

A Retrospective, Cross-Sectional Study of an In-Home Breastfeeding Programme

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A thesis submitted in accordance with the requirements
for admission to the Degree of Doctor of Philosophy

Australian Catholic University, Brisbane, Australia

January 2014

Certificate of Authorship / Originality

I hereby declare that the work herein, is the result of my own investigations and all references to ideas and work of other researchers have been specifically acknowledged. I hereby certify that the work embodied in this thesis has not already been accepted in substance for any degree and is not being currently submitted in candidature for any other degree.

Signature of the candidate:

Date:

Robyn Enid (Kearsley) Thompson

A woman is the full circle. Within her is the power to create, nurture and transform.

~ Diane Mariechild ~

Dedicated to the dynamic women influencing my life

My mother Nita Emily Kearsley (Markham) 92 years

Her sister Doris Muriel Quill (Markham) (1917 – 2012)

My mother-in-law Alice Isabel Thompson (Twining) (1915 - 1984) and

Joanne Marie Thompson my daughter

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Acknowledgements

A Postgraduate Award (ACUPA) granted by the Australian Catholic University (ACU) supported this thesis. This study would not have eventuated without the timely recognition of my work and the positive encouragement and professional direction of my three supervisors Professors Sue Kildea, Lesley Barclay and Sue Kruske. Albeit late in my career, they are the reason for my transition from practice to research. I thank each of them for their similar but different expertise and for giving me this opportunity to continue past retirement in my much-loved profession.

My sincere thanks to the Darebin Maternal & Child Health (MCH) and Darebin City Council managements for the professional autonomy granted me during the Darebin In-Home Breastfeeding (DIHB) programme. Thank you to Joanne Fittock, Carol Ewart, Jan Black, Rhys Thomas and Karin Linden and the Maternal and Child Health nurses for their individual expertise and ensuring that breastfeeding women residing in Darebin had access to the programme. Special appreciation goes to Karin Linden, Senior Research Project Officer, for her unfailing support with the data analysis over the entire programme and the study. To Dr Jennifer Peat, Honorary Professor Research Consultant (ACU) and Alex McGeigh Research Assistant, Midwifery Research Unit, thank you for your support. Special thanks to the Mater Research Unit (MRU) for including me in their team, to Kathy Hassad and Tonia Graveson for their welcoming approach to the day-to-day intricacies involved with students.

The contribution of many people is the catalyst for learning something new every day. Women, their partners, babies, grandmothers and families invited me to into their homes. Through these families I was provided the opportunity of learning by continuous midwifery care, teaching me ancestral wisdom and self-knowledge, while sharing their

experiences of pregnancy, labour, birth and breastfeeding. Thank you to the women and their families who participated and consented to share their (de-identified) data, photographs and stories. To my family and friends, specially Robyn McKenzie (Noone) for her life-long friendship, colleagues and fellow students, thank you for your unrelenting support and unreservedly sharing your time, patience and knowledge over many years.

Stepping back in time, I gratefully acknowledge, Verna Rodda (deceased), Sheena Scholten and Grace Green, for guiding my positive midwifery pathway at Western General (formerly Footscray Hospital). Thank you to my long-term colleague Adele White, Jan Robinson, Maggie Lecky-Thompson and Caroline Flint, who were inspirational in my professional progress. Marg Phelan, Meryl Hammond and Maureen (Mo) Davy for the journey we shared with Darwin women and families. Clare Lane for her midwifery support through birthing with women at home and to Sally-Ann Brown and Carolyn Hastie for their constant caring. Professor Sally Tracy, Dr Barbara Vernon and David Vernon for their interest and encouragement in my work. Justine Caines for her political expertise and unlimited energy standing strong for the rights of Australian women and midwives. Respected medical colleagues, obstetricians George Thoms (deceased) and Bruce Sutherland (retired), Doctors Peter Lucas, Sam Heard and their life partners for their unquestionable support and professional assistance.

I am grateful for the wisdom and unconditional nurturing of my late mother-in law Alice Thompson. Much credit goes to my husband Glen for his consistent side-by-side support and recognition of the importance of partnership freedom. To my children Mark, Joanne and Melanie (stillborn) and Emi my daughter-in-law, thank you for teaching me about pregnancy, labour, birth, breastfeeding, the transition to motherhood, the teenage years and grandmothering. I lovingly thank Joanne, Marie and Jacki, my three soul mates, for the

fun, music, worldwide travels and their professional acuity in developing my breastfeeding education systems. Thank you to my brother Owen and sister-in-law Kerry for inviting me to be their midwife for the birth of Emma 24 years ago. To my son Mark and daughter-in-law Emi thank you for the privilege of being your midwife for the birth of Joshua in Japan and 18 months later Kai in Melbourne. I respect the unconditional assistance of the Japanese Midwives Association (JMA), paving the way for me to be with Emi to birth at home in Japan in March 1993.

The ebb and flow of birth and death have been integral to my learning about continuous care through the life cycle. Kai was born at home September 23rd 1995 just six days before my father died after a tragic medical mishap. Mark my son was born just months before my grandmother died in 1965. What a privilege it was to be with my good friend Sheena Scholten to help her with the gentle transition of her beautiful daughter ‘young’ Sheena at home. Comforted by her mother and her brothers Andrew and John, young Sheena passed peacefully at home, just prior to her 27th birthday, 1963-1990. I am grateful to Emi’s mother Tomiko and her late husband Mitsuake. They travelled from Japan to Mark and Emi’s home in Melbourne, Mitsuake diagnosed with pancreatic cancer, wished to have a dignified and peaceful passing at home with his family beside him. My colleague, Doctor Peter Lucas and his partner Susie Simms, were pivotal in helping us with Mitsuake and are now involved in the medical care of my once dynamic, 93 year old mother, who is incapacitated with Alzheimer’s.

Cheers to my now adult grandsons Joshua 21, Kai 19 and my niece Emma 24 for their accumulative years of wisdom as they continue to teach me.

Prologue



Uluru Dreaming by Sharon Brown. This collection of fabrics, the piecing and sewing together took four years to complete (Brown, 2002).

Thesis writing, like the ancient, creative art of quilting is a long intriguing process. A collection of small pieces meticulously arranged and rearranged, accomplishes a meaningful piece of re-defined patchwork portraying individual depth, dimension, experience and knowledge

Robyn Thompson

This study prompted me to reflect on many aspects of my personal and professional life and while each step of the journey has involved unique learning, the most significant experience has been a major shift from practice to research. Writing has placed together the numerous pieces that have influenced many experiences. While raising a young family, the time was right after nine years at home to return to professional life, balancing the responsibilities of study, work and family commitments. As a mature age student on a rapid learning curve, I completed consecutive post-graduate qualifications for Midwifery, Child and Family Health and a Bachelor of Applied Science. New experiences extended through the life cycle from gentle birth to dignified death at home and evolved into 'being with women and babies' through the spectrum from early pregnancy to six postnatal weeks and up to school age.

As a hospital employed midwife I contributed to restructuring the antenatal outpatients and the labour ward. The emphasis for this project was introducing a welcoming, woman-friendly environment through aesthetic improvements, departmental process

reorganisation, capital works and structural remodelling. Personalising administrative processing reduced waiting times, increased choices and the freedom for increased activity for women rather than confinement during labour. More about my professional experiences is published in the book 'With Women' (Vernon, 2007).

For the first decade of my hospital based midwifery experience it was considered best practice to assist women to a vaginal birth. Experienced midwives taught me how to midwife with women who gave birth to twins and breech babies without medical assistance. Caesarean Section was considered major abdominal surgery that should be avoided when possible. In the 1970s and 1980s medical assistance was readily available and only if needed. There was unwritten reasonable and responsible cooperation between women, midwives, general practitioners and obstetricians. This professional relationship changed in the late 1980s when midwife autonomy diminished as the number of obstetric registrars, resident doctors and medical students increased. The autonomous role of the midwife transitioned to the medicalised midwife with increasing induction of labour and resultant obstetric interventions that enveloped women and the natural labour and birth process.

My change from hospital employment to self-employed midwifery in 1987 was first stimulated by listening to presentations by midwifery leaders who were working in their own practices and later by a chance meeting with members of the homebirth group in Melbourne. The Darebin In-Home Breastfeeding programme was initially conducted in parallel with my private midwifery and breastfeeding practice. I found myself intrigued by the distinct difference in the practice of breastfeeding and the complications observed between the women referred to the Darebin programme and those who gave birth at home.

Through this research and future writing, I look forward to encouraging gentler, mother-baby-friendly breastfeeding practice. I also look forward to encouraging women, midwives and obstetricians to consider how they can participate harmoniously, to expand women's self-confidence and relinquish unnecessary professional intervention in the labour and birth process. Most importantly, I hope to promote how to keep mother and baby together from the moment of birth and facilitate uninterrupted breastfeeding for at least the crucial first 72 postpartum hours. Ultimately, my desire is to share the study results through this thesis, future presentations, publications and education and to participate in further research.

Abstract

Background: Breastfeeding complications impact on the woman's ability to initiate and sustain breastfeeding. A local government in-home breastfeeding programme was established to provide support for breastfeeding women after hospital discharge. A purpose built database to record maternal-infant data was piloted during 2001-2003 and data continued to be collected until 2007. This thesis reports on the analysis of the data collection 2003-2007, including demographic information, presenting complications, observational, diagnostic and photographic data.

Research Questions: What were the main characteristics and experiences of the women with breastfeeding complications who presented for professional assistance through the Darebin In-Home Breastfeeding programme? What are the implications for breastfeeding women and midwifery practice, from the analysis and findings of this data?

Methods: A retrospective, cross-sectional analysis of breastfeeding data using descriptive, bivariate and logistic regression analysis. This analysis was conducted to determine the prevalence of the presenting complications and associated antecedents to the complications.

Results: Australian born (82.6%), primiparous (72.6%) older women (mean age 34 years) who had an abdominal delivery rate of (35.2%) with a 38.6% regional and 27.8% intramuscular administration of narcotics in labour and delivery were overrepresented when compared to the national averages. Of the 653 retrospectively analysed records, nipple trauma was the most common presenting complication in 78.0% of the study participants. Logistic regression analyses showed statistical association of nipple trauma with facio-mandibular asymmetry (OR = 8.83, 95% CI [1.05, 73.95]), nipple malignment

(OR = 2.75, 95% CI [1.21,6.28]), the cross-cradle hold (OR = 1.78, 95% CI [0.93,3.41]) and inflammatory mastitis (OR = 3.21, 95% CI [1.63,6.33]). At the completion of one in-home breastfeeding session, 92.5% of the participants reported either partially or fully reaching their goal of pain relieved breastfeeding that continued despite existing trauma.

Implications for Midwifery Practice: Professionalisation of labour, birth and breastfeeding disturbs immediate postpartum mother-baby union. Delay and interruption to breastfeeding over the first 72 postpartum hours interferes with bio-physiological milk production, inhibits the unique sequence of neuro-sensory mammalian behaviours and challenges the physiological stabilisation of the newborn. Self-directed mother-baby breastfeeding that involved changes to the practice of nipple malalignment and fine-tuning to achieve facio-mandibular symmetry was introduced to relieve painful nipple trauma. These principles appear to have potential to reduce the risk of common breast and nipple complications.

CHAPTER ONE: INTRODUCTION

Introduction

This thesis first describes the Darebin In-Home Breastfeeding (DIHB) programme and then the retrospective analysis of maternal-infant records ($n = 653$) derived from the programme for the study. The programme was initiated, developed and delivered between 2001-2007 and was specifically designed to meet the needs of Darebin women with breastfeeding complications. The author undertook the establishment of the programme, the data collection and the data analysis. The programme data for the four years 2003-2007 were retrospectively analysed for this study.

My own role in the study has been identified and justified by using limited autoethnography (Arnold, 2011). This has allowed my professional knowledge, experiences, participative observations, actions, education and academic thinking to be openly acknowledged to bring together a richer mix of the data and enhanced analysis (Chang, 2008).

A retrospective analysis of the records ($n = 653$) of the breastfeeding women who participated in the programme was conducted and is the focus of the analysis and findings of this thesis. This thesis explores and describes the breastfeeding problems, observations, the diagnoses and the possible reasons for the presenting complications.

Programme Overview 2001-2007

Background

To place this study in context, an overview of the in-home breastfeeding programme 2001-2007 is provided. The purpose of the programme was to support the growing demand for breastfeeding assistance in the Darebin community.

During 2000, I was providing relieving maternal and child health (MCH) services for the City of Darebin. The nurses working in the community based local government centres found that their practice time had become increasingly absorbed with women returning home from hospital who were requesting assistance with breastfeeding complications. The increased demand impacted on the remainder of the time the nurses could spend with other clients and some felt they did not have the time or experience to deal with the range of presenting complications.

My practice over the past 25 years has included women who were referred with breastfeeding complications. In 2001, a position specific to the provision of an in-home breastfeeding programme was integrated into the Darebin MCH service and funded by the Darebin local government to meet these increasing demands. I was appointed to this inaugural position to design, develop, deliver and report on a suitable programme. In-home appointments were arranged for three or more days per week, however the service was not extended to weekends and public holidays.

During the programme, data were recorded contemporaneously while using a database to record responses to the same sequence of questions asked for each woman. The initial database was one I had developed for my midwifery and breastfeeding practice. This version was revised, developed and expanded over the first two years of the programme

with the assistance of local government staff. The recording and regular analysis of the data from the outset showed a consistency in the type of breastfeeding problems. The senior research analyst for the Darebin local government was appointed to assist with the de-identification, coding, statistical analysis and storage of the programme data. In the first instance simple descriptive analysis was completed for the years 2001-2003, after this the database was modified. Data collected from the final iteration of this database (2003-2007) has been used in this thesis.

The Setting

The programme was set in Darebin, a metropolitan region 20 kilometres north of Melbourne, Australia. Darebin is a local government precinct that encompasses a geographical area of 53 square kilometres. At the time of the programme (2001 to 2007) twenty-one qualified MCH nurses (14.7 full-time equivalent) provided services out of 11 centres across the nine suburbs. During 2001-2007 over 128,000 people resided in this culturally diverse community. Of these 35.0% originated from 148 countries. One in three people were from non-English speaking countries, there were 105 different languages and more than 40.0% of the people spoke languages other than English at home. As at the 30th June 2008 the Darebin population was 137,360 with 10.8% being children from birth to eight years (Victorian Government, 2010).

Transition from Hospital to Community Services

In the state of Victoria, the government Registrar of Births, Deaths and Marriages requires notification in writing of a live born baby to be lodged within 21 days of birth by the responsible person (Victorian Government: Registration of Births, 1996). The midwife present with the woman at the time of birth completes a confidential birth notification and the hospital's administration ensures transmission of the notice to the respective local

government services, within the predetermined boundaries. The local governments' administrative departments are responsible for the distribution of the confidential birth notices to the appropriate MCH nurses within the local government boundaries.

These systems effectively mean that no mother or baby should miss having contact with and ongoing access to, the local MCH nurse in the community following hospital discharge. This support for mothers and babies is available until the children are school age.

Referral Process

Though resources were limited initially, there was no exclusion of women accessing the in-home programme who lived within the geographical boundaries. The Darebin Council allocated increased resources with demand, which was supported by regular reporting of the data and client satisfaction with the programme. The MCH nurses referred the majority of women to the programme. A small number of referrals were also received from the Australian Breastfeeding Association (ABA), midwife colleagues, hospital staff and community medical practitioners. Some were referred by the MCH after-hours telephone line or by other women and a few women residing outside the boundaries self-referred via word-of-mouth, or were referred by another professional.

Coordination of the In-Home Sessions

The coordination of the in-home sessions allowed for women to telephone in advance to make a tentative booking that was confirmed on the morning of the planned session. This arrangement identified a mutually agreed approximate arrival time that was based on the starting time of earlier breastfeeds. The in-home service accommodated three or four women per day, over three or four days per week. The number of days per week remained flexible, increasing and decreasing according to demand. The appointment times would

sometimes be adjusted to accommodate occasional impromptu requests from MCH nurses calling for rapid-response assistance for a small number of women. The travel time between appointments ranged between five to 20 minutes, depending on traffic in the region. This system worked without too much disruption and very few appointments were rearranged. My annual leave and conference leave were pre-planned. My position was not filled in my absence, however the women did have access to MCH nurses in their community clinics.

Meeting with women in the privacy of their homes provided an ideal environment and was reported by the women to be convenient, flexible and relaxed. After the initial greetings and a short settling in period, a detailed collection of information commenced and was entered onto an electronic record as explained below. This included discussion about the informed consent for recording and storing information and photography according to the Privacy Act also explained below. Permission was sought from the women in advance for students and other professionals wanting to attend the sessions to observe.

The in-home sessions were tailored to meet the needs of the individual mother and baby and timed to coincide when the baby was due to feed. An unhurried, observed breastfeed followed when the baby's cues indicated the time was right. Ideally, it was preferable to observe a full breastfeed that synchronised with the baby's natural waking time. Without this timing the babies were more likely to snack feed rather than complete a breastfeed. Completing a full breastfeed involved the baby feeding to self-determined satisfaction using both breasts. The breastfeed averaged one-hour, this included a 'rest-stretch-digest' [my language] period between the first and second breast to ensure time for digestion. Another 45 minutes to one hour allowed for individual education, further discussion, questions, answers, completion of data collection and a negotiated ongoing breastfeeding

plan. This one-to-one time and recording of comprehensive data gave me the opportunity to gain awareness of the social and physical environment that influenced these women and their babies. During these closely observed (hands-off) sessions I had the opportunity to identify and share information about multiple factors influencing the individual breastfeeding women.

Breastfeeding Observations

Attention to detail was required while talking with the women and observing them breastfeed. The contemporaneous recording of consistent detailed data was sensitively gathered. The primary intent was to consider the individual woman's experience of pain and be mindfully aware of any physical trauma and her emotional state while facilitating a calm, unhurried environment for her to breastfeed. This was necessary to reduce the fear or anxiety associated with painful trauma. Detailed attention was paid to the baby's feeding, communication cues, body language, facial expressions and reflexes. Individual strategies were aimed at expediting pain free breastfeeding, restoring maternal confidence and the re-commencement or continuation of breastfeeding in the shortest possible time.

The Database

The development of the database was based on 40 years of professional midwifery experience; 25 of those years were in the home environment where I was accustomed to being with women for the duration of pregnancy, labour, birth and breastfeeding for up to six postnatal weeks. I recalled being struck by the difference in the breastfeeding issues that I experienced with women who had birthed in hospital, compared to women who birthed at home who rarely appeared to have problems.

Modifications were made to improve the design and layout of the electronic database during the first two years of it operating at Darebin, 2001 and 2002. These modifications

resulted in improved and consistent data being collected over the last four years of the programme (2003-2007). The modifications also accommodated the use of a hand-held Personal Data Assistant (PDA) minimising technological obtrusion during the interviews and allowing for questions, responses and data entry to flow with the observations and discussions. The multiple horizontal columns were converted to two user-friendly vertical columns to fit the PDA screen. The final Excel database contained 18 main sections with 12 sub-sections for quantitative data entries. There were also 12 descriptive sections to record short-text notations such as the women's comments, my own observations, recommendations and any other relevant information. The sections of the database can be seen at Appendix 4.

Regular Programme Monitoring and Evaluation

During the programme, the data were regularly monitored to evaluate the presenting problems and outcomes and to establish if the programme continued to meet the requirements of the women. Additionally, the first assessment made by the women was recorded at the end of the observed breastfeed. This was done to capture an immediate response to the outcome of the breastfeed based on any modifications that were undertaken following my suggestions. The women were asked to compare this breastfeed with previous feeds. On a scale of one to five the women rated their experience of the observed breastfeed from no improvement (1) through to excellent improvement (5).

The second assessment made by the women was at the completion of the two-hour session. The women were asked to rate their experience on a scale of one to three if they had fully (1), partially (2), or not achieved (3) their overall goal for an improved understanding of breastfeeding during the entire session. In addition, telephone calls and written correspondence sent to and stored at the central MCH office were received via unsolicited

feedback. This information was not recorded in the database and has not been used in this thesis, however it did subsequently contribute to the sustainability of the programme.

Consent and Secure Storage of Information

The women were protected by Information Privacy Principles under the Privacy Act 1988 (Commonwealth Government of Australia, 2000), the Victorian Health Records Act (Victorian Government, 2001), the City of Darebin Privacy Notice and the Darebin MCH service requirements for the recording and storage of client information (City of Darebin, 2009). These Acts govern the conduct of Government agencies. Professional ethics also governed my actions in the collection, use and disclosure of personal records.

As part of my professional responsibility, the in-home session was preceded by an explanation about the woman's rights to privacy, consent, refusal and the right to withhold, withdraw or correct information. Consent obtained from the women included the recording of personal information that would be de-identified and coded for analysis, reporting and for professional presentations. Deidentified programme data were securely stored to protect unauthorised access, misuse and loss of information in the same way as the general MCH Data System. The data were regularly synchronised to the Darebin Local Government mainframe server where all records are kept by the MCH service for six years and archived for 25 years following the last contact. After this legislated period they can be permanently deleted from the mainframe storage system (Victorian Government, 2011). The extensive content of the programme database was also relevant to the records of the MCH service and therefore remained a coded record of reference stored by the MCH service for the legislated period.

Photography and Audio-visual Consent

The same informed consent process applied for clinical photography. To provide visual support for the observed complications and enhance the data collection, consent was obtained and recorded in the database to take photographs using a small pocket camera. All of the women who participated verbally consented to their photographs being used for education, presentation and publication. No one declined, or requested withdrawal of photographs at a later date. Though most of the photographs were unidentifiable, close-up macro shots using a small zoom lens camera; facial blurring has been applied to photographs used in this thesis. The women decided which photographs were appropriate to use and they were offered a copy for their own records. Consent included the photographs remaining in my possession securely stored on a specific password protected external hard drive.

Organisational Reporting

Regular reports were provided to the Darebin MCH service and local government managements on the outcomes of the in-home sessions. Professional discussions relating to the programme continued during regular meetings with the nurses. Educational and simple descriptive feedback about the rate of complications, diagnoses and breastfeeding outcomes of the women they referred to the programme were presented. These regular meetings were considered valuable and the nurses acknowledged that they felt supported with their day-to-day workload, being able to refer women presenting with breastfeeding complications.

Introduction to the Study

In 2008 a team of midwifery researchers assisted me to further understand and explore the experiences of the women captured so comprehensively in the database. These researchers encouraged me to further analyse the data and to use the experience to enhance my own academic and research development.

Questions Raised from Observations

My observations and the data collected from the women raised a number of questions. The most significant being: Why did so many breastfeeding women experience difficulties? In particular, why was nipple trauma appearing to be such a common painful presenting problem? Why did women seem to experience breast engorgement? Why were women reporting crying-unsettled babies described with symptoms of gastro-intestinal disturbance? Why were other methods of feeding commonly introduced in hospital and continued at home for women who planned to breastfeed? For example, from my observations it appeared that there was:

- A reliance on breast pumps to express breast milk.
- Babies receiving expressed breast milk via the bottle rather than the breast.
- Babies receiving artificial milk formula rather than breast milk.

These observations informed the aim, research questions and objectives of my research project.

The Study Aim

The aim of this study was to explore and understand the reasons women were experiencing difficulties in breastfeeding and to use this improved understanding to contribute to knowledge that guides midwifery practice and professional effectiveness.

Research Questions

- What were the main characteristics and experiences of the women with breastfeeding complications who presented for professional assistance through the DIHB programme?
- What are the implications of these findings for midwifery and for breastfeeding practice with women?

Objectives

The objectives were to:

- Undertake and report the results of a retrospective, analysis of the maternal-infant records (n = 653) from the DIHB programme for the period 2003-2007;
- Describe the strategies used to alleviate the breastfeeding complications;
- Analyse the breastfeeding techniques the women described and demonstrated in relation to the presenting problems, particularly painful nipple trauma;
- Report on the women's evaluation of the modified breastfeeding techniques;
- Draw on the literature and my extensive practical experience to explain the reasons for the breastfeeding complications; and
- Make recommendations for midwifery policy, education and practice on strategies produced in the analysis.

Overview of the Thesis Structure

This thesis consists of six chapters. Chapter One provided an introduction to breastfeeding, an overview of the six-year in-home breastfeeding programme and an introduction to the study aims and objectives.

In Chapter Two a review of the literature highlights the national and international benefits of breastfeeding and raises concerns about the ‘pathologisation’ of breastfeeding. The effects of maternal and newborn separation, the associated delay to and routine interruption of, the first and early breastfeeds are described. In this chapter a theoretical basis for breastfeeding was drawn from the disciplines of anatomy, physiology, psychology and neuroscience. A review of the literature was published and is attached as Appendix 3.

Chapter Three reports on the methodology and methods used in the study. The integration of quantitative and autoethnographic methodologies is explained. This chapter also includes the process of obtaining ethical approval, potential bias, analytical methods and the limitations of retrospective research.

Chapter Four presents the results of the data analysis and the key findings. The key findings included the outcomes of analyses of the presenting complications, diagnoses and outcomes of the breastfeeding session. This chapter also presents bivariate and logistic regression analysis in relation to the primary outcome of nipple trauma.

Chapter Five synthesises the results presented in Chapter Four and discusses the principle findings of the study in relation to precursors, possible causes, hypotheses and explanations drawn from theory and the literature, for the most common breastfeeding complexities identified in the data analysis.

Chapter Six concludes the thesis with recommendations around future research and professional practice changes that consider the uniqueness of the human mother and baby partnership. Implications for midwifery education and practice changes are reported.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Chapter One introduced an overview of the Darebin programme, the setting, demography, geographical boundaries and a synopsis of the Darebin MCH service. This chapter provides an overview of the literature, tracking events that influenced breastfeeding in Australia over 40 years (1970–2010). The review includes events such as the medicalisation of women in labour and birth, increased reliance on technology, the effects of opioids administered in labour and birth, maternal and newborn birth trauma and the professionalisation of breastfeeding.

The Significance of Breastfeeding

The significance of breastfeeding has far reaching implications for global and national policy setting, as seen in the statement by the World Health Organisation (WHO) recommending human breast milk as the world's best natural food resource for human babies (WHO, 2011). Kramer & Kakuma (2012), in a Cochrane review of optimal duration of breastfeeding, reconfirmed the established maternal and newborn health benefits of exclusive¹ breastfeeding for at least six months. The Cochrane review reiterates the maternal benefits and emphasises the psycho-physiological, nutritional, immunological and the cognitive growth and development benefits for the baby, alongside the economic benefits of sustained breastfeeding.

¹ Though exclusive breastfeeding (breast milk only) for the first six months is recommended, individual circumstances may lead to the introduction of foods between four and six months for some babies while breastfeeding continues.

In the presence of this scientific knowledge, declining breastfeeding rates continue to cause international concern (WHO, 2011). The American Academy of Pediatrics (AAP) policy reaffirmed the WHO breastfeeding recommendations, adding that infant nutrition should be “considered a public health policy and not only a life-style choice” (American Academy of Pediatrics, 2012, p. e827). Australian breastfeeding rates also fall significantly behind the recommended WHO and the United Nations Children’s Fund (UNICEF) targets of exclusive breastfeeding for the first six months (WHO, 2011).

The Australian Institute of Family Studies (AIFS) commenced a longitudinal wave study of Australian children in 2004. This national study is following the development of 10,000 children and families. The data reported on Cohort B in the 2006-2007 Annual Report consisted of 5,000 participants representing infants from birth to one year and of these 92.0% were breastfed at birth. However, in the first week of life some babies were no longer exclusively breastfeeding and by the end of the first week there was a decline to 80.0%. Progressive decline continued to 46.0% at four months and by six months only 14.0% of babies were breastfed maternal milk, without the introduction of other food or milk products. This longitudinal study identifies policy opportunities for improving early intervention and prevention strategies to increase breastfeeding rates to at least six months for Australian babies (AIFS, 2007).

The first Australian National Breastfeeding Strategy 2010-2015 was endorsed by the Australian Health Ministers in their 2009 conference (Australian Health Ministers Conference, 2009). The Australian strategy recognises the WHO recommendations acknowledging the health and economic benefits associated with strategic support, to increase targets across the Australian states and territories. The target is to increase the

percentage of fully breastfed babies from 14.0%, to 50.0% at six months of age by 2015 and to sustain breastfeeding for at least twelve months, preferably longer.

More recently, it has been reported in the United Kingdom (UK) that a trial of 130 women living in deprived areas of South Yorkshire and Derbyshire who will give birth between November 2013 and March 2014, were to be offered a financial incentive by the National Health Scheme to breastfeed (British Broadcasting Commission, 2013). If this trial is successful a nation wide pilot scheme could commence in England in 2014. The programme is promoting the health benefits of breastfeeding as well as better education. The geographical areas for the trial were chosen because of low breastfeeding rates with just one in four women breastfeeding by six to eight weeks, compared to the UK average of 55.0%.

Known Benefits of Maternal Breast Milk

Across the spectrum of milk-producing mammals, naturally derived proteins, fats, carbohydrates, minerals, trace elements and vitamins, immunological and growth factors benefit the young of each of the species. Maternal milk, the world's scientifically recognised food, meets the entire macro and micro-nutrients for the first six months and longer (McClellan, Miller, & Hartmann, 2008). Scientific knowledge continues to inform us that maternal milk also reduces the risk of gastrointestinal, infectious and chronic diseases, allergies and infant obesity. A Cochrane Review reported that the continuation of regular breastfeeding day and night, stimulates the regular release of the milk producing hormones prolactin and oxytocin and this may suppress the bio-physiological rise of the hormones oestrogen and progesterone, delaying ovulation and return of menstruation (Kramer & Kakuma, 2012). The same review also reported that the risk of developing

cardiovascular disease, juvenile diabetes and dental caries is also reduced with breastfeeding.

Reported maternal health benefits of breastfeeding include early postpartum uterine involution while immediate postpartum and continued exclusive breastfeeding may reduce the risk of postpartum haemorrhage (Eidelman et al., 2012). Breastfeeding has also been reported to be associated with lower incidence of postpartum weight retention and a reduced risk of serious illnesses such as diabetes, ovarian and breast cancers (WHO, 2011). Recent research has also isolated stem cells in breast milk (Thomas, Zeps, Cregan, Hartmann, & Martin, 2011).

Promoting, Initiating and Sustaining Breastfeeding

The global strategy for infant and young child feeding promotes and supports exclusive breastfeeding (WHO, 2003). The strategy includes avoiding the unnecessary separation of mothers from their babies at birth. Midwives have a professional responsibility to promote the avoidance of unnecessary separation and to unobtrusively observe the first undisturbed postpartum hour, while continuing to facilitate undisturbed breastfeeding. Term gestation together with reasonable birth and discharge weights are generally indicative of healthy newborns capable of engaging in self-directed neuro-sensory behaviours to seek and locate the mother's breast and nipple (Genna, 2013). In doing so these babies draw early viscous colostrum for metabolic stabilisation and sustenance (Smillie, 2013).

Supporting women to initiate, establish and sustain breastfeeding carries the professional responsibility of avoiding the use of intra-oral feeding apparatus (devices) for babies (WHO, 2008). The literature leans toward avoiding the use of intra-oral devices including dummies (pacifiers) because of the potential to interfere with regular feeding and milk production (Jaafar, Jahanfar, Angolkar, & Ho, 2012), which may result in the cessation of

breastfeeding and the development of dental anomalies in childhood (Duncan, McNamara, Ireland, & Sandy, 2008).

Howard et al (2003), in a randomised clinical trial, found that feeding with a cup or teat was found to have a detrimental effects on sustained breastfeeding, while the use of a dummy in the neonatal period was detrimental to exclusive and overall breastfeeding. The first Australian National Infant Feeding Survey, conducted in 2010, reported that 96.0% of babies in the study were initially breastfed and at five months only 15.0% continued. The regular use of a dummy was cited in the survey as one of three factors associated with considerably lower breastfeeding rates. Twenty-five percent of those babies who regularly used a dummy were breastfed to four months, compared to 45.0% who did not regularly use a dummy. The study found 88.5% began using a dummy before the baby was one month old (AIHW, 2011).

Numerous trials have considered ways to increase and sustain breastfeeding in Australia and overseas. A Cochrane review of 34 studies from 14 countries reported evidence for continuation of exclusive breastfeeding being more effective with lay support (Britton, McCormick, Renfrew, Wade, & King, 2007). The same review reported that combinations of lay and professional support were more effective than professional support alone and face-to-face support was more effective than telephone advice. To date, breastfeeding techniques taught in modern practice have largely been unquestioned, that is with the exception of a few studies such as, optimal positioning for the release of primitive neonatal reflexes (Colson, Meek, & Hawdon, 2008) and the sacred hour of uninterrupted skin-to-skin contact from birth (Phillips, 2013). No research has explored the scientific implications of the combination of these taught techniques increasingly introduced since the 1980s, in relation to breast and nipple complications.

The Australian Breastfeeding Strategy promotes programmes that focus on the nutritional, social and economic benefits of increasing breastfeeding rates (Australian Health Ministers Conference, 2009). Recommendations from this key strategy include revisiting the WHO Code on the Marketing of Breast Milk Substitutes and providing breastfeeding support for women in all settings by improving referral pathways to supportive networks such as the Australian Breastfeeding Association (ABA).

Midwives are in a privileged position to ensure the professional ethics of ‘first do no harm’ (C. Smith, 2005, p. 371) are upheld. These ethics apply if interventions are deemed more harmful than beneficial for women during labour and birth. They can be applied with the initiation of breastfeeding and at least until breastfeeding is established. Midwives are the key health professionals whose ‘authentic presence’ is with women during labour, birth and the initiation and establishment of breastfeeding (Schmied, Beake, Sheehan, McCourt, & Dykes, 2011). The education and practices of midwives over the past 40 years has evolved alongside other significant changes in the management of pregnancy, labour and birth in Westernised societies. A number of events that changed professional support for breastfeeding are detailed below.

Medicalisation of Midwives

Rapid bio-technological growth in the 1970s and 1980s saw changes whereby medicalisation effectively altered the expert role of the midwife, slotting capable women and autonomous midwives into compliant roles (Flint, 1986). The medicalisation of midwives created a social belief, that there was one-way-only for women to receive maternity services and that was by the containment of practising midwives within the panopticon of hospital obstetrics (Davis & Walker, 2012). Influenced by medical practice, midwives conformed to modification of a large component of their scope of practice to

support changed obstetric practice (Hyde & Roche-Reid, 2004). The transition to institutionalised obstetric practices with restrictive regimes confined women to beds and separated them from their babies at birth. The continued advancement of medicalisation and bio-technologies in labour and birth contributed to undermining the postpartum initiation and establishment of breastfeeding (Ball, 2008).

Extensive reliance on complex bio-medical technologies became the norm replacing professional midwifery knowledge to the point where experienced midwives found it more difficult to incorporate their sensory knowledge and skills into labour, birth and breastfeeding practice (Flint, Poulengeris, & Grant, 1989). Most Western midwives now depend almost entirely on electronic fetal monitoring devices to record the intrapartum beat-to-beat baseline variability of the fetal heart rate. Student midwives in Australia may graduate without confident aural skills to detect the normality versus abnormality of the variable fetal heart rate changes with the monaural pinard stethoscope (Fahy, Foureur, & Hastie, 2008).

Institutionalised medical and government constraints on the qualified midwife continue to make it difficult for the majority of practising Australian midwives to retain a continuous, autonomous and primary professional role. Only a small number of qualified midwives in 2013 practice to professional capacity across the full scope of midwifery (Australian Government, 2009). Australian midwifery, unlike New Zealand, has little capacity for midwives to provide midwifery services through individually negotiated ‘partnerships’ with women, extending through the entire maternity cycle up to six postnatal weeks and over more than one pregnancy (Guilliland, Tracy, & Thorogood, 2006).

Davis-Floyd (2000) succinctly expresses the consequences of techno-medical interventions:

...The problem is that far too often, technomedical interventions are not reserved for the small percentage of births that actually need them; rather, they are performed on most laboring women. By interfering with the normal process of labor, such interventions often generate the very complications they are designed to prevent (p. 10).

Professional midwifery practice encompasses being with women through the entire maternity cycle to optimise the facilitation of initiating, establishing and sustaining breastfeeding with a mindful focus on practice that pays attention to in-the-moment detail without unnecessarily touching the mother or her baby (McKenzie & Hassed, 2012).

Obstetric Opioids

The confinement of women to hospital labour rooms and restriction to hospital beds for delivery amplified pain and escalated the need for pharmacological pain control (Kitzinger et al., 2006). The neuro-physiological effects of opioids on the babies of mothers administered narcotics in labour have long raised concerns by midwives, researchers and other health professionals, particularly in relation to newborn and neonatal breastfeeding behaviours (Wittels, Scot, & Sinatra, 1990). Administration of these drugs can be via a single injection, intermittent or continuous infusion into the epidural space, or the cerebrospinal fluid for spinal anaesthesia. For longer acting anaesthesia a combined epidural-spinal procedure is performed.

Scholarly debate continues as to the use of regional anaesthetic drug combinations of opioids and low dose cocaine derivatives such as bupivacaine to reduce motor and sensory nerve sensation (Buckley, 2009). It remains unclear if opioid and other drugs administered into the epidural or subarachnoid space (neuraxial), directly affect the neonatal brain tissue to decrease neuro-sensory breastfeeding behaviours (Szabo, 2013).

A prospective cohort study of 1,289 women administered epidural and general anaesthetic opioids found the women were significantly more likely to partially, rather than exclusively breastfeed (Torvaldsen, Roberts, Simpson, Thompson, & Ellwood, 2006). Compared to women using non-pharmacological methods for pain relief, the women who had opioid pain relief experienced problems in the first few days and ceased breastfeeding in the first 24 postnatal weeks.

A comparative observational study found that the method of delivery affects the breastfeeding mother and baby, while the effects of opioids and analgesics increase the need for additional support for postpartum breastfeeding (Cakmak & Kuguoglu, 2007). Concentrations of the potent analgesic Fentanyl were found to be greater in colostrum than in serum in a study undertaken after administration of an analgesic dose of the drug (Steer, Biddle, Marley, Lantz, & Sulik, 1992).

In 2011, the Australian perinatal data showed that of the women who gave birth (N = 240,150), 76% were administered analgesia for pain in labour and some had more than one method. The types of analgesia were inhalational 52.1%, regional (epidural, spinal, caudal) 31.8%, while 21.8% had systemic opioids (Li Z, Zeki R, Hilder L, & EA, 2013). Of the women who had an instrumental or abdominal delivery in 2011, (N = 131,848), anaesthesia was administered to 94.6%.

Other studies raised concerns about the effects of obstetric analgesia on maternal-fetal and newborn hepatic (liver) metabolism. Gow, Ghabrial, Smallwood, Morgan, & Ching, (2001) referred to a range of scientific research, noting that dose-per-body-weight drug administration may be less harmful in adult physiology, but has different effects on the individual fetal and newborn hepatic physiology. Kumar and Paes (2003) identified newborn respiratory depression following maternal epidural analgesia and concluded that

these neonates were more prone to respiratory sequelae. They also reported that epidural opioids diffused freely from the epidural space into the maternal blood, crossed the placental barrier and impacted on the fetal and newborn immature central nervous system (CNS), resulting in marginally increased opioid concentrations deposited in fetal peripheral tissue (Kumar & Paes, 2003). Szabo (2013), argues that previous studies addressing maternal opioids and breastfeeding have design limitations and to discern if there are significant associations with opioids on neonatal brain tissue further research is required.

Labour and Birth Interventions

There is considerable evidence about the adverse impact that medicalisation of women's birth experiences can have on initiating and establishing breastfeeding (L. Smith, 2010). Medical-surgical induction of labour and delivery by abdominal surgery continues to be a common obstetric labour and birth intervention. In 2011, 54.8% of all women who gave birth (N = 297,126) in Australia had a spontaneous onset of labour and for 19.1%, labour had not commenced, 26.0% were induced and 17.9% were augmented with labour in progress. The overall national trend for abdominal delivery over the last 10 years increased and since 2010 the rate increased by 0.7%. There were 95,894 abdominal deliveries performed in 2011. The rate of primary abdominal delivery varied by parity; 33.2% were primiparous and 10.3% multiparous women. Of all the women who gave birth, 19.1% had an abdominal delivery without the commencement of labour and 13.1% where labour had commenced (Li Z et al., 2013).

In 2011, 26.8% of Australian women who had a vaginal delivery had an intact perineum following a vaginal delivery. There were varying degrees of perineal trauma ranging from

episiotomy 15.6%, first degree tear (includes grazing) (22.1%), second degree (25.7%), third or fourth degree and episiotomy with extended tear (5.0%) (Li Z et al., 2013).

As explained by Genna (2013), routine professional practices that delay or interrupt the ambience for immediate postpartum union can delay initiation of breastfeeding. Such interruption between the mother and newborn may negatively affect primary integration of the neuro-physiological visual (sight), auditory (hearing), tactile (touch), olfactory (smell) and gustatory (taste) senses. In addition, the senses of body orientation and movement that can be affected include vestibular (balance and gravity), kinaesthetic (muscle, tendon and joint movement) and proprioceptive (body position).

Increasing Incidence of Birth Trauma

Birth trauma during the maternity phase is defined as a physical or psychological event involving “actual or threatened serious injury or death to the mother or her baby” (Beck & Watson, 2008, p. 229). Birth trauma involving forceps and vacuum extraction that results in significant bruising and wounds as well as mechanically difficult births associated with cranial and facial asymmetry, can significantly influence the first and early breastfeeds (Genna, 2013). Maternal or newborn trauma that delays the spontaneous physical, sensory and emotional contact at birth or results in extended separation may alter the normal bio-physiological rhythm that synchronises maternal milk production (Beck & Watson, 2008).

Neville and Morton (2001) explain how predetermined endocrine programming for increasing mammalian breast milk volume occurs over the first three to four postpartum days. Delayed colostrum/milk transfer increases the physiological accrual of milk sodium that leads to low milk volume. The authors report that the breastfed baby (with facio-mandibular and intra-oral symmetry) draws a volume of 100mls of colostrum on the first day, this increases with uninterrupted feeding patterns to an average of 500mls of

transitional milk at three to four days.

Maternal Trauma

A 2010 Cochrane review reports that instrumental delivery is commonly used to expedite delivery and the impact of instrumental delivery can be associated with significant complications for the mother, the baby or both (O'Mahony, Hofmeyr, & Menon, 2010). There were 32 studies (n = 6,597 women) in this Cochrane review where the authors found that forceps were more likely than vacuum extraction to achieve a vaginal delivery. However, the use of forceps significantly increased third or fourth-degree tear rate (with or without episiotomy), vaginal trauma, use of general anaesthesia and flatus incontinence or altered continence. Birth trauma for the mother is frequently associated with consequential physical pain or discomfort, delaying postnatal recovery and contributing to sleep deprivation and possible postnatal psychological sequelae (Kendall-Tackett, 2007). Vaginal lacerations incurred from surgical and instrumental interventions influence the mother's confidence and her ability to nurture and breastfeed her newborn. Pain increases the risk of administration of opioids and slower postnatal recovery contributes to lower breastfeeding rates (Baker, 2005).

Perineal muscle trauma such as incision (episiotomy), or spontaneous tearing, may impact on the postnatal psycho-social well-being of the mother (Sahu, 2011). Immediate postpartum repair of the wound is recommended to reduce the associated pain and the risk of bleeding (Fernando & Sultan, 2004). These authors also advised that uninterrupted neuro-behavioural integration for immediate postpartum breastfeeding might be affected by this delay. They reported that the risk factors as well as the morbidity associated with perineal injury is a major health problem that affects over 60% of women in the UK and

that 91% of these women report at least one persistent symptom around the eighth postnatal week.

Perineal muscle wounds can result in scar tissue that contributes to delayed physical and emotional recovery as well as painful sexual problems (Mass, 2004). A study by Sheehan (2006) found that if women were distressed in the weeks following the birth their confidence decreased and consequential maternal distress “negatively impacted on themselves, the baby and the family” (p. 135). In the UK over 500,000 births are reported per year. The Royal College of Obstetricians and Gynaecologists (RCOG) estimate that 85% of women who have a vaginal birth will suffer some degree of perineal trauma and 60% to 70% will require suturing (Sahu, 2011).

Newborn Trauma

The 2010 Cochrane review also reported on the effects of instrumental delivery for the baby and found that facial injury was more likely to occur with forceps, though there were fewer cases of cephalhaematoma. The metal Ventouse cup for vacuum extraction compared to the soft cup was more likely to result in vaginal delivery however, there were more cases of scalp injury and cephalhaematoma (O'Mahony et al., 2010). Birth trauma is responsible for almost all cases of neonatal trauma and therefore, such injuries have the potential to affect breastfeeding (Pinto, Meoded, Poretti, Tekes, & Huisman, 2012).

In a review of neonatal medical records, Hughes et al (1999) expressed concerns about the limited consideration given to the consequences of neurophysiological and physical exposure to mechanical birth trauma, particularly newborn cranio-facial and neck injuries that influence the baby's ability to breastfeed. Mechanical extraction of the baby's head via extraction by forceps or vacuum can result in skeletal (skull) and soft tissue (scalp) trauma such as oedema, bruising, indentations and facial or cranial fractures of the

newborn. Less common serious injury such as intracranial subdural haemorrhage has been identified following instrumental delivery (Pinto et al., 2012).

Instrumental extraction of the baby's head may also impede smooth function of the bilateral temporo-mandibular joint (TMJ) restricting connective movements of the lower jaw, cranial bones and cervical vertebrae C1 and C2 (atlas and axis) (Vallone, 2004). A case study of 114 babies found that the main physical findings from infant birth injury involved soft tissue or skeletal injury. Injuries involving the TMJ, the cranial plates and cranial suture lines are more likely to result in restricted asynchronous suck-swallow (J. Miller, Miller, Sulesund, & Yevtushenko, 2009). Impaired TMJ movement limits mandible and mouth opening and may also involve oral-pharyngeal reflexes, periauricular, facial and jaw pain and headache impeding early intrinsic intra-oral vacuum for effective drawing and swallowing rhythm (Castelo, Gaviao, Pereira, & Bonjardim, 2005). An increase in these injuries has led to an increase in the number of babies referred for paediatric chiropractic or osteopathic alignment (Barham-Floreani, 2005; Erickson, Hewitt, Watson, Rosner, & Hewitt, 2009). Newborn trauma also complicates the integral cerebral coordination of sensory information, impacting on the basic neuro-physiological processing for accomplishing mammalian responsive (adaptive) behaviours for the initiation and continuation of breastfeeding (Genna & Sandora, 2008).

Professionalising Breastfeeding

Historically, breastfeeding practices across professional disciplines and other groups have been fundamentally enveloped in social values, attitudes and knowledge at the time (Bartlett, 2005). The emergence of Lactation Consultancy in the late 1980s was perceived to be the new international science that would improve breastfeeding rates, decrease complications and the transition to artificial formula. However, professionalisation of

breastfeeding has not reflected an increase in sustained breastfeeding over the past two decades in spite of international developments and the considerable effort invested in trying to improve breastfeeding duration for Australian women (Barclay et al., 2012). This raises concern, if not questions, particularly when women report feeling confused by contradictory variations in professional information, practice and education for breastfeeding (Hauck, Graham-Smith, McInerney, & Kay, 2010).

One study found that the process of milk production in the first postpartum week is critical to establishing breastfeeding (Dewey, Nommsen-Rivers, Heinig, & Cohen, 2003). These authors concluded that other factors identified for establishing and sustaining breastfeeding past this critical period, were strongly influenced by parity. There were also other modifiable risk factors such as maternal weight, the duration of labour, the type of delivery, medications administered in labour, the use of artificial milk products and dummies. They recommended that all mothers and babies should be evaluated at 72 hours postpartum to determine their breastfeeding progress.

Devaluing of Women and Infant Capacity to Breastfeed

It appears that the modern phenomenon of the professionalising of labour, birth and breastfeeding has created formidable barriers with inflexible individual and institutional rules for women and babies. Schmied, Sheehan & Barclay (2001) explain that:

One of the greatest challenges for researchers who are also midwives immersed in the profession, is the presentation of research findings that are controversial and challenge our current approach to care...and the professionalising of breastfeeding (p. 44).

An action research study undertaken in Sweden by Nyman, Bondas, & Berg (2013), examined midwives' responses to a changed approach to practice in the labour ward setting. The all-encompassing phenomenon was one of women being confined to a space in a hospital labour room with midwives who were confined to routines and systemised practices. According to Nyman et al, the midwives in these settings integrated relatively impersonal technocratic norms into their beliefs and behaviours, which may result in women being denied their right to give birth in their preferred way. When the mother is confined, the newborn's first contact is likely to be handling by someone other than the mother. In humans, separation shortly after birth is unique to the 20th century and this practice diverges from evolutionary history where, "neonatal survival depends on close virtually continuous maternal contact" (Moore, Anderson, Bergman, & Dowswell, 2012, p. 2).

Midwives appear to be increasingly challenged by policies and practices that overlook the importance of facilitation of unhindered unity of the mother with her newborn immediately following birth. Professionalisation and the many tasks that are undertaken in the first and early postpartum hours may ignore the need for a mother to hold, nurture and breastfeed her baby in her own good time, without interruption and to continue breastfeeding undisturbed for as long as required for the baby to harmonise the neuro-sensory behaviours for nurturing and self-satisfaction (Almeida & Novak, 2004).

The idiom, '...isation' in Figure 1, illustrates how 'professionalising' has changed practice. The Model is designed to convey how current practices involve oppressive controls over women, birth and breastfeeding that appear to confuse and inhibit the mother and baby and are not supported by the theory drawn from anatomy, physiology and neurobiology. It appears that the 'professionalisation' (doctors, midwives lactation

consultants, allied health professionals with their different pathologies) may overwhelm a woman's intrinsic capacity to draw on her own knowledge. Being overwhelmed may diminish her self-confidence and primary capacity to hold, nurture and feed her baby. Overbearing professional behaviour has the potential to set women up to believe they have failed as seen in the audio-visual breastfeeding presentation² (Australian Broadcasting Commission, 2008). Behaviour that evokes professionally insensitive dialogue, listening and observation appears to be related to professionals losing sight of the embodied nature of breastfeeding (A Sheehan, Schmied, & Barclay, 2010).

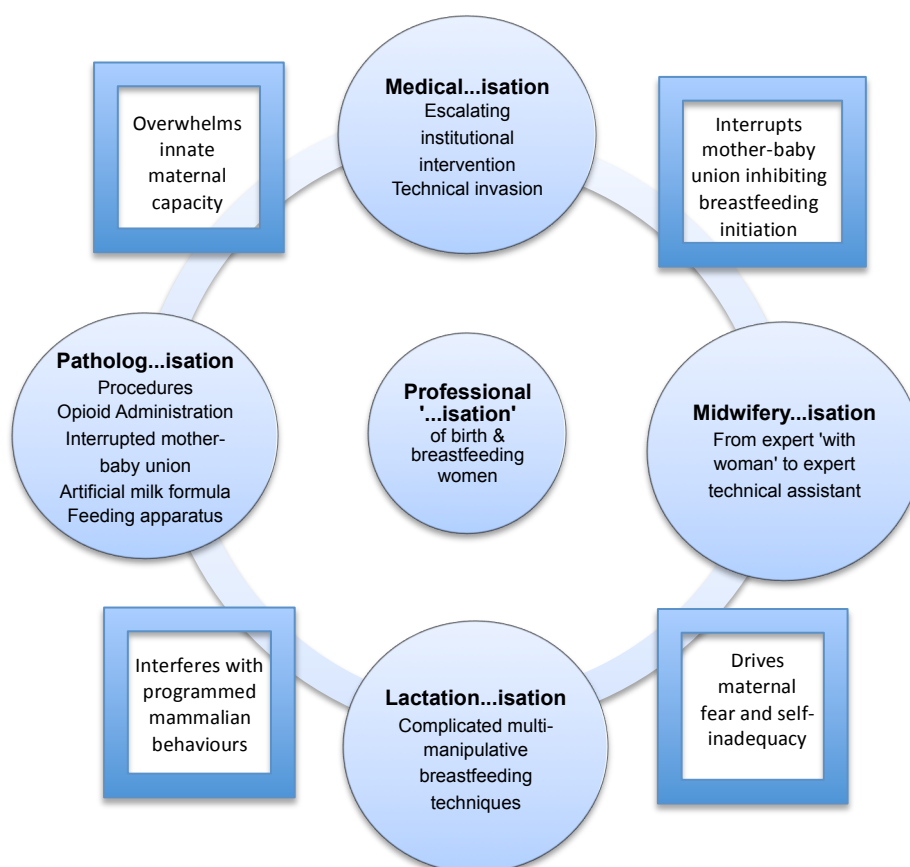


Figure 1: Devaluing of Women and Infant Capacity to Breastfeed

² The Video Clip No.1 Visiting a Breastfeeding Day Centre shown on the secure (password protected) website <http://www.thesis.breastfeedingconsultant.com/> (password: robynthompson1123) provides an understanding of how professional behaviour appears to devalue the breastfeeding woman and her baby.

Breastfeeding Techniques

During the late 1980s and 1990s international lactation consultants Chele Marmet and Rebecca Glover called for significant changes to breastfeeding techniques to prevent sore nipples (Glover, 1994; Marmet, 1991). Despite the neuro-scientific information of neuro-sensory behaviours, instructional information from the 1980s has shown women how to ‘position’, ‘attach’ and ‘latch on’ babies to the breast. These practices are embedded in the myriad of international breastfeeding promotional literature, audio-visual productions, on-line information, in education programmes and professional practice, see for example (La Leche League International, 2010). Significant variations in breastfeeding techniques by many authors occurred as the increasing volume of literature referred to the progression of a sequence of manoeuvres of the breast, nipple and the baby. Wiessinger (2004), a La Leche League International (LLLI) leader provides a succinct chronological view of world authors (1982 to 2003) who provided the instructions for ‘latch-on’. Various techniques were progressively taught as the ‘correct position’, and a ‘good latch’, ‘nipple-to-nose’ and ‘more areola visible at the upper lip’; each with the intention of preventing sore nipples including instruction on how to get most of the areola into the baby’s mouth.

Variations of positioning, holding and attaching the baby have been promoted to accommodate specific groups of women, for example those categorised as obese (Jevitt, Hernandez, & Groër, 2007). Other instructions have related to hand-holding the head or not, hand-holding the neck, or a hand pushing in across shoulders (Newman, 2009). Reshaping the breast is referred to in some educational material and literature as the ‘C-hold’, the ‘U-hold’, the ‘V-hold’ and the ‘hamburger hold’, while other language includes the ‘bulls-eye’ latch (Eastman, 2000). The ‘Special-K’ logo is also used to demonstrate the analogy of a wide-open mouth in on-line breastfeeding tips for women (Breastmates, 2012). Many breastfeeding advisory websites demonstrate the cross-cradle hold with the

nose-to-nipple and rapid arm movement technique to rapidly thrust the baby onto the breast (Raising Children Network, 2013). The accumulative practice of these manoeuvres over time, were intended to ensure a ‘good latch’ to prevent nipple trauma (Glover, 1994; Marmet & Shell, 2007).

These multiple intricacies of the instructional process, using elaborate techniques, appear to many experienced midwives (myself included) to have created maternal confusion. This practice makes the act of breastfeeding too complex for the mother and baby to coordinate. Additionally, the natural neuro-sensory abilities of the baby to seek the breast and nipple for nourishment and survival are disturbed in the act of ‘teaching’ women hands-on breastfeeding. Such complex techniques with contradictory messages may have contributed to the “searing pain and discomfort” that some women reported (Schmied et al., 2001, p. 45). In a prospective cohort study by Schwartz et al, (2002) the presence of painful complications such as engorgement, mastitis, nipple pain, nipple trauma, the practice of using bottles/teats and expressing breast milk in the first three postnatal weeks, were all associated with cessation of breastfeeding. The confusion and fear associated with painful expectations may make it difficult for many women to continue to the next and subsequent breastfeeds. In addition, inappropriate professional support such as dominance, impatience, conflicting advice and the language used may lead to feelings of self-inadequacy and emotional and physical avoidance, all of which may result in the cessation of breastfeeding.

Anatomical Review

The anatomical and physiological explanations of the mechanisms for transfer of milk flow from the breast into the oropharynx and stomach and the aetiology of sore nipples described in the 1980s remain important today (Woolridge, 1986a, 1986b). A more recent ultrasound study by Geddes et al (2008) provides an improved understanding of the posterior tongue movement and the changes that occur with intra-oral vacuum pressures during drawing and swallowing episodes.

The experience of observing Darebin women with breastfeeding complications, modify their breastfeeding technique (explained below) then comment on how they felt pain relief while feeding over existing nipple trauma, led me to self-observation by palpating the anatomical and muscular function of my intra-oral cavity (Chang, 2008). At the same time, I began to review the anatomical literature and construct anatomical models (albeit adult models) of the head neck and shoulders using the on-line programme *Visible Body* (Visible Body, 2007-2013). This anatomical review was the beginning of developing an improved understanding of the cranio-cervical spine, the associated ligaments and muscles, the intra-oral cavity and the close proximity of the physiological function of the neuro-sensory organs in relation to the breastfeeding baby. The purpose of taking these steps was to improve my understanding of what I was observing and what women were reporting and to explore possible reasons for different types of nipple and breast complications that were occurring.

Cranio-cervical Spine

Holding the breastfed baby by the sub-occipito-cervical spine, along the nuchal ligament when using the cross-cradle hold appeared to restrict the rotational head and neck movements. This restriction appeared to prevent appropriate activation of the neuro-

sensory behaviours of the baby seeking the breast and locating the nipple. The first two cranio-cervical joints, the Atlas (C-1) and Axis (C-2) allow the head freedom to rotate and tilt, the 7th cervical vertebral connects with the brachial plexus to activate the shoulder, arm and hand movements (Tubbs et al., 2011).³ The model below (Figure 2), shows the close association of the first two cervical vertebrae (Atlas and Axis) to the position of the hand when using the cross-cradle hold and the relationship to the spinal cord and brain (Visible Body, 2007-2013).

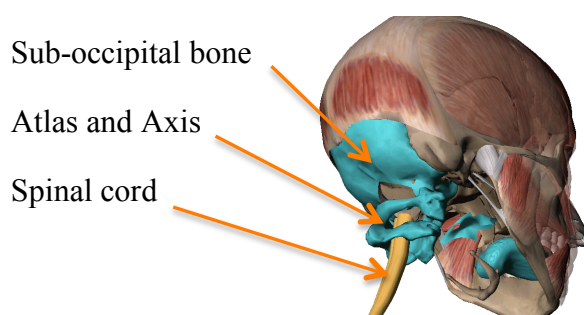


Figure 2: Cranio-cervical model

Nuchal Ligament

Gray's Anatomy for Students, describes the nuchal ligament as a triangular flat structure that attaches at the midline of the sub-occipital bone extending the length of the cranio-cervical spine to attach the spinous process of the 7th cervical vertebrae (Drake, Vogl, & Mitchell, 2009). The bio-mechanical nuchal ligament is anatomically described as the stabilising ligament because it stabilises flexion and extension of the head and neck (Anatomy Expert, 2010). The stabilising nuchal ligament connects the seven cervical vertebrae to provide flexible skeletal stability (Benke, Yu, Peden, & O'Brien, 2011). The broad lateral surfaces and posterior edge of the ligament provide attachment for adjacent

³ The publishers of Visible Body, Argosy Publishing provided written consent to reproduce the three-dimensional anatomical models for publication in this Thesis (Visible Body, 2007-2013)

muscles including the trapezius (Drake et al., 2009). In conjunction with the trapezius muscle the nuchal ligament supports the head and allows it to resist hyperflexion and hyperextension and facilitates returning the head to the stabilised resting anatomical position as shown in Figure 3 (Visible Body, 2007-2013). A study of the cranio-cervical spine by Yoganandan et al (2001) provides a description of the soft tissue responses using mathematical modelling of biomechanical flexible responses of the cranio-cervical spine in children aged one, three and six. The results were compared with biomechanical modelling of adult responses under pure compression, tension, flexion and extension. These included variations of combined compression-flexion and compression-extension moments. The results indicated that soft tissue-related anatomical changes in children have a predominant effect on the biomechanical responses. The possible effect of forces applied to the cranio-cervical spine and nuchal ligament of the newborn and young breastfeeding baby does not appear to be scientifically researched nor accounted for in teaching women to breastfeed.⁴

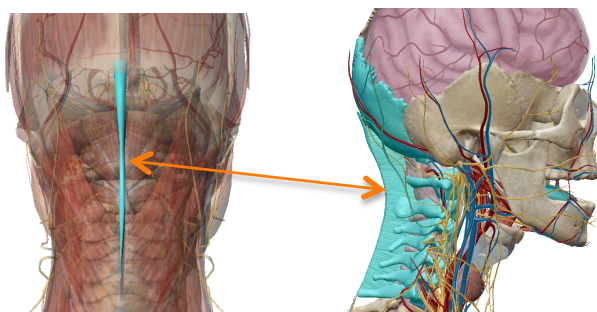


Figure 3: Posterior and cross-sectional view of the attachment of the nuchal ligament to the first seven cervical vertebra

⁴ The forceful forward thrusting of the baby held by the cranio-cervical spine along the nuchal ligament can also be viewed on Video Clip No.1 Visiting a Breastfeeding Day Centre on the secure (password protected) website <http://www.thesis.breastfeedingconsultant.com/>

Trapezius Muscle

Like the nuchal ligament, the trapezius muscle Figure 4, originates at the sub-occipital bone, extends over the cranio-cervical spine and attaches to the nuchal ligament and both shoulders at the scapular spine posteriorly and the lateral third of the clavicle anteriorly (Matsuoka et al., 2005). The trapezius muscle and the sub-occipito-cervical spine, assist the stable rotation, elevation, depression and adduction of the scapulae and they elevate the clavicles to stabilise the shoulders and assist movement of the arms and hands (Visible Body, 2007-2013).

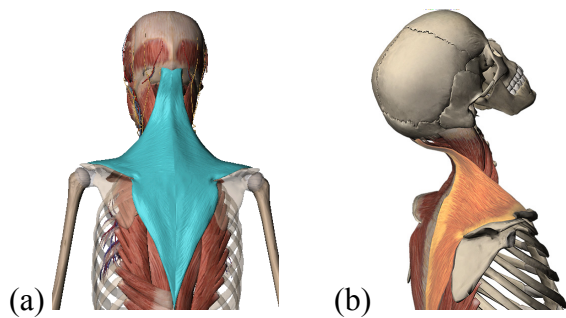


Figure 4: (a) The trapezius muscle attaches at multiple points and (b) extends and flexes the neck and stabilises the shoulders

Hard and Soft Palates

The intra-oral view of the proximity of the hard palate to the nose and the junction of the hard and soft palates are shown in Figure 5 below (Visible Body, 2007-2013). The nostrils open into the posterior nasal cavity. The hard and soft palates form the roof of the mouth and partition the oral and nasal cavities. The hard palate, commonly known as the bony palatal arch, forms the upper anterior oral cavity. The surface is hard horizontal convex bone, covered in dense tough muco-periosteum and is bounded by the upper gums and upper jaw (maxilla). The maxilla forms the anterior two-thirds of the hard palate, while the horizontal processes of the palatine bones situated at the back of the nasal cavity, form the posterior third of the hard palate.

The soft palatal cleft articulates with the anterior hard palate to form the soft palate. The posterior soft palate contains no bony supports and forms the posterior part of the roof of the mouth. The sides of the soft palate adjoin the pharynx while the lower border remains free terminating in the small pendulous uvula hanging superior to the oropharynx. In its relaxed position, the anterior surface of the soft palate is concave with a median ridge, the posterior surface is convex (Visible Body, 2007-2013). The nipple is drawn to the distance of the posterior soft palatal cleft and adjunct breast tissue moulds to fill the shape of the anterior hard palate.

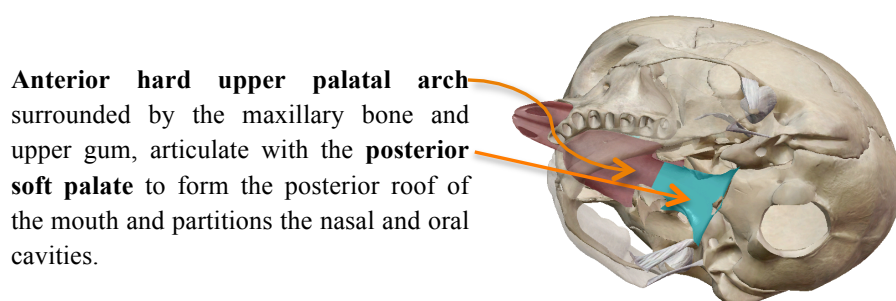


Figure 5: The junction of the anterior hard palate, posterior soft palate shaped superiorly by the maxilla

Tongue Muscle and Chin

The tongue muscle functions with four intrinsic muscles and synchronises with four sensory nerves with extrinsic muscles that originate from other anatomical structures. As shown in the model Figure 6, the extrinsic genioglossus muscle is shown originating at the intra-oral midline of the chin (mental spine) and spans to form the inferior body of the tongue to provide flexible movement (Visible Body, 2007-2013).

During breastfeeding, the tongue muscle and lower jaw provide harmonised motivation for milk flow (Woolridge, 1986b). Symmetrical rhythmical drawing and swallowing episodes allow the tongue muscle to massage the nipple and adjunct breast tissue intra-orally. Simultaneously, the rhythmical movement of the mandible in harmony with tongue

movement appears to facilitate the point of the chin to massage the external breast tissue. Asymmetrical mandibular movement can be a possible contributor to ‘latch’ difficulties, nipple pain and poor milk transfer (Wall & Glass, 2006).

During observation of breastfeeding the baby instinctively seeks to locate the nipple, mouthing and touching and as the lips move naturally over the nipple the tip of the protruding tongue locates, licks and tastes. As the mouth opens to a natural width the slightly extended tongue draws the nipple and adjunct breast tissue with increasing intra-oral vacuum pressure into the mouth. The baby draws the nipple along the middle of the tongue muscle to the distance of the soft palatal cleft where potential for nipple trauma is reduced (Genna, 2013). The adjunct breast tissue fills the remaining intra-oral space, melding to fit the unique shape of the baby’s intra-oral cavity and palatal arch.

An ultrasound study by Geddes et al, (2008) highlighting the importance of vacuum in milk removal showed that milk only flows from the nipple ducts into the oral cavity when the downward movement of the posterior tongue creates an intra-oral vacuum. The downward movement of the posterior tongue together with the increasing vacuum pressure stimulates milk flow into the oropharynx, which stimulates rhythmical swallowing episodes (Geddes et al., 2008). The rhythmical movement of the mandible and chin coordinated with facio-mandibular symmetry, appears to assist the effective drawing⁵ of the nipple and breast whereby the nipple reaches to the distance and is protected by the soft palatal cleft, which has the potential to reduce pain or prevent further nipple trauma. Further ultrasound studies would be beneficial to examine the intra-oral difference during

⁵ An example of this can be viewed on Video Clip No.2 Breastfeeding with Existing Complications on the secure (password protected) website <http://www.thesis.breastfeedingconsultant.com/>

symmetrical and asymmetrical facio-mandibular contact with the breast. In addition, further ultrasound investigation may assist improved understanding of the intra-oral positioning of the nipple during the cross-cradle hold with malalignment of the nipple-to-nose technique.

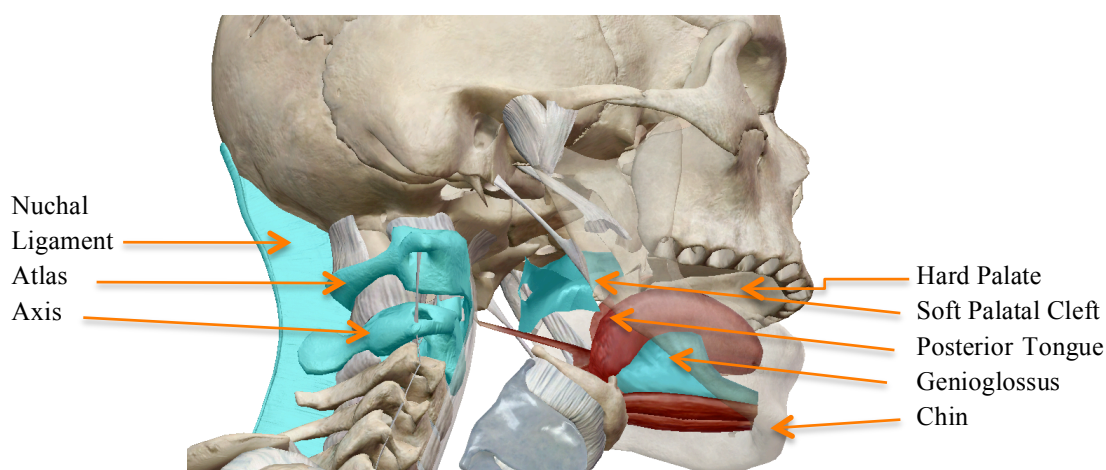


Figure 6: The Nuchal ligament, cervical vertebrae (atlas and axis), soft palatal cleft and the posterior tongue. The inferior genioglossus muscle insertion of the tongue to the chin.

Neuro-Sensory Organs

Twelve pairs of cranial nerves connect the muscles and ligaments of the sensory organs (ears, nose, eyes) and the motor function of the tongue muscle and pharynx to the spinal cord and brain (Anatomy Expert, 2010). The neonatologist Phillips (2013), explains that mother-baby face-to-face and voice-to-ear communication, eye-to-eye contact, hand-to-body touching, are all pleasant interactions that form psycho-emotional attachment and brain development. Synaptic neuronal brain connections are formed as the baby is soothed by the mother's voice and touch while shielded from excessive light and loud noise.

Olfactory information from the receptor cells in the nasal epithelium responds to the maternal odors transferring specific messages to the newborn brain a prerequisite for adaption of the newborn to extra-uterine life (Bussell & Vosshall, 2012; Visible Body, 2007-2013). Prenatal aromatic substances in the mother's diet may be transferred to the

amniotic fluid suggesting the newborn olfactory system is capable of detecting distinctive odours produced by the lactating mother (Winberg & Porter, 1998).

Doucet, Soussignan, Sagot & Schaal (2007), in a study of 55 mother-baby pairs found that volatile compounds originating from secretions around the areolar, arouse and motivate newborn mouthing, stimulate eye opening and delay or reduce crying. These behaviours, can be observed when the newborn is untouched by others from birth and self-orientates to locate the mothers breast and nipple (Gangal, Bhagat, Prabhu, & Rajlakshmi, 2007). It appears that unwarranted intrusions and unnecessary delays to the stimulation of neuro-sensory behaviours and learned recognition of maternal signature odors are likely to derail these inborn skills, as found in studies of mice (Logan et al., 2012). This scientific research explains that the trigger for the first suckling in newborn mice is a blend of chemicals specific for each mouse mother, negating previous evidence of pheromones activating first sucking. Instead, it was found that the initiation of sucking is dependent on a blend of maternal ‘signature odors’ that are learned and recognised in utero. Activation of the olfactory cortex (perception of smell) and other researched sensory behaviours substantiate the way the newborn mammal is reliant on the cranio-cervical spine movement to facilitate olfactory activation to knowingly locate the nipple.⁶

⁶ Please see Video Clip No.3 The First Postpartum Breastfeed on the secure website <http://www.thesis.breastfeedingconsultant.com/>

Essential Prerequisites for Adaptation of the Newborn

Skin-to-Skin: Radiant Maternal Warmth

A Polish study (Mikiel-Kostyra, Mazur, & Boltruszko, 2002) and later studies (Bergman, Linley, & Fawcus, 2004; Moore, Anderson, & Bergman, 2007) identified that babies who remained undisturbed, in contact with their mother's body preferably skin-to-skin, breastfeeding leisurely without interruption and according to individual need, successfully negotiated self-feeding without distressed cries. Healthy babies are born with the instinctive neuro-sensory behavioural skills and motivational desire to locate the breast and nipple and self-negotiate breastfeeding when skin-to-skin with the mother from the moment of birth (McGrath & Kennell, 2002). The first hours following the birth are critical to the physiological and emotional stability of both the mother and baby when they remain together, untouched by others.

Neuro-sensory Behaviours

The distinct intention of the newborn is to locate the nipple for transitioning from the intra-uterine ingestion of amniotic fluid, to external nourishment with maternal colostrum and milk (C. Wagner, Taylor, & Johnson, 2008). Transitioning from amnion to colostrum and later to milk ingestion, the newborn's sensory expectations are observed to orientate to the breast to knowingly stimulate maternal hormone release and milk flow (Schaal, 2005). These essential prerequisites assist the adaptation of the highly skilled newborn to physically move, slowly and rhythmically on the warm maternal body, gradually orienting toward the breast (Genna & Smith, 2007). Initiation of the rooting response involves integration of neuro-sensory behavioural skills (Genna, 2007). Both intrinsic and extrinsic factors influence the newborn's feeding behaviour (MacMullen & Dulski, 2000). Anatomically, the first two cervical vertebrae, the atlas and axis, with the stabilising effect

of the nuchal ligament, facilitate rotational head mobility for the baby to synchronise the neuro-sensory behaviours that stimulate the rooting reflex (Gangal et al., 2007).

Activation of the olfactory system stimulated by perception of smell detects familiar chemosensory signature odours of the mother, essential prerequisites for adaptation of the highly skilled newborn to breastfeed (Bartocci et al., 2000; Bussell & Vossell, 2012). Genna (2007) author and osteopath defined early sensory integration of neuro-behaviours, as the coordination of optimal cerebral processes that excite touch, smell, taste, [sight, hearing, voice, temperature and physical movement] for survival.

The newborn initiates breastfeeding during the first postpartum hour and if uninterrupted, can be observed to leisurely feed on-and-off both breasts, stopping at times to interact with the mother. Because the first hour after birth is so momentous, the Loma Linda University Children's Hospital in California has named it 'the sacred hour' (Phillips, 2013). All professionals should respect this time and wherever possible mothers and babies should remain together untouched by others for at least the first three postpartum hours and preferably over the first 72 hours. Hofer (2006) Professor of Psychology revealed how the unique psycho-biological features of early mother-baby interaction influenced early sensory and motor integration, learning, communication, motivation and regulated infant behaviours. During the following postpartum days babies who are not separated from their mothers generally breastfeed frequently and are most likely to have established adequate milk volume around 72 hours (Yamauchi & Yamanouchi, 1990).

The First 72 Postpartum Hours

Separation of mother and baby, delaying the first postpartum breastfeed and interruption to breastfeeding over the first 72 postnatal hours may increase the risk of insufficient transfer of colostrum, milk stasis, breast engorgement and delayed milk production and other

psycho-physiological stabilising factors. Delayed or failed transfer of viscous colostrum from the breasts during the early postpartum hours in synchrony with complex physiological changes, are associated with high levels of breast milk sodium increasing the risks of painful congestion, breast engorgement, slow milk production and the probability of nipple trauma (Neville & Mortan, 2001). The symptoms of hot, hard, painfully oedematous breasts, with visible or palpable glandular tissue lumps, may compound the risk of nipple trauma due to the increased size of the breast and associated reduction in erectile nipple tissue that is taken up by the engorged congestion of the breast and areola (Mass, 2004).

Delayed breastfeeding in the first postpartum hour or interrupted breastfeeding during the first 72 postpartum hours, in the current system, is often combined with regimented routine practices and early discharge. An Australian study of midwives ($n = 1,105$) found that one third reported that they had separated mothers and babies soon after birth (Cantrill, Creedy, & Cooke, 2004). They acknowledged that routine practice interventions took precedence over the opportunity for the baby to breastfeed without interruption. Establishing uninterrupted breastfeeding from birth was not consistently promoted in midwifery practice.

The inconsistencies of practice and subsequent breastfeeding interruptions may contribute to the failure to transfer adequate colostrum from the breasts during the first and early breastfeeds. Though the healthy human newborn has the ability to initiate breastfeeding without unnecessary intervention from others, the reality is that the majority of midwives are not yet confident in practising ‘hands-off’ the mother and baby (Dyson et al., 2006; Law, Dunn, Wallace, & Inch, 2007). A comparative study by Law et al, (2007) showed that midwives practised with considerable variations in postnatal breastfeeding and after a

four-hour ‘hands off’ workshop, the immediate postnatal knowledge and problem solving skills for these midwives had increased.

Professional obligation carries a duty-to-protect the first union and the first breastfeed, implying that the midwife who is with the woman ‘mindfully’ observes the connected mother and baby (McKenzie & Hassed, 2012). The prudent midwife can resist touching the maternal breasts or the baby and ensure that they are not separated or interrupted, unless there is a valid reason for emergency assistance.

Physiological Transition: Milk Production

Lactogenesis II is defined as the formation of milk from the time of birth to plentiful secretion (Salahudeen, Koshy, & Sen, 2013). The same authors define lactogenesis II as delayed if it occurs at 72 postpartum hours. This may be due to the gradual physiological increase in milk volume that peaks around 72 hours postpartum when breastfeeding is uninterrupted from birth. There appears to be a [lag] time between reducing levels of colostrum prior to the volumetric increase in transitional milk and commonly observed newborn behavioural changes around the same time. This observation is supported by the findings of Neville & Morton (Neville & Morton, 2001) in a scientific study of the physiology and endocrine changes for postpartum milk production. Their research explains that during the first two postpartum days, large molecules of low volume viscous colostrum dominate early mammary secretion. The more substantial volume increase occurs between 36 and 96 hours postpartum and is recognised as the ‘milk coming in’, that is the mechanism of lactogenesis II.

A transitional period between colostrum and gradually increasing milk volume may be evidenced by the frustrated behaviour of the newborn. The restless behaviour of the crying baby may be diagnosed as hunger or thirst and is commonly associated with a consistent

theme that there is not enough milk being produced for the baby (Dykes, 2005). Exclusive breastfeeding from birth may be ceased when this occurs and this transitional behaviour treated by introducing artificial milk formula using feeding apparatus in the first three postpartum days, which may result in the early cessation of breastfeeding (Schwartz et al., 2002).

Draw-Swallow Rhythms

The unborn baby draws and swallows amniotic fluid to quench thirst and satisfy appetite as well as hiccupping (Witter, Dipietro, Costigan, & Nelson, 2007) and regularly yawning (Sherer, Smith, & Abramowicz, 2001). Fetal swallowing activity is influenced by fetal maturation, neuro-behavioural state and the volume of amniotic fluid (Ross & Nijland, 1998). Amniotic fluid contains many nutritional and developmental properties such as protein, growth factors, hormones and specific immunological properties (Underwood & Sherman, 2006). Fetal swallowing for ingestion of amniotic fluid provides amnion metabolism, thermoregulation, anti-inflammatory processes, hydraulic cushioning protection, buoyancy and space for movement of breathing, swallowing and body and limb movement (Leung & Suen, 2013).

An ultrasound study by Geddes, et al (2008) highlighted the importance of milk removal by showing that milk only flows from the nipple ducts into the oral cavity when the downward movement of the posterior tongue creates an intra-oral vacuum. The ultrasound studies of Woolridge (Woolridge, 1986b) and Geddes raised my interest in improving my understanding of intra-oral function and as mentioned before, this led to the anatomical and soft tissue exploration of my own intra-oral cavity while using my thumb during simulated episodes of drawing and swallowing (see Appendix 5).

Identifiable rhythms associated with drawing and swallowing milk flowing over the posterior tongue into the oropharynx, occur with a sequence of changes in the rhythmical movement of the mandible, chin and the swallow reflex. Draw-swallow rhythms at the beginning of a breastfeed adapt to the volume of milk propulsion in harmony with the baby's precise synchronised breathing (Goldfield, Richardson, Lee, & Margetts, 2006). The pressure of high volume milk stored in the breast creates an early rapid propulsion through the nipple ducts (Genna, 2013). Vis-à-vis, when the milk volume is reduced the baby's intermittent drawing efforts become shorter and less frequent; the compression of the nipple and adjunct breast tissue is firmer during efforts to stimulate further milk flow. These changes inform when the baby is swallowing in contrast to stimulating milk flow, or nurturing toward the end of the feed. Intermittent episodes of synchronised deeper, longer drawing episodes occur with the intra-oral compression of the nipple [at the anatomical distance of the soft palatal cleft] and downward movement of the posterior tongue (Geddes et al., 2008).

Common Reasons for Cessation of Breastfeeding

Maternal and/or neonatal pain associated with birth trauma and bruising, plus the belief that there is not enough milk were common reasons identified in the literature for cessation of breastfeeding (Hegney, Fallon, & O'Brien, 2008). The presence of painful nipple and breast complications was identified as another reason for ineffective breast stimulation resulting in the decline of milk volume perpetuating the cyclical fear of low milk volume (Schwartz et al., 2002).

Imposed practices that interfere with the complex motor responses of the functionally integrated oral cavity and pharynx for drawing, swallowing and breathing (A. Miller, 2002) may result in cessation of breastfeeding. Practical education and practice around

current breastfeeding techniques that involve excessive, hands-on or forceful assistance by others inhibits the natural act of breastfeeding and appears to hinder the mother and baby's orderly tactile behaviour (Klaus, Kennell, Plumb, & Zuehlke, 1970). Alternatively, avoiding touching or interrupting a woman and her baby, enables the woman and the alert baby to complete the neuro-sensory physiological responses to breastfeed by themselves (Ingram, Johnson, & Greenwood, 2002). Externally-controlled manoeuvres of the breast, nipple and infant alter the unique timing and sequencing of newborn neuro-sensory and reflexive ability to self initiate breastfeeding (Colson et al., 2008). These professionally imposed practice techniques may have inadvertently contributed to increased nipple trauma and decreased breastfeeding rates.

Conclusion

This chapter highlighted significant events that influenced breastfeeding in Australia from the early 1970s commensurate with the rise in institutionalisation and medical intervention in labour and birth. Midwives forfeited their traditional practice as they became increasingly ensconced in medically guided, technical practices that redefined the progress of labour but arguably built an overt expert status rather than an 'authentic presence' in relation to breastfeeding (Schmied et al., 2011). Many authors refer to medically managed labour, intensified pain, intrapartum administration of opioid drugs and how these practices impede unity of the human mammal pair that may involve hours of separation of the mother and baby from birth (Facchinetti, Bagnoli, Bracci, & Genazzani, 1982; Government of Western Australia, 2009; Kumar & Paes, 2003; Torvaldsen et al., 2006). The professionalising of birth and breastfeeding contribute to delayed initiation, shorter duration of first breastfeed and decrease in sustained duration of breastfeeding (Barclay, 2011). The healthy newborn without professional assistance is capable of breathing air

soon after birth and is stimulated by self-directed movement. The unmedicated baby is aroused and awake within the first two hours of birth, approximately the same time it takes to complete the first postpartum breastfeed (Parsons, Young, Murray, Stein, & Kringelbach, 2010). The next chapter introduces the study design including the methods used for the retrospective review of a breastfeeding programme.

CHAPTER THREE: METHODOLOGY AND METHODS

Introduction

This chapter describes and explains the methodology employed in the study and the research methods used for the data collection and analyses to assist in understanding the phenomena of breastfeeding complications. This study reports on the data analysis of a cross-section of breastfeeding women (n = 653) presenting to the in-home breastfeeding programme between 2003 and 2007. Justification of the study design and methods employed are provided. Potential bias, the study outcomes, ethics approval, the analytical methods and the limitations of retrospective research are also addressed in this chapter.

Positioning Myself in the Study

My own midwifery experience, both in the hospital system and providing services for women through pregnancy, labour and birth at home (≥ 700 births over 25 years) and over the following six postnatal weeks influenced the way in which I participated with breastfeeding women in the Darebin programme. I was both concerned and intrigued by the breastfeeding differences that I witnessed between women using the two services of hospital and home. The women who gave birth at home almost universally breastfed and rarely had any problems or required additional assistance. In contrast, women attending the Darebin service, who had birthed in either public or private hospitals, appeared to have a completely different breastfeeding experience. Witnessing these differences had a great impact on me and was influential in how I assessed the women, the advice and information I provided and in the type of data I then collected and recorded.

A large proportion of the professional breastfeeding advice I shared with the women seemed different to the advice that had been provided by midwifery colleagues practising

in the hospital system. The most common differences were the teaching by midwives of the cross-cradle hold and the common sequence of manoeuvres of the nipple, breast and the baby that resulted in observations of facio-mandibular asymmetry.

When attempting to understand and critique the experiences of these women in a scholarly way it was important to recognize and articulate how my own personal involvement influenced the study. After reading a range of theoretical papers and textbooks I found that auto-ethnography provided a way for locating my own professional experience and knowledge in the discussion, interpretation and comprehension of the results in this thesis (Arnold, 2011).

Chang (2008) reports that auto-ethnography can assist the researcher to identify relevant data and may improve understanding of the data analysis. It allows the researcher's professional experience to be exposed and used. Auto-ethnography justified and validated my participation in the study as well as the development and content of the database of complications I was seeing as a professional. It also helped to interpret the findings of the data analysis. Auto-ethnography allowed me to collect qualitative comments and record them as short-text notations. With the permission of the women I was able to use photography to capture observations I made to provide visual confirmation of the nature and location of the observed trauma(s). Again, with permission some video footage has also been collected.

The inclusion of short-text notations with quantitative data allowed potential reasons for the breastfeeding complications and painful nipple trauma to be identified and described. When applied to this study, 'auto' allows for descriptions of my professional experience and practice, which explains the modifications that were made to achieve pain relief. 'Ethno' relates to the culture of the midwifery profession, identifying aspects of education,

practice and teaching of common breastfeeding techniques described by the women. 'Graphy' legitimises the inclusion of individual short-text descriptive reflections made by the women and photography in context of the diagnoses and assessment made by myself with the quantitative data analysis. For example, some common descriptions that were recorded in the database as short-text notations were 'this has been confusing', 'I was told many different things'. When demonstrating the breastfeeding technique they had been using I would commonly hear 'this is how I was taught', 'it is difficult', 'it doesn't feel right', 'my wrist hurts', or 'my shoulder is painful'. After the women modified the technique and fine-tuned to achieve facio-mandibular symmetry it was common to hear 'why wasn't I told this before', 'this is different', 'it feels sensitive but there's no pain', or 'this feels normal'. The modifications and fine-tuning is described in Appendix 6.

Retrospective Cross-sectional Study Design

Cross-sectional studies have a hybrid design that may include aspects of cohort or case control studies (Kogevinas & Chatzi, 2009). This study employed a retrospective cross-sectional design to answer the research aim and objectives. This design was utilised to collect, organise and examine the prevalence of breastfeeding problems in a self-selected population of women breastfeeding for the first time. Cross-sectional studies determine prevalence involving groups of people who hold similar characteristics and don't require long-term follow up or repeat measures. These studies are often hypothesis generating, confirmation of the hypothesis can be more rigorously tested in a prospective study with a stronger design, using a cohort or randomised controlled trial (Mann, 2003).

A cross-sectional study cannot determine cause and effect (Mann, 2003). However, a comprehensive understanding about the common breast and nipple complications in this group of women may allow for conclusions to be drawn about the phenomena of painful

nipple trauma across a wider breastfeeding population (Shuttleworth, 2010). Inferences can also be made about possible relationships between breastfeeding complications and modifiable interventions, or experiences of women during labour, birth and the first few postpartum days. For example, it allows speculation such as a possible relationship between women who were exposed to opioids and their experience of the first postpartum breastfeed and breast or nipple complications. This study cannot prove cause and effect however it can show a possible association.

Participants

Women in the Programme

The local MCH nurses employed within the Darebin local government boundaries provided women with information about the programme or directly referred those who were experiencing breastfeeding complications. A small number of the women required more than one in-home session. The need for a return visit would be determined either at the completion of the first session, or by the women requesting another appointment for a return visit. Data from return visits were not included in this study.

Women in the Study Population

Initially there were 704 maternal infant records retrieved from the in-home programme 2003–2007. After cleaning of the data 51 records were excluded (see below for inclusion and exclusion criteria). There were 653 records remaining to be retrospectively analysed for the study.

Inclusion Criteria: The first in-home session for women with a breastfeeding complication was analysed. Only women with singleton babies were included in the analysis.

Exclusion Criteria: Any in-home sessions other than the first session were excluded. Records for women who had twins were also excluded.

Ethics

The Darebin MCH service and local government management approved the use of the in-home programme data for retrospective analysis with a letter of agreement. Ethics application made to the Australian Catholic University (ACU) resulted in an exemption by the Human Research Ethics Committee (HREC), on the basis that the statistical analysis for the study was using previously collected, non-identifiable data.

At the commencement of each in-home session the women were informed of their rights and individual consent was obtained for the recording of the data. They were also informed about how the data would be coded, protected and stored in keeping with the requirements for informed consent under the City of Darebin Privacy Notice (2009), the Commonwealth Government of Australia Guidelines under the Privacy Act (2000) and the Victorian Government Health Records Act (Victorian Government, 2001) as explained in Chapter One. Individual consent for taking, storing and the professional use of photographs was also obtained. The photographs were beneficial in supporting the data analysis and demonstrating my observations of the variations of nipple trauma and breast complications.

Consent was also obtained for four video clips to be used for professional education, these have been edited to present to the examiners in support of this thesis. Three one-minute clips and one 14-minute clip together with a preamble have been placed on a password protected, secure website for viewing by the examiners. Though ethically it could be challenged that the professional relationship and trust I had with the women were the main

drivers for this consent, it is important to acknowledge that the photographs and video clips added valuable depth, understanding and visual knowledge of the individual complication(s). Equally, the video clips provide a visual understanding of the way women are initially taught to breastfeed, how they continued to breastfeed over existing trauma and how the newborn capably orientated to self-initiate breastfeeding. The 14-minute clip takes the viewer through an edited version of an observed breastfeed during an in-home session showing the importance of the baby feeding from both breasts as explained in Appendix 7. Access to these video clips will be provided for the examiners via a protected source for privacy reasons and will be removed at the completion of the examination.

The Programme Data

While employed for initiating, developing and maintaining the in-home programme over the six years, 2001-2007, I undertook the contemporaneous collection of maternal-infant data. The specifically designed database supported regular analyses of electronically recorded data. The modifications made to the database in 2001 and 2002 were explained in Chapter One. During the first two years the most common presenting problem of painful nipple trauma together with other breastfeeding complications were identified.

The information collected was primarily for identifying influencing factors and possible reasons of the breastfeeding complications, which were more apparent within the early days and weeks of hospital discharge. This information was categorised into variables that allowed for quantitative analyses and reporting. The numeric responses to the established sequence of questions were supported by relevant short-text notations and were recorded in the corresponding sections of the database. Please see Appendix 4 for details of the content of the database for all 18 sections and the 12 sub-sections. As described previously, the examination of the first two years of the database enabled the data

collection tool to be refined so the following four years (2003-2007) allowed consistent data collection against all variables.

The Study Dataset

Data recorded from 2003 to 2007 were cleaned and retrospectively analysed. The 18 sections included questions on demographics, maternal and neonatal data, place of birth, labour and delivery, pain control, past breastfeeding history, the first postpartum breastfeed, breastfeeding experienced in the first 72 postpartum hours, artificial formula feeding, the presenting (current) issue(s) information from the observed breastfeed, diagnoses and types of feeding apparatus (devices) introduced in hospital and used at home.

The study dataset consisted of single and multiple response questions. The majority of the questions elicited a 'yes', or 'no' response. If a response was not reported or was omitted, it was recorded as 'not stated'. There were a few exceptions to the 'yes' or 'no' responses. For example, the question relating to perineal tear status was recorded numerically as 1 = first-degree, 2 = second-degree or 3 = third degree perineal tear. The length of labour was recorded in hours and minutes, numeric data were collected for the number of breastfeeds in 24 hours.

Bias

Observed Bias

The possible risk of bias was considered in relation to my dual role as the practitioner for the programme and the researcher for the study. However, the risk of bias was minimised, as the study was undertaken after the data was collected. Additionally, this could be seen as a strength, because all of the data were collected by the one researcher thus the

observations and diagnosis of conditions were consistent over the study collection period. To further reduce the risk of bias any records for additional in-home sessions for the same mother and baby were excluded from the study data. The exclusion of maternal-infant records with the delivery of twins was due to the data for both babies being recorded in the mother's record.

Analysis Bias

The records were de-identified, coded and the analyses performed by a local government appointed statistician, reducing the risk of bias that may have been introduced by myself as the involved professional.

Selection Bias

It is possible that this group of women, who had clearly decided to try and continue breastfeeding, may have introduced a form of selection bias. Postpartum women who successfully breastfed were not part of the study thus the results cannot be generalised to this group of women. The inclusion of other women who had already given up breastfeeding, or had never tried to breastfeed may have changed the results and would need to be tested in further prospective studies.

Recall Bias

As some of the data for first in-home sessions were collected several weeks after the event it is possible that inconsistencies exist as a result of recall bias.

Reliability, Replication and Validity

The professional breastfeeding observations and the modifications that were made were all systematically and carefully recorded (Ellis, Adams, & Bochner, 2010). The same midwife (myself) asked the same questions of each woman while observing the breastfeed. The

same database was used for four consecutive years; this consistency of replication suggests that the study is reliable (Bryman, 2012). The quantitative data and short-text descriptions provided contemporaneous information of what actually happened during the first in-home session.

Variables for Descriptive Analysis

The aim of considering the chosen variables for analysis was to explore possible reasons for the breastfeeding difficulties in particular, the most common presenting problem of painful nipple trauma. This was informed by my own broadly based experience as a midwife who for forty years has practised in a range of professional settings.

Where appropriate, comparisons of percentages and frequency distributions were made between the Darebin study data (2003-2007) and the 2007 Australian data. These comparisons were made to determine the similarity, or not, of the Darebin study participants to the broader population of child bearing women. This would allow estimations of the generalisability of the study conclusions. The Australian data were accessed and retrieved online from *Australia's mothers and babies report*, the annual government report of perinatal statistics (Laws & Sullivan, 2009).

Maternal Characteristics

The demographic variables of maternal age, parity, country of birth and spoken language were recorded in the dataset. Short-text notations were used to record additional information and comments made by the women. For example, notations were made in relation to pregnancy, labour and method of delivery variables. Methods of pain control were recorded as 'yes' or 'no' responses with short-text notations. Reflective assessment

of prenatal education and self-preparation for breastfeeding were reported by the women and recorded with ‘yes’ or ‘no’ responses.

Labour and Delivery Characteristics

The variables for labour and delivery analysis included methods of pain control, method of delivery and perineal status. These were recorded as ‘yes’ or ‘no’ with the exception of the degree of perineal tear, which was recorded with a number such as 1, 2, or 3. These factors are known to influence the initiation (and duration) of the first postpartum breastfeed and the establishment or cessation of breastfeeding (Riordan, Gross, Angeron, Krumwiede, & Melin, 2000).

Methods of Pain Control

The variables for the methods of pain control in the dataset provided information on the number of women who responded ‘yes’ or ‘no’ to the use of one or more types of pain control. The methods of pain control were inhalational gases, general or regional anaesthesia, intramuscular opioids and natural methods that included massage, movement, warm water shower or warm water immersion.

Method of Delivery

The variables for the method of delivery were categorised into vaginal or abdominal. The women whose babies were born vaginally were categorised into two sub-sections, instrumental or non-instrumental. Abdominal delivery⁷ refers to the surgical procedure

⁷ There are only two anatomical methods for a baby to be born, vaginal or abdominal. A woman can give birth to her baby or the baby may be mechanically delivered with forceps or vacuum extraction vaginally. The other method is via major abdominal surgery traditionally referred to as Caesarean Section (CS). In this thesis the language CS has been changed to reflect the anatomical method.

Caesarean Section (planned – with no onset of labour, or unplanned – with labour in progress). The method of delivery was recorded with a ‘yes’ or ‘no’ response and the length of labour in hours and minutes. These variables may affect the commencement time and the duration of the first postpartum breastfeed and may result in other interruptions to breastfeeding over the first 72 hours.

Postpartum Characteristics

Two primary postpartum variables known to be fundamental to initiating and establishing uninterrupted breastfeeding were recorded as the commencement time of the first postpartum breastfeed from birth and the duration of that first breastfeed. The data in relation to both variables was valuable to providing information about the effect on establishing breastfeeding. Of particular interest were possible connections between delayed commencement and short duration, in terms of nipple trauma, breast engorgement, milk volume and the cessation of any, or exclusive breastfeeding around 72 to 96 postpartum hours (Brownell & Howard, 2012). The other data of interest from these two variables were regarding reducing the risk of developing breast engorgement around 72 postpartum hours. Engorgement is most common during the peak of postpartum milk volume and can occur as a result of delayed, infrequent or interrupted removal of milk from the breast postpartum (M. Smith, 2000). Other variables known to affect the postpartum initiation and establishment of breastfeeding were the introduction of artificial milk formula in hospital as well as, the various types of feeding apparatus used to deliver these feeds (Keemer, 2011).

Commencement of the First Postpartum Breastfeed

This information for the commencement time of the first postpartum breastfeed was recorded in time-intervals commencing from less than 15 minutes, 15 minutes to one hour,

one to two hours, two to twenty four, twenty four to forty eight, forty eight to seventy two and more than 72 hours postpartum. Commencement of the postpartum breastfeed within the first hour of birth is known to be important for the neuro-sensory behavioural transition to initiating and establishing breastfeeding (Cantrill et al., 2004; Genna, 2007). The effective uninterrupted transfer of colostrum and transitional milk has bio-physiological benefits for the mother and baby and may reduce the risk of nipple trauma that can be associated with breast engorgement around 72 postpartum hours (Winberg, 2005).

Duration of the First Postpartum Breastfeed

Most of the literature appears to refer to the duration of breastfeeding as to how long breastfeeding was sustained. There is little evidence in relation to the duration of the undelayed, uninterrupted completion of the first breastfeed for the early and efficient transfer of sufficient viscous colostrum for physiological stabilisation. One study refers to delivery room routines and does recommend uninterrupted breastfeeding during the first hour after birth or until the first breastfeed is completed (Righard & Alade, 1990). Facilitating undisturbed breastfeeding over this early period of the first postpartum breastfeed assists regular ductal flow of colostrum, reducing the possible risk of milk stasis, breast engorgement, inflammatory mastitis and nipple trauma during the peak of postpartum milk volume. Three variables were recorded as 'yes' or 'no' responses. A short duration breastfeed was less than one hour; a medium duration was one to two hours; and a long duration was more than two hours.

Other Feeding Methods In-Hospital

The first postpartum week is a critical window of opportunity for the establishment of breastfeeding (Dewey et al., 2003). Alternative feeding methods involved using a range of apparatus known to affect the initiation and establishment of breastfeeding. The individual

methods were recorded in the database as ‘yes’ or ‘no’ responses. The data items included receiving artificial formula and/or expressed breast milk fed via bottle and teat, syringe or cup. A range of other apparatus such as dummies (pacifiers) and nipple shields were also introduced prior to hospital discharge. Exclusive breastfeeding data were included in this dataset. Recording and analysis of these variables was important in establishing how many newborns were introduced to a range of feeding methods involving the use of various apparatus.

Neonatal Characteristics

The neonatal variables included gestational age recorded in weeks, as well as birth and discharge weights recorded in grams. Each of these three neonatal variables were compared with Australian Mothers and Babies 2007 data (Laws & Sullivan, 2009).

In-Home Breastfeeding Session

The dataset for the in-home session was divided into three main variables; (1) the presenting problem(s); (2) the observed breastfeed; and (3) the diagnosis. Two maternal self-assessments were made during the session. The first was made at the completion of the observed breastfeed, the second at the completion of the entire session, both are described in the diagnoses below.

Presenting Problem(s)

The women reported the presenting problem(s) at the beginning of the session. Each question in four sections was recorded with a ‘yes’ or ‘no’ response. More than one response was possible with each data item collected. The four sections were (1) nipple trauma; (2) breast complication; (3) baby issue(s); and (4) maternal issue(s). Short-text notations were included.

Nipple Trauma

To identify, systematically record, analyse and explain the most common types of nipple trauma reported and diagnosed, the nipple was divided into three anatomical areas - the nipple tip, nipple body and nipple base. Figures 7 – 9 below identify these areas. The presence of trauma in each of these individual categories were recorded as ‘yes’ or ‘no’ observed responses. If the actual trauma was reported by the women and was not observed, it was recorded only as a short-text notation. Nipple pain was also associated with the altered-shape of the nipple, while some had a compressed ridge formation across or on one side of the nipple (see Figure 10). A proportion of women had scab formation and bleeding nipples (Figures 11 and 23), a few had breast pump trauma to the areola and some had more than one area of nipple trauma thus requiring multiple response categories. These areas are identified in Figures 11 and 12. There were many variations to the degree of trauma, these ranged from grazed nipples, to open wounds. The wound variations were not measured or tested in this study, nor were the variations to individual breast, areola and nipple shapes and sizes. The following images are provided to demonstrate the types of nipple trauma diagnosed.



Figure 7: Nipple tip trauma

Nipple body trauma

Diagnosed if the body of the nipple between the tip and base was traumatised.



Figure 8: Nipple body trauma

Nipple base trauma

Diagnosed if the base of the nipple adjunct to the areola was traumatised.



Figure 9: Nipple base trauma

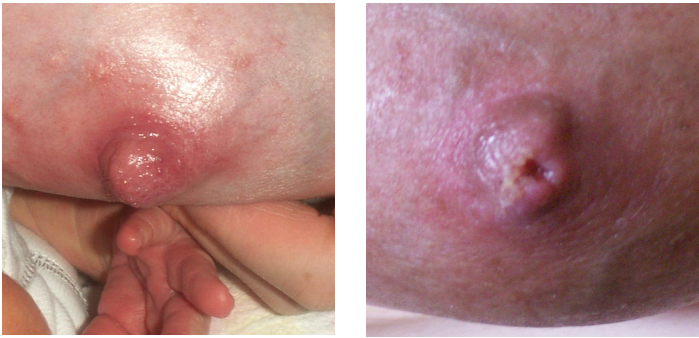
Shape-altered Diagnosed when the nipple is not the normal shape immediately on detachment. This type of trauma appears to be consistent with the tongue compressing the nipple to the shape of the hard palate. Or the gums compress the edge of the nipple forming a ridge.	
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Figure 10: Nipple shape-altered and nipple trauma

Scab / bleeding Diagnosed when there was scab formation that results in bleeding from the wound as the scab softens with the saliva during feeds.	
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Figure 11: Nipple scab/bleeding

Multiple Traumas Multiple traumas. Nipple tip, body, base, areola, bleeding and excessive pressure from the breast pump.	
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Figure 12: Multiple nipple traumas

Maternal and Baby Issues

The variables for the maternal issue(s) were to identify how the women were feeling at the time of the session. These were categorised into the following feelings: (1) exhaustion; (2) overwhelmed; (3) sleep-deprived; (4) emotionally labile; and (5) nutritional issues, each recorded as ‘yes’ or ‘no’ response. These variables often invoked spontaneous descriptions by the women on how the demands on their time with a new baby had changed. There were also high expectations among first time mothers for their young babies to sleep longer at night. The following variables were reported for the baby: (1) unsettled; (2) crying; (3) sleepy; (4) jaundice level (1, 2 or 3); (5) slow weight gain; (6) rapid weight gain; (7) weight loss; (8) vomiting; (9) reflux; (10) tongue tie; (11) use of artificial formula; and (12) medication(s). Other variables included the recording of administration of (13) Vitamin K and (14) Hepatitis B. Except for jaundice, these variables were recorded as ‘yes’ or ‘no’ response, whereas the level of jaundice was recorded as ‘1’ (mild), ‘2’ (moderate) and ‘3’ (significant).

Observed Breastfeed

The observational variables were separated into four categories: (1) the type of hold used by the mother – cross-cradle (Figure 13); cradle-hold (Figure 14); twin hold (Figure 15); and lying down (Figure 16). (2) The alignment of the nipple involving a quick sequence of manoeuvres of the nipple and breast and the baby; and (3) facio-mandibular symmetry or asymmetry. These variables were recorded as ‘yes’ or ‘no’ responses and included the option of short-text notations.

Cross-cradle Hold

The cross-cradle hold demonstrated in Figure 13, shows how the mother was taught to hold her baby by the cranio-cervical spine with her hand extended along the underlying

nuchal ligament. The cradle-hold in Figure 14 shows modifications for three women from the cross-cradle to the cradle-hold with facio-mandibular symmetry. Figures 15 and 16 demonstrate the least style of the twin hold and lying down to breastfeed. Refer to Appendix 2 for a detailed explanation.

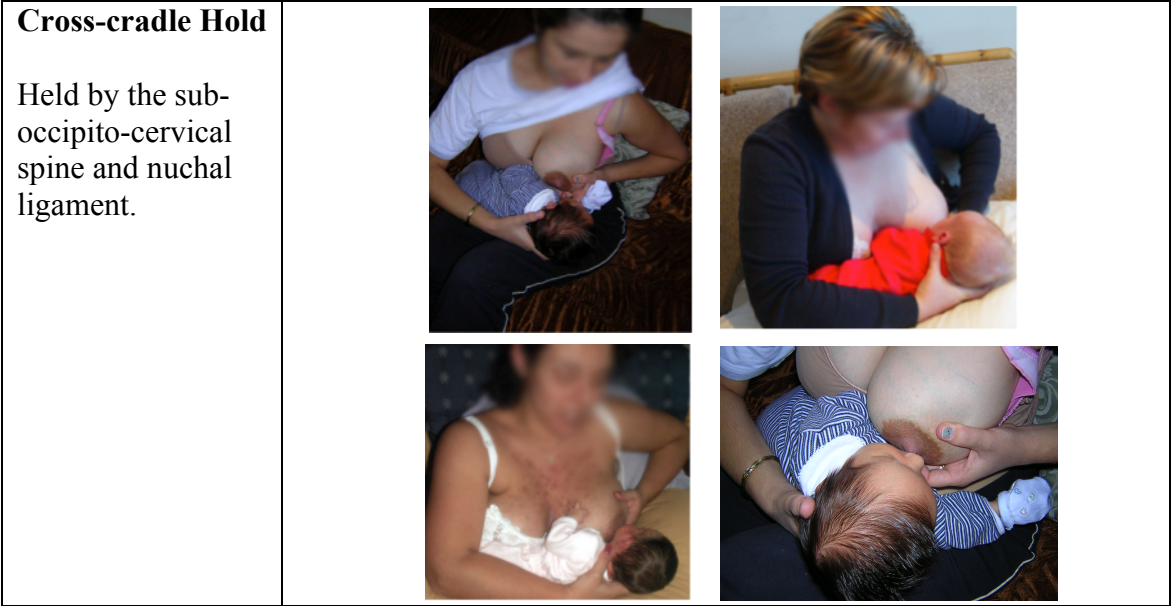


Figure 13: Cross-cradle hold

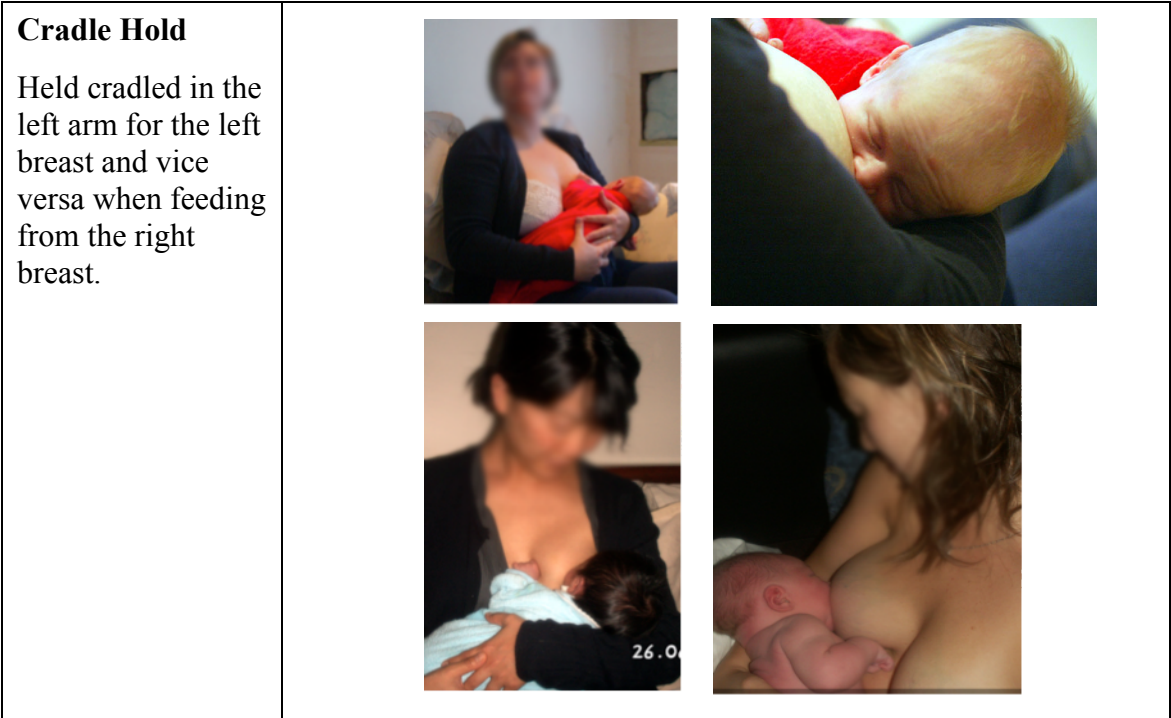


Figure 14: Cradle-hold



Figure 15: Twin hold



Figure 16: Lying down

Nipple Malalignment

The variable ‘nipple malalignment’ resulted from the observed practice of directing the nipple to the baby’s nose, followed by a quick consecutive sequence of associated manoeuvres of the nipple, breast and baby. The women explained that the educational aim for this practice was to get the baby on the breast with the widest possible opening of the mouth. When this rapid sequence was observed it was recorded collectively as a ‘yes’ or ‘no’ response to the variable nipple malalignment.

Facio-mandibular Asymmetry

The variable ‘facio-mandibular asymmetry’ appeared to be contributing to painful nipple trauma. This was recorded when one or more of the four anatomical facial markers (nose, chin and cheeks) were observed to be distorted thus not in symmetrical contact with the breast (Figure 17). These data were recorded as ‘yes’ or ‘no’ response to one or more of the following observations:

- Drawing the nipple only

- Vacuum ineffective
- Chin (mentum) not massaging deep in the breast
- Chin, nose and cheeks not in symmetrical contact with the breast.



Figure 17: Facio-mandibular asymmetry

Alternatively, facio-mandibular symmetry was observed when all four markers were in symmetrical contact with the breast. That is, all four contact points contact the breast to form a symmetrical circle for improved intra-oral drawing (vacuum) and rhythmical swallowing episodes. At the same time, the point of the chin massaged the breast tissue, the nose and both cheeks were against the breast and there were no visible gaps between the four markers and the breast (Figure 18).

Facio-mandibular Symmetry

Symmetrical circle showing four visible contact markers and various views of the cradle-hold and symmetrical contact at the breast.



Figure 18: Facio-mandibular symmetry

Modifications

After the women had demonstrated how they were breastfeeding, they made individual modifications to the cross-cradle and twin-hold, nipple malalignment and facio-mandibular asymmetry where appropriate. The modifications incorporated an explanation of the anatomical considerations that assisted the mother to participate with the baby relying on more natural sensory and reflexive neuro-behaviours, to attain self-directed oral contact with the nipple and breast. These were recorded in the dataset as 'yes' or 'no' responses to the modifications made. The modifications are discussed in Chapter Five.

Diagnoses

Based on the individual maternal-infant history and the assessment of the observed breastfeed a diagnosis was made for one or more of the categories following the completion of the observed breastfeed. The variables for diagnoses were recorded in two categories: (1) the type of nipple trauma (nipple tip, body, base; nipple shape altered and scab formation with or without bleeding) as described above (see Figures 7 – 12); and (2) the type of breast complications (see Figures 19 – 22 below). Each variable was recorded as a ‘yes’ or ‘no’ response and further descriptive information recorded in short-text notations.

Type of Nipple Trauma

The type of nipple trauma observed and diagnosed is explained above (see In-Home Breastfeeding Session section and Figures 7 – 9 above).

Blistered Nipple Ducts, Milk Stasis and Inflammatory Mastitis

The diagnostic variables of blister formation blocking the nipple duct(s) (inspissated) and Milk stasis (pooled milk) (Figure 19) appeared to be precursors to inflammatory mastitis (Figure 20) and each of the categories could also be associated with nipple trauma. Each category was recorded with a ‘yes’ or ‘no’ response and was collectively recorded for inflammatory mastitis. There was also the option to include further information in short text notations. Milk stasis was diagnosed when the milk flow was prevented by a blockage such as blister(s), or scab formation over one or more nipple duct outlets. On observation, milk stasis was usually isolated to one segment or the axillary *Tail of Spence* (Figures 19 (b) and 21).

Mastitis was diagnosed when one or both breasts were painfully engorged and oedematous with localised or generalised inflammation, predisposing to the symptomatically similar complications of engorgement, mastitis. Infectious mastitis and breast abscess was medically treated with antibiotics. Other complications included low milk volume (low supply), high milk volume (oversupply) and breast engorgement.

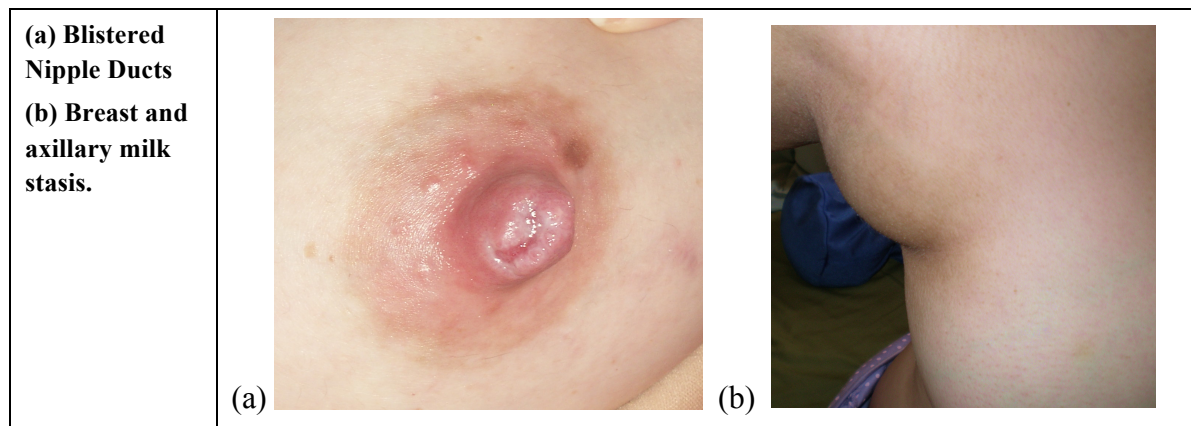


Figure 19: (a) Blistered nipple ducts with nipple trauma and (b) breast and axillary milk stasis



Figure 20: Engorgement, mastitis and nipple trauma

Low Milk Volume

This diagnosis was made when the baby was observed to have intense drawing episodes in an effort to stimulate the milk flow. In the presence of low milk volume occasional or no changes to intermittent regular swallowing episodes were observed. Other factors included information about the method of delivery, early breastfeeding history, the baby's behaviours, as well as the mother's estimation of the volume, consistency, colour and frequency of urinary output and stools.

High Milk Volume

High milk volume often referred to as oversupply was diagnosed when very full, heavily laden breasts, rounded in shape that temporarily reduced the size and shape of the nipple were observed. In the presence of high milk volume the Darebin women seemed to be using only one-breast per feed, that is one breast every 3 to 4 hours. This practice appeared to compound the problem of high milk volume. The diagnosis of high milk volume (oversupply) was recorded as a 'yes' or 'no' response to and if appropriate a short-text notation was made regarding the use of one breast per feed.

Breast Engorgement

There were two variables for breast engorgement (Figures 20 and 21). The first was reported by the woman when reflecting on her experience of engorgement in hospital recorded as a 'yes or no' response. Breast engorgement was defined as hot, hard, painfully oedematous breasts occurring around 72 postpartum hours. The second also recorded as 'yes or no' response was reported when it was observed during the in-home session. Reducing engorgement is important to the prevention of painful nipple trauma and mastitis, such prevention may improve the rates of establishing and sustaining breastfeeding (Mass, 2004).



Figure 21: Engorgement

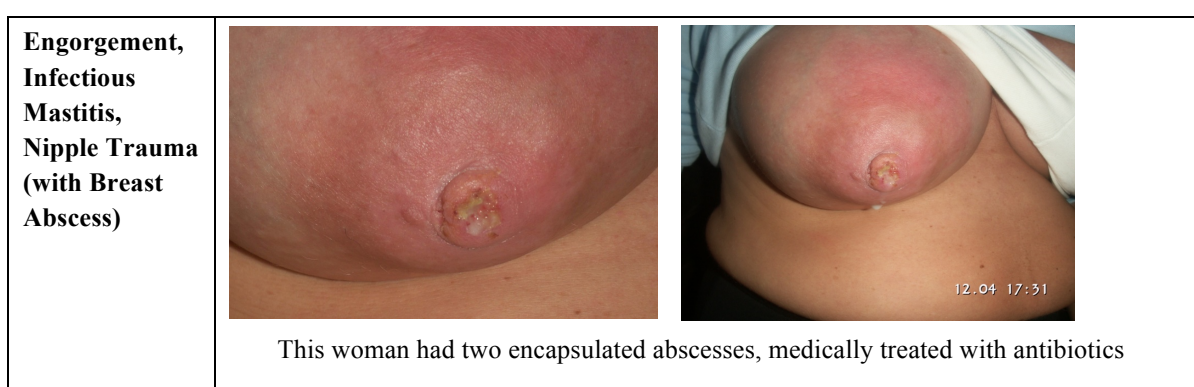


Figure 22: Mastitis, nipple trauma and two breast abscesses in the same breast

Breast Pump Trauma

Breast pump trauma was diagnosed by observing the presence of petechial trauma and bruising observed around the areola consistent with the area of contact with the breast flange as seen in Figure 23(b). The women described the area as sensitive. This trauma appeared to be related to the way the women used the breast pump. On observation they didn't understand how the breast pump pressures and frequencies could be regulated to individual comfort. They believed if the pressure was set to high and the pumping action set on fast they could quickly extract milk from the breast. They were not aware of how to use the pump to simulate the rhythm of the baby drawing and swallowing, in order to effectively stimulate the release of the pituitary hormones prolactin and oxytocin, rather than trying to extract milk from the breasts.



Figure 23: (a) Nipple tip, areola, (b) breast pump trauma and (c) scab formation, bleeding

Feeding Apparatus Used at Home

In addition to the apparatus (devices) introduced in hospital, information was collected separately on the range of apparatus used for feeding or pacifying babies in the home. The description of the seven variables for these were: (1) wide base/short nipple teat; (2) flat/short/tapered teat; (3) long teat; (4) short dummy; (5) flat/short dummy; (6) cherry shaped dummy; and (7) other devices such as finger, syringe, cup, breast pump and nipple shield. More than one device could be recorded as a 'yes' or 'no' response. The variety of shapes, length and texture of the intra-oral devices was of interest in relation to the intra-

oral anatomical and muscular adaptation, required by the breastfeeding baby and the affect this may have on nipple trauma, milk production and oral development.

Two Maternal Self-Assessments

There were two maternal self-assessments completed. The first assessment made on the completion of the observed breastfeed was important to reporting on the effectiveness of any modifications made during the breastfeed. The women were asked to consider the outcome of the current breastfeed in comparison with previous breastfeeds. This first assessment was recorded as a 'yes' or 'no' response to one of five variables regarding improvement or no improvement. These were: (1) none; (2) some; (3) good; (4) very good; and (5) excellent.

The second assessment made at the end of the two-hour in-home session was also important to understand if the women had reached their expected goal and felt confident to continue breastfeeding. At the end of the in-home session, the women reflected on the entire session to establish if they had reached the goal(s) they expected. This was recorded as a 'yes' or 'no' response to three variables: (1) not achieved; (2) partly achieved; and (3) fully achieved.

Data Analysis

Descriptive statistics and frequency distributions were initially used to describe and summarise the dataset. Descriptive analysis included demographic, maternal, labour, delivery, postpartum and neonatal characteristics as well as the observations and diagnoses made during the in-home sessions. Further analyses for the study involved using chi-square test, bivariate and logistic regression analysis.

The most common presenting problem identified by annual reports, reported by the women and observed by myself during the in-home session was nipple trauma thus it was the primary outcome of interest. To understand what factors were associated with the primary outcome of nipple trauma further statistical testing of chi-square, bivariate and logistic regression analyses were undertaken to determine potential predictors.

Chi-square Analysis

Chi-square cross-tabulations for predictors of nipple trauma were used with no simultaneous control of other potential confounding factors. As some cells had small, expected frequencies, Yates's correction was used to adjust the Pearson chi-square analysis to prevent overestimation of statistical significance (Salkind, 2010).

Bivariate Analysis

Bivariate analysis was used to determine the significance of the relationship and examine the effect that the 10 independent variables may have on the dependent variable nipple trauma. The independent variables were derived from the literature as well as my own knowledge, experience, observations and my reasoning about what could be contributing to painful nipple trauma(s).

Logistic Regression

Logistic regression analysis explored the risk factors that predisposed the Darebin women to the dependent variable, nipple trauma. The p value for probability was initially determined using the chi-square test with a p value of less than 0.05 considered significant. However, it was decided that if the p value was defined as $p < 0.05$ the variables in the model that were thought to be clinically important would not be captured (that is the cross-cradle hold, nipple malalignment and facio-mandibular asymmetry and breast

complications). Therefore, statistical significance was defined as $p < 0.10$ only for the inclusion of variables in the regression model (Bursac, Gauss, Williams, & Hosmer, 2008; Hosmer & Lemeshow, 2000).

Ten categorical predictors that had qualitative criterion were transferred into binary variables where ‘1’ reflected the presence of an event and the reference group was coded ‘0’ (Table 1).

Table 1: Illustrates the recoding to binary variables

<i>New binary variable</i>	<i>‘0’</i>	<i>‘1’</i>
1. Method of delivery	Vaginal Birth (spontaneous)	<u>Vaginal Delivery</u> (instrumental) <u>Abdominal Delivery</u> (planned not in labour, or unplanned labour in progress)
2. Opioid drugs	No opioids	Opioids (intramuscular/ regional/general anaesthetic)
3. Commencement of the postpartum breastfeed (from time of birth)	Commenced in less than one hour	Commenced in more than one hour
4. Duration of the postpartum breastfeed (from commencement to completion)	Duration (2hrs or more)	Duration (less than 2 hours)
5. Cross-cradle includes twin hold	Cradle hold	Cross-cradle
6. Nipple malalignment	Alignment - no manoeuvres	Malalignment - manoeuvres of nipple, breast and baby
7. Facio-mandibular asymmetry	Symmetrical	Asymmetrical
8. Breast complications	No milk stasis, blistered nipple duct(s) or mastitis	Milk stasis, blistered nipple duct(s) or mastitis
9. Artificial milk formula	No artificial milk formula	Artificial milk formula introduced
10. Breast engorgement	No breast engorgement	Breast engorgement

Assumptions

Odds ratios (OR) with 95% confidence intervals (CI) were presented for the primary outcome of nipple trauma. An OR of one, represented lower odds of nipple trauma while an OR greater than one, was interpreted as increased odds of having nipple trauma. Several OR values were significant at $p < 0.10$ and the OR indicated a large effect. However, the associated confidence interval estimates included 1.0. These variables were identified as potentially important predictors therefore they were retained in the regression model. Prior to conducting the logistic regression analysis, the assumptions were met. Statistical significance was defined as $p < 0.10$. A p -value greater than 0.05 and less than 0.10 indicated a weak association; the size of the OR that indicates whether the effect is important; an OR >2 was considered clinically important.

Each subject provided only one data point for the dependent (outcome) variable; therefore the data met the assumption of independent observations. In regards to the assumption of adequate sample size, there was a minimum of 50 cases for each of the independent variables, except for facio-mandibular asymmetry in the analysis. Some of the CIs were wide because some of the cell sizes were small which is common in observational studies; these were interpreted with caution in the regression model.

Collinearity diagnostics were performed in SPSS (version 19) to detect possible collinearity between the independent variables (SPSS, 2011). The variance inflation factor (VIF) value was less than five, indicating no collinearity between the variables, satisfying this assumption. An examination of the correlation matrix also demonstrated low correlations between the predictor variables.

Study Limitations

Consistently recorded quantitative data with short-text notations could only identify associations between the variables by measuring a range of variables on an individual basis. The reliability and validity of the data was supported by consistent data collection methods. Though the multiple-response questions prevented definitive evaluation of some aspects of the breastfeeding assessments, the suggested modifications and the outcomes, they were beneficial in highlighting the many factors that impacted on the women's ability to breastfeed.

Conclusion

This Chapter discussed the methods, the data collection tools, the database content, definitions of the variables and analyses undertaken. The limitations of this study were described.

Chapter Four explores the key findings of the retrospective cross-sectional analysis of the 653 maternal-infant records comprising of maternal and infant data for the study. This descriptive study used statistics to undertake a retrospective analysis of contemporaneously recorded data of women who presented with breastfeeding complications. This study was also informed by extensive professional experience and observations that are illustrated by using photographs to identify some of the observed complications.

CHAPTER FOUR: RESULTS

Introduction

The previous chapter explained the methodology used for this study including the ethics approval, limitations and the analytical methods. This chapter presents the key findings of the retrospective descriptive study. This includes bivariate and logistic regression analysis of 653 maternal-infant records that comprised of data collected for the period 2003-2007. The data describing the women and their experiences in hospital are presented in the following categories: the maternal demographics, labour and delivery characteristics, the postpartum characteristics and neonatal characteristics. Following on from that is a section describing what the women presented with and what was observed during the in-home session. In the Darebin data the place of birth was recorded by the hospital the women attended however, more specific data that defined private or public services were not recorded.

Some comparative analyses are made with the 2007 national datasets reported by the Australian Institute of Health and Welfare, such as the maternal characteristics of age, parity, the type of delivery and the method(s) of pain control administered during labour as well as the perineal status following vaginal birth (AIHW, 2009). Logistic regression analysis, examined the association between nipple trauma and 10 independent variables as possible predictors. These criteria were informed by my clinical observation and experience and supported by bivariate analysis and the literature.

Maternal Characteristics

The following data compares the 2003-2007 Darebin study data, analysed from maternal-infant records (n = 653), with the data of Australian women who gave birth in 2007 (N = 289,496), to provide an overview of the maternal characteristics of the women who were presenting to the programme.

Maternal Age

The Darebin women had a mean age of 34.0 years. This was higher than the mean age of 29.9 years for Australian women who gave birth in 2007 (N = 289,496) see Table 2. A small number were under 20 years (0.2%), 5.8% were 40 years and over, while the highest proportion (76.9%) was aged 30-39 years and 3.8% did not state their age.

Of the Australian women, the age ranged from 15 to 56 years, the highest proportions were aged between 25 and 34 years. Almost one third were 30 to 34 years. Table 2 below shows a statistically significant difference across every age group with higher proportions of the Darebin women in the older age categories.

Table 2: Maternal age of Darebin women 2003-2007 and Australian women who gave birth in 2007

Maternal Age	Darebin Women (n = 653)		AIHW Women (N = 289,496)		
	Number (%)	95% CI	Number (%)	95% CI	p-value
<20	1 (0.2)	(0.00, 0.01)	11912 (4.1)	(0.04, 0.04)	< 0.01
20-24	7 (1.1)	(0.00, 0.02)	42233 (14.6)	(0.14, 0.15)	< 0.01
25-29	80 (12.3)	(0.10, 0.15)	77481 (26.8)	(0.27, 0.27)	< 0.01
30-34	254 (38.9)	(0.35, 0.43)	93414 (32.3)	(0.32, 0.32)	0.03
35-39	248 (38.0)	(0.34, 0.42)	54138 (18.7)	(0.19, 0.19)	< 0.01
40+	38 (5.8)	(0.04, 0.08)	10292 (4.2)	(0.03, 0.04)	0.02

Australian Data, 2007 (AIHW, 2009).

Parity

As seen in Table 3, 72.6% (n = 474) of the Darebin women had given birth to their first baby; 23.0% (n = 150) their second baby, while 2.6% had given birth to three babies, 0.5% to four or more and 1.4% of cases were not stated. Of the Australian women (41.6%) had given birth to their first baby, 33.5% their second baby, 24.7% to three or more babies and 0.2% were not stated (AIHW, 2009). There was a statistically significant difference across all of the parity categories with the Darebin women having fewer babies.

Table 3: Parity of Darebin women 2003-2007 and Australian women 2007

Parity	Darebin Women (n = 653)		AIHW Women (N = 289,496)		
	Number (%)	95% CI	Number (%)	95% CI	p-value
Primip	474 (72.6)	(0.69, 0.76)	120475 (41.6)	(0.41, 0.42)	< 0.01
Multip 2	150 (23.0)	(0.20, 0.26)	96877 (33.5)	(0.33, 0.34)	< 0.01
Multip 3	17 (2.6)	(0.02, 0.04)	44573 (15.4)	(0.15, 0.16)	< 0.01
Multip 4+	3 (0.5)	(0.00, 0.01)	27038 (9.3)	(0.09, 0.09)	< 0.01

Australian Data, 2007 (AIHW, 2009).

Country of Birth and Spoken Language

A comparison of the Darebin study and Australian data showed that a higher percentage of the Darebin women were Australian born (82.2% and 75.0% respectively). English was the most common language spoken at home for the Darebin women (91.0%). Eight percent spoke English and another language while 0.9% spoke only another language at home. Of the Darebin women 15.5% were born overseas in 33 different countries, while the country of birth for 2.3% was not stated. The Australian Bureau of Statistics (2011) reported that 60.0% of the Darebin population (total population 143,057 of which 73,057 were females) were born in Australia, 40% were born overseas and of those 38.7% spoke a language other than English at home.

The Australian Institute of Health and Welfare (2009) data showed that 24.3% of Australian women who gave birth in 2007 were born in countries outside Australia and for 0.5% the country of birth was not identified. The language spoken category was not reported in the Australian data. Despite the multicultural representation of the Darebin region, the Australian-born women were mostly accessing the in-home service.

Prenatal Breastfeeding Education and Self-Preparation

The majority of the Darebin women rated their prenatal education and self-preparation for breastfeeding as inadequate. The data showed that 82.55% (n = 539) of the Darebin women responded to the question on prenatal preparation and education. Of these women, only 4.6% rated their education and self-preparation as good, while 77.8% rated it poor and 17.6% of the cases were not stated.

Labour and Delivery Characteristics

Methods of Pain Control for Labour and Operative Delivery

There were a total of 1,048 responses to the questions on methods of pain control in labour. This number represented women who reported more than one method of pain control. As seen in Table 4, only 0.9% had a general anaesthetic, compared to 8.2% for all Australian women who gave birth in 2007 (AIHW, 2009). A total of 38.6% of Darebin women were administered regional anaesthesia (27.2% epidural, 11.4% spinal block, caudal was not reported). This was compared to 31.7% for Australian women (caudal, spinal and spinal-epidural included). Of the Darebin women, 27.8% were administered intramuscular opioids, compared to 24.9% of Australian women. Furthermore, 21.1% of Darebin women, compared to 40.9% of Australian women, used inhalational gases (nitrous

oxide and oxygen). Only 11.8% used natural (shower, water immersion, massage and mobility) or no methods for pain control. Data were not recorded for natural methods of pain control in labour for Australian women in 2007. Darebin women were statistically significantly more likely to have been administered regional anaesthetic and opioids during labour and birth (Table 4).

Table 4: Anaesthesia and pain control for Darebin women and Australian women who gave birth in 2007

Anaesthesia and Pain Control	Darebin Women (n = 1048)		Australian Women (N = 237,023)		
	Number (%)	95% CI	Number (%)	95% CI	p-value
General Anaesthesia	9 (0.9)	(0.00, 0.02)	7305 (8.2)	(0.08, 0.08)	< 0.01
Regional	404 (38.6)	(0.36, 0.42)	75165 (31.7)	(0.31, 0.32)	< 0.01
IM Opioid	291 (27.8)	(0.25, 0.31)	58968 (24.9)	(0.25, 0.25)	0.03
Inhalation	221 (21.1)	(0.19, 0.24)	117819 (49.0)	(0.50, 0.50)	< 0.01
Natural Methods	16 (1.6)	(0.01, 0.02)	NA	-	
No methods	107 (10.2)	(0.08, 0.12)	NA	-	

Australian Data, 2007 (AIHW, 2009).

NA = not available

The Darebin and Australian data excludes local anaesthesia (perineal and pudendal nerve block).

Note: more than one type of anaesthetic is recorded therefore the totals of the individual categories are greater than 100%.

Type of Birth

Of the Darebin women 35.2% reported having an abdominal delivery, (15.3% were planned surgery and 19.9% unplanned). In 2007 the Australian average was 30.9% for abdominal delivery (18.1% were planned and 12.8% unplanned) as shown in Table 5. The instrumental vaginal delivery rate of 25.7% for the Darebin women included vacuum extraction (11.6%) and forceps (14.1%). Only 35.7% reported having a non-instrumental vaginal birth; this figure included 0.3% who gave birth immersed in warm water (waterbirth) and 3.4% of cases were not stated. The Australian data showed that approximately 1 in 9 women (11.2%) had an instrumental delivery (mechanical extraction by vacuum [7.5%], forceps [3.6%]) while 57.9% gave birth (vaginal) without instruments,

waterbirths were not reported (AIHW, 2009).

Of the Darebin women who experienced a vaginal birth (61.7%), (instrumental, non-instrumental and water immersion), 84.1% reported at least one other intervention such as induction of labour, administration of pharmacological drugs, episiotomy (perineal incision) and regional or general anaesthesia. Three babies in the Darebin study were medically diagnosed and confirmed by my recorded observation to have cranial and facial birth trauma associated with delivery by mechanical extraction. There was a statistically significant difference across all categories for the type of delivery with Darebin women more likely to have an abdominal or instrumental delivery (see Table 5).

Table 5: Method of delivery for Darebin women 2003-2007 and Australian women who gave birth in 2007

Type of Delivery	Darebin Women (n = 653)		Australian Women (N = 289,496)		
	Number (%)	95% CI	Number (%)	95% CI	p-value
Abdominal	230 (35.2)	(0.32, 0.39)	89371 (30.9)	(0.31, 0.31)	0.02
Vaginal Instrumental	168 (25.7)	(0.22, 0.29)	32377 (11.2)	(0.11, 0.11)	< 0.01
Vaginal Non instrumental & waterbirth	233 (35.7)	(0.32, 0.39)	167676 (57.9)	(0.58, 0.58)	< 0.01
Not Stated	20 (3.1)				

Australian women who delivered in 2007 (AIHW, 2009).

Perineal Status – Vaginal Delivery

The data for the Darebin women (n = 423) and the Australian women (N = 200,053) includes multiple responses as some women who had a vaginal delivery reported more than one type of perineal trauma. Of the Darebin women 23.6% reported no perineal trauma (intact). The highest proportion (33.1%) of women had an episiotomy (perineal incision). Though the overall perineal tear rate was 33.8% (first degree 22.2%, second degree 11.1%, third degree 0.5%), the women were less likely to have a second-degree tear

and more likely to have an episiotomy. The combined episiotomy and extended tear rate was higher (4.3%) than that of Australian women (2.4%). There were no fourth degree perineal tears reported by the Darebin women.

Of the Australian women who gave birth in 2007, 34.3% had no perineal trauma (intact) following vaginal delivery, 14.6% had an episiotomy and 2.4% had an episiotomy with a perineal tear. The perineal tear rate of 44.3% included the diagnosis of perineal grazing (first degree 20.4%, second degree 23.8% and third or fourth degree 1.5%), Table 6. There was a statistically significant difference across most categories showing Darebin women were more likely to have experienced perineal trauma with more than double the rates of episiotomy and episiotomy including a tear when compared to Australian women.

Table 6: Perineal status of the Darebin women 2007 and Australian women who gave birth in 2007

Perineal Status	Darebin Women (n = 423)		Australian Women (N = 200,053)		
Vaginal Delivery	Number (%)	95% CI	Number (%)	95% CI	p-value
Intact	100 (23.6)	0.20, 0.28	68666 (34.3)	0.34, 0.35	< 0.01
Episiotomy	140 (33.1)	0.29, 0.38	29214 (14.6)	0.14, 0.15	< 0.01
Episiotomy & tear	18 (4.3)	0.03, 0.07	4816 (2.4)	0.02, 0.02	< 0.01
Tear 1st degree	94 (22.2)	0.19, 0.26	40841 (20.4)	0.20, 0.21	0.01
Tear 2nd degree	47 (11.1)	0.08, 0.14	47688 (23.8)	0.24, 0.24	< 0.01
Tear 3 rd /4 th degree	2 (0.5)*	0.00, 0.02	3049 (1.5)	0.01, 0.02	0.761
Other	NA		5748 (2.9)	0.03, 0.03	
Not stated	22 (5.2)		31 (0.0)		

NA = Not available

Australian women who delivered in 2007 (AIHW, 2009).

*No Darebin women reported a 4th degree tear

Postpartum Characteristics

Commencement of the First Postpartum Breastfeed

Only 39.3% of the Darebin women commenced breastfeeding within the first postpartum hour, 44.3% were delayed from two to 24 hours and a further 11.2% were delayed 24 to 72 hours (see Figure 24). The first postpartum breastfeed was six and half times more likely to be delayed for more than one hour if women had an abdominal or instrumental delivery (χ^2 (1, n = 619), = 115.5 $p < .000$) with an OR = 6.548, 95% CI = [4.585, 9.354].

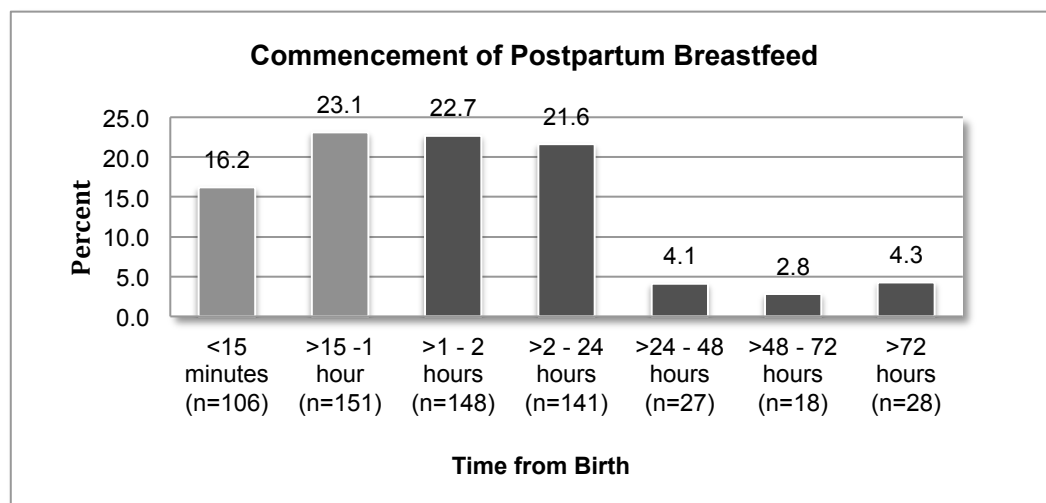


Figure 24: Commencement of first breastfeed for Darebin women and babies 2003-2007

Commencement of the First Postpartum Breastfeed with Engorgement

The commencement time of the first breastfeed was divided into less than one hour, one to two hours and more than two hours. To test for an association between the commencement time of the first postpartum breastfeed (hours from birth) and breast engorgement (in-hospital), the chi-squared test for linear trend was applied. The longer the delay in commencing the first breastfeed, the more likely the women were to experience breast engorgement χ^2 (1, n = 619), = 5.274 $p < .022$) see Figure 25.

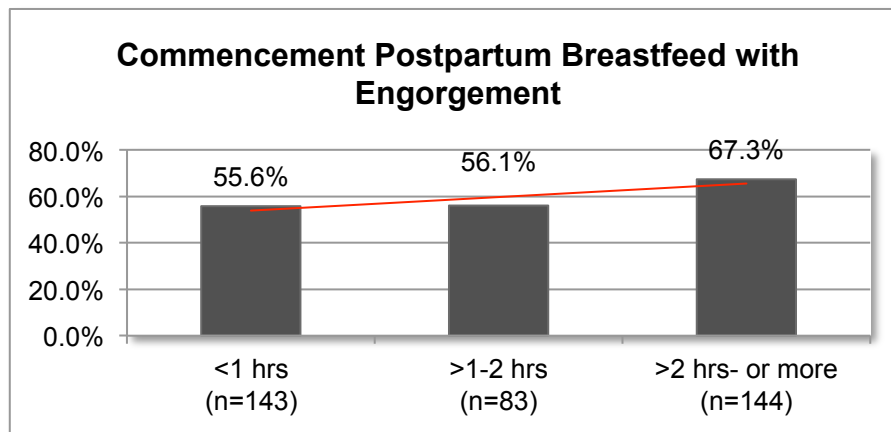


Figure 25: Association of the commencement time of the first breastfeed with engorgement

Commencement of First Postpartum Breastfeed with Opioids

Of the women (n = 462) who were administered opioids, only 31.4% (n = 145) commenced breastfeeding within the first postpartum hour. Of those who were not administered opioids 71.2% (n = 111) commenced within the first hour. To test for an association between the commencement time of the first postpartum breastfeed and the administration of maternal opioids, the chi-square test was applied. An association was found with women who were administered opioids and these women were also more likely to experience delayed commencement of the first postpartum breastfeed $\chi^2(1, n = 618) = 76.01, p = < .001$ with an (OR = 5.393, 95% CI = [3.621, 8.031]).

Commencement of the First Postpartum Breastfeed with Nipple Trauma

To test for an association between the commencement time of the first postpartum breastfeed (hours from birth) with nipple trauma, the chi-square test for linear trend was applied and found to be not significant, $\chi^2(1, n = 619) = 3.815 p = < .051$ (see Figure 26).

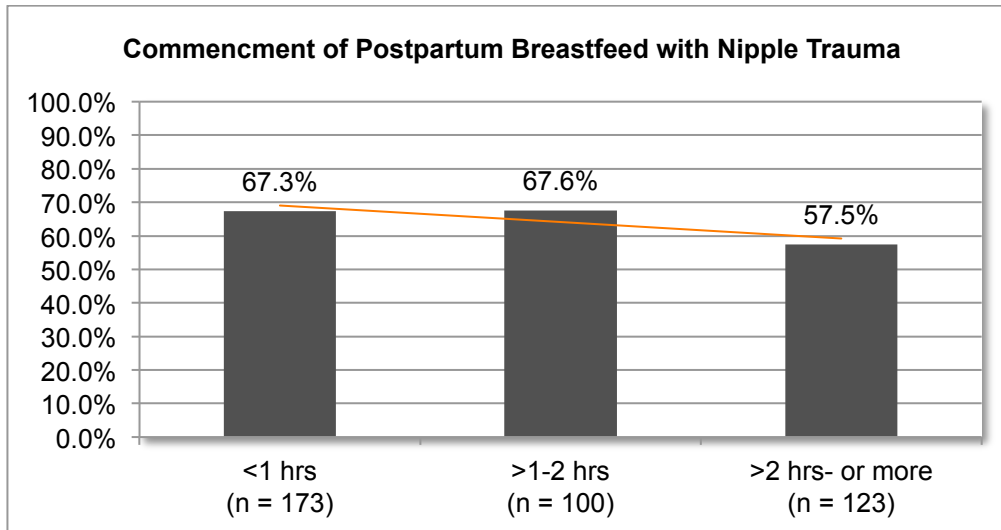


Figure 26: Association of the commencement time of the first breastfeed with nipple trauma

Duration of the First Postpartum Breastfeed

For 87.7% of the Darebin women, the duration of this first breastfeed was less than one hour. Only 4.3% continued to breastfeed between one to two hours. A small number (2.6%) reported continuing for more than two hours for their first postpartum breastfeed; 5.4% were not stated (see Figure 27).

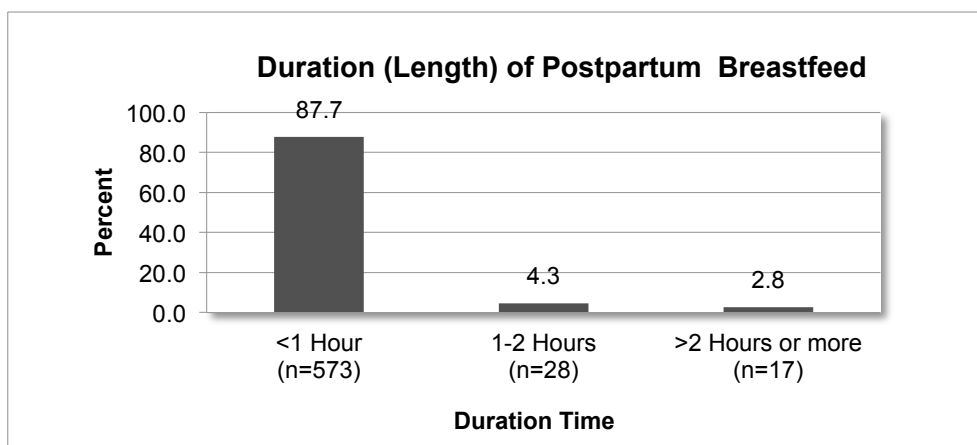


Figure 27: Duration of first breastfeed for Darebin babies 2003–2007

Duration of First Postpartum Breastfeed with Engorgement

To establish the number of women who had experienced breast engorgement, the women were asked to reflect on their experience of the third to fourth days following birth in relation to the physiological ‘milk coming in’. Over half (57.6%) described breast engorgement as having painfully swollen, hot, hard lumpy breasts, associated with episodes of feeling hot and cold and emotionally labile. Though the remainder (42.4%) reported no engorgement, some described very full breasts without the more extreme symptoms of engorgement.

To test for an association between the duration of the first postpartum breastfeed (in hours) with breast engorgement around 72 postpartum hours, the chi-square test for linear trend was applied. The result revealed, the shorter the duration of the first breastfeed the more likely the women were to experience engorgement $\chi^2 (1, n = 618), = 4.445, p = .035$.

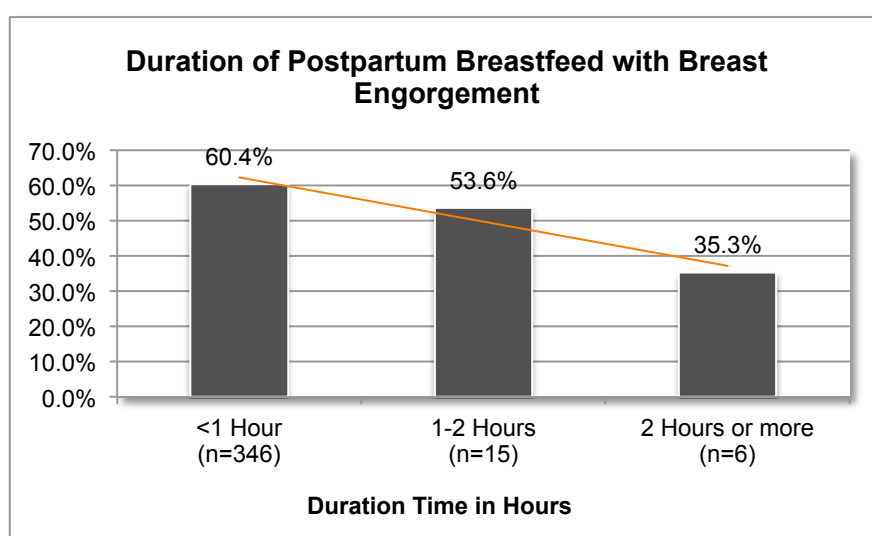


Figure 28: Association of the duration of the first breastfeed with engorgement

When the duration of the first postpartum breastfeed was divided into three categories (less than one hour, one to two hours and more than two hours) the women who breastfed for less than one hour were almost three times more likely to experience engorgement in hospital with an (OR = 2.758, 95% CI = 1.006, 7.556) (see Figure 28).

Duration of First Postpartum Breastfeed with Opioids

The women (n = 462) administered opioids were more likely to have a shorter (less than 2 hours) first postpartum breastfeed (98.3%) compared to the women who did not use opioids (94.3%). To test for an association between the duration of the first postpartum breastfeed and the administration of maternal opioids, the chi-square test was applied. An association was found where the women were more than three times more likely to experience a short duration for the first postpartum breastfeed $\chi^2(1, n = 618) = 6.97, p = < .008$ with an (OR = 3.436, 95% CI = [1.302,9.066]).

Other Feeding Methods and Feeding Apparatus In-Hospital

A high proportion of the Darebin babies (64.0%) were introduced to more than one method of feeding in hospital, including feeding with expressed breast milk (EBM). Only 36.0% of the women reported that they exclusively breastfed while in hospital. Artificial milk formula was introduced to 45.9% of the babies. Comparative Australian data, specific to the introduction of artificial formula while in hospital, was unavailable due to different data collection and reporting systems. The mother's EBM was fed to 47.6% of the babies in the study, while some were breastfed then topped-up with artificial formula. Both EBM and artificial formula were given via a range of apparatus, including by bottle and teat (45.2%) and via other devices (44.6%) such as a cup, spoon, syringe or nasogastric tube (see Figure 29).

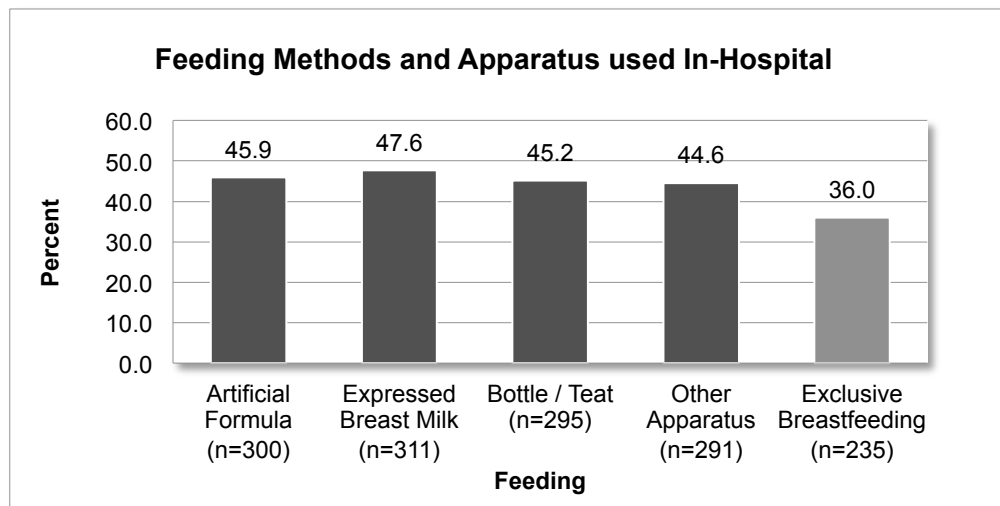


Figure 29: Feeding methods and feeding apparatus used in-hospital 2007

Apparatus with Opioids

The babies of the women (n = 643) who were administered any opioids were more likely to be fed via various feeding apparatus (51.7%) compared to 26.6% of women who did not use opioids. To test for an association between the use of apparatus and the administration of maternal opioids, the chi-square test was applied. An association was found where the women were almost three times more likely to use feeding apparatus if they were administered opioids $\chi^2(1, n = 643), = 31.6, p = < .000$ with an (OR = 2.948, 95% CI = [2.01, 4.34]).

Apparatus with Nipple Trauma

The women (n = 653) whose babies were fed in hospital with artificial formula (45.9%) and/or expressed breast milk (47.6%) via various apparatus were more likely to experience nipple trauma (60.4%). To test for an association between the use of apparatus and nipple trauma, the chi-square test was applied. An association was not found $\chi^2(1, n = 653), = 2.99, p = < .083$ with an (OR = 0.745, 95% CI = [0.53, 1.04]). The Darebin data showed that 62.6% (n = 409) babies were introduced to dummies and teats in hospital.

Neonatal Characteristics

Gestational Age

At the time of birth, 86.7% of the Darebin babies (singleton) were term with gestational ages ranging from 37 to 42 weeks. A total of 10.4% were under 37 weeks and 2.9% were not stated. There were no babies born beyond 42 completed weeks. The mean gestation was 39.4 weeks, (95% CI [39.23, 39.51]). In comparison, the mean gestational age for Australian live born singleton babies in 2007 (N = 292,027) was 38.9 weeks, the proportion of babies born at term (37-41) weeks was 92.4% and 1.0% were 42 weeks and over. Almost 7.0% cent were preterm (AIHW, 2009) (see Table 7).

Table 7: Gestational age at birth of Darebin babies 2003-2007 and Australian live babies 2007

Gestational Age	Darebin (n)	Darebin %	Australian 2007 %
<37 weeks	68	10.4	6.6
37- 42 weeks	566	86.7	92.4
Not stated	19	2.9	1.0
Total	653	100.0	100.0

Australian women who delivered live babies in 2007 (AIHW, 2009).

Birth Weight

The Darebin study data showed a higher birth weight and the mean weight was 3,401 grams (SD = 501, 95% CI [3361.20, 3440.82]), while 6.3% were not stated. The Australian data on birth weight for babies showed 81.8% between 2,500 and 3,499 grams at birth, 5.8% were below 2500 grams, with 1.8% over 4000 grams. The average birth weight of liveborn babies in Australian in 2007 was 3,374 grams (Table 8).

Table 8: Birth weight in grams of Darebin babies 2003-2007 and Australian babies 2007

Birth Weight (grams)	Darebin (n = 653)	Darebin %	Australian 2007 (N = 292,027) %
<2500	25	3.8	5.8
2500-2999	70	10.7	15.0
3000-3499	252	38.6	35.9
3500-3999	209	32.0	30.9
4000-4499	46	7.0	10.2
4500 >	10	1.5	1.8
Not stated	41	6.3	0
Total	653	100.0	100.0

Australian women who delivered live babies in 2007 (AIHW, 2009).

The mean weight of the Darebin babies on hospital discharge was 3,241 grams (SD = 452, 95% CI [3204.82, 3276.60]) with only 5.2% less than 2,500 grams.

The In-Home Breastfeeding Session

Presenting Problem(s)

This section reports on the data for the presenting breastfeeding problem(s) that were described by the women during the in-home session as their reason for seeking breastfeeding assistance.

Nipple Complications

Of the women, 64.2% reported having nipple complications while 3.5% reported other issues of inverted or flat nipples. In addition, 3.5%, experienced areola trauma found to be associated with corresponding circumference of the silicone or plastic breast flange during motorised or manual breast pumping. The anatomical variations of nipple trauma ranged from nipple tip to nipple body, base and areola trauma, discussed further under ‘diagnosis’ below. All of the women with nipple trauma reported associated pain. The intensity of individual pain was not measured in this study.

Breast Engorgement

At the in-home session 14.7% women reported breast engorgement as their presenting problem, 8.4% with mastitis. A Pearson 2 x 2 chi-square test was applied and found that women who experienced breast engorgement in hospital were more than five times more likely to be diagnosed with inflammatory mastitis during the in-home session χ^2 (1, n = 653), = 5.379, p = .02) with an (OR = 1.87, 95% CI = 1.095, 3.193).

Maternal Issues

During the in-home session 79.0% of the women reported one or more of the following since hospital discharge: feeling overwhelmed, exhausted, emotionally labile, sleep deprived and nutritionally depleted.

Observations

Cross-Cradle Hold

When asked at the beginning of the in-home session to demonstrate how they were currently breastfeeding, the women were typically taught to use the cross-cradle hold technique, which was demonstrated by 84.5% of the women (this included the twin hold as explained in Chapter One). The most commonly used cross-cradle technique involved holding the baby by sub-occipito-cervical spine along the nuchal ligament, the same principle applied to the small number who used the twin hold. The more traditional cradle-hold was demonstrated by 11.6%, while 0.8% lay down to feed, 3.1% of cases were not stated. See Appendix 2 for a description of the cross-cradle hold.

Nipple Malalignment

Nipple malalignment was closely associated with a sequence of manoeuvres such as reshaping the breast, redirecting the nipple to the baby's nose (nipple malalignment),

sweeping the nipple over the lips and rapid arm movement (RAM). The aim was to coordinate these manoeuvres to get as much of the areola as possible into the baby's mouth when the mouth was open widest. This observed combination was recorded in the database as nipple malalignment. Only 7.2% were observed to facilitate the baby to self-initiate of neuro-sensory behaviours that involves the newborn rooting to seek the breast and nipple for breastfeeding (see Appendix 2 for a description of nipple malalignment and the associated manoeuvres).

Facio-mandibular Asymmetry

Facio-mandibular asymmetry refers to asymmetrical contact of the four facial markers (nose, chin and both cheeks) with the breast. Of the babies who were asymmetrical on breast contact, the majority (91.7%) were drawing only the nipple into the oral cavity, 8.27% of cases were not stated. Most importantly, 90.2% of the babies were asymmetrical (distorted), whereby one or more the four facial markers were not contacting the breast (see Figure 30). Over seventy percent (71.2%) were observed to have ineffective vacuum with poor oral seal at the breast associated with arrhythmical drawing and swallowing (sucking) episodes, 9.19% of cases were not stated. The observations showed that the chin was not placed into the glandular breast tissue (which is necessary for effective massaging of the breast tissue) for 50.8% of the babies. Only 4.3% of the babies were observed to have symmetrical facio-mandibular contact with the breast, whereby the nipple as well as breast tissue was drawn intra-orally. This meant that all four facial markers were in symmetrical contact with the breast and no visible gaps were observed. Drawing and swallowing episodes were rhythmical and coordinated.

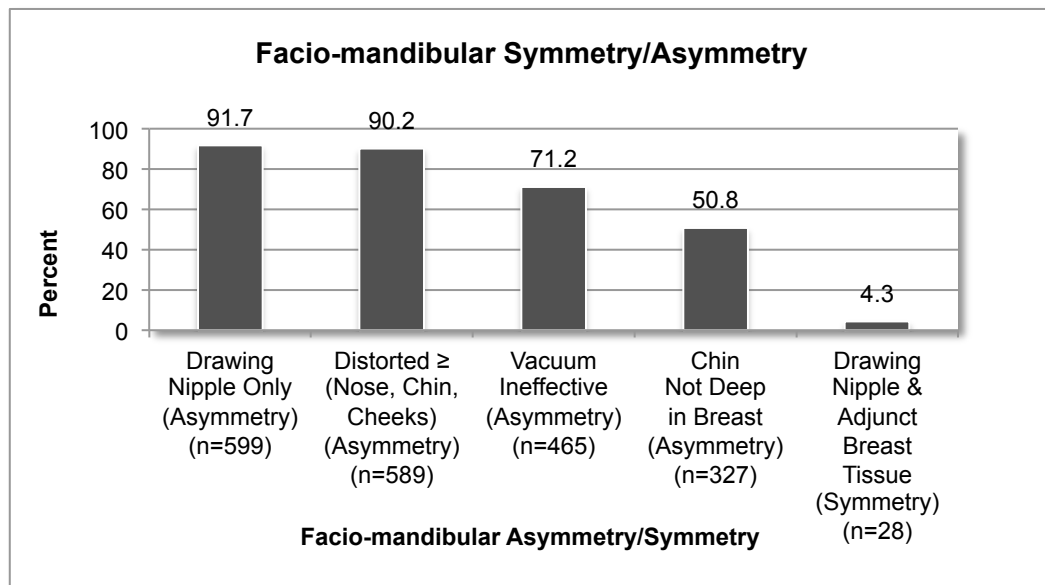


Figure 30: Five categories associated with facio-mandibular asymmetry or symmetry

Note: each of the bars relates to separate questions recorded in the observation of the breastfeed, Section 14 in the database.

Number of Breastfeeds in 24 Hours

At the time of the in-home session, 594 women (91%) responded to the question on many times in 24 hours their baby's breastfed; the highest proportion 61.9% (n = 404) breastfed seven times in 24 hours. There were 13.3% who breastfed between 8 and 12 times and 15.9% who fed less than seven times in 24 hours these babies were more likely to be combined breast and artificial formula feeding.

Diagnoses

Nipple Trauma

A total of 78.0% of women were diagnosed with nipple trauma. The type of nipple trauma varied. For some women it consisted of cracks and bleeding, to deep tissue damage, while others had more than one type of nipple trauma. As previously mentioned the nipple was divided into three anatomical areas to identify the variations in the types of nipple trauma. The most common diagnosis was nipple tip trauma (58.7%), followed by nipple body

trauma (10.1%) and nipple base trauma (9.2%). In addition, 33.1% had a painful ridge formation or altered nipple shape, 10.6% had scab formation covering the nipple ducts and/or bleeding nipples (see Figure 31). Some women had all three anatomical areas of nipple trauma. In some cases these included both nipples.

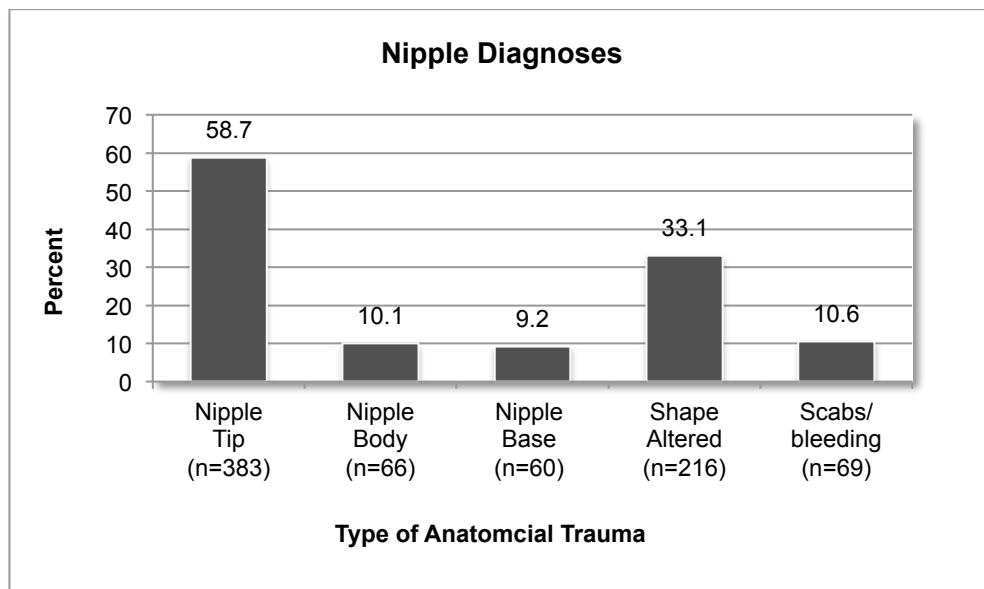


Figure 31: Categories of nipple diagnosis

Inflammatory Mastitis

The diagnosis of inflammatory mastitis was derived from the combination of the following three categories: blister formation blocking one or more nipple ducts (inlissated), milk stasis in one or more segments of the breast. Two women had mastitis that was associated with abscess formation, one of those had two abscesses in the same breast and both women were medically treated (Table 9).

Table 9: Three categories associated with inflammatory mastitis

1	Blistered (inspissated) nipple ducts (one or more nipple duct outlets blocked by blister formation restricting milk flow that appeared to be associated with milk stasis.	2.0%
2	Milk stasis	7.7%
3	Mastitis (two cases of medically treated mastitis with encapsulated breast abscess were included in this category).	6.6%

Low and High Milk Volume

Almost a quarter (22.5%) of the Darebin women described low milk volume (low supply), which was tested for an association with nipple trauma (OR = 0.63, 95% CI [0.44, 0.92], $p = 0.02$). Low milk volume had a statistically significant association with less nipple trauma. Interestingly, there was no significant relationship found between high milk volume (12.4%) and nipple trauma (OR = 1.37, 95% CI [.83, 2.26], $p = 0.22$).

Breastfeeding Modifications

Of the Darebin women, 84.5% were invited to make modifications to the cross-cradle or twin hold, to the cradle-hold. Additionally, 88.4% agreed to eliminate the sequence of manoeuvres and fine-tune facio-mandibular asymmetry to achieve symmetry of the nose, chin and both cheeks when the baby began swallowing. In the presence of asymmetry, it was possible to fine-tune without taking the baby off the breast and the movements for fine-tuning were coordinated once the baby began swallowing. Four simple movements involved the mother moving her baby's body slightly to her right or left to fine-tune nose to contact and contour the breast and for chin contact to be adequate for massaging the breast. To achieve symmetrical contact of the left and right cheek against the breast, the mother slightly altered the tilt or angle of the baby's body. These four movements were used to gain symmetrical contact of all four markers with the breast. The women were also asked to try breastfeeding without using pillows or other props.

The aim of these suggestions was to assist the women to focus on symmetry during natural contact and to breastfeed confidently without having to rely on props for comfortable breastfeeding. Facio-mandibular symmetry and effective drawing of the nipple and adjunct breast tissue resulted from these suggestions. The women reported that the pain was relieved during effective and rhythmical drawing and swallowing episodes, even when they continued to feed over existing nipple trauma.

Maternal Assessment at Completion of the Breastfeed

At completion of the feed more than half the women (53.3%) described feeling more comfortable with reduced pain while feeding over existing nipple trauma. Only 0.5% reported no improvement; 12.3% experienced some to good improvement, while 82.5% reported a very good to excellent outcome following individual modifications, 4.7% of cases were not stated (Figure 32).

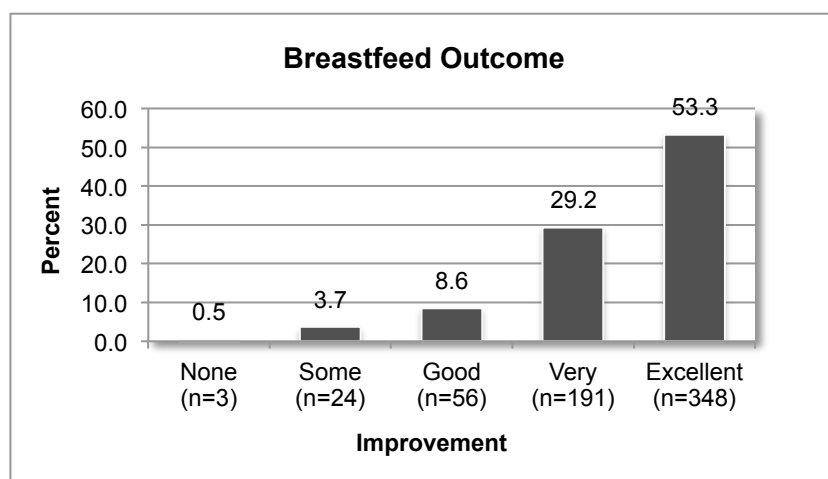


Figure 32: Outcome of observed breastfeeds self-assessed by the women

Maternal Assessment at completion of the In-Home Session

This final assessment was different to the maternal assessment made at the completion of the breastfeed above. At the completion of the two-hour, in-home session, each woman assessed if her goals had been met for the session. Of the 653 women, 50.1% reported they

had fully achieved their goal for improved breastfeeding, 42.4% reported they partly achieved their goal and 1.1% felt they had not achieved their goal and would require one or more follow up visits, 6.4% of cases were not stated.

Nipple Trauma: Primary Outcome

The primary outcome of interest for this study was nipple trauma. The anatomical areas of nipple tip, body/base/bleeding and scab formation/alterd shape were combined into one variable for further analyses. A total of 509 women (78.0%) had nipple trauma.

Bivariate Analysis

Table 10 shows the results of the 2 x 2 chi-square cross tabulations for predictors of nipple trauma with no simultaneous control of other potential confounding factors. These categorical predictors transferred into binary variables where “1” reflected the presence of an event and the reference group was coded ‘0’. As some cells had small, expected frequencies, Yates’ correction was used to adjust the Pearson chi-square analysis, to prevent overestimation of statistical significance (Salkind, 2010).

Table 10: Bivariate analysis association between independent variables with nipple trauma

Independent variables	Odds Ratio	95% CI	p-value*
Facio-mandibular asymmetry	16.8	5.03, 56.14	< .01
Nipple malalignment	6.4	3.68, 10.99	< .01
Cross-cradle hold	3.5	2.13, 5.74	< .01
Inflammatory mastitis	2.7	1.46, 4.91	< .01
Breast engorgement	1.6	1.12, 2.15	0.008
Artificial milk formula	0.9	0.68, 1.28	0.65
Abdominal/Instrumental delivery	0.9	0.65, 1.23	0.49
Opioid drugs	0.7	0.46, 0.98	0.04
Postpartum breastfeed commenced <1 hour	0.8	0.56, 1.09	0.15
Postpartum breastfeed duration 2-3 hours	0.4	0.11, 1.33	0.13

*Yates (1934) continuity correction

A statistically significant association with nipple trauma was found for facio-mandibular asymmetry, nipple malalignment, the cross-cradle hold and inflammatory mastitis. There were no statistically significant associations found in the bivariate analysis between nipple trauma and artificial formula, abdominal/instrumental delivery and the commencement or duration of the postpartum breastfeed. The women who were administered intramuscular, regional and general anaesthetic opioids were less likely to have nipple trauma; this relationship was in the opposite direction from what was expected.

Logistic Regression Model

To further examine the association between nipple trauma and the independent variables, regression analysis was undertaken. The strongest predictors identified in the bivariate analysis were added to the logistic regression model: facio-mandibular asymmetry, nipple malalignment, cross-cradle hold and inflammatory mastitis.

Breast engorgement was not used in the regression model because when it was added to the model during the modeling process it was not significant. Further, the standard error also increased or decreased by more than 10%, which suggested it was too closely related to one of the other variables in the model. The odds of the women having nipple trauma were more than eight times greater for those whose babies had facio-mandibular asymmetry on breast contact, (OR = 8.83, 95% CI [1.05, 73.95]), (see Table 11). However, the large confidence interval must be taken into consideration. This is possibly due to the small sample size, however may also be a random error.

Table 11: Logistic Regression Model for primary outcome of nipple trauma

Variable	Odds Ratio	95% CI	p-value
Facio-mandibular asymmetry	8.83	1.05, 73.95	0.05
Nipple malalignment	2.75	1.21, 6.28	0.02
Cross-cradle hold	1.78	0.93, 3.41	0.08
Inflammatory mastitis	3.21	1.63, 6.33	<0.001

Note: $R^2=0.092$ (Cox & Snell), .126 (Nagerlkerke). Model χ^2 (4, N = 653) = 57.46, $p < 0.001$

The logistic regression model identified facio-mandibular asymmetry, nipple malalignment and inflammatory mastitis. The cross-cradle hold lost significance in this model.

Additional Findings

Findings that were not within the scope of this study, mentioned briefly in this chapter, require further detailed observation and analysis. These additional findings may give rise to important questions that could be considered for future research.

A total of 51.3% of women described crying unsettled babies. There appeared to be two common associations with the unsettled-crying baby. The symptoms of gastro-intestinal disturbance (reflux and colic) appeared to be associated with the practice of using only one breast per feed and/or the regular maternal ingestion of oral vitamins and fish-oil supplements. Some women also ingested a range of other oral products, for example, Chinese herbal, naturopathic and homeopathic remedies. These baby and maternal issues, appeared to have negative implications for breastfeeding women in addition to the key finding of nipple trauma with 79.5% of the women (n = 519) reporting one or more experiences of feeling physically exhausted, overwhelmed and sleep deprived. The breastfeeding modifications applied to the unsettled baby with gastro-intestinal disturbance in this study are described in more detail in Appendix 7.

Conclusion

The chapter reported on the key findings from the retrospective analyses of the total sample of the Darebin study participants from 2003-2007, comparing some data with that of the Australian women who gave birth in 2007 (AIHW, 2009). Chapter Five presents the implications for these results in context of the aims and objectives of the study, in context of the study questions and data analysis. In addition, Chapter Five explores common precursors and key issues arising from the data analysis.

CHAPTER FIVE: DISCUSSION

Introduction

Chapter Four presented the key findings of the retrospective analysis of 653 maternal-infant records for this study. The data collected for the period 2003-2007 included descriptive, bivariate and logistic regression analysis. Chapter Five revisits the aims and objectives of the study and synthesises the key findings against the literature and my own professional practice with breastfeeding women. The key findings arising from the data analysis in relation to nipple trauma were explored, in particular the cross-cradle technique, malalignment of the nipple and facio-mandibular asymmetry. This chapter also discusses the anatomical review of the occipito-cervical spine, nuchal ligament and intra-oral anatomy in relation to possible causes of the high rates of nipple trauma and breast complications. Suggested modifications to the currently taught breastfeeding techniques are proposed later in the chapter. Suggestions are also made to assist midwives to facilitate an environment that supports undisturbed breastfeeding during the first 72 postpartum hours.

This study set out to explore and understand the reasons why women were presenting to the DIHB programme with breastfeeding difficulties and to use this improved understanding to inform midwifery practice and professional effectiveness. The objectives of the study were to undertake a retrospective, analysis of the 653 maternal-infant records (2003-2007) and to report the findings. The objectives included analysis of the breastfeeding techniques described and demonstrated by the women in relation to their presenting problems and description of the strategies used to alleviate the complications and their impact on breastfeeding. Finally, the objectives were to draw on the literature and

my clinical expertise to make recommendations for midwifery and breastfeeding practice to assist sustained breastfeeding.

The literature review highlighted the professionalisation that has occurred around breastfeeding over the past 40 years and the effects of maternal and newborn separation with outcomes of delayed commencement and interruption of breastfeeding from birth. A theoretical underpinning of breastfeeding was drawn from the disciplines of anatomy, physiology, psychology and neuroscience. An anatomical review of the cranio-cervical spine, the nuchal ligament and the intra-oral cavity, as well as revising mammalian neuro-sensory and physical behaviours, assisted in explaining the basis of many of the presenting problems experienced by the Darebin women.

An increasing abundance of studies, reviews, reports, articles, educational material, books and websites offer a diverse range of instruction and information to assist women to breastfeed and to overcome the associated complications experienced by many women. There is little evidence however, of the effect of professional teaching techniques on different types of nipple trauma and breastfeeding complications. A study of optimal positions for breastfeeding by Colson et al, (2008) suggests that breastfeeding initiation is innate for both mother and baby, it is not learned. This challenges the current information and teaching routine that is central to what is described as breastfeeding support. The results of this thesis provide further evidence to support a different approach.

Revisiting the Key Findings of the Study

The Darebin women who presented for breastfeeding assistance were mostly Australian born (82.2%) aged between 30-39 years (76.9%) with a mean age of 34 years. Just less than three-quarters (72.6%) were primiparous women who were breastfeeding for the first

time. They differed from the average Australian woman giving birth in most results, for example they were more likely to be older, having their first baby and were Australian born. The midwives who followed breastfeeding techniques introduced to midwifery practice over the past 40 years taught them to breastfeed. These techniques appeared to be associated with nipple and breast complications, incongruent with anatomical knowledge and were consistent with preventing the neuro-sensory integration of mammalian behaviours for breastfeeding.

Diagnosis, using maternal history and observation found there were one or more categories of nipple trauma (78.0%), the most common being nipple tip trauma (58.7%), for a photographic example of these categories see (Chapter Three, Figures 7 – 12). Bivariate analysis found nipple trauma to be associated with facio-mandibular asymmetry (OR = 16.8, 95% CI [5.03, 56.14]); nipple malalignment (OR = 6.4, 95% CI [3.68, 10.99]); the cross-cradle hold (OR = 3.5, 95% CI [2.13, 5.74]); complications leading to inflammatory mastitis (OR = 2.7, 95% CI [1.46, 4.91]) and engorgement (OR = 1.6, 95% CI [1.12, 2.15]), discussed in more detail below. Once multivariate analysis was undertaken the facio-mandibular asymmetry, nipple malalignment and inflammatory mastitis remained significantly associated with nipple trauma. Many women had a combination of these factors, each of which are discussed in more detail below commencing in order of the observational sequence of the cross-cradle hold, nipple malalignment and facio-mandibular asymmetry.

The Cross-Cradle Hold

Much of the literature and educational material produced teaches the cross-cradle hold, (holding the baby by the sub-occipito-cervical spine, with the hand extending along the nuchal ligament) see for example, (Glover, 1994; La Leche League International, 2010;

LLLI, 2008; Marmet, 1991; Newman, 2009; Wiessinger, 1998). Medical anthropologist, Ball's (2008) research and other work (Genna & Diklah, 2010; Glover, 1994), suggests that holding the baby in this manner restricts the baby's movements, preventing or limiting the baby's ability to activate the instinctive neuro-sensory rooting behaviours associated with smell, taste and tactile touching of the breast. Ball proposes that not only does the cross-cradle hold restrict the baby's movements and neuro-sensory behaviours it is likely, together with the sequence of taught manoeuvres, to be associated with many of the breastfeeding complications the women in this study were experiencing. This is supported by the findings presented in this thesis.

When the Darebin women described and demonstrated how they had been taught to hold the baby to breastfeed, 84.5% were using the cross-cradle hold and this included a small number who used the twin-hold. The twin-hold also involved handling the baby by the sub-occipito-cervical spine along the nuchal ligament.⁸ The cross-cradle hold significantly increased the odds of nipple trauma by a factor of more than three (OR 3.5, 95% CI [2.13, 5.74]), though it lost significance in the multivariate analysis.

During the in-home breastfeeding session I observed the position of the baby's head, face and body in relation to the mother's body, breast and nipple while she demonstrated the cross-cradle hold. This included observing how the breast was reshaped and the nipple redirected to the baby's nose. Other observations closely related to the cross-cradle hold were made as part of my overall observation of the breastfeeding mother and baby however, they were not recorded as separate variables in this study. They included the

⁸ A typical description of the cross-cradle hold is described in Appendix 2 and can be seen in Figure 13

individual woman’s posture; the shape and size of her body her breasts and nipples; the natural direction of her nipples; the length of her arms from shoulder to elbow in relation to her body shape and her dexterity. These overall observations guided my decisions for recommending any modification to the mother’s breastfeeding technique.

In my experience, the cross-cradle and twin-hold both interfere with the underlying anatomical structures and function of the head, neck and shoulders during breastfeeding. The underlying stabilising nuchal ligament extends from the median external occipital protuberance attaching to the spinous processes of the Atlas (C-1) and to the seventh cervical vertebrae. The underlying anatomical relationship of the cranio-cervical spine and nuchal ligament to the commonly taught cross-cradle hold is illustrated in the Visible Body (2007-2013) model Figure 33 (a) and (b) below.



Figure 33: (a) Cross-cradle hold left breast, hand over the sub-occipito-cervical spine and nuchal ligament and (b) the stabilising ligamentum nuchae

When the mother is taught to breastfeed this way she needs to understand how the baby’s natural head movement is restricted. Restriction of rotational head movement prevents the baby from moving the head naturally to engage in neuro-sensory behaviours and self-locate the breast and nipple. The baby held in the cross-cradle technique can also be observed to hyperextend the head when reacting to the forward thrusting rapid arm movement that is often applied over this area (see Appendix 2, Glossary of Terms for further explanation of the nuchal ligament).

The women also reported other problems; these included perceived low milk volume, high milk volume, blistered nipple duct(s), milk stasis, breast engorgement and mastitis. Perceived low milk volume (22.5%) was first noticeable around 24 to 48 hours postpartum and they described the baby's behaviour as being 'unsettled' during this time. They described the baby as feeding small amounts frequently. Professional advice to introduce artificial milk formula at this time was described by many of the women (with 45.9% doing so). This practice is noted in the literature as being due to the perception that there is not enough milk (Dykes, 2005). On discussion very few of the women knew the natural postpartum process involved with milk production, the importance of continued breastfeeding without the introduction of artificial formula and what to expect of the baby's behaviours over the first 72 postpartum hours until breast milk volume increases.

Nipple Malalignment

The Darebin women had been taught to reshape the breast, direct the nipple to the baby's nose (nipple malalignment), then sweep the nipple over the lips and rapidly thrust the baby onto the breast. Bivariate analysis showed that nipple malalignment increased the odds of painful nipple trauma by a factor of six (OR = 6.4, 95% CI [3.68, 10.99]) with the significance remaining in the multivariate analysis (OR = 2.75, 95% CI [1.21, 6.28]).

Directing the 'nipple-to-nose' remains a common breastfeeding practice taught by midwives. Most of the Darebin women (88.4%) were observed to practice intentional redirection of the nipple away from its natural anatomical position. They would first reshape the breast then apply digital pressure above the nipple with the thumb, to turn the nipple up toward the baby's nose see for example, (Figures 34 and 35 below) as well as (Glover, 1994; LLLI, 2008).

Figure 34 depicts reshaping the breast using the C-Hold to redirect the nipple to the nose. This practice is not identified as nipple malalignment however I argue that it should be described this way.

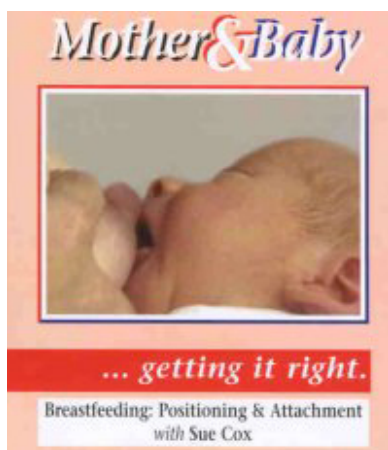


Figure 34: Reshaping the breast using the C-Hold

Figure 35 depicts the cross-cradle hold, re-shaping the breast and using the hamburger or sandwich hold with thumb pressure to redirect the nipple-to-nose (malalignment) and demonstrates how the nipple enters the roof of the mouth at the level of the hard palate. (Sourced on-line from Google Images 10003159.jpg <http://www.canelabox.com/wp-content/uploads/2013/03/mama.jpg>)



Figure 35: Cross-cradle hold, re-shaping the breast to redirect the nipple-to-nose using the hamburger or sandwich hold

On-line educational material and video clips that influence this breastfeeding practice are readily accessible for many women, see for example, Newman (2009) and also the Infant and Young Child Feeding Model Chapter (p.31). This explains the ten steps to successful breastfeeding for medical students and allied health professionals, providing instructions to teach the mother to direct the nipple to the nose, the top lip, or the roof of the mouth (WHO, 2009).

Reshaping the Breast

There are many instructions for holding the breast described in on-line material and in the literature. In the late 1980s, the C-hold was recommended as a way of women supporting the breast to reduce breastfeeding complications and achieve a better latch (Minchin, 1989a, 1989b; Newman, 2009). Since then, many other descriptions for holding the breast have emerged with titles such as, the U-hold, V-hold, scissor, cigarette and the teacup hold (Walker, 2006). Holding the breast in a particular way has also been described in educational material as the hamburger or sandwich hold (Wiessinger, 2004). The purpose is to mimic holding and reshaping the breast in a way that simulated holding a hamburger or sandwich prior to the baby's mouth contact. Some authors recommend not tipping the nipple upward to the nose because improper latch may result in nipple abrasion (C. Wagner, McGraham, Hope, & Hughes, 2006), though this has not translated into a change of practice.

Nipple-to-Nose

Nipple-to-nose (as pictured above in Figures 34 and 35) presented in an audio-visual video recording by Cox (1996, 2007) was originally recommended for premature babies and quickly became a recommendation for all babies. This practice is still shown and described in much of the information accessible for breastfeeding women. Innumerable photographs

and popular on-line video clips such as the one by Newman (mentioned previously), as well as graphics and written descriptions depict and describe this practice, now recommended for most breastfed babies. Breastfeeding Naturally, a video clip published in New Zealand is another example of the range of information that can be accessed by women on-line (Breastfeeding New Zealand, 2009).

Sweeping the Nipple Over the Lips

The highest proportion of the study participants were using a combination of the cross-cradle hold, aligning the nipple to the baby's nose, then sweeping the nipple over the lips in an attempt to create a wider than natural gape of the mouth. The practice of sweeping the nipple over the baby's lips was observed after first aligning the nipple to the nose. Other information describes brushing, tickling or stroking the lips with the nipple to entice a wider than normal opening of the mouth. The women described this as the way they were taught to stimulate the baby to open the mouth wide. Much of the educational material including graphics, photos and audio-visual clips teach these manoeuvres; for example the Australian Parenting Website (Raising Children Network, 2013) recommends these manoeuvres. The practice is often referred to as mother-led attachment. A number of authors for over 20 years have recommended this technique, see for example (Minchin, 1989b; Newman, 2009; Righard & Alade, 1992).

The recommended action of sweeping the nipple over the lips contrasts with knowledge of the neuro-sensory behaviours engaged with the rooting reflex. The healthy newborn like other mammal species activates anatomical rotational head movement stimulated by the newborn senses of smell, touch, taste and sight. These neuro-sensory behaviours, harmonise with the motor coordination of arms, hands, body, legs and feet, facilitated by movement of larger muscles physically guiding the baby to seek the breast and locate the

nipple (Genna, 2013). The baby has the ability to reach, touch and massage to arouse the erectile tissue, to position the nipple for oral contact and to stimulate the release of maternal and newborn oxytocin (Gangal et al., 2007).

Rapid Arm Movement

The practice of rapid arm movement (RAM) used in conjunction with nipple malalignment (re-shaping the breast, directing the nipple-to-nose and sweeping the nipple over the lips) was a consecutive sequence most commonly used in conjunction with cross-cradle hold. The women were taught the RAM manoeuvre to synchronise rapid forward thrusting of the baby onto the breast to ensure a substantial amount of the areola was placed into a wide-open mouth (C. Wagner et al., 2006). Rapid arm movement was shown in an educational video in 1991 and like the others components in the sequence of manoeuvres quickly became common practice (Marmet, 1991). There is no evidence in the anatomical literature or studies on newborn and young babies that suggests this action is necessary. In this study, it led to the need for modifications that engaged the mother and baby in mammalian principles explained later in this chapter.

The Effect of this Sequence of Quick Manoeuvres

The taught sequence of rapidly executed multiple manoeuvres (reshaping the breast to direct the nipple-to-nose, sweeping the nipple over the lips and rapid arm movement) is challenged by Colson (2008) who advocates for the practice of ‘biological nurturing’. When the baby was positioned on the mother’s reclining body, Colson found that primitive reflexes are released and assist the newborn to self-directed breastfeeding. The healthy human newborn, like other mammals as described by neurologists and authors such as Smillie (2013) is capable of moving instinctively to the mother's nipple to self-negotiate breastfeeding for nourishment and emotional satisfaction.

During the Darebin in-home sessions, the collective sequence of these quick manoeuvres was observed to restrict the baby's head and body movement and therefore, the baby's own neuro-sensory and physical movements that could self-initiate breastfeeding (Genna, 2013). In addition, women in the study were observed to distort or twist their own posture, alter the shape of their breast and the anatomical direction of her nipple. The nipple was observed to enter the mouth at the level of the anterior hard palate (roof of the mouth). This was coupled with incomplete drawing of the nipple and breast tissue. This sequence was frequently associated with nipple sucking and painful feeding in the presence of existing nipple trauma and breast complications.

It appeared that the women who were taught the cross-cradle hold with the sequence of manoeuvres were unaware of the ability of the human baby, like other mammals, to move instinctively to the breast and nipple. Smillie (2013) explains that:

...Cultural inclination to restrain and protect newborn head movements has kept many of us from noticing or utilizing...infant capability...restraining of the [head, neck and body] at the beginning of the sequence while attempting to force the end of the sequence (latch) can potentially cause infant anxiety, stress, neurobehavioural disorganization and breast refusal (p. 85).

While the baby's head and body movement was restricted by the cross-cradle hold, the nipple appeared by the mother's description to be compressed between the tongue and the hard palate. Instead of the nipple being drawn into the intra-oral cavity to the distance of the soft palatal cleft and the breast tissue moulding to a unique fit in the oral cavity, the anatomically malaligned nipple-to-nose technique, appeared to result in the nipple being drawn only as far as the anterior hard palate. The women described a sensation of the nipple being compressed by the end of the tongue against the 'rough' corrugated surface of

the anterior hard palate. This was unlike the self-directed neuro-sensory behaviours of the baby who locates the nipple with the protruding anterior tongue. As soon as the baby detached, alteration to the shape of the nipple could be observed and also different types of nipple trauma. Soon after, the nipple returned to individual normal shape. Alternatively, if the nipple and breast tissue was self-located and drawn by the baby along the midline of the tongue, to the distance of the soft palatal cleft and the nose, chin and both cheeks remained in symmetrical contact with the breast the women reported ‘reduced pain’.

Information on the numerous education techniques, the language and the variations in advice over time raises questions about the necessity of these manoeuvres for breastfeeding (Wiessinger, 2004). The Kellymom parenting and breastfeeding website for example, demonstrates a three part animation of the manoeuvres used for educational purposes and is presented in this thesis with permission (Kellymom., 2011). The first graphic in Figure 36 (a) below shows the nipple pointed in the direction of the baby’s nose as the mouth opens and the baby is held by the sub-occipito-cervical spine over the nuchal ligament. The second graphic, (b) shows the nipple entering the mouth at the level of hard palate with the mouth open and as the head extends the chin touches the breast to negotiate drawing the malaligned nipple and the third graphic (c), shows the baby being thrust onto the breast with the chin compressed and the nose not contacting or contouring the breast (Kellymom., 2011; A. Miller, 2002).

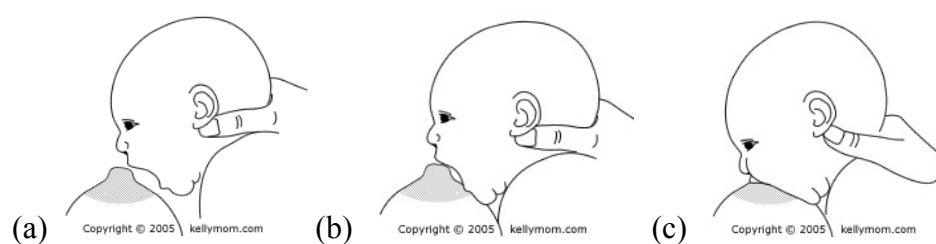


Figure 36: (a) Nipple malalignment, holding the nuchal ligament, (b) extension of the head and nipple entering the mouth at the level of the hard palate, (c) rapid arm movement to forward thrust the baby onto the breast

Though this sequence of taught manoeuvres progressively introduced by professionals over time was intended to prevent nipple trauma, this practice is not in accord with the primary neuro-sensory behaviours for breastfeeding: visual (sight), auditory (hearing), tactile (touch), olfactory (smell) and gustatory (taste) as described by Genna (2013) and nor does it make sense anatomically. The women in this study were six times more likely to experience nipple trauma when nipple malalignment was present. Recommended modifications to these practices are explained later in this chapter.

Facio-mandibular Asymmetry

Anatomical facio-mandibular asymmetry in the context of this study was identified with the way women were taught by midwives to breastfeed using the cross-cradle hold, with nipple malalignment and rapid thrusting the baby onto the breast. Facio-mandibular asymmetry was diagnosed when one or more of the four facial markers (nose, chin and cheeks) were observed to be asymmetrical with the breast. Asymmetry was observed for 90.2% of the study participants (see for example, Chapter Three, Figure 17). Wall & Glass (2006), refer to mandibular asymmetry as contributing to poor latch, nipple pain, poor milk transfer and may also be a contributor to idiopathic neck stiffness.

An incomplete oral seal (due to the asymmetry and malalignment described above) resulted in incoordinate mandibular movement with incomplete drawing of both the nipple and breast tissue for 91.7% of the Darebin babies. The women whose babies were asymmetrical at the breast were 16 times more likely to experience nipple trauma. Ineffective vacuum (71.2%) and incoordinate swallowing rhythm occurred with asymmetry of the nose, chin and cheeks when the baby's head was excessively flexed or deflexed on observation. Forward flexion of the head was observed to result in the nose being compressed into the breast rather than contacting and contouring the maternal breast.

Deflexion moved the nose away from the breast resulting in the chin being buried in the breast. Likewise, some babies were observed to have one nostril and cheek compressed into the breast when the baby's head was tilted to one side. This created ineffective face to breast contact, with the opposite nostril, cheek and the breast. This asymmetry of one half of the four markers (i.e. nose, chin and cheeks) appeared to increase intra-oral compression on one side of the nipple resulting in a ridge formation and altered nipple shape (see Figure 17, Chapter Three).

Precursors to Inflammatory Mastitis

The presenting problems of blister formation over the nipple duct(s) and milk stasis were analysed collectively, as they appeared to be precursors to inflammatory mastitis. Milk stasis occurred for 7.7% of the Darebin women and appeared to be associated with blister formation covering the outlet of one or more nipple duct(s). Though not so common, blister formation sealed the ductal outlet(s) for 2.0% of the women, resulting in pain and blockage of milk flow through the ductal outlet(s). If these factors are present from the initiation of breastfeeding, poor intra-oral vacuum occurs and therefore the nipple rests forward in the oral cavity, the tongue compresses the nipple into the hard palatal bone. Poor vacuum and continuous friction on the nipple, result in blister and/or scab formation over the ductal outlets. When this occurs milk flow is obstructed, remaining in the ductal networks and glandular tissue resulting in inflammatory mastitis. Consistent with the women in the Darebin study are the claims by author Riordan (2005) who refers to milk blisters sealing nipple duct outlet(s). Inflammatory mastitis occurred in 6.6% of the Darebin women. There were two women who had mastitis with encapsulated breast abscess; they were both medically assessed and prescribed antibiotic therapy.

Engorgement

Breast engorgement experienced by over half of the Darebin women (57.6%) in hospital was reported to occur most commonly around 72 postpartum hours. An association was found between the short duration of the first postpartum breastfeed and engorgement (60.4%). Interruption to early breastfeeding may interfere with removal of ample colostrum and therefore transitional milk from the breasts. Factors such as restricted breastfeeding and the introduction of artificial milk products may also interfere with adequate removal of colostrum and transitional milk during the first 72 postpartum hours. Less engorgement was reported by women (35.3%) who breastfed for two or more hours. The majority of women (87.7%) reported a short duration first postpartum breastfeed (less than one hour). Breast engorgement was also observed during the in-home session (10.9%) and (6.6%) experienced early onset mastitis following hospital discharge. See Chapter Three, Figure 20.

Uninterrupted postpartum breastfeeding can continue leisurely for two to three hours. These findings are supported by the literature, which highlights the importance of the first few postpartum hours to removal of adequate colostrum from the breasts. This undisturbed process assists bio-physiological hormonal changes for milk production as well as metabolic stabilisation of the baby during the change from swallowing pre-birth amniotic fluid to post birth colostrum (Schaal, 2005). However, the wide variation in professional practices and handling of the baby by others from birth delays the immediate union of the mother and baby and therefore delays the first breastfeed and transfer of colostrum (Cantrill, 2007).

The longer the first postpartum breastfeed was delayed the more likely the women were to experience breast engorgement in hospital. Only 39.3% of the Darebin babies commenced

the first postpartum breastfeed within one hour of birth, while 44.3% commenced after the end of one hour and up to 24 hours, another 11.2% commenced between 24 to 72 hours or more.

Review of the Anatomy

A review of the underlying anatomical structures of the head, neck, nuchal ligament (cranio-cervical spine) and the shoulders (trapezius muscle) was undertaken. This was of particular interest in relation to the 84.5% of women who had been taught cross-cradle hold. Building three dimensional coloured models of the anatomy enabled a visual comprehension of the close connections of the spinal cord and brain to the sub-occipito-cervical spine, the intra-oral cavity and the sensory organs (Visible Body, 2007-2013). These models, the literature and the intra-oral ultrasound study by Geddes et al (2008) provided in-depth understanding of the coordination of the posterior tongue during drawing and swallowing. The intra-oral models also enabled viewing the proximity of the anterior and posterior tongue muscle in relation to the hard and soft palates. The possible positioning of the nipple and breast tissue during drawing and swallowing episodes could be seen in another cross-sectional model. In addition, these models were valuable in reviewing the tongue muscle in relation to the temporo-mandibular joints, the mandible and chin. Similarly, the proximity of the sensory organs (eyes, nose, lips, mouth, tongue and ears) to the sub-occipito-cervical spine and nuchal ligament were clearly identified as were the connection of the shoulders, arms and hands (touch) to the brachial plexus. This review provided an anatomical explanation for the proposition tested in this thesis confirmed by the bivariate analysis, which showed a significant association between facio-mandibular asymmetry and nipple trauma by a factor of almost 17 (OR = 16.8, 95% CI [5.03, 56.14], $p < .01$). Likewise, an association was found between nipple malalignment

and nipple trauma (OR = 6.4, 95% CI [3.68, 10.99], $p < .01$) and the cross-cradle hold (OR = 3.5, 95% CI [2.13, 5.74], $p < .01$).

The Early Hours of Breastfeeding

The golden hour is a term used by emergency and neonatology professionals. In practice it is applied to the first hour following trauma, or the first hour of neonatal life (Annibale & Bissinger, 2010; Lerner & Moscati, 2001). Neonatologist and infant developmental specialist Phillips (2013), refers to the first postpartum hour as the ‘sacred hour’ explaining that the initiation of breastfeeding within the first hour should be honoured, cherished and protected whenever possible. Complementing the work of Phillips, close observations in this study supported the importance of the first postpartum hour and likened it to the importance of the ‘golden hour’ for facilitating the first uninterrupted breastfeed

The first breastfeed was delayed for more than an hour for 60.7% and was interrupted mostly for routine procedures during the first breastfeed. These delays were six times more common when women had an abdominal delivery and five times more common if they had opioids. Particular attention should be paid to the commencement time and the duration of the first postpartum breastfeed and non-interruption to achieve early and satisfactory transfer of colostrum for physiological stabilisation of the newborn. Equally important is the avoidance of interfering with the mother and baby’s ability to breastfeed. Therefore, ensuring avoidance of any of the predictors of nipple trauma (the cross-cradle hold, nipple malalignment and facio-mandibular asymmetry) found in this study can be important to reducing the risk of nipple trauma. Likewise, the first unhurried and undisturbed postpartum breastfeed may continue over a period of two to three hours without any interruptions by others to ensure that the mother feels connected with her baby.

The transitional physiological (lag) time between colostrum reduction and gradual increase of milk volume may be evidenced by changes in the baby's behaviour. A restlessness associated with crying, unsettled and frustrated behaviour may be observed to commence around 24 hours to 48 hours and most likely is connected with high frequency feeding from both breasts, until changes in the draw-swallow rhythm can be observed to synchronise with increasing episodes of milk flow. This unsettled behaviour has been linked to the perception of not enough milk (Dykes, 2005) which may lead to the introduction of artificial formula during the first 72 postpartum hours and may result in the cessation of breastfeeding (Schwartz et al., 2002).

It was during this first 72-hour period that 45.9% of the Darebin babies were reported by the mothers to be introduced to artificial milk formula, while 47.6% were fed expressed maternal milk and some were introduced to one or more methods of feeding. A study by Wagner et al, (2013) of 2,946 women who were interviewed found that 92% reported feeding difficulties, breast pain, low milk volume and the use of formula on the third postpartum day.

Institutional disruptions, controlled by routinised professional practices continue to be hazardous for the initiation of breastfeeding in the first hour and the establishment of breastfeeding over the first 72 hours (Dumas et al., 2013). A Cochrane review (2012) of thirty-four randomised controlled trials involving 2,177 participants (mother-babies) found a statistically significant positive effect of the first intimate skin-to-skin contact between the mother and baby with breastfeeding duration at one to four months. Immediate union of the mother and baby like all mammals can be observed to evoke neuro-sensory

behaviours that orientate the baby toward the mother's breast and nipple. These newborn behaviours⁹ can be seen on the secure website for this thesis and similarly on the on-line video *Breast Crawl*, produced by medical practitioner Gangal et al (2007). These newborns explore the mother's warm body, while 'deliberately crawling' to locate the nipple and self-initiate breastfeeding.

This mammalian process is supported by the interactions between the mother and healthy newborn if they remain undisturbed in naked body contact in a quiet, warm and private environment (Cantrill, 2007). An article by Winberg (2005) reviewed 30 years of works that demonstrated early naked body contact influenced maternal and newborn physiology and behaviours. Carberry, Raynes-Greenow, Turner, & Jeffery (2013) found that for each hour of separation that elapses from the time of birth, a marked increased risk of breastfeeding difficulties occurs. The same authors refer specifically to these difficulties being experienced by primiparous women and those who had abdominal delivery. These factors were over represented in the Darebin women where 72.6% were first time mothers, 35.2% were delivered by abdominal surgery and 25.7% had an instrumental vaginal delivery, all of which were likely to have influenced delay of the first breastfeed between birth and 24 postpartum hours for 83.6% of the women.

Obstetric Opioids

Academic debate continues about the circulatory, neuro-physiological and metabolic effects of maternal opioids on the unborn, newborn and neonate. The newborn is solely reliant upon its own hepatic elimination (conjugation) of opioids and other drugs

⁹ Video Clip Number 3 The First Postpartum Breastfeed can be viewed on the secure website <http://www.thesis.breastfeedingconsultant.com/>.

administered to the mother (Gow et al., 2001). More often than not, less intervention in labour and birth is better for the newborn's physiological adjustment and stabilisation (Mercer, Erickson-Owens, Gaves, & Haley, 2007). The Darebin data showed that 67.3% of the women were administered opioids intrapartum and postpartum. The only variable in a prospective cohort study by Torvaldsen et al (2006) that was significantly associated with both partial breastfeeding in the first week and breastfeeding cessation during the first 24 weeks was intrapartum analgesia. Of the Darebin women 0.9% had a general anaesthetic, 38.6% had regional anaesthesia (epidural and spinal) and 27.8% were administered postpartum (intramuscular) opioids. Adult dose-per-body-weight of opioids administered to the mother is also considered a contributing factor to newborn narcotic respiratory depression (Kumar & Paes, 2003). Respiratory depression increases the risk of the baby being separated from the mother for transfer to the intensive or special care nursery (Ball, 2008).

Sleepy Babies

Support for opioid affected babies who are too sleepy to self-initiate the first postpartum breastfeed may be necessary for several days. Rhythmical, regular expression of maternal milk may be required to feed the baby and assist hepatic conjugation of the opioids and renal function and maintain the babies caloric needs. The women who had opioids in this study were five times more likely to have a delay in commencing breastfeeding in the first postpartum hour when compared to women who did not have opioids (31.4% vs. 71.2%) (OR = 5.393, 95% CI = [3.621, 8.031]). The women who had opioids were three times more likely to breastfeed for a short duration of less than two hours than the women who did not have opioids (98.3% vs. 94.3%) (OR = 3.436, 95% CI = [1.302, 9.066]). They were also almost three times (OR = 2.948, 95% CI = [2.01, 4.34]) more likely to use various feeding apparatus, which is likely to be associated with why they did not experience as

much nipple trauma (OR = 0.745, 95% CI = [0.53, 1.04]). Babies were also more likely to be fed with artificial formula or maternal expressed breast milk given via various apparatus such as bottle and teat (45.2%) and other devices (44.6%). This is challenging for mothers and babies who are unable to breastfeed and for the babies who are too sleepy to breastfeed. In addition, well over half (62.6%) of the Darebin babies were fed with bottle and teat. The teats varied in shape, size, width, length texture and flow rates. These non-pliable intra-oral apparatus affect normal sucking patterns that develop over the first three postnatal days and early weeks of breastfeeding (da Costa et al., 2010). A randomised clinical trial by Howard et al (2003), found that regardless of the apparatus introduced, sucking intra-oral feeding devices had detrimental effects on sustained breastfeeding.

Separation of Mother and Newborn

Previous evolutionary history shows that neonatal survival depended on close and virtually continuous maternal contact (Moore et al., 2012). The most harmful outcome of the near-universal uptake of medicated hospital deliveries according to Ball (2008) is the separation of mother and newborn in the post-birth period. In a study by Moore et al (2007), it became apparent that separation undermines the proportion of mothers initiating, establishing and sustaining breastfeeding. This was the case with the Darebin women who reported that the type of birth they experienced delayed the commencement of the first postpartum breastfeed and increased the time they were separated from their babies at birth. Carberry et al (2013) in a cross-sectional study of women and babies highlighted:

...the need to focus on establishing appropriate breastfeeding within the first hour to prevent early feeding problems, especially for women who are first time mothers and those who have had [an abdominal delivery] (p. 2).

A number of policies established around institutional practices delay or interrupt the first postpartum breastfeed and remove babies from the mother. These include the professional tasks such as labelling (identification), weighing, checking, warming and clothing, alongside the administration of vaccination and intramuscular injection of vitamin K. However, the exposed newborn skin surface on the maternal body protects the baby from cooling while a warmed cover over the exposed body surface absorbs surface moisture and gives the mother and her newborn, the freedom to discover each other and commence the first postpartum breastfeed unhindered (Moore et al., 2007). Newborn care provided by immediate skin-to-skin contact with the mother in a warmed environment improves colonisation of skin flora and physiological stabilisation (Bergman et al., 2004). The same authors reported that cardio-respiratory instability for separated babies in the first six hours was consistent with the behaviours of other mammalian species.

Hofer (2006), a professor of developmental psychobiology, explains from laboratory research with mammal rats that when the strong bond between mother and baby was severed by separation a series of traumatic bio-physiological reactions occurred. Apart from cardiac rates falling by 40% regardless of ancillary heat or tactile stimulation, behavioural responses commenced with an initial burst of calling, then active searching for the mother, followed by a long decline in activity as the baby despairs if there is failure to make contact. For these reasons Hofer recommended that newborns should not be separated from their mothers.

In some modern practice settings the role of the midwife at both practice and policy level suggests that change toward woman-centred care across the scope of midwifery practice is required to reduce separation of mother and baby occurring (Homer et al., 2009). A survey conducted by the Queensland Centre for Mothers & Babies (2013) has identified that

despite a change in guidelines, only 14.1% of women in public maternity services and 7.4% in private birthing facilities reported skin-to-skin time within five minutes of birth for at least one hour. Likewise, only 13.0% of multiparous, 10.2% of primiparous women, 16.7% of women who had a vaginal birth and 2.1% of women who had an abdominal delivery had skin-to-skin contact for at least one hour immediately after birth.

Returning to Mammalian Principles

Mammalian Principles

The human baby, like other mammalian species, relies on neuro-sensory behaviours that guide self-initiation of breastfeeding at birth (Bussell & Vosshall, 2012). Reviewing the evolution of milk production with reference to five mammalian species McClellan, Miller, & Hartman (2008) concluded that, despite species-specific differences, all mammals are born with the capability of drawing maternal milk within minutes of birth. The mother knowingly protects her baby and within minutes the newborn knows how to orientate toward the breast, locate the nipple to draw and swallow colostrum and breathe in perfect synchrony (Chamberlain, 1998). Neuro-sensory behaviours of the unborn baby, including olfactory response to various familiar maternal odours are critical behaviours learned and recognised in-utero prior to birth and the first breastfeed (Bussell & Vosshall, 2012). Immediate uninterrupted contact between the mother and her baby at birth, when untouched by others, benefits from the accomplishment of physiological transition and neuro-behavioural responses during the transition from fetal to neonatal life over approximately the first four to six hours (Ferber & Makhoul, 2004).

Phillips claims the first postpartum breastfeed is a once-in-a-lifetime experience not to be interrupted unless the baby or mother is unstable and requires medical resuscitation

(Phillips, 2013). Authors Genna & Sandora (2008) link normal sucking with inborn mammalian sensory reflexes, explaining that similar imprinted neuro-behaviours are known to exist between humans and other milk producing mammals. Efficient intra-oral function assists the transfer of stored viscous colostrum soon after birth; thus begins the bio-physiological digestive change for the newborn from ingestion of amniotic fluid to colostrum and maternal breast milk (C. Wagner et al., 2008).

Facilitating and Respecting the Environment

Central to the effectiveness of the first postpartum breastfeed and therefore, the intra-oral transfer of early colostrum is the facilitation of a quiet, calm and unhurried environment for the mother and baby (McClellan et al., 2012). This includes an environment where uninterrupted feeding from both breasts is facilitated during the first and early days of breastfeeding. Uninterrupted feeding assists the regular transfer of sufficient colostrum and the physiological transition to a rapid rise in milk volume peaking around 72 postpartum hours.

Discussions with the Darebin women highlighted routine hospital procedures that occurred shortly following birth that delayed and interrupted their union with the baby. Prudent midwives are well placed at the time of birth to ensure that both the commencement and the duration of the first postpartum breastfeed is not delayed or interrupted, especially for routine, non life-threatening procedures such as weighing and measuring babies. Traumatized or challenged babies can also be observed and supported by midwives to see if they engage in neuro-sensory behaviours when they remain in gentle contact with the mother. Even in difficult circumstances responsible professionals can ensure unity of mother and baby and protection of the pair can be mindfully observed.

Contradictory Messages

Thirteen years ago Schmied et al (2001) recognised the effect of ‘expert’ professionalisation of breastfeeding on women and their babies. Ten years later in a metasynthesis, Schmied et al (2011), emphasised the importance of [mindful] ‘communication skills’ and ‘supportive relationships’. Barclay et al (2012), revisited professionalisation of breastfeeding and found in their analysis that efforts to improve sustained breastfeeding rates have failed. The authors concluded that the ‘authentic’ and ‘facilitative’ presence of midwives had a major role in women initiating and establishing breastfeeding.

Challenges for Midwives

The majority of the Darebin women (77.8%) reported that their prenatal preparation and education (including attending classes, reading books and viewing audio-visual presentations) failed to adequately prepare them for the challenges of breastfeeding. The most common reflective comment made during the in-home session was that they had insufficient information to confidently deal with the practical issues, particularly painful nipple trauma, engorgement, mastitis and the unsettled, crying baby.

Cantrill, Creedy & Cooke (2004) recommended further education for midwives with the focus on the importance of optimal facilitation of breastfeeding from birth. They also recommended further research to investigate how midwives teach new mothers to breastfeed. Similarly, Colson et al (2008) challenged routine teaching and claimed that the initiation of breastfeeding is ‘innate’ for the mother and the baby. The authors described and compared primitive neonatal reflexes and feeding behaviours with mothers in semi-reclined positions with the newborn skin-to-skin from birth. These were termed ‘biological nurturing’ and were demonstrated to be collectively pivotal to establishing breastfeeding.

However, in contrast to biological nurturing the Darebin women were taught the cross-cradle hold (84.5%) together with a sequence of restrictive manoeuvres of the breast, nipple and the baby.

Prudent midwives can also resist separation of mother and baby at birth and delayed commencement of the first postpartum breastfeed. However in many instances it will take more than individual midwives to make a difference. System changes are likely to be required for women who are experiencing institutional birth for example, only 16.2% of the Darebin women commenced breastfeeding within the first 15 minutes and 39.3% within the first hour of birth.

Midwives can reduce unnecessary interruptions and refrain from advising mothers to introduce artificial milk formula. The international Baby Friendly Health Initiative (BFHI) introduced in Australian hospitals in 1993 promotes the ‘Ten Steps to Successful Breastfeeding’ (BFHI, 2008). However the use of milk formula products continues to be recommended to women in Australian hospitals and breastfeeding rates have not increased. This was evidenced by the Darebin babies who were fed artificial milk formula (45.9%) during the first few days of life and given that most of these babies were born at term the need for this must be questioned. While considering new ways of providing their services, midwives can assist by ensuring the provision of a mother-baby friendly, quiet and unhurried environment that minimises unnecessary intrusion into women’s private space. Midwives are best placed with their professional knowledge, to unobtrusively observe the capability of the healthy newborn without touching the mother or baby and without carrying out routine practices that unnecessarily disturb the pair. Furthermore, the teaching of uninterrupted breastfeeding requires quiet, mindful observation of facio-mandibular symmetry for efficient intra-oral function for milk transfer and pain free

breastfeeding. This early observation has the potential to reduce the rate of painful nipple trauma as experienced by 78% of the study participants.

Regional anaesthesia and the abdominal delivery dominate obstetric practice; 35.2% of Darebin women were delivered by abdominal surgery and over one third (38.6%) were administered regional anaesthesia. The perineal trauma rate was also common with the episiotomy rate at 33.1%, the episiotomy with tear rate 4.3% also almost double the national rate of 2.4%. Medical procedures, the physiological affects of opioids, physical traumas, hospital policies and routine postnatal practices that disturb or delay the union of mother and baby over the first 72 postpartum hours or up until hospital discharge, have the potential to negatively influence the initiation and establishment of early breastfeeding.

Knowledge about physiological milk volume in relation to newborn communication behaviours and breastfeeding techniques may assist women and midwives in avoiding the unnecessary interference and particularly the introduction of artificial milk products in this transitional period for the mother and newborn over the first 72 postpartum hours. Additionally, the current teaching of breastfeeding involves others putting the baby on the breast for the mother, holding the baby by the cranio-cervical spine along the nuchal ligament, anatomically aligning the nipple to the baby's nose while teaching the cross-cradle hold, which appears to result in facio-mandibular asymmetry, nipple malalignment and nipple trauma. Results from this thesis suggest that all of these factors are leading to the nipple trauma that women are experiencing.

Recommendation for Midwives¹⁰

From my experience, the first and early breastfeeds are the key to achieving sustained breastfeeding for most women. To ensure individual progress, it is important for the midwife to first establish any previous maternal breastfeeding history and to understand any cultural influences. It is also important to assist each individual woman to understand the natural physiological, emotional and behavioural changes associated with the postpartum mother and her newborn from birth. One of the most important challenges for midwives is to confidently and unobtrusively remain with women for the entire first postpartum breastfeed and to ensure only the mother handles the baby. Unless absolutely necessary, ensure the mother and baby remain together so that they can breastfeed intermittently and undisturbed over the first 72 postpartum hours or until hospital discharge.

Midwives can be encouraged to:

- Ensure that the mother understands how she can use the cradle hold to avoid restriction of the baby's ability to move and rotate the sub-occipital cervical spine, as the baby desires.
- Avoid nipple-to-nose malalignment and refrain from forcefully thrusting the baby onto the breast.

¹⁰ Please see Video Clip No.4 Exploring, preventing and Understanding Breastfeeding Difficulties on the secure website <http://www.thesis.breastfeedingconsultant.com/>

- Ensure the mother understands the difference between facio-mandibular asymmetry and symmetry by suggesting modifications that result in symmetry of the nose, chin and both cheeks at the breast, without taking the baby off the breast.
- Assist the mother to understand her ability to produce colostrum and transitional milk to sustain her newborn without the need for additional fluids.
- Assist her in understanding the mammalian baby's cues for feeding and neuro-sensory behaviours for locating the breast and nipple.
- Be aware of the baby's neuro-sensory, gastro-intestinal and emotional cues for satisfaction.
- Understand how the practice of using both breasts per feed benefits the mother and the baby.¹¹
- Inform her about cranio-cervical spine and intra-oral anatomy in relation to the effect on the baby and pain free breastfeeding.

Individual Modifications and Fine-tuning

The primary strategy of all therapy is to assist women with a quick reduction of pain to allow breastfeeding to continue (Abou-Dakn, Richardt, Schaefer-Graf, & Wockel, 2010). The strategies used in this study were aimed at reducing painful nipple trauma and breast complications to expedite healing. The strategies were based on anatomical, bio-physiological and neuro-sensory behavioural knowledge, of the breastfeeding mother and baby.

¹¹ The benefits of both breasts per feed is explained in Appendix 7

Individual modifications made in consultation with the Darebin women who were continuing to breastfeed with nipple trauma led to changing the cross-cradle hold (81.9%) to the cradle-hold, while also ceasing the practices of nipple malalignment (nipple-to-nose) and thrusting the baby onto the breast. This was the first time that these women had used the cradle-hold and the first time they had been informed of how to fine-tune the baby to achieve facio-mandibular symmetry, without taking the baby off the breast. At the completion of the one-hour breastfeeding session 82.5% of the women reported the outcome of the in-home breastfeed following the modifications and fine-tuning of facio-mandibular asymmetry as very good or excellent, enabling them to continue breastfeeding over existing trauma.¹²

The mother fine-tuned her baby to individual comfort without taking her baby off the breast by using one or more of four fine adjustments that involved slight directional movement of the baby once drawing and swallowing commenced. These directional movements of the baby depended on the observed position of the four facial markers on the breast. The first two movements symmetrically aligned the nose and chin. To achieve symmetry the mother gently moved the cradled baby by sliding the body slightly to the right, or slightly left across her body, generally no more than a centimetre, until the nose contoured and remained in contact with the breast and the point of the chin effectively massaged the breast tissue. The next two movements adjusted the cheeks so there are no visible gaps between the breast and cheeks. This was achieved by slightly changing the tilt of the baby's comfortably cradled body. The mother gently used the cradling arm and hand to slightly change the tilt of the upper or lower shoulder and body. The upper shoulder and

¹² For an explanation of the modifications and fine-tuning see Appendix 6

torso were turned slightly over, just enough to ensure the upper cheek contacted the breast, or the lower shoulder slightly under for the lower cheek to contact the breast. These fine movements allowed all four facio-mandibular markers to be in symmetrical contact and without any gaps between the markers and the breast resulting in the circle of symmetry (my language) being complete observed by the four visible areas of contact when the baby comes off the breast (see Chapter Three, Figure 18).

Maternal Ingestion of Vitamin and Other Supplements

An unexpected finding occurred in relation to a common issue reported by concerned mothers whose babies were unsettled and crying with associated limited periods of sleep. This issue was not evidenced until later in the programme, therefore this is not part of the data analysis for this study. A number of babies ($n = 163$) were observed demonstrating fussing behaviours on the breast or they turned away and refused to take the breast. Of these babies the maternal history showed regular maternal ingestion of oral vitamins and fish oil and supplements commenced in pregnancy and continued during breastfeeding. The mothers described the babies as having reflux or vomiting and colic and several mothers described the smell and/or taste of fish oil or a bitter taste in their breast milk.

A recent study relating to odour of breast milk found that aroma changes were predominantly due to lipid degradation processes that occurred during frozen storage of breast milk (Spitzer, Klos, & Buettner, 2013). Though ample information is available on the activation of the olfactory system (smell), the body of literature on the sensory qualities of smell and taste of human milk during maternal supplement ingestion is scarce (Bartocci et al., 2000; Bussell & Vossall, 2012). One study by Hausner et al, (2008) confirmed that volatile flavours are transmitted from a mother's diet into her breast milk in selective and relatively low amounts. Further research is needed to determine if the

conventional use of vitamin supplements are transmitted and have possible effects on the gastro-intestinal tract of the unborn baby ingesting amniotic fluid and the newborn and young baby ingesting breast milk. These unsettled, crying babies may have contributed to 79.5% of the Darebin women who reported feeling overwhelmed and exhausted, emotionally labile and sleep deprived.

Limitations

The primary limitation with all retrospective studies is the inability to determine a cause-and-effect relationship between the intervention and the outcome (Beilin et al., 2005). The data analysis can only show association between variables, even though the data were collected contemporaneously. Therefore, it was not possible to determine a cause-and-effect relationship between the previously taught breastfeeding techniques, the presenting complications and the outcomes following my professional recommendations and modifications of breastfeeding practice. As mentioned in Chapter Three, consistently recorded quantitative data and some short-text notations could only identify associations between the variables by measuring a range of variables on an individual basis. The reliability and validity of the data were supported by consistent data collection methods.

The initial setting up of the database to meet the requirements of a small screen PDA posed some early difficulties, which were overcome based on expert advice with the revision of the Excel spread sheet layout. The layout and format were reviewed to accommodate additional questions and assist analysis. The overall quality and integrity of the data were high and required only minor cleaning. Multiple-response categories to some questions prevented more definitive conclusions being drawn. The multiple responses were however, beneficial in highlighting the difficulty of identifying the complexities associated with detailing breastfeeding data.

There were limitations in the recording of the individual components of the sequence of manoeuvres used by the women. Therefore, the manoeuvres observed were recorded as a complete sequence under nipple malalignment, that is directing the nipple-to-nose, sweeping the nipple over the lips to stimulate the rooting response and RAM, the technique used to rapidly thrust the baby onto the breast in synchrony with a wide gape of the mouth. These manoeuvres were observed many times, assessed and recorded in the database and were seen in conjunction with the largest proportion of women who had been taught to use the cross-cradle hold.

A further limitation occurred in that, there were no pain scores used in this study, to measure the pain and severity of the observed degrees of nipple trauma and breast complications.

Conclusion

This chapter synthesised findings of the study with the literature to explain the high rates of breastfeeding complications experienced by the Darebin women. The data analysis confirmed that three anatomical predictors (cradle hold with nipple malalignment and facio-mandibular asymmetry) significantly contributed to painful nipple trauma. These predictors appear related to system issues (separation of mother and baby in the hours following birth) and practice issues (the ways midwives are instructing women to position their baby onto the breast). They also contributed to the engorgement that was present for women in hospital, often lasting several weeks and diagnosed during the in home sessions. The analysis suggests that being cognisant of mammalian neuro-sensory behaviours from the time of birth and over the first 72 postpartum hours could improve to initiation and establishment of pain free breastfeeding. Chapter Six concludes with a summary of the thesis and includes information to assist midwives in their practice with breastfeeding women and key recommendations for policy and midwifery practice.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION

Introduction

This study aimed to identify the main characteristics of the women who presented with breastfeeding complications through the Darebin programme, including the antecedents of these problems. Chapter Five synthesised the findings of the study with the literature alongside my own professional experience in an attempt to explain the key findings. Nipple trauma was experienced by 78.0% of the women seeking advice and was associated with the cross-cradle technique for holding the breastfeeding baby, facio-mandibular asymmetry of the baby at the breast and nipple malalignment, all of which were likely to be a result of instructions provided by the attending health professional in hospital. This final chapter concludes the thesis with a number of recommendations for policy makers, educators and practitioners to improve the breastfeeding experiences for as many women as possible.

Acknowledgement of the unique breastfeeding experience of the individual mother and her baby is crucial. It is equally important to understand possible causes of nipple trauma and breastfeeding complications. This study identified that the way women were taught to breastfeed contributed to the development of breastfeeding complications. Predictors of nipple trauma included the cross-cradle hold and inflammatory mastitis. Other contributing factors started immediately following birth and included the delay in the commencement and the short duration of the first breastfeed. This first breastfeed was six and half times more likely to be delayed for more than one hour if women had either an abdominal or instrumental delivery and five times more likely for women who had received opioids. Opioids were also associated with a shorter duration of the first postpartum breastfeed.

Over half of the women (57.6%) described breast engorgement in hospital. A chi-square test for linear trend revealed the women who breastfed for less than one hour were three times more likely to experience engorgement in hospital. Artificial milk formula was introduced to 45.9% of the babies. These issues highlight the importance of the first hours (up to approximately 72 hours) following birth.

Midwives have a responsibility to critique and challenge the consequences of national, state and local policies, which continue to impact on women's ability to successfully initiate and sustain breastfeeding. The current organisational structure of our maternity systems demands rapid throughput of women during labour and birth. These demands restrict the role of the midwife to be 'with women' and hinder the facilitation of a quiet, protected and private space for labour, birth and breastfeeding to occur uninterrupted, for most women. Little time is available for detailed, undisturbed observation of the first and early breastfeeds, which is crucial to reducing pain and trauma and sustaining breastfeeding. Strategies used in the Darebin programme to relieve painful nipple trauma were based on ensuring the mothers and babies had undisturbed and unlimited time to complete the observed breastfeed.

To increase breastfeeding rates it will be necessary to review the way in which midwifery services are provided. Midwives must ensure that mothers and babies are united from birth and remain undisturbed with every opportunity to continue breastfeeding from birth through the first 72 postpartum hours.

The following recommendations are provided to improve policy; education and midwifery practice to more effectively support the breastfeeding experience for women and their newborn babies.

Recommendations

1. Promote the instinctive neuro-sensory feeding capacity of the newborn from birth, ensure that the ‘sacred hour’ is respected and that mother and newborn are not separated, including unnecessary touching, controlling or interfering over the duration of that first breastfeed
2. The duration of the first feed should ideally last between two to three undisturbed hours and the mother and baby remain together uninterrupted over at least the first 72 hours, preferably untouched but others.
3. Update education of midwives and student midwives about the anatomy of the cranio-cervical spine, the nuchal ligament, related reflexes and the intra-oral cavity in relation to, preventing nipple trauma and complications such as engorgement and mastitis.
4. Encourage midwives to refrain from participating in, or instructing women to use manipulative manoeuvres, such as reshaping the breast to direct the nipple to the baby’s nose, intentional stroking of the nipple over the lips and using a rapid arm movement to forward thrust the baby onto the breast.
5. Educate women, midwives and student midwives to understand and assess the anatomical indications of facio-mandibular asymmetry and symmetry.
6. Promote mammalian breastfeeding that requires the more natural cradle-hold to prevent handling of the sub-occipito cervical spine. The baby’s head rests comfortably on the mother’s forearm (rather than restricted by the angle of the elbow). The mother’s upper arm and elbow rests comfortably by her side. The mother’s hand rests comfortably and naturally on the baby’s back. The baby is turned comfortably on its side, with one hand tactile either side of the breast. There

is clear access of lips (mouth) over the nipple and freedom of the head to complete rotational and bobbing movements necessary for neuro-sensory rooting activity.

7. Midwives should work with women so they understand normal changes in newborn behaviours that are expected to occur in response to physiological milk production over the first 72 postpartum hours. These observed changes are explained in Chapter Five as the lag-time, under the heading ‘The Early Hours of Breastfeeding’.
8. Observe and explain to the mother the different rhythms associated with the movement of the mandible, during the changing phases of stimulating hormone release to drawing and swallowing episodes.
9. Promote the practice of the baby feeding to self-directed satisfaction from both breasts per feed, to improve the digestive system of the unsettled/crying baby and to assist the regulation of milk volume.
10. Ensure artificial formula does not replace breastfeeding or alternatively expressed maternal milk unless it is essential for the wellbeing of the baby.

Further Research

Further research is required to confirm the results of this study. Testing some of these recommendations in a package of care (as a complex intervention) within a randomised controlled trial would provide Level-1 evidence to support the findings. In particular, ensuring facio-mandibular symmetry of the baby at the breast as well as nipple alignment at every feed over the first 72 hours. Further intra-oral ultrasound and micro-camera studies are required to gain more knowledge of the positioning of the nipple, the movement of the tongue muscle, mandible and chin, together with the cross-cradle and cradle techniques, with nipple alignment/malalignment and facio-mandibular

symmetry/asymmetry. Striving to ensure the infant has prolonged skin-to-skin time whereby breastfeeding is commenced in the first hour after birth and remains undisturbed for at least two or more hours with uninterrupted feeding over the first 72 hours could also be tested as a core component of the complex intervention. Increased knowledge about the possible presence and effect of, the maternal ingestion of vitamins and fish oil substances transported in liquor and maternal milk, on the gastro-intestinal system of babies, is another area requiring further research.

Conclusion

Nipple trauma is a painful and stressful issue for many women and its impact on the duration and sustainability of breastfeeding is not really known. The findings of this study may offer some explanation as to why only 14% of Australian women are exclusively breastfeeding at six months.

The Australian Government's objective is to increase the percentage of fully breastfed babies from the current 14%, to at least 50% at six months by 2015 (Australian Health Ministers Conference, 2009; NHMRC, 2003). This may not be achievable by 2015. However, if midwives are supported to revise their understanding of anatomy, mammalian behaviours and unconditional respect for the skills and capacity of women and their babies, it maybe possible to ensure more satisfying and pain-relieved experiences that are highly likely to increase breastfeeding rates.

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Appendix 1: Acronyms

3-D	Three-dimensional view
ACUPA	Australian Catholic University Postgraduate Award
ACU	Australian Catholic University
ACM	Australian College of Midwives
AIFS	Australian Institute of Family Studies
AfMP	Artificial Milk Products
AIHW	Australian Institute of Health and Welfare
AAP	American Academy of Pediatrics
ARM	Artificial Rupture of Membranes
BFHI	Baby Friendly Hospital Initiative
C1	First cervical Vertebrae (Atlas)
C2	Second cervical Vertebrae (Axis)
C7	Seventh Cervical Vertebrae (Prominens)
COAG	Council of Australian Governments
CNS	Central Nervous System
DIHB	Darebin In-Home Breastfeeding
EBM	Expressed breast milk
IBLC	International Board of Lactation Consultant Examiners
KPI	Key Performance Indicators
LLLI	La Leche League International
LCANZ	Lactation Consultants of Australia and New Zealand
LC	Lactation Consultant
LSAC	Longitudinal Study of Australian Children
MCH	Maternal Child Health (in the state of Victoria)
MCFH	Maternal Child & Family Health
NHMRC	National Health and Medical Research Council
OPD	Out Patients Department
OR	Odds Ratio
PCA	Patient-controlled analgesia
RAM	Rapid arm movement
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation
TMJ	Temporo-Mandibular Joint
UNICEF	United Nations Children's Fund
VIF	Variance Inflation Factor
WHO	World Health Organisation

Appendix 2: Glossary of Terms and Definitions

Cross-cradle Hold

The cross-cradle hold, one of a number of breastfeeding techniques, involved holding the baby by the sub-occipito-cervical spine, with the hand extended along the nuchal ligament. The baby was held with the opposite arm to the breast being used. For example, when feeding from the left breast the mother's left arm was bent at the elbow so she could hold and reshape her left breast with her left hand. The baby was laying in a lateral position facing the mother's body as her right arm extended along the baby's back and pressed against the spine while her elbow pressed inward and her hand was placed over the sacral area (nappy) to hold the baby firm and close. Her right thumb and forefinger held the bilateral occipital protuberances at the base of the skull behind the ears (sometimes on the ear lobes) preventing rotational movement of the Atlas (C-1) and Axis (C-2). The web between the right forefinger and thumb spread to the width of the base of the baby's head. With this grip the last three fingers and her right palm and wrist extended along the cranio-cervical spine (C-1 to C-7), over the nuchal ligament (ligamentous nuchae). The articulation of the heel of the hand pressed into the superior aspect of the shoulders over the region of the 7th cervical vertebrae (Parsons et al., 2010). To reshape her breast the mother's left thumb depressed the upper aspect of the areola to redirect her nipple towards the baby's nose. These anatomical actions for holding the breastfeeding baby in the cross-cradle hold are vice versa when feeding from the right breast. An alternative to the forefinger and thumb holding the occipital protuberances was to hold the baby along the neck as the hand extends further into the middle of the shoulders. These same anatomical actions applied to the twin-hold, where the baby is lying laterally under the mothers arm along one side of her body instead of across her body. The baby was held using the same

technique as the cross-cradle hold with the mother's hand holding the sub-occipito-cervical spine along the nuchal ligament.

The cross-cradle hold altered the mother's natural posture while her upper body was twisted to accommodate holding the baby. The upper arm moved backwards as the elbow bent to enable holding and re-shaping the breast. The upper body, breast and nipple rotated laterally with the lateral movement of the upper body and at the same time the arm and hand holding the baby against the body reached to hold the sub-occipito-cervical spine. To compensate for this twisting of the upper body, the mother attempted to push her breast and nipple back toward the baby's mouth, while simultaneously performing the sequence of taught manoeuvres as described previously.

Please refer to colour plate Figure 13.

Facio-mandibular Symmetry

The nostrils contoured the individual shape of the breast as both nostrils and the tip of the nose were in contact with the breast. The hinged temporo-mandibular joint facilitated the downward movement of the mandible to activate a natural opening of the mouth. The upper lip rolled outward and curled up fitting under the nostrils to make space at the outer aspect of the nostrils to assist breathing. The lower lip rolled down and curled out to rest on the upper aspect of the chin while the point of the chin (mentum) pressed against the breast massaging deep in the external tissue. The inner mucous membrane surface of the upper and lower lips created an external seal of the mouth and breast. Both cheeks were against the breast. When symmetry was observed there were no visible gaps between the four markers and the breast. Facio-mandibular symmetry assisted the propulsion of positive pressure milk flow and rhythmical swallowing episodes.

Facio-mandibular Asymmetry

Asymmetrical facio-mandibular contact was described in this study when the facio-mandibular markers of the nose, chin and both cheeks were not in symmetrical contact with the breast. Nipple feeding was commonly observed and in addition, there was ineffective drawing of both the nipple and adjunct breast tissue, evidenced by incoordinate mandibular movement and swallowing episodes.

The incoordinate swallowing episodes occurred when the baby's head was either flexed or deflexed on mouth to breast contact. A deflexed head moved the nose away from the breast preventing the nose from contacting and contouring the individual shape of the breast. Alternatively, forward flexion of the head moved the chin away from the breast (50.8%) preventing the deep massaging effect the breast tissue, with the chin and mandible moving in rhythmical harmony with the intra-oral tongue muscle. Asymmetry was also associated with the head being offset to one side, either right or left depending on which breast was being used or with a combination of these asymmetries such as deflexed and offset, or flexed and offset, depending on the baby's posture and cranio-cervical rotation. In these circumstances, one cheek and the adjacent nostril was compressed against the breast, while the other cheek and nostril was not contacting the breast. Being offset or asymmetrical was more likely to result in the gums pinching the edge of the nipple, which was evidenced on detachment by the altered shape and a raised ridge on one side of the nipple.

Lactation Consultant

A Lactation Consultant is defined by the International Board of Lactation Consultant (IBCLC) as a specialist in the field of lactation. The International Board of Lactation

Consultant Examiners (IBLCE) is the only certifying body authorised to award this credential.

The term Lactation Consultant has been replaced in this thesis by midwife and maternal, child health nurse with expertise in breastfeeding and may refer to me in the first person or as a breastfeeding consultant.

Mode of Delivery/Birth

There are two modes of a baby being born, vaginal or abdominal. For the purpose of this thesis the two modes are referred to as: **1.** Vaginal = spontaneous birth, or instrumental delivery. **2.** Abdominal surgery = planned not in labour, or unplanned in labour.

Multiparous

A multiparous woman refers to a woman having given birth to more than one baby.

Nipple Malalignment

Malalignment of the nipple is described as the practice of digital re-direction of the nipple to the baby's nose, followed by a quick succession of manoeuvres of the breast, nipple and the baby. This quick consecutive succession was observed when (1) the breast was reshaped to direct the nipple to point at the baby's nose, (2) the nipple was then manoeuvred in a sweeping motion over the lips to stimulate a wider gape of the mouth and then (3) a rapid arm movement was used to thrust the baby onto the breast as the mouth opened and the head extended backwards. These collective manoeuvres resulted in the nipple entering the intra-oral cavity at the level of hard palate (the roof of the mouth) as the head hyperextended in response to holding the cranio-cervical spine, nuchal ligament and the forward thrust. These three parts of the succession of manoeuvres appeared to be involved with nipple pain and trauma.

Nuchal Ligament

The nuchal ligament (ligamentous nuchae) is anatomically described as a triangular flat structure that attaches at the midline of the sub-occipital bone and extends the length of the cranio-cervical spine to attach the spinous process of the 7th cervical vertebrae (C-7). The nuchal ligament supports and stabilises the head movement; it resists hyperflexion and hyperextension. The broad lateral surfaces and posterior edge of the ligament provide attachment for the dorsal muscles of the neck of which the out layer is the trapezius. The biomechanical action stabilises flexible movement, connects the cervical vertebrae and the trapezius muscle to facilitate returning the head to the anatomical position.

Primiparous

Primiparous refers to a woman having given birth to her first baby.

Appendix 3: Publication and Presentations Arising from this Study

Women and Birth (2011) 24, 97–104



available at www.sciencedirect.com



journal homepage: www.elsevier.com/locate/wombi



REVIEW

An account of significant events influencing Australian breastfeeding practice over the last 40 years

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Received 5 March 2010; received in revised form 25 August 2010; accepted 26 August 2010

KEYWORDS

Intra-oral anatomy;
Bio-physiology;
Primal reflexes;
Mammalian behaviours;
Breastfeeding;
Birth;
Birth trauma;
Opioids

Abstract

Background: Low breastfeeding duration rates reflect the pain and distress experienced by many women who discontinue breastfeeding in the early weeks and months of life. This paper explores modern key historical events that have significantly influenced Australian breastfeeding education and practice.

Method: Relevant literature reviewed from 1970 to 2010 identified key events that appear to have contributed to the decrease in Australian breastfeeding rates and the increase in women experiencing breastfeeding complications, particularly nipple pain and trauma.

Findings and discussion: The rise in institutionalisation and medical intervention in labour and birth has also medicalised midwifery practice. Technocratic intrusion and institutionalised care is contributing to the separation of the mother and newborn at birth. Delayed mother–baby initiation of breastfeeding and interruption of the duration of the first, and subsequent breastfeeds, negatively affects the innate ability of the mother and newborn to establish and sustain breastfeeding. The ‘pathologising’ of breastfeeding that involve midwives teaching women complicated and unnatural breastfeeding techniques interfere with instinctive sensory and mammalian behaviours and further contributes to the high complication rates.

Conclusion: Midwives are encouraged to reflect on their role as ‘experts’ in the breastfeeding process and give confidence to women so that they utilise their instinctive ability to breastfeed by self-determined techniques that encourage mammalian skills for newborn sustenance and survival.

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Introduction

The decline in Australian breastfeeding rates is a significant public health concern with large discrepancies between

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recommendations by the World Health Organisation (WHO) and the National Health and Medical Research Council (NH&MRC) and documented rates in Australia.¹ Breastfeeding initiation rates in Australia as high as 88% is not sustained with many women experiencing difficulty including pain and nipple trauma, resulting in only 18% continuing to breastfeed at six months.

Numerous trials have considered ways to increase initiation and sustain breastfeeding in Australia and overseas. A Cochrane review of 34 studies from 14 countries by Britton et al. (2007) reported evidence for continuation of exclusive breastfeeding being more effective with lay support and that combinations of lay and professional support were more effective than professional support alone, and face-to-face support was more effective than telephone advice.² To date, with the exception of a few studies,^{3–5} the multiple manipulative techniques used for teaching breastfeeding have largely been unquestioned. No research has explored the implications of modern techniques in relation to nipple trauma.

The National Health and Medical Research Council (NH&MRC)⁶ and the National Breastfeeding Strategy 2010–2015⁷ promote programmes to increase breastfeeding rates with the focus on nutrition, health, social and economic benefits. Recommendations from these key policy documents include revisiting the WHO Code of Marketing of Breast-milk substitutes, providing support for breastfeeding in all settings, increasing education and awareness, providing continuity of care and improved referral pathways and support networks.^{6,7}

Midwives play an important role in influencing women's breastfeeding experience. This paper explores changing professional practices around breastfeeding. It aims to identify key events that may be contributing to the continuing pain and distress experienced by many breastfeeding women.

Search strategy

A search strategy retrieved articles from a range of databases, including CINAHL, Medline, PubMed, Academic Search, and the Cochrane Database of Systematic Reviews. The parameter was set from 1970 to 2010, although a selection of texts from the 1940s to the late 1960s were also included. Additional materials were sourced from libraries, electronic media, Google Scholar, the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF) reports and research publications. The key words used in advanced search strategies included: labour, birth, drugs; breastfeeding, nipple pain and trauma; neonatal cranial, spinal and intra-oral anatomy; neuro-physiology, sensory smell, taste, touch, reflexes and instincts; mammalian behaviours and survival skills.

Medicalisation of birth

The medicalising of birth, a phenomenon described across a range of disciplines commenced in the 1700s, has increased the institutionalisation of women in western maternity services.^{8–10} More recently Kieran O'Driscoll (1973) led a new obstetric era advocating a management regime that would decrease the length of labour, stating that every primigravida woman could be 'delivered' within 12 h. The O'Driscoll

regime activated and accelerated the progress of individual normal labour by the surgical procedure artificial rupture of membranes (ARM), followed by the intravenous infusion of the synthetic oxytocic drug, Syntocinon.^{10,11} This same active management regime soon applied to multigravida women. Obstetricians realised they could reduce overnight call-out and disruption to their consulting times by inducing these women in the morning, and most would be delivered by the evening. Around the same period, a growing obstetric belief in placental malfunction increased the fear of fetal risk past 40 weeks gestation. The diagnosis of 'overdue'¹² created more fear and altered individual gestational parameters¹³ resulting in higher induction rates, introducing another modern phenomenon of 'cascading' intervention,^{14,15} that impacted on breastfeeding.

In Australia today the reported public hospital rates of induced labour range from 23% to 30%.¹⁶ A Cochrane Review (2006) concluded that induction of labour after 41 weeks or later, compared to awaiting spontaneous onset of labour at least 1 week is associated with fewer perinatal deaths. However, the same review reported that the absolute risk is extremely small and recommended that women should be appropriately informed on both the relative and absolute risks.¹⁷

Technology and changing midwifery practice

Since the 1970s, the role of the midwife has responded to multiple medical and technological practice changes. These include rising medical and surgical interventions, mechanised labour regimes alongside declining breastfeeding rates and the increasing use of infant formula.^{18,19} Influenced by these medical and social changes, midwives have modified a large component of their scope of practice to support obstetric practises.²⁰ Medicalisation effectively altered the expert 'with woman' role of the midwife.¹³ In the revised role of technical assistant the midwife became responsible for overseeing the intrapartum acceleration of induced labour, to achieve the promise of a time limited 12 h labour.²¹

Medicalisation of normal labour and birth stimulated ongoing national and global debate that focused on the economics of increasing public health costs for obstetric procedures and non-essential medical interventions.^{15,22} In modern health reform very little debate has focused on "optimised psychophysiological wellbeing"²³ or the woman's ability and innate strength to complete her labour, birth and breastfeeding journey in her unique way with the guiding expertise of the autonomous midwife.

Continuous monitoring of labour

By the late 1970s, aggressively marketed new technologies introduced to birthing services, included electronic fetal monitors equipped with transducers that attached to intra-uterine catheters. These closed circuit machines measured intra-uterine pressure via the insertion of a long catheter into the uterus at the time of rupturing the membranes. The catheter remained in situ throughout the labour and relayed intra-uterine pressure readings back through the system to a transducer that calibrated and automated the administration of a calculated dosage of intravenous Syntocinon. Rapid

technological growth in the 1980s saw the engineering and use of volumetric intravenous infusion pumps that delivered digitally programmed preset rates of Syntocinon, replacing the intra-uterine closed circuit machinery.

The medically modified midwife presided over Syntocinon infusions managing the intravenous rate that synthetically increased an unnatural velocity of uterine contractions. Technology continued to replace the constant "guardianship" of the midwife 'being with woman' to observe and protect the undisturbed progress of labour.²⁴ With the advent of electronic fetal monitoring machinery, midwife auscultation skills diminished to the extent that some student midwives may graduate without confident aural skills to detect variable fetal heart changes with a monaural pinard stethoscope used exclusively for about 30 years into the late 19th and early 20th centuries.²⁴

As the use of electronic fetal monitoring increased, women attached to the machinery and confined to bed were physically restricted in their natural desire for body movement. These women experienced positional awkwardness. They were no longer able to achieve self-determined, unrestricted physical birth when secured with legs in stirrups. These confining factors amplified pain escalating the need for pharmacological pain relief.^{25,26} Davis-Floyd (2000) succinctly expresses the consequences of techno-medical interventions that are no longer:

...reserved for the small percentage of births that actually need them; rather, they are performed on most labouring women. By interfering with the normal process of labour, such interventions often generate the very complications they are designed to prevent.^{27, p10}

Obstetric opiates

Concerns have been raised by midwives, and other health professionals, about the poorly studied effects of obstetric opiates on newborn feeding behaviour, commonly described as the 'sleepy', 'lazy' or 'poor' feeder.²⁸ Torvaldsen (2006) conducted a prospective cohort study of 1289 women administered epidural and general anaesthetic opioids. These women were significantly more likely to partially (rather than fully) breastfeed, experience difficulties in the first few days and cease breastfeeding in the first 24 postnatal weeks, than women using non-pharmacological methods for pain relief.²⁹ The AIHW Report (2007) analgesia data, reported that of all women who laboured spontaneously or where labour was induced ($n = 237,023$), 75% were administered analgesia, 25% had systemic opioids and 32% had regional analgesia.

A study by Gow (2001) raised concerns about the effects of obstetric analgesia on maternal-fetal and newborn hepatic (liver) metabolism, including the elimination effect of these drugs during breastfeeding. Gow also refers to a range of scientific research noting that dose-per-body-weight drug administration may be less harmful in adult physiology, but have different effects on the individual fetal and newborn hepatic physiology.^{15,30}

Kumar (2003), identified newborn respiratory depression following maternal epidural analgesia combined with opioids and concluded that these neonates were more prone to

respiratory sequelae in-utero and after birth.^{31,32} The same author reported that epidural opioids diffused freely from the epidural space into the maternal blood, crossed the placental barrier and impacted on the fetal and newborn immature central nervous system (CNS), resulting in slightly higher opioid concentrations deposited in fetal peripheral tissue.³¹

Increasing incidence of birth trauma

Birth trauma experienced by the mother or the baby significantly influences the first and early breastfeeds. Birth trauma is defined as a physical or psychological event involving "actual or threatened serious injury or death to the mother or her baby" during the maternity phase.^{33, p229} Potentially harmful practices such as birth interventions involving caesarean section,^{16,34} perineal incision, third and fourth degree tears, epidural or spinal anaesthetic and opiate analgesics continued to increase. Limited consideration is given for the consequences of psychosocial and physical exposure to mechanical birth trauma, particularly newborn cranio-facial and neck injuries that impact on early breastfeeding difficulties and subsequent breastfeeding duration.^{22,35}

Medical-surgical induction of labour and caesarean section continue to be common obstetric practice, with Australia having one of the highest caesarean section rates in the western world. The rate of caesarean section was 31% in 2007 ($n = 89,371$), a significant increase from 21% in 1998.³⁶ In 2007, the national induction of labour rate was 25% of women who gave birth and 63% ($n = 200,053$) experienced some degree of perineal trauma ranging from first, second, third or fourth degree tear to episiotomy and episiotomy with extended tear.³⁶

Birth trauma associated with consequential physical pain or discomfort delays postnatal recovery, contributing to sleep deprivation and possible postnatal psychological sequelae for the mother.³⁷ Pain incurred from surgical interventions impact on the mother's confidence and ability to nurture and breastfeed her newborn, contributing to lower breastfeeding rates.²² Soft tissue scarring may extend to an emotionally distressing aftermath of delayed physical recovery and painful sexual problems.⁴⁷ A study by Sheehan (2006) found that if women were distressed in the weeks following the birth their confidence decreased, and consequential "maternal distress negatively impacted on themselves, the baby and the family".^{38, p135} Obstetric interventions and trauma is more likely to separate mothers from babies, delaying union at birth and the initiation of mammalian skills. Separation sometimes extends for long periods, complicating or preventing early and ongoing breastfeeding.

Mechanical extraction of the baby's head, via forceps or vacuum, can result in skeletal and soft tissue trauma such as oedema, bruising or indentations. It may also impede smooth function of the bilateral temporomandibular joint (TMJ) restricting lower jaw and self-regulated cervical vertebrae (atlas and axis) movements.^{39,40} Miller (2009), in a case study of 114 babies, found that the main physical findings because of infant birth injury involved soft tissue or skeletal injury. Injuries involving the TMJ, the cranial plates and cranial suture lines are more likely to result in restricted unsynchro-

nised suck-swallow.⁴¹ Impaired TMJ movement limits mouth opening and may also involve periauricular, facial and jaw pain, and headache impeding early intrinsic intra-oral vacuum for effective sucking.^{42,43} An increase in these injuries has led to an increase in the number of babies referred for paediatric osteopathic or chiropractic alignment.^{44,45}

Newborn trauma complicates the initiation and integration of cerebral coordination of sensory information and the basic neuro-physiological processing for accomplishing responsive (adaptive) breastfeeding behaviours.⁴⁶ Separation and delayed breastfeeding in the first 72 h of birth can result in increased risk of additional pain and discomfort associated with maternal breast engorgement and consequent nipple trauma.⁴⁷ Conversely, a Polish hospital study identified that babies who remained undisturbed and in contact with their mother's body can successfully negotiate self-feeding without distressed cries, providing the elements are not "harsh, mechanical or rushed".^{48, p1288}

Maternal and/or neonatal pain associated with birth trauma and bruising, nipple pain and trauma, and the belief that there is not enough milk were identified in the literature as three common reasons for discontinuing breastfeeding.^{49,50} Evidence of nipple pain and trauma recorded by Gunther as early as 1945 and painful nipple trauma contributing to breastfeeding decline has increased since then.^{37,51–54} Persistent nipple pain and trauma inhibits cyclical hormone function slowing the milk ejection (letdown) reflex, while ineffective intra-oral contact diminishes appropriate synchronisation for breast stimulation leading perpetuating women's belief in declining milk volume, confirming the fear of low supply.⁵⁵

Medicalising breastfeeding: lactation consultants and professional knowledge

Breastfeeding practices across professional disciplines and other groups have fundamentally been enveloped historically in the social phenomenon of values, attitudes, knowledge's and socio-political structures of the time.^{56,57} In 1985, Maureen Minchin author and founder of the Australian Lactation Consultants Association (ALCA) proclaimed a special interest in the politics and professionalisation of lactation consultancy. Minchin embarked on an education campaign to improve the knowledge of lactation and the act of breastfeeding for Australian women.⁵⁸ Also in 1985, the La Leche League International (LLL) facilitated a gathering of sixty experts drawn from various health professions and geographic regions including the Australian Breastfeeding Association (ABA).^{59,60} Collectively these bodies developed standards, competencies and scope of practice in preparation for founding the International Board of LC Examiners (IBLCE), the official body that administers the voluntary certification and examination for lactation consultants across six continents.^{61–63} The IBLCE reported a total of 21,200 LCs worldwide (2010), Australia has the highest number of 2185 out of a total of 4754 in the Asia-Pacific Region.⁶³ Australian and New Zealand Associations are currently merging to become the Lactation Consultants Australia and New Zealand (LCANZ) with a combined number of 2412.^{58,61,63}

The increased professionalisation of breastfeeding has not reflected an increase in sustained breastfeeding for Australia-

lian women over the past two decades. This could be considered a problematic phenomenon in modern breastfeeding giving cause for concern, if not question, particularly when women describe the multiple variations in professional information and breastfeeding techniques as confusing and contradictory.⁶⁴ Modern education and practice barriers that interfere with instinctive maternal–infant connections have the potential to increase complexities, resulting in mother–baby disconnection increasing the risk of breastfeeding cessation.^{3,57}

Breastfeeding techniques

During the late 1980s and 1990s international LCs, Chele Marmet, Ellen Shell, and Australian Rebecca Glover called for significant changes to breastfeeding techniques in an attempt to prevent the abiding phenomenon of 'sore nipples'.^{52,65,66} Instruction to 'attach' babies to the breast embedded in international breastfeeding promotional literature, changed education programmes and professional practice. Significant variations in breastfeeding occurred in response to the large volume of literature that referred to techniques aimed at achieving the correct 'position', 'attachment', a good 'latch' to prevent 'sore nipples', and getting most of the areola into the baby's mouth.^{50–54,65–75} Variations of positioning, holding and attaching the baby included information targeting specific groups of women, for example those categorised as obese.⁵⁰

Methods advised in the literature included the 'cross-cradle' hold thought to be preferable for the small baby. This method of holding the baby was used alongside the 'rapid arm movement' (RAM), a timed forward-thrusting technique, recommended to get the baby on with a wide-open mouth, often referred to as the 'Kellogg's Special K' mouth. The principle for this instruction was to put more breast tissue into the baby's mouth to ensure a good latch. Later, a multiple sequence of new techniques advised the combination of the cross-cradle hold, re-shaping the breast, redirection of the 'nipple to nose' followed by an emphasised stroking movement of the nipple over the lips, to hyper-stimulate the oral rooting reflex to achieve a wider opening of the mouth. These multiple manipulations of the breast and nipple were intended to sequence with the RAM technique, in unison with a wide-open mouth.^{51,55,65,66,76}

The introduction of these elaborate techniques to 'attach' a baby to the breast, have had the disabling effect of confusion, making the act of breastfeeding too complex for many women and neurologically disturbing for the baby. Women often feel unable to manage the multiple intricacies of the instructional process. Such complex techniques may have contributed to the "searing pain and discomfort" as described by one third of women reported in the work of Schmied et al.^{77, p45} In the presence of pain, trauma, confusion and fear women struggle to commit to the next and subsequent breastfeeds. Feelings of inadequacy can lead to emotional and physical avoidance and may result in cessation of breastfeeding.⁷⁷

In modern times, the science of lactation tends to camouflage the instinctive or mammalian act of breastfeeding for survival and may be a contributing factor to decreasing breastfeeding rates. Practical education around current

breastfeeding techniques that involves excessive, hands-on or forceful assistance by others alters the natural act of breastfeeding, alternatively hands-off enables the mother and baby to complete the neuro-physiological act by themselves.⁷⁸

The authors suggest that these newly adopted breastfeeding 'techniques' hinder the baby's sensory survival skills, innate rooting reflex and intra-oral function. Multiple externally controlled manipulations of the breast, nipple and infant alter instinctive timing and the unique sequencing of neurological reflexes by the infant, to breastfeed with only the mother's innate guidance.³ These multiple techniques may have inadvertently contributed to increased nipple pain and trauma.

Linking intra-oral anatomy with mammalian sensory integration

The biomedical work of Woolridge (1986), in infant feeding, proposed a scientific perspective on 'sore' nipples that identified the importance of intra-oral synchronisation for breastfeeding. His simple anatomical and physiological explanation of the "mechanisms by which a baby removes milk from the breast", improved knowledge of intra-oral anatomy; an understanding that remains important today.^{74, p1}

Since the work of Woolridge, Colson (2008) and Geddes (2008) have added to this science. Geddes, using intra-oral ultrasound vision of breastfeeding infants, demonstrated that breast milk flowed without accentuated peristalsis, recommending further investigation into the tip of the tongue in milk removal.⁷⁹ Geddes research showed how the infant applies increased intra-oral vacuum pressure with lowering of the mid-posterior tongue during the suck-swallow cycle. Geddes postulates that this may be important knowledge for babies experiencing difficulty obtaining an adequate oral seal at the breast. Colson (2008) observed and described neonatal reflexes and various feeding positions as 'Biological Nurturing'. Colson suggests that innate mammalian behaviours and activation of newborn reflexes were fundamental to establishing breastfeeding and recommends further experimental comparative studies to build on this preliminary work.³ Improved understanding of intra-oral function of the tongue position and movement during the vacuum and swallow rhythms is one of several factors that raises further questions about contemporary manipulative techniques as a probable cause for nipple trauma.⁷⁵

Imprinted neurobehavioral similarities exist between humans and other mammals, linking intra-oral function with mammalian sensory skills.⁸⁰ The unborn baby is already able to hiccup, yawn, quench thirst and satisfy appetite by innate swallowing of liquor at regular intervals, in preparation for breastfeeding.^{81–83} Genna (2007) defines the sensory integration of these behaviours as the coordination of optimal cerebral processes that excite touch, smell, and taste [sight, heat and sound] for survival.⁸⁴ Synchrony of these innate behaviours to smell, taste and self-locate the nipple can be observed with the healthy newborn.⁸⁵ The newborn's neurological desire to stimulate the flow of colostrum for survival follows location of the nipple with symmetrical mouth to breast contact and synergistic, intra-oral function.^{81–83,86} Unwarranted intrusions to these instinctive processes can

derail these skills, impede ample colostrum/milk transfer and increase the risk of breast engorgement resulting in difficult or painful breastfeeding.⁴²

Discussion

In modern times, little attention in the ancient, skilled survival ability of the human mother and baby is acknowledged. Humans, like all mammals with equivalent brain size and neocortical structure, are capable of achieving breastfeeding from birth.⁸⁷ Success is more likely in the absence of unnecessary medical intervention, pain, trauma or the effects of suppressive drugs and without the influence of forceful hands-on techniques.⁸⁷ Modern breastfeeding practice needs challenging by revisiting old knowledge central to "biological nurturing" and essential to liberating innate abilities to initiate and support breastfeeding.^{3,77}

To achieve recommended exclusive breastfeeding from birth to six months requires changes in education and practices that significantly and adversely influence Australian breastfeeding.^{88–90} Dismantling these social and practice barriers necessitates a paradigm shift that includes unconditional respect for the skills and innate capacity of women and their babies.

Breastfeeding duration could be improved by establishing the balance between necessary and unnecessary medicalisation and mechanisation of the bodies of healthy women.⁹¹ Striking this balance primarily gives birth back to women and revives the role of the midwife to a presence that is 'with woman' and less with supervising machinery. "Midwifery guardianship", the role of the midwife to protect the woman's birth space enabling undisturbed birth and breastfeeding, has the potential to decrease painful labour and birth procedures and to reduce emotional trauma.^{13,24} A determined focus on these factors could lead to significant reduction in the induction of labour, use of Syntocinon and narcotic drug administration, a known inhibitor to exclusive breastfeeding.²⁹

Demedicalisation of women and birth involves revision and modification of current teaching to reduce complexities that interfere with mammalian survival instincts, newborn-neonatal reflexes, intra-oral function and maternal knowledge that guides lactation and breastfeeding. Midwifery education and practice can modify teaching of forceful breastfeeding techniques and enable the facilitation of quiet, protected space for women and babies. Midwives can assist with reducing unnecessary birth interventions, they can ensure mothers and babies remain connected from birth, and as far as possible support the practice of untouched early-uninterrupted, initiation of mammalian principles that extend over the following postnatal days until hospital discharge. Child, maternal and family health nurses can ensure the same principles continue over the following weeks until breastfeeding is established.⁷⁷

The authors believe that increased, satisfying and sustained breastfeeding for most healthy babies can be assisted by the National Breastfeeding Strategy 2010–2015⁷ and by preparing change around the following eight strategies. (1) Reduce unnecessary birth interventions.^{91–93} (2) Avoid interfering with mammalian neurological and instinctive survival skills.³ (3) Understand the connections between the CNS,

TMJ, cranio-spinal and intra-oral anatomical, neurological and physiological functions.^{39,75,94} (4) Maintain mother–baby contact from birth for at least the first 72 h, preferably longer, even when assisted birth is necessary. (5) Resist professional touching, controlling or interfering with the first and early breastfeeds. (6) Avoid breast manipulation, nipple redirection and rapid thrusting of the baby to the breast. (7) Increase research and improve knowledge about the possible effects of pharmaceutical and other substances transported to the unborn and breastfed baby⁹⁵ and, (8) avoid overt and covert use and promotion of non-human milk products for babies.

Conclusion

This review highlighted several significant events that influenced breastfeeding in Australia from the early 1970s commensurate with the rise in institutionalisation and medical intervention in labour and birth. At the same time, midwives became ensconced in the use of medical technology, inadvertently medicalising a large component of traditional midwifery practise. Actively managed labour intensified pain requiring increased administration of opiate drugs despite, the known effects on foeto-maternal bio-chemical conjugation, including the suppressive effect on the newborn CNS impeding the innate ability of the baby to breastfeed.⁹⁶ The authors argue that the complexities of increasing medicalisation of labour and birth and the professionalising and ‘pathologising’ of breastfeeding is contributing to delay in the first breastfeed, separation of mother and baby and the decrease in the duration of breastfeeding.⁷⁷ A return to instinctive, mammalian techniques is required to improve women’s breastfeeding experiences. Only then do we believe we will see a rise in breastfeeding duration with the associated health benefits.

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Presentations

ACMQ State Conference 20th September 2012. SeaWorld Resort, Main Beach, Gold Coast, Queensland.

International Confederation for Midwives (ICM), 30th Triennial Congress Prague, Czech Republic 1 – 5 June 2014.

Appendix 4: Example of the Excel Database used in this Study

Excel Database, showing part of the 18-section database. Section 1 to 5 and section 14 with subsections show how the two-column spreadsheet was designed for the size of the PDA screen.

© Client Record 2007 Sample	RECORDED BY: Robyn Thompson
Date	24/02/07
Session (Hrs)	2
Consent & Privacy Act	Y
Mother	Section 2
First Name	Deidentified Coded
Family Name	Deidentified Coded
Address	Deidentified Coded
Suburb	Deidentified Coded
Postcode	3070
Telephone	Deidentified Coded
Date of Birth	Deidentified Coded
Country of Birth	Aust
Language Spoken	English
Date of Discharge	26/02/07
Baby	Section 3
Name	Deidentified Coded
Date of Birth	21/02/07
Time of Birth	08:30
Gestation wks	40
Birth Weight grams	3290
Discharge Weight grams	3000
Date of Discharge	26/02/07
Age	3 days
Pregnancy	Section 4
Primipara	1
Multi 2	
Multi 3	
Multi 4 >	
Pregnancy Notes:	Well through pregnancy. Breech presentation at 36 weeks natural adaptation to cephalic presentation at 38 weeks

Birth Place (Name/Public, Private)	Section 5
Hospital	Deidentified
Birth Centre	Deidentified
Homebirth	Deidentified
Other	Deidentified
Labour & Birth	Section 6
Spontaneous onset	
Induction (medical oxytocin/surgical ARM)	1
Vaginal Birth	
Vaginal Water Birth	
Vaginal Delivery Vacuum Extraction	
Vaginal Delivery Forceps	
Perineum Episiotomy (incision)	1
Perineum Tear (degree) (1=1 st , 2=2 nd & 3=3 rd)	3
Abdominal Delivery (not in labour) surgery planned	
Abdominal Delivery (in labour) surgery unplanned	
Complication(s)	1
Length Labour (Hours)	11
Lab/Birth Notes:	Augmented with IV Oxytocin after spontaneous rupture of membranes and onset of labour. Hypertension in Labour. Episiotomy extended to 3 rd degree tear.

OBSERVE B/FEED *	Section 14
Type of Hold	
Cradle	
Cross-cradle head/neck/shoulders (nuchal line)	1
Twin (nuchal line)	1
Distorted (twisted torso)	1
Other	
Nipple Alignment plus (Multiple Manipulations)	
Nipple to nose	1
Flicking lower lip & RAM	1
Mouth to nipple	
Distorted	
Other	
Facio-Mandibular (Asymmetry/Symmetry)	
Nipple only (asymmetry)	1
Nipple & Breast (symmetry)	
Vacuum Ineffective (asymmetry)	1
Chin not Deep (asymmetry)	1
Distorted (nose/cheeks/chin not contacting breast)	1
None	
Other	
B/Feed Outcome	
No improvement	
Some	
Good	
Very good	
Excellent	
No. B/Feeds: 24 hours	7
Observe Feed Notes: *	Tense putting the baby on the breast anticipating pain. Plus hand holding the baby over nappy area. Facio-mandibular asymmetry.

Appendix 5: Self-Exploration: Intra-oral Palpation and Simulation

The diversity of the types of nipple trauma raised many questions that led me to explore my intra-oral cavity with simulated thumb sucking. The purpose of drawing the thumb was to gain an improved understanding of the function of the intra-oral cavity. While simulating intermittent drawing and swallowing episodes I was able to palpate:

- Synchronised movement of the tongue with the mandible
- Structure and shape of the hard and soft palates
- Tongue movement with variations in intra-oral vacuum pressures
- The relative distance required for the thumb pad to be drawn to the soft palatal cleft
- The sensation with the thumb pad encircled by the soft palatal cleft and the upper surface of the tongue
- The sensation of the lowering of the posterior tongue during swallowing
- The compression of the thumb pad between the anterior tongue and hard palate
- The anatomical relationship of the nipple tip, body and base to the intra-oral structures of the hard and soft palates and the gums
- The synchronised movement of the TMJ, mandible, chin with simulated drawing and swallowing.

Exploring this phenomenon also improved my understanding of the rooting response, then the self-directed drawing of the soft thumb pad to the distance of the soft palatal cleft (representing the nipple). For example, as the mouth opened, the tip of the tongue protruded over the teeth (gum) and resting against the mucous membrane inside the lower lip. The tip of the tongue moved the lower lip slightly outward to allow the tongue to curve comfortably

around the thumb pad. The head was slightly extended to simulate facio-mandibular symmetry. The increasing intra-oral vacuum pressure progressively guided my soft thumb pad along the midline of the upper surface of the tongue to the distance of the soft palatal cleft. Once fully drawn the whole thumb representing the nipple and breast tissue was cradled between the curved midline of the tongue. The soft palatal cleft was palpable with the soft pad of my thumb. The remainder of the thumb simulating the breast tissue occupied the intra-oral mid to anterior tongue area adjacent to the hard palate. The non-pliable bony structure of the extended thumb did prevent natural moulding for a unique fit into the shape of the hard palate (roof of the mouth).

The upper surface of the tongue muscle from the posterior to the anterior tip rhythmically massaged the underside of the thumb during intermittent, simulated drawing and swallowing episodes. Changes in intra-oral vacuum pressures together with rhythmical movement of the tongue during simulated drawing and swallowing were synchronised with the rhythmical movement of the mandible and chin. The sensation of the soft palatal cleft and the soft upper surface of the posterior tongue could be felt as these two areas encircled the soft thumb pad. During this simulated exploration the soft surrounds and rounded space could be identified during the lowering motion of the mid to posterior tongue together with the variations in intra-oral vacuum pressures as explained by Geddes et al, in their ultrasound study (Geddes et al., 2008).

This self-exploration assisted palpation of subtle changes in the placement of the thumb while simulating the rotational movements of the head, to explore possible intra-oral changes with modifications during fine-tuning for facio-mandibular asymmetry. For example, when the head was flexed forwards or extended backwards the position of the soft pad of the thumb moved forward on the upper surface of the tongue away from the posterior tongue and soft

palatal cleft. During simulated drawing and swallowing episodes with the thumb pad now placed in the posterior hard palate, the mandible and chin movement was incoordinate. With the soft thumb pad moved forward on the tongue my upper teeth (gum) were over the centre thumb joint; this resulted in the thumb bending and therefore, redirecting the soft pad into the hard palate. Alternatively, extension of the head moved the thumb pad forward and therefore it was compressed by the anterior tongue into the corrugations behind the gum in the anterior hard palate. When turning the head and neck too far left or right, the intra-oral placement of the thumb was off-centre and the teeth (gum) compressed the near side edge of the thumb. The intra-oral palpation during each of these rotational movements was consistent with the asymmetry of the corresponding facio-mandibular markers of the nose, chin and both cheeks.

Self-exploration and simulation provided me with an improved understanding of the work of Geddes and Woolridge and the way women reported their experience of nipple pain and trauma (Geddes et al., 2008; Woolridge, 1986b). I also tried to imagine how it would feel for the newborn and young breastfeeding baby to be pushed forward by the back of the head, neck and shoulders every mealtime.

Appendix 6: Modifications and Fine Tuning

Modifying facio-mandibular asymmetry and improving intra-oral contact with the nipple and breast tissue to achieve pain free breastfeeding was based on observations of the individual mother and baby. Changes to my practice were influenced by my review of the literature and anatomy. Being able to breastfeed over existing trauma with an immediate sense of pain reduction may be the way in which women can continue breastfeeding without removing the baby from the breast or offering artificial milk products.

Pain relief occurred when the cross-cradle hold was changed to the cradle-hold and neuro-sensory feeding replaced the manoeuvres of the nipple, breast and baby. The cradle-hold seemed to be more comfortable for the mother particularly when she rested her elbows comfortably by her sides to provide adequate room for the baby's head to move about while seeking the nipple. With the mother's back well supported, the baby rested comfortably across her body cradled by the left or right arm (left breast – left arm; right breast – right arm) and with the baby's body weight resting on her knees. Her hand rested naturally along the baby's back according to her individual body structure and without the hand holding the baby by the nappy. Observation showed that holding the nappy distorted the relaxed elongated nature of the baby's body and tended to flex the head, compress the nose and move the chin away from the breast and therefore, the mouth and lips were not in symmetrical contact with the nipple.

While observing the mother and baby working together with the baby comfortably cradled and already facing the breast, the baby was more likely to self locate the nipple. On contact with the nipple, the lips and mouth opened naturally, the tip of the tongue protruded on or over the gum line to locate the nipple. With the protrusion of the tip of tongue against the

mucous membrane of the lower lip, the lip rolled slightly outward. As the nipple and breast tissue was drawn intra-orally, symmetrical facio-mandibular contact occurred. At this stage, some simple fine-tuning (as explained below) for refining facio-mandibular symmetrical contact of the four markers was generally necessary.

During observation, fine-tuning appeared to compliment the intra-oral synergistic rhythmical drawing and swallowing episodes that involve the tongue muscle, the soft palatal cleft, the hard structure of the palatal arch, the movement of the mandible and the temporo-mandibular joints, the internal cheek pads drawing inwards and the negative intra-oral pressures for drawing and harmonising the positive pressure of intermittent milk flow.

In the presence of existing nipple trauma, initial pain according to the women did occur as the nipple was first drawn with the increasing intra-oral negative vacuum pressure. The women experienced pain relief once the nipple was drawn to the level of the soft palatal cleft. They described reduced compression of the nipple and a sense that it was protected by the circle of the soft palatal cleft and the upper surface of the posterior tongue and during rhythmical swallowing episodes that harmonised with the intermittent flow of milk into the oropharynx and therefore reduced compression there was often reduced pain. The women explained how they no longer felt the nipple being compressed into, or frictioned between, the middle or tip of the tongue muscle and the hard palate and how that resulted in marked pain relief at the point of milk flow into the oropharynx. The two most common short-text notations to the experience of reduced pain were, “it doesn’t hurt” and “why wasn’t I told this before”. When the baby detached the shape of the nipple had returned to a rounded shape compared to the previous altered shape.

In comparison to the cross-cradle hold, the more natural cradle-hold involved gently cradling the baby thus removing the awkward postural twist of the mother’s upper body observed with

the cross-cradle hold. The baby lay comfortably cradled in one arm facing the breast and generally placed one hand either side of the breast for tactile contact. Some baby's were observed to manoeuvre the breast with the hands to gain better access to the nipple. In the cradle-hold there was no restriction of the sub-occipito-cervical spine; the baby could freely move the head. The mother's hand rested naturally without pressure over the shoulder-thoracic area and without holding the baby by the sacral area over the nappy. The baby had better access and more headroom to accomplish self-directed breastfeeding when the mother allowed her elbows to rest comfortably by her sides. The individual mother may or may not support her breast and for those who had larger breasts a small towel/face-washer was rolled and placed under the breast to help maintain support, particularly when heavily laden with milk. Supporting the breast in these circumstances helps prevent the weight of the breast dragging the nipple forward in the mouth from the posterior to the anterior tongue. Supporting the heavier breast also helped to maintain the nipple in a more natural position for locating and intra-oral drawing.

Appendix 7: Why Both Breasts Per Feed?

Based on my experiences, most babies who breastfed to self-regulated satisfaction used both breasts each feed cycle and appeared to settle and sleep well between feeds. These babies tended to have an average of seven self-regulated breastfeeds over a period of 24 hours. Most often the baby would commence the current feed on the last breast used in the previous feed cycle.

The principle for both breasts per feed was based on observing unsettled and crying babies who appeared to have reflux and colic. The aim was to prevent over-distension of the stomach and allow time for gastric predigestion and therefore the digestive system.

The baby fed until he/she indicated both gastric volume and emotional satisfaction before slipping off the first breast. The baby's stomach relative to the size of the baby's hand provided us with an anatomical indication of what the baby may comfortably tolerate. Self-regulated time for the baby to rest-stretch-and-digest was followed by a nappy change between the end of the first and prior to the commencement of the second breast. This was important for enzyme pre-digestion and transfer of the gastric content. The baby alerted the mother by repeating the neuro-sensory behavioural cues to commence the second breast and refill the stomach.

Alternatively, if using only one breast per feed, or commencing the feed with the fullest breast first, the babies were unsettled. It appeared that the high volume of milk transferred rapidly, over-expanded the small stomach beyond volumetric capacity. Under pressure the oesophageal sphincter at the entry to the stomach appeared to release the gastric pressure, which manifested as gastro-oesophageal reflux. Using one breast per feed with high volume milk was associated with more frequent feeding episodes, often referred to as snack feeding.

These babies found it difficult to settle and needed to be held upright for long periods sometimes sleeping in arms from one feed to the next. Snack-feeding babies may have 10 or more feeds over 24 hours resulting in tired, overwhelmed mothers and babies who cry and find it hard to settle with gastro-intestinal disturbance.

經驗

Experience

知識

Knowledge

賢明

Wisdom

Tomiko Aoyagi

