	Alert-Responsive	Unsettled-Irregular	Lack Conf. in CT	Easiness	Global Confidence	Alert during Feeds	Irritable during Feeds	Lack of Conf. in BF
Assisted Birth	+***	– **								
BE Positive	– ***	+***								
Anx-Afraid BE				+***						
PN Positive			+***			+***	+**			
PN Distress	+***									
PN Phys Well		+**					+**		– **	
Exp. Supported			+*							
No. of Children		+***			– ***					– ***
Infant Age			+***	– ***		+***		+***	– ***	
Birth Weight									– **	
First feed - BF		+***								
Gender - female		+*								
Inc. ≤ £27,000		+**								
Meconium										+***
Partner & Comp						+**				
Higher Educ			– **			– *		– *		
Emot. Stability							+**			
Currently BF								– ***		
Extroversion		+**								
Conscientious								+***		
Openness		+**	+**			+***				
EPDS total				+***	+***	– **	– ***		+***	+***
STAI State	+***									

*p<0.05, **p<0.01, ***p<0.001 * = sig. β in regression model (p<0.05): positive (+) / inverse (–) relationship

Note: Regression models included the inter-correlated STAI State for 24 hr baby and EPDS for MABS

6.4 Summary

- Objective physical perinatal factors such as birth mode were associated with perceived infant behavioural outcomes, especially during the first 24 hour period.
- Subjective and psychological perinatal factors also influenced specific areas of mother-reported infant behaviours for both newborns and older infants.
- Regression analyses highlighted that, while both physical and psychological perinatal factors predicted maternal perceptions of newborn behaviours, overall infant behaviour during the first 30 weeks was largely predicted by subjective maternal states during and post birth; and also by postnatal depression scores and maternal personality.
- Physical and psychological factors also combined to predict maternal reports of confidence in caretaking and breastfeeding during the first six months, which may have run parallel to or been bi-directionally associated with distinct infant behaviours.
- Overall, the key research findings support the concept that subjective maternal perceptions of childbirth contribute to early infant behavioural style.

These results reflect in part the findings of Ayers and colleagues (2016): that alongside the actual physical experience, subjective birth experience is a strong factor in maternal feelings of birth trauma and the diagnosis of postpartum PTSD. Correspondingly, they echo the beliefs of maternity care providers interviewed in Study One of this thesis who spoke of the infant 'mirroring' their mother's emotional state. As previous authors have suggested, the young infant appears highly sensitive to fluctuations in maternal mood (Eastwood et al., 2012).

6.5 Discussion

The aim of Study Three was to examine which factors affecting mothers' individual experiences of childbirth and the perinatal period might influence her perceptions of her young infant's behavioural style known as temperament. The study had several notable findings, with numerous physical and psychological aspects of childbirth and the perinatal period found to affect both infant behaviour scores and maternal confidence outcomes. However, it was mostly subjective and psychological factors combined with maternal personality traits (e.g. Openness and Emotional Stability) that predicted infant behaviour and maternal confidence scores. The

findings confirm and extend prior knowledge, and could have important implications for maternity practice, particularly for mother-infant dyads experiencing a difficult birth.

The data were analysed in three main stages. First, after controlling for established maternal and infant covariates, the results provided further evidence on the potential impact of certain physical perinatal factors (e.g. birth mode) upon neonatal behaviours such as crying and fussing (e.g. Taylor et al., 2000; Gitau et al., 2001; Douglas & Hill, 2013). Similarly, factors such as start of labour method and in-labour occurrences, pain relief medications or natural methods were associated with positive or negative differences in both 24 Hour Baby and MABS (0-6 months) infant behaviour scores. These were all in the expected direction. For example, acceleration of labour, foetal blood sample or epidural were associated with higher Cry-Fuss and Unsettled-Irregular scores, while Hypnobirthing and Gentle Birth of Head were associated with higher Alert-Responsive and infant Easiness ratings. Physical perinatal events also influenced self-reported maternal confidence and self-efficacy ratings. In turn, these were associated – possibly bi-directionally – with maternal perceptions of infant behaviour.

The second major finding was that both subjective factors (such as Birth Emotions) and psychological variables (e.g. maternal personality traits and EPDS) were associated with infant behaviour measures. Self-reported subjective factors encompassed individual maternal experiences of pregnancy, birth and the postpartum period and were based on mothers' self-reported physical and emotional states during these three perinatal periods. For example, Positive Physical Pregnancy included broad statements such as 'had plenty of energy' and 'found pregnancy easy', while Positive Emotional Pregnancy included 'felt calm/happy/excited about the birth'. These subjective physical and psychological experiences were associated with one another and with the physical birth experience. Equally, subjective pregnancy experiences were associated with subjective birth experiences (such as Anxious-Afraid or Neglected Birth Emotions) which, in turn, were associated with postpartum experiences, i.e. whether the mother felt Postnatal Positive/ Distress or Postnatal Physical Wellbeing.

Finally, physical, subjective and psychological factors were examined through predictive statistical procedures, and multiple linear regressions were conducted for each of ten outcome variables. Certain physical factors such as Assisted Birth and First Feed Breastfed were identified as significant predictors of perceived 24 Hour Baby behaviours alongside gender and

subjective predictors such as Postnatal Distress for Cry-Fuss Baby or Positive Birth Emotions for Alert-Content Baby. Also, certain covariates such as Birth Weight and especially Infant Age, emerged as significant contributors to infant behaviour aged 0-6 months. However, it was maternal psychological characteristics (e.g. personality traits) and postnatal mood together with subjective factors (reported birth and postnatal physical and emotional states) that were the most consistent predictors of young infant behavioural style as measured by MABS.

Consistent with the literature linking postnatal maternal mood with maternal behaviour, confidence and self-efficacy (e.g. James-Roberts & Wolke, 1987; Bandura, 1994; Feldman et al., 2009), subjective and psychological perinatal variables were also associated with maternal confidence. Indeed, together with parity or birth order (Number of Children), psychological factors (such as Emotional Stability or EPDS score) and subjective factors (such as Postnatal Positive) appeared the most stable predictors of maternal confidence. For example, mothers who had more children and reported better emotional and physical wellbeing post birth also reported greater confidence. Conversely, more depressed mothers reported lower confidence.

Maternal trait anxiety may interact with early infant regulatory (crying, feeding and sleeping) problems to predict lower maternal confidence (Matthies et al., 2017), and evidence has shown associations between postnatal depression, lower maternal self-efficacy, and infant attachment insecurity (Kohlhoff & Barnett, 2013). Therefore, postnatal maternal psychological wellbeing, confidence and self-efficacy appear to be important factors in developing infant temperament, and it has been suggested that programs to reduce maternal anxiety and promote maternal confidence may help to prevent regulatory problems in young infants (Matthies et al., 2017).

The main factors contributing to reported early infant behaviours and maternal confidence and self-efficacy will be further discussed under the subheadings below.

1. *Physical perinatal factors*

a) Birth mode

A major factor associated with perceived infant behaviours was Birth Mode. Assisted Birth was associated with the highest perceived Cry-Fuss 24 Hour Baby and Unsettled-Irregular infant behaviours (0-6 months). Assisted Birth also predicted higher Cry-Fuss 24 Hour Baby scores, while this effect was reversed for Alert-Content Baby. These findings may have several separate though related components. Potential risks of a difficult labour include foetal heartrate

deceleration, hypoxia, uterine rupture, and other signs of foetal or maternal distress (Stephansson et al., 2016). Also, newborn behaviours could be related to actual physical pain experienced by the foetus during a prolonged or obstructed labour leading to the assisted birth (Taylor et al., 2000). As discussed in the literature review (Chapter Two), whilst forceps should be used carefully and without excessive compression of the foetal skull (Horan & Murphy, 2016), they can often cause regional bruising and swelling, and occasionally a more severe facial or brain injury may occur (RCOG, 2020). It is also possible that an earlier problem such as foetal or maternal distress resulted in the assisted birth, thereby causing these maternal ratings of unsettled newborn behaviours.

Although a significant difference continued for Birth Mode overall, the data varied between different age groups and therefore significant differences were not seen for Unsettled-Irregular behaviours between each specific birth mode, and Assisted Birth was not retained as a predictor of Unsettled-Irregular infant behaviours (0-6 months). Instead, Anxious-Afraid Birth Emotions and EPDS came through as predictors, both of which may have been indirectly connected to Birth Mode, as will be discussed later. Notably however, when separated by the factor Infant Age Groups, Bonferroni analyses of behavioural differences according to Birth Mode highlighted some interesting discrepancies between the three separate age groups. Whilst Unsettled-Irregular behaviours were at a similar level to one another after assisted birth or elective CS in the first infant age group (0-10 weeks), a large mean difference according to Birth Mode emerged in the older age group (21-30 weeks). Higher mean Unsettled-Irregular behaviours occurred after Assisted Birth in the oldest age group, indicating that infants may recover sooner after Planned CS than Assisted Birth.

These findings are consistent with previous research highlighting assisted birth as the most stressful birth mode for the neonate (Taylor et al., 2000; Douglas & Hill, 2013). In the first study, maternal and umbilical cord cortisol levels were examined in relation to birth mode and infant stress response to inoculations at 8-12 weeks. The greatest stress response (measured by crying and salivary cortisol) was found after assisted birth, and the least after elective CS. A small follow up study (Gitau et al., 2001) also found umbilical cord cortisol levels to be highest after assisted birth and lowest after elective CS. However, sample sizes were relatively small in each group of Gitau et al.'s (2001) study and it only examined differences immediately post birth. In contrast, when behavioural differences over the first six months were considered here, infant behaviour appeared most settled after a spontaneous physiological birth and least settled

after assisted birth. This finding was in contrast to all other interventionist birth modes where any negative influences were reported over a comparatively shorter time-frame. The results presented here therefore extend prior research by examining infant behaviour up to thirty weeks, finding that initial differences in unsettled behaviours according to birth mode could potentially remain over time. However, it was not a repeated measures design, the three infant age groups each comprising separate groups of individual infants, and therefore this factor may have contributed to the differences observed here between the age groups.

Nevertheless, these differences still occurred despite an overall finding that infants were likely to be more settled and regular in their routines with increased age, both in the present study and elsewhere (e.g. James-Roberts et al., 2015). Drawing on Douglas and Hill (2013), it was hypothesised that a more stressful birth experience for the infant may have triggered a negative feedback loop in the infant's hypothalamic-pituitary-adrenal (HPA) axis responsible for their developing stress response system. Therefore, if a genetically susceptible infant (Belsky & Pleuss, 2009) is further sensitised by early stressors occurring during the birth, this could potentially lead to longer term interactional cry-fuss, feeding and sleeping problems and reduced soothability (Douglas & Hill, 2013b), otherwise known as regulatory problems (Schmid, Schreier, Meyer & Wolke, 2011).

b) Breastfeeding

Breastfeeding is considered an instinctive newborn behaviour that is highly sensitive to external stimuli from emotions such as fear (Bergman, 2016), and is therefore potentially dependent on the mother's physical and emotional response to her birth and her new baby. Many pain relief medications, especially pethidine, are widely believed to have a negative impact on mother and infant alertness post birth, and consequently on normal newborn suckling behaviours and breastfeeding initiation (Widström et al., 2011). However, the findings in the present study showed no significant effects of pethidine on MABS infant behaviour measures or maternal breastfeeding confidence scores. Mothers who managed to overcome initial difficulties and continue breastfeeding after pethidine may account in part for this lack of association. As MABS asks questions relating specifically to the past seven days, mothers who did not continue to breastfeed would not have completed this section of the questionnaire. Moreover, while just 108 participants did not breastfeed for the first feed, only 146 out of the total 999 were not breastfeeding on completion of the survey, indicating that most initial breastfeeders in this study managed to continue, regardless of birth or pain relief experiences.

Notably, breastfeeding for the first feed predicted more Alert-Content 24 Hour newborn behaviours. It was also associated with less unsettled and irregular infant behaviours over the first six months. This has several potential explanations. The mother feeling able to breastfeed for the first feed (rather than expressing breast milk or using formula) could signify that she had a more normal physiological birth with less pain relief medication, as shown by prior research (Widström et al., 2011; Brown & Jordan, 2013). In their recent systematic review, Uvnäs-Moberg and colleagues (2019) outline how the positive hormonal and physiological wellbeing of mother and infant post birth is directly related to a spontaneous physiological birth experience. However, in the present study, though First Feed Breastfed was positively associated with Normal Birth and inversely associated with Emergency CS, it was not associated with either Assisted Birth or Planned CS. Again, this could be linked to the persistence of the breastfeeding mothers in this study, the majority managing to initiate and continue breastfeeding at a higher rate than the wider UK maternal population.

The predictive value of First Feed Breastfed for perceived Alert-Content newborn behaviours might also be connected to the way breastfeeding involves close skin to skin contact. Together, skin to skin and breastfeeding can help to regulate neurohormonal physiology systems after a more difficult birth, enhancing the flow of oxytocin, lowering cortisol levels, and benefitting mother-infant neurobiological wellbeing and synchrony post birth (Carter, 2014; Feldman, 2015; Mooney-Leber & Brummelte, 2017). This may work to even greater effect alongside a physiologically normal birth through continuing to stimulate mother-infant oxytocin systems, thereby reducing any residual fear, anxiety, stress and pain, increasing sociability and promoting bonding between the dyad (Moberg, 2014; Uvnäs-Moberg et al., 2019).

This close contact and breastfeeding could help to build a secure attachment, benefitting the infant's physical, cognitive, emotional and social development (Murray et al., 2014). Moreover, breastfeeding is the natural, programmed outcome of birth for mother and infant (Widström et al., 2011). Therefore, it may be the most rewarding behaviour for the dyad, potentially enhancing both actual newborn behaviour and maternal perceptions of this initial 24 hour period, including her baby's behaviour and wellbeing. While lowering stress levels via mother and infant hormonal systems, successful breastfeeding may also increase maternal happiness (Brown, 2018), boost the immune system of the mother as well as infant (Groer et al., 2005), and reduce her risk for postnatal depression through decreasing inflammation in the

body (Kendall-Tackett, 2007). In turn, this might benefit infant wellbeing and temperament (Murray et al., 2014).

2. *The importance of the psychological birth experience*

While multiple physical factors showed clear associations with newborn and continuing infant behaviours, psychological factors such as postnatal depression scores and self-reported maternal physical and emotional states during the perinatal period were also associated with differences in perceived infant behaviours and maternal confidence. Moreover, subjective maternal birth states were related to subjective maternal postnatal states, and these in turn were related to postnatal depression scores. Consistent with previous research exploring maternal mood disorders after difficult birth experiences (Ayers et al., 2016), correlational analyses in this study also showed that certain subjective factors, such as Anxious-Afraid, Postnatal Maternal Distress and EPDS depression scores, were directly related to interventionist birth modes and a difficult physical birth experience. Therefore, the physical and psychological experiences of childbirth appear to be intricately inter-connected. Furthermore, the persistence of maternal pain after childbirth, irrespective of birth mode, has been highlighted as a predictor for postnatal depression (Eisenach et al., 2014).

In line with this, the current findings support the qualitative results of Study One (Chapter Four), where maternity care providers observed that mother and infant appear to respond together as a reciprocal dyadic unit to both physical and psychological aspects of their birth experience. It is also consistent with the findings of Study Two (Chapter Five), which suggested that maternal perceptions of childbirth and perceptions of their infant's behaviour were often aligned, despite mothers not always explicitly perceiving such a connection. The current findings may therefore provide further support for the possibility of associations between a difficult birth involving obstetric interventions, negative birth emotions such as fear and anxiety, lack of maternal control over her own birthing circumstances, and postpartum mood disturbances (Blom et al., 2010; Ayers et al., 2016; Field, 2017).

Although birth interventions, birth mode, pre- and post-natal complications and pain relief methods were associated with influences on infant behaviour scores from 0-6 months, regression analyses highlighted that it was mostly psychological and subjective maternal factors that predicted these infant behaviours beyond the first 24 hours. This could mean that

infants may recover from their birth experience faster than their mothers, as previously considered in relation to birth mode. It could also indicate that strong psychological variables, such as EPDS scores, may override other potential contributing factors, as observed by Leigh and Milgrom (2008) in their paper on early parenting stress. In the present study, this occurred particularly with regard to maternal confidence, while subjective maternal perceptions of her birth experience – denoted here by birth and postnatal states – had more influence over infant behaviour than physical events. This aligns with other research (Ayers et al., 2016) showing that maternal subjective perceptions of her birth as traumatic contribute more than the actual physical birth experience to her development of postpartum PTSD. As previously discussed, while obstetric factors also contribute to postnatal mood disorders (Murray & Cartwright, 1993; Ayers et al., 2016), maternal mood may impact on mother-infant interactions and subsequent infant behaviour and development (Murray, Halligan & Cooper, 2018).

While it is important to remember that newborn Cry-Fuss behaviours predicted maternal Postnatal Distress, maternal depression (EPDS) scores predicted reported negative infant behaviours such as Unsettled-Irregular and Irritability during Feeds. These findings support previous research identifying a link between postnatal depression and perceptions of more 'difficult' infant behaviour (McGrath et al., 2008; Britton, 2011). Although Gonidakis et al. (2008) raised the possibility that depressed mothers may interpret their infant as crying more and sleeping less than an objective rater, as highlighted here, this relationship is likely to be bi-directional. A crying, irritable infant may affect maternal mood, exacerbated by sleep deprivation (Eastwood et al., 2012), or an infant may sense maternal mood, becoming more difficult (Martini et al, 2017).

How might maternal wellbeing be associated with infant behaviour?

There are a number of potential pathways for how maternal birth experience, maternal wellbeing and infant behaviour could be interacting with one another.

a) Maternal psychological experience of birth

Starting with the concept that experience of childbirth may affect maternal wellbeing, according to maternity care providers in Study One (Chapter Four), if a mother has a positive birth she is more likely to feel confident and empowered by the experience. Equally, many health professionals stated that if the mother has a negative or 'traumatic' birth experience, in

terms of unexpected and undesired obstetric interventions, being moved from home to hospital, or not receiving the care and support she needs, she may feel a range of negative emotions post birth including anger, distress, sadness and guilt. Health visitors and doulas in particular noted that she may also feel a sense of detachment from her baby, reflecting findings by Ayers et al. (2006).

Here, subjective maternal perceptions of physical and psychological perinatal states predicted newborn infant behaviour scores. Alongside Assisted Birth, Postnatal Distress predicted perceptions of more Cry-Fuss behaviours in her newborn. This postnatal maternal distress was associated, not just with Birth Mode but also with negative birth emotions such as Anxious-Afraid and Neglected Birth Emotions, where a mother may feel 'ignored' or even 'abandoned'. Therefore, a mother who experienced a difficult birth was more likely to report a distressed newborn infant. Equally, a distressed infant predicted greater maternal Postnatal Distress.

Corresponding to this, positive perinatal states such as Positive Birth Emotions were found to predict more positive infant behaviours. Feeling positive during birth and experiencing less pain or exhaustion post birth predicted perceptions of more Alert-Content newborn behaviours. Given that the mother's pain levels and the potential trauma of unplanned birth interventions were associated with increased crying and fussing behaviours, a potential pathway for this is via an easier birth and recovery journey for the mother. It could also be that a mother who feels happier and calmer during and after birth has an easier newborn due to the positive hormonal pathways between mother and infant (Buckley, 2015). Furthermore, a mother who experiences positive birth emotions, and therefore increased levels of oxytocin and beta-endorphins, may simply *perceive* her newborn infant as more alert and content (McGrath et al., 2008).

In relation to MABS infant behaviours, having a 'supported' experience and feeling positive post birth predicted more ongoing alert and responsive infant behaviours and were associated with perceptions of overall infant Easiness. These mothers rated their midwife as helpful and informative, and felt 'emotionally supported' throughout. This finding aligns with recent evidence showing that mothers experience less anxiety post birth if they felt well cared for during birth (Field, 2017). Again, this could be linked to the way a supported mother who is feeling positive about her birth perceives her infant, the way the infant behaves after an easier, more positive birth experience, or possibly a combination of the two. Experience Supported also involved being able to 'listen' to her body as well as having a more directed second stage.

This was despite guided 'Valsalva' pushing increasing the risk of foetal distress (Sandström et al., 2017). However, Study Two (Chapter Five) findings showed that mothers may find their midwife's guidance reassuring, and this could potentially filter through to the neonatal response.

Finally, a mother's sense of physical and psychological wellbeing post birth predicted Global Confidence, Easiness, and less Irritability during Feeds. While they are connected, subjective maternal postnatal states might therefore be considered equally as important as birth emotions.

b) Subjective maternal states and birth mode

Subjective emotional states during birth and immediately afterwards were related to Birth Mode. For example, Assisted Birth and Emergency CS were both associated with Anxious-Afraid Birth Emotions and Postnatal Distress, in addition to a lack of Postnatal Physical Wellbeing, which involved feeling exhausted and in pain. In contrast, a normal birth was associated with Positive Birth Emotions, Postnatal Physical Wellbeing and a more Positive Experience overall. Mothers could also experience Positive Birth Emotions and Postnatal Physical Wellbeing after a Planned CS, although equally they were more likely to report higher levels of Postnatal Distress, possibly due to postpartum pain and reduced mobility afterwards.

These findings might be linked to predictability, reflecting Study Two findings where mothers appeared to be happier with their physical birth experience if they had expected the interventions, e.g. in the case of planned induction or planned CS. These mothers also perceived their infant's behaviour post birth as more settled and content, and generally easier over the first weeks or months. The present study extended these findings through quantitative methods of analysis. Here, positive or negative subjective birth and postpartum maternal states were associated with, and at times predicted, early infant behaviours. For example, Positive Birth Emotions predicted maternal perceptions of Alert-Content 24 Hour behaviours, while Anxious-Afraid Birth Emotions predicted more Unsettled-Irregular infants.

One pathway by which this might be occurring is the finding that mothers were less Confident in Caretaking during the first six months after either Assisted Birth or Emergency CS, which could mean they interpreted their infant as more unsettled, or it could be that maternal anxiety post birth led to more unsettled infant behaviours. This illustrates the potential cost of a more unpredictably stressful experience to mother-infant wellbeing. Indeed, earlier research found

that the development of postpartum depression might be more likely after an emergency CS when compared to forceps or spontaneous physiological birth (Boyce & Todd, 1992), although this topic has been debated. However, it is supported by Ayers and colleagues' meta analysis (2016), which relates the development of PTSD to both the physical and psychological birth experience, also suggesting comorbidity with depression. In the current study, an unplanned, more interventionist birth mode was associated with negative birth emotions such as Anxious-Afraid or Neglected, and with Postnatal Distress which in turn was associated with higher depression scores. These factors could therefore potentially combine to affect the mother's relationship with her infant and subsequent infant behavioural style (Murray et al., 2014). However, this topic will be further discussed under *Postnatal Maternal Mood*.

As speculated by prior research (Douglas & Hill, 2013), these findings regarding maternal perceptions could also be connected to the interacting hormonal systems of the mother-infant dyad. Higher cortisol levels may have an adverse impact on their HPA axes, potentially also causing changes to the infant microbiome and epigenome, as discussed in the literature review (Dahlen et al., 2013, 2014; Almgren et al., 2014). If so, this could have consequences for the future behaviour and development of the neonate (Gitau et al., 2001; Wolke et al., 2009; Schmid et al., 2010; Prokasky et al., 2017). Notably, early behavioural style is considered indicative of future personality development (Gartstein & Rothbart, 2003). Consequently, the infant's stress response system, if activated by a difficult birth coupled with the mother's negative psychological response or some other traumatic event, might remain more reactive throughout childhood (Carey & McDevitt, 2016).

Subjective maternal response to birth may therefore be a factor in the mother's own postnatal wellbeing (Ayers et al., 2016) and her subsequent perceptions of and interactions with her baby (Murray et al., 2014) in addition to the infant's behavioural response (Taylor et al., 2000). In the present study, the mother's greater sense of wellbeing both during and post birth was reflected in her higher levels of reported confidence and self-efficacy and her perceptions of more positive infant behaviours. Predictability of birth events could play a key role in situations where the mothers' sense of agency and control is increased or diminished. Recent psychological research shows that agency in relation to free choice is particularly important for negative unpredicted events (Tanaka & Kawabata, 2019). More specifically, a Dutch study found that women were less happy with the care they received if they had experienced an instrumental vaginal (assisted) birth, an emergency CS, less control during the active (dilation)

stage, or a more directed second (pushing) stage (Baas et al., 2017). This may help to explain the differences in maternal and infant response between a planned or unplanned CS in the present study. An elective CS should involve at least an element of predictability, choice, and a chance to prepare.

c) Postpartum maternal mood and infant attachment

In this study, EPDS total scores were the strongest predictor of several infant and maternal outcome variables. These included more unsettled, irritable and irregular infant behaviours and lower confidence in caretaking, breastfeeding and overall. These findings could mean that depressed mothers perceive their infant as more difficult (McGrath et al., 2008). They may also indicate that the mother's personal feelings of birth trauma represented by negative birth and postnatal emotional states contribute to postpartum depression, as they do to PTSD (Ayers et al., 2016). Furthermore, a challenging birth experience might lead directly to increased unsettled infant behaviours via physiological pathways as discussed, which could also result in lower maternal confidence combined with more negative thoughts and feelings.

However, we know that prenatal and postnatal depression predict a more unsettled infant temperament (Davis et al., 2004; Shapiro, Jolley, Hildebrandt, & Spieker, 2018). Therefore, a mother's psychological state during and after birth might also influence her infant's behaviour. Conversely, excessive infant crying predicts later EPDS scores, particularly if the mother feels unable to console her baby (Radesky et al., 2013). The current findings reflect this research, particularly in relation to EPDS scores as a predictor of maternal confidence and self-efficacy. As well, if mothers in this study felt unconfident in caring for and breastfeeding their unsettled infant, they were potentially more susceptible to developing postpartum depression, and these factors are likely to be bi-directional (Britton, 2011). Once established, however, postnatal depression may have negative consequences for the infant's future (Murray et al., 2014).

A body of previous evidence shows that postnatal maternal mood may affect mother-infant interactions and subsequent infant behaviour and development (e.g. Murray, 1992; Beck 1995). More recent research reaffirms associations between postnatal depression, maternal withdrawal, and subsequent interactional difficulties between the mother-infant dyad, potentially affecting maternal-infant bonding and infant outcome even after maternal mood improves (Murray et al., 2014, 2018; Oyetunji & Chandra, 2020). As these authors observe, the association between maternal mood and infant behavior could occur via the mechanism of

infant attachment. This is highlighted by the extensive work of Ainsworth, including the Strange Situation experiment where the mother is asked not to respond to her infant's cues for attention and social communication (Ainsworth & Bell, 1970). Through this research, Ainsworth first provided evidence for the importance of maternal sensitivity and showing appropriate responses to her baby in subsequent infant attachment security.

On this basis, maternal sensitivity is considered vital to infant wellbeing (Bernard, Meade & Dozier, 2013). It is also associated with higher levels of oxytocin in the mother-infant dyad (Feldman et al., 2012) which are known to have a calming and bonding effect on both mother and infant (Uvnäs-Moberg, 2014; Uvnäs-Moberg et al., 2019). In contrast, depressed mothers have lower oxytocin levels and are more likely to avoid or ignore their infant's cues (Mah, Van Ijzendoorn, Out, Smith, & Bakermans-Kranenburg, 2017). This could be because they may find it more difficult to identify and process positive infant signals and non-verbal cues such as smiling (Arteche et al., 2011). Notably, in the Arteche study, there was no difference in interpreting sad infant cues between anxious or depressed mothers and the control group.

Therefore, if clinical interventions such as acceleration disrupt these natural processes, this could affect the mother and infant's hormonal systems and subsequent mode of birth. Thus, childbirth could potentially influence maternal mood, both directly through her perceived experience and indirectly through her hormonal systems. In turn, maternal mood may impact on both the mother's ability to nurture her infant and the synchrony that would normally develop between them (Feldman, 2012). This influence of negative maternal mood on mother-infant synchrony may have adverse consequences for infant stress reactivity and fear regulation, and future mother-infant attachment (Feldman et al., 2009; Feldman, 2017). In contrast, due to high levels of oxytocin, beta-endorphins and prolactin present during and after a normal physiological labour and birth, sensitive parenting behaviours and the development of mother-infant synchrony are encouraged (Feldman, 2017). Normal birth therefore facilitates these natural hormonal and bonding processes (Uvnäs-Moberg et al., 2019).

Further to this idea, attachment security in infancy is known to predict attachment security in later life, influencing the infant's future ability to form secure attachments with others (Waters, Merrick, Treboux, Crowell, & Albersheim, 2000). Attachment security may also act as a buffer against stress and HPA activation (Beatson & Taryan, 2003). Conversely, if the infant's HPA axis is activated by insecure attachments in infancy, or other stressors during this sensitive

period of early development (potentially including the birth itself), this may predispose the infant to anxiety, depression or other mental health problems in response to stressors in later life (Beatson & Taryan, 2003; Bar-Haim, Dan, Eshel, & Sagi-Schwartz, 2007). Thus, originating with Bowlby's Attachment Theory and further developed by Ainsworth (Bretherton, 1992), the neurobiology of attachment may have far reaching consequences for the behaviour, development, and future wellbeing of the infant. One potential mechanism through which this might occur is the influence of the mother's psychological and hormonal response to childbirth on early attachment behaviours.

d) Maternal personality

The mother's personality also appeared to play a significant role in MABS infant behaviour and maternal confidence outcomes and in maternal perceptions of newborn behaviour. The trait of 'Openness to new experiences' was especially significant, predicting more Alert-Content newborn behaviours and perceived Easiness overall, in addition to higher Alert-Responsive scores. Conscientiousness predicted the factor Alert during Feeds, and Emotional Stability predicted Global Confidence, though did not directly contribute to infant behaviour. Extroversion was another predictor of Alert-Content 24 Hour Baby, while Agreeableness and Emotional Stability were also positively associated with initial Alert-Content Baby scores. Although Emotional Stability was not retained as a predictor variable for infant behaviour, it was inversely related to EPDS scores which came through as a strong predictor of Unsettled-Irregular infant behaviours over the first six months. Maternal mood and personality and infant behavioural styles therefore appear to be reciprocally associated with one another.

Hence, multiple heritable maternal character traits were important predictors of perceived infant behaviours. These results reflect the findings of Study One (Chapter Four) where health professionals held the view that a calmer mother is likely to have a calmer infant. The mother's personality might influence both the way she initially responds to her newborn and the postnatal environment she creates (Carey & Devitt, 2016). Its impact on infant behaviour could therefore occur through a combination of genetic and environmental influences. Furthermore, some aspects of the original Infant Behaviour Questionnaire (Rothbart, 1981) are considered to map onto four of the Big 5 personality traits (Ahadi & Rothbart, 1994; Rothbart, Ahadi & Evans, 2000), infant temperament therefore relating to subsequent personality development.

More specifically, infant positive and negative affectivity, particularly in relation to self-regulation and reactivity, help to predict later childhood character, which is considered dually influenced by hereditability and life experiences (Slobodskaya & Kozlova, 2016). This idea is furthered by Bergman (2016) who outlines how, while the original DNA template governs brain development until 10-14 weeks gestation, by 20 weeks the brain is 'anatomically' constructed and open to experience-induced epigenetic changes, both in utero and post birth. Thus, potentially the birth may affect the infant's behaviour and developing personality. This could also be indirectly connected to maternal personality through the type of birth a mother is more likely to have depending on her character (Johnston & Brown, 2013).

e) Doulas and other female birth companions

A less anticipated finding was that the presence of a birth partner together with a 'birth companion' positively predicted maternal perceptions of overall infant Easiness. Therefore, perceived infant Easiness was not predicted by the mother having only her birth partner but by the presence of both a partner *and* a companion (such as a doula, relative, friend, or other birth attendant – normally female). It could simply be that two supportive figures in the birthing room contributes more effectively to a positive birth experience with positive outcomes, including maternal perceptions of easier infant behaviours. However, another possibility is that continuous emotional support from a female companion, such as a doula, may lessen maternal stress levels and encourage a shorter labour and normal birth with lower use of analgesia and higher infant Apgar scores post birth (Bohren et al., 2017).

Consistent with this, research literature over several decades has illustrated the positive psychological impacts of doula support in the birth room (e.g. Sosa et al., 1980; Kennell et al., 1991; Bohren et al., 2017), alongside the physiological stress-reducing benefits of doula support to mother-infant oxytocin systems (Buckley, 2015). This may contribute to an explanation for the enhanced maternal perceptions of her infant's behaviour shown here. The Bohren et al. Cochrane review (2017) also speculated that postpartum depression rates might be lower after a doula accompanied birth. This could also benefit maternal perceptions of infant behaviour (McGrath et al., 2008; Britton, 2011; Murray et al., 2014). Moreover, mothers accompanied in labour by a doula are known to have increased confidence in caretaking, lower levels of depression, and to think more positively of their infants (Klaus & Kenell, 1997).

However, there might be differences between mothers who are more or less informed about emotional support offered by doulas and also between those who can or cannot afford a doula. These factors could reflect socio-economic and racial differences. Horsley (2018) highlights these racial differences in relation to women's knowledge about and the affordability of doulas. The author argues that such discriminatory factors could play a role in the higher mortality rates for US black infants caused by several factors of inequality, including poorer quality of maternity care (David & Collins, 2007). Similarly, the infant mortality rate is higher in socially deprived areas of the UK, and also highest here for black and Pakistani mothers (ONS, 2018). Alongside common factors of social and economic disadvantage such as diet and lifestyle, research has found that unconscious racial discrimination by health professionals contributes to this disparity between mortality rates (e.g. Smedley, Stith, & Nelson, 2003).

Educated mothers who can afford doulas are also more likely to be involved in a private antenatal preparation group, and therefore may be generally more prepared and feel more confident about their ability to birth, all of which could contribute to more positive physical and psychological outcomes for mother and infant. Consequently, they may be more likely to have a positive birth experience and to feel more supported and confident as mothers. This relates back to Experience Supported predicting perceptions of Alert-Responsive infant behaviours.

Another potential issue concerning the added benefit of doula or female companion support in the birth room is the anecdotal knowledge that fathers can sometimes feel 'in the way' of midwives and other health professionals. Indeed, evidence shows that fathers in the birth room may feel excluded, anxious, frustrated or fearful at times and in need of support themselves (Steen et al., 2012). Notably, infant Easiness was not predicted by the mother having *only* a 'birth companion' such as a doula or friend. It was predicted by the presence of *both* a partner and a companion. Therefore, it may have been this combination that enabled the mother to have more positive perceptions of her infant. Hence, a less well recognised position of the doula or other female birth companion could be to facilitate the father to support his partner by providing an extra reassuring presence. This idea may offer a possible explanation for the significance of two birth attendants rather than one for perceived infant Easiness. Consequently, a further potential negative outcome of the recent COVID-19 pandemic might be that many mothers were told they could only have one birth partner or companion during childbirth. However, as this is still a new topic, it would require future investigation.

f) Sociodemographic status and maternal expectations of motherhood

Finally, sociodemographic variables were associated with certain infant behaviours. Household income equal to or less than £27,000 a year was associated with maternal perceptions of more Alert-Content newborn infants. Likewise, mothers who did not attend higher education were more likely to perceive their infant as Alert-Responsive, and Easier overall.

These findings might be explained through research showing that higher income mothers with higher education in established careers can find the transition to motherhood more challenging, with lower life satisfaction after having a baby (Harwood, McLean, & Durkin, 2007). This could be exacerbated by the trend for educated women to start their family later (ONS, 2018).

Unrealistic expectations can result in disappointment, potentially contributing to depressive symptoms (Martin, Bulmer & Pettker, 2013) which could negatively impact on maternal confidence and ability to bond with her infant – a finding that was echoed in Study One. Consistent with this idea is evidence showing that parents of higher social class, and therefore in higher income brackets, may have higher expectations of their children's future (Lareau, 2011; Irwin & Elley, 2013). Indeed, as mentioned above, mothers with a higher education level are more likely to attend private antenatal classes, perhaps with a greater expectation that childbirth and infants can be predicted, planned for and controlled (Zadoroznyj, 1999). In line with this, prior research has suggested that maternal expectations of motherhood may affect the mother's perceptions of her infant's temperament (e.g. Eastwood et al., 2012).

In addition, maternal age was positively associated with more Alert-Content behaviours, making the above findings less clear as older mothers might be expected to have a higher income as a population group. In a systematic review on maternal satisfaction with childbirth expectations, Hodnett (2002) found that, although sociodemographic factors remained in the predictive models, control and perceived support from caregivers overrode the factors of maternal class and socioeconomic status. Thus, when the reality of childbirth does not match the mother's expectations, even in a medically 'normal' childbirth model and whatever her social class, she may feel traumatised (Hodnett, 2002). However, sociodemographic factors may also affect mothers' social support, with those experiencing less support or under financial strain more prone to postnatal depression (Eastwood et al., 2012). Further research could explore how maternal background interacts with perceptions of infant behaviour.

6.6 Limitations

This study provided an in-depth exploration of a concept previously only alluded to in the research literature on childbirth and infant behaviour (Taylor et al., 2000). Namely, that potentially long-term physiological impacts of childbirth on the infant's behaviour and stress response system (Douglas & Hill, 2013) might be mediated by the mother's response to the birth. Prior research has provided explorations of birth mode and medication in relation to early infant temperament, and separately examined both the effects of childbirth experience on maternal mood and the adverse impacts of maternal perinatal mood disorders on the offspring. There appears to be a distinct lack of literature, however, that amalgamates these physiological and psychological perinatal factors in relation to determining infant behavioural outcomes. The present study therefore aimed to conduct a detailed examination of the potential significance of subjective maternal aspects of childbirth and the perinatal period, in combination with physiological and psychological factors, and relate them all to infant behavioural patterns during the first 30 weeks.

The online nature of the study allowed for a reasonably large, nationwide data collection strategy from the sample population, enabling further examination of ideas generated by Studies One and Two. This therefore enabled patterns that had arisen in the analyses of qualitative data in the previous two studies to be further explored and highlighted in relation to the UK as a whole, rather than with a focus on specific regions. However, this research method has its drawbacks. As ethnic minority use of the internet is slightly below average (GOV.UK, 2019), this may have contributed to the sample population consisting mostly of white Caucasian mothers with a regular online presence on sites such as netmums.com. The sample was also skewed towards breastfeeding, older mothers who had a live-in partner, which may relate to their wider use of the types of internet site who took interest in the study and agreed to hold it on their platforms. However, this is a common factor in all self-selection methods of recruitment. Therefore, in a future survey of this kind, more active recruitment of ethnic minorities would be needed. Nevertheless, although mothers with a higher education and higher household income were more likely to participate than less educated lower income mothers, there was still a wide variation in socio-economic status within the sample population.

Another limitation was the length of the questionnaire. Based on a wish to reduce the possibility of outside factors confounding the results – and including the detailed Mother and Baby Scales

in its entirety for the most accurate picture of recent infant behaviours – the survey consisted of over a hundred questions. The scale and detail of the survey could have therefore been a possible deterrent to non-English speakers or mothers with a lower level of education. While a substantial number of mothers completed the survey (1152), some may have begun and found it too extensive and time-consuming, while just 999 met all the study inclusion criteria. However, to counterbalance this possibility, the questions were structured briefly and simply. With few exceptions (e.g. for infant age or first weight), they were presented in an easy to comprehend and respond to multiple choice format. Despite this necessity of making the questionnaire relatively brief and accessible, the in-depth quality of the data collected meant that detailed quantitative comparisons could be made between factors while attempting to disentangle the complex interwoven network of variables relating to the subject matter.

A major drawback to employing a self-report retrospective survey is the issue of subsequent validity of findings in regard to accurate recall of autobiographical memories, which has led to some researchers adapting these methods (e.g. Belli, 1998). However, having had a period of reflection since the potentially emotive and anxious birth situation could feasibly aid more accurate recall. As well, retrospective questionnaires have become a cost-effective and acceptable method of collecting pregnancy and childbirth data (e.g. Intong et al., 2017). Questionnaires about childbirth have been found to have excellent validity during the first few months post birth (e.g. Bat-Erdene, Metcalfe, McDonald, & Tough, 2013). Arguably therefore, the results concerning the birth experience are fairly accurate.

Retrospective reports of infant behaviour could be affected by biased memories of events and current behaviours during periods involving growth spurts, teething or weaning, all of which may alter the infant's normal behavioural patterns. They could also be influenced by maternal mood (McGrath et al., 2008). However, as outlined in the literature review, while there are significant differences between reported and observed infant behaviour scores from depressed mothers (Pauli-Pott et al., 2000), these are considered small (McGrath et al., 2008). In general, ratings of infant behaviour scores are significantly associated with observer ratings (Rothbart, Chew & Garstein, 2001; Henderson & Wachs, 2007; Zenter & Bates, 2008). Furthermore, an infant behaviour questionnaire was chosen that would ask mostly about specific everyday behaviours and maternal feelings in relation to recent events (MABS) – concerning only the past seven days – and the survey was completed within six months of the birth.

A final limitation was the self-selecting nature of the sample population. This affected the type of participant who completed the online questionnaire, making the recruitment strategy less inclusive. Participants encountered the advertisement for the study through their online social networking, via internet sites such as bounty.com or netmums.com, or came across it through common social media channels, including online breastfeeding support groups. This may have contributed to the large influx of breastfeeding mothers for the survey. However, this also meant a more homogeneous sample, which could help to clarify the findings in terms of the specific impacts of a mother's physical and psychological birth experience on infant behaviour. Another potentially negative element of self-selection methods can be that only individuals with an interest in the subject matter ask to participate. However, based on the positive response rate to the interviewer approaching mother and baby groups in Study Two (approximately 95%), most new mothers were interested in participating in research about childbirth and infant behaviour, regardless of their own unique birth experience.

6.7 Conclusions

These findings add to the previous two studies in this thesis, in addition to the large body of research illustrating the sheer complexity of childbirth and its potential outcomes for the mother-infant dyad. In the present study, the detailed examination focused on infant behavioural outcomes. However, maternal feelings of confidence and self-efficacy were also acknowledged due to their potential influences on both maternal and infant behaviour and wellbeing (James Roberts & Wolke, 1987, 1988). This study aimed to combine the previously separate research topics of physical impacts of childbirth on the infant and psychological impacts of childbirth on the mother, together with the compound effects of postpartum maternal mood on mother-infant bonding and attachment and on infant behaviour and development. In doing so, the findings highlighted how infant and maternal outcomes of childbirth may be jointly influenced by physiological and psychological variables.

The findings could provide further support for the current UK maternity and midwifery services' objective to develop a model of continuous, emotionally supportive care for all expectant mothers (NHS England National Maternity Review, 2016). As recommended by the WHO (2018), supporting the mother's emotional as well as physical wellbeing would potentially benefit her postnatal psychological state, and therefore her perceptions and experiences of her infant's behaviour.

Chapter Seven

General Discussion

The aim of this thesis was to investigate whether childbirth was associated with early infant behavioural style. Three interconnected studies examined this central research problem. In Part One of the thesis, this question was investigated qualitatively by exploring the perceptions and beliefs of maternity care providers and mothers in relation to maternal birth experience and early infant behaviour. Novel concepts arising in the data and the literature were then examined through quantitative analysis, with Part Two highlighting multiple physical and psychological birth factors associated with neonatal and older infant (0-6 months) behaviours. Notably however, it was mostly subjective experiences of childbirth and the immediate postnatal period that predicted maternal perceptions and interpretations of her infant's behaviour during the first thirty weeks. Other significant factors included infant age, maternal personality and postnatal depression. These findings connected previously separate fields of research.

The thesis was inspired by studies examining the physiological impacts of birth on neonatal behaviours (e.g. Taylor, Fisk & glover, 2000; Gitau et al., 2001; Douglas & Hill, 2013); and further informed by psychological research exploring maternal psychological response to a challenging or traumatic birth experience (e.g. Murray & Cartwright, 1993; Ayers et al., 2006, 2008, 2016). Bringing these two elements together was a body of research highlighting the adverse effects of negative prenatal and postnatal maternal mood on early brain development and future behaviour (Field et al., 2004) via neurotransmitter imbalances including higher cortisol and lower dopamine and serotonin levels (Diego et al., 2004). Negative effects of maternal mood can be reinforced by the depressed mother's inability to communicate effectively with her infant, disrupting early mother-infant interactions (Lundy, Field & Pickens, 1996; Murray et al., 1996b) with adverse impacts on their relationship (Ayers et al., 2006). Subsequently, such negative patterns may impact on infant, child and adolescent behaviour and development (Murray, 1992; Halligan et al., 2007; Murray et al., 2011, 2018).

Obstetric complications and interventions, in particular unpredicted birth and postnatal events and experiences, may adversely influence maternal and infant behavioural style. For example, augmentation of labour, epidural, assisted birth or emergency CS, possibly leading to separation of mother and infant post birth, can have a negative impact on the dyad's reciprocal

behaviour and wellbeing. Early infant behavioural patterns may set a precedent for future mother-infant interactions, mutual 'biobehavioural synchrony' and the longer-term relationship, which could have a lasting impact on the infant's future socio-emotional, behavioural and cognitive development (Murray et al., 2014; Feldman, 2017).

Multiple factors were therefore considered and integrated within this thesis. While prior research had explored the neonatal stress response to birth (e.g. Dahlen et al., 2013; Douglas & Hill, 2013), and examined obstetric medication effects on the foetus (Lester et al., 1982; Brazelton & Nugent, 1995), none had yet fully explored potential connections between physical and psychological perinatal factors and early infant behavioural style. Most evidence has focused solely on the first days and weeks post birth (e.g. Taylor et al., 2000). Although research has separately explored impacts of birth on maternal mood (e.g. Ayers et al., 2006) and the influence of negative maternal mood on infant behaviour (Murray, 1992) and development (Murray et al., 2018), there is limited direct evidence around continuing impacts of childbirth on infant wellbeing, or around the central concept to this thesis – that the mother's subjective experience of childbirth may be associated with early infant behavioural patterns.

Hence, this exploratory mixed methods research, using a convergent parallel design (Creswell, 2013; Creswell & Hirose, 2019) set out to investigate maternal experiences of childbirth and infant behavioural style by incorporating a diverse set of factors over a longer time-period. Within the overarching question, '*Does childbirth experience influence maternal perceptions of infant behaviour?'* the thesis aimed to answer three sub-questions:

1. Can differences in early infant behaviour be identified depending on birth experience?
2. If so, may such behavioural differences be explained solely by the physical birth experience or do maternal perceptions of the birth matter too?
3. Which are the most significant perinatal factors in early infant behavioural patterns?

7.1 The three studies

The thesis sought to unite the distinct though related research fields described above through three inter-connected studies. These were designed to conduct an in-depth exploration of the

subject and to triangulate qualitative and quantitative findings. This chapter will summarise and integrate the studies in relation to the research questions before discussing their limitations and implications for practice and potential future research in the field.

7.1.1 *Study One (Chapter Four)*

The first study was conducted as an initial exploration of the subject and involved interviews with eighteen maternity care providers including midwives, health visitors and doulas. Broad, open questions were used to draw out their genuine perceptions and beliefs rather than guiding them in the direction of the research questions. Maternity care providers were asked whether they believed that birth might affect infant behaviour, and also whether maternal feelings and behaviour towards her baby could be affected by the birth experience. Responses were rich and diverse and by no means unanimous, although overall they highlighted some of the potential pathways for birth impacts on neonatal behaviours. Their responses often reflected previous research on specific topics such as unsettled infant behaviour after assisted birth (Gitau et al., 2001; Miller et al., 2005; Berqvist et al., 2009), or the effects of pain relief on early breastfeeding behaviours (Ransjo-Arvidson et al., 2001; Brown and Jordan, 2013).

Most participants believed that newborn infants could be affected by their physical experience of birth. Birth mode, foetal positioning, complications, interventions and pain relief medications were mentioned as possible factors that might interfere with normal labour and birth. This corresponds with research emphasising the physiological impacts on the neonate of such factors (e.g. pethidine, assisted birth or Caesarean section); and it has previously been speculated that births involving interventions may cause long-term epigenetic changes to the infant's stress response system and microbiota (Dahlen et al., 2013; Douglas & Hill, 2013).

However, with their recurrent theme 'Baby Mirrors Mother', these interviews highlighted the possibility of a mother's individual response to the birth affecting her baby's behaviour more than the physical birth experience. Several participants noted that, while some mothers may experience extensive obstetric complications yet not feel traumatised, others can have a heightened stress response to a seemingly 'normal' birth which they experienced as difficult (Svanberg, 2019). This aligns with a large body of research conducted by Ayers and colleagues (e.g. Ayers et al., 2008; 2016) highlighting the importance of the mother's subjective response to birth to her psychological wellbeing, alongside more objective measures such as birth mode.

Maternity care providers believed that the mediating mechanism between birth and infant behaviour could be maternal mood. Corresponding to the literature (Andersson, 2016; Ayers et al., 2016; Yildiz, Ayers, & Phillips, 2017), many health professionals felt that a difficult birth could encourage the development of depression or PTSD, and in turn, postnatal mood affected the baby (Murray, 1993; Murray & Cartwright, 1993; Murray et al., 2014; Feldman, 2017). However, although maternal postnatal depression is associated with more withdrawn infant behaviours and negative impacts on development (Feldman, 2017), the relevance of the mother's subjective response to childbirth for infant behavioural outcomes has previously only been suggested (Taylor et al., 2000).

Therefore, while infants may be physiologically affected by their birth during the first few days – especially if the birth involved complications, interventions or medication – in the longer term, maternity care providers felt that infant behaviour reflected postpartum maternal mood, regardless of their physical birth experience. This corresponds with evidence around postnatal depression and infant development (e.g. Murray, 1992; Murray et al., 2014). Consequently, maternity care providers felt that all mothers require the appropriate support during childbirth (Horsch & Garthus-Niegel, 2019; Patterson, Hollins Martin, & Karatzias, 2019). They also believed that postnatal support was equally important to the new mother, particularly for more vulnerable mothers, e.g. young mothers (Love et al., 2005; Iliadou, 2012; Bohren et al., 2017).

7.1.2 *Study Two (Chapter Five)*

Running in parallel to Study One, though analysed and interpreted separately, the second study explored maternal perceptions of childbirth and infant behaviour via semi-structured interviews of 22 mothers with a singleton healthy infant in its first year. Again, the questions were designed in an open-ended format, allowing mothers to speak uninterrupted for extended periods about their experiences, without leading or guiding them in any way that could create research bias. Mothers were asked to describe their birth experience and their baby's behaviour post birth, and to say whether they felt the two were in any way connected. In contrast to health professionals in the first study, most mothers believed there was no link between their birth and their baby's behaviour. However, a simple content analysis indicated strong patterns in the data, highlighting a potential association between maternal birth stories and perceptions of their infants' early behavioural style. Mothers who experienced normal birth or planned interventions and who felt 'in control' and 'empowered' by their birth experience were more likely to report alert, content, responsive and settled infant behaviours during the early

postnatal period. Conversely, mothers who found their birth physically or emotionally difficult were more likely to report their infant as excessively sleepy, unsettled or irritable.

As with Study One, these findings were consistent with literature concerning the impacts of specific birth interventions (e.g. Douglas & Hill, 2013) and pain relief medications (e.g. Brown & Jordan, 2013) on neonatal behaviours. However, the apparent association arising between the subjective maternal birth experience and perceptions of infant behaviour was a new finding, which supported the health professional theme of 'Baby Mirrors Mother'. As outlined above, it is connected to research in an adjacent field (e.g. Ayers et al., 2008, 2016) demonstrating that subjective maternal perceptions of birth can influence post-traumatic stress symptoms more than objective measures. Consequently, Study Two highlighted the need to further explore potential pathways between subjective maternal birth experiences and infant behavioural style.

7.1.3 *Study Three (Chapter Six)*

The two first exploratory qualitative studies provided a strong basis for analysis of Study Three: an online survey designed to examine the multiple physiological and psychological perinatal variables that might affect infant behaviour, with a particular focus on the birth itself. Study Three utilised a detailed questionnaire and quantitative methods of analysis to explore potential pathways between the physical and psychological birth experience and early infant behavioural patterns in approximately a thousand mother-infant dyads. It investigated which perinatal factors were most associated with specified infant behavioural outcomes, and which predicted early infant behavioural style when all other significant factors were held constant.

The results of Study Three illustrated how a diverse range of factors contributed to early infant behaviour patterns, including birth mode, subjective maternal perceptions of her birth experience, postpartum mood and personality. Several notable findings emerged from the survey data to support and extend the findings of the qualitative studies, while also reflecting prior research in related fields of study. These highlighted potential associations between negative birth experiences and postnatal distress, especially in more vulnerable women (Ayers et al., 2016; Blom et al., 2010; Field, 2017). The findings also showed that Postnatal Distress predicted more Cry-Fuss newborn behaviours, and this was bi-directional, while higher depression scores contributed to ongoing Unsettled-Irregular and irritable infant behaviours.

In addition, 24 Hour Baby behaviours were associated with the Mother and Baby Scales (MABS: 0-6 months), a finding reflected by previous indications that early infant behaviours relate to later personality development (Ahadi & Rothbart, 1994; Rothbart et al., 2000). The potential ongoing effects of early stressors such as the impacts of birth or maternal depression on the infant's HPA axis and their regulatory emotional and stress response systems (Dahlen et al., 2013; Douglas & Hill, 2013) may present further problems for the psychological wellbeing of parents struggling to care for an unsettled infant or difficult child (Britton, 2011).

Although based on maternal reports of childbirth and infant behaviour, the data appeared to support previous findings that the physical birth experience may directly impact neonatal behaviour (Taylor et al., 2000; Gitau et al., 2001; Douglas & Hill, 2013). This could occur via stress hormones such as cortisol, or alternatively via the combination of positive hormones (e.g. oxytocin and beta-endorphins) present during physiological birth (Buckley, 2015; Uvnäs-Moberg et al., 2019; Widström et al., 2019). However, while physical factors (e.g. induction, pain relief or birth mode) continued to be associated with unsettled infant scores over the first thirty weeks, confirming patterns shown in maternal interview data, only assisted birth was retained as a predictor for perceived Cry-Fuss newborn infant behaviours. Notably, it was psychological factors – postnatal depression scores and subjective maternal emotional states (feeling anxious, afraid, ignored or abandoned during birth, or distressed postnatally) – that predicted ongoing unsettled infant behaviours from 0-6 months.

Similarly, positive maternal experiences of childbirth and feeling physically and mentally fit post birth, together with the positive personality traits of Emotional Stability and Openness, predicted maternal perceptions of overall infant Easiness. These results highlighted that maternal interpretations of the birth may be equally important to more objective measures such as birth mode, complications and interventions.

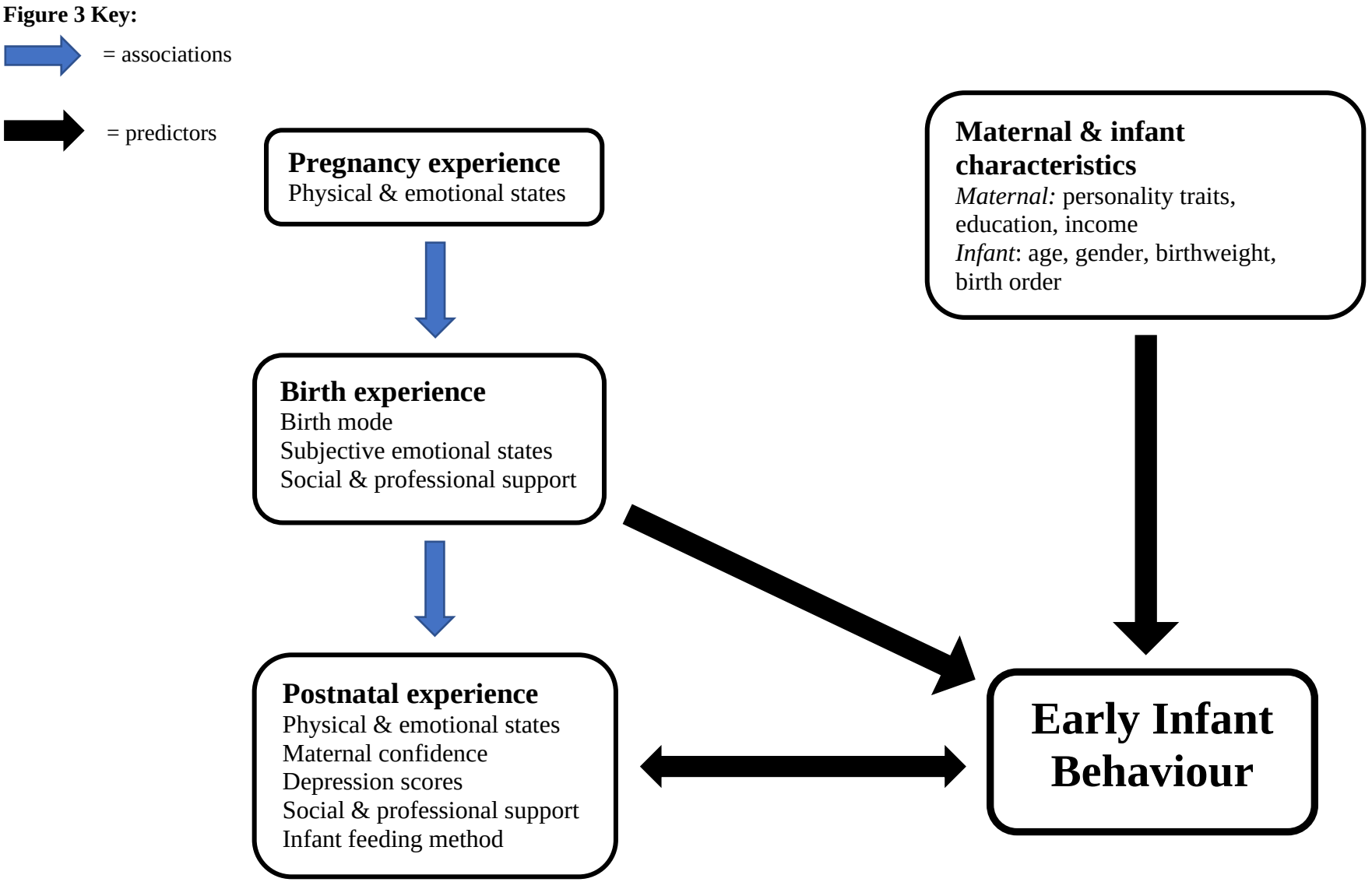
Thus, the quantitative data gave further support to the qualitative results, extending their findings by establishing several discrete factors that were associated with or predicted infant behaviours, while controlling for confounders established in preliminary data analysis (including birth weight, gender, infant and maternal age, parity, education and income). Figure 3 below highlights the main factors identified as having the strongest associations and predictive value for infant behavioural outcomes. It shows the importance of both physical and psychological factors at all stages of the perinatal journey, and the ability of the appropriate

social and professional support to shield and protect mother and baby from the impacts of a negative birth experience. The figure is separated into three main sections, each covering a stage of the perinatal journey. The first section (pregnancy experience) highlights how maternal experiences during pregnancy may influence the birth experience. The second section (birth experience) highlights the impacts of physical and emotional states during childbirth – both directly upon infant behaviour, and indirectly via its effect on postnatal mood and wellbeing. The third section (postnatal wellbeing) shows how this also contributes to infant behaviour. In addition, certain maternal and infant factors were significant predictors of infant behavioural outcomes, as shown in the 'additional factors' section. For example, maternal personality characteristics played a key role, probably for both hereditary and environmental reasons.

Whilst highlighting potential adversities such as assisted birth, postnatal maternal distress and depression scores, Figure 3 also indicates factors that benefitted infant behaviour. Social and professional support, especially during birth and postnatally, predicted easier, more positive infant behaviours, potentially preventing or helping to combat the impacts of a negative birth and postnatal experience. While consistent with literature on increased support and maternal-infant outcomes (Horsch & Garthus-Niegel, 2019; Delicate, Ayers, & McMullen, 2020), these findings showed that support is crucial to positive maternal perceptions of her baby's behavioural style. In turn, this could influence the development of a secure mother-infant relationship. Other factors may have indirectly influenced outcomes via their associations with maternal wellbeing and confidence and infant behavioural style. These include: birth interventions, pain and pain relief, how gently the head was born, and skin to skin contact. However, as these factors did not remain as final predictors, they are not included in Figure 3.

The need for increased support of the mother-infant dyad during and after the birth could be particularly important given the findings here around maternal confidence. As suggested in Figure 3, some results were bi-directional and progressive. For example, if a mother had a crying fussing newborn – which was more likely after birth interventions and an unpredicted operative birth (assisted delivery or emergency Caesarean section) – she reported higher Postnatal Distress, and could at an increased risk of developing postpartum depression with its associated Lack of Confidence in Caretaking and Breastfeeding.

Figure 3 Representation of findings – perinatal factors contributing to early infant behavioural style



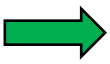
Lack of appropriate support may feasibly contribute to longer term negative impacts on mother-infant bonding and consequently on infant development (Murray et al., 2014). Although bonding and attachment were not specifically measured in Study Three, they were discussed in detail by health professionals in Study One. Therefore, difficulties in bonding and attachment processes could be a key point in this connection between maternal response to childbirth (such as Postnatal Distress) and interpretations of her baby's behaviour. Indeed, a recent study by Stuijfzand, Garthus-Niegel and Horsch (2020) showed that maternal distress at one month postpartum – in turn associated with a traumatic birth experience – adversely impacts mother-infant bonding at three months postpartum. Their findings also highlighted antenatal support in the pathway to a positive or negative birth experience and postpartum PTSD. Furthermore, Davis et al. (2008) found associations between PTSD symptoms post childbirth and more negative maternal perceptions of her infant alongside lower attachment.

Despite their probable contribution to outcomes, as no direct measures were used to assess symptoms of PTSD and bonding-attachment behaviours, they were not included in Figure 3. Nevertheless, the suggested pathway in this thesis between maternal birth experience and perceived infant behavioural style via the influences of postpartum maternal mood on mother-infant bonding and attachment warrants further investigation. To include PTSD symptoms as well as bonding and attachment behaviours between mother and infant post birth would therefore add to a more complete theoretical model for future testing (see Figure 4 below). In line with Stuijfzand et al.'s (2020) findings, professional and social support during pregnancy have also been added to this model. Thus, Figure 4 aims to provide a fuller picture of the possible mechanisms behind the associations found here between maternal childbirth experience and infant behavioural style. The 'Potential pathway' box illustrates how a negative birth experience may begin a pathway of Postnatal Distress, symptoms of PTSD, bonding and attachment issues, and maternal perceptions of more difficult, unsettled infant behaviours.

Figure 4 Key:

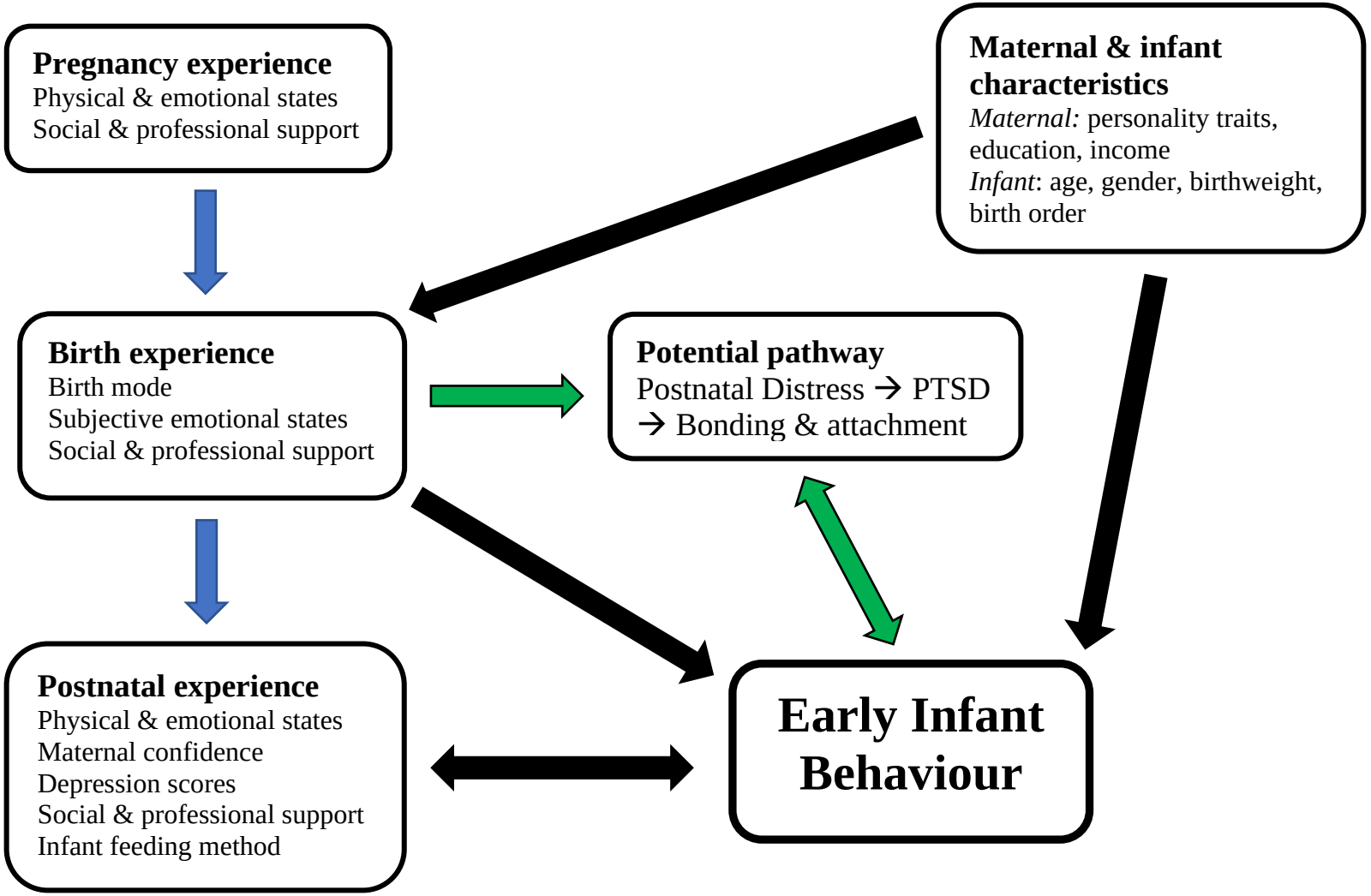
= associations

= predictors



= hypothetical contributors for future testing based on the findings and wider research literature

Figure 4 **A theoretical model of perinatal factors contributing to early infant behavioural style**



7.2 Consolidating the findings and reflecting on the research questions

This thesis aimed to examine the research problem, *Does childbirth experience influence maternal perceptions of infant behaviour?* from different perspectives (e.g. mother or midwife), using a convergent/concurrent parallel design (Fetters et al., 2013) to explore and triangulate the findings. Triangulation of the data between different participant groups and different research methodologies provided a sense of cohesion between the studies. As they corresponded closely with one another, it added clarity to the research questions whilst increasing the credibility, trustworthiness and validation of the qualitative and quantitative results (Noble & Heale, 2019). In particular, the perceptions and beliefs of maternity support workers in Study One (Chapter Four) – who conceivably view childbirth and maternal-infant behaviours more objectively than mothers – enhanced the credibility of the mother-report methods used in Studies Two and Three (Chapters Five – Six).

Taken as a whole, several key findings emerged consistently across the qualitative studies that were strengthened by the quantitative findings of Study Three:

1. The physical experience of childbirth, in particular obstetric complications, may have a direct impact on perceived neonatal behaviours during the initial postnatal period.
2. Reported Cry-Fuss behaviours during the first 24 hours were associated with continuing Unsettled-Irregular infant behaviours (0-6 months).
3. Subjective maternal birth experience (involving labour, birth and post birth states), personality and postnatal mood predict early infant behavioural patterns (0-6 months).
4. Physical birth factors (e.g. Birth Mode) were associated with subjective birth states (e.g. Birth Emotions Positive or Anxious-Afraid).
5. Subjective birth states (e.g. Positive, Anxious-Afraid or Neglected) were associated with subjective postnatal states (Postnatal Positive/ Physical Wellbeing/ Distressed), which in turn were related to Edinburgh Postnatal Depression Scale (EPDS) scores.
6. Postnatal distress and depression were major factors in ongoing Unsettled-Irregular infant behaviours and in maternal Lack of Confidence in Caretaking and Breastfeeding.

The most significant new finding was that, although the objective birth experience (birth mode) predicted newborn infant behaviour during the first 24 hours, subjective birth experience and psychological factors (e.g. EPDS) predicted infant behavioural style during the first six months.

7.2.1 *How might these findings be explained?*

Maternity care providers mentioned how, if a mother felt exhausted, in pain or overwhelmed post birth, she may initially appear more emotionally detached from her infant and find it harder to bond as a result. They outlined the ways in which the subjective birth experience – whether 'empowering' or 'traumatic' – may then affect a mother's mood and her perceptions of and interactions with her newborn infant. Differences in infant behaviour may also occur directly through infant pain experienced during and after a difficult birth, and indirectly via active hormonal channels between mother and baby (Buckley, 2015), and equally, via maternal behaviour influenced by postnatal mood. Those involved in postnatal care observed that the newborn appeared to 'sense' their mother's mood and wellbeing, which they mirrored in their general behaviour and how settled they were. Health visitors believed that negative maternal mood could adversely affect the mother-infant relationship and the future development and wellbeing of the infant, depriving them of the essential social communication required for healthy physical, brain and behavioural development (Murray & Andrews, 2005).

Study Two highlighted that mothers who had experienced unplanned obstetric interventions were more likely to have negative emotions attached to the memory of their birth, experiencing more difficult, unsettled neonatal behaviours, and sometimes delays in bonding. In contrast, those who had experienced a planned induction or planned CS reported a more positive experience and easier early infant behaviours. Mothers who had a planned intervention for medical reasons (such as diabetes) felt they had made an informed choice and were subsequently more likely to view their birth as positive and their baby's behaviour as easy. Informed choice and feeling in control of birth events were therefore important issues (De Schepper et al., 2015). Notably, while having the opportunity to make informed decisions before and during childbirth is known to significantly enhance maternal experience – and is now enshrined in law (Chan et al., 2017) – not every mother feels empowered to fully participate in decision making processes around her birth (Patterson et al., 2019).

These findings were extended by Study Three (Chapter Six) data which indicated that maternal perceptions of the birth were related to her postnatal emotional state (Postnatal Positive or Distress), which in turn was associated with her depression (EPDS) scores. Notably, it also highlighted that mothers with higher EPDS ratings reported their infants as more Irritable during Feeds and more Unsettled-Irregular in their sleeping, feeding and elimination routines.

Overall, postnatal maternal mood and infant age appeared the most significant determinants of infant behaviour scores. In general, older infants were reported as more Alert-Responsive, settled and regular in their routines than younger infants. However, depressed mothers reported infants who were more Unsettled-Irregular and Irritable during Feeds throughout the first thirty weeks, supporting prior evidence that depressed mothers may perceive their infants as less settled (McGrath et al., 2008).

Britton (2011) suggested that unsettled infant behaviours might also influence the mother's response to her baby, a new mother potentially feeling overwhelmed by the prospect of caring for a crying or irritable newborn. This was supported by Study Three's findings that Cry-Fuss 24 Hour Baby behaviours predicted Postnatal Maternal Distress (Chapter Six). Moreover, this bi-directional component of maternal distress and infant behavioural style was discussed by several health professionals in Study One (Chapter Four). Notably however, although midwives and health visitors are trained to objectively observe maternal-infant wellbeing and behaviour, health visitors often see more vulnerable women, which could colour their view.

To summarise, the findings confirmed that the mother's subjective birth experience may affect her perceptions and interpretations of her baby's behaviour more than the physical experience, particularly if the birth affected her mood. Consequently, a mother's subjective response to birth may mediate the impact of the physical birth experience on the neonate. Indeed, infants in Study Three appeared to reflect their mother's mood: whether she continued to feel positive or distressed post birth together with her sense of physical wellbeing affected mother-reports of infant behaviour alongside maternal confidence ratings.

7.2.2 *What do these findings mean for mother-infant wellbeing?*

How a mother perceives her birth experience, and well she recovers physically and emotionally, may affect her baby's wellbeing and behaviour as well as her own confidence and self-efficacy, with important implications for the future wellbeing of them both. Unnecessary interventions may activate maternal stress and epigenetic neonatal adaptations, instigating negative changes in the infant's future stress reactivity, emotional regulation and behaviour (Fuemmeler et al., 2016; Downe, Powell Kennedy, Dahlen, & Craig, 2019). Once maternal post-traumatic stress or depression sets in it may be difficult to cure; and one Cochrane review showed that only very intensive professional support measures in the early postnatal period can help prevent the onset of such postpartum mood disorders (Dennis & Dowswell, 2013).

Furthermore, although postpartum depression (PPD) interventions that occur after depression has become established may still help the mother, they have not been found to immediately improve mother-infant interactions, maternal sensitivity, or subsequent infant attachment security and infant behavioural outcomes related to sensitive parenting (Murray et al., 2014). Negative maternal mood after a difficult birth may therefore lead to more insecure attachment for the infant as the mother becomes depressed, withdrawn and detached, finding it difficult to be emotionally available or respond sensitively to her baby's needs, in particular to the infant's vulnerability or distress cries (Bernard, Meade & Dozier, 2013). Bernard et al.'s research (2013) shows that infants of depressed mothers may remain more insecurely attached, with negative implications for their future social and emotional development. Furthermore, insecure attachment during infancy may predispose the future child and adolescent to constantly raised cortisol levels and affective disorders such as anxiety and depression (Murray et al., 2014).

7.2.3 *Birth trauma*

Linked to Study Three's findings on impacts of Postnatal Distress on mother-infant wellbeing, birth trauma was an often-raised issue in the qualitative studies: Subjective experiences of trauma and subsequent feelings of sadness and regret were narratives arising frequently in the maternity care provider and mother interview data. While maternity care providers in Study One emphasised that even a 'normal' birth may be perceived as 'traumatic' by the mother, Study Two highlighted specific maternal reasons for perceiving their birth in this way. As discussed, these were often linked to unexpected birth interventions, or a perceived threat, losing control, lack of choice, receiving inadequate support from partner or midwife, and at times a large disparity between prior expectations and the reality of giving birth (Ford & Ayers, 2011; Lliadou, 2012; De Schepper et al., 2015). The findings are consistent with existing research on the subjective nature of birth trauma and consequently the importance of providing appropriate support for mothers during and after childbirth (Slade, 2006; Andersen et al., 2012; Horsch & Garthus-Niegel, 2019; Delicate, Ayers, & McMullen, 2020).

Studies Two and Three (Chapters Five – Six) also highlighted that the psychological experience of birth and how they felt afterwards were related to the physical experience (in terms of birth mode, complications and interventions). In addition, mothers who felt anxious, afraid or neglected during the birth, and disappointed, angry, guilty or distressed after a birth that did not go as they had wished or expected, were more likely to report symptoms of

postnatal distress and depression, possibly signifying a traumatic response (Stuijfzand et al., 2020) although this was not measured specifically. Mothers in Study Two especially reported experiencing postnatal distress if separated from their baby post birth – whether for paediatric checks or to go to NICU. These findings correspond with a systematic review by Bell and Andersson (2016) investigating women's experiences of childbirth and development of PPD. They also echo prior evidence that acute postpartum distress in parents with an infant in NICU is associated with the development of clinical depression or PTSD (Shaw et al., 2009).

7.2.4 *Possible long-term impacts of a negative birth experience on mother and infant*

These results concerning postnatal distress and depression were consistent with a substantial body of evidence highlighting the impacts of postnatal mood on mother-infant bonding and infant behaviour (e.g. Ayers et al., 2006; Murray et al., 2014). Adverse influences of negative maternal mood on the early mother-infant relationship and infant behaviour may have a continuing effect on the infant's future temperament and development (Feldman, 2017). One large birth cohort study found that symptoms of depression and anxiety were associated with a more difficult infant temperament at 8 weeks, while postpartum PTSD contributed to socio-emotional problems at 2 years, particularly in boys and for those who had been rated by their mothers as difficult at the 8 week point (Garthus-Niegel et al., 2017).

Longitudinal studies show that behaviourally difficult infants may become more difficult children, with an increased likelihood of developing behavioural and developmental disorders (e.g. Thomas & Chess, 1977). Consistently unsettled infant behaviours predict future behavioural problems in the child (Wolke, 2002; Schmid & Wolke, 2014). Moreover, infants with a higher cortisol response to stressors are more likely to become anxious or depressed teenagers (Halligan et al., 2007; Murray et al., 2011). Therefore, if the foetal or newborn stress response system is over-stimulated, by either internal or external factors (such as birth mode, medication or maternal distress), this may create problems stemming from the mother and infant's joint physical and psychological birth experience, with potentially long-term negative consequences at an individual, family and societal level.

Birth and postnatal experiences are therefore important on every level. Postpartum PTSD has also been associated with reduced breastfeeding initiation (Garthus-Niegel et al., 2018), with public health implications and the possibility of further exacerbating maternal feelings of guilt,

grief and regret (Brown, 2018). Consequently, the WHO and UNPF (2008) issued a statement that early treatment of perinatal mood disorders may benefit maternal mental health as well as infant health and growth. It is increasingly recognised that maternal mental wellbeing must be taken seriously during and post childbirth, not least because of its impacts on the infant's emotional, behavioural and cognitive development (Murray et al., 2014; Feldman, 2017).

7.2.5 *Social and professional support*

Adequate social and professional support during and after childbirth was another major issue that arose in all three studies. For instance, Study Three highlighted that mothers who were supported by both a birth partner and birth companion were more likely to rate their infant as easier overall, and those who felt supported during their birth specifically reported more Alert-Responsive infant behaviours. Indeed, it has been known for several decades that higher levels of emotional support given to the birthing mother help reduce birth interventions and maternal stress and trauma while increasing positive interactions and bonding behaviours between mother and infant post birth (Sosa et al., 1980).

Also, due to strong associations between positive psychological and sensory input and a safe effective birth, when labouring women are treated kindly, using only gentle touch, their stress and cortisol levels, heartrate and perceptions of pain decrease (Uvnäs-Moberg, 2015). We know that hormones such as cortisol or oxytocin are transferred directly from mother to foetus (Gitau et al., 1998). How the mother experiences her birth could therefore have a direct impact on the neurohormonal and physiological state of the infant post birth (Gitau et al., 2001), potentially affecting their current and future response to stressors (Douglas & Hill, 2013).

Mothers in Study Two (Chapter Five) who reported a positive birth, regardless of whether they had experienced obstetric interventions, emphasised how beneficial they found the positive relationship with their midwives or other health professionals during the birth and beyond. This was in stark contrast to mothers who had a more negative experience – including those who had a normal physiological birth but felt neglected by busy on-duty staff or by their partner, sometimes due to hospital protocols enforcing separation, for instance during a night induction. Experiencing this type of 'Neglect' affected maternal interpretations of her baby's behaviour, with these mothers reporting more crying and unsettled behaviours during the early post birth period. These findings were confirmed in Study Three (Chapter Six), where Neglected Birth Emotions (feeling abandoned or ignored) were associated with Postnatal Distress and higher

maternal depression and Unsettled-Irregular infant behaviour scores. This highlights a recurrent issue in maternity health care, given that we have known of the multiple physiological and psychological benefits of continuous one-to-one care during labour and birth for a long time (e.g. Scott, Berkowitz, & Klaus, 1999). As Svanberg stated 'Too often, a kind word or a loving touch would have made all the difference' (Svanberg, 2019, p14).

Thus, it is well known that women can be deeply affected by the quality of care they receive during childbirth (Horsch & Garthus-Niegel, 2019; Patterson et al., 2019). Consequently, it has been suggested that health professionals could be educated about the subjective nature of birth experience relating to the development of postpartum mood disorders, enabling maternity care providers to create a feeling of safety in a compassionate and supportive environment so that a woman can birth her baby without the fear or stress that may lead to the development of postpartum depression or PTSD (Bell & Andersen, 2016; Horsch & Garthus-Niegel, 2019).

This idea could be of particular importance given that there is not yet any definitive cure for mothers with ongoing post-traumatic stress after childbirth. Nevertheless, several studies have shown how brief and cost-effective crisis interventions (such as CBT or expressive writing) may help to reduce symptoms of acute post-traumatic stress and depression for mothers with infants in NICU (e.g. Shaw et al., 2013; Horsch et al., 2016). The study using expressive writing also found that these women required fewer follow-up specialist appointments, indicating reduced future health care costs following the early intervention.

As with depression, maternity care providers in Study One (Chapter Four) described how mothers suffering from feelings of distress or trauma post birth may feel emotionally detached towards their infant. This lack of emotional availability of the distressed mother towards her infant is supported by the literature on PTSD after childbirth (e.g. Ayers et al., 2006; Parfitt & Ayers, 2009). Mothers with post-traumatic stress can find it difficult to help their infant learn to manage their regulatory emotional systems when they are struggling with their own emotional state, potentially creating a dysfunctional mother-infant relationship which may cause problems for the infant's future socio-emotional development (Schechter et al., 2010). Could a higher level of social and professional support during childbirth therefore potentially reduce the distressed mother's tendency to become withdrawn and show reduced sensitivity towards her newborn, in turn affecting the infant's future emotional regulation, behaviour, and development? (Murray, 1996; Murray et al., 2014; Feldman, 2017).

In support of this concept, Study Three highlighted that labour support from both a partner and another companion contributed to maternal perceptions of overall infant Easiness, while having a Supported Experience predicted more Alert-Responsive infant behaviours (0-6 months). Previous research has also recognised that high levels of social and professional support during childbirth benefits the mother's physical and mental health post birth (Lliadou, 2012). While intensive caregiver support may effectively help the mother to cope with the pain and stress of labour, it also increases the mother's self-esteem and helps to prevent postpartum depression (Hodnett, 2002b; Bohren et al., 2017). This effect is considered to occur due to positive interpersonal interactions and advocacy supporting the normal physiology of a labouring woman, as established in earlier doula research (Klaus & Kennell, 1997).

Thus, alongside the specialist clinical care offered by midwives, continuous social support from a doula or other female companion appears to be more effective than intermittent support, although there are debates around continuous care (e.g. Scott et al., 1999). A Cochrane systematic review found that mothers allocated to continuous support from a person who was neither hospital staff nor related were more likely to have a shorter, spontaneous birth without analgesia (Hodnett, Gates, Hofmeyr & Sakals, 2013). Moreover, their infants were less likely to have a low five minute Apgar score, the medical indication of neonatal physiological wellbeing at birth (Apgar, 1952). This evidence is consistent with other research on healthier birth outcomes when a doula is present throughout labour and birth (Gruber et al., 2013).

Based on extensive research evidence around the benefits of a spontaneous physiological birth on postnatal mother-infant neuro-hormonal systems and postnatal maternal mood (Buckley, 2015; Uvnäs-Moberg et al., 2019), a relaxed atmosphere with continuous one-to-one care could be crucial to the current and future wellbeing of the mother-infant dyad. This may include emotional support, information and advocacy on behalf of the mother, which could be even more important when she is experiencing obstetric complications; although, as continuous care enhances the normal physiological processes of labour and birth, it simultaneously reduces the likelihood of unnecessary interventions (Hodnett et al., 2013).

Furthermore, a longitudinal study of approximately 450 mothers recruited during pregnancy found that symptoms of PTSD were most likely after obstetric interventions and inadequate care (Creedy et al., 2000). Ensuring that mothers who require interventions receive adequate

social and professional support during and post childbirth may therefore help to reduce the mother's post-traumatic stress response (King, McKenzie-McHarg, & Horsch, 2017), which in turn could benefit the infant's emotional regulation system and their future cognitive and behavioural development (Horsch & Garthus-Niegel, 2019). Supporting immediate skin to skin care and breastfeeding may also help to rebalance maternal and infant stress response systems (Carter et al., 2014), which could aid their recovery and the mutual bonding process after a challenging birth experience (Ayers et al., 2006; Ayers et al., 2016).

In cases of PPD, which is often comorbid with post-traumatic stress (Dekel et al., 2019), preventative measures or early intervention strategies may also be preferable to later measures, as once established, patterns of insecure infant attachment, problems with emotional regulation and behaviour, and poor cognitive development can be difficult to remedy (Murray et al., 2014). These early impacts on infant behaviour are thought to continue after the mother has recovered from PPD, and may be more serious where added socio-economic risk factors are involved or if her depression becomes chronic or severe (Murray et al., 2011). In such cases, as previously mentioned, longitudinal studies have shown that PPD may predispose the future adolescent to anxiety or depression (Halligan et al., 2007; Murray et al., 2011); and the future adult to heightened stress responsivity (Barry et al., 2015). Therefore, the prevention and treatment of postpartum mood disorders, via the appropriate support systems, are vital to supporting infant emotional and behavioural development.

However, midwives in the UK and across the western world are working under time constraints and other restrictions often beyond their control, which may be disempowering both for them and the mothers they care for (Renfrew et al., 2019). This highly pressurised atmosphere that many midwives find themselves working in cannot practicably be benefitting the mothers and infants dependent on their care. Instead it may encourage defensive and technologically based midwifery practice (Scamell, 2016) and midwives deliberately or unwittingly influencing women to accept the institutional model of an interventionist birth (Plested & Kirkham, 2016). As birth interventions have increased, so has the threat of litigation and consequent fear of litigation amongst maternity care providers, which can also lead to defensive, risk avoidant behaviours during childbirth (Symon, 2000). It is within this atmosphere of fear, blame and litigation that many of the 'unnecessary interventions' mentioned by the WHO occur, which may in fact increase the risk of negative outcomes for mother and infant (WHO, 2018, p8).

Consequently, midwives and obstetricians are working within an increasingly risk-averse culture (Kirkham, 2013; Dahlen, 2014), often including a genuine fear of catastrophe, the stress of which can be transferred to mother and foetus during pregnancy and birth (Dahlen & Caplice, 2014). Indeed, fear of childbirth contributes to difficult infant temperament at 8 weeks (Thiel et al., 2020). It may also lead to traumatised women on the end of 'dehumanising' care (Nicholls & Ayers, 2007), negatively impacting the new mother's life, her psychological wellbeing, and her relationships with her partner and baby (Ayers et al., 2006; Delicate, Ayers, Easter, & McMullen, 2018; Simpson, Schmied, Dickson, & Dahlen, 2018). With so many low-risk women experiencing interventions, Dahlen (2014) has proposed that the emphasis of modern childbirth seems to be placed more on averting risk than facilitating safety.

Indeed, while these factors lead to a less personal form of maternity care, they do not always enhance safety for mother or infant (Dahlen, 2014). Risks attached to unnecessary medical interventions include increased maternal and neonatal morbidity and mortality and longer term psychological risks affecting mother and infant (Renfrew et al., 2014). Also, one online survey of approximately 2000 midwives found that modern maternity practice is causing anxiety and depression in midwives, whose aspiring role is to guide and support the mother throughout her labour and birth. Instead, they frequently find they are not given the time or space to fulfil this task, and are consequently experiencing high levels of emotional distress in the workplace, which can result in occupational burn out (Hunter, Fenwick, Sidebotham, & Henley, 2019).

7.3 Implications for future maternity and perinatal care

Childbirth appears to be a highly significant physical and emotional life event for mothers and their babies. According to the beliefs of the maternity care providers interviewed in Study One (Chapter Four), it is a delicate time for mother and infant, who were viewed as inseparable in their response. Consequently, birth experience has the potential to impact not only maternal emotional wellbeing but also infant behavioural style. Study One highlighted the valuable insights of health professionals and doulas working to support women throughout pregnancy, birth and the early postnatal period. Many health professionals discussed the significance of promoting a calm birthing environment, reducing stress and offering emotional support during and after birth, which they believed might help to counterbalance the possible negative impacts of a difficult birth upon maternal, neonatal and older infant behaviours.

Findings from Studies Two and Three confirmed this idea, contributing to the existing literature and building upon previous research, while highlighting that maternal wellbeing and infant behavioural outcomes benefitted jointly from supportive physical and emotional perinatal care. As one health visitor aptly commented, *"We look after the mothers so that they can look after their babies.*" This could have important implications for future practice. Helping to increase maternal resilience and protect vulnerable women from negative perinatal experiences is essential. Possibly, women could be assessed during pregnancy for vulnerability factors as defined in the meta-analysis by Ayers et al. (2016). Increased support could then be offered to these women, and to those experiencing an operative birth. As Ayers et al. (2016) also suggest, women could be asked about their subjective birth experience, followed by steps to aid and support mother-infant bonding processes after a difficult birth (Murray et al., 2014).

The findings in this thesis may therefore be significant for funding and further training for more extensive health professional support of mothers and their infants. However, in our current maternity healthcare climate of over-stretched resources and increased demands on midwives' time, these aims could be difficult to meet. Given Study Three's results around the advantages of a more supported experience (extra birth companion) for perceived infant Easiness, overall it might be as beneficial in the longer term to support the work of doulas within the NHS.

This idea is supported by a body of prior evidence from doula research utilising randomised trials to highlight multiple physical benefits (such as fewer interventions) (Campbell, Lake, Falk, & Backstrand, 2006) as well as health and psychosocial benefits to the mother-infant dyad including increased breastfeeding rates, greater self-esteem and lower depression scores at six weeks postpartum (Klaus & Kennell, 1997). In this meta-analysis, one important additional benefit was more positive maternal perceptions of her baby and greater ability to cope with caregiving. Having a doula present during the birth also appeared to encourage fathers in their caregiving role. In addition, qualitative research emphasises the complementary role that doulas can play alongside essential midwifery care (McLeish & Redshaw, 2018).

Vulnerable younger and lower income mother-infant dyads may particularly benefit from doula care during their labour (Hans et al., 2013). In this randomised control trial, infants in the group allocated to doulas benefitted from more child-centered parenting behaviours and positive encouragement from their mother. These mothers also responded better to infant distress at four months, and their infants showed fewer signs of distress during mother-infant interactions.

Although Hans et al. (2013) found that these perceivable differences in mother and infant behaviours after doula care diminished over time, they suggested that the positive results could be sustainable by providing longer term postnatal support to vulnerable new mother-infant dyads. Another randomised control trial of young mothers and infants found improved interactions after a doula home care program, specifically in relation to infant learning – namely increased stimulation and speech from mothers towards their infants (Edwards, Vieyra, & Hans, 2020). Hans, Edwards and Zhang (2018) also found that postnatal doula support reinforced other positive infant care behaviours, such as placing the infant on their back.

While it is important for a mother's physical and emotional wellbeing that her doula complements her midwife, the presence of a doula might also encourage more informed choices to take place in the birth room. All pregnant and labouring mothers are entitled to be fully informed of both the benefits and risks of any interventions they are offered (Olde et al., 2006; Chan et al., 2017). Medical interventions (such as induction) that can save lives (for instance during pre-eclampsia) may also increase maternal anxiety, further interfering with normal birth physiology (Chapman & Charles, 2009). For example, an induction may increase the need for effective pain relief such as an epidural (NHS England National Maternity Review, 2016). It could also increase the chance of foetal hypoxia and distress due to the strength of contractions, potentially leading to a need for further interventions such as a Caesarean section (Danilack et al., 2016) or assisted birth (Ryan & McCarthy, 2016; NHS England National Maternity Review, 2016; NHS Direct Wales, 2019).

A recent Irish participatory action study of fifteen interviews with mothers emphasised that the true essence of 'choice' means women being offered the time, space, and in-depth discussion with a maternity health professional who they know and trust to help them reach their decision (O'Brien, Butler, & Casey, 2017). However, maternal interview data from Study Two (Chapter Five) highlighted that 'informed choice' does not always fulfil these criteria, with women's autonomy and wishes often affected by 'Health Professional Authority', external or personal circumstances and lack of available resources (Kingdon et al., 2009). Moreover, actual choice can be very difficult in a situation where medical urgency seems paramount.

As well, midwives often act as mothers' advocates, especially in hospital settings where multiple protocols are in place. However, this situation may be helped by the mother knowing and feeling comfortable with her midwife. Continuity of carer including one-to-one midwifery

care during childbirth – ideally from a known and trusted midwife – were highlighted as major objectives for best practice in the most recent national maternity review, *Better Births* (NHS England, 2016). They were also the objectives of *Changing Childbirth* (Department of Health, 1993), a previous Expert Maternity Group report commissioned by the government regarding the provision of accessible, woman-centred maternity care alongside maintaining the physical safety of mother and infant at all times. However, these objectives for best practice may have more impetus on this occasion, aided by a growing body of scientific research evidence (e.g. Renfrew et al., 2014) and the support of WHO (2018) intrapartum guidelines for a safe *and* satisfying birth experience which optimises normal biological and psychological processes where possible, using obstetric and neonatal services where required, and only in agreement with the mother. Thus, women should be enabled to practice informed choice with a trusted and informative care provider (Chan et al., 2017).

Furthermore, Public Health England guidance (Gov.uk, 2019b) states that, despite the historic separation of physical and psychological perinatal care, given that 10-20% of women suffer from mental health problems within a year after giving birth, it is time to integrate these two different though complementary forms of care. They emphasise the importance of supporting mother-infant and mother-partner relationships to encourage positive infant development, and discuss promoting mental health from conception to birth and beyond, as set out in NICE guidelines (NICE, 2014). In cases of birth trauma, specific NICE recommendations (NICE, 2018) include regular treatment sessions of high intensity psychological interventions such as trauma-focused CBT or eye movement desensitisation and reprocessing. However, birth trauma may be easier to prevent than to cure, with huge potential savings in the longer term.

Given the evidence presented here, it is time to invest in increased emotional support for mothers and their infants during childbirth and the critical early postnatal period of adjustment to motherhood, particularly for vulnerable, young, or first-time mothers. While this would incur costs in the short-term, it could have long-term benefits, not least the potential for future health and education savings. Utilising doulas during childbirth could free up valuable time and resources for specialised midwife care to focus on areas of expertise in the more physical aspects of birth, whilst providing mothers with the continuous emotional support they require for positive birth and postnatal outcomes (Kennell, Klaus, McGrath, Robertson, & Hinkley, 1991). This could benefit the mother's mental outlook post birth, including perceptions of her birth experience and her baby's behaviour.

As stated in Chapter One, considering how a healthy newborn infant should be expected to thrive socio-emotionally, behaviourally and cognitively (Murray et al., 2014), both the birth itself and the mother's response to the birth experience may have consequences for her baby's development, behavioural style and future welfare. Mother and infant are interconnected on many levels. Therefore, ensuring that women have the best possible birth experience is crucial to mother-infant physiological and psychological wellbeing. This should include full participation in decision making and informed consent, no unnecessary interventions, and the appropriate social and professional support during and after childbirth.

7.4 Implications for childbearing women

Given these findings, mothers may wish to gain as much knowledge about the mechanisms of normal physiological labour and birth as possible. This could be through attending informative and supportive antenatal classes. While it is helpful to know about alternative birth modes such as Caesarean sections, and when they might be required, mothers should also be aware of their basic human rights during childbirth (Chan et al., 2017). These include the right to choose whichever type of perinatal care they feel is best suited to themselves and their baby (for example midwife led or consultant led), and know that it is acceptable to ask for a different midwife during labour if they do not feel appropriately cared for or listened to – as this is necessary for positive outcomes (Patterson et al., 2019).

Considering the recent MBRACE report (MBRACE-UK, 2020), it is especially important that the needs and anxieties of vulnerable women (e.g. young or single mothers) and black and Asian women are met. Birth partners or companions may be in the best position to enquire about medical reasons for any recommended interventions, or equally to ask for medication or an intervention if they feel it is needed), and therefore they could be prepped beforehand. Unless the situation dictates instant emergency action, mothers ought to feel they have time to weigh up the costs and benefits of any particular intervention, discuss it in private with their birth partner and a known and trusted midwife (Sandall et al., 2016; Chan et al., 2017), reaching their own judgement and decisions in relation to the birth and their baby's safety and wellbeing. Expectant mothers instinctively want optimal outcomes of good physical and emotional health for their offspring, and accordingly should be supported to make their own informed choices.

Thus, mothers-to-be may wish to gather as much support as they can, perhaps recruiting an extra birth companion, whilst also ensuring they have adequate postnatal support. Where this is not possible for personal, financial or other reasons (e.g. a lack of available doulas who live close enough to be summoned at short notice), mothers might consider other available options. For example, a homebirth is considered a safe choice for 'low risk' women (Brocklehurst et al., 2011), and normally involves two midwives being present throughout the birth. Another option is to try a waterbirth, which is normally accompanied by two midwives and also considered safe for low risk pregnancies (Barry, McMahon, Banks, Fergus, & Murphy, 2020).

7.4.1 *Birth and breastfeeding during a pandemic*

The studies contained within this thesis were conducted pre-pandemic. However, during COVID-19 lockdowns, homebirth and waterbirth services were temporarily removed in some areas alongside restrictions on birth companions, despite a strong human rights argument to retain freedom of choice in childbirth (Romanis & Nelson, 2020). This presented a problem for women who were deprived of the opportunity for informed choice, continuous care, and in some cases, any advocacy or social support in the birth room (Renfrew et al., 2020a). As the pandemic continues, women will need to somehow reclaim their rights to an emotionally supportive birth environment with companions of their choice.

The findings reported in this thesis reaffirm the benefits of breastfeeding for mother and infant wellbeing (Brown, 2018). In some instances during the current pandemic, supposedly to avoid infection, infants were delivered by Caesarean section and separated at birth from COVID-infected mothers, depriving women of the chance to breastfeed, with potential harm to maternal and infant health (Tomori, Gribble, Palmquist, Ververs, & Gross, 2020). These practices are contrary to COVID-related WHO recommendations (WHO, 2020) and are therefore thankfully no longer occurring in the UK. Recent UNICEF UK infant feeding guidelines (UNICEF UK, 2020) clearly state that breastfeeding helps to prevent infectious disease and other harms and therefore should be promoted, especially during a pandemic. Thus, mothers should be encouraged to keep their baby close, have plenty of skin to skin contact, and feel entitled to ask for breastfeeding support post birth (Brown, 2020; Renfrew et al., 2020b).

7.5 Limitations

The research presented in this thesis closely examined some previously under-explored areas around potential impacts of childbirth on early infant behaviours. The three studies

complemented one another, with patterns identified in the first two qualitative studies confirmed by quantitative findings in the third study. Although this had the potential to create research bias in Study Three (Chapter Six), the strict criteria of statistical methods employed in the data analyses were closely adhered to (Field, 2009). Consequently, the rigorous mixed methods approach allowed the findings to be triangulated, improving their overall validity and credibility and demonstrating that self-reported physical and psychological maternal states during and post birth may predict maternal perceptions of infant behaviour during the first thirty weeks. However, there were also several limitations to the studies as discussed below.

7.5.1 *Are the findings applicable to the wider UK mother-infant population?*

Both the qualitative and quantitative studies lacked cultural diversity. In the qualitative studies, this could be due to an actual lack of diversity between North Bristol and West Wales where the research took place. For Study Three, the reasons may be connected to internet usage amongst ethnic minority populations. According to the Office for National Statistics (ONS, 2019), 99% of the UK population of childbearing age (16-44 years) are recent internet users. These figures were slightly lower in England and Wales during 2014-2016 when the survey was recruiting mothers (ONS, 2017). As an internet survey, the third study had the potential to reach most of the sample population of English speaking mothers. However, ethnic minorities and lower SES groups may have slightly lower rates of internet usage (GOV.UK, 2019; Yoon, Jang, Vaughan, & Garcia, 2020), which could have contributed to the sample being skewed towards more white Caucasian mothers than the wider UK population. Future research in this area would therefore need to place an emphasis on recruiting a more ethnically diverse sample.

Although the survey sample was distributed across socioeconomic groups, it was not an entirely equal spread. This could be due to limited access or understanding if there was no internet at home or English was a second language. However, as previously mentioned, the relative lack of diversity may have provided a more homogeneous sample with fewer confounders when comparing birth experience to mother-infant outcomes. This concept is supported by a study comparing PPD in higher, middle and lower income countries, finding that the mechanisms for PPD are similar between all nationalities, although the different contexts of contrasting countries led to varying rates of diagnosis (Herba et al., 2016). Arguably, mother-infant behavioural outcomes of childbirth experiences in the UK would also be similar, although the environmental context of the home might differ between nationalities, thus exerting additional influences on infant behavioural style.

Nevertheless, varying household incomes between ethnic groups could potentially play a role in infant outcomes. Although higher income and education levels appeared to have a negative effect on maternal perceptions of infant behaviour in Study Three – possibly linked to higher maternal expectations – poverty is generally found to have an adverse impact on maternal stress and the home environment (Cooper & Stewart, 2013). As recognisable problem behaviours in young children appear to be growing, this trend could relate to a multitude of factors to do with today's society and the growing disparity in lifestyles between different social classes and ethnic groups. Social and financial strain alongside postnatal depression may increase parenting stress (Leigh & Milgrom, 2008; Cooper & Stewart, 2013). In turn, as already discussed, postnatal depression – exacerbated by socioeconomic factors – may affect mother-interactions, infant behaviour, and the infant's future emotional, behavioural and cognitive development (Murray et al., 2014).

Notably, evidence suggests that the quality of caregiver support (including the attitudes and behaviours of health professionals, the mother's relationship with caregivers during labour and birth and her involvement in decision making – i.e. informed choice) can override potentially strong physical factors such as labour pain, the physical environment, immobility during labour, interventions, ethnicity and socioeconomic status (Hodnett, 2002). However, this quality of support and involvement in decision making could be more difficult where there are language barriers to effective communication of the woman's needs and wishes (Small, Rice, Yelland, & Lumley, 1999). Practices that enable non-English speaking mothers to communicate during birth, combined with culturally sensitive interventions, may be needed to help to prevent postnatal depression and its impacts on infant behaviour (Herba et al., 2016).

7.5.2 *Socioeconomic diversity in the sample population*

Further to the lack of ethnic diversity was the general lack of heterogeneity in both the qualitative and quantitative sample populations. The majority of mothers in Studies Two and Three (Chapters Five and Six) were white Caucasians who had a live-in partner and were breastfeeding their infant, again indicating that the results may not apply to the wider general UK population of mothers and infants. However, purposive sampling was used in the second part of recruitment for mothers in Study Two to capture a sample of formula feeding mothers-infant dyads. Furthermore, the maternity care providers in Study One (Chapter Four) who cared for women from all races and backgrounds discussed similar patterns to those emerging in

Study Two (Chapter Five) and which were found to predict mother-reported infant behavioural outcomes in Study Three (Chapter Six). The health professional data in Study One therefore increased the confirmability of maternal ratings of infant behaviour. As noted above, the overall cultural similarities in the sample populations could also serve to highlight specific differences in infant behaviour according to birth experience for these mothers.

7.5.3 *Self-selection of participants*

A further limitation was that mothers and health professionals in all three studies were self-selecting, and therefore had shown interest or replied to a request to participate in a study specifically about childbirth and infant behaviour, potentially leading to biased views with only interested individuals agreeing to participate. Nevertheless, while a similar thread of themes ran through all three studies, the responses were rich and varied. This was especially apparent in the maternal interview data in Study Two where a majority of mothers, particularly those with a negative birth experience, did *not* feel that it had affected their infant's behaviour. As well, for Study Three, after an initial placing of the study advertisement on specific online platforms, snowball sampling was used with individuals encouraged to share the questionnaire link via their own social media channels, eventually reaching a more socioeconomically diverse group. As with much behavioural research (particularly online), there was a leaning towards mothers with higher educational levels than the UK population average, potentially biasing the results towards more highly educated mothers. However, education level was controlled for throughout the study.

7.5.4 *Self-report measures*

All data collection was limited to self-report measures via interviews and an online questionnaire, potentially creating biased results as participating individuals may have had preconceived notions of birth and infant behaviour and responded to questions accordingly. However, this did not appear to be an issue in any of the studies. Moreover, self-report measures have become a reliable method for collecting psychological and behavioural data, as shown by the wide use of the EPDS and various versions of the Big Five personality inventory. These well-established measures are used internationally and across many nations and languages (e.g. Romero, Villar, Gómez-Fraguela, & Lopez-Romero, 2012).

Maternity care providers and mothers gave balanced answers to the questions, often contemplating all eventualities before giving their verdict. As aforementioned, the maternity

care providers in Study One (Chapter Four) could be considered external raters of maternal birth experiences and early infant behaviours, supporting data from the other two studies. It is possible that the mothers in Studies Two and Three (Chapters Five – Six) experienced recall bias due to inaccurate memory of birth events or their baby's behaviour post birth. To counterbalance this possibility, infants included in the survey were < 6 months old. In addition, the infant behaviour questionnaire used in the survey was a validated questionnaire that asks about specific feelings and behaviours over the past seven days rather than requesting mothers to make a judgement of their infant's overall behaviour. Where this was the case, as in the 'impressions' section of the Mother and Baby Scales, it was made clear to the reader by using the words 'maternal perceptions of…' However, such general impressions related solely to overall infant Easiness and maternal Global Confidence. Arguably, the rest of the questionnaire – which does not ask mothers to make any judgements concerning their baby's behaviour – can be interpreted as actual infant behavioural style or developing temperament.

7.5.5 *Unaccounted factors*

Finally, while the questionnaire was as detailed as it could feasibly be, there are always factors that cannot be accounted for. One of these was maternal nutrition during pregnancy and breastfeeding. We know that nutritional factors such as low serum iron levels may influence infant temperament (Wachs et al., 2005). However, maternal nutritional status would be impossible to measure accurately in an interview or a survey, and difficult to gauge without multiple new questions. Extra questions were not considered appropriate as they would have substantially increased the interview and survey lengths. Despite this, the maternal interviews and survey were able to question mothers on their infant's feeding style, which could be interpreted as giving an approximate estimate of the infant's nutritional status – although infant health also depends on the mother's diet and lifestyle when she is breastfeeding. Breastfeeding mothers could be anaemic or lacking in some other essential nutrient such as calcium. Therefore, in a further study over a longer time period, mothers could also be questioned about their own diet during pregnancy and the postnatal period, and their infant's diet post weaning.

7.6 New research questions emerging from the data

Some pertinent questions arose from these findings: First, what impact are rising birth intervention rates having on postnatal mood disorders, with their subsequent negative impact

on maternal sensitivity and responsiveness (WHO, 2020b), mother-infant interactions (Murray et al., 2104) and infant behaviour? (Lundy et al., 1996; Murray et al., 1996b). Second, could a mother's perceptions of her birth experience, her postnatal mood, and consequently her baby's behaviour be aided by increased support during and post childbirth? (Love et al., 2005; Iliadou, 2012; Horsch & Garthus-Niegel, 2019).

1. *Are rising numbers of birth interventions affecting postnatal mood disorder rates?*

Childbirth interventions are still rising despite warnings from WHO (2018) that excessively high rates could be counter-productive to mother and infant's physical and psychological wellbeing. Meanwhile, the incidence of postpartum depression appears to be also increasing, with one study conducted across several countries declaring maternal PPD a global public health issue (Herba, Glover, Ramchandani, & Rondon, 2016).

Prior research has shown that infant behavioural and cognitive development is mediated by post-traumatic stress and depression (Field, 2010; 2017). However, until the advent of the City Birth Trauma Scale (Ayers, Wright & Thornton, 2018), birth trauma has been difficult to measure consistently and comprehensively. Indeed, childbirth has only been recognised as a potentially traumatic event in research since 2000, and included in the list of potentially traumatic events leading to PTSD as defined by the American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013) since 2014 (Svanberg, 2019).

Although approximately 60% of new mothers may have a negative birth experience (Svanberg, 2019), and up to a third perceive their birth experience as 'traumatic' (Creedy, Shochet, & Horsfall, 2000; Garthus-Niegel et al., 2013), a recent meta-analysis shows that actual diagnosed postpartum PTSD occurs after approximately 4% of births (Yildiz et al., 2017). However, figures fluctuate widely between studies. Despite exact figures being difficult to obtain, it is conceivable that the rising rates of birth interventions could be driving an increase in prevalence rates of these highly comorbid postpartum mood disorders.

Rising levels of interventions are also influenced by the issue of 'informed choice', with some women actively seeking the increased sense of control and predictability that may accompany

a planned induction or planned CS (McAra-Couper, Jones, & Smythe, 2012). Nevertheless, in Study Two as elsewhere (Kotaska, 2017), several mothers felt they were not given all the options during their consultation to make an informed choice, instead feeling pressured into agreeing to 'possibly unnecessary' medical interventions. This style of maternity care may result in reduced satisfaction with the birth experience (WHO, 2018), potentially developing into a postpartum mood disorder, particularly if birth plans were disrupted or the mother feels she received inadequate care (Benoit, Westfall, Treloar, Phillips, & Mikael Jansson, 2007).

2. ***Are postnatal mood disorders preventable through increased support, with the potential for positive impacts on mother-infant relations and infant behaviour?***

Given the evidence around increased support during childbirth, as discussed earlier, the National Maternity Care Review, *Better Births* (NHS England 2016), and the WHO Intrapartum Guidelines (2018) have placed maternal and infant wellbeing at the heart of their recommendations for continuous respectful professional care throughout labour and birth, alongside a companion of the mother's choice. Increased social and professional support for mother and infant throughout the perinatal period may help to lower maternal anxiety during childbirth, increasing positive outcomes and experiences, and therefore benefitting the infant both directly and indirectly (Hodnett et al., 2013).

Women experience better outcomes when they have a known and trusted midwife caring for them throughout the birth (Sandall, Soltani, Gates, Shennan, & Devane, 2016). Interpersonal factors (communications between mother and midwife) are also the most significant contributors to how the mother perceives her birth and whether she develops symptoms of PTSD afterwards (Harris and Ayers, 2012; Patterson et al., 2019). Preventative, respectful, supportive and ideally continuous care therefore not only promote the safety of mother and infant during childbirth, but also ensure continuing maternal emotional wellbeing (Renfrew et al., 2014). This encourages a more positive mother-infant relationship (Feldman, 2017) and positive infant temperament traits such as sociability and lower stress reactivity (Feldman et al., 2009). Facilitating the father to help care for the mother during pregnancy, childbirth and post birth may also have a profound effect on mother-infant outcomes (Beaumont, 2015).

Patterson et al.'s (2019) systematic review of mothers' and midwives' experiences of interactions during and post childbirth reaffirmed that positive interactions (including a mother's involvement in decision making and perceived midwife control and confidence) may significantly help to reduce stress and improve the mother's birth experience, resulting in a lower incidence of post-traumatic stress. Alongside maternal expectations of the birth being met, these factors may facilitate mother-infant attachment and bonding processes (Ayers et al., 2006; Nicholls & Ayers, 2007; Parfitt & Ayers, 2009) and improve maternal perceptions of her infant (Davies et al., 2008). In turn, appropriate early maternal response to her newborn has been shown to benefit the infant's future wellbeing (Feldman, 2017), with long-term gains to emotional regulation, behavioural and cognitive development (Murray et al., 2014).

7.7 Future research directions

Some potential future research directions also emerged from the data analysis across the studies. Research involving a more diverse spread of ethnic groups, relationship status and feeding methods needs to be conducted. In addition, a case study could be carried out to look at a small group of mother-infant dyads in more detail, using trained objective observations to compare with the maternal reports and diaries that are the mainstay of this type of research (James-Roberts & Wolke, 1987). This would help to further validate the present findings and provide an interesting in-depth addition to the three studies conducted here, although it may be costly and time-inefficient, making it difficult to include enough mother-infant dyads for any significant quantitative analysis.

A longitudinal follow-up study of mothers and infants in Study Three (Chapter Six) could also be of interest to discover how mothers observed their infant's behavioural style as they entered early childhood. As Study Three was a cross-sectional rather than repeated measures design, it might also be helpful in a further study to question mothers at several time points from pregnancy through to the first six months or year post birth. This would enable comparisons of changes that may occur with age, dependent on birth experience, rather than comparing different infants across different age groups as in Study Three of this thesis.

Based on the findings in this thesis (see Figure 3 for a summary, p. 254), a negative birth experience and postnatal distress following a difficult birth experience may adversely impact

mother-infant bonding and infant behavioural style. Consequently, it would be fitting for any future research in this field to include a measure of post childbirth traumatic stress disorder and a measure of mother-infant bonding and attachment behaviours (as shown in Figure 4, p. 256).

Research is also needed to explore the impacts of the coronavirus pandemic on mothers who gave birth amidst 'social distancing' laws, particularly in light of the temporary withdrawal of birthing pools and homebirths, restrictions on partner access to hospital for scans during pregnancy and during the first stage of labour, and the limited number of companions permitted in the birth room (Renfrew et al., 2020a). It would be interesting to examine the impacts of such COVID-19 related restrictions on mothers' response to their birth, and on maternal psychological wellbeing and perceived infant behaviour post birth; and in addition, to explore the impacts of COVID-19 fear and restrictions on early mother-infant contact, including skin to skin, and subsequent infant breastfeeding and bonding behaviours (Renfrew et al., 2020b).

7.8 Conclusions

Research exploring the potential connections between childbirth experience and infant behaviour is sparse. Studies have separately examined the various stages in the continuous progression from the pregnancy and birth experience, through postpartum mood to infant behavioural patterns. However, this appears to be the first research that aimed to fully unite these discrete elements. From an in-depth analysis of all three studies presented here, it appears that the mother's subjective response to childbirth could be a mediating mechanism for the mother-infant dyad's mutual recovery from the birth. Birth may affect the infant's behaviour, both directly through the physiological impact of birth interventions on infant stress reactivity (Taylor et al., 2000; Douglas & Hill, 2013), and indirectly through postnatal maternal distress and the impact of maternal mood disorders on mother-infant attachment and infant emotional regulation and behaviour (Murray et al., 2014; Feldman, 2017). Thus, mothers and their newborn infants should be perceived as an inseparable unit – including their mutually interconnected hormonal systems – throughout the pregnancy, birth and postnatal journey.

The hormones released during and after normal childbirth affect mother-infant interactions, bonding and breastfeeding behaviours (Uvnäs-Moberg et al., 2019; Widström et al., 2019). The neurohormonal balance of mother and infant during the perinatal period is therefore key to the

present and future wellbeing of the dyad. While mothers release hormones such as oxytocin, beta-endorphins and prolactin during a physiological birth, promoting normal biological calm and bonding behaviours, both mother and infant can sustain high stress hormone levels after birth complications (Gitau et al., 2001). Equally, infants of depressed mothers release more cortisol than their non-depressed counterparts (Murray, Halligan, Goodyer, & Herbert, 2010).

The findings presented in this thesis highlighted that the addition of an extra companion and feeling supported during childbirth benefitted mother-infant psychosocial outcomes and maternal perceptions of her baby. Continuity of carer has also been found to significantly improve outcomes in relation to several risk factors including obstetric interventions, preterm birth, and foetal or neonatal death (Sandall, Soltani, Gates, Shennan, & Devane, 2016). Ensuring that the recommended model of woman-centred care set out by *Better Births* (NHS England National Maternity Review, 2016) is followed could therefore have positive future implications for the mother-infant relationship, the development of secure attachment behaviours, and ultimately both their physical and psychological wellbeing.

Consequently, this thesis highlighted the need for mothers to experience continuous, supportive care during childbirth and the post birth period, together with the high level of physical care which enables a physically safe birth. Indeed, scientific research is increasingly showing that physical and psychological care are not a dichotomous choice – instead they complement one another. Empathic, relationship-based, science-based and 'humanistic' care, rather than the modern 'depersonalised' and 'over medicalised' model, helps to optimise normal mother-infant physiology during and after birth (Uvnäs-Moberg et al., 2019; Page & Newman, 2020). It decreases maternal stress hormones during birth while increasing the all-important mother-infant exchange of positive hormones (such as oxytocin and beta-endorphins) which are essential for effective birthing, bonding and breastfeeding (Buckley & Uvnäs-Moberg, 2019).

While obstetric interventions can often be live saving, and some are designed to improve maternal comfort (e.g. pain relief), increased control of the normal birth process exercised today by medical professionals means that 'unnecessary interventions' can too often occur (WHO, 2018, p8). The risks of non-medically indicated interventions may include higher levels of maternal and neonatal morbidity and mortality, as well as longer term psychological risks affecting both mother and infant (Renfrew et al., 2019). Furthermore, as discussed, such

interventions may interfere with normal birth and post birth physiology, adversely affecting maternal and infant behaviours (Uvnäs-Moberg et al., 2019).

Therefore, although birth interventions can be necessary, the balance between presumed physical safety and maternal-infant physiological and psychological wellbeing may have swung too far in a medical direction and could be counter-productive. Fear of litigation has increased with the rise in obstetric interventions, often leading to defensive and risk avoidant behaviours during childbirth (Symon, 2000; Betrán et al., 2018). Instead, the appropriate time for any medical interventions should be only when indicated by abnormality (Page & Newman, 2020). It may be time for maternity services in the UK and elsewhere to adopt the WHO (2018) human-rights based objectives to meet not only clinical requirements for a safe labour and birth but also the psychological and emotional needs of women that optimise their health, emotional wellbeing, and birth satisfaction. These evidence-based recommendations would aim to ensure that women have a sense of involvement and control in the decision making around their birth, having a companion of their choice, and the freedom to move around and birth in their chosen position, all of which contribute positively to a sense of personal achievement and a more fulfilled new mother (WHO, 2018). Given that all three studies within this thesis have shown how the impacts on the mother of a challenging, interventionist birth may also affect her baby, protecting normal labour and birth, and ensuring a positive maternal experience wherever possible, is vital for mother and infant wellbeing (Page, 2017).

This thesis provides further support for current WHO (2018) intrapartum guidelines placing mother and infant at the heart of personalised, woman-centred care while avoiding all 'unnecessary' interventions, though with rapid referral when required. The WHO (2018) have recommended that the mother's experience of care should be valued as highly as the clinical care she receives. Quality care, respect, privacy, and the ability to make informed choices are becoming internationally acknowledged as basic human rights during childbirth (Khosla et al., 2016). A mother should be able to give birth in a clinically and psychologically safe environment, including continuous support throughout labour and good communication and respectful care from health professionals (Renfrew et al., 2014, 2019). Also, medical interventions should only be used when indicated, in agreement with the mother, and where there is solid evidence that they will improve outcomes while minimising harm (WHO, 2018).

This approach to a positive birth experience for mother and infant would empower women by maintaining their dignity, confidentiality, and subsequent emotional wellbeing alongside their own and their baby's physical safety. It would help protect long-term mother-infant physiological and psychological wellbeing, which could benefit the behavioural style of the infant with positive future implications for their socio-emotional, cognitive and behavioural development (Feldman, 2017). Therefore, if the mother's neurohormonal state could be protected during childbirth wherever possible, she and her baby might stand a better chance of beginning their new life together in a way that would optimise their normal instinctive behaviours, leading to an easier infant temperament and thus a more positive future for both.

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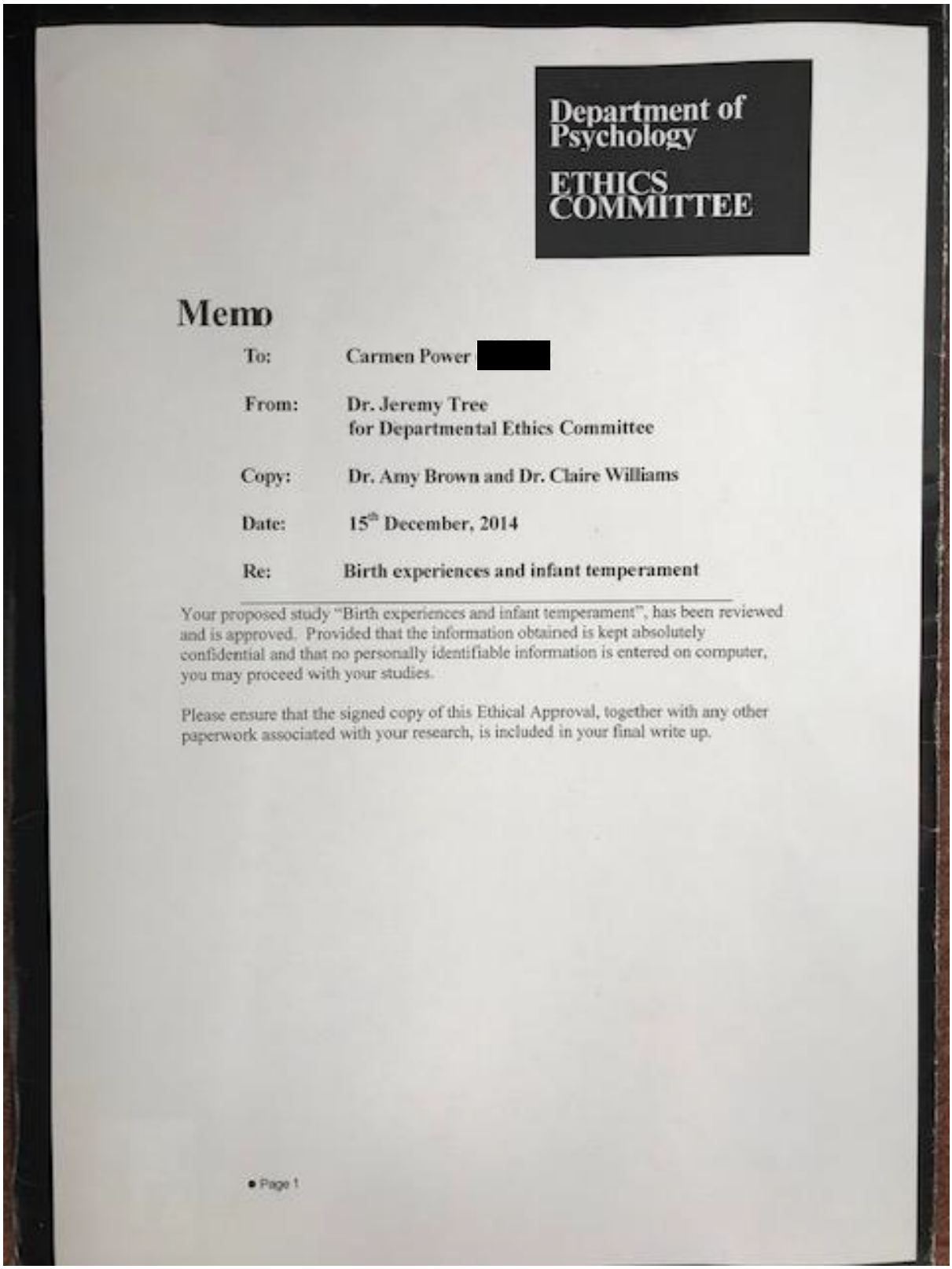
APPENDICES

Appendix One: Study One

Appendix 1A. Ethical approval for Studies One and Two



Department of Psychology

ETHICS COMMITTEE

Memo

To: Carmen Power [redacted]

From: Dr. Jeremy Tree
for Departmental Ethics Committee

Copy: Dr. Amy Brown and Dr. Claire Williams

Date: 15th December, 2014

Re: Birth experiences and infant temperament

Your proposed study "Birth experiences and infant temperament", has been reviewed and is approved. Provided that the information obtained is kept absolutely confidential and that no personally identifiable information is entered on computer, you may proceed with your studies.

Please ensure that the signed copy of this Ethical Approval, together with any other paperwork associated with your research, is included in your final write up.

Page 1

Appendix 1B. Recruitment Advertisement for Studies One and Two

Birth Study

Hello

My name is Carmen and I am a postgraduate research student at Swansea University. I am exploring birth experiences and infant temperament, and I'm looking for pregnant mothers or mothers of babies up to 12 months of age to interview, and also birth professionals e.g. midwives and doulas, to interview as part of my research.

If you are in one of the above categories and are interested in participating in the research, or would like to know more before going ahead, drop me a line on [redacted] for more information or to arrange a meeting. The interviews will be entirely confidential, and any information will be anonymously added to the study results. You are under no obligation if you consent to take part, and are free to withdraw yourself and any information given to the researcher from the study at any point.

Thanks for your time

Carmen

Appendix 1C. Study One: Brief, Background Information and Consent Form

Thank you for taking the time to do this interview.

Before beginning, this form will ask you some general background questions about yourself and your number of years in your profession/role. The aim of the interview is to better understand the relationship between childbirth experiences and young infant temperament.

If there are any questions you do not wish to answer for any reason please just say you would rather not reply. Similarly, if you do not wish to carry on with the interview for any reason please do not continue.

There are no right or wrong answers. We are interested in your honest experiences and opinions so please answer as fully as possible. Any information that you do give during the interview will only be used for the purposes of the study, and will be kept confidential. You will not be identified from your answers in any way. If you wish to withdraw from the study you can do so at any time.

If you have any questions before or afterwards please do not hesitate to get in contact with Carmen Power or supervisor Dr Amy Brown in one of the following ways:

Carmen Power email: [redacted] Dr Amy Brown email: [redacted]k

Please read through the following statements and tick your response to each one. If you can answer yes to one of the top two questions and to the statements please continue.

Are you a birth professional such as a midwife or doula?

Yes / No

I have read and understood the study information above

Yes / No

I understand that any information I give will be treated confidentially

Yes / No

I understand that any personal details will be removed, making my contribution anonymous

Yes / No

If I wish to withdraw from the study at any time I will tell the researcher and my data will not be included in the study

Yes / No

I understand that I am not obliged to take part in the study

Yes / No

I agree to take part in the study

Yes / No

Birth professionals, please state your working title (e.g. midwife / doula) ——————

Thank you for your time

Appendix Two: Study Two

Appendix 2A. Study Two: Brief, Consent Form and Demographics Details

Thank you for taking the time to do this interview.

Before beginning, this form will ask you some general background questions about yourself and your baby. The aim of the interview is to better understand the relationship between childbirth experiences and young infant temperament.

If there are any questions you do not wish to answer for any reason please just say you would rather not reply. Similarly, if you do not wish to carry on with the interview for any reason please do not continue. Importantly if answering any of the questions raises concerns about yourself or your child in any way, or about other worries that you have, you should contact your health visitor or GP for further advice or support, or I can give you contact details for the Birth Trauma Association.

There are no right or wrong answers. We are interested in your honest experiences and opinions so please answer as fully as possible. Any information that you do give during the interview will only be used for the purposes of the study, and will be kept confidential. You will not be identified from your answers in any way. If you wish to withdraw from the study you can do so at any time.

If you have any questions before or afterwards please do not hesitate to get in contact with Carmen Power or supervisor Dr Amy Brown in one of the following ways:

Carmen Power email: [redacted] Dr Amy Brown email:

[redacted]

1. Please read through the following statements and tick your response to each one. If you can answer yes to one of the top two questions and to the statements please continue.

Do you have a baby aged between birth and 12 months or are you pregnant?

Yes / No

I have read and understood the study information above

Yes / No

I understand that any information I give will be treated confidentially

Yes / No

I understand that any personal details will be removed, making my contribution anonymous

Yes / No

If I wish to withdraw from the study at any time I will tell the researcher and my data will not be included in the study

Yes / No

I understand that I am not obliged to take part in the study

Yes / No

I agree to take part in the study

Yes / No

2. Some background information about yourself and your baby

I am 18 years or above

Yes / No

My baby has no major health problems

Yes / No

I have no major health problems

Yes / No

My baby weighed at least five pounds at birth

Yes / No

My baby was born after 37 weeks

Yes / No

My baby was not a multiple birth

Yes / No

Mothers, please complete the following to the best of your ability. It is background information to the study. If there are any questions you do not wish to answer then please leave blank.

a) Your age ---------- years

b) Highest level of education ----------

c) Occupation before birth ----------

d) Are you planning to return to work? Yes / No

e) Are you married or living with a partner? Yes / No

f) How many children do you have ----------

Thank you for your time

Appendix 2B. Study Two: Data Summary

Birth type (vertical); behaviour type (BB); and mother (M) quotes on baby's behaviour

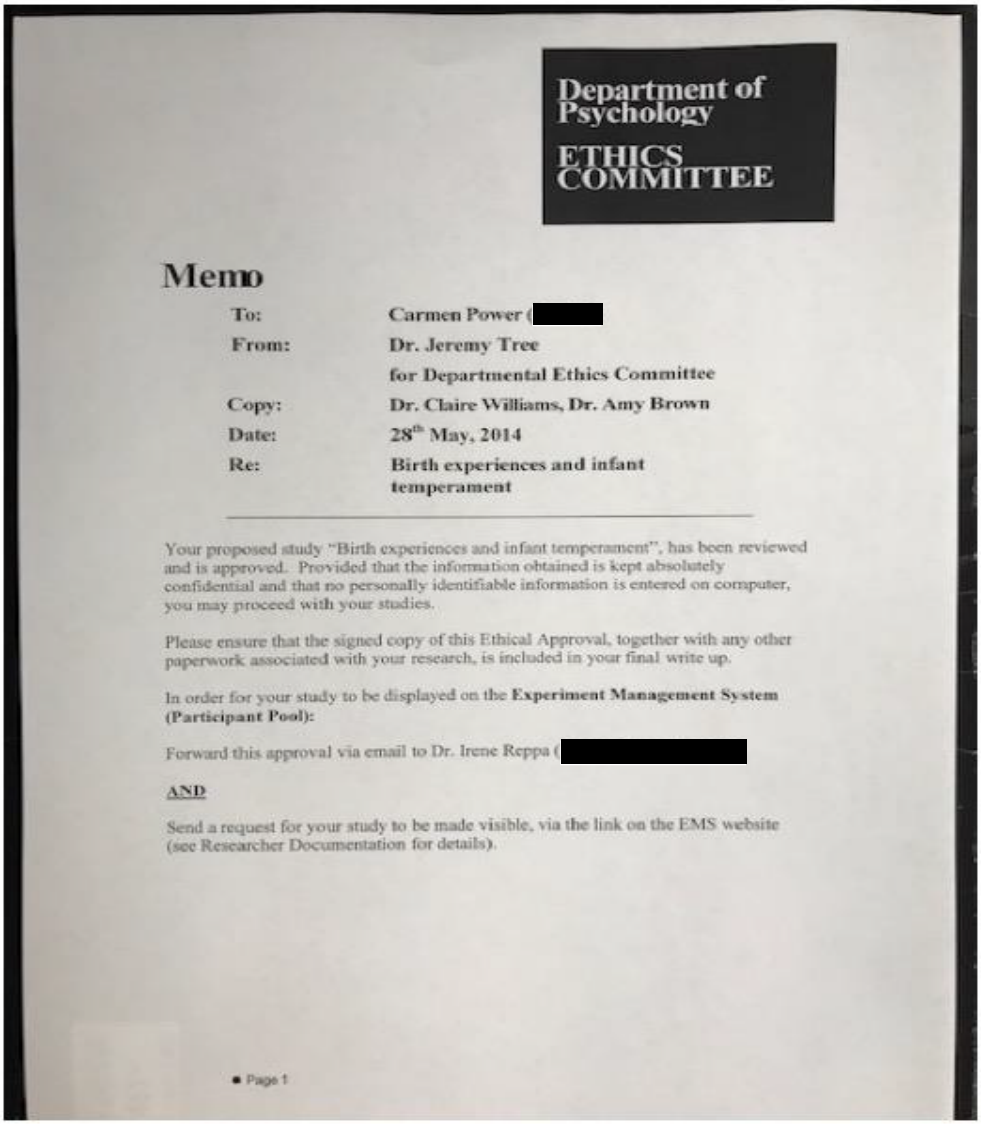
	M	BB	*In mothers' own words*
Normal births	3	easy	so calm & content… very easy… happy, smiles a lot, is very good at being passed around
	5	easy	very chilled out… She only cries when she's really upset about something.
	7	easy	Sleep was good… quite a content little baby. As long as he's fed he will self-soothe, let me leave the room, go to anybody.
	16	easy	Generally quite chilled out as long as she's fed and got some sleep. She's very easy to settle. I mean we don't have extended periods of crying.
	20	easy	She's quite laid back, she's very sociable, she's been very alert from very early on and interactive… generally cheerful and really good fun.
	11	easy	He's been brilliant. He's really happy, he's really placid.
	12	easy	He's been fab at feeding. In general he sleeps really well.
	8	mixed	Well straight after the birth she was very sleepy… She's quite a persistent baby in that she's generally happy but I would say if something displeases her she's got quite a feisty vibe on her… the only thing that will console her when she wakes up at night is breastfeeding… She won't let my partner… she will scream and keep screaming until she gets me.
	10	mixed	He was waking a lot in the night to feed. And then probably from about 2 months old he's been a really laid back baby. He's been really calm. (In NICU) they were doing obs. every half hour which was very disruptive for him… he'd scream and cry… He didn't have a very nice start.
Clinical births	4	easy	She's lovely… She's very happy, really smiley, gets on well with everyone… calm, happy and interested… such a good sleeper
	19	easy	Brilliant. Perfect. He's, the way he is makes me really broody. I just want to eat him… Yeah he's a very chilled out little boy.
	21	easy	She was really hungry. She's quite mellow. She's always been happy.

13	mixed	He's been marvellous… he didn't make a whimper in his dad's arms. He's not a whingey baby at all. He wouldn't latch on, so screaming while we got the syringe or the cup ready… but that didn't last long. He does tend to wake a lot but that's 'cause he's feeding – they tell you to wake them…
22	mixed	She's a really good baby. She sleeps really really well. She feeds really, really well. She's a really contented happy baby. Very rarely will she whinge or cry. She's really active… I'd say about 6-8 weeks it (sickness) calmed down, not completely… They said it was wind and colic.
6	mixed	She's been a good sleeper. She's very easy at the moment. In the early days she had that solemn look and wouldn't let anyone else hold her. I struggled with breastfeeding… She did cry quite a bit in the early days (until 6 months)
23	mixed	She's calm and cuddly. She's really content, a lovely, lovely girl. In the early days she didn't like feeding so… sort of had to force her to breastfeed. I felt like she just needed to be back in the womb. She was contented on me.
1	difficult	Strong… very angry when he's changed or bathed… very nosey, very alert and curious… very hard… he screams his head off. Feeding… was a battle. It feels like the hardest job I've ever had.
2	difficult	Surprisingly well initially… Looking back there wasn't a time when he wasn't crying… wasn't sleeping… at 6 months he got a lot better… happier.
14	difficult	I think… he was just associating breastfeeding with pain. We really struggled with him the first couple of weeks. The first few weeks he was waking up every 2-3 hours, and then I was feeding him for practically a whole hour… nightmare… he didn't smile until a couple of weeks ago (at 10 weeks).
15	difficult	She's definitely a more clingy baby than my first, she does not like to be put down, she doesn't lie down, she's quite sicky. She won't settle away from me.
17	difficult	The first few weeks he was just constantly sick, constantly in pain and screaming…. Jittery. He does it all the time, it's like he's startled and his hands sort of shake.
18	difficult	The first 3 weeks she screamed a lot, yeah it was constant all day screaming. She really wasn't contented at all. But she did sleep.

Note: Data of mother 9 was removed – previous stillbirth still affecting maternal mood

Appendix Three: Study Three

Appendix 3A. Study Three: Ethical Approval



Department of Psychology

ETHICS COMMITTEE

Memo

To: Carmen Power ([redacted])

From: Dr. Jeremy Tree
for Departmental Ethics Committee

Copy: Dr. Claire Williams, Dr. Amy Brown

Date: 28th May, 2014

Re: Birth experiences and infant temperament

Your proposed study "Birth experiences and infant temperament", has been reviewed and is approved. Provided that the information obtained is kept absolutely confidential and that no personally identifiable information is entered on computer, you may proceed with your studies.

Please ensure that the signed copy of this Ethical Approval, together with any other paperwork associated with your research, is included in your final write up.

In order for your study to be displayed on the **Experiment Management System (Participant Pool):**

Forward this approval via email to Dr. Irene Reppa ([redacted])

AND

Send a request for your study to be made visible, via the link on the EMS website (see Researcher Documentation for details).

Page 1

Appendix 3B. Study Three: Recruitment Advertisement

Online Advert

Hello

My name is Carmen and I am doing a postgraduate research project in Health Sciences at Swansea University exploring birth experiences and baby behaviour. I am looking for mothers with a baby aged 0 – 6 months to complete a questionnaire exploring their experiences of pregnancy and childbirth and thinking about their baby's behaviour and mood.

The questionnaire takes about 20 minutes to complete, and will ask you some questions about your pregnancy and birth, followed by questions about your baby (e.g. sleep, feeding) and your feelings. There are no right or wrong answers – I am interested in your honest experiences and opinions. Any information that you give in the questionnaire will only be used for the purposes of the study and will be confidential. You will not be identified from your answers in any way.

If you have a baby aged from birth to 6 months and would like to take part in my study, please follow the link below for further details and to participate in the survey. If you would like more information about the study before deciding whether to take part please contact me: [redacted]

Here is the link to the questionnaire: https://www.surveymonkey.com/s/childbirthexperiences

Thank you for your time

Carmen Power

Appendix 3C. Survey: Maternal Experiences of Childbirth and Infant Behaviour

Do you have a baby aged between birth and 6 months?

Thank you for taking the time to complete this questionnaire looking at your experience of childbirth. It will ask you some general background questions about yourself and your baby before focusing on the pregnancy and birth, your baby's behaviour since birth, and your feelings around caring for your baby. The aim is to better understand the relationship between childbirth experiences and young infant temperament.

If there are any questions you do not wish to answer for any reason please just leave them blank. Similarly if you do not wish to carry on completing the questionnaire for any reason please do not continue. Importantly if answering any of the questions raises concerns about yourself or your child in any way, or about other worries that you have, you should contact your health visitor or GP for further advice or support.

There are no right or wrong answers - we are interested in your honest experiences and opinions so please answer as fully as possible. Any information that you do give in the questionnaire will only be used for the purposes of the study, and will be kept confidential. You will not be identified from your answers in any way. If you wish to withdraw from the study you can do so by closing the browser. When you press the submit button at the end, your information will be anonymously added to the study.

If you have any questions please do not hesitate to get in contact with Carmen Power or supervisor Dr Amy Brown in one of the following ways:

Carmen Power email: [redacted]

Dr Amy Brown email: [redacted]
Phone: [redacted]

1. Please read through the following statements and tick your response to each one. If you can answer yes to each question please continue.

	Yes	No
I have read and understood the study information above	○	○
I understand that any information I give will be treated confidentially	○	○
I understand that any personal details will be anonymous	○	○
If I wish to withdraw from the study before completion I will close the browser	○	○
I understand that I am not obliged to take part in the study	○	○
I agree to take part in the study	○	○

2. Please read through the following statements and select your response to each one.
If you can answer yes in agreement to each statement please proceed with the questionnaire.

	Yes	No
I am 18 years or above	○	○
I have a baby aged between birth and 6 months	○	○
My baby has no major health problems	○	○
I have no major health problems	○	○
My baby weighed at least five pounds at birth	○	○
My baby was born after 37 weeks	○	○
My baby was not a multiple birth	○	○

Background information

Please fill this section out as accurately as you can. It is background information to the study. Any questions you do not know or do not wish to answer please leave blank.

3. Your age

4. Your highest level of education achieved

- ◯ No formal qualifications
- ◯ GCSE or equivalent
- ◯ A level or equivalent
- ◯ Degree or equivalent
- ◯ Vocational qualification
- ◯ Postgraduate or equivalent

Other (please specify)

5. Were you employed before the birth of your first child?

- ◯ Yes Full time
- ◯ Yes Part time
- ◯ No

6. Your occupation (if relevant)

7. Have you or are you planning to return to work?

- ◯ Yes full time
- ◯ Yes part time
- ◯ No

8. Your ethnic group

- ◯ White (British/ Irish/Other)
- ◯ Mixed/Multiple Ethnic Group (White Asian/ White Carribbean/Other)
- ◯ Asian/Asian British (Chinese/ Bangladeshi/ Pakistani/Other)
- ◯ Black African/ Black Carribbean/ Black British (Other)
- ◯ Other Ethnic Groups (Arab/ Other)

Other (please specify)

9. Where you live

- ◯ Wales
- ◯ England
- ◯ Scotland
- ◯ Ireland
- ◯ Northern Ireland
- ◯ Other

10. The first 3 letters of your postcode

11. Your approximate total monthly household income before tax (including any income from tax credits, benefits or savings)

- ◯ Less than £1000 / month
- ◯ £1001 - £1700 / month
- ◯ £1701 - £2700 / month
- ◯ £2701 - £4200 / month
- ◯ £4201 or more / month
- ◯ Rather not answer
- ◯ Don't know

Other (please specify)

12. Which best describes your relationship status?

- ◯ Married
- ◯ Cohabitting
- ◯ Single
- ◯ Partner (not living with)
- ◯ Divorced
- ◯ Widowed

13. How many children do you have?

◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5+

Your Pregnancy

The next questions and statements look at your recent experience of Pregnancy and Childbirth. Please indicate how much you agree or disagree with the following statements in relation to your experiences. Remember that pregnancy and childbirth are very personal experiences and there are no right or wrong answers. We are interested in looking at these birth experiences through the eyes of the mother.

14. Did you experience any complications during pregnancy? Please tick all that apply

- [ ] None
- [ ] Threatened miscarriage
- [ ] Unexplained bleeding
- [ ] Low lying placenta
- [ ] Placenta Praevia
- [ ] High blood pressure
- [ ] Pre eclampsia
- [ ] Gestational diabetes
- [ ] Baby too small for dates
- [ ] Baby too big for dates
- [ ] Antenatal depression
- [ ] Too much fluid
- [ ] Too little fluid
- [ ] Hyperemesis
- [ ] Obstetric cholestasis

Other (please specify)

15. During my pregnancy I ...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Felt happy and excited about the birth	○	○	○	○	○
Felt anxious and fearful about the birth	○	○	○	○	○
Felt calm	○	○	○	○	○
Felt stressed	○	○	○	○	○
Coped well with the pregnancy	○	○	○	○	○
Looked forward to the birth	○	○	○	○	○
Dreaded the birth	○	○	○	○	○
Had plenty of energy	○	○	○	○	○
Felt tired and drained	○	○	○	○	○
Enjoyed being pregnant	○	○	○	○	○
Found pregnancy difficult	○	○	○	○	○

Your Birth

Please answer these questions to the best of your ability. If you do not know the answer then please leave blank.

16. Where did you give birth?

- ◯ Hospital
- ◯ Home
- ◯ Midwife led unit

Other (please specify)

17. I am happy with the choice of where I gave birth

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

18. Was the birth

- ◯ Vaginal (spontaneous)
- ◯ Forceps delivery
- ◯ Ventouse delivery
- ◯ Planned Caesarean
- ◯ Emergency Caesarean

19. Did you have a birthing partner or companion?

- ◯ Yes birthing partner
- ◯ Yes a birthing companion e.g. doula / friend / relation
- ◯ Yes a birthing partner + companion
- ◯ No neither

20. How did your labour start? Please tick all that apply

- [ ] Naturally
- [ ] Membrane sweep
- [ ] Waters ruptured artificially to start labour
- [ ] Induced by pessary
- [ ] Induced by drip
- [ ] Induced by pessary and drip
- [ ] Planned caesarean section
- [ ] I don't know

Other (please specify)

21. Did any of the following occur during your labour?

	Yes	No	I don't know
Membranes artifically ruptured	○	○	○
Drip to speed up labour	○	○	○
Continuous monitoring	○	○	○
Trace to baby's head	○	○	○
Foetal blood sample	○	○	○

22. If you had an emergency caesarean section do you know why? Tick all that apply

- [ ] Pre-eclampsia
- [ ] Eclampsia
- [ ] Antepartum haemorrhage
- [ ] Cord prolapse
- [ ] Placenta difficulties
- [ ] Cephalopelvic disproportion
- [ ] Baby in distress
- [ ] Failed induction
- [ ] Failure to progress
- [ ] Labour had gone on too long
- [ ] Breech labour
- [ ] Baby did not descend enough
- [ ] Baby was in the wrong position
- [ ] Exhaustion
- [ ] Maternal illness
- [ ] I don't know

Other (please specify)

23. The first stage of labour is normally divided into two parts: the 'latent' and the 'active' stages. The latent stage is from the onset of contractions up until 'established labour' begins at 4cm dilation. Do you know how long this lasted (if applicable)?

24. The active stage of labour is from 4cm when contractions tend to become more regular and powerful and labour is considered to be 'established'. Do you know how long your active stage of labour was? If unsure please leave blank.

25. The second stage of labour is often known as the 'pushing stage'. Do you know how long this stage lasted?

26. After your baby had been born and it was time to deliver the placenta did you have an injection for this?

- ◯ No injection
- ◯ Injection (e.g. in leg)
- ◯ Injection through cannula
- ◯ Don't know

27. How painful would you rate labour on a scale of one to ten
(with one being not at all painful and ten being the worst pain imaginable)?

◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9 ◯ 10

28. Which of the following methods of pain relief and/or natural methods did you use during labour? Please tick all that apply

- [ ] None
- [ ] Gas and air
- [ ] Pethidine
- [ ] Meptid / equivalent
- [ ] Spinal block
- [ ] Epidural
- [ ] General anaesthetic
- [ ] Relaxation
- [ ] Water
- [ ] Controlled breathing
- [ ] Accupuncture
- [ ] Hypnobirthing
- [ ] Tens
- [ ] Homeopathy
- [ ] Reflexology
- [ ] Massage
- [ ] Visualisation / distraction techniques (e.g. music)

Other (please specify)

29. I am happy with my choice of pain relief and/or natural methods

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

30. Did you experience any of the following complications after the birth? Please tick all that apply

- [ ] None
- [ ] Manual removal of the placenta
- [ ] Severe headache
- [ ] Severe backache
- [ ] Hypertension
- [ ] Post-partum haemorrhage
- [ ] Post-partum eclampsia
- [ ] Shock
- [ ] Wound problems
- [ ] Circulation problems
- [ ] Maternal illness
- [ ] Anaemia
- [ ] Urinary problems
- [ ] Bowel problems (including constipation and piles)
- [ ] Breast problems
- [ ] Baby needing special care / intensive care

Other (please specify)

31. Did you experience any tearing? Please tick all that apply

- [ ] None
- [ ] Graze / superficial (no stitching)
- [ ] First degree
- [ ] Second degree
- [ ] Third degree
- [ ] Fourth degree
- [ ] Episiotomy
- [ ] I don't know

32. Did your baby

	Yes	No	Don't know
Suffer distress during the birth	○	○	○
Have meconium in the waters	○	○	○
Need resuscitation after birth	○	○	○

33. How did you feel during your birth?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Calm	○	○	○	○	○
Relaxed	○	○	○	○	○
Focused	○	○	○	○	○
Aware	○	○	○	○	○
'On another planet'	○	○	○	○	○
Confident	○	○	○	○	○
Happy	○	○	○	○	○
Strong	○	○	○	○	○
Determined	○	○	○	○	○
Energised	○	○	○	○	○
Ecstatic	○	○	○	○	○
Vulnerable	○	○	○	○	○
Afraid	○	○	○	○	○
Anxious	○	○	○	○	○
Confused	○	○	○	○	○
Ignored	○	○	○	○	○
Abandoned	○	○	○	○	○
Distressed	○	○	○	○	○
Overwhelmed	○	○	○	○	○
Exhausted	○	○	○	○	○

Other (please specify)

34. How did you feel after the birth?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Content	◯	◯	◯	◯	◯
Relaxed	◯	◯	◯	◯	◯
Relieved	◯	◯	◯	◯	◯
Proud	◯	◯	◯	◯	◯
Exhilarated	◯	◯	◯	◯	◯
Enamoured	◯	◯	◯	◯	◯
Euphoric	◯	◯	◯	◯	◯
Alert	◯	◯	◯	◯	◯
Detached	◯	◯	◯	◯	◯
Distressed	◯	◯	◯	◯	◯
Exhausted	◯	◯	◯	◯	◯
Vulnerable	◯	◯	◯	◯	◯
Confused	◯	◯	◯	◯	◯
Overwhelmed	◯	◯	◯	◯	◯
Angry	◯	◯	◯	◯	◯
Frustrated	◯	◯	◯	◯	◯
Traumatised	◯	◯	◯	◯	◯
Guilty	◯	◯	◯	◯	◯
Numb	◯	◯	◯	◯	◯
In pain	◯	◯	◯	◯	◯

Other (please specify)

35. How do you feel now about your birth?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
The birth went better than I expected	○	○	○	○	○
I think I had an easy birth	○	○	○	○	○
I felt comfortable during labour	○	○	○	○	○
I felt free to move about in labour	○	○	○	○	○
I stayed mostly on the bed during labour	○	○	○	○	○
I felt in control during labour	○	○	○	○	○
I felt emotionally supported	○	○	○	○	○
My midwife was helpful	○	○	○	○	○
I was given adequate information about everything that took place	○	○	○	○	○
I was told when or how to push	○	○	○	○	○
I felt free to listen to my body during labour and birthing	○	○	○	○	○
The baby's head seemed to ease itself out gently	○	○	○	○	○
Giving birth was a positive experience	○	○	○	○	○

About your baby

..

36. How old is your baby in weeks?

37. Is your baby a

- ◯ Girl
- ◯ Boy

38. How many weeks pregnant were you when your baby was born?

- ◯ Less than 37 weeks
- ◯ 37
- ◯ 38
- ◯ 39
- ◯ 40
- ◯ 41
- ◯ 42
- ◯ More than 42 weeks

39. How much did your baby weigh at the first weighing after birth?

40. How much did your baby weigh last time you checked?
(If not weighed recently please leave blank)

41. If you know, what was your baby's Apgar score one minute after birth?

42. And the Apgar score five minutes after birth?

43. Did you have skin-to-skin contact after the birth? (your baby being placed naked on your chest)

- ◯ Yes
- ◯ No
- ◯ Don't know

44. If so how soon after the birth did it occur?

45. How long was it for?

46. Thinking about your baby in the 24 hours after birth...

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
My baby's head looked bruised and swollen	◯	◯	◯	◯	◯
My baby appeared calm and relaxed	◯	◯	◯	◯	◯
My baby seemed irritable	◯	◯	◯	◯	◯
My baby was very sleepy	◯	◯	◯	◯	◯
My baby cried a lot	◯	◯	◯	◯	◯
My baby smiled	◯	◯	◯	◯	◯
My baby latched onto the breast easily	◯	◯	◯	◯	◯

47. How did you feed your baby for the first feed?

- ◯ Breastfed
- ◯ Expressed milk
- ◯ Formula fed
- ◯ Other

48. Are you currently breastfeeding?

- ◯ Yes exclusively
- ◯ Yes partly
- ◯ No

49. If you have breastfed and are no longer breastfeeding how old was your baby when you stopped?

50. Does your baby suffer from colic?

- ◯ Yes
- ◯ No
- ◯ Don't know

Your baby and your feelings

This section is about you and your baby over the previous 7 days.

51. In the following, a number of statements are given about baby's and parents' behaviour and feelings. Please answer each question by ticking one of the numbers. "0" is circled if the statement does "not at all apply". The choices "1, 2, 3, 4" indicate increasing degrees of agreement, and "5" indicates that the behaviour or feelings occur "very often/very much".

	0 (Not at all)	1	2	3	4	5 (Very much/often)
When I talk to my baby s/he seems to take notice	○	○	○	○	○	○
My baby has fussed before settling down	○	○	○	○	○	○
It makes me insecure when my baby cries	○	○	○	○	○	○
My baby has fussed or cried at times when I know s/he is not hungry	○	○	○	○	○	○
My baby has settled quickly and easily	○	○	○	○	○	○
I've felt confident about looking after my baby	○	○	○	○	○	○
My baby watches my face	○	○	○	○	○	○
During the last 24 hours I've needed to coax my baby to persuade her/him to settle after a feed	○	○	○	○	○	○
I've felt clumsy in caring for my baby	○	○	○	○	○	○
I would have liked more advice on what to do during this period	○	○	○	○	○	○
After feeds I've used rocking or cuddling to settle my baby	○	○	○	○	○	○
My baby clings to me when s/he is held	○	○	○	○	○	○
Looking after my baby has been more difficult than I expected	○	○	○	○	○	○

	0 (Not at all)	1	2	3	4	5 (Very much/often)
After feeds my baby's mood has been fussing or crying	○	○	○	○	○	○
When my baby is feeding s/he gazes into my eyes	○	○	○	○	○	○
I've been feeling anxious about coping	○	○	○	○	○	○
My baby's mood after a feed has varied from one feed to another	○	○	○	○	○	○
My baby has varied in how easy s/he is to settle	○	○	○	○	○	○
I think I've been coping alright with my baby	○	○	○	○	○	○
At this age my baby is disinterested in interacting with people	○	○	○	○	○	○
During the last 24 hours my baby's sleeping and waking behaviour has been disturbed by wind/hiccups	○	○	○	○	○	○
I've been afraid that I may drop my baby	○	○	○	○	○	○
I've asked for help when my baby is unsettled	○	○	○	○	○	○
My baby is really alert and attentive	○	○	○	○	○	○
In between night-time feeds my baby was fussing and crying	○	○	○	○	○	○
To settle my baby I've given her/him a top-up feed	○	○	○	○	○	○
I've felt worried I might hurt my baby when handling her/him	○	○	○	○	○	○
I think my baby is responsive	○	○	○	○	○	○
In between feeds my baby has been irritable	○	○	○	○	○	○

	0 (Not at all)	1	2	3	4	5 (Very much/often)
I've felt unsure whether I've been doing the right thing whilst looking after my baby	○	○	○	○	○	○
To settle my baby I've carried her/him around	○	○	○	○	○	○
When I play with my baby s/he responds straight away	○	○	○	○	○	○
I cope well with my baby when s/he is unsettled	○	○	○	○	○	○
The length of the period between feeds has varied	○	○	○	○	○	○
My baby has spent long periods between feeds unsettled or only settled if held	○	○	○	○	○	○
I think I've been making a good job of being a mother	○	○	○	○	○	○

Overall Impressions and Experiences

Your Baby and Yourself

52. Your Baby (a)

	-3 Very irritable	-2	-1	0	+1	+2	+3 Very calm
Overall how irritable is your baby?	○	○	○	○	○	○	○

53. b)

	-3 Very poor	-2	-1	0	+1	+2	+3 Very good
Overall how good a sleeper is your baby?	○	○	○	○	○	○	○

54. c)

	-3 Very drowsy	-2	-1	0	+1	+2	+3 Very alert
Overall how alert and responsive is your baby?	○	○	○	○	○	○	○

55. d)

	-3 Very difficult	-2	-1	0	+1	+2	+3 Very easy
Overall how difficult is your baby?	○	○	○	○	○	○	○

56. Yourself (a)

	-3 Very unsure	-2	-1	0	+1	+2	+3 Very confident
Overall how confident do you feel about coping with your baby?	○	○	○	○	○	○	○

57. b)

	-3 Very difficult	-2	-1	0	+1	+2	+3 Very easy
Overall how stressful do you find it looking after your baby?	○	○	○	○	○	○	○

58. c)

	-3 Very anxious	-2	-1	0	+1	+2	+3 Very composed
Generally how anxious a person do you think you are?	○	○	○	○	○	○	○

59. Thinking about feeding your baby (over the last few days), please answer each question by ticking one of the numbers. "0" is ticked if the statement does "not at all apply". The choices "1, 2, 3, 4" indicate increasing degrees of agreement, and "5" indicates that the behaviour or feelings occur "very often/very much".

	0 Not at all	1	2	3	4	5 Very much/often
During feeds my baby has tended to be awake and alert	○	○	○	○	○	○
During feeds my baby has tended to fuss and cry	○	○	○	○	○	○
My baby has been irritable during feeds	○	○	○	○	○	○
The mood of my baby during feeds has varied	○	○	○	○	○	○
During feeds my baby has tended to be drowsy	○	○	○	○	○	○
I've been enjoying feeding my baby during the last 24 hours	○	○	○	○	○	○
My baby's over-activity (kicking, turning head, etc.) has been making it difficult to feed him/her	○	○	○	○	○	○
My baby has been reluctant to suck	○	○	○	○	○	○
After feeds my baby has been lively and active	○	○	○	○	○	○
During the last 24 hours my baby has interrupted feeding by becoming drowsy or sleepy	○	○	○	○	○	○
During this period feeding has been easy	○	○	○	○	○	○
During the last 24 hours my baby has interrupted feeding by wind, hiccups or tummy ache	○	○	○	○	○	○

	0 Not at all	1	2	3	4	5 Very much/often
After feeds my baby's mood has been awake and alert	○	○	○	○	○	○
During the last 24 hours my baby has interrupted feeding by fussing and crying	○	○	○	○	○	○
I've asked for help to settle my baby	○	○	○	○	○	○

60. If you are breastfeeding ...

	0 Not at all	1	2	3	4	5 Very much/often
I've had problems with breastfeeding because I've been tense	○	○	○	○	○	○
My lack of technique has held up breastfeeding	○	○	○	○	○	○
I felt I haven't always had enough milk to satisfy my baby	○	○	○	○	○	○
My lack of confidence has held up breastfeeding	○	○	○	○	○	○
The after-effects of birth have been making breastfeeding difficult for me	○	○	○	○	○	○
Breastfeeding has been hampered by the conflicting advice I've been given	○	○	○	○	○	○

About you

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

61. How much do you see yourself as:

	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
Extraverted, enthusiastic	◯	◯	◯	◯	◯	◯	◯
Critical, Quarrelsome	◯	◯	◯	◯	◯	◯	◯
Dependable, self disciplined	◯	◯	◯	◯	◯	◯	◯
Anxious, easily upset	◯	◯	◯	◯	◯	◯	◯
Open to new experiences, complex	◯	◯	◯	◯	◯	◯	◯
Reserved, quiet	◯	◯	◯	◯	◯	◯	◯
Sympathetic, warm	◯	◯	◯	◯	◯	◯	◯
Disorganised, careless	◯	◯	◯	◯	◯	◯	◯
Calm, emotionally stable	◯	◯	◯	◯	◯	◯	◯
Conventional, uncreative	◯	◯	◯	◯	◯	◯	◯

If anything crops up which concerns or worries you in the next section, please contact your health visitor or doctor for the appropriate support. As you have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt IN THE PAST 7 DAYS, not just how you feel today.

62. I have been able to laugh and see the funny side of things

- ◯ As much as I always could
- ◯ Not quite so much now
- ◯ Definitely not so much now
- ◯ Not at all

63. I have looked forward with enjoyment to things

- ◯ As much as I ever did
- ◯ Rather less than I used to
- ◯ Definitely less than I used to
- ◯ Hardly at all

64. I have blamed myself unecessarily when things went wrong

- ◯ Yes most of the time
- ◯ Yes some of the time
- ◯ Not very often
- ◯ No never

65. I have been anxious or worried for no good reason

- ◯ No not at all
- ◯ Hardly ever
- ◯ Yes sometimes
- ◯ Yes very often

66. I have felt scared or panicky for no good reason

- ◯ Yes quite a lot
- ◯ Yes sometimes
- ◯ No not much
- ◯ No not at all

67. Things have been getting on top of me

- ◯ Yes most of the time I haven't been able to cope at all
- ◯ Yes sometimes I haven't been coping as well as usual
- ◯ No most of the time I have coped quite well
- ◯ No I have been coping as well as ever

68. I have been so unhappy that I have had difficulty sleeping

- ◯ Yes most of the time
- ◯ Yes sometimes
- ◯ Not very often
- ◯ No not at all

69. I have felt sad or miserable

- ◯ Yes most of the time
- ◯ Yes quite often
- ◯ Not very often
- ◯ No not at all

70. I have been so unhappy that I have been crying

- ◯ Yes most of the time
- ◯ Yes quite often
- ◯ Only occasionally
- ◯ No never

71. The thought of harming myself has occurred to me

- ◯ Yes quite often
- ◯ Sometimes
- ◯ Hardly ever
- ◯ Never

72. A number of statements which people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you feel right now, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at all	Somewhat	Moderately	Very much
I feel calm	◯	◯	◯	◯
I am tense	◯	◯	◯	◯
I feel upset	◯	◯	◯	◯
I am relaxed	◯	◯	◯	◯
I feel content	◯	◯	◯	◯
I am worried	◯	◯	◯	◯

This is the end of the questionnaire. Thank you very much for taking the time to complete it.
Any questions please get in contact via the ways listed at the start of the questionnaire.
Please remember all responses will be treated confidentially.

Some people experience worries or concerns that arise as part of, or alongside, being a parent. It is possible that completing this questionnaire may have drawn your attention to problems you experience as a parent and/or other factors. If you feel that talking to someone might help with these problems we would strongly advise you to contact your Health Visitor or GP. If they cannot help you they should be able to put you in contact with someone who can.

The address to write to the Birth Trauma Association for support is:

Birth Trauma Association
PO Box 671
Ipswich
Suffolk
IP1 9AT

Alternatively, PANDAS Foundation provide advice and support for families suffering from pre and postnatal depressive illnesses. Their helpline is: 0843 28 98 401.

73. We may conduct some follow up research or a similar study in the future, for example a longitudinal study on childhood temperament in relation to birth experiences. If you would be willing to be contacted with details of the study as a possible future participant please enter your email address below. Your details remain confidential at all times and will not be passed on to any other persons or organisations.Thank you

Appendix 3D. Summary Table of factors affecting 24 Hour Baby and MABS

Outcome measures	Significant independent variables	Predictor variables
24 Hr Baby	***Associated factors***	***Post – regression factors***
Cry-Fuss	(Gest. Age*), No. Children (Birth order)***, Preg. Comps.***, PN Comps. ***, Birth Place (BP)***, (Latent stage*), Active Stage ***, 2nd Stage***, Natural Start***, *pre-labour:* ARM**, Drip**, Pess & Drip***, *in-labour:* ARM***, Acceleration***, EFM***, FSE***, FBS***, Pain***, (No Med.*), G&A***, Pethidine***, Epidural***, Relaxation***, Water***, Hypnobirth (HB)***, Tear or Episiotomy**, Foetal Distress***, Meconium***, Resuscitation**, Assisted Birth***, Gentle Birth Head***, Skin2Skin***, First Feed**, Positive Emotions Pregnancy***, Positive Physical Pregnancy***, Pos. BE***, Neglected BE***, Aware-Alert BE***, Anxious-Afraid***, PN Distress***, PN Pos.***, PN Phys. Well.***, Experience Pos.***, Exp. Supported***, Experience Directed***, Extrovert***, Conscientious**, Emotional Stability***, Open**, (EPDS***), State Anxiety***	Assisted birth*** Positive Birth Ems. (-)*** Postnatal Distress*** STAI State Anxiety***
Alert-Content	Gender**, Mother Age**, (Income*), No. Children***, (Mother Educ.*), Pregnancy Comps.***, PN Comps. ***, Birth Place***, Natural start***, *pre-labour:* ARM**, Pessary**, Drip**, Pess & Drip**, *in-labour:* ARM***, Accel.***, EFM***, FSE***, FBS***, Pain***, No med.**, G&A***, Pethidine***, Epidural***, Relaxation***, (Water*), (Breathing*), HB***, (Tear-Epis.*), Visualisation**, Assisted Birth***, Foetal Distress***, (Meconium*), Resusc.***, Gentle Birth***, Sk2Sk***, First Feed***, Pos. Emot. Preg.***, Pos. Phys. Preg.***, Pos. BE***, Neglected BE***, Aware-Alert BE***, Anxious-Afraid***, PN distress***, PN Pos.***, PN Phys. Well.***, Experience Pos.***, Exp. Supported***, Exp. Directed***, Extrovert***, Agreeable**, Emotional Stability***, Open***, (EPDS***), State Anxiety***	Female Infant* Number of Children*** Income ≤ £27,000** Assisted Birth (-)** First Feed Breastfed*** Positive Birth Emotions*** PN Physical Wellbeing** Extroversion** Openness**
MABS	**Associated Factors**	**Post – Regression**
Alert-Responsive	Infant Age***, Mother Education**, (BP*), Latent stage**, Sweep**, (Gentle Birth Head*), Positive Emot. Preg.** (Pos. Phys. Preg.*), Pos. BE***, Neglected BE***, Aware-Alert BE**, Anxious-Afraid***, PN Distress***, PN Pos.***, Exp. Pos.***, Exp. Supported***, (Exp. Directed*),	Infant Age*** Higher Education (-)** Postnatal Positive*** Experience Supported*

	(Extrovert*), Agreeable**, (Emotional Stability*), Openness***, EPDS***, (State Anxiety***)	Openness**
Unsettled-Irregular	Infant Age***, (Birth weight*), No. Children/Birth order**, Gender**, Preg. Comps.**, (PN Comps.*), BP**, Active Stage**, 2nd Stage**, (Natural start*), *in labour:* (ARM*), (Accel.*), EFM**, (FSE*), (Assisted Birth*), Pain***, (G&A*), Epidural**, (HB*), Foetal Distress***, GentleBirth***, Sk2Sk**, (First Feed*), Positive Emot. Preg.***, Pos. Phys. Preg.***, Pos. BE***, Neglected BE***, Aware-Alert BE**, Anxious-Afraid BE***, PN distress***, PN Pos.***, PN Phys. Wellbeing***, Experience Pos.***, Exp. Supported**, Exp. Directed***, Extrovert***, Agreeable***, Conscientious***, Emotional Stability***, Open***, EPDS***, (State Anxiety***)	Infant Age (-)*** Anxious-Afraid Birth Emotions*** EPDS total***
Lack of Confidence Caretaking	No. Children***, Preg. Comps.***, (PN Comps.*), Active Stage**, 2nd Stage**, Natural Start***, Pess & Drip**, *in-labour:* (ARM*), (Accel.*), EFM**, (FBS*), Assisted Birth**, Emerg. CS**, Pain**, Pethidine**, Epidural***, Foetal Distress**, (Gentle Birth*), (Sk2Sk*), Pos. Emot. Preg.***, Pos. Phys. Preg.**, Pos. BE**, Neglected BE***, Aware-Alert BE**, Anxious-Afraid BE***, PN Distress***, PN Pos.**, PN Phys. Well.***, Exp. Pos.***, Exp. Supported**, Exp. Directed***, (Extroversion*), Conscientiousness**, Emotional Stability***, EPDS***, (State Anxiety***)	No. of Children (-)*** EPDS total***
Easiness	Infant Age***, Mother Educ.**, (Preg. Comps.*), (Pain*), (Epidural*), (Reflexology* - *small group*), (Gentle Birth*), Birth Partner & Companion**, (Sk2Sk*), Positive Emot. Preg.***, Pos. Phys. Preg.**, Pos. BE***, Neglected BE**, Anxious-Afraid BE***, PN Distress***, PN Positive***, PN Physical Wellbeing***, Exp. Pos.***, (Experience Supported*), (Extrovert*), Agreeable**, (Conscientious*), Openness***, Emotional Stability***, EPDS***, (State Anxiety***)	Infant Age*** Higher Education (-)* Postnatal Positive*** Birth Partner & Comp.** Openness*** EPDS total (-)**
Global Confidence	No. Children***, (Preg. Comps.*), PN Comps.**, (Pain*), (Pethidine*), Tear-Epis.**, Foetal distress***, (Resusc.*), Gentle Birth**, Pos. Emot. Preg.***, Pos. Phys. Preg.***, BE Pos.***, (BE Neglected*), BE Aware-Alert**, BE Anxious-Afraid***, PN Distress***, PN Positive***, PN Physical Wellbeing***, Experience Positive***, Exp. Supported**, Extroversion***, Agreeableness***, Conscientiousness***, Emotional Stability***, Openness***, EPDS***, (State Anxiety***)	Postnatal Positive** PN Physical Wellbeing** Emotional Stability** EPDS total (-)***
Alert during Feeds	Infant Age***, Mother educ.**, (Acupuncture* - *small group*), (Current Feeding Method*), (Pos. Phys. Preg.*), (BE Pos.*), (PN Pos.*),	Infant Age*** Higher Education (-)*

	(Extrovert*), Conscientious***, (Emotional Stability*), (Open*), EPDS**, (State Anxiety*)	BF Currently (-)*** Conscientiousness***
Irritable during Feeds	Infant Age***, Birth Weight***, No. Children***, Preg. Comps.**, PN Comps.**, (*in-labour* ARM*), (Pethidine*), Foetal Distress**, Positive Emotional Pregnancy***, Pos. Physical Pregnancy***, BE Pos.**, BE Aware-Alert**, BE Anxious-Afraid***, PN Distress***, PN Pos.***, PN Phys. Well.***, Exp. Pos.**, Extroversion**, Agreeable**, (Conscientious*), Emotional Stability***, Openness***, EPDS***, (State Anxiety***)	Infant age (-)*** Birth Weight (-)** PN Phys Wellbeing (-)** EPDS total***
Lack of Confidence Breast-feeding	Infant age**, Gestational Age**, No. Children***, (Preg. Comps.*), PN Comps.***, BP**, (Active Stage*), 2nd Stage**, Natural Start***, Sweep**, Pess & Drip**, *in-labour:* ARM***, Accel.***, EFM***, (FBS*), Assisted Birth***, (G&A*), (Spinal*), Epidural***, Foetal Distress***, Meconium**, Gentle Birth Head***, Sk2Sk**, (Current Feed*), Pos. Emotional Pregnancy***, BE Neglected***, BE Aware-Alert**, BE Anxious-Afraid***, PN Distressed***, (PN Pos.*), PN Phys Well.***, (Exp. Supported*), Exp. Directed***, Extrovert**, Emotional Stability***, EPDS***, (State Anxiety***)	No. of Children (-)*** Meconium in Waters*** EPDS total***

* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Note: bracketed factors were removed in regressions (stage 2) – see Chapter Six methods

Abbreviations: BP – birth place, BE – birth emotions, PN – postnatal, No. – number, Educ. – education, Preg. – pregnancy, Phys. – physical, Pos. – positive, Exp. – experience, Comps. – complications, HB – hypnobirth, Resus. – resuscitation, Sk2Sk – skin to skin, Med. – pain relief medication, G&A – gas and air, ARM – artificial rupture of membranes, Pess. – pessary, Accel. – acceleration of labour, EFM – electronic foetal monitoring, FSE – foetal scalp electrode, FBS – foetal blood sample, EPDS – Edinburgh Postnatal Depression Scale, Em./Emot. – emotion/s/al, Epis. – episiotomy