School of Public Health

A Cohort Study of Factors Influencing Breastfeeding in Regional Western Australia

Kylee Nicole Cox

This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University

November 2016

DECLARATION

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Kylee Nicole Cox

Signature:_____

Date:_____

ABSTRACT

Breastfeeding is accepted as the best way of feeding infants, with strong evidence of the benefits in the short and long term. Health authorities recommend exclusive breastfeeding to around six months of age but despite the evidence of the benefits of breastfeeding and generally encouraging rates of initiation, few mothers meet this goal.

Compared to the body of evidence for determinants of breastfeeding practice in rural areas of developing countries, there are few studies of breastfeeding behaviour in rural and regional areas of industrialised countries from which to draw conclusions. Additionally, variations in demography and study methodology mean that findings may not be generalizable to other populations. The Rural Infant Feeding Study (RIFS) aimed to determine the factors associated with breastfeeding practices from birth to 12 months of age in rural Western Australia.

A cohort of 427 women and their infants were recruited from hospitals in regional Western Australia and followed for a period of 12 months. Information about feeding methods was gathered in hospital and at a further seven follow-up contacts.

Data were analysed and described using summary statistics and univariate regression analysis was used to screen for potentially significant factors associated with breastfeeding practice. Multivariate logistic regression was employed to determine the independent effects of identified factors, controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. Survival analysis to determine duration of breastfeeding practices was conducted using the Kaplan Meier technique and determinants of breastfeeding duration were identified using Cox's proportional hazards model, to determine the effect of predictor variables on the risk for cessation of breastfeeding.

Of the 1170 women eligible to participate in the study, 819 were contacted and 489 women gave consent to participate. Of those women, 427 completed the baseline survey, representing 52% of women contacted.

Breastfeeding was initiated by 97.7% of the mothers in this cohort, with 82.7% exclusively breastfeeding at hospital discharge. The strongest predictors of exclusive breastfeeding at discharge in this study were health-service related. Mothers whose infants who did not require admission to the Special Care Nursery had more than four times the odds of exclusively breastfeeding at discharge (aOR 4.43, 95% CI 1.98-9.99). Mothers had greater odds of exclusive breastfeeding at discharge if they perceived that the advice given by hospital staff was consistent (aOR 3.99, 95% CI 1.94-8.22) or if they fed their infant on demand in hospital (aOR 3.33, 95% CI 1.59-6.95). The breastfeeding practice of maternal grandmothers was also a significant predictor, and women whose own mothers had breastfed had more than four times greater odds of exclusively breastfeeding at discharge (aOR 4.14, 95% CI 1.87-9.16). Additionally, mothers who perceived their partner to prefer breastfeeding had greater odds of exclusively breastfeeding at discharge than those mothers who perceived their partner to be ambivalent about breastfeeding or to prefer bottle-feeding (aOR 2.51, 95% CI 1.23-5.09).

Smoking during pregnancy was the strongest predictor of exclusive breastfeeding cessation before six months (aHR 3.21, 95% CI 1.89, 5.46). Other factors such primiparity, a Body Mass Index (BMI) of <30 and a return to work after six months were associated with reduced risk of breastfeeding cessation before both six and 12 months.

A favourable attitude towards breastfeeding and a perception that that infant's father was supportive of breastfeeding were independent positive predictors of breastfeeding duration. The median duration of exclusive breastfeeding was approximately three times longer (16 weeks vs. 5 weeks, $p<0.0001$) and the median duration of any breastfeeding to 12 months was more than twice as long (48 vs. 22 weeks, $p<0.001$) for mothers with an Iowa Infant Feeding Attitude Scale (IIFAS) score >65. Additionally, women whose own mother had breastfed at least one child

had significantly lower risk of ceasing exclusive breastfeeding before six months (aHR=0.61, 95% CI 0.42-0.91). Consistent with other research, the results of this study highlights the relationship between modifiable risk factors, such as smoking during pregnancy and pre-pregnancy obesity, with poor breastfeeding outcomes for rural women. Strategies to address these risk factors prior to delivery may contribute to improved breastfeeding rates in this cohort.

Health service-related factors remained influential on breastfeeding duration. Women who had attended antenatal classes were more likely to be exclusively breastfeeding at six months than those who had not attended classes (aHR 0.61, 95% CI 0.41-0.91). Women who practiced rooming-in and demand feeding in hospital in accordance with baby-friendly principles also had lower risk of ceasing exclusive breastfeeding before six months. Geographical distance from services did not significantly influence breastfeeding outcomes in this cohort.

The findings suggest that hospital practices are not only strong predictors of early breastfeeding practice, but also remain influential on breastfeeding duration. Delivery of antenatal breastfeeding education for rural women, in a range of modalities that actively includes infants' fathers, is required to ensure that mothers are equipped with the skills and knowledge to manage breastfeeding in the early postnatal period. Encouraging rural health services to consistently support the principles of baby-friendly hospital practices in the early postpartum period may also help the establishment of exclusive breastfeeding for rural women as well as support both exclusive and any breastfeeding duration. The focus for health services, regardless of geographical location, should be on creating and maintaining a knowledgeable, confident and supportive workforce where health professionals are equipped to provide timely and practical assistance for breastfeeding mothers. Novel and innovative ways to offer this support should be explored, particularly for geographically and socially isolated women in rural and remote communities. Most importantly, health professionals should be skilled in assisting women to develop their self-efficacy around breastfeeding to maximise their ability to identify and solve breastfeeding problems using the resources available.

This study has also demonstrated the potential for online sources of support, particularly for geographically isolated women, to increase exclusive breastfeeding duration. Further research is required to explore this medium and determine the most effective ways of engaging rural women to improve breastfeeding outcomes.

At a broader level, breastfeeding as the normal and desirable way of feeding infants needs to be promoted in rural communities, particularly for young women and their potential partners, to develop positive attitudes towards breastfeeding. Examining the breastfeeding knowledge, attitudes and intentions of adolescents in rural areas will contribute to the evidence base. Supportive strategies such as breastfeeding-friendly workplaces demonstrate commitment to breastfeeding and should be considered by rural employers to increase the likelihood of meeting breastfeeding goals.

ACKNOWLEDGEMENTS

There are a number of people to whom I am deeply grateful in realising the end of this doctoral study:

- To my supervisor and friend Dr Roslyn Giglia, who continued to encourage and guide me throughout this journey and shared the many highs and lows of the process. Without your insight into the juggling act that is completing a PhD with a family, I would not have made it this far.
- To Professor Colin Binns, for your seemingly infinite wisdom about all things breastfeeding. Your generosity in sharing your knowledge and compassion for others is truly inspiring, and I am indebted to your guidance.
- To Dr Yun Zhao, for your ability to make sense of the numbers that I presented to you and patiently explaining the context. Thank you for making me a better interpreter of the data.
- To the maternity and child health staff of country WA who contributed to the study in recruiting mothers and supporting the presentation of data, particularly my former colleagues in Geraldton. You are a vital and valued workforce, continuing to do the very best for new mums and their families.
- To my parents Jenny and Rod for their unfailing belief that I was capable of achieving this goal, and their continued support of the value of education. I cannot thank you enough. To my husband Scott and daughters Sophie and Madeline, thank you for accepting less of me as a wife and mother at times. I promise I will make it up to you.
- And finally, to the mothers who gave of their time to participate in this study, I thank you for your patience and willingness to share the journey of your baby's first year with me.

I dedicate this thesis to my family

For believing that I could

LIST OF INCLUDED PUBLICATIONS

The following is a list of publications and the objectives addressed:

Cox, K., Giglia, R., Zhao, Y., & Binns, C. W. (2014). Factors associated with exclusive breastfeeding at hospital discharge in rural Western Australia. *Journal of Human Lactation, 30*(4), 488-497. doi: 10.1177/0890334414547274

- To determine the prevalence of any breastfeeding in the first 12 months in regional WA
- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.

Cox, K., Binns, C. W., & Giglia, R. (2015). Predictors of breastfeeding duration for rural women in a high-income country: evidence from a cohort study. *Acta Paediatrica*. doi: 10.1111/apa.12999

- To determine the prevalence of any breastfeeding in the first 12 months in regional WA
- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.

Cox, K., Binns, C. W., & Giglia, R. (2015). The influence of infant feeding attitudes on breastfeeding duration: evidence from a cohort study in rural Western Australia. Int Breastfeed J, 10: 25 doi: 10.1186/s13006-015-0048-3

- To determine the prevalence of any breastfeeding in the first 12 months in regional WA
- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.

Breastfeeding beyond the Big Smoke: Who provides support for mothers in regional Western Australia? *(Australian Journal of Rural Health)*

- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.

Giglia, R., Cox, K., Zhao, Y., & Binns, C. W. (2014). Exclusive Breastfeeding Increased by an Internet Intervention. *Breastfeeding Medicine*. doi: 10.1089/bfm.2014.0093

- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months in regional WA.
- To evaluate participants' perceptions of online sources of information to support breastfeeding in regional areas

CONFERENCE PROCEEDINGS

Cox K, Giglia R, Binns C. Breastfeeding in Regional Western Australia: What Help do Rural Women Need? *Community Health Nurses National Conference*. 26 – 28 August 2010, Geraldton, Western Australia. (Oral presentation)

Cox K, Giglia R. Breastfeeding in Regional Western Australia – What are Country Mums Doing? *Dietitians Association of Australia National Conference*. 26 – 28 May 2011, Adelaide, South Australia

Cox K, Giglia R, Binns C. Breastfeeding in Rural Western Australia; Will the Targets be achieved? *International Congress of Dietetics*. 5 – 8 September 2011, Sydney, New South Wales.

Cox K, Giglia R, Binns C. Breastfeeding in Regional Western Australia: Will the Targets be Achieved? *Mark Liveris Health Sciences Research Student Seminar*. 11 November 2013, Bentley, Western Australia. (Oral presentation)

Cox K, Giglia R, Binns C. Breastfeeding in Regional WA: Can Dietitians Make a Difference? *Dietitians Association of Australia (WA Branch) State Symposium*. 22 November 2013, Perth, Western Australia. (Oral presentation)

Cox K, Giglia R, Binns C. Breastfeeding in Regional WA: The Influence of Knowledge and Attitudes on Feeding Practice. *Dietitians Association of Australia National Conference*. 15-17 May 2014, Brisbane, Queensland. (Oral presentation)

Cox K, Giglia R, Binns C. Breastfeeding advice and support: What do rural mothers need and where do they get it? *Community Health Nurses WA Conference (CHNWA).* 22-24 August 2014, Rottnest Island, Western Australia. (Oral presentation)

“While breastfeeding may not seem the right choice for every parent, it is the best choice for every baby.”

Amy Spangler

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1 - Introduction

1.1 Statement of the Problem

Breastfeeding is the optimal method of feeding infants and has been described as one of the most cost-effective public health measures in preventing childhood mortality and morbidity (National Health and Medical Research Council, 2012), with benefits for both mothers and their babies (Horta & Victora, 2013). Strong evidence from both developed and developing countries has shown that infants benefit from breastfeeding in the short-term with protection against respiratory and gastrointestinal tract infections (Ajetunmobi et al., 2015; Patel et al., 2014) to medium- and long-term benefits such as reducing the risk of childhood obesity (Monasta et al., 2010; Rossiter et al., 2015) and chronic diseases in adulthood (Horta & Victora, 2013). For mothers, breastfeeding has been shown to protect against ovarian and breast cancer (Ip et al., 2007), aid in postpartum weight loss (da Silva Mda et al., 2015) and decrease maternal depression (Mezzacappa, 2004).

Despite the substantial evidence to support the benefits of breastfeeding, particularly exclusive breastfeeding to six months, few mothers in developed countries achieve this milestone. Previous research has identified factors that influence the initiation and duration of breastfeeding, but evidence from regional areas of developed countries is limited. Additionally, methodological differences and variation in definitions across studies make comparison of results difficult. Cohort studies allow identification of causal influences and reduce the likelihood of recall bias, which can result in overestimated rates of breastfeeding duration.

1.2 Study Aims and Objectives

The aim of this research was to evaluate the current infant feeding practices of women in rural Western Australia (WA), as well as determining the barriers and enablers to initiating and maintaining breastfeeding in this region.

The research objectives were as follows:

- To determine the prevalence of 'any breastfeeding' in the first 12 months in rural WA.
- To identify factors that positively influence mothers in initiating and maintaining breastfeeding in the first 12 months, in rural WA.
- To identify factors that negatively influence mothers in initiating and maintaining breastfeeding in the first 12 months, in rural WA.
- To identify sources of information on breastfeeding used by mothers in the rural WA
- To compare results with the Perth Infant Feeding Study (PIFS) I and II in order to determine differences in influences between rural and metropolitan areas.
- To evaluate participants' perceptions of online sources of information to support breastfeeding in rural areas.

1.3 Study Design

To address the stated aims and objectives, a longitudinal cohort study was undertaken using a version of the PIFS II data collection instruments, which was modified to capture additional demographic information. Participants were followed for a period of 12 months to determine infant feeding practices including breastfeeding prevalence. The data collection tool was kept to its original format as much as possible to allow direct comparative analysis of the two data sets in order to determine if differences existed between urban and rural populations within Western Australia. Comparison to the PIFS I dataset was limited to breastfeeding initiation and exclusive breastfeeding at discharge, as the cohort was only followed for a period of 24 weeks.

The study also included a nested randomised controlled trial designed to examine the effectiveness of an online breastfeeding support intervention for regional women. The intervention randomly allocated access to a study website which allowed women to participate in support forums and seek advice from a lactation consultant. Further detail about the study design is provided in Chapter 3.

1.4 Definition of Terms

Breastfeeding practice is defined in this study using the World Health Organization's breastfeeding definitions, adopted for use in Australia (Webb et al., 2001). The following terms used in this thesis are defined below:

- **Incidence of breastfeeding**; the proportion of infants who were ever breastfed
- **Prevalence of breastfeeding;** the proportion of all infants being breastfed at any intensity at specified ages
- **Breastfeeding initiation**; the infant's first intake of breastmilk. An infant who ever received breastmilk is included in the incidence of initiation.
- **Breastfeeding duration**; The total length of time an infant received any breastmilk at all from initiation through until weaning is complete, regardless of whether other foods or liquids were introduced.
- **Prelacteal feeds;** the provision of any liquid (including water) other than mother's breastmilk, provided before the initiation of breastfeeding.
- **Exclusive breastfeeding**; The infant has received only breastmilk from his/her mother or a wet nurse, or expressed breastmilk, and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines. If an infant had received a prelacteal feed, they were no longer considered exclusively breastfed.
- **Full breastfeeding**; an infant for whom breastmilk is the main source of nourishment. The rate of *fully breastfed* infants includes the rate of infants who are *exclusively breastfed* (breastmilk only) as well as those who are *predominantly breastfed* (those who receive breastmilk in addition to other fluids, excluding infant formula).

- **Predominant breastfeeding**; indicates that the infants' predominant source of nourishment has been breastmilk, but the infant may also have received water and water-based drinks (sweetened and flavoured water, teas, infusions etc); fruit juice; oral rehydration solution (ORS); drop and syrup forms of vitamins, minerals and medicines; and ritual fluids (in limited quantities). All other food-based fluids are excluded, non-human milk.
- **Complementary feeding**; also referred to as mixed feeding. The child has received both breastmilk and solid or semi-solid food (this may include any food or liquid including non-human milk)

Other terms used include:

- **Rooming-in**; the practice of having an infant remain with the mother on a 24-hour basis
- **Demand feeding**; also referred to as "unrestricted" or "baby led" feeding. It describes the practice of feeding based on infants' cues, with variations in frequency and length of feeds between infants and from day to day (Vallenas, 1998).

1.5 Abbreviations

ABF Any breastfeeding

ARIA Accessibility/Remoteness Index of Australia

AUD Australian dollar

BF Breastfeeding

BMI Body Mass Index

CI Confidence Interval

EBF Exclusive breastfeeding

HR Hazard Risk

IIFAS Iowa Infant Feeding Attitudes Scale

LBW Low Birth Weight

OR Odds Ratio

PIFS Perth Infant Feeding Study

PIFS II Perth Infant Feeding Study Mark II

RR Relative Risk

SD Standard Deviation

SPSS Statistical Package for the Social Sciences

USA United States of America

UK United of Kingdom

WHO World Health Organization

1.6 Significance of the Study

Breastfeeding is a key indicator in public health improvement and Australian health authorities continue to support and promote breastfeeding through the Dietary Guidelines (National Health and Medical Research Council, 2013) and Infant Feeding Guidelines (National Health and Medical Research Council, 2012). The trend towards exclusive breastfeeding to around six months nationally is encouraging, but still requires vigilance.

This research will contribute to the understanding of issues faced by rural mothers in establishing and maintaining breastfeeding and, as contemporary longitudinal breastfeeding data for regional areas is limited, contribute to the literature. The provision of timely and accurate advice to women experiencing problems assists in maintaining breastfeeding, ultimately resulting in improved health outcomes for women and their infants. This research has the potential to address issues faced by women in rural and remote areas in accessing advice and support from health professionals, likely resulting in women who may have ceased breastfeeding to continue. The public health benefits from improved breastfeeding rates in rural areas will have significance in promoting the health of rural and remote communities.

1.7 Limitations of the Study

The limitations of this study can be grouped into methodological and sampling issues:

- Longitudinal cohort studies experience some loss of participants over time to follow-up, and this has the potential to create a bias towards participants that are undertaking the desirable behaviour (in this case breastfeeding).
- The use of online survey methods to collect data for the follow-up surveys may have conferred selection bias, with lower income households less likely to have computer access (Australian Bureau of Statistics, 2011).
- The inclusion of the nested randomised controlled trial in this larger study allowed the intervention group access to additional breastfeeding information and support, which may reduce the generalizability of the results to other rural settings.
- Finally the reliance on self-reported behaviours for data may have contributed to a positive bias amongst participants, with the preference to report desirable behaviours.

The ways that each of these potential limitations was addressed are described at relevant points in the discussion chapters.

1.8 Organisation of Thesis

This thesis is presented as a combination of chapters that detail the current literature, methodology and results of the study, as well as published papers that address the key objectives of the study. They are as follows:

Chapter 2: Literature Review. This chapter outlines the evidence for determinants of breastfeeding practice in rural areas of developed countries through a systematic literature review. Details of the literature search strategy and quality assessment tools utilised are provided.

Chapter 3: Methodology. The study design, data collection and data analysis techniques employed in this research are detailed in this chapter. Detailed description of the dataset including inclusion and exclusion criteria and data analysis undertaken is provided.

Chapter 4: Results. The results of the study are summarised in this chapter, with data presented as it relates to breastfeeding initiation and duration. The chapter consists of descriptive data in compiled tables and figures as well as results of multivariate analysis where relevant.

Chapter 5: Factors associated with breastfeeding initiation and breastfeeding at discharge from hospital are presented in this chapter through a published paper entitled:

Breastfeeding at Discharge from Hospital in Rural Western Australia

The chapter is presented using the conventions and styles required by the publisher with respect to referencing, word limitations and presentation of tables and figures.

Chapter 6: The predictors of breastfeeding duration are presented in this chapter through a paper entitled:

Predictors of Breastfeeding Duration for Rural Women in a High Income Country: Evidence from a Cohort Study

The chapter is presented using the conventions and styles required by the publisher with respect to referencing, word limitations and presentation of tables and figures.

Chapter 7: Breastfeeding knowledge and attitudes and their influence on breastfeeding duration were specifically explored in this chapter through a paper entitled:

The Influence of Infant Feeding Attitudes on Breastfeeding Duration: Evidence from a Cohort Study in Rural Western Australia

The chapter is presented using the conventions and styles required by the publisher with respect to referencing, word limitations and presentation of tables and figures.

Chapter 8: Breastfeeding support and advice for rural women was a factor identified in the literature review as of interest in rural communities, and the findings related to this are presented in this chapter, through a paper entitled:

Breastfeeding beyond the Big Smoke: Who provides support for mothers in regional Western Australia?

The chapter is presented using the conventions and styles required by the publisher with respect to referencing, word limitations and presentation of tables and figures.

Chapter 9: The influence of online information sources on breastfeeding practice was quantified and the findings are presented in a chapter entitled:

Exclusive Breastfeeding Increased by an Internet Intervention

The chapter is presented using the conventions and styles required by the publisher with respect to referencing, word limitations and presentation of tables and figures.

Chapter 10: Conclusions and Recommendations. A summary of the findings based on the research objectives and recommendations for practice are presented in this chapter.

References and Appendices are also included, containing information about the study tools utilised. The citation and author contribution declarations for each published paper are given at the beginning of the relevant chapter.

Chapter 2 - Literature Review

2.1 Introduction

Breastfeeding is the optimal method of feeding infants and the benefits of breastfeeding are well recognised for both mothers and their babies (Horta & Victora, 2013). Strong evidence from both developed and developing countries has shown that infants benefit from breastfeeding in the short-term with protection against respiratory and gastrointestinal tract infections (Ajetunmobi et al., 2015; Patel et al., 2014), to medium- and long-term benefits such reducing the risk of childhood obesity (Monasta et al., 2010; Rossiter et al., 2015) and chronic diseases in adulthood (Horta et al., 2007). For mothers, breastfeeding has been shown to protect against ovarian and breast cancer (Ip et al., 2007), aid in postpartum weight loss (da Silva Mda et al., 2015) and decrease maternal depression (Mezzacappa, 2004).

Continued debate about the optimal duration of breastfeeding led the World Health Organization (WHO) to conduct a systematic review of the optimal duration of breastfeeding (Kramer & Kakuma, 2001) and a subsequent Expert Consultation recommended that infants, both in developed and developing countries, be exclusively breastfed to six months of age (World Health Organization, 2001). This recommendation has been adopted into breastfeeding policies by public health agencies globally (Cattaneo et al., 2010; United States Department of Health and Human Services, 2010) including Australia's National Breastfeeding Strategy (Australian Health Ministers' Conference, 2009) and Infant Feeding Guidelines (National Health and Medical Research Council, 2012) reflect measures to protect, promote, support and monitor breastfeeding.

While there is a substantial and growing body of evidence around the determinants of breastfeeding in developed countries, the evidence from rural settings is limited. Inconsistencies in definitions and methodology have contributed to the challenges in identifying influences on breastfeeding practice in this setting.

This chapter aims to provide a review of the literature describing the evidence for the determinants of breastfeeding initiation and duration in the context of regional and rural populations of developed countries. A brief history of breastfeeding in developed countries and current prevalence is presented along with a summary of the physiology and benefits of breastfeeding. The search strategy for the review is outlined including the tools used to assess the quality and strength of the evidence. Determinants of breastfeeding practice relevant to rural populations are described and recommendations for further research are provided.

2.2 Breastfeeding in Developed Countries

Although there is evidence that artificial feeding of infants was practiced as early as 2000BC, it was not until the mid-19th century that the first commercial infant formula was made available (Stevens et al., 2009). Marketing of infant formula increased rapidly after this, and together with improvements in the supply of infant formula and development of non-milk formulas, which were promoted directly to medical professionals, breastfeeding experienced a decline until the 1970s (Stevens et al., 2009). Following negative publicity for infant formula companies and their role in developing countries coupled with public awareness campaigns about the importance of breastfeeding in the 1970s, rates began to rise again in Australia and other developed countries.

Despite the substantial evidence to support the benefits of breastfeeding, particularly exclusive breastfeeding to six months, few mothers in developed countries achieve this milestone. Retrospective cross-sectional surveys are commonly employed in national data collections, from which much of the breastfeeding rate data is drawn. The National Immunization Survey is conducted annually in the United States and uses random-digit dialing to survey households with children aged 19–35 months about childhood immunisation. Respondents are also asked about breastfeeding practice as part of the survey. Prior to 2011, only landlines were included in the survey sampling, however subsequent analysis of a dual-frame sampling methodology which included respondents using cell phone

found that there was little significant difference in estimation of breastfeeding initiation or the duration of exclusive breastfeeding (Centers for Disease Control and Prevention, 2015). Analysis of the 2010 National Immunization Survey data (n=24,348) found that even though the rate of breastfeeding initiation was 76.5%, only 16.4% of infants overall were exclusively breastfed to six months (Centers for Disease Control and Prevention, 2015).

The United Kingdom's Infant Feeding Survey (IFS) has been carried out every five years since 1975 and the 2010 survey was the eighth time the survey has been conducted (McAndrew et al., 2012). The 2010 IFS found that although 81% of mothers initiated breastfeeding, only 1% were exclusively breastfed at six months (McAndrew et al., 2012). This survey, using an unclustered sample of 30,760 births, was drawn from all registered births across the United Kingdom between August and October 2010. The sampling process aimed to attain a sample size sufficient to produce separate estimates for the four countries within the UK, resulting in different sampling fractions dependant on population; in Wales and Northern Ireland, all births in the sampling period were selected, whereas births were drawn at random from those registered in England and Scotland (McAndrew et al., 2012).

Breastfeeding initiation rates in Canada are higher than those in the UK and the US, with approximately 88% of mothers in 2011-12 Canadian Community Health Survey initiating breastfeeding, however only 26% exclusively breastfed their infants for six months or more (Statistics Canada, 2013). The Canadian Community Health Survey collected responses from 130,000 women aged 15-55, who had delivered a baby in the previous five years. Breastfeeding initiation was defined as ever having been breastfed and exclusive breastfeeding was defined as the infant receiving only breastmilk and no other liquids or solids, in line with the WHO definition of exclusive breastfeeding.

The 2010 Australian National Infant Feeding Survey (ANIFS) was the first large-scale national survey of infant feeding practices, behaviours and attitudes conducted in Australia and aimed to provide baseline data on breastfeeding and other infant

feeding practices by Australian mothers and carers (Australian Institute of Health and Welfare, 2011). The survey used the Medicare (universal health insurance) enrolment database for the sampling frame, identifying 52,008 children up to the age of 24 months as eligible. A total of 28,759 infants and children comprised the final sample, a response rate of 56%. The survey found a near-universal rate of breastfeeding initiation to be approximately 96%, but only 15% of infants were exclusively breastfed up to six months (Australian Institute of Health and Welfare, 2011).

Whilst national data collections can provide information about breastfeeding initiation and overall duration, their retrospective nature means that they are less accurate in determining true prevalence of exclusive breastfeeding. Recall periods for estimation of exclusive breastfeeding can vary in length, and in the case of large-scale surveys such as the National Immunisation Survey, can be as long as 19 months (Centres for Disease Control and Prevention, 2015). Recall of the duration of 'any breastfeeding' tends to be accurately reported even after a period of years, however recall of exclusive breastfeeding duration is much less accurate and frequently over-reported (Greiner, 2014). It is possible that mothers either misunderstand the definition of exclusive breastfeeding (Burnham et al., 2014) or that definitions provided by researchers are inconsistent (Greiner, 2014). Additionally, with the rise in promotion of breastfeeding as the optimal infant feeding method, mothers may knowingly overestimate duration of exclusive breastfeeding, reflecting social desirability (Burnham et al., 2014).

2.3 Breastfeeding in Australia

From the 1970s, where the rate of breastfeeding initiation was approximately 40-45% (Australian Bureau of Statistics, 2003), Australia has enjoyed a much higher breastfeeding initiation rate compared with other developed nations. The 2010 Australian National Infant Feeding Survey found that breastfeeding was initiated for 96% of children aged 0-2 years, but at 3 months only 39% were exclusively

breastfed, and only 15% of infants between 5 and 6 months were exclusively breastfed (Australian Institute of Health and Welfare, 2011).

Although data on breastfeeding practices exists for Australian metropolitan areas, data in rural Australia is limited and tends to be cross-sectional. Additionally, comparison of breastfeeding prevalence across studies is complicated due to inconsistencies in defining breastfeeding, and a recent review has found that numerous studies overestimate the prevalence of exclusive breastfeeding (Binns et al., 2009). Data from rural areas of New South Wales (NSW) in the 2001 Child Health Survey showed 'any breastfeeding' in 48.9% of infants up to the age of 6 months (Hector & King, 2005), however there is no available comparative data for 'exclusive breastfeeding' (Labbok, 2001). In a study of 58 women from rural South Australia only 55% and 50% of women were still breastfeeding at three and six months, respectively (Stamp & Casanova, 2006), however the small sample size, differences in breastfeeding definitions, convenience sampling and data collection methods make comparisons to other studies difficult.

As the most contemporary national breastfeeding data for Australia, the 2010 ANIFS reported breastfeeding initiation rates based on Australian Standard Geographical Classification (ASCG) Remoteness Areas (Australian Institute of Health and Welfare, 2004) and found that whilst differences in breastfeeding initiation existed between geographical locations, no gradient was evident (Australian Institute of Health and Welfare, 2011). A total of 94.2% of women living in remote / very remote areas initiated breastfeeding compared to 90.2% in major cities, 90.0% in inner regional areas and 91.5% in outer regional areas. Exclusive breastfeeding duration to six months in remote / very remote regions was greater than that of major cities (15.9% vs. 14.5%), but lower than that of inner and outer regional areas (17.4% and 19.6% respectively) (Australian Institute of Health and Welfare, 2011), however no confounding factors were controlled for in this analysis. Whilst the ANIFS provides some evidence for breastfeeding outcomes, the lack of contemporary longitudinal data for rural women in Australia presents challenges in determining the influences on breastfeeding practice for this population group.

2.4 Physiology of Breastfeeding

Breastmilk is a complete food for infants, providing all the nutrients required for the first six months of life (World Health Organization, 2009). Mature human milk is characteristically lower in protein and sodium chloride and higher in lactose and oligosaccharides than either infant formula or cow's milk, with an average fat content of 43.8g/L (National Health and Medical Research Council, 2012). Breastmilk contains sufficient vitamins for infants in the first six months, unless the mother is herself deficient, and meets an infant's fluid requirements without the need for additional fluids even in hot climates (National Health and Medical Research Council, 2012).

Breastmilk is unique in its ability to meet the changing needs of an infant as it grows. The secretion of colostrum in the first few days after delivery provides the infant highly concentrated quantities of antibodies and is proportionately higher in protein, minerals and fat-soluble vitamins than the more mature milk that follows. This composition allows the delivery of essential immunoprotective factors to the newborn infant and assists in the preparation of the gut to receive the nutrients provided in breastmilk. From this point, the breastmilk volume increases and composition changes to reflect the needs of the infant. From two weeks onwards, milk is considered mature (World Health Organization, 2009).

In addition to the macronutrients, breastmilk has an unmatched immunological profile, providing protection against a number of diseases experienced in early infancy. Bioactive factors such as immunoglobulins, polyunsaturated long-chain fatty acids and oligosaccharides protect the infants intestinal mucosa, reducing the risk of infection, while lipases and growth factors assist in digestion of breastmilk in the immature gut (National Health and Medical Research Council, 2012; World Health Organization, 2009)

The production of breastmilk is a complex interplay of hormonal feedback and control. Prolactin, one of the two hormones that directly influence breastmilk production, increases during pregnancy, stimulating the production of breast tissue.

Whilst the levels of prolactin are high during pregnancy, lactation is suppressed due to the presence of oestrogen and progesterone. The delivery of the placenta after childbirth leads to a decrease in the levels of progesterone, allowing prolactin to initiate milk production (World Health Organization, 2009).

Blood levels of prolactin vary dependant on stimulation of the breast via the suckling infant. The stimulation of the nipple prompts release of prolactin by the anterior pituitary gland, causing the alveoli to produce milk. Prolactin is at its highest level approximately 30 minutes after the commencement of a feed, which in turn stimulates milk production for the subsequent feed. In the early stages of breastfeeding establishment, the feedback cycle is critical to breast milk production. Although prolactin remains essential to milk production, the relationship between the amount of prolactin and the amount of breast milk does not appear to be as close (World Health Organization, 2009).

In addition to the role of prolactin in stimulating milk production, oxytocin plays an important role in the release of breastmilk from the breast tissue. The release of oxytocin from the posterior pituitary gland both in anticipation of a feed and also as a response to the infant suckling is known as the “let-down reflex” or “milk ejection reflex”. Other stimuli such as touching or smelling her infant, or hearing her infant cry can also trigger the reflex in a breastfeeding mothers. The psychological effects of oxytocin on mood and stress have also been documented. Close skin contact between mothers and infants can stimulate the secretion of oxytocin, promoting positive bonding (World Health Organization, 2009).

2.5 Benefits of Breastfeeding / Risk of Formula Feeding

2.5.1 Health benefits

The paradigm of breastfeeding as beneficial and therefore formula feeding as normal has been central to the dilemma for public health advocates of breastfeeding for decades. The majority of studies examining infant feeding present the results in the context of the benefits of breastfeeding, reinforcing the

view that formula feeding is the baseline for comparison. While this approach is still valid, re-framing of the data to determine the health risks of formula feeding, including re-analysis with breastfeeding as the standard is becoming more widely reported. (McNiel et al., 2010; Stuebe, 2009)

Whilst the benefits of breastfeeding in terms of protection against diarrhoeal disease are crucial in curtailing infant mortality in developing countries, the risk for childhood illnesses are not limited to these settings. Infants who are formula-fed have a significantly increased risk of infectious diseases such as acute otitis media, gastrointestinal infections and lower respiratory tract infections. In addition, formula feeding increases the risk of less common childhood illnesses such as necrotising enterocolitis (NEC), acute myelogenous leukemia, acute lymphocytic leukemia and Sudden Infant Death Syndrome (SIDS) (Ip et al., 2007; United States Department of Health and Human Services, 2011)

Furthermore, the protective effect is not limited to short term outcomes. Meta analyses of longer-term outcomes have demonstrated that breastfed infants have a reduced risk of developing chronic diseases such as childhood asthma, atopic dermatitis (eczema), childhood obesity and Type 2 diabetes mellitus (Horta & Victora, 2013; Ip et al., 2007; United States Department of Health and Human Services, 2011)

In addition to providing protection against childhood illnesses and chronic disease later in life, mothers who breastfeed also experience health benefits. In the short-term, breastfeeding reduces the risk of excessive post-partum blood loss through an increased rate of uterine contraction (Labbok, 1999). The contraceptive effect of breastfeeding through suppression of menses is also acknowledged, conferring an additional benefit in reducing iron loss (Labbok, 1999). In the longer term, the risk of breast and ovarian cancers is reduced in women with a history of lactation, as well as reduced risk of diabetes and postpartum depression (Ip et al., 2007).

2.5.2 Psychosocial benefits

Notwithstanding the physiological benefits of breastfeeding, the process of breastfeeding an infant allows the development of a bond between mother and infant (United States Department of Health and Human Services, 2011). Breastfeeding creates interdependence between mother and infant as it encourages regular close skin-to-skin contact (Moore et al., 2012; National Health and Medical Research Council, 2012). Breastfeeding provides frequent opportunities to focus on the infant and may contribute to a mother's confidence in her breastfeeding skill (Moore et al., 2012). There is evidence of a positive association between breastfeeding duration and reduced incidence of postpartum depression, however it is not clear if breastfeeding duration modifies the risk of depression or if early cessation of breastfeeding occurs as a result of postnatal depression (Ip et al., 2007).

2.5.3 Economic benefits

Compared with formula feeding, breastfeeding is virtually cost-free. In addition to the cost of formula, artificial feeding requires other equipment such as bottles and teats, and time spent in preparation, cleaning and sterilising of feeding equipment. For households with low and fixed incomes, artificial feeding can represents a significant cost in household budgets.

In addition to the economic benefits of breastfeeding for an infant and its family, there are wider community, national and global economic benefits to be gained. Studies have quantified the savings in healthcare costs for infants fed exclusively on breastmilk, based on reduced illness and hospitalisation resulting from reduced risk. In 2001, a landmark analysis of the cost of suboptimal breastfeeding in the United States concluded that $USD 3.6 billion could be saved every year if breastfeeding rates reached the Healthy People targets (Weimer, 2001). A decade later, the cost of suboptimal breastfeeding in the United States was estimated to be approximately $13 billion per annum (Bartick & Reinhold, 2010). In Australia, an economic analysis of hospitalisation costs for the treatment of infants and children

0-4 years for gastrointestinal illness, respiratory illness, otitis media, eczema and NEC in the Australian Capital Territory (ACT) concluded that higher exclusive breastfeeding rates could produce potential savings of between $60-$120 million annually across the Australian hospital system (Smith et al., 2002).

Whilst direct healthcare costs for illnesses attributable to the use of formula are significant, inclusion of indirect costs, such as absences from employment to care for sick children, claims on health insurance and the cost of premature death are additional economic burdens.

Beyond the calculation of costs due to ill-health attributable to formula use, the production of breastmilk has been shown to contribute significantly to the Gross Domestic Product (GDP). Economic analysis of the value of achieving the breastfeeding goals and targets in Australia concluded that this measure was worth more than any other micro-economic reform, yielding a net benefit of at least $AUD 3 billion annually (House of Representatives Standing Committee on Health and Ageing, 2007).

2.5.4 Environmental benefits

As a food source, breastmilk has several advantages over artificial infant feeding methods; it is renewable, naturally occurring and requires no additional packaging. Breastfeeding requires none of the manufacturing, transport, preparation and marketing of artificial infant formula, all of which confer an environmental cost. In the US Surgeon General's *Call to Action to Support Breastfeeding*, it has been estimated that for every one million formula-fed infants in the United States, 150 million tins of formula are consumed (United States Department of Health and Human Services, 2011) and while a proportion of those will be recycled, the contribution of manufacturing of infant formula to landfill worldwide is evident.

Infant formula is not a sterile product and there have been cases of contamination with *Cronobacter sakazakii,* a bacterium associated with cases of sepsis, meningitis, cerebritis and necrotizing enterocolitis in low birth weight infants (World Health Organization, 2015). Poorly regulated manufacturing processes for formula have also resulted in contamination with substances such as melamine, as was the case in China in 2008, resulting in the deaths of at least six infants and the hospitalization of more than 50,000 infants and young children (Tang et al., 2015). Whilst these issues are not common in developed countries, they highlight the risks associated with manufactured infant food. However, it remains that a significant proportion of formula-fed infants in developed countries continue to be at increased risk of ill-health resulting from incorrect preparation of infant formula, such as poor personal hygiene practices and poor sterilisation of feeding equipment (National Health and Medical Research Council, 2012).

2.6 Determinants of Breastfeeding Initiation and Duration in Developed Countries

While it is recognised that breastfeeding is nutritionally, socially and economically superior to formula feeding, there remain a myriad of reasons for lower than ideal breastfeeding initiation and duration rates across the world.

Determinants of breastfeeding initiation and duration have been examined extensively in previous reviews of the literature over the last 15 years (Callen & Pinelli, 2004; Dennis, 2002; Meedya et al., 2010; Scott & Binns, 1999; Thulier & Mercer, 2009). It has been noted that inconsistencies in the earlier evidence were likely due to the use of univariate analyses to report significant associations (Scott & Binns, 1999), however most contemporary research utilises multivariate analysis techniques. The factors described can be grouped broadly into four categories: sociodemographic, biomedical, psychosocial and health service related variables.

2.6.1 Sociodemographic

Maternal age

Maternal age has been consistently cited as a significant influence on both breastfeeding initiation and duration in both the Australian (Forster et al., 2006; Nicholson & Yuen, 1995; Scott et al., 1999; Scott et al., 2001) and international literature (Dubois & Girard, 2003; Ibanez et al., 2012; Thulier & Mercer, 2009). It is widely recognised that mothers who are older are more likely to begin breastfeeding and breastfeed for longer, independent of other sociodemographic factors. In a review of breastfeeding prevalence in industrialised countries, younger maternal age (<25 years) was associated with lower rates of breastfeeding initiation and continuation in Germany, Canada, the United States, France, Japan, Norway, the Netherlands, the United Kingdom and Sweden (Ibanez et al., 2012). In the United States, analysis of the 2003/2004 National Immunizations Surveys found that 51.4% of mothers aged 19 years or younger initiated breastfeeding compared with 75.4% of mothers aged 30 years or more (Forste & Hoffmann, 2008).

The literature frequently reports a negative association between younger age and breastfeeding outcomes; however few studies have examined reasons why. A study of 4,366 women from two Australian states investigating the factors influencing breastfeeding practices amongst young women found that while women aged under 25 were just as likely to initiate breastfeeding as those 25 or older, the odds of ceasing breastfeeding by 6 months were almost two times greater (aOR 1.76, 95% CI 1.34–2.33) (Biro et al., 2014). The authors found that younger mothers were more likely to be experiencing multiple stressful life events, be single, have lower or fixed incomes through poorer paid employment or social security, be more likely to smoke and be overweight. These factors potentially contribute to disadvantage for young women in accessing support for breastfeeding that meets their needs, therefore any approaches should be tailored to address this vulnerable group. In rural areas, access to tailored breastfeeding support services for younger women may be limited by personal socioeconomic and wider organisational resource constraints.

Marital Status

Marital status, as a marker of socioeconomic status, has been positively associated with breastfeeding practice, although the evidence is not consistent. A review of determinants of breastfeeding initiation and duration across Canada, the United States, Europe and Australia found that women who were married or partnered were more likely to initiate breastfeeding, and to breastfeed for longer periods of time (Callen & Pinelli, 2004), however methodological limitations of the review including selection and recall biases, as well as inconsistent definitions of breastfeeding were noted. A study of infant feeding practices of 538 women in metropolitan Perth found no significant independent association between marital status and breastfeeding or duration (Scott, Binns, Graham, et al., 2006; Scott, Binns, Oddy, et al., 2006), a finding reflected in a study conducted a decade earlier (Scott et al., 1999). The authors noted that sociodemographic inequalities were more significant in populations where breastfeeding initiation rates were 80% or less and concluded that their influence on breastfeeding practice was less apparent as initiation approached universality (Scott, Binns, Graham, et al., 2006).

Maternal Education and Income

Other sociodemographic markers such as higher levels of educational attainment and family income are also positively associated with both breastfeeding initiation and duration (Dennis, 2002; Dubois & Girard, 2003; Meedya et al., 2010; Scott & Binns, 1999; Thulier & Mercer, 2009). Mothers with higher levels of education, at least completing high school, have been consistently shown to be more likely to initiate breastfeeding and have longer breastfeeding duration (Dennis, 2002; Dubois & Girard, 2003; Meedya et al., 2010; Scott & Binns, 1999). Similarly, women who have a lower level of family income, who are employed in lower paying work or are unemployed have lower levels of both breastfeeding initiation and duration (Dennis, 2002; Scott & Binns, 1999; Thulier & Mercer, 2009).

Whilst lower family income *per se* is a significant independent influence on breastfeeding, the socioeconomic environment in which infant feeding decisions are made is also influential. An example of this is the Special Supplemental

Nutrition Program for Women, Infants and Children (commonly referred to as WIC), a US Federal government grant program that provides nutritious foods, nutrition education (including breastfeeding promotion and support), and referrals to health and other social services to participants at no charge. WIC serves low-income pregnant, postpartum and breastfeeding women, and infants and children up to age five who are found to be at nutritional risk (United States Department of Agriculture Food and Nutrition Service, 2014). Participants are eligible for assistance if their income falls at or below 185% of the U.S. Poverty Income Guidelines (currently USD $44,123 for a family of four) and are individually determined to be at "nutritional risk" by a health professional or a State or locally trained health official.(United States Department of Agriculture Food and Nutrition Service, 2014) In the financial year 2012/13, over 8.6 million women, infants, and children per month (on average) received WIC benefits.(United States Department of Agriculture Food and Nutrition Service, 2014)

In addition to the provision of food through the program, WIC provides infant formula to women who are not breastfeeding their infant. It has been estimated that over half the formula used in the US is provided to mothers at no cost through WIC (Kent, 2006).

Although one of the stated roles of the WIC program is to provide breastfeeding promotion and support (United States Department of Agriculture Food and Nutrition Service, 2014), the impact on breastfeeding rates is limited. In 2005, less than 1% of the WIC budget was set aside for activities that promoted breastfeeding (Ryan & Zhou, 2006), and while breastfeeding rates among WIC participants have increased, they are proportionate with increased rates amongst the general population (Thulier & Mercer, 2009). WIC participants are consistently less likely to breastfeed their infants compared with eligible non-participants suggesting that provision of formula may have a negative effect on breastfeeding in this group (Li, Darling, et al., 2005; Ryan & Zhou, 2006). As noted in a review of breastfeeding outcomes across developed countries, the United States was the only country included in the review that provided free infant formula to low income families

(Callen & Pinelli, 2004). The results of studies that use WIC participants to determine breastfeeding practice must therefore be interpreted with caution.

Ethnicity

Differences in breastfeeding outcomes for women of different ethnic backgrounds have been consistently demonstrated in the literature, with the majority of evidence originating from the United States. Many studies have examined the influence of ethnicity on breastfeeding practice, and research in the United States has demonstrated significant differences in breastfeeding initiation and duration between Caucasian, Hispanic and African-American ethnic groups (Centers for Disease Control and Prevention, 2006). Women of Hispanic background are more likely to begin and continue to breastfeed, whereas African American women are less likely to choose breastfeeding, after controlling for other confounding sociodemographic factors. Conversely, in the United Kingdom, women from South Asian (Indian: aOR 1.9, Pakistani: aOR 2.2, Bangladeshi: aOR 5.1), black Caribbean (aOR 9.2) and black African (aOR 10.5) backgrounds had greater odds of initiating breastfeeding compared to white women, and greater odds of breastfeeding at three and six months (Kelly et al., 2006).

In Australia, initiation of breastfeeding is near universal, but differences exist between cultural groups when determining breastfeeding duration. The initial infant feeding practices and beliefs of migrant women from Turkey and Vietnam compared with Australian-born women were explored in a study of 300 women who gave birth at a tertiary women's hospital in Melbourne, Australia. The authors found variation in rates of breastfeeding initiation dependant on cultural background, from 75% amongst Vietnamese women up to 98% amongst Turkish women (McLachlan & Forster, 2006). A study of factors influencing breastfeeding to six months in an Australian population found that Asian-born women were 2.9 times more likely to be breastfeeding at six months than those born in Australia (Forster et al., 2006). In a study of breastfeeding practices of Chinese women living in Australia and China, the authors found that those living in Australia had increased

odds of initiating breastfeeding as well as increased odds of breastfeeding to 12 months of age compared to those living in China (Chen et al., 2013).

Breastfeeding rates amongst Aboriginal women vary significantly dependant on geography. Traditionally, Aboriginal infants were exclusively breastfed for at least six months, with prolonged breastfeeding up to four years of age (Gracey, 2000), although increasing acculturation has seen duration more commonly to around two years of age. Increasing urbanisation is generally associated with decreased breastfeeding duration amongst Aboriginal women and remoteness is postulated as a protective factor for breastfeeding. In a study of Aboriginal infant feeding practices in Western Australia, the authors found that infants living in extremely remote areas had more than eight times the odds of breastfeeding for three months or more than their urban counterparts (OR 8.65, 95% CI 4.30-17.50) (Cromie et al., 2012). While a study of 425 Aboriginal women in suburban Perth did not find significant differences in initiation compared with that of non-Aboriginal women (Binns et al., 2004), a longitudinal study of infants born in urban South Western Sydney found that fewer mothers of Aboriginal infants initiated breastfeeding (64.7%) compared with non-Aboriginal infants (75.2%), and no Aboriginal infants were exclusively breastfed at six months of age (Craig et al., 2011). Whilst it is likely that there is some interaction of cultural and ethnic factors in the decision to breastfeed, the findings demonstrate similarities to non-Aboriginal mothers of similar social class, suggesting that the sociodemographic factors are more relevant predictors of breastfeeding rates than Aboriginality alone (Binns et al., 2004).

2.6.2 Health Service-related Factors

For most women in developed countries, the birth of their infant takes place in a hospital. Whilst this setting is unlikely to influence their decision to breastfeed, the environment in which they are encouraged and supported to feed their infant is critical to the success of their breastfeeding journey (Atchan et al., 2013). Health services that actively support early and sustained contact, minimise separation of

mother and infant and ensure the provision of effective and timely professional support for breastfeeding are well placed to assist mothers to meet their breastfeeding goals. The Baby Friendly Hospital Initiative (BFHI) was launched in 1991 as an initiative of the WHO and United Nations Children's Fund (UNICEF) in response to the Innocenti Declaration of 1990 (World Health Organization, 2014). Under the BFHI, hospitals are assessed and accredited as 'Baby Friendly' if they comply with the *'Ten Steps to Successful Breastfeeding'*, a set of guiding principles for health services to provide a supportive breastfeeding environment for mothers and their new infants.

Since its inception, the BFHI and the associated Ten Steps have been successfully introduced into over 15,000 facilities in 134 countries, including 77 accredited hospitals in Australia (Baby Friendly Hospital Initiative Australia, 2011). The distribution of BFHI accredited hospitals is not uniform however, and not all women in regional, rural or remote areas of Australia will have access to an accredited facility.

Factors such as distance from health services, lack of health care options and lack of community breastfeeding support services have been identified as contributing to a lower rate of breastfeeding in rural areas compared with metropolitan areas (Flower et al., 2008; Hector & King, 2005; Stamp & Casanova, 2006). The Australian Commonwealth Government's *Best Start* inquiry into the health benefits of breastfeeding found that women in regional and remote communities in Australia do not have the same level of breastfeeding support available to women in urban areas (House of Representatives Standing Committee on Health and Ageing, 2007).

Rooming-in

Although co-sleeping with infants has been practiced by mothers for millennia, the advent of hospital births in the early part of the 20th century resulted in frequent separation of the mother-infant pair, through the use of nurseries (Vallenas, 1998). Reasons for this separation included the consideration of other mothers in shared rooms, allowing mothers to sleep at night and the provision of a great level of

supervision of infants by staff. This separation reduces interaction between a mother and her infant, and may result in reduced bonding and maternal confidence (Vallenas, 1998). Allowing unrestricted access to each other encourages mothers to recognise their infant's cues for hunger and promotes demand feeding. Rooming-in is one of the 10 Steps to Successful Breastfeeding and encourages health services to maximise opportunities for breastfeeding in the early postpartum period. Recognition of the importance of practices that support breastfeeding establishment has seen rooming-in become commonplace in Australian maternity services and as such it is difficult to demonstrate differences in breastfeeding initiation and duration rates compared with other practices (National Health and Medical Research Council, 2012).

Where it is not routine due to societal or cultural beliefs and practices, studies have found significant positive associations between rooming-in and breastfeeding duration. An analysis of Taiwanese national survey data of the effects of rooming-in on breastfeeding outcomes in 12,455 women found that those who practiced 24-hour rooming-in had almost five times the odds of exclusively breastfeeding at 6 months than those who did not practice rooming in at all (aOR 4.91, 95% CI 4.44–5.43) (Chiou et al., 2014).

Demand Feeding

A healthy term infant needs to be fed approximately 8-12 times over a 24-hour period in the first two weeks of life, but may vary according to their needs and amount of milk consumed at each feed (National Health and Medical Research Council, 2012). In addition to the number of feeds, the length of each feed is highly variable; therefore frequent feeding in the early postpartum period encourages the establishment of adequate breastmilk supply.

The notion of fixed feeding schedules was first seen in the early 20th century, as part of a movement to make infant feeding more scientific (Vallenas, 1998). There was a belief that infants needed a prescribed period of time to allow emptying of the stomach, and that prolonged feeding caused vomiting, diarrhoea and failure to

thrive (Vallenas, 1998). Whilst the science of breastfeeding has demonstrated that these are incorrect theories, it is likely that they continue to be supported in some instances.

Feeding an infant on demand has been established as a significant predictor of breastfeeding duration (Merten et al., 2005), assists in the establishment of milk supply and supports the process of bonding with the infant. As with rooming-in, demand feeding is considered routine practice for Australian maternity services, although evidence suggests that staff understanding and personal views can be discordant with these practices (Walsh et al., 2011).

Supplementary, Complementary and Prelacteal Feeds

The introduction of supplementary, complementary or prelacteal feeds to an infant without medical indication, particularly in the early postpartum period is negatively associated with breastfeeding initiation and duration (National Health and Medical Research Council, 2012). Secondary analysis of a subset of breastfeeding women (n=1,907) from a national longitudinal Infant Feeding Practices study in the US found that mothers who only provided their infant breastmilk in accordance with BFHI principles had approximately half the odds of having ceased breastfeeding before six weeks (aOR 0.47, 95% CI 0.34–0.64) (DiGirolamo et al., 2008). In an analysis of the effect of baby-friendly practices on national breastfeeding prevalence in Switzerland, Merten et al reported that infants who received supplementary formula in hospital had a significantly lower duration of breastfeeding compared with infants who received only breastmilk (16 weeks versus 35 weeks, $p<0.0001$) (Merten et al., 2005).

Whilst the provision of food to an infant who is receiving inadequate nutrients is necessary for ensuring survival, there is no evidence to suggest that this needs to be provided routinely for healthy term infants with no other medical indication. Previous research has found that for infants where supplementation was for medical reasons, there was no significant association between formula use and breastfeeding duration, although supplementation without medical indication was

associated with shorter duration of 'exclusive' and 'any breastfeeding' (Ekstrom et al., 2003).

Use of pacifiers

The use of pacifiers, dummies and other soothers has been recorded over many hundreds and possibly thousands of years (Castilho & Rocha, 2009) and has become a cultural norm in many societies. In a review of international child care practices, the authors reported rates of pacifier usage for infants aged 10-14 weeks ranging from 12% in Japan, to 71% in some Eastern European countries (Nelson et al., 2005). In Australia, pacifier use is widespread, with one study reporting that 79% of infants born to primiparous mothers had used a dummy (Mauch et al., 2012).

While there is some evidence that the use of pacifiers may be protective against Sudden Infant Death Syndrome (SIDS), the mechanism for this effect is unclear. Moreover, the risks for infants in using pacifiers include potential infections from inadequate sterilisation, introduction of bacteria from the use of sweeteners such as honey and also transfer of oral bacteria from mothers to infants, leading to dental caries. Prolonged use of pacifiers has also been associated with recurrent otitis media, oral candidiasis and oral malocclusions. (Jaafar et al., 2012)

The relationship between pacifier use and breastfeeding outcomes has been studied extensively. It has been suggested that pacifiers can increase intervals between feeds and therefore may increase the volume of breastmilk consumed at each feed, however other observational evidence suggests that when an infant uses a pacifier, they tend to suck at the breast less frequently, resulting in reduced milk production, ultimately leading to increased risk of breastfeeding cessation (Scott, Binns, Oddy, et al., 2006). Given the observational evidence to suggest that the use of non-nutritive devices such as pacifiers has a negative effect on breastfeeding outcomes, the World Health Organization's *Ten Steps for Successful Breastfeeding* recommends that devices such as pacifiers and artificial teats are not given to breastfeeding infants (World Health Organization, 2014).

Previous research has found that the negative association between pacifier use and breastfeeding duration was not limited to those who were ambivalent about breastfeeding. A longitudinal study of 556 mothers in Perth found that the use of a pacifier at two weeks was associated with lower odds of breastfeeding to six months, after adjusting for the presence of breastfeeding problems (aOR 0.40; 95%CI 0.25-0.63) (Binns & Scott, 2002). This negative association was also seen in a further longitudinal study of the determinants of breastfeeding duration in Perth, where early pacifier use (within the first four weeks) was associated with an almost 100% increase in risk of ceasing full breastfeeding cessation by six months of age and 'any breastfeeding' by 12 months (Scott, Binns, Oddy, et al., 2006).

The decrease in breastfeeding duration may be a consequence of less frequent feeding, resulting in reduced milk production, but there has been some contention about whether pacifier use is a marker for breastfeeding difficulties or precedes those problems (Scott, Binns, Oddy, et al., 2006). In a systematic review of the evidence on the influence of pacifier use on breastfeeding duration, the authors concluded that;

> "for mothers who are motivated to breastfeed their infants, pacifier use before and after breastfeeding was established did not significantly affect the prevalence or duration of exclusive and partial breastfeeding up to four months of age." (Jaafar et al., 2012, p2).

In a subsequent commentary on the findings of the review, Binns and Lee noted that based on the methodology used in the randomised controlled trials cited, the conclusion was valid where pacifiers were introduced after 14 days but the evidence did not support the conclusion "started from birth". They reiterated that clinicians should advise mothers that pacifiers should only be introduced when breastfeeding was well established. (Binns & Lee, 2012).

Professional Breastfeeding Support

Along with a mother's social supports, there is strong evidence to suggest that appropriate, timely and consistent advice from health professionals is positively associated with breastfeeding outcomes (Renfrew et al., 2012). This is particularly

important for women in rural areas with limited support from family and friends, which, if not supplemented by professional support, may contribute to a double disadvantage for rural communities (House of Representatives Standing Committee on Health and Ageing, 2007).

Breastfeeding advice and support in the antenatal period, through education sessions or antenatal visits (Lumbiganon et al., 2012) and structured postnatal breastfeeding support is associated with increased breastfeeding duration (Beake et al., 2012). Whilst women find professional supports important to help them achieve their breastfeeding goals, one study found that access to these supports was low (Kervin et al., 2010).

In addition to providing appropriate and evidence-based information about breastfeeding, satisfaction with advice and support provided by health professionals is significantly positively associated with breastfeeding outcomes (Hauck et al., 2011). A review of women's experiences with breastfeeding support found inconsistent and conflicting advice provided by busy staff in a standardised and directive way contributed to feeling of stress and confusion. The authors recommended that health services ensure nurses and midwives developed effective information giving and communication skills more fully; and that a learner-centred approach to breastfeeding education was adopted (Joanna Briggs Institute, 2012).

There is evidence that even a neutral or ambivalent attitude to breastfeeding from health professionals can negatively influence breastfeeding duration. A study of 1620 women in the United States found that a perceived neutral attitude towards breastfeeding by hospital staff was related to cessation of breastfeeding before six weeks of age, particularly in those women who only intended to breastfeed for a short period of time (DiGirolamo et al., 2003).

2.6.3 Psychosocial

Breastfeeding knowledge

Breastfeeding knowledge assists mothers to make informed decisions about breastfeeding, but also ensures that she is well equipped to manage breastfeeding difficulties (O'Brien et al., 2009b; Susin et al., 1999). Having information about the physiology of breastmilk production, the process of attachment and milk let-down, and the changing requirements of an infant over time gives breastfeeding mothers confidence in responding to her infant's cues for feeding and assurance that her infant's needs are being met (Pugin et al., 1996). A Cochrane review of the effectiveness of antenatal education in increasing breastfeeding duration reviewed data from 16 randomised controlled studies involving 8262 women, mostly from developed countries including the USA, Canada, UK and Australia (Lumbiganon et al., 2012). The authors concluded that although there was insufficient evidence to recommend a particular form of antenatal education, it appeared that peer counseling, lactation consultation and formal breastfeeding education during pregnancy increased breastfeeding duration (Lumbiganon et al., 2012).

Sources of breastfeeding information

It is difficult to separate the influence of breastfeeding knowledge from the sources of information from which that knowledge is derived. Whilst it is well accepted that provision of information does not directly result in increased knowledge, there is evidence that giving women information about breastfeeding is an important part of supporting positive breastfeeding outcomes (Chezem et al., 2003; Gage et al., 2012; Newby et al., 2014; Susin et al., 1999; Zimmerman, 1999).

The format in which breastfeeding information is delivered appears to have a significant impact on breastfeeding outcomes. Meta-analyses have demonstrated that information delivered in person from health professionals such as midwives or medical professionals is associated with increased breastfeeding initiation and duration (Dyson et al., 2005; Lumbiganon et al., 2012).

The use of the Internet to provide breastfeeding information is a relatively novel approach and as technologies become more sophisticated, the potential to influence breastfeeding outcomes increases. Women are now more than ever looking to online sources of information about infant health, including infant feeding (Lagan et al., 2010, 2011; Newby et al., 2015). The rise in popularity of personal devices such as smart phones and tablets means that breastfeeding information is increasingly more accessible (Taki et al., 2015). Smart phone applications that create personalised messages and advice, or allow virtual connections with a lactation professional, could potentially increase access to breastfeeding information and support regardless of physical location or time of day.

As the online breastfeeding information landscape changes rapidly, there is a risk that women will seek advice or support from sources that promote artificial feeding in the guise of breastfeeding support. This can be in the form of direct advertising of products or through "educational" websites sponsored or hosted by formula manufacturers or related products. A review of the social media presence of a range of infant formula manufacturers and distributers in the United States found that these companies had engaged a variety of platforms to interact with consumers (Abrahams, 2012). Interactive websites, mobile apps and financial relationships with parenting blogs as well as Facebook, Twitter and YouTube were all used to promote infant formula brands, with resultant violations of the World Health Organization's International Code of Marketing of Breast-milk Substitutes (Abrahams, 2012). The review acknowledged the unanticipated challenges that the era of social media presented to the ongoing enforcement of the Code and noted the importance of providing objective advice about the use of social media for educational purposes (Abrahams, 2012).

Whilst the advertising of formula suitable for infants under the age of 12 months has been banned in Australia since 1992, formula manufacturers can continue to promote "toddler milks", which are almost without exception sold in packaging identical to infant formula, without restriction (Berry et al., 2010). Studies have

shown that women are unable to distinguish between advertising for formula and toddler milks, believing that they are collectively formula (Berry et al., 2010). Given that evidence consistently identifies relationships between exposure to formula advertising and decreased rates of breastfeeding initiation and duration, the need to protect breastfeeding from these messages is critical (Berry et al., 2010).

Static or non-interactive formats of breastfeeding information appear to be less effective in supporting breastfeeding outcomes. Evidence from a systematic review and met-analysis of primary care-based breastfeeding support interventions suggests that the provision of written breastfeeding information (such as pamphlets and booklets) alone does not appear to improve breastfeeding initiation or duration (Guise et al., 2003). Furthermore, evidence for the use of video as an educational tool in supporting breastfeeding is not conclusive. A randomised controlled trial of a breastfeeding intervention with 450 women in Singapore found the use of a short 16 minute breastfeeding education video in the antenatal period significantly increased the rate of exclusive breastfeeding at both six weeks and six months compared with routine antenatal care (Su et al., 2007). However, this finding was not supported by the results of a randomised trial where 522 low-income women attending a prenatal clinic viewed an educational video on either breastfeeding or prenatal nutrition and exercise. The authors found that exposure to the breastfeeding video did not affect breastfeeding initiation or early post-partum breastfeeding practice, suggesting that the use of video alone in the prenatal clinic was not an effective strategy (Kellams et al., 2016). The authors concluded that reliance on a single resource is insufficient to influence breastfeeding outcomes for this target group and a multifaceted approach to improving breastfeeding outcomes might be required.

Infant feeding attitudes

Positive attitudes towards breastfeeding are significant positive influences on both breastfeeding initiation and duration (Bertino et al., 2012; Dungy et al., 2008; Inoue et al., 2013; Rosen et al., 2008; Scott, Binns, Oddy, et al., 2006; Susin et al., 1999). Mothers' attitudes towards breastfeeding as the choice of infant feeding method

have been shown to influence the likelihood of her initiating and continuing to breastfeed, more so than sociodemographic factors such as age and education (Scott et al., 2004).

Mothers who are predisposed towards breastfeeding are consistently found to have greater duration of breastfeeding regardless of intensity (Bertino et al., 2012; Yen-Ju & McGrath, 2011). Closely linked to self-efficacy, a woman's conviction that breastfeeding is the best choice for feeding her infant is a powerful influence on her decision. Those mothers who believe that breastfeeding is more convenient, healthier and cheaper are less likely to introduce formula to their infant than those who find breastfeeding to be embarrassing, restrictive or uncomfortable (Dennis, 2002). Additionally, making informed decisions about feeding methods requires knowledge about the benefits of breastfeeding as well as the risks of formula feeding (Chezem et al., 2003).

Measurement of maternal infant feeding attitudes has been the subject of extensive research and validated tools have been developed to quantify the effect on breastfeeding practice. The use of the Iowa Infant Feeding Attitudes Scale (IIFAS) (De la Mora & Russell, 1999) is one tool that has been reliably replicated in a number of settings to determine the strength of infant feeding attitude (Dungy et al., 2008; Flower et al., 2008; Scott et al., 2004; Shaker et al., 2004; Wilkins et al., 2012). Research has demonstrated that not only does the IIFAS predict maternal infant feeding attitude (Dungy et al., 2008; Inoue et al., 2013; Sittlington et al., 2007; Wilkins et al., 2012), but is also an accurate measure of paternal attitudes (Mitchell-Box et al., 2013; Scott et al., 2004; Tohotoa et al., 2009).

Support of significant others – mother/partner/peers

Fathers' feelings about infant feeding have been the subject of research with evidence demonstrating that positive attitudes about breastfeeding are significantly associated with breastfeeding initiation and duration (Arora et al., 2000; Avery & Magnus, 2011; Chezem, 2012; Duong et al., 2005; Giugliani et al., 1994; Maycock et al., 2013; Mitchell-Box & Braun, 2013; Scott et al., 1997).

There is little doubt that support from an infant's father increases the likelihood of an infant being breastfed, but there is limited evidence about the nature of support that is required. In an exploratory study of parent's perception of effective breastfeeding support, the authors concluded that emotional, practical and physical supports provided by fathers is important to promote successful breastfeeding (Tohotoa et al., 2009). Antenatal education sessions were subsequently developed to explicitly assist fathers to gain essential breastfeeding knowledge, identify practical ways to support breastfeeding and promote the need for positive attitudes towards breastfeeding. The authors found that infants whose father had attended the antenatal education session had greater odds of being breastfed to six weeks (aOR 1.56, 95% CI 1.06-2.30), although the odds were greater for older fathers and those in higher socioeconomic groups (Maycock et al., 2013).

Grandmothers are a strong source of support for mothers, and a grandmother's own infant-feeding experiences can be highly influential. Grandmothers who have themselves breastfed impart both practical breastfeeding knowledge and an affirmation that breastfeeding is the normal way to feed an infant (Grassley & Eschiti, 2008). The literature shows that grandmothers who are supportive of breastfeeding increase the likelihood of a mother initiating breastfeeding and decrease the risk of early cessation.

Yet another sphere of support for new mothers is social or peer support. As distinct from peer counselling, social support may be in the form of mothers groups, or may be informal perceived support from friends or other community members. Studies in urban settings have shown that women who feel supported in their decision to breastfeed are more likely to initiate and continue to breastfeed their infant. In a study determining the effectiveness of an early-childhood obesity prevention intervention in first-time parent groups in Melbourne, Australia, breastfeeding practice was measured among mothers attending parent groups from six weeks to six months of age. The results showed that mothers who attended groups where a higher proportion of infants had ceased to be breastfed had greater odds of also

ceasing breastfeeding before six months, independent of other sociodemographic confounders (aOR 2.1, 95% CI 1.3–3.3) (Cameron et al., 2010). This finding suggests that positive modelling of behaviour and social support in addition to a shared social normative behaviour may influence breastfeeding duration.

Community acceptability of breastfeeding is another critical factor in a woman's decision to breastfeed. In an analysis of community perceptions of breastfeeding from 1995-2009 in Western Australia, the authors reported that although attitudes to breastfeeding has improved significantly, 20% of the population still believed it was unacceptable to breastfeeding in public, or was only acceptable if done discretely (Meng et al., 2013). The authors noted that women aged over 44 years, people born outside of Australia and those with lower levels of education were the most likely to hold the view that breastfeeding in public was unacceptable. More recently, a survey of public opinion about public breastfeeding amongst New York City residents found that more than half (50.4%) believed that women should not breastfeed in public, with the lowest levels of support from older residents (65 years or older), those with Asian cultural backgrounds and those with lower levels of education (Mulready-Ward & Hackett, 2014).

Return to employment

Return to paid employment is often cited in the literature as a significant influence in both breastfeeding initiation and duration. In their review of factors influencing breastfeeding practice, Scott and Binns postulated that inconsistent findings could be due to methodological differences in the way that the two factors have been studied (Scott & Binns, 1999). Studies that have examined the intention to return to work have generally found that planned resumption of employment did not significantly influence breastfeeding initiation, whereas studies which investigated the effect of returning to the workforce found that this was significantly associated with decreased duration of breastfeeding.

The point at which mothers return to work following the birth of their child significantly affects the duration of breastfeeding. Additionally, full-time

employment in the first year appears to be a strong negative influence on breastfeeding duration (Cooklin et al., 2008). A secondary analysis of data from the Longitudinal Study of Australian Children (LSAC) (n=3,697) found that women employed full-time in the first six months had lower odds of breastfeeding to six months compared to mothers who were not employed (aOR = 0.35, 95% CI 0.22-0.55), and part-time employment (<30 hours per week) was also negatively associated with breastfeeding duration (aOR = 0.49, 95% CI 0.37-0.64) (Cooklin et al., 2008). The authors noted that this finding contradicted other studies where women in part-time employment had similar breastfeeding duration to that of non-employed mothers, and postulated that it may reflect the absence of workplace breastfeeding supports in Australia, as well as the demands of employment and maintaining breastfeeding. The finding does however suggest women returning to work in any capacity may be at risk of ceasing breastfeeding prematurely.

Provision of paid maternity or parental leave, either employer-initiated or nationally legislated, is a potentially protective factor against premature breastfeeding cessation as it allows women to take time from the paid workforce to care for her infant. Paid maternity leave is likely to be most effective for women where return to work is necessary to generate income (Cooklin et al., 2012). A prospective cohort study of 129 women who were employed in pregnancy in Victoria, Australia found that women who had returned to work by 10 months postpartum had lower odds of breastfeeding (aOR = 0.3, 95% CI 0.1-0.7), although the authors acknowledged that a proportion of women would have ceased breastfeeding regardless of return to work. The finding did however strengthen the evidence that employment negatively impacts on breastfeeding duration and requires focus to ensure employers are equipped to support breastfeeding mothers.

Breastfeeding decisions – intention and timing

A positive association between intention to breastfeed and breastfeeding initiation has been reported in the literature, although caution should be exercised in assessing the evidence. An examination of statistical models used to predict breastfeeding contends that including “intention to breastfeed” as an independent

variable in predicting breastfeeding initiation is spurious, as it is unlikely that breastfeeding would occur in the absence of intention (Peat et al., 2004). Whilst breastfeeding intention *per se* may not be methodologically robust in predicting initiation, there is evidence to suggest that both the timing of the breastfeeding decision and intended breastfeeding duration are accurate predictors of both breastfeeding initiation and duration.

The point at which women decide how they are to feed their infant is strongly associated with breastfeeding outcomes. An estimated 30-50% of women decide how they will feed their infant before conception (Wagner et al., 2006) and research has found that women who decide their feeding method before they are pregnant are more likely to initiate breastfeeding than those who choose their feeding method during pregnancy or after the birth of the baby (Scott et al., 1997; Scott, Binns, Graham, et al., 2006). Furthermore, women who decide to breastfeed before the birth of their baby have longer duration of breastfeeding (Donath et al., 2003; Lawson & Tulloch, 1995).

The association between intended and actual duration of breastfeeding has been examined in a number of studies, illustrating a strong correlation between intended and actual practice (Bai et al., 2010; Chezem et al., 2003; Donath et al., 2003). Donath et al studied the relationship between prenatal infant feeding intentions and breastfeeding duration in 10,548 women in Avon, UK. The results showed that women who intended to breastfeed for at least five months had a mean breastfeeding duration of 4.4 months (95% CI 4.3-4.4), compared with 2.5 months (95% CI 2.4-2.6) for women who intended to only breastfeed for one month (Donath et al., 2003).

Breastfeeding self-efficacy

Self-efficacy, as a construct of social learning theory, describes the cognitive process of an individual's perceived ability to regulate his or her own motivation, emotions and social environment in the performance of a particular behaviour (Dennis, 1999), and has been consistently shown to be predictive of health behaviours. Self-

efficacy has been described as pivotal in the performance of behaviours as it reflects an individual's perceived ability rather than their actual skill. Furthermore, as perceptions relate to the performance of particular tasks in specific settings, self-efficacy is highly variable and situation-dependant (Dennis, 1999).

Confidence in her own breastfeeding ability is a key tenet in the success of a woman's breastfeeding journey. The increased confidence and self-efficacy that women may develop after successfully breastfeeding may contribute to longer breastfeeding duration, however women who have less positive experiences with breastfeeding may choose not to initiate breastfeeding for subsequent children. Measuring self-efficacy has therefore been examined as a strategy to identify women who may be at risk of not breastfeeding, or at risk of early cessation of breastfeeding. (Baghurst et al., 2007; Dennis, 2006; Hauck et al., 2007).

2.6.4 Biomedical

Parity

Studies examining the influence of parity on breastfeeding initiation and duration have been equivocal in their findings. There is evidence to suggest that primiparous women are more likely to initiate breastfeeding, and other research contends that multiparous women are more likely to continue to breastfeed for longer. The reasons for this disparity are complex, but may be partly explained by distinct roles that parity plays in breastfeeding success. In addition to the contribution of previous breastfeeding experience and resultant confidence in the skill of breastfeeding, it has been observed that breastmilk volume rises faster in the first week after birth for multiparous women as compared to primiparous women (Hilson et al., 2004).

Infant health problems (including admission to Special Care Nursery)

Infants who have health problems diagnosed at birth or develop complications as a result of birth are less likely to be breastfed. The reason for this may be two-fold; firstly poor infant health may imply problems which preclude optimal establishment

of breastfeeding and secondly; any resultant separation of mother and infant reduces access and therefore opportunities for breastfeeding (Scott & Binns, 1999).

Whilst the evidence is clear that infants born of low birthweight (LBW) are at higher risk of poor health outcomes than those of normal birthweight, breastfeeding initiation rates are lower for this cohort of infants (Pinelli et al., 2001). Low birth weight has been associated with poorer breastfeeding outcomes, however the evidence suggests that weight *per se* may be less significant than the issues resulting in that weight (for example intrauterine growth retardation, congenital abnormality or prematurity). A systematic review of interventions to improve breastfeeding outcomes within neonatal units noted that responses to feeding interventions would differ between infants dependent on these factors, therefore need to be accounted for in multivariate analysis (McInnes & Chambers, 2008).

In addition to health problems that may impact on breastfeeding for a variety of reasons, admission to a Neonatal Intensive Care Unit (NICU) compounds the risk for infants at a time when breastmilk is most important. The physical, emotional and logistical challenges related to breastfeeding in high-care environments are barriers to achieving optimal breastfeeding practice in this vulnerable group (Benoit & Semenic, 2014). Conditions diagnosed at birth that necessitate admission to a high-care nursery results in physical separation of mothers and infants, reducing opportunities for early breastfeeding initiation. Whilst mothers are encouraged to provide expressed breastmilk (EBM) for their infant, significant support is required to maintain breastmilk supply during a time of increased stress. Additionally, the lack of privacy, inconsistent breastfeeding support and inflexible facility routines in high-care environments such as NICUs present barriers to maintaining breastfeeding for these infants (Benoit & Semenic, 2014).

Breastfeeding difficulties (including attachment and supply)

Difficulty with breastfeeding in the early post-partum period has been found to negatively impact on breastfeeding success (Dennis, 2002; Meedya et al., 2010; Scott, Binns, Oddy, et al., 2006; Thulier & Mercer, 2009). Breastfeeding difficulties in

this early period are common, with some studies finding approximately one third of women reporting at least one problem (DiGirolamo et al., 2005; Scott, Binns, Oddy, et al., 2006). Despite breastfeeding being perceived as a natural and instinctive skill, many women are surprised to experience pain or difficulty in establishing breastfeeding (Thulier & Mercer, 2009), although it has been suggested that women who experience breastfeeding problems in the early postpartum period but continue to breastfeed develop higher levels of self-efficacy and may be at a reduced risk of early breastfeeding cessation (Scott, Binns, Oddy, et al., 2006).

Concern about not producing enough milk to feed their infant is the most frequently cited reason provided for introducing formula or solids to an infant (Dennis, 2002; Meedya et al., 2010; Thulier & Mercer, 2009). While many women believe that they do not produce enough breastmilk to feed their infant, the true rate of breastmilk insufficiency is believed to be about 5% of lactating women (Thulier & Mercer, 2009). Concerns about milk supply are closely linked to women's breastfeeding self-efficacy and it is postulated that women who believe in their ability to breastfeed are confident in their bodies ability to produce sufficient breastmilk (Meedya et al., 2010). In addition, physical difficulties such as attachment problems, sleeplessness and fatigue have also been cited as reasons for cessation of breastfeeding (Thulier & Mercer, 2009).

Delivery Method

The intrapartum experience has been investigated in terms of its role in breastfeeding outcome, and an association between caesarean delivery and breastfeeding success has been examined in the literature. A systematic review of breastfeeding outcomes after caesarean delivery (CD) compared with vaginal delivery (VD) found that breastfeeding initiation and breastfeeding at discharge were lower for CD, although amongst women who had initiated breastfeeding, there were no significant differences in breastfeeding at six months attributable to delivery method (Prior et al., 2012). Delay in putting the infant to the breast or physical difficulties in attempting to feed the infant have been postulated as reasons for poor breastfeeding outcomes in this group. Other research has noted

that the association is restricted to breastfeeding initiation, but not to duration once breastfeeding has commenced (Dennis, 2003). Caesarean delivery has been associated with delayed onset of lactation (Lind et al., 2014; Scott et al., 2007). Caesarean delivery of an infant involves the use of pain medications, which are highly lipid soluble, crossing the placenta and rapidly diffusing into the foetus, leading to suboptimal breastfeeding behaviours including diminished early sucking (Lind et al., 2014). In addition to the direct effects of medications, the postoperative care routines required after caesarean delivery may necessitate separation of the mother and infant, reducing the opportunity to establish skin-to-skin contact and frequent nursing moments. Infants who are born prematurely or with health problems that require transfer to a neonatal intensive care unit are at greater risk of not being breastfed due to their physical separation from their mother and the emotional distress (Dewey et al., 2003).

Assisted vaginal delivery (also referred to as instrumental or operative vaginal delivery) involves the use of instruments such as forceps or vacuum to assist movement of the infant through the birth canal (O'Mahony et al., 2010). The association between assisted delivery and breastfeeding outcomes has been examined in the literature; however there is some difficulty in comparing results of studies due to the differences in grouping of the experiences. It has been argued that assisted delivery, as a function of change in the anticipated delivery method, may have a negative effect on breastfeeding initiation. There is however some evidence to suggest that breastfeeding initiation rates are higher amongst women who experience assisted delivery and that breastfeeding may be seen as "…a coping strategy that serves to normalize an abnormal experience and allows the individual to once again assume control." (Watt et al., 2012).

Alcohol

The use of substances such as tobacco and alcohol has been shown to have a negative impact on breastfeeding initiation and duration. Breastmilk production is a complex interplay of hormonal controls, with the delivery of the placenta triggering the release of neuroendocrine responses, particularly prolactin and

oxytocin. Alcohol consumption exerts a physiological effect on lactation, suppressing the action of oxytocin on initiating the let-down reflex and delaying breastmilk let down. A systematic review of the effect of alcohol on lactation identified that alcohol consumption at relatively low concentrations (0.3g/kg body weight or 1.5 standard Australian drinks) negatively impacts on lactational performance through delayed let-down and decreased breastmilk yield (Giglia, 2010). These findings are contrary to popular belief that alcohol consumption promotes lactation, including breastmilk volume, assists infants to sleep and relaxes the breastfeeding mother (Giglia, 2010).

There is limited evidence in the literature regarding the relationship between alcohol consumption and breastfeeding duration. In a study of 587 women in Perth, Australia, results showed that women who drank alcohol during pregnancy were significantly more likely to drink during lactation. Furthermore, after adjustment for potential confounders, women who consumed three or more standard alcoholic drinks per day were almost twice as likely to discontinue breastfeeding (HR 1.9, 95% CI 1.1, 3.0) than women who drank at low-risk levels (<2 standard drinks) (Giglia et al., 2008). The authors postulated that the relationship between alcohol consumption and breastfeeding duration could be possibly explained by introduction of formula as a result of reduced breastmilk yield, disturbed infant sleep patterns or minimisation of the risk of transmitting alcohol through breastmilk to the infant. They also noted that women who intended to breastfeed for at least 6 months consumed alcohol at lower levels during lactation, suggesting that they may have a greater level of general health awareness (Giglia et al., 2008).

Smoking

Smoking is a health issue for women and children and the effect of smoking on reproductive health outcomes is significant. Smoking is associated with increased rates of premature delivery and stillbirth and infants born to smoking mothers are more likely to be of low birth weight (Amir & Donath, 2002).

It has been established that women who smoke are less likely to intend to breastfeed, less likely to initiate breastfeeding and breastfeed for a shorter duration than women who do not smoke (Amir & Donath, 2002). Whilst smoking has been associated with poorer breastfeeding outcomes, there is some conjecture as to whether this is a physiological or psychosocial mechanism. Nicotine, the active component of tobacco, has been shown to exert a negative effect on breastmilk supply by suppressing prolactin levels, and breastfed infants of smoking mothers have urinary nicotine metabolites in much greater concentrations than formula fed infants of smoking mothers (Amir & Donath, 2002). In their review of the epidemiological evidence for the physiological effects of smoking on breastfeeding practice, Amir and Donath concluded that although there was a consistent association across study designs and settings, the variation in breastfeeding rates amongst smoking women indicated that other psychosocial factors are likely to be influential (Amir & Donath, 2002).

Maternal Obesity

The growing problem of obesity in both developed and developing nations has a significant impact on a number of health outcomes, including pregnancy. Obesity during pregnancy has become a common obstetric risk factor, with reported prevalence of between 18-38% in the US (Chu et al., 2008; Galtier-Dereure et al., 2000) and 34-43% in Australia (Callaway et al., 2006; McIntyre et al., 2012). Adverse maternal and neonatal outcomes as a result of overweight confer increased costs and appear to be associated with lower socioeconomic status (Donath & Amir, 2008).

A systematic review of maternal obesity and breastfeeding intention, initiation and duration found that overweight or obese women plan to breastfeed for a shorter period, are significantly less likely to initiate breastfeeding and breastfeed for a shorter duration (Amir & Donath, 2007). Poor lactation outcomes associated with maternal obesity, notably the failure to establish breastfeeding and early breastfeeding cessation, have been noted in both experimental animal studies as well as epidemiological research (Hilson et al., 2004). The mechanism for poor

outcomes is not clear, although delayed lactogenesis as a result of either delays in the fall of progesterone levels or difficulties in achieving effective attachment to stimulate milk production has been postulated (Hilson et al., 2004). Additionally, rates of surgical delivery are higher amongst obese women, conferring greater obstetric risk.

2.7 The Evidence for Rural Areas of Developed Countries

Whilst there is a large and growing body of evidence examining determinants of breastfeeding behaviours in general, it appears that the rationale for conducting research examining breastfeeding behaviours in rural areas is primarily based on the premise that rural communities have a higher prevalence of a number of the risk factors previously identified as influencing breastfeeding behaviour. For example, higher proportions of rural women experience lower educational attainment and poorer socioeconomic status than their non-rural counterparts (National Rural Health Alliance Inc., 2012b). Furthermore, women in rural areas are more likely to be overweight and smoke during pregnancy (Joyce & Hutchinson, 2012).

It is difficult to quantify the influences on breastfeeding behaviour for rural women because little evidence exists. Australian data from national surveys points towards differences in breastfeeding initiation and duration rates across classifications of remoteness, however the evidence is not consistent and there are a number of limitations. Firstly, the bulk of the data collected is cross-sectional and therefore does not allow determination of causation. Secondly, the sampling frame necessitates recall of breastfeeding behaviours that may be adversely affected by factors of social desirability, as well as ambiguity in the definition of breastfeeding exclusivity.

Evidence from other developed countries has employed a variety of classification methods for rurality as well as variation in definitions for breastfeeding practice. Much of the evidence from the United States is based on samples drawn from

assistance programs such as WIC, contributing a level of bias due to the provision of free infant formula for eligible participants. Variation in breastfeeding definitions, particularly for exclusive breastfeeding, further complicates the comparison of data of studies within and between rural settings across countries. Finally, the cross-sectional and retrospective nature of the published evidence limits the determination of causation from these studies.

The limited data on breastfeeding practices for women living in rural areas of developed countries may indicate that there are few differences in the determinants of breastfeeding between rural and urban areas, based on socioeconomic markers. It may also be a function of the logistics of conducting large-scale methodologically robust studies in rural areas from which conclusions may be drawn. To this end, the following review of the literature seeks to determine the extent and quality of evidence for factors influencing breastfeeding practice in rural areas of developed countries and to determine if these influences differ significantly from those reported in urban areas.

2.8 Review Methodology

2.8.1 Definition of Terms

There is no established convention for the term "developed country" under the United Nations system of economic grouping (United Nations (Statistics Division), 2013). For the purposes of this review, the term 'developed' describes countries that have a high degree of industrialisation, a high gross domestic product (GDP), high levels of personal income, well-developed infrastructure and high standards of living. Countries such as Australia, New Zealand, the United States of America (USA), Canada, Japan, Germany, France, Italy, Spain, and the United Kingdom (UK) are often cited as examples of developed countries.

The terms "rural" and "regional", although widely used, are ill-defined in the literature. Numerous classification methods are employed in research, and vary

across countries. Furthermore, much of the literature relies on the assignation of a rural classification by the researcher, rather than using any standardised or validated classification system. For this reason, all classifications of rurality within developed countries were considered in this review to enable wider inclusion of results.

2.8.2 Variations in methodology / definitions

Despite a plethora of literature describing breastfeeding behaviours, comparison of studies remains problematic due to a lack of consistency in the definition of breastfeeding practice and methodological weaknesses in study design. This is particularly true of exclusive breastfeeding, defined by the WHO as referring to an infant who receives breastmilk (including colostrum, expressed breastmilk or breastmilk from a wet nurse), and may include drops or syrups such as vitamins, minerals and medicines, but no other fluids (World Health Organization, 1991). While determination of overall breastfeeding behaviour may be less problematic, variation in the way that information about exclusive breastfeeding is collected may create bias in the data. Maternal recall of breastfeeding practice has been shown to be a reliable and valid estimate for overall breastfeeding duration, however recall of exclusive breastfeeding duration is less accurate (Li et al., 2005). Furthermore, in their review of breastfeeding studies in Australia, Binns et al found that only half of the studies that claimed to measure exclusive breastfeeding used a definition consistent with the WHO. The authors noted that this anomaly potentially overestimated the prevalence of exclusive breastfeeding and recommended that 24-hour recall methodology should not be used to measure exclusive breastfeeding (Binns et al., 2009). The methodological limitations related to definition and recall of practice both contribute to the challenges in comparison of the limited data in rural settings.

2.8.3 Differentiating between breastfeeding initiation and duration

Previous reviews of breastfeeding practice in other settings have identified that predictors of breastfeeding initiation are not necessarily those of breastfeeding

duration although some influences are consistent across both (Scott & Binns, 1999). This review therefore has considered the evidence on both breastfeeding initiation and duration as discrete influences in rural areas.

2.9 Search Strategy

A literature review was conducted using the electronic databases Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline, Web of Knowledge and ProQuest for full-text English language publications between 1995 and 2014. These databases were chosen to ensure maximum coverage of all likely repositories for breastfeeding research across multiple discipline areas, and aimed to capture research in less prominent journals. The search timeframe was limited to the period 1995-2014 to reflect research examining contemporary infant feeding practices globally promoted through the Baby Friendly Hospital Initiative (BFHI) and current recommendations for the optimal duration of exclusive breastfeeding.

The search terms used were 'breastfeeding', 'breast feeding', 'rural', 'initiation' and 'duration'. Observational studies including retrospective and prospective cohort studies, randomised controlled trials and other intervention studies were considered within search parameters. In order to ensure that relevant articles were not inadvertently eliminated from the search due to restrictive search criteria, records were manually screened using titles and abstracts, and those not meeting the search criteria were excluded from the search results. Retrieved articles were then cross-referenced to provide additional related articles not captured in the database searches.

2.9.1 Exclusions

Studies where the research was conducted in developing countries, or did not examine breastfeeding initiation or duration as the primary outcome were excluded from the review. Studies that reported prevalence data without analysis by rurality or determinant were also excluded, as were case report or review studies and

opinion pieces. Unpublished research, abstracts and conference presentations were not considered in this review.

2.9.2 Strength and quality of evidence

The strength of the studies presented in this review was determined using the National Health and Medical Research council (NHMRC) evidence levels (National Health and Medical Research Council, 2000). Although this classification was developed primarily for use in assessing clinical evidence, the system has been used to quantify the quality of evidence for public health issues, including infant feeding (Giglia, 2010; National Health and Medical Research Council, 2012). Adjunct information from sources such as expert consensus statements has been previously incorporated into reviews of breastfeeding practice and has been given a rating of Level V. The levels used are described below in Figure 2.1:

Figure 2.1: Strength of Study Evidence

	NHMRC level of evidence
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III-1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test/post-test
V	Evidence provided by expert consensus statements, experimental animal and cell studies

Studies chosen for full-text review were assessed against the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement

(Vandenbroucke et al., 2007). Quality assessment was made using the Quality Checklist from Academy of Nutrition and Dietetics Evidence Analysis Manual (Academy of Nutrition and Dietetics, 2012). The quality of studies was rated as positive (+), neutral (ø) or negative (-).

2.10 Search Results

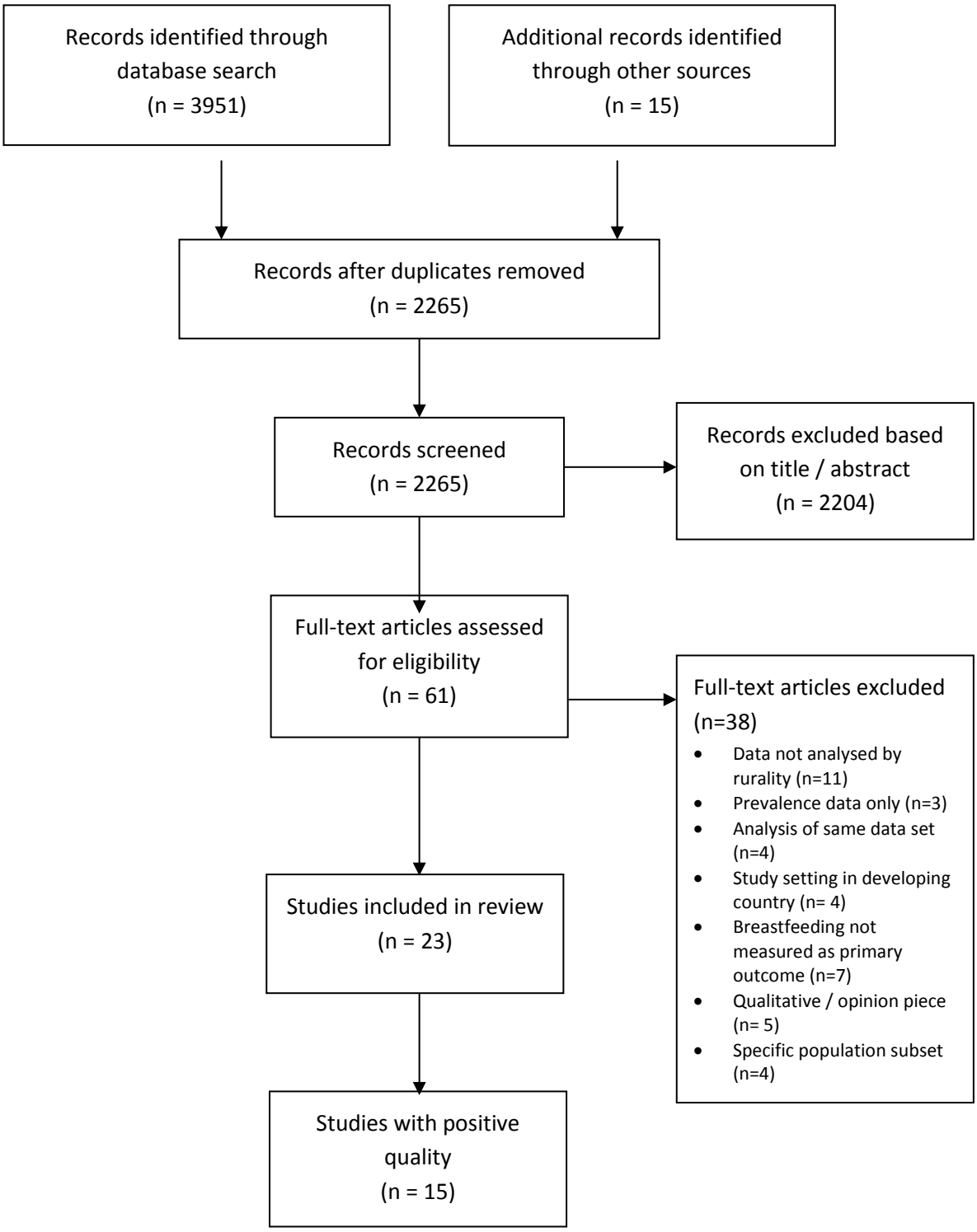
The results of the search are presented in Figure 2.2. Of the 3951 references returned from the database searches, 1701 were duplicates, and were therefore removed. The remaining 2265 references were scanned for relevance using the title and abstract and those not meeting the inclusion criteria were removed. The remaining 61 references were retrieved and assessed and upon review a further 38 were found not to meet the inclusion criteria and were discarded. A total of 23 references were retained for critical appraisal and were assessed for this review. The study details for each reference are provided in Table 2.1.

Of the studies selected for review, 16 were conducted in rural USA, five in rural Australia, one in rural Scotland and one study drew participants from both rural Australia and Sweden. Rurality was reported as geographic by the researchers in the majority of studies however few provided a definition for rurality. Where a definition was given (n=4), a variety of validated geographical classification systems were used. All of the studies considered reported data analysed by rurality, although not all variables of interest were reported in every study.

Of the 23 studies considered, 18 were conducted in or analysed data from an exclusively rural population, while the remaining five compared rural and urban cohorts. Six studies reported on breastfeeding initiation only and 10 reported on duration only. The remaining seven studies examined determinants of both initiation and duration of breastfeeding. Three studies examined exclusive breastfeeding, however the definitions vaired between studies and only one study used the WHO definition of exclusive breastfeeding.

Overall, the strength of the evidence was moderate, with 11 studies being prospective cohort studies (n=7), comparative intervention studies (n=3) or pseudo-controlled randomised trials (n=1) (an acceptable level of evidence for aetiological studies). The remainder of the studies were cross-sectional (n=6), secondary analyses of existing data sets (n=3), retrospective cohort studies (n=1) or cohort studies using convenience samples (n=2). Of the 11 studies rated as having moderate strength of evidence, eight had positive study quality. Of the six cross-section studies, three had positive study quality and two were assessed as neutral. Two of the secondary analysis studies were also assessed as having positive study quality and one as neutral. A summary of the findings for studies rated as either positive or neutral is provided in Table 2.2. These studies form the basis of the review of evidence as presented in the remainder of this chapter. Four studies were found to have negative study quality, primarily due to insufficient sample size and non-representative samples and therefore were not incorporated in the review.

Figure 2.2: Review process for literature search



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009).
*P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement.
PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

Table 2.1: Studies selected for review

Reference	Setting	Study Characteristics	Outcome variable	NHMRC Evidence level	Quality score

Elliott-Rudder (Elliott-Rudder et al., 2014)	Australia	• Clustered randomised controlled trial of motivational interviewing (MI) intervention in rural NSW (n=330)
		  ○ Intervention (n=154)
		  ○ Control (n=176)
		• Conducted in general practice settings in two regional centres (population 60,000-80,000, >250km from major city by road)
		• Recruitment at 24-36 weeks gestation
		• Eligibility criteria: receiving postnatal care from participating general practice and continued breastfeeding to at least 8 weeks
		• Intervention: structured conversation to support continuation of BF, conducted at immunisation visit (2,4 or 6 months)
		• EBF definition permitted medicines, but no breastmilk substitute
		• Full / predominant BF permitted partial substitution with water based fluids
		• BF rates measured at 4 and 6 months
		• Duration measured in weeks
			Duration of exclusive and full/predominant BF to 6 months	III-1	+

Sjöström et al(Sjostrom et al., 2013)	Australia, Sweden	• Prospective cohort study rural women from Sweden and Australia (n=391) • Sweden (n=300) – regional municipality of mid-northern Sweden (population 55,284) • Australia (n= 91) – regional city in north-eastern Victoria (population 27,110) • Self-report questionnaire • antenatal data collected at 17-20 weeks gestation • follow up at 2 months after birth • breastfeeding duration was dichotomised at 2 months as yes/no	ABF at 2 months	III-2	+
Lynch, Bethel et al(Lynch et al., 2012)	USA	• Secondary analysis of data from North Carolina Pregnancy Nutrition Surveillance System (PNSS) 2003-2007 (n=240,054) • Sample drawn from women enrolled in federally funded public health programs (including WIC) • Rurality defined using 4-category rural/urban continuum (North Carolina Department of Commerce) • Rural: county population density <500 people/mile^2 • 90% of county population in rural areas or county has not urban areas with population of 10,000 or more	BF initiation	IV	+

		• data collected at first post-partum visit (within 6 weeks of delivery) and any subsequent visits during WIC certification period • breastfeeding initiation considered to have occurred if mother indicated that she had "ever breastfed" her most recent infant in the post-partum period			
Bailey, Wright(Bailey & Wright, 2011)	USA	• Cross-sectional study of infants born in two maternity hospitals in Southern Appalachia (n=2,323) • Rurality not defined – geographical location stated as rural by authors • Data collected through chart review • BF initiation considered to have occurred if newborn chart indicated that baby was breastfed at least once during delivery hospitalisation	BF initiation	IV	+
Weiner(Wiener & Wiener, 2011)	USA	• Secondary analysis of 2007 National Survey of Children's Heath dataset (n=27,388 children aged 0-5) • Computer assisted telephone interview survey of households to collect immunisation and other age-eligible health information • Rurality determined using the Rural Urban Commuting Area taxonomy (including population density and population work commuting patterns) • BF initiation determined from question *"was [child's name] ever breastfed or fed breast milk?"*	BF Initiation	IV	ø
Murimi et al(Murimi et al., 2010)	USA	• Cross-sectional convenience sample of women enrolled in WIC program during pregnancy in a rural parish in central Louisiana (n=130) • Definition of rurality not provided – location stated as rural by authors • Infants age range 6-18 months • Breastfeeding initiation / duration / intensity not defined • Breastfeeding duration measured in weeks	BF Initiation / duration (ABF)	IV	-
Sparks(Sparks, 2010)	USA	• Secondary analysis of the national Early Childhood Longitudinal Study – Birth Cohort (ECLS-B) (n=10,550) • Data from birth certificate and 9-month parental interview used to construct all variables • BF initiation was defined as positive response to the question *"did you ever breastfeed [your] child?"* • Rurality defined using Census 2000 Urban and Rural Classification (US Census Bureau)	BF initiation	IV	+
O'Brien et al (O'Brien et al., 2009a)	Australia	• Prospective cohort study of women delivering in two regional Queensland hospitals (n=375) • Definition of rurality not provided – location stated as rural by authors	BF Duration (FBF/ABF)	III-2	+

		• women recruited in hospital after delivery of infant • initial questionnaire completed in hospital with follow-up phone call at 6 months post-partum • breastfeeding definitions in line with Australian guidelines • Breastfeeding duration (weeks) measured at 0-14 days and 6 months			
Flower(Flower et al., 2008)	USA	• Longitudinal cohort study of infants in rural North Carolina and Pennsylvania (n=1,287) • Rurality not defined – counties selected were given as rural by author although data on geographic isolation (measured by distance from subjects home to community assets) was collected • Breastfeeding duration determined at 2 and 6 months via home visit interview • Breastfeeding initiation consistent with national infant feeding surveillance surveys (National Immunization Survey) and defined by response to question: *"Has [target child] ever been fed breastmilk?"* • Breastfeeding duration was determined by response to question: *"How old was [target child] when he/she completely stopped being fed breastmilk?"* • Duration measured in days/weeks • Exclusive breastfeeding: whether or not the infant had received formula, cow's milk, infant cereal, juice, any sugar-containing liquids, or any solids	BF Initiation / duration	III-2	+

Hoddinott(Hoddinott et al., 2006)	Scotland	• Peer coaching intervention in four geographical postcode areas of rural northeast Scotland (n=1155)
		  ○ Intervention (n=557)
		  ○ Control (n=598)
		• Rurality defined using geographical postcode areas within rural Local Health Care Co-operative area
		• Babies born to mothers registered within the study area were eligible.
		• Women recruited at antenatal booking to attend wither group-based and/or 1:1 peer coaching
		• Data collected at 1,2,6 weeks and 4,8 months
		• Breastfeeding initiation defined as any baby who was put to the breast, even if only once
		• EBF defined as no infant formula given
		• BF duration measured in weeks
			BF Initiation / duration (ABF)	III-1	+

Stamp, Cassanova(Stamp & Casanova, 2006)	Australia	• Retrospective cohort drawn from eligible births at two hospitals in regional South Australia (n=58) • Rurality defined by geographical location, population densities and distance to birthing facilities • Women recruited from birth records and interviewed via phone call • Mean age of infants: 8 months • Breastfeeding initiation not defined • Breastfeeding intensity (exclusive / partial) not defined	BF duration (ABF)	IV	-
Wilhelm et al(Wilhelm et al., 2006)	USA	• Convenience sample from three Western rural community hospitals (n=73) • Rurality not defined – location stated as rural by authors • Participants recruited at antenatal classes or preadmission procedures • Exclusion criteria: infants admitted to NICU, birth weight <2500g, gestation <37 weeks, bilirubin >15mg/dl • Data collected at baseline, day2-4 (home visit), 2 and 6 weeks, and 6 months • Breastfeeding initiation not defined • Mothers reported last day of sustained BF (any breastfeeding during the previous 24-hr period). • BF duration measured in days	BF duration (ABF)	III-1	ø
Jirajwong et al (Jirojwong et al., 2005)	Australia	• Cohort study of women delivering in two regional Queensland hospitals (n=143) • Rurality defined by authors using geographical location, low population density and distance to maternity services • Breastfeeding determined by question item assessing regularity of breastfeeding • Exclusive breastfeeding defined as no bottle feeding • BF duration measured in weeks	BF Duration (EBF/ABF)	III-2	-
Hilson(Hilson et al., 2004)	USA	• Cohort study women delivering in a 10-county area of rural New York state (n=114) • Rurality not defined – study participants drawn from a 10-county service area in a geographical location stated as rural by authors • Eligible subjects (women intending to breastfeed, singleton foetus) recruited at routine prenatal visit • Baseline data collected via oral interview antentally • Additional information collected from medical records • Subjects contacted daily by phone on days 1-5 • Data collected on feeding method, feeding frequency (24-hr recall), quantify of formula / water given and symptoms associated with Lactogenesis II	BF Duration	III-2	+

		• Subjects followed up at 8-12 months by phone to determine duration of ABF / EBF • BF duration determined by response to questions: “are you still breastfeeding?” “When did you stop breastfeeding altogether?” and “When did you first start to introducing things other than breastmilk (eg formula, solid foods, etc)?” • BF duration measured in weeks			
Zaghloul(Zaghloul et al., 2004)	USA	• Cross-sectional review of medical records for infants delivered at a regional hospital in south-east Arkansas (n=1,260) • Rurality not defined – subjects drawn from study area in a geographical location stated as rural by the authors • Eligibility criteria: mothers who delivered infants at regional medical centre during study period • Exclusion criteria: records with insufficient information (transferred newborns, deceased newborns, deceased mothers) • Breastfeeding initiation not defined – information obtained from newborn profile form completed by nursing staff	BF Initiation	IV	+
Hanson et al (Hanson et al., 2003)	USA	• Cross-sectional telephone survey of women who delivered in a 13-country area of north-western Minnesota (n=414) • Rurality not defined – subjects drawn from study area in a geographical location stated as rural by the authors • Eligibility criteria: all full-term (>36 weeks) infants born during study period • Exclusion criteria: women who had left the region, could not speak English, deceased infant • Data collected via phone interview (age range of infants 4-16 months) • BF initiation defined as having ever breastfed • BF duration determined by self-reported infant age at which breastfeeding discontinued • Data reported in months	BF initiation / duration	IV	+
Barton(Barton, 2001)	USA	• Cross-sectional study of low-income mothers from 23 rural counties in Kentucky (n=45) • Rurality not defined – subjects drawn from study area in a geographical location stated as rural by the authors • Subjects recruited in the first month post-partum from health care facilities within study area • Eligibility criteria: ≥14 years old, living with healthy, full-term infant; • met criteria for WIC / AFDC food assistance / aid programs	BF Initiation/ duration	IV	-

		• data collected via face-to-face interview at 1-2 months and 4-6 months • BF initiation not defined • BF duration not defined • BF duration measured in months			

Scott et al(Scott et al., 2001)	Australia	• Prospective cohort study of 1059 women in rural southeast Queensland and metropolitan Perth
		  ○ Urban (n=556)
		  ○ Rural (n=503)
		• Rurality not defined - subjects drawn from study area in a geographical location stated as rural by the authors
		• BF definitions in line with the Interagency Group for Action on Breastfeeding
		• Full partial and overall BF measured
		• Data collected at baseline in hospital following birth
		• Follow-up via phone at 2, 6, 10, 14, 18 and 24 weeks (urban) and 2 weeks, 6 weeks, 3 and 6 months (rural)
		• BF duration measured in weeks
			BF Initiation / duration (ABF)	III-2	+

Novotny(Novotny et al., 2000)	USA	• Cross-sectional survey of all live births in Hawaii in 1989 (n=2,011) • Rurality not defined - subjects drawn from study area in geographical locations including those stated as rural by the authors • Response rate 51% • Age range of infants: 14-19 months • BF initiation, duration and intensity not defined • BF duration data collected in days, weeks and months and converted to days for analysis • Data reported in months	BF duration	IV	ø
Kum-Nji et al(Kum-Nji et al., 1999)	USA	• Cohort study of infants born in a regional medical centre in north-west Mississippi (n=420) • Rurality not defined - subjects drawn from study area in a geographical location stated as rural by the authors • Eligibility criteria: all live births in study period • Response rate: 70% of eligible births • Subjects recruited following delivery • Data collection via interview in hospital • Additional information collected via medical records • BF initiation determined by staff observation of breastfeeding	BF Initiation	III-2	+

Shaw, Kaczorowski(Shaw & Kaczorowski, 1999)	USA	• Peer counselling intervention in nine health departments in rural West Tennessee (n=291)
		  ○ Intervention (n=156)
		  ○ Control (n=135)
		• Rurality not defined - subjects drawn from study area in a geographical location stated as rural by the authors
		• Eligibility criteria: women registered antenatally for WIC program with participating health departments within study area
		• Exclusion criteria: women who had not been seen in antenatal period by health department staff
		• BF initiation defined as any attempt to breastfeed
		• BF at 6 weeks defined as one or more episodes of BF daily
		• BF duration measured in weeks
			BF Initiation / duration (ABF)	IV	+

Schafer(Schafer et al., 1998)	USA	• Peer counselling intervention study in rural Iowa (n=136)
		  ○ Intervention (n=72)
		  ○ Control (n=64)
		• Rurality not defined - subjects drawn from study area in a geographical location stated as rural by the authors
		• Eligibility criteria: pregnant women referred by WIC clinics (intervention) and all pregnant and postpartum women enrolled in WIC (control)
		• BF initiation was defined as “ever to breast” at least once
		• BF duration defined as ‘any breastfeeding”
		• Self-reported BF data collected by health clinic staff at 12 weeks (both control and intervention)
		• BF duration measured in weeks
			BF Duration	III-1	ø

Hilson(Hilson et al., 1997)	USA	• Cross-sectional review of medical records at regional maternity facility in rural New York state (n=1109) • Rurality not defined - subjects drawn from study area in a geographical location stated as rural by the authors • Eligibility criteria: singleton births to women 19-40 yrs during study period • Exclusion criteria: infants adopted a birth, <37 weeks gestation, not born at facility, died in infancy, or who had significant medical condition at birth. Mother without pre-pregnancy weight and height data were also excluded • BF initiation defined as attempting to breastfeed at delivery • Successful BF initiation determined by continued BF at hospital discharge • BF duration data collected at well baby visits at 2 weeks and at 2, 4, 6, 9, 12, 15,	BF Initiation / duration (ABF/EBF)	IV	+

		18 and 24 months • EBF duration defined as the last time the mother reported feeding only breastmilk without introducing juice, formula or solid foods • ABF duration defined as the last time a mother reported feeding any breastmilk to her infant • BF duration reported in weeks			

1. Elliott-Rudder, M., et al., Motivational interviewing improves exclusive breastfeeding in an Australian randomised controlled trial. Acta Paediatr, 2014. 103(1): p. e11-6.
2. Sjostrom, K., et al., Comparison of breastfeeding in rural areas of Sweden and Australia - a cohort study. Women Birth, 2013. 26(4): p. 229-34.
3. Lynch, S., et al., Rural and urban breastfeeding initiation trends in low-income women in North Carolina from 2003 to 2007. J Hum Lact, 2012. 28(2): p. 226-32.
4. Bailey, B.A. and H.N. Wright, Breastfeeding initiation in a rural sample: predictive factors and the role of smoking. J Hum Lact, 2011. 27(1): p. 33-40.
5. Wiener, R.C. and M.A. Wiener, Breastfeeding prevalence and distribution in the USA and Appalachia by rural and urban setting. Rural Remote Health, 2011. 11(2): p. 1713.
6. Murimi, M., et al., Factors that Influence Breastfeeding Decisions among Special Supplemental Nutrition Program for Women, Infants, and Children Participants from Central Louisiana. Journal of the American Dietetic Association, 2010. 110(4): p. 624-627.
7. Sparks, P.J., Rural-urban differences in breastfeeding initiation in the United States. J Hum Lact, 2010. 26(2): p. 118-29.
8. O'Brien, M., et al., Exploring the influence of psychological factors on breastfeeding duration, phase 1: perceptions of mothers and clinicians. J Hum Lact, 2009. 25(1): p. 55-63.
9. Flower, K.B., et al., Understanding breastfeeding initiation and continuation in rural communities: a combined qualitative/quantitative approach. Matern Child Health J, 2008. 12(3): p. 402-14.
10. Hoddinott, P., A.J. Lee, and R. Pill, Effectiveness of a breastfeeding peer coaching intervention in rural Scotland. Birth, 2006. 33(1): p. 27-36.
11. Stamp, G.E. and H.T. Casanova, A breastfeeding study in a rural population in South Australia. Rural Remote Health, 2006. 6(2): p. 495.
12. Wilhelm, S.L., et al., Motivational interviewing to promote sustained breastfeeding. J Obstet Gynecol Neonatal Nurs, 2006. 35(3): p. 340-8.
13. Jirojwong, S., et al., What were the outcomes of home follow-up visits after postpartum hospital discharge? Aust J Adv Nurs, 2005. 23(1): p. 22-30.
14. Hilson, J.A., K.M. Rasmussen, and C.L. Kjolhede, High Prepregnant Body Mass Index is Associated With Poor Lactation Outcomes Among White, Rural Women Independent of Psychosocial and Demographic Correlates. Journal of Human Lactation, 2004. 20(1): p. 18-29.
15. Zaghloul, S., et al., Correlates of breastfeeding initiation in southeast Arkansas. South Med J, 2004. 97(5): p. 446-50.
16. Hanson, M.B., et al., Correlates of breast-feeding in a rural population. Am J Health Behav, 2003. 27(4): p. 432-44.
17. Barton, S.J., Infant feeding practices of low-income rural mothers. MCN Am J Matern Child Nurs, 2001. 26(2): p. 93-7.
18. Scott, J.A., et al., Factors associated with breastfeeding at discharge and duration of breastfeeding. J Paediatr Child Health, 2001. 37(3): p. 254-61.
19. Novotny, R., et al., Breastfeeding duration in a multiethnic population in Hawaii. Birth, 2000. 27(2): p. 91-6.

Table 2.2: Summary of study findings

Reference	Outcome variable	Summary of findings	Strengths/weaknesses
Elliott-Rudder, 2014	BF duration	Intervention group had higher rates of EBF and FBF at 4 months • EBF: OR 1.88, 1.01-3.50 • FBF: OR 1.95, 1.03-3.69 No differences were detected at 6 months	• Sufficient sample size • BF definitions consistent with WHO definitions • Confounders accounted for in analysis
Sjöström et al, 2013	BF duration	• Women in Sweden more likely to be BF (ABF) than Australian (OR = 2.41 (1.50-4.38))	• Response rates differ between Sweden and Australia • No differentiation between EBF and ABF • No multivariate analysis
Lynch, Bethel et al, 2011	BF initiation	• 49.8% of rural women initiated BF compared with 65.4% in mixed urban counties • urban residence increased odds of BF initiation (aOR=1.61, 1.56-1.66) • BF initiation varied dependant on ethnic background and place of residence	• Examined race/ethnicity and urbanicity trends in BF initiation among low income women in Nth Carolina • Large sample size, but limited to low income (WIC) participants
Bailey, Wright, 2011	BF initiation	Increased odds of not initiating BF associated with: • High school education – aOR 1.82 (1.49-2.23) • Single marital status – aOR 1.61(1.30-1.99) • Lack of insurance – aOR 1.51 (1.20-1.92) • Multiparity – aOR 2.12 (1.71-2.63) • Smoking – aOR 2.00 (1.58-2.53) • Illegal drug use – aOR 1.45 (1.01-2.05)	• Representative of population • No differences were described between the two sites, therefore unclear if they were significantly different
Weiner, 2011	BF Initiation	Prevalence of BF in rural Appalachia 57.6% (95% CI 55.4-59.8) Risk of not being breastfed higher for: - rural children (OR 1.28) - rural children in Appalachia (OR 1.78) children in Appalachia more likely to be formula fed than other rural areas of US (OR 1.35)	• Prevalence data only • Large, nationally representative data set • Cross-sectional, unable to assess causation • Self-report of BF practice and rurality • Limited assessment of contributing factors
Sparks, 2010	BF initiation	• Urban residence increased odds of BF initiation aOR 1.56 (1.24-1.97) • Rural residence increased odds of BF initiation for women with low incomes aOR 1.68 (1.11-2.54) • BF initiation varied dependant on ethnic background in rural areas	• Large sample, representative • Limited to WIC participants

O'Brien et al, 2009	Duration (FBF/ABF)	• Higher self-efficacy scores and faith in breastmilk were positively associated with BF duration • Women with planned duration of BF <6 months were more than twice as likely to cease breastfeeding prematurely if they had planned to breastfeed for 6 months or less (OR =2.19).	• Sufficient sample size • Analysis considered confounders
Flower, 2008	Initiation / duration	Predictors of BF initiation: (OR) -Higher levels of education 2.44 -Marital status 1.63 -Primarity 1.77 -WIC participant 0.39 -Employed / WIC 2.08 Risk of BF cessation: (HR) -Higher level of education 0.47 -Employment 1.36 -WIC participation 1.99	• No distinction between ABF and EBF • Prior BF experience not assessed • No inclusion of Spanish speaking women in sample • Qualitative assessment limited to women from NC
Hoddinott, 2006	Initiation / duration (ABF)	• Significant increase (6.8%) in ABF in study population, compared with decline in rates of BF across Scotland • BF rates increased against baseline rates at all time points to 8 months, but not consistent across study areas and not linked to sociodemographic factors	• Unable to randomize intervention • Unable to link BF outcomes with attendance at group coaching
Wilhelm et al, 2006	BF duration (ABF)	Mean duration of breastfeeding (days): • MI: 98.1±71.9 • Control: 80.7±71.9 Difference not statistically different	• Small convenience sample (variation in protocols) • Unclear if it is representative • No multivariate analysis
Hilson 2004	BF Duration	Late onset of lactogenesis II associated with higher BMI, primiparity and lower scores for breastfeeding behaviour.	• Small sample • Unexpected BMI distribution
Zaghloul 2004	Initiation	• Odds of formula feeding were higher for women who were: Black 2.6 (1.7-4.0) <12 years of education 1.6 (1.1-2.3) • Women were less likely to formula feed if they: attended antenatal classes 0.4 (0.3-0.7) were unmarried 0.4 (0.2-0.6)	• Sufficient sample size • No definition of EBF • Cross-sectional data unable to establish causation

Hanson et al, 2003	BF initiation / duration	• BF initiation associated with higher (college) education and less than full time work (aOR 3.08, (1.17-8.15)) • BF duration associated with college education and less than full time work, but not significant in multivariate analysis • Unintended pregnancy was strongest predictor of BF cessation before 6 months	• No information about nature of employment • Analysis of duration was undertaken on mothers who had already breastfed to 3 months
Scott et al, 2001	Initiation / duration (ABF)	Factors associated with BF at discharge: Maternal age 1.51 (1.00-2.29) Born in Australia/NZ 1.98 (1.14-3.43) Primiparous 2.08 (1.28-3.45) Admitted to SCN 0.55 (0.35-0.86) Father prefers BF 9.13 (4.83-17.26) Grandmother prefers BF 2.16 (1.15-4.03) Decided to BF before Pregnancy 3.08 (2.04-4.67) Factors associated with shorter duration of BF: Maternal age 0.49 (0.38-0.65) Maternal education 0.49 (0.33-0.72) Admitted to SCN 1.56 (1.16-2.08) Father prefers BF 0.58 (0.45-0.75) Decided to BF before Pregnancy 0.58 (0.44-0.77) Intended to BF <4 mths 4.18 (2.81-6.22)	• Sufficient sample size • BF defined • Differences in response rates for urban and rural subjects (response bias)
Novotny, 2000	BF Duration	79% of women were breastfeeding at discharge from hospital rates of ABF at specified time points: - 2/12 77% - 6/12 45% - 12/12 16% early weaning was associated with: Japanese ethnicity overseas-born mother speaking language other than English at home introduction of formula and/or solids employment WIC participation	• Long recall period may contribute to bias • Low response rate • Unclear if sample is representative (participants and non-participants were significantly different)

		breastfeeding problems Infant illness Living on rural island was protective against BF cessation (HR 0.83 (95% CI 0.68-0.89)	
Kum-Nji et al, 1999	BF Initiation	• BF initiation higher for white women than black women (44% vs 20%, p<0.001) • Odds of initiating BF were higher for women who: Knew a friend who breastfed 7.1 Was married 2.9 Had a relative who breastfed 2.8 Had a baby born >2500g 3.2	• Sufficient sample size • Initiation – defined as observed BF by research or hospital staff
Shaw, Kaczorowski, 1999	BF initiation / duration (ABF)	- BF initiation was increased in peer counsellor intervention group (IG) (53% vs. 33%, p<0.001) - BF duration to 6 weeks higher in IG (26% vs. 13%, p=0.006) - Women in IG more likely to initiate BF (aOR=2.43, 95% CI 1.23-4.67) and be breastfeeding at 6 weeks (aOR=2.78, 95% CI 2.08-9.51)	• Retrospective data collection, use of health records • Potential bias in convenience sampling of participating health departments
Schafer, 1998	BF Duration (ABF)	- Significant increase in breastfeeding / nutrition knowledge in intervention group (IG) - BF initiation: IG - 82% CG - 31% - BF at 4 weeks: IG - 56% CG – 10% - mean duration of ABF: IG - 5.7 weeks CG - 2.5 weeks	• Small sample • No analysis of confounders • Selection bias in intervention group.
Hilson, 1997	Initiation / duration (ABF/EBF)	• high BMI associated with lower BF initiation: o overweight: OR 2.54, p<0.05 o obese: OR=3.65, p<0.0008 • high BMI associated with lower BF duration: o overweight: RR=1.42, p<0.04 o obese: RR=1.43, p<0.02	• Sufficient sample size • Significant differences between participants and non-participants

2.11 Factors Influencing the Initiation and Duration of Breastfeeding in Rural Areas of Developed Countries

2.11.1 Socio-demographic

Maternal age

As in urban areas, maternal age is a significant predictor of breastfeeding behaviour in rural areas. In their study of 1059 rural and urban women in Queensland, Scott et al found that the odds of breastfeeding at discharge for a woman aged 30 was 1.5 times higher (OR 1.51, 96% CI 1.00-2.29) and the risk of ceasing breastfeeding before six months was half that of women than a woman of 20 years of age (RR=0.49, 95% CI 0.38-0.65), however they found no association between breastfeeding initiation or duration and place of residence (Scott et al., 2001). The authors concluded that the differences in breastfeeding rates observed between rural and urban areas may be more influenced by sociodemographic differences "...rather than any intrinsic differences between rural and urban women."(Scott et al., 2001, p 258)

In a cross-sectional study of 240,054 women drawn from data collected from the North Carolina Pregnancy Nutrition Surveillance System (PNSS), multivariate logistic regression analysis identified maternal age as a significant predictor of breastfeeding initiation, independent of rurality. Compared with mothers younger than 18, the odds of initiating breastfeeding by mothers aged between 18 and 34 years were 1.2 times greater, while those aged over 34 had nearly 1.3 times greater odds of initiating breastfeeding, for both rural and urban women independent of other sociodemographic factors (Lynch et al., 2012). Analysis of the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), a nationally representative probability sample of children from across the United States, found that the odds of initiating breastfeeding was 1.2 times greater for mothers aged 35 years or older (aOR 1.19, 95% CI 1.00-1.41) after controlling for other factors including rurality (Sparks, 2010).

A prospective cohort study comparing breastfeeding outcomes in 391 women between rural areas of Australia and Sweden also found significant differences in the influence of maternal age. Univariate analysis of demographic characteristics found that the odds of breastfeeding at two months for rural Australian women aged 25 years or younger were 10 times lower compared to those aged over 25, however this effect was not seen in rural Swedish women (Sjostrom et al., 2013).

Given the strength of the evidence for the influence of maternal age on breastfeeding initiation and duration in both urban and rural areas, it is recommended that strategies should be developed to encourage and support younger rural women to begin and continue to exclusively breastfeed their infants.

Marital Status

Whilst there is some evidence to suggest that breastfeeding practices are influenced by marital status in rural areas, this appears to be moderated by the country in which the study was conducted. Studies where marital status was found to be significantly associated with breastfeeding outcomes were all conducted in the United States and all studies noted breastfeeding initiation rates from 18-50%. Lynch et al reported that the odds of married women initiating breastfeeding were almost 1.5 times greater than for single mothers (aOR 1.47, 95% CI 1.44-1.50), after controlling for other sociodemographic factors including rurality (Lynch et al., 2012). In a cross-sectional study of 1,260 women examining breastfeeding initiation in rural Arkansas, multivariate analysis found that women who were unmarried had 2.5 times lower odds of initiating breastfeeding than married mothers (aOR 0.4, 95% CI 0.2-0.6) (Zaghloul et al., 2004). Similarly, a study of breastfeeding initiation amongst 420 women in rural Mississippi found that the odds of initiating breastfeeding for women who were married were almost three times higher than those who were unmarried, after controlling for other sociodemographic factors (aOR 2.9, 95% CI 1.6-5.3) (Kum-Nji et al., 1999).

Whilst few studies determine the quality of relationships in terms of level of support, it is reasonable to assume that women who have a partner are more likely

to receive support for child rearing, including support in infant feeding, than those who are single. For single mothers in rural areas, particularly those who are experiencing greater levels of socioeconomic disadvantage and who may be without the support of extended family or health professionals, this may confer an additional risk. Where breastfeeding initiation rates are high, understanding the level of social support for rural women may be a more effective marker for breastfeeding support than marital status.

Maternal Education

The evidence that maternal education influences breastfeeding practice in rural areas of developed countries supports the findings of other research. Flower et al reported that rural women with high school education (aOR 1.65, 95% CI 1.11-2.44) or college education (aOR 2.44, 95% CI 1.44-4.15) had greater odds of initiating breastfeeding than those who had not completed high school (Flower et al., 2008). Bailey et al, in their study of breastfeeding initation amongst rural women, reported that 71% of the women with at least some college education initiated breastfeeding compared with 43% of women with high school education and college educated women had lower odds of exclusively formula feeding than those with high school education (aOR 0.55, 95% CI 0.45-0.67) (Bailey & Wright, 2011). Completion of high school was also significantly associated with breastfeeding initiation in North Carolina, where both rural and urban mothers with more than 12 years of education were more than 1.8 times more likely to initiate breastfeeding, after controlling for other sociodemographic factors (Lynch et al., 2012). In a study of breastfeeding outcomes amongst 1,109 women in rural New York, women with a college education were less likely to cease breastfeeding than those with high school education, although this association was not seen with exclusive breastfeeding (Hilson et al., 1997).

Similarly, in a sample of 414 mothers from rural Minnesota, women with a college education had greater odds of initiating breastfeeding than those with less than college education (OR 3.19, 95% CI 1.84-5.55), an effect only marginally attenuated by the adjustment for employment (aOR 3.08, 95% CI 1.17-8.15) (Hanson et al.,

2003). The authors noted that whilst univariate analysis found a significant association between education and breastfeeding duration to six months, it did not remain a significant association after controlling for employment and other sociodemographic factors.

In rural settings where breastfeeding initiation is very low, the effect of maternal education remains significant. Zaghloul et al reported that the odds of formula feeding from birth for mothers in rural Arkansas was greater for mothers with only high school education than those with a higher level of education (aOR 1.6, 95% CI 1.1-2.3) (Zaghloul et al., 2004).

The evidence is not universal however, and one rural study where maternal education was reported as a variable of interest did not find any significant association based on univariate analysis. Sjöström et al noted that while Swedish women with high school education had lower odds of breastfeeding at two months (OR 0.3, 95% CI 0.1-0.7) than those with university level education, the effect was not significant for Australian women (OR 1.4, 95% CI 0.5-4.0) (Sjostrom et al., 2013). It has been postulated that social inequalities in early breastfeeding practice are less apparent as prevalence approaches universality, which may explain a lack of association found in studies from countries where breastfeeding initiation rates are consistently above 80%.

The evidence suggests that in both urban and rural areas where breastfeeding initiation is low, women with lower educational attainment are at greater risk of not initiating or continuing to breastfeed.

Socioeconomic Status

Despite the health systems that exist in developed countries across the globe, there are differences in health outcomes for citizens of these countries dependant on their place of residence. People living in rural and regional areas of developed nations have statistically lower levels of education, income and access to health services. Whilst rural communities are not geographically or demographically

homogenous, living in rural and remote areas is typically characterised by reduced access to health and other services and poorer health outcomes, supporting the evidence for lower rates of breastfeeding practice.

Proxy measures of SES, such as insurance status, have been used in studies to determine socioeconomic influences on breastfeeding in rural areas. A secondary data analysis of the US 2007 National Survey of Children's Health (n=27,388) examined differences in breastfeeding prevalence between rural Appalachia and urban areas of the United States based on Federal Poverty Level (FPL) status, medical home (comprehensive primary health care) status and insurance status. The authors found that the prevalence of breastfeeding was significantly lower in rural Appalachia (0.576, 95% CI 0.554-0.598) than in other rural areas (0.687, 95% CI 0.661-0.713), other urban areas (0.770, 95% CI 0.757-0.784) and the US overall (0.755, 95% CI 0.743-0.767) (Wiener & Wiener, 2011). The authors concluded that the impact of socioeconomic factors such as insurance availability and poverty levels in rural areas were significant and contributed to the lower rates of breastfeeding in rural areas.

Insurance status was also found to be a significant predictor of breastfeeding initiation in a study of 2,323 women in rural Appalachia, with women who were uninsured having 1.5 times greater odds of not initiating breastfeeding than those with private insurance (aOR 1.51, 95% CI 1.20-1.92) (Bailey & Wright, 2011).

As a proxy measure of socioeconomic status, participation in or eligibility for WIC is a significant predictor of breastfeeding outcomes. Sparks et al (2010) found that while family income level did not remain significant in the multivariate analysis of factors influencing breastfeeding initiation in a rural sample, the use of WIC benefits in the previous 12 months was associated with reduced odds of initiating breastfeeding (aOR 0.68, 95% CI 0.52-0.88) (Sparks, 2010). Similarly, multivariate analysis of data from the Family Life Project, a study of 1,287 mothers from rural North Carolina and Pennsylvania, found that while family income was not a

significant predictor of breastfeeding initiation, women who had participated in the WIC program were 61% less likely to initiate breastfeeding (Flower et al., 2008).

As for urban areas of developed countries, the evidence suggests a strong association between socioeconomic status and breastfeeding practice in rural areas. The results of studies where subjects were WIC participants should be interpreted with some caution, as the provision of free formula is unique to the United States, thereby reducing the generalizability to other countries. However, given that rural women tend to have lower socioeconomic status, which may contribute to lower levels of access to health services or supports for breastfeeding, the influence on breastfeeding initiation and duration is significant.

Ethnicity

Whilst there is limited high quality evidence about the influence of ethnicity on breastfeeding practice from rural Australia, studies conducted in the United States have consistently found an association between race and breastfeeding in initiation and duration in rural areas. Where race was determined in the studies selected for this review, rural women with Hispanic cultural backgrounds were most likely to initiate breastfeeding. Lynch et al found that compared with rural African-American women, rual Hispanic women had more than seven times the odds of initiating breastfeeding (aOR 7.33, 95% CI 6.83-7.87) (Lynch et al., 2012). There is some evidence however that acculturation may alter the strength of the effect of ethnicity. Sparks et al noted in their multivariate analysis that the odds of breastfeeding initiation were higher amongst rural Hispanic women who were born in Mexico (aOR 5.22, 95% CI 1.20-22.71) compared with those born in the United States (aOR 1.10, 95% CI 0.32-3.81) (Sparks, 2010). The authors postulated that maintaining strong cultural connections and traditions was easier in rural areas for Hispanic women, supporting the hypothesis that longer periods of residence in the United States is associated with lower levels of breastfeeding initiation and continuation for this cultural group.

In rural Arkansas, where breastfeeding initiation rates have been historically low, Zaghloul et al reported that only 18% of mothers involved in the study began breastfeeding their infants (Zaghloul et al., 2004). Univariate analysis found that African-American mothers had more than five times the odds of formula feeding their infant than Caucasian mothers (OR 5.2, 95% CI 3.8-7.2), and even after controlling for other sociodemographic factors, had more than twice the odds of formula feeding (aOR 2.6, 95% CI 1.7-4.0) (Zaghloul et al., 2004). Similarly, a study conducted in rural Mississippi found that while 24% of women initiated breastfeeding, only 20% of African-American women began breastfeeding (Kum-Nji et al., 1999).

Cultural acceptance of breastfeeding amongst rural African-American populations has been examined in a number of studies, with authors reporting that breastfeeding was less accepted in these communities compared to Caucasian populations (Flower et al., 2008). Kum-Nji et al noted in their analysis of factors associated with breastfeeding initiation amongst rural women of differing races, that African-American women who "knew a friend who breastfed" had more than five times the odds of breastfeeding (aOR 5.5, 95% CI 2.7-11.3) whereas the odds for Caucasian women were only 1.5 times greater (aOR 1.5, 95% CI 1.2-1.9). Similarly, rural African-American women who had a close relative who breastfed had almost 3 times the odds of breastfeeding (aOR 2.9, 95% CI 1.4-6.1) compared with Caucasian women (aOR 1.3, 1.0-1.3) (Kum-Nji et al., 1999). The authors concluded that these women served as positive role models and social supports for women where breastfeeding was not commonplace. Additionally Flower et al noted in their ethnographic exploration of breastfeeding determinants that African-American women believed breastfeeding was more acceptable in Caucasian communities due in part to a greater level of attachment or bonding that white women had with their infants (Flower et al., 2008).

Of the eight studies that reported race or ethnicity as a variable under study, three failed to find a relationship with breastfeeding practice (Bailey & Wright, 2011; Hanson et al., 2003; Shaw & Kaczorowski, 1999). The evidence suggests that for

rural areas, ethnicity may be a significant factor where the population is relatively heterogeneous, where cultural practices related to breastfeeding behaviour differ and where the breastfeeding initiation rates are lower.

2.11.2 Health service-related

Professional Breastfeeding Support

Of the studies selected for review, only one examined postnatal professional breastfeeding support as a variable under study. In their cluster randomised controlled trial of a motivational interviewing intervention on breastfeeding duration, Elliott-Rudder et al reported significantly higher odds of exclusive breastfeeding at four months in rural women in the intervention group (aOR 1.88, 95% CI 1.01-3.50) (Elliott-Rudder et al., 2014). The authors concluded that proactive face-to-face contact with breastfeeding mothers could be effective in supporting breastfeeding with a modest investment in training for primary care staff such as nurses. While two studies reported on prenatal care as a variable, (Bailey & Wright, 2011; Kum-Nji et al., 1999) it was not clear what breastfeeding support or education had been provided. One study reported that almost three quarters of the respondents had been encouraged to breastfeed, predominantly by a nurse or nutritionist. It was estimated that less than 20% of encouragement received was from physicians (Kum-Nji et al., 1999).

Given the limited evidence for the influence of professional support on breastfeeding practice, it is difficult to assess the strength of this factor in rural settings. Evidence from urban areas suggests that consistent breastfeeding messages from health professionals both before and after the birth of an infant, along with timely support for breastfeeding problems can increase breastfeeding initiation and duration. Examination of novel and flexible support strategies for rural women is required to determine recommendations in this setting.

Baby-friendly practices

Whilst there was some evidence that professional breastfeeding support provided postnatally was effective, few studies examined early postnatal health service practices (such as rooming in and demand feeding) as variables of interest and none reported significant associations with breastfeeding outcomes.

Scott et al reported a non-significant positive association between rooming-in and breastfeeding duration (Scott et al., 2001), however this varaibale was not reported by rurality. It has been suggested that any association is more indicative of a parenting attitude than a cause-effect relationship. The lack of evidence for these factors may reflect the ubiquitous nature of practices such as rooming-in and demand feeding in both rural and urban areas in countries such as Australia. Alternatively, it may reflect the lack of penetration of the BFHI in countries such as the United States, where only around 4% of live births occur in Baby Friendly facilities (Centers for Disease Control and Prevention, 2011). Despite the limited evidence from rural settings, it is prudent to recommend that rural health services continue to implement baby-friendly practices to support breastfeeding.

2.11.3 Psychosocial

Knowledge and attitudes

Of the studies selected for review that addressed psychosocial factors as determinants of breastfeeding practice in rural areas, all noted a relationship between positive attitude and breastfeeding. In their study of 375 women in rural Queensland, O'Brien et al reported that psychological factors were significantly associated with breastfeeding duration. In addition to factors such as dispositional optimism, rural women with greater faith in breastmilk had greater odds of both 'full breastfeeding' (OR 1.36, 95% CI 1.14-1.63) at six months and 'any breastfeeding' (OR 1.70, 95% CI 1.26-2.29) to six months (O'Brien et al., 2008). The ethnographic study as part of the Family Life Project in rural North Carolina and Pennsylvania found that mothers who did not initiate breastfeeding were less positive about breastfeeding and cited factors such as pain, embarrassment, lack of social acceptability and a planned return to work as reasons for not breastfeeding

their infants (Flower et al., 2008). Additionally, rural women reported pain and embarrassment along with return to employment as reasons to discontinue breastfeeding (Flower et al., 2008).

In their study of the role of body mass index (BMI) on lactation outcomes in a sample of 114 women in rural New York, a breastfeeding knowledge score was assigned to participants based on answers to a set of nine true-false questions. The results found that there were no significant differences in the mean breastfeeding score based on BMI, but significant differences were detected in the mean scores of primiparous ($\bar{x}$=5.7±2) and multiparous women ($\bar{x}$=6.8±5, P<0.001) (Hilson et al., 2004). This finding supports the notion that multiparous women will likely have some breastfeeding experience; therefore greater breastfeeding knowledge. However few multiparous women in this sample had prior breastfeeding experience, therefore the authors were unable to determine if this factor exerted an independent influence in mitigating the negative association with breastfeeding duration (Hilson et al., 2004).

Whilst few rural studies have directly measured maternal breastfeeding knowledge, other research has evaluated breastfeeding education such as antenatal classes, or instruction from health professionals after birth as a proxy measure. In the study of correlates of breastfeeding initiation in 1,260 women in rural Arkansas, Zaghloul et al reported that mothers who attended childbirth education classes before birth had approximately half the odds of formula feeding their infant from birth, independent of other sociodemographic variables (aOR 0.4, 95% CI 0.3-0.7) (Zaghloul et al., 2004). Similarly, Kum-Nji et al reported that rural African-American women who reported receiving prenatal breastfeeding education had 2.5 times the odds of initiating breastfeeding (aOR = 2.5, 95% CI 1.0-6.3), however it was not significant for Caucasian women in this sample (Kum-Nji et al., 1999). Scott et al noted that while attendance at antenatal classes was a significantly associated with breastfeeding at discharge in univariate analysis of their rural sample, it did not remain significant after controlling for other factors (Scott et al., 2001).

Evidence from rural studies for the influence of knowledge on breastfeeding duration is limited. In their prospective cohort study of 391 women comparing breastfeeding experiences in rural Sweden and Australia, Sjöström et al reported that Swedish mothers who indicated that they had received enough information about breastfeeding after the birth of their infant had more than twice the odds of breastfeeding at two months (OR 2.3, 95% CI 1.14-4.76). This factor was not significant for Australian mothers (Sjostrom et al., 2013), however no confounders were controlled for and the number of Australian mothers participating was small (n=91).

Whilst limited, the evidence for knowledge and attitudes as an influence on breastfeeding practice suggests that, as for urban areas, positive attitudes and greater breastfeeding knowledge are associated with greater breastfeeding initiation and duration. Strategies to ensure that rural women have access to breastfeeding education antenatally and in the early postnatal period will contribute to improved breastfeeding outcomes in this setting.

Support of Significant Others – mother/partner/peers

None of the studies selected for review directly assessed paternal infant feeding attitudes, however two studies examined mothers' perceptions of paternal infant feeding attitude. Scott et al reported that women who perceived that their partner was supportive of breastfeeding had more than nine times the odds of breastfeeding at discharge (aOR = 9.13, 95% CI 4.83-17.26), and approximately half the odds of ceasing breastfeeding before six months (aRR = 0.58, 95% CI 0.44-0.77) than those women who perceived that their partner was either ambivalent about breastfeeding or preferred bottle feeding (Scott et al., 2001). While the data was not reported by rurality, the finding supports the evidence from O'Brien et al who demonstrated in their examination of psychological influences on breastfeeding in a rural sample that partner's feeding preference was a reliable predictor of breastfeeding duration to six months (aOR = 0.61, 95% CI 0.41-0.90)(O'Brien et al., 2008).

The influence of support extends beyond a woman's partner, and research has shown that family support for breastfeeding is positively associated with breastfeeding initiation in rural areas. In a retrospective cohort study of 291 women evaluating the effectiveness of a peer counselling program on breastfeeding initiation and duration in rural West Tennessee, women who perceived that they had a high level of family support twice the odds of initiating breastfeeding, independent of other factors (aOR = 2.05, 95% CI 1.64-3.98), although the effect did not remain significant for predicting breastfeeding duration (Shaw & Kaczorowski, 1999).

There is limited evidence from the literature to determine the effect of maternal grandmothers feeding preference on breastfeeding initiation and duration in rural areas. In one study selected for review, the authors found that whilst not as strongly predictive as paternal feeding preference, women whose own mother preferred breastfeeding had more than twice the odds of breastfeeding at discharge (aOR = 2.16, 95% CI 1.15-4.03) (Scott et al., 2001). The effect however did not remain significant for breastfeeding duration. Given the limited evidence, it is difficult to determine the effect on breastfeeding practice in a rural setting. In the context of overall breastfeeding support, however, it is prudent to recommend that maternal grandmothers in rural areas be included in strategies to improve knowledge about breastfeeding in order to provide greater support for their daughters.

Shared social norms and vicarious experience are strong influences on behaviour and have been investigated in relation to breastfeeding practice in rural areas. As part of a wider breastfeeding intervention in rural Scotland, women who formed a positive attitude after seeing infants being breastfed had more than six times the odds of intending to initiate breastfeeding than women who felt uncomfortable or embarrassed (aOR 6.72, 95% CI 2.85–15.82), although the effect was not significant for actual breastfeeding initiation (Hoddinott et al., 2010). These findings are particularly relevant for rural areas of Australia and other developed countries, where population densities are lower and exposure to breastfeeding may be

infrequent. Women who live outside major regional centres or large towns may not have access to parenting or other breastfeeding support groups, reducing opportunities to share experiences and gain peer support.

There is limited evidence of the influence of social support on breastfeeding practice from rural areas. Only one study selected for review reported on social supports as an independent variable. In a study of factors influencing breastfeeding initiation in rural Mississippi, women who "knew a friend who breastfed" had more than seven times the odds of initiating breastfeeding than those who did not (Kum-Nji et al., 1999).

Whilst the evidence suggests that the influence of significant social supports such as partners and grandmothers are strong, there is less evidence around the influence of social supports on breastfeeding practice in rural settings. Findings from research in other settings suggest that factors such as peer support and wider social acceptability, and its relationship with ethnicity, would likely remain a significant factor for rural areas, particularly those with heterogeneous demography. Innovative breastfeeding peer support strategies for geographically isolated women are required to ensure that breastfeeding continues to be seen as the normal and desirable method of infant feeding. Additionally, policies that strengthen community support for breastfeeding, including the promotion of the right for women to breastfeed in public places, are critical to improving breastfeeding rates in rural areas.

Return to Employment

Returning to paid employment has also been cited as a negative influence on breastfeeding duration in rural areas (Flower et al., 2008; Hanson et al., 2003), however the evidence is inconsistent. Flower et al reported that women in their rural southern USA sample who were employed at the time of birth of their infant had significantly lower odds of initiating breastfeeding, after controlling for other potential confounders (aOR 0.36, 95 % CI 0.20-0.66). Furthermore, the risk of

ceasing breastfeeding before six months was greater for rural women who were working (aRR = 1.36, 95% CI 1.07-1.75) (Flower et al., 2008).

Of the studies that examined return to employment, two found no significant relationship between breastfeeding duration and employment status of rural women. Shaw and Kazcorowski noted that employment was not significantly associated with breastfeeding at six weeks in their study of 291 women in West Tennessee, although the sample was drawn from WIC participants, which may have resulted in some selection bias (Shaw & Kaczorowski, 1999). Scott et al also failed to find an independent association between breastfeeding practice and either intention to return to work or actual return to work in their study of 886 women in urban and rural women (Scott et al., 2001).

The reasons for differences in the findings in these studies may reflect the perceived lack of workplace support for breastfeeding in rural areas, particularly if women are returning to low paid employment where there is limited flexibility for supporting breastfeeding. This hypothesis is supported by the findings of a study investigating correlates of breastfeeding practice in rural Minnesota, where mothers with high school education who worked full-time had approximate half the odds of initiating breastfeeding than those women with similar education levels in part-time employment (aOR = 0.49, 95% CI 0.27-0.87) (Hanson et al., 2003). This finding led the authors to postulate that women with lower education levels may be employed in positions that do not allow them to flexibly meet their infants breastfeeding needs, and they may feel inhibited requesting breastfeeding support from their employer (Hanson et al., 2003).

Although the evidence for the association of employment and breastfeeding practice in rural areas is limited, and in some cases conflicting, continued attention to other socioeconomic factors such as type and intensity of employment as well as educational attainment will assist in identifying women in rural areas who are most in need of support. Additionally, strategies to address the capacity of rural

employers to support breastfeeding will assist rural women to continue to breastfeed.

Timing of Breastfeeding Decisions

In rural areas, evidence for the timing of the breastfeeding decision on breastfeeding initiation and duration is limited, but has been shown to have positive influence. O'Brien et al examined psychological factors as predictors of breastfeeding duration for rural women and found that the timing of the infant feeding decision was significantly associated with duration (O'Brien et al., 2008). This finding supports those of Scott et al, who reported that both rural and urban women who decided on their infant feeding method prior to pregnancy had over three times the odds of breastfeeding at discharge (aOR 3.08, 95% CI 2.04-4.67) and approximately half the odds of having ceased breastfeeding before six months (aRR 0.58, 95% CI 0.44-0.77) (Scott et al., 2001).

As with timing of the decision to breastfeed, the evidence for intended breastfeeding duration as an influence on practice in rural areas is also limited. Two of the studies selected for review identified intended duration as a significant independent factor in determining actual breastfeeding duration. O'Brien et al found that rural women who planned to breastfeed for six months or less had more than twice the odds of ceasing breastfeeding before six months (aOR 2.19, 95% CI 1.52-3.16) after adjusting for other sociodemographic and psychological variables (O'Brien et al., 2008). Similarly, Scott et al found that women who intended to breastfeed for four months or less had more than four times the risk of ceasing breastfeeding before six months (aRR 4.18, 95% CI 2.81-6.22) (Scott et al., 2001), however this data was not reported by rurality. The authors also noted that women who were undecided about how long they would breastfeed for had greater odds of ceasing before six months, suggesting that encouraging and assisting women to form a concrete breastfeeding goal that was consistent with recommendations may increase the likelihood of continued breastfeeding.

Given the limited evidence of the influence of breastfeeding intentions on practice in rural settings, it is difficult to determine the strength of the association in rural areas. Evidence from other settings suggests that assisting rural women prior to conception to form positive views about breastfeeding; decide on breastfeeding as the preferred feeding method; and anticipate breastfeeding duration in line with current recommendations is likely to result in increased breastfeeding initiation and duration in this setting.

Breastfeeding Self-Efficacy

Interventions that address modifiable risk factors such as self-efficacy have been shown to influence breastfeeding duration, however evidence for the effect of self-efficacy on breastfeeding duration in rural settings is limited. Only two of the studies selected for review examined the effect of self-efficacy on breastfeeding practice. In a randomised controlled trial involving a sample of 330 women in rural New South Wales, a motivational interviewing (MI) intervention was tested to determine the effect on breastfeeding duration (Elliott-Rudder et al., 2014). The intervention, a structured conversation to support continued breastfeeding, was delivered by practice nurses at scheduled immunisation visits (at two, four and six months) to a rural general practice. The results showed that at four months, women in the intervention group had greater odds of having exclusively breastfed in the previous 24 hours (aOR 1.88, 95% CI 1.01-3.50), although there were no differences at six months. There was no significant difference in the odds of exclusively breastfeeding at either 4 months or 6 months when the "since birth" recall method was used, suggesting that the study may have overestimated the effect of motivational interviewing on continuous or true exclusive breastfeeding in this cohort. Additionally, the authors noted that exclusive breastfeeding at six months was uncommon, and suggested that more comprehensive interventions may be needed to see change in the breastfeeding intensity rates.

In their assessment of the influence of psychological factors on breastfeeding duration in a cohort of rural women in Queensland, O'Brien et al reported that breastfeeding self-efficacy (as measured using the Breastfeeding Self-Efficacy Scale)

was a reliable predictor of 'any breastfeeding' to six months. The authors noted that the lack of association between self-efficacy and duration of full breastfeeding was inconsistent with findings from their previous studies, but postulated that the inclusion of other psychological factors may have influenced rural mothers' feeding decisions (O'Brien et al., 2008).

The evidence for the influence of self-efficacy on breastfeeding practice in rural settings is limited, however there is some evidence from other settings to suggest that it is potentially significant. The measurement of a woman's confidence in her ability to breastfeed may allow health services and health professionals to tailor advice and support for breastfeeding based on current experiences and encourage exploration of strategies to overcome challenges in reaching breastfeeding goals. Brief intervention through techniques such as motivational interviewing can be implemented with minimal training and show great promise for rural settings where difficulties in recruitment of specialist staff exist.

2.11.4 Biomedical

Parity

The influence of parity on breastfeeding practice is equally inconsistent in urban and rural settings, based on the findings of this review. In their evaluation of peer counselling effectiveness in rural West Tennessee, Shaw and Kraczorowski found no independent relationship between parity and breastfeeding initiation or duration (Shaw & Kaczorowski, 1999). A study of 2,323 women in rural Southern Appalachia found that multiparous women had more than twice the odds of choosing formula feeding than primiparous women (aOR = 2.12, 95% CI 1.71-2.63) (Bailey & Wright, 2011). In the comparison of breastfeeding experiences in rural Sweden and Australia, Sjöström et al noted that while primiparous Australian women lower odds of breastfeeding at two months (OR = 0.2, 95% CI 0.1-0.6), this was not significant for Swedish women (OR = 0.9, 95% CI 0.4-1.7). Although there were no significant differences between the two groups in terms of sociodemographic characteristics, it is unclear as to the extent that potential confounders influenced the outcome, as

multivariate analysis was not reported. Quantitative analysis of the Family Life Project data in rural North Carolina and Pennsylvania found that primiparous women had almost twice the odds of initiating breastfeeding than multiparous women (aOR = 1.77, 95% CI 1.08-2.90), however there was no association between parity and breastfeeding duration to six months (Flower et al., 2008).

Three of the studies selected for review conducted analysis of parity as an independent variable using rural and urban subjects as a combined group. Parity was found to be a strong predictor of breastfeeding initiation in a prospective cohort study of 886 urban and rural Australian women, with primiparous women having more than twice the odds of breastfeeding at discharge than multiparous women (aOR = 2.08, 95% CI 1.28-3.45) (Scott et al., 2001). No association was found between parity and breastfeeding duration after controlling for other potential confounders. Analysis of the data from the North Carolina Pregnancy Nutrition Surveillance System (PNSS) found that the odds of breastfeeding initiation were higher for multiparous women (aOR = 1.29, 95% CI 1.27-1.32) (Lynch et al., 2012), whereas Sparks et al in their analysis of the national Early Childhood Longitudinal Study–Birth Cohort (ECLS-B) data found that first-time mothers had higher odds of initiating breastfeeding (aOR = 1.42, 95% CI 1.1-1.65) (Sparks, 2010).

One of the assumptions in interpreting this data may be that multiparity infers previous breastfeeding history, and moreover that this experience was positive. Of all the studies that examined multiparity as a variable of interest in breastfeeding initiation, only one reported previous breastfeeding history. Further research examining the role of previous breastfeeding experiences is required to determine the influence of parity in rural settings, however given the inconsistent results in both urban and rural studies, it is recommended that other predictors be used to identify rural women at risk of not initiating breastfeeding, or of ceasing breastfeeding prematurely.

Low birthweight

Seven studies examined birthweight as a variable of interest, however only two studies reported any significant relationship between birthweight and breastfeeding outcomes. Scott et al reported that low birth weight was significantly negatively associated with breastfeeding at discharge from hospital in the combined rural and urban sample, however the result failed to remain significant after multivariate analysis (Scott et al., 2001). Kum-Nji et al noted that infants in rural Mississippi with a birthweight ≥2500g had more than three times the odds of being breastfed from birth than those with a birthweight <500g (aOR = 3.2, 95% CI 1.0-3.5) (Kum-Nji et al., 1999), however the data was not adjusted for gestational age or presence of foetal growth restriction, which may influence the outcome.

Admission to Special Care Nursery

The evidence for an association between poor infant health, and admission to a NICU, and poorer breastfeeding outcomes in rural areas is mixed. Sjöström et al noted that infants born to rural Swedish mothers who were admitted to the NICU had one fifth the odds of being breastfed at two months compared with those infants not admitted (OR = 0.2, 95% CI 0.1-0.7), although this factor was not significant for rural Australian mothers (Sjostrom et al., 2013). Similarly, Scott et al reported that infants who were admitted to a Special Care Nursery (SCN) had approximately half the odds of breastfeeding at discharge (aOR = 0.55, 95% CI 0.35-0.86) and greater risk of having ceased breastfeeding before six months (aRR = 1.56, 95% CI 1.16-2.08) (Scott et al., 2001), however this finding was not reported by rurality.

Bailey and Wright, in their study of breastfeeding initiation in rural Tennessee, did not find an association between admission to high-care nursery and breastfeeding initiation. They contended that although their results concurred with other studies, the measurement of infant health might not have been sufficiently sensitive to determine an association (Bailey & Wright, 2011). Similarly, Flower et al did not find a significant association between significant infant health problems (including admission to NICU and prolonged hospital stay beyond mother's discharge) and breastfeeding initiation or duration in their rural sample (Flower et al., 2008). These

findings are consistent with other research, which has also failed to demonstrate significant association between infant health and breastfeeding initiation and duration.

As with urban areas, the evidence for this factor as an independent influence in rural areas is inconclusive. Other factors such as maternal self-efficacy and supportive hospital practices are likely to contribute to improved breastfeeding outcomes where barriers exist. Furthermore, methodological improvements to study design, such as measuring length of stay in high-care nurseries, may be able to detect associations in rural settings.

Delivery Method

In rural areas, studies examining the association between delivery method and breastfeeding practice have reported inconsistent results. Sjöström et al found that rural women who experienced either an instrumental vaginal birth or caesarean birth had one fifth the odds of breastfeeding at two months compared with those women who experienced unassisted delivery (OR 0.2, 95% CI 0.1-0.5) (Sjostrom et al., 2013), although the results were not adjusted for confounders. Conversely, in a study of the effectiveness of a peer-counselling program in rural West Tennessee, the authors concluded that delivery via caesarean section was not significantly negatively associated with breastfeeding initiation or duration in this rural cohort (Shaw & Kaczorowski, 1999). In their study of breastfeeding outcomes a combined rural and urban sample, Scott et al found that despite women who experienced vaginal delivery having greater odds of breastfeeding at discharge from hospital, they failed to find an independent association between delivery method and either breastfeeding at discharge or breastfeeding duration (Scott et al., 2001). It is unlikely that inconsistencies between studies are due to any fundamental differences between rural and urban women and the influence of delivery method on breastfeeding practice. Rather, these inconsistencies may reflect the differences in grouping of delivery methods, with some studies including assisted delivery with surgical delivery, and others grouping non-surgical deliveries (vaginal and assisted) together.

As with urban areas, the evidence for an association between delivery method and breastfeeding practice in rural settings is inconsistent. It is recommended that rural health services continue to promote policies and practices such as those recommended by the WHO that minimise the separation of mother and infant and offer support for mothers who have delivered via caesarean to manage any physical difficulties associated with attachment.

Smoking

The association between smoking and breastfeeding outcomes has been examined in rural settings. Bailey and Wright reported that 43% of their sample of 2,323 women in rural Southern Appalachia smoked at some point in their pregnancy, and had twice the odds of not initiating breastfeeding than non-smokers (aOR 2.00, 95% CI 1.58-2.53) after adjusting for potential confounders (Bailey & Wright, 2011).

Three of the studies selected for review examined smoking, both during pregnancy and lactation, and found while smoking during pregnancy was significantly negatively associated with breastfeeding initiation and duration in univariate analysis, it did not remain significant in multivariate analysis (Bailey & Wright, 2011; Flower et al., 2008; Hanson et al., 2003).

The evidence for the association between smoking and breastfeeding practice in rural areas is conflicting; however there is strong evidence in other settings that smoking is adversely associated with breastfeeding intention, initiation and duration. In addition, smoking may act as an indicator of general health awareness and may present opportunities for health professionals to discuss health-promoting behaviours with pregnant women. Given the higher rate of smoking in rural areas amongst women of childbearing age, it is recommended that rural health services continue to tackle smoking in pregnancy and during breastfeeding in order to positively influence breastfeeding behaviour.

Maternal Obesity

The relationship between maternal obesity and breastfeeding practice was examined in two studies selected for review. In a cross-sectional study of 1109 women in rural New York state, researchers found that whilst there was no significant difference in attempting to establish breastfeeding between women who were normal weight, overweight and obese women, those who were overweight (OR=2.54, $p<0.05$) and obese (OR=3.65, $p<0.05$) had lower odds of establishing breastfeeding in hospital (Hilson et al., 1997). The authors concluded that excess adiposity may play a role in delayed lactogenesis. The study also reported higher risk of discontinuation of exclusive breastfeeding in overweight (RR=1.42, $p<0.05$) and obese (RR=1.68, $p<0.01$) women. The authors postulated that a dose response to initiation and duration exists, with greater levels of overweight giving rise to lower levels of breastfeeding success. Mechanical difficulties were offered as an explanation, but could not be determined from the study.

A more recent study of breastfeeding outcomes for 151 women in rural New York state found that those with a higher pre-pregnant BMI were more likely to experience delayed lactogenesis compared with those of normal weight (Hilson et al., 2004). Additionally, obese women were at higher risk of early cessation of breastfeeding (RR=2.43, 95% CI 1.50-4.20 $p<0.002$), although there were not significant differences between BMI groups for cessation of exclusive breastfeeding. When adjusted for potential confounders such as intention to return to work, shorter planned duration of breastfeeding, less satisfaction with appearance, greater indifference towards breastfeeding and delayed lactogenesis, obese women were still at more than twice the risk of early cessation of breastfeeding than normal/underweight women (aRR=2.37, 95% CI 1.11-5.04; $p=0.03$). The addition of breastfeeding behaviour scores (a measure of a series of mother/infant responses, attachment and positioning required for successful breastfeeding) to the model, the relative risk became non-significant, suggesting that behaviour may play a role in the relationship between obesity and breastfeeding duration, however the small sample size in addition to the unexpected distribution of association of primiparity and increased BMI and meant that the authors were unable to determine whether

obesity was independently associated with delayed lactogenesis (Hilson et al., 2004).

Whilst there is a growing body of evidence for the association between maternal pre-pregnancy obesity and poor breastfeeding outcomes in the literature, only two of the studies included in this review reported obesity as an independent variable in rural settings. What is known however is that as the prevalence of obesity rises in developed countries, so does the number of women of reproductive age who are overweight and obese. Given the rising level of obesity amongst women of childbearing age and the additional burden of obesity in rural communities, these findings are critical to ensuring that rural women who are overweight are offered support to successfully establish breastfeeding and assisted to return to a healthy weight for subsequent pregnancies.

Other Factors

Of the studies selected for review, none reported breastfeeding problems as a variable under study; therefore it is not possible to determine the strength of evidence for this factor in rural settings. Further research may provide more evidence, but the literature suggests that strengthening maternal self-efficacy may be effective strategy in assisting rural women to identify breastfeeding problems, and seek help to manage them. Likewise, no analysis of the influence of pacifiers on breastfeeding outcomes was reported in any of the studies, however, given that evidence of the negative impact of pacifier use on breastfeeding exists for other settings, it would be prudent to recommend that rural health services continue to support the principles of BFHI and discourage the use of pacifiers before the establishment of breastfeeding.

None of the studies selected for review reported on alcohol consumption as a variable under study, therefore it is not possible to determine the strength of this factor on breastfeeding outcomes in rural areas. However, given the physiological evidence for poor lactational outcomes in other settings and the strong evidence

around general health outcomes, rural health services should continue to promote current alcohol consumption recommendations for breastfeeding women.

There was no evidence for the influence of sources or types of breastfeeding information on breastfeeding outcomes from the reviewed studies. A number of studies examined methods of support offered to breastfeeding women in rural areas, however none identified innovative technologies, such as online or web-based support or 'virtual' breastfeeding consultations. Given the increasing reliance on electronic media for a range of functions, both in rural and urban areas, further evidence for the effectiveness of such supports is recommended.

2.10 Limitations of Review

This review of breastfeeding determinants has some limitations and these should be considered in the generalisation of the findings. Firstly, while the overall quality of the studies was moderate, most studies were cross-sectional in nature, negating the determination of causality. Secondly, it appears that the term 'rural' is inconsistently defined, interpreted and applied in the literature, making comparison of studies challenging. The majority of the studies included in this review relied on familiarity with geographical location as the marker of rurality. The use of standard classification methods for determining rurality would assist in applying the findings in other settings. Thirdly, the breastfeeding definitions used across the studies were not consistent, and few studies examined breastfeeding exclusivity. Finally, much of the evidence from the United States was based on samples drawn from WIC participants, where provision of low cost or free formula to mothers is widespread, limiting the generalisability of these findings.

2.11 Conclusion and Recommendations

Whilst the evidence for the determinants of breastfeeding initiation and duration in rural areas of developed countries is limited, the findings from the studies reviewed add to the evidence base and inform further research. The strong association

between sociodemographic variables and breastfeeding practice are in line with findings in other settings and reinforce the need to encourage and support rural women from sociodemographically disadvantaged backgrounds to breastfeed their infants. Additionally, addressing modifiable biomedical factors such as pre-pregnancy obesity, alcohol consumption and smoking for women of childbearing age in rural communities should be a priority in order to reduce the risk of suboptimal breastfeeding outcomes.

This review has also confirmed the importance of practices employed by health services, regardless of geographical location, to support the establishment and continuation of breastfeeding. Practices that minimise the separation of mother and infant; encourage early and sustained opportunities for breastfeeding establishment and offer consistent support should continue to be promoted in rural maternity facilities. Rural health services should also continue to focus on creating and maintaining a knowledgeable, confident and supportive workforce where health professionals are equipped to provide timely and practical assistance for breastfeeding mothers. Novel and innovative ways to offer this support should be explored, particularly for geographically and socially isolated women in rural and remote communities. Most importantly, rural health services should ensure that their staff are skilled in assisting women to develop their self-efficacy around breastfeeding in order to maximise their ability to identify and solve breastfeeding problems using the resources available.

At a broader level, breastfeeding as the normal and desirable way of feeding infants needs to be promoted in rural communities, particularly for young women and their potential partners, in order to develop positive attitudes towards breastfeeding. Supportive strategies such as breastfeeding-friendly workplaces demonstrate commitment to breastfeeding and should be considered by rural employers to increase the likelihood of meeting breastfeeding goals.

This review has identified areas where evidence is limited and given the lack of methodologically robust studies in rural settings, there is a need for further

research to determine influences on breastfeeding practice, based on consistent breastfeeding definitions using suitable methodology.

Chapter 3 - Methods

3.1 Study Aim

The aim of this research was to evaluate the current infant feeding practices of women in rural Western Australia (WA), as well as determining the barriers and enablers to initiating and maintaining breastfeeding in this region.

3.2 Background

3.2.1 Overview

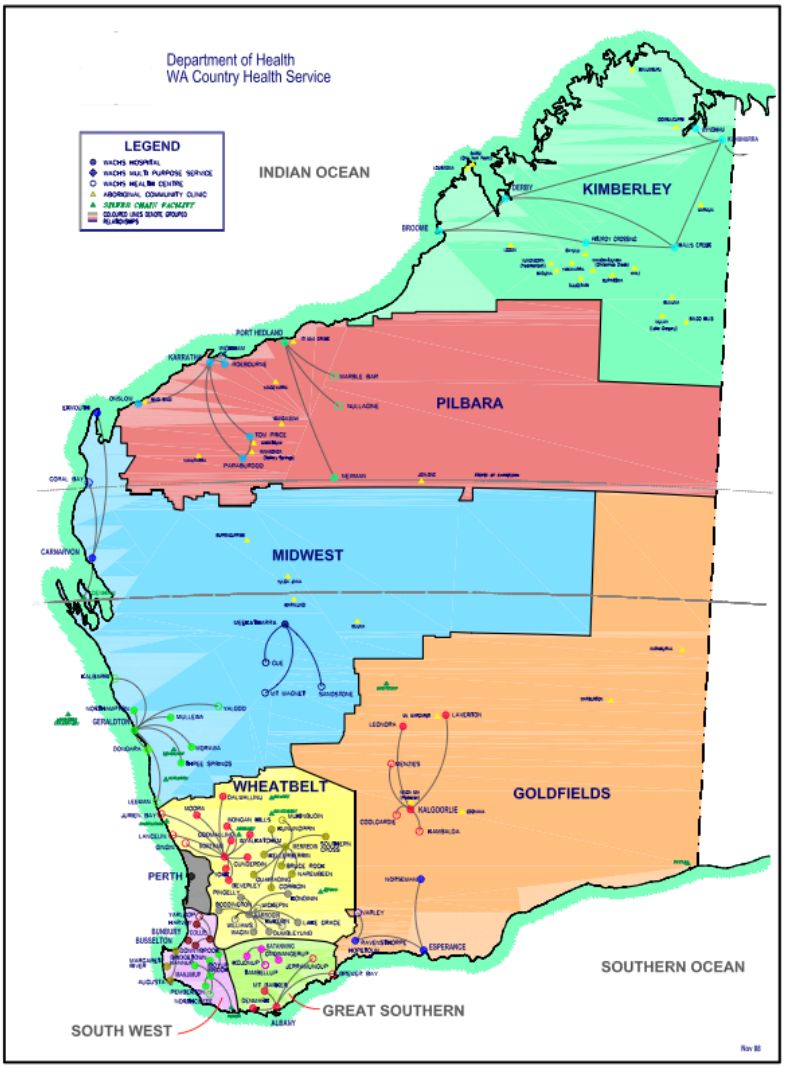
Western Australia (WA) is a vast state, with a landmass of 2.5 million square kilometres covering one third of Australia. Whilst it is larger than Western Europe in size, approximately 75% of the 2.35 million residents of WA live in the Perth metropolitan area (Australian Bureau of Statistics, 2012). The remainder of the state is sparsely populated, with resultant variations in access to services such as health care, including maternity services. Of the 30,843 births in WA in 2010, 7,153 (23%) were to women who resided in non-metropolitan locations (Joyce & Hutchinson, 2012).

In 2010 the Estimated Resident Population of non-metropolitan WA was 509,713, accounting for 22% of the state's population (Australian Bureau of Statistics, 2012). The demography of rural WA differs slightly to the state overall, with a greater proportion of Aboriginal people (9% vs. 3%) and fewer residents born overseas (14% vs. 31%). The majority of country residents (95%) speak English at home, compared with 87% across WA.

Non-metropolitan WA is divided into geographical regions for a variety of purposes, but often aligned to the functions of health, education, land management, economic development and government. The regions vary in geography and climate, industry, population density and demography. Of the four primary regions involved in this study, each has a regional centre characterised by urban housing

and amenities, with populations ranging from 6,500 - 30,000 people. The majority of regional populations tend to be concentrated in and around regional centres; however people living in remote communities can face travel times of 6-12 hours to the closest regional centre to access health services.

Figure 3.1: Regions of Western Australia



The regions involved in the study have a mixed industry base, with mining, agriculture, fishing and tourism the primary sectors. At the time of commencement of this study, Western Australia was experiencing a significant upturn in the mining sector, which in turn impacted on the demographics of the regions under study.

3.2.2 Health indicators

The crude birth rate for the state in 2010 was 13.5 per 1,000 total population, compared with 14.0 for country WA (Joyce & Hutchinson, 2012). Aboriginal women accounted for 16% of births in non-metropolitan WA in 2010 (Joyce & Hutchinson, 2012), with a higher age-specific birth rate than that for non-Aboriginal women of childbearing age (97.5 per 1000 women vs. 65.9 per 1000 women) (Joyce & Hutchinson, 2012).

Delivery by caesarean accounted for 25% of births in country WA in 2010, compared with 34% for the state as a whole. It should be noted that this figure is influenced by the higher rate of caesarean in the state's tertiary maternity service (which would include high risk or complicated pregnancies transferred from country locations), however the two country private hospitals recorded rates of 28% and 35% respectively (Joyce & Hutchinson, 2012).

Of the infants admitted to a Special Care Nursery facility in WA in 2010, almost one quarter (22%) stayed no more than one day and just under one half (49%) had a stay of 1-3 days (Joyce & Hutchinson, 2012). The median length of stay post-delivery in WA in 2010 was 3.0 days (Li et al., 2012).

3.2.3 Health Services

Publicly funded acute and primary care health services in non-metropolitan WA are provided across the seven health regions by the WA Country Health Service (WACHS) (see figure 3.1). WACHS is a government statutory authority under the Hospital and Health Services Act 1927 and is recognised by the Commonwealth Government as the single legal entity for Country Local Health Networks in Western Australia (WA Country Health Service, 2011).

WACHS manages 70 hospitals across country WA regions, with obstetric services provided at 23 locations within those health regions, primarily in regional centres and larger towns (WA Country Health Service, 2011). There are two private

hospitals in non-metropolitan WA, both operated by the St John of God Health Care group, a private, not-for-profit Catholic health care organisation.

Routine antenatal care in country WA is primarily provided by general practitioners, although women in some locations also have access to specialist obstetricians and midwife-run antenatal clinics. In 2010, a third of women in country WA were in their first trimester at the time of their first antenatal visit, however just over 1% of did not receive any antenatal care during their pregnancy (Joyce & Hutchinson, 2012).

Obstetric services in country areas support routine, uncomplicated births. Where hospitals have Special Care Nurseries capable of providing secondary neonatal care at Level 2a/2b (generally in regional centres) the need for transfer may be reduced, however high risk pregnancies; infants who are born <37 weeks gestation or <2,500g; or have significant health issues may require transfer to a metropolitan tertiary facility.

3.3 Support for Breastfeeding in Country WA

3.3.1 Breastfeeding Policy

The provision of breastfeeding support is recognised by health professionals as critical in ensuring the best outcomes for mothers and infants. In 2009, the WA Health Department endorsed the Baby Friendly Health Initiative - Hospital Breastfeeding Policy (Department of Health, 2009), which aimed to create an environment in which breastfeeding was encouraged, supported and promoted within WA Health maternity facilities. The policy required all WA Health facilities and staff to adhere to the principles of the Baby Friendly Health Initiative (BFHI) and the WHO Code of Marketing of Breast Milk Substitutes. The '10 Steps to Successful Breastfeeding' formed the key elements of the policy and staff who provided breastfeeding advice to mothers and families were required to complete training as specified under the BFHI accreditation process. As there is no specific data to support the level of compliance with the policy in WA, it is difficult to determine the

extent to which the policy enabled those healthcare environments supported and encouraged breastfeeding. The near-universal breastfeeding initiation rates reported in state and national infant feeding data however suggest that maternity facilities in WA are providing breastfeeding support.

3.3.2 BFHI Accredited Facilities

There are currently three BFHI accredited maternity facilities in WA, all located in the metropolitan area of Perth. At the commencement of this study, one non-metropolitan hospital within the study catchment area was accredited as Baby Friendly, but this accreditation lapsed in 2013.

3.3.3 Breastfeeding support services

Breastfeeding support varies across regions, however at a minimum midwives staff all hospitals with obstetric facilities. Antenatal classes provide information about breastfeeding and are offered by both public and private hospitals; however these are generally only conducted in regional centres or towns with sufficient population size and may be run only when there is demand. Additional community support is provided by Child Health Nurses, some of whom have undertaken additional training in breastfeeding. Child health clinics are provided by regional health services, but may be on a visiting basis to small towns and can vary in frequency from weekly to monthly. Face to face support from breastfeeding support groups, board-certified lactation consultants, and peer counselling services may be offered but are dependent on the presence of these resources within the local communities. Services such as breastfeeding helplines (including those provided by the Australian Breastfeeding Association and the Ngala parenting support service) and telephone or online consultations with lactation consultants are also available. For women who live outside regional centres, access to these services depends on access to transport or reliable telecommunications such as phone (landline or mobile) or Internet access.

3.4 Study Overview

A prospective cohort study of 427 women was conducted in rural Western Australia between March 2010 and November 2012. Women who had delivered at a non-metropolitan hospital in one of four WA Country Health Service health regions were invited to participate in the study. Those mothers who consented to participate were asked to complete a baseline questionnaire, and were subsequently contacted at 4, 10, 16, 26, 32, 40 and 52 weeks after the birth of their baby to complete follow-up questionnaires, either online or by telephone.

The study also included a nested intervention to determine the effectiveness of an online intervention to support breastfeeding practice. Participants who consented to take part were randomly assigned to either the intervention or control group and were able to access infant feeding information via a specifically designed website. Mothers who were assigned to the intervention group were also able to take part in discussion forums and seek support from a certified lactation consultant in addition to the information available to the control group from the website.

3.5 Survey Instruments

The survey instruments were based on the Perth Infant Feeding Study (PIFS) data collection tools, modified to capture rural-specific demographics and allow for completion online through a survey. The tools were kept as consistent with the PIFS versions as possible to allow direct comparison between the studies, as outlined in the study objectives in Chapter 1. The tools had been previously validated for use in urban populations, therefore were piloted prior to use in the study on a small sample of four women who had recently delivered a baby at a regional hospital. These women were not participants in the subsequent study. The survey tool had been previously used in infant feeding research and validated in countries including Australia (Graham et al., 2005), China (Xu et al., 2007), Kenya (Lakati et al., 2002) and Vietnam (Duong et al., 2005).

The survey tools contained identical questions in all formats (hard copy, online and interviewer-led) with minor modifications to the order of the questions in the online version to ensure that the collected data was transferrable in a consistent format to the data analysis software.

As both the baseline and follow-up survey instruments were designed to be primarily self-administered, a level of literacy was assumed and required of participants. Previous usage of the hard copy baseline tool and the follow-up tool via phone interview, in addition to the feedback from the pilot testing, indicated that the instrument used language that was easy to understand.

Whilst the survey content was identical in all formats of the tool, the use of online data collection in addition to the hard copy and interviewer-led formats was a novel method for this survey. There is potential for online survey methods to confer a selection bias, with lower income households less likely to have computer access (Australian Bureau of Statistics, 2011), however there were no significant sociodemographic differences found between respondents using either method.

3.5.1 Baseline Questionnaire

The baseline survey instrument was a 21 page structured questionnaire, containing 67 items and taking approximately 30-40 minutes to complete. Both closed- and open-ended items were included in the tool and answers to the open-ended items were subsequently recoded (see Appendix 1). The survey was provided in hard copy format to all mothers upon recruitment to the study and assistance was provided to those mothers who were unable to physically complete the hard copy. The baseline questionnaire was also replicated in an online survey facility and was able to be completed electronically (for example where the mother preferred this method or where the original hard copy survey had been lost before completion and return to the researchers).

The baseline questionnaire was designed to determine breastfeeding initiation, identify infant feeding method while in hospital and to collect information on variables known, or suspected, to be associated with breastfeeding duration, including:

- socio-demographic factors (e.g. maternal age, education, occupation, ethnicity, marital status, family income, partner's occupation, distance from regional centre, length of residence in regional WA)
- psychosocial factors (e.g. maternal infant feeding attitudes and beliefs, influence of significant others, social support, infant feeding intentions)
- bio-medical factors (e.g. method of delivery, infant health problems, breastfeeding problems, maternal weight status)
- health and lifestyle behaviours prenatally and antenatally (e.g. smoking status, alcohol intake, level of physical activity)
- hospital practices (e.g. early mother-infant contact, demand feeding, rooming-in, antenatal and postnatal education)
- sources of information about infant feeding, both before the birth of their baby and during their hospital admission

3.5.2 Follow up Questionnaire

At the specified time points, mothers were contacted via an email reminder with a link to the survey if they had elected to complete the survey online. Mothers were contacted by phone where they indicated that they did not have Internet access, or preferred to complete the survey with the researcher. The follow-up questionnaire was also based on the PIFS II survey instrument and the content was identical for both formats. Minor modifications, such as question order, were made to the electronic format to ensure the data collected was transferred in a consistent format for analysis. Questions included in the follow-up questionnaire were designed to elicit information on current feeding practices, the types of problems experienced by women during the course of lactation, health and lifestyle behaviours undertaken postpartum, and to identify the time of weaning and

reasons for the cessation of breastfeeding (see Appendix 2). The questionnaire took approximately 15-30 minutes to complete, dependant on changes to feeding method (ie when formula or solids were introduced, additional questions were asked). Additional questions were included for subjects in the intervention group, related to use of online sources of infant feeding information and usefulness of the Nurturing Together website for supporting breastfeeding.

3.6 Data Collection

3.6.1 Sample Inclusion / Exclusion Criteria

All mothers over the age of 18 who had delivered an infant without significant health problems at the identified hospitals were eligible for the study. Mothers also needed to be able to speak and read English without the need for an interpreter, and normally reside in a non-metropolitan area of Western Australia. Participation of mothers under the age of 18 who wished to take part in the study was assessed against the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council et al., 2007 (updated December 2013)) to determine if their inclusion was ethical. One participant was 17 at the time of giving consent, but turned 18 during the course of the study and was therefore included in the sample.

Mothers ineligible to participate in the study were those whose infants required transfer to a metropolitan tertiary neonatal intensive care unit; those who required an interpreter; and those who were deemed unfit for medical or other reasons by the medical or nursing staff. Mothers who did not deliver their infant in hospital (ie homebirth) or who delivered at a hospital outside the study regions (ie at metropolitan hospitals or interstate) were also ineligible.

3.6.2 Sample Size

It was anticipated that the recruitment process would take approximately 12 months based on the historical number of deliveries in the region, and the experience of researchers from PIFS and PIFS II. To detect a prevalence of "any breastfeeding" at six months of 50%, a final sample size of 400 was calculated using the StatCalc program of Epi Info™, assuming power of 0.80 and significance of 0.05. Allowing for approximately 20% loss to follow-up, an initial sample of 500 was estimated. This estimation was calculated using the StatCalc program of Epi Info 2000. (Centers for Disease Control and Prevention, 2008)

3.6.3 Recruitment

The study sample was recruited from non-metropolitan hospitals (both public and private) across four WA Country Health Service regions between March 2010 and November 2011.

Women who had recently delivered a baby in hospital were contacted and invited to participate in the study by research staff with assistance from maternity staff at each hospital. Attempts were made to contact all eligible mothers. Where possible, the researcher or midwife visited the mother prior to discharge to and invited her to participate in the study. In some instances, it was not possible to talk with the mother, for example where she had visitors, where staff identified the mother as not appropriate to contact at that time (for example, if she had developed post-delivery complications), or where the maternity staff requested that mothers not be disturbed. There were also occasions where mothers had been discharged prior to being provided with information about the study. Where contact details were available, contact with the mother was attempted through the Child Health Nurse, who provided information about the study, including the consent form.

After explaining the study, the research assistant or maternity staff member provided the mother with a study information sheet, which also acted as the

consent form (see Appendix 3). The signed consent form was copied and returned to the mother, along with a username and password for completing subsequent surveys if she indicated that she had Internet access and was willing to use this method of contact. The login details allowed the mother to access the *Nurturing Together* website, which contained information about infant feeding and acted as the repository for the survey responses. All mothers who consented to participate in the study and who had access to the Internet were able to access the basic website with links to infant feeding information and the survey tools.

The online intervention was nested within the cohort study. Details of the specific methodology for this study are presented elsewhere (Giglia et al., 2015). Mothers recruited to the cohort study were alerted on the Information and Consent Form that they may be contacted via email regarding receiving information and assistance via a website. This was also explained by the recruiting research officer. Once enrolled in the cohort study, participating mothers created their own log in username and password in order to complete the online surveys pertaining to the cohort study. Upon completing this information an automated email was generated and sent to the mother. The email contained a link to the Information and Consent Form for the website intervention study and the option to consent to be involved in this nested intervention. Once consent was received, mothers were randomly assigned to the intervention or control group using an automated process through the website. Those mothers not consenting could remain in the cohort study and receive only those questions pertaining to the cohort study on infant feeding in rural Western Australia. Those mothers consenting to participate in both the cohort study and the Internet intervention received questions in their cohort study at the time points outlined in the Information and Consent Form that also pertained to the Internet intervention.

3.6.4 Administration of Baseline Questionnaire

After consenting to take part in the study, all mothers were given the baseline questionnaire to complete, along with a reply-paid envelope to enable the

responses to be sealed. Completed hard copy surveys were either left in a marked box at the ward administration area, or were posted using the reply-paid facility. Mothers were encouraged to complete the survey whilst in hospital to ensure accuracy of data. Where the survey was not received in hard copy (for example where mothers had left hospital before completing the survey or had misplaced the survey forms) the researchers arranged for electronic access to the survey forms for completion through the online survey facility. The content of the online survey form was identical to the hard copy form to ensure consistency of data, with minor modifications to the order of some questions to ensure that the data could be transferred accurately from the survey collection tool to the data analysis software files.

Baseline surveys were checked after collection and attempts were made to contact mothers either by email or phone to clarify information that was missing or unclear.

3.6.5 Administration of Follow-up Questionnaires

Mothers were contacted a further seven times after they completed the baseline in-hospital survey. The follow-up contacts were scheduled at 4, 10, 16, 26, 30, 42 and 52 weeks post-partum. The questions asked in the follow-up questionnaire were identical for both the online and telephone participants, with the exception of question order to allow the survey system to skip non-relevant or previously answered questions.

Online

Links to each age-relevant survey were emailed to participants via the Nurturing Together website, allowing completion of the follow-up surveys online. The link was unique to each participant and contained general confirmation questions to verify identity. At each time period, questions about current feeding method, changes to feeding method, baby's health and mothers wellbeing were asked, as well as questions related to feeling about breastfeeding, including cessation of breastfeeding if relevant.

A list of mothers who had not completed their surveys at each time point was generated by the Nurturing Together website, which was linked to the survey collection tool. This was cross- checked with a manual review of the surveys within the collection tool. Where the system detected that a survey had not been completed, reminder emails were automatically re-sent with the survey link. Once completed, the survey was recorded in the survey collection system and no further emails about that survey were sent. Attempts were made to contact by phone those mothers who had received repeated reminder emails about overdue surveys. If mothers were unable to be contacted after a minimum of five phone calls, a letter encouraging them to contact the researcher was sent. If they were still uncontactable, they were considered lost to follow-up.

Telephone

Mothers who did not have Internet access were contacted by the researcher via telephone at each of the seven time points to complete the follow-up surveys. Answers to the questions were recorded on a hard copy form and kept in a secure location at the Combined Universities Centre for Rural Health (CUCRH) or at Curtin University. At the first phone interview, a suitable time of day for future contact was identified, in order to accommodate their and their infant's routine. If the mother was contacted at a time that was not convenient for any reason, an alternative time was arranged to complete the interview. Completion of the survey questions took between 15 and 30 minutes, dependant on whether the mother had experienced any feeding or health problems, or if the feeding method had changed in the preceding time period. Attempts were made to contact mothers within three days of the scheduled interview date, and if contact was unsuccessful, a further six attempts were made at different times of the day to reach them. If the researcher was still unable to make contact with the mother, a letter was sent to the postal address provided on the consent form, emphasising the value of her participation in the study and encouraging the mother to make contact with the research team (see Appendix 4). If no response was received to this letter, the mother was considered lost to the study follow-up.

3.6.6 Management of non-respondents and incomplete data sets

As described above, in some circumstances it was not possible to contact eligible women following the delivery of their infant. Where possible, efforts were made to contact those women through the health service via the home visiting midwives or child health nurses to invite their participation in the study, however a number of women remained uncontactable. These women accounted for the majority of non-participants from the eligible cohort.

There were a small number of eligible women (n=16) who declined to participate in the study. When this occurred, the researcher requested some basic demographic details, such as age, parity, level of education, marital status, family income and level of health insurance. It was explained that the information would assist in determining if the sample was representative and would remain confidential. Of those women who declined to participate, a further 13 also declined to provide the demographic information. The right of non-participants to decline to provide this information was respected by the researcher, however subsequent analysis of the sample found no significant differences in sociodemographic variables compared to the cohort of women from the study catchment area who delivered in the study period (see Chapter 4).

Women who consented to the study but did not complete the baseline survey were not included in any analysis. In order to retain sufficient power for analysis, participants who completed the baseline survey but were unable to be contacted at any of the subsequent follow-up time points were coded as incomplete data sets and included in subsequent analysis.

3.6.7 Online Intervention

Participants in the study were randomly assigned to the intervention or the control group upon enrolment. The intervention was designed to provide best practice

infant feeding information, and the content of the Web site was developed using formative research with the target group and the current evidence-based infant feeding recommendations at the time. The intervention group were able to ‘‘post’’ on the discussion forums, initiate e-mail conversations with other group members, and contact a certified lactation consultant or the chief investigator online (and using a Webcam) with any questions. The intervention group had access to the study Web site, and mothers in the control group accessed a Web site that redirected them to helpful parenting and infant feeding Web sites which had been assessed for accuracy of information. The allocation to control or intervention group was ‘‘without prejudice,’’ and all mothers received normal postpartum maternity services available in the community.

3.7 Ethical Considerations

The study design and data collection methods, including the survey instruments, were approved for use by the Curtin University Ethics committee (see Appendix 5), and of the participating health services ethics committees. Prior to obtaining consent to take part in the study, women were provided with a verbal summary of the research as well as detailed written information in the form of combined information and consent form. Mothers were informed of the voluntary nature of participation, and that withdrawal at any time was permissible and without prejudice. Consent to participate was sought only after the study had been explained and any questions regarding the research were answered.

Once consent was obtained, study participants were allocated a unique identification number, which was used to track responses to the follow-up questions. Contact details such as telephone number, postal and email addresses were requested to enable contact for follow-up surveys and were stored separately from the survey responses.

Confidentiality of the data was assured, with all completed hard copy surveys kept in a locked cabinet at either Curtin University or the Combined Universities Centre for Rural Health in Geraldton, accessible only by the research team. Online

responses were de-identified and stored as data files protected by a password and accessible only by the research team. All subsequent data analysis was performed on de-identified data and results were presented in grouped format.

3.8 Data Analysis

All data were coded, entered into and analysed using IBM SPSS Statistics for Windows (SPSS) Version 21 (IBM, 2011). Analyses of data distribution were conducted to identify coding and data entry errors. Plausibility checks were undertaken to assist in identifying inconsistent data, then cleaned and corrected where necessary.

Online responses to the baseline and follow-up questionnaires were downloaded as SPSS files and the open-ended questions were manually re-coded. Data were checked for accuracy after entry into the data file, to ensure that all responses were consistent with previous data. Where there was a discrepancy, the mother was contacted to clarify the response. Recall bias was minimised by collecting the information as close the specified age as possible, however as behaviours were self-reported, it is possible that mothers overestimated the duration of both exclusive and overall breastfeeding.

3.8.1 Outcomes of interest

The primary outcomes of interest in this study were breastfeeding initiation, duration of exclusive breastfeeding and duration of any breastfeeding, using the definitions as provided in Chapter 1. Breastfeeding at discharge (both exclusive and any) were also assessed as outcomes of interest in relation to health service factors.

3.8.2 Variables

Maternal age, education level, occupation and income

Maternal age categories were constructed to allow comparison to data from the PIFS I and II studies. Age categories based on 5-year intervals also allowed comparison to international literature. Levels of educational achievement used in

the PIFS I and II tools were retained to allow direct comparison to these studies and to Australian census data. Occupational titles were recoded to align with the Australian and New Zealand Standard Classification of Occupations (Australian Bureau of Statistics, 2013a). Family income categories were based on Australian census data and modified to reflect higher median income levels in Western Australia at the time of the study.

Remoteness

The Accessibility/Remoteness Index of Australia (ARIA) classification was used to categorise participants' remoteness. The ARIA methodology is a comparatively simple geographical approach, as calculation of ARIA categories is based on road distance measures, using point locations of each town and service centre to determine the score. This methodology makes the score relatively robust over time, however it is based on a number of assumptions regarding car ownership and road conditions, which may not always hold true in all areas of Australia, particularly remote and very remote locations (Australian Institute of Health and Welfare, 2004).

3.8.3 Descriptive and Univariate Analysis

Once the data was re-coded and checked for consistency, outliers and other errors were identified using frequency tables and graphs and subsequently corrected. Frequency distributions, means and standard deviations were then generated to describe demographic characteristics of the sample such as maternal age, gestational age and birth weight. Frequencies were also produced for all variables collected through the questionnaires. Univariate analysis was employed to allow comparison between variables of interest and further describe the sample. Where the outcome variables were continuous, the paired t-test was used to compare means and determine significant differences. Where the outcome variables were categorical, the chi-square test was used to determine significant associations. Fisher's Exact Test was used where cell counts were <5. All tests were two sided and a p value of less than 0.05 was considered statistically significant.

3.8.4 Multivariate analysis

To determine factors associated with breastfeeding outcomes, variables previously reported in the literature to be predictors of initiation and duration were investigated using binary logistic regression analysis. Those found to have significant associations with the outcomes of interest were subsequently entered into multivariate logistic regression models using a backwards stepwise procedure. Variables from this study that were not found to have significant associations, but which had been previously identified in the literature as potential confounders, were also added to the model to ensure that all potential factors were included.

In addition to the production of summary statistics to describe the sample and simple associations between variables of interest, statistical tests were applied dependant on the outcomes of interest. The following is a summary of the statistical testing applied:

Breastfeeding Initiation and Breastfeeding at Discharge from Hospital

Descriptive summary statistics were produced to describe the sample. Univariate logistic regression analysis was used to screen for potentially significant factors influencing breastfeeding initiation and breastfeeding at hospital discharge. Association between breastfeeding practice ('any' and 'exclusive' breastfeeding at discharge) and the significant factors reported in univariate logistic regression analysis were then examined using multiple logistic regression, controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. Backward elimination procedure was applied to obtain the final model in the regression analysis. All tests were two sided and a p value of less than 0.05 was considered statistically significant.

Breastfeeding at Specified Time Points

Univariate logistic regression analysis was used to screen for potentially significant factors influencing breastfeeding duration. Association between breastfeeding

practice ("any" and "exclusive" breastfeeding) at four months (17 weeks), six months (26 weeks) and 12 months (52 weeks) and the significant factors reported in univariate logistic regression analysis were then examined using multiple logistic regression, controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. Backward elimination procedure was applied to obtain the final model in the regression analysis. All tests were two sided and a *p* value of less than 0.05 was considered statistically significant.

Breastfeeding Duration

Survival analysis provides a picture of 'time-to-event' and is commonly employed in determining breastfeeding duration where the event is the cessation of breastfeeding practice (ref). Survival analysis is particularly useful in studies where data is incomplete or censored (due to withdrawal from the study or the continuation of the behaviour past the completion of the study). The duration of breastfeeding practices in this study was conducted using the Kaplan Meier technique, as it allows for the presence of censored data (that is, it accounts for participants who continued to breastfeed beyond the study period or who were lost to follow-up). Survival plots were produced to illustrate the duration of breastfeeding relative to selected variables (see Chapter 4).

Determinants of breastfeeding duration were identified using Cox's proportional hazards model, to determine the effect of predictor variables on the risk for cessation of breastfeeding. As with survival analysis using the Kaplan Meier technique, the Cox's proportional hazards model can accommodate censored data, making it an appropriate model for analysis of breastfeeding duration (Akter & Rahman, 2010). The hazard model assumes that independent variables exert an equal degree of hazard at each time point and provides a useful estimate of the net effect of independent variables on the event (in this case, the cessation of breastfeeding) as well as the impact on other independent variables. The Cox's proportional hazards model has advantages over other multivariate analysis models in analysis of breastfeeding duration as it allows assessment of the effect of

multiple variables over time (Akter & Rahman, 2010). Reporting of adjusted hazards ratios (aHR) provides further information about the influence of explanatory variables on 'time-to-event' outcomes such as cessation of exclusive breastfeeding before six months and is commonly employed in studies examining breastfeeding duration.

To determine variables for the Cox's proportional hazards model analysis, univariate logistic regression analysis was first used to screen for potentially significant factors influencing breastfeeding duration. Association between breastfeeding practice ("any" and "exclusive" breastfeeding) and the significant factors reported in the univariate logistic regression analysis were then entered into the model, controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. A p value of <0.10 was used for initial inclusion into the model to ensure that all confounders were adequately controlled for. Backward elimination procedure was applied to obtain the final model in the regression analysis and generate the aHR for each independent variable. All tests were two sided and a p value of less than 0.05 was considered statistically significant.

Chapter 4 - Results

4.1 Descriptive Summary

4.1.1 Participation Rate

Of the 1170 women eligible to participate in the study, 819 were contacted (70% of those eligible) and 489 women gave consent to participate (60% of those contacted) (see Figure 4.1). A total of 427 completed the baseline survey, representing 87% of consenting participants and 52% of women contacted. Women who had been discharged from hospital in the first 24 hours, women who were not on the ward at the times that the researcher visited, or who had been identified as not appropriate to contact by midwifery or medical staff (for example, those mothers who had developed post-delivery complications) accounted for those not contacted.

Of the 427 women who consented to participate, 414 were enrolled in the nested intervention (207 in the intervention group and 207 in the control group). The remaining 13 participants indicated that they did not have Internet access, therefore were not included in the intervention.

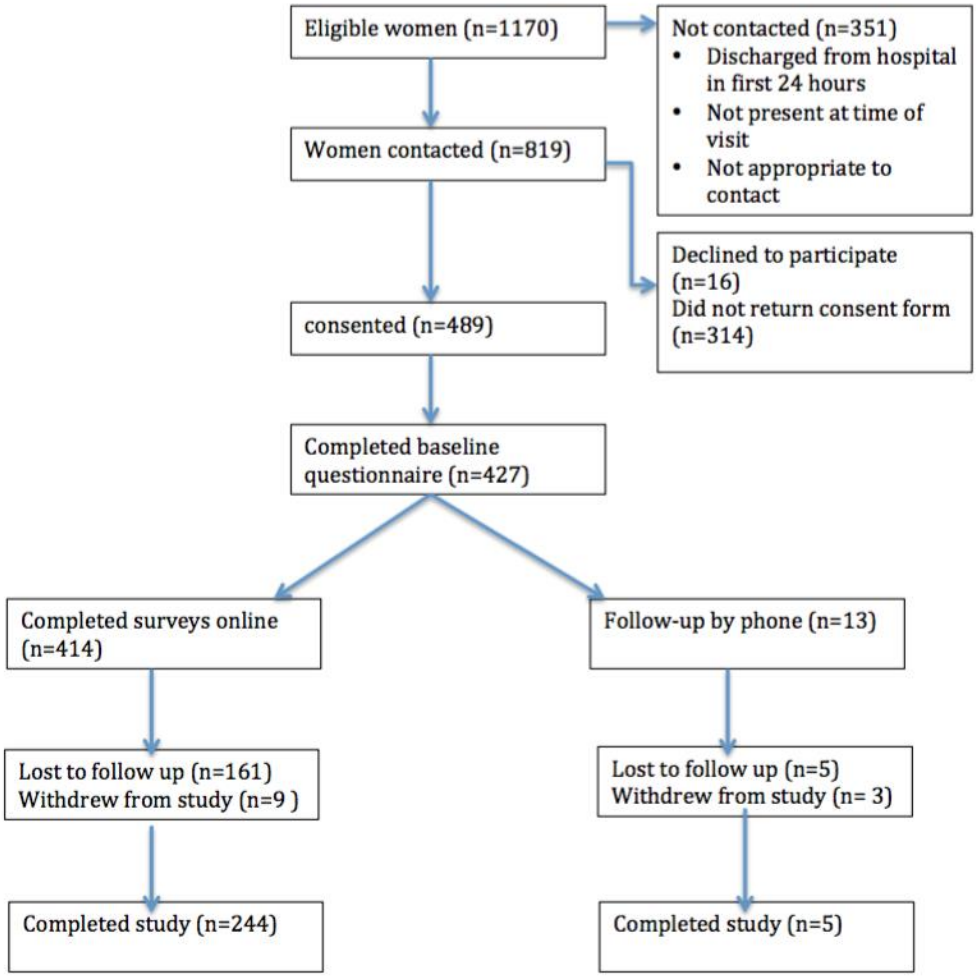
4.1.2 Participants vs. Lost to Follow-up

A total of 178 (41.6%) mothers had incomplete data sets, having failed to complete all of the surveys at the specified time points after completion of the baseline questionnaire. Compared with the women who remained in the study, women lost to follow-up were more likely to be younger, single and have public health insurance (Medicare) only. They were also less likely to have a higher degree and be employed in higher-level occupations. A comparison of the sociodemographic characteristics between participants and those lost to follow-up is provided in Table 4.1.

4.1.3 Participants vs. Regional and State-wide Births

Compared with births in Western Australia in the corresponding time period, mothers in this study were older (mean age 30.2 years (±5.2) vs. 29.6 years (±5.7), p=0.02), and the mean birth weight of their infants was greater (3523g (±471), vs. 3337g (±601), p<0.001). There were significant differences in the proportion of babies delivered via caesarean section (28.3% vs. 33.6%, p=0.026) and a greater proportion of mothers in the study were born in Australia or New Zealand (85.0% vs. 72.0%, p<0.001).

Figure 4.1: Study Flowchart



Compared with births in the regions under study, mothers in the study were older (p<0.001), and more likely to be married (p= 0.02). There were also fewer women born in countries other than Australia or New Zealand (p<0.001).

Of the 489 women who consented to participate in the study, 427 completed the baseline survey. Selected demographic characteristics of the participants are given in Table 4.2. The majority of mothers (85%) were Australian-born, and 93% indicated that they were partnered (married or de facto). More than half of the participants (56.7%) had an annual family income of $72,800 or more, and 59.9% indicated that they had private health insurance. Around one third of women (31.2%) were not in the paid workforce in the six months prior to the study and 28.8% indicated that they were on paid parental leave.

The mothers who participated in this study were of similar age to mothers giving birth in WA (mean age 30.2 years (±5.2) vs. 29.6 years (±5.7)). Babies born in the rural area were slightly heavier (3523g (±471), vs. 3337g (±601), p<0.001). Fewer infants were delivered via caesarean section (28.3% vs. 33.6%, p=0.026) and a greater proportion of mothers in the study were born in Australia or New Zealand (85.0% vs. 72.0%, p<0.001).

Table 4.1: Sociodemographic characteristics of completed participants versus those lost to follow-up (n=427)

Characteristic	**Completed Study (n=249)** n (%)	**Lost to follow-up (n=178)** n (%)	**X^2**
Maternal age (years)			X^2=12.901, df=3 p=0.005
<25	23 (9.2%)	34 (19.1%)	
25-29	75 (30.1%)	63 (35.4%)	
30-34	94 (37.8%)	49 (27.5%)	
35+	57 (22.9%)	32 (18.0%)	
Marital Status			X^2=7.939, df=1 p=0.005
Single	7 (2.8%)	16 (9.0%)	
Married/de facto	239 (96.0%)	158 (88.8%)	
Missing	3 (1.2%)	4 (2.2%)	
Education level			X^2=10.394, df=2 p=0.006
Didn't complete high school	24 (9.6%)	33 (18.5%)	
Completed high school/trade	112 (45.0%)	86 (48.3%)	
Bachelor degree or higher	107 (43.0%)	55 (30.9%)	

Missing	6 (2.4%)	4 (2.2%)	
Mother's country of birth			X^2=2.510, df=2 *p*=0.285
Australia / New Zealand	210 (84.3%)	153 (86.0%)	
UK / Ireland	19 (17.6%)	7 (3.9%)	
Other	17 (6.8%)	14 (7.9%)	
Missing	3 (1.2%)	4 (2.2%)	
Annual household income (AUD)			X^2=3.377, df=1 *p*=0.066
<$72,800	89 (35.7%)	78 (43.8%)	
≥$72,800	151 (60.6%)	91 (51.1%)	
Missing	9 (3.6%)	9 (5.1%)	
Mothers occupation			
Managerial / professional	114 (45.8%)	53 (29.8%)	X^2=10.240, df=4 *p*=0.037
Technical / trades	16 (6.4%)	15 (8.4%)	
Clerical / admin	91 (36.5%)	76 (42.7%)	
Labourer	10 (4.0%)	9 (5.1%)	
Unemployed	14 (5.6%)	16 (9.0%)	
Missing	4 (1.6%)	9 (5.1%)	
Partners occupation			X^2=1.173, df=4 *p*=0.788
Managerial / professional	79 (31.7%)	45 (25.3%)	
Technical / trades	79 (31.7%)	56 (31.5%)	
Clerical / administration	24 (9.6%)	14 (7.9%)	
Labourer / machine operator	61 (24.5%)	47 (26.4%)	
Unemployed/student	2 (0.8%)	2 (1.1%)	
Missing	4 (1.6%)	14 (7.9%)	
Remoteness Classification (ARIA)[1]			X^2=3.581, df=4 *p*=0.466
HA (Highly Accessible)	8 (3.2%)	11 (6.2)	
A (Accessible)	150 (60.2%)	109 (61.2%)	
MA (Moderately Accessible)	58 (23.3%)	37 (20.8%)	
R (Remote)	19 (7.6%)	12 (6.7%)	
VR (Very Remote)	14 (5.6%)	6 (3.4%)	
Missing	0	3 (1.7%)	
Parity			X^2=0.049, df=1 *p*=0.824
Primiparous	103 (41.4%)	75 (42.1%)	
Multiparous	145 (58.2%)	101 (56.7%)	
Missing	1 (0.4%)	2 (1.1%)	
Maternal pre-pregnancy Body Mass Index (BMI) (kg/m^2)			X^2=1.344, df=3 *p*=0.719
<19.99	24 (9.6%)	16 (9.0%)	
20.00-24.99	113 (45.4%)	79 (44.4%)	
25.00-29.99	62 (24.9%)	47 (26.4%)	
≥30.00	42 (16.9%)	22 (12.4%)	
Missing	8 (3.2%)	14 (7.9%)	
Infant's birthweight			X^2=4.736, df=2
<2500g	3 (1.2%)	4 (2.2%)	
2500-3999g	201 (80.7%)	152 (85.4%)	
≥4000g	45 (18.1%)	19 (10.7%)	

[1] Australian Institute of Health and Welfare. *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare; 2004.

Missing	0	3 (1.7%)	*p*=0.094
Delivery method			X^2=1.305, df=2
Vaginal	138 (55.4%)	106 (59.6%)	
Assisted (forceps/suction)	35 (14.1%)	25 (14.0%)	*p*=0.521
Caesarean	76 (30.5%)	45 (25.3%)	
Missing	0	2 (1.1%)	

Table 4.2: Selected demographics of study participants (n=427)

Characteristic	n	%
Maternal age (years)		
<25	57	13.3
25-29	138	32.3
29-34	143	33.5
35+	89	20.8
Marital status		
Single	23	5.4
Married / de facto	397	93.0
Missing	7	1.6
Maternal education		
Did not complete high school	57	13.4
Completed high school /trade	198	46.4
Bachelor degree or higher	162	37.9
Missing	10	2.3
Mother's country of birth		
Australia / New Zealand	363	85.0
UK/Ireland	26	6.1
Other	31	7.3
Missing	7	1.6
Annual household income (AUD)		
<$72,800	167	39.1
≥$72,800	242	56.7
Missing	18	4.2
Mothers occupation		
Managerial / professional	167	39.1
Technical / trades	31	7.3
Clerical / admin	167	39.1
Labourer	19	4.4
Unemployed	30	7.0
Missing	13	3.0
Remoteness Classification (ARIA)[2]		
HA (Highly Accessible)	19	4.4
A (Accessible)	259	60.7
MA (Moderately Accessible)	95	22.2
R (Remote)	31	7.3
VR (Very Remote)	20	4.7

[2] Australian Institute of Health and Welfare. *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare; 2004.

Missing	3	0.7
Parity		
Primiparous	178	41.7
Multiparous	246	57.6
Missing	3	0.7
Maternal pre-pregnancy Body Mass Index (BMI) (kg/m^2)		
<19.99	40	9.4
20.00-24.99	192	45.0
25.00-29.99	109	25.5
≥30.00	64	15.0
Missing	22	5.2
Infants birth weight (g)		
<2500	7	1.6
2500-3999	353	82.7
≥4000	64	15.0
Missing	3	0.7
Method of Delivery		
Vaginal	244	57.1
Assisted (forceps/suction)	60	14.1
Caesarean	121	28.3
Missing	2	0.5

4.1.5 Participants vs. the Perth Infant Feeding Study 1992/1993 (PIFS I) and Perth Infant Feeding Study 2002/2003 (PIFS II) cohort

Mothers in the PIFS I and PIFS II studies were significantly younger than those in this sample (27.7 yrs and 28.4 yrs vs. 30.2 yrs, $p<0.0001$) and fewer were born in Australia or New Zealand (75.7% and 72.9% vs. 85.0%, $p<0.05$). Mothers in this rural sample were more likely to have a completed tertiary education (37.9% vs. 11.8%, $p<0.0001$) than those in the PIFS II cohort. Babies born to mothers in the rural sample were heavier than those in the previous PIFS studies (3523g (±471) and 3412 (±495) vs. 3403 (±354), $p<0.0001$), and had a greater gestational age (39.5 weeks vs. 39.2 weeks, $p<0.001$) than those in the PIFS II cohort.

Significantly more women in this study delivered infants by caesarean section compared to those in the PIFS I (28.5% vs. 17.0%, $p<0.05$) and fewer mothers were married (86% vs. 94.5%, $p=0.01$). There were no significant differences in mothers' marital status, or pre-pregnancy body mass index (BMI), parity or delivery method for mothers in the PIFS II cohort.

4.2 Factors Associated with Early Breastfeeding Practice

4.2.1 Breastfeeding initiation

A total of 97.0% of mothers initiated breastfeeding in this sample (see Table 4.3). The most frequent reason for not initiating breastfeeding was that formula feeding allowed the infant's father to assist in feeding (n=10). Other reasons given for choosing formula feeding from birth included knowing how much milk the baby was getting at each feed (n=8), formula feeding being easier (n=8) and negative prior experiences with breastfeeding (n=8).

A number of factors were found to be significantly associated with breastfeeding initiation after univariate analysis, primarily related to psychosocial factors. Breastfeeding initiation was significantly associated with planned pregnancy (X^2=9.291, p=0.004), deciding on feeding method before pregnancy (X^2=18.214, p<0.001), having a positive infant feeding attitude as indicated by an IIFAS of ≥65 (X^2=6.902, p=0.017), and perceiving that the infant's father preferred breastfeeding (X^2=8.652, p=0.006). Breastfeeding initiation was also significantly associated with health service-related factors such as vaginal delivery (X^2=8.673, p=0.007), receiving encouragement to breastfeed at birth (X^2=6.955, p=0.021), allowing early breast contact in the first 30 minutes after delivery (X^2=16.337, p<0.001) and feeding on demand (X^2=16.002, p=0.001).

Breastfeeding initiation was not significantly associated with sociodemographic factors such as maternal age, marital status, income, occupation or education levels. Similarly, biomedical factors such as parity, maternal obesity, alcohol or tobacco use were not significantly associated with breastfeeding initiation.

4.2.2 Breastfeeding at discharge from hospital

By time of discharge from hospital, 95.2% of mothers were still breastfeeding, with 82.5% exclusively breastfeeding (see Table 4.3). As with breastfeeding initiation, psychosocial factors such as having a planned pregnancy (X^2=10.571, p=0.002),

deciding on feeding method before pregnancy (X^2=21.325, p<0.001), having a positive infant feeding attitude as indicated by an IIFAS of ≥65 (X^2=11.232, p=0.001), and perceiving that the infant's father preferred breastfeeding (X^2=8.815 p=0.004) were all significantly associated with any breastfeeding at discharge. Health service-related factors such as receiving encouragement to breastfeed at birth (X^2=11.443, p=0.003), allowing early breast contact in the first 30 minutes after delivery (X^2=17.778, p<0.001) and feeding on demand (X^2=14.462, p=0.001) were also significantly associated with any breastfeeding at discharge. Significant positive associations were also found between access to paid maternity leave (X^2=5.429, p=0.024), being married or partnered (X^2=8.029, p=0.029) and any breastfeeding at discharge.

Exclusive breastfeeding at discharge was associated with a number of similar psychosocial factors including positive maternal infant feeding attitudes, deciding on infant feeding method prior to pregnancy and perceiving that the infant's father preferred breastfeeding (see Table 4.4). Women whose own mothers' breastfed an infant had significantly greater odds of exclusive breastfeeding at discharge. In addition to these factors, biomedical factors such as parity, infant birthweight and maternal obesity were significant influences on breastfeeding exclusivity at discharge. As with any breastfeeding, health service-related factors such as vaginal delivery, early breast contact, demand feeding and receiving encouragement to breastfeed at birth were significantly positively associated with exclusive breastfeeding at discharge. Women who reported 'rooming-in' with their infant had approximately twice the odds of breastfeeding exclusively at discharge. Admission to a Special Care Nursery (SCN), experiencing breastfeeding problems in hospital and perceiving that conflicting advice had been given were negatively associated with exclusive breastfeeding at discharge.

Exclusive breastfeeding at discharge was not significantly associated with any of the sociodemographic factors previously identified in the literature, including geographical remoteness as measured by the ARIA score.

Table 4.3: Breastfeeding practices of RIFS participants by sample characteristic (n=427)

Characteristic	n	% Initiating BF (95% CI)	% ABF at discharge (95% CI)	% EBF at discharge (95% CI)
Maternal age (yrs)				
≤29	191	97.9 (95.8-99.9)	93.6 (90.0-97.1)	81.4 (75.8-87.0)
≥30	230	97.4 (95.3-99.5)	96.9 (94.6-99.2)	83.8 (79.0-88.6)
Missing	6			
Parity				
Primiparous	177	98.3 (96.4-100.0)	95.4 (92.3-98.6)	76.8 (70.6-83.1)
Multiparous	244	97.1 (95.0-99.2)	95.0 (92.2-97.8)	86.8 (82.5-91.1)
Missing	6			
Maternal education				
Did not complete	57	94.7 (88.8 – 100.0)	93.0 (86.1-99.8)	80.7 (70.1-91.3)
Completed Yr 12	85	98.8 (96.5-100.0)	92.9 (87.4-98.5)	81.2 (72.7-89.7)
Technical / trade	110	97.2 (94.1-100.0)	95.5 (91.5-95.4)	82.6 (75.3-89.9)
Bachelor degree	159	98.1 (96.0-100.0)	97.5 (95.0-99.9)	85.5 (80.0-91.1)
Missing	16			
Income Level (AUD)				
<$72,799	166	97.0 (94.4-96.0)	94.0 (90.3-97.6)	84.3 (78.8-90.0)
≥$72,800	237	98.3 (96.6-99.9)	96.6 (94.3-98.9)	82.6 (77.8-87.5)
Missing	24			
Mother's country of birth				
Australia / New	356	98.0 (96.6-99.5)	95.2 (93.0-97.5)	81.7 (77.6-85.7)
UK/Ireland	26	96.2 (88.2-100.0)	96.2 (88.2-100.0)	88.5 (75.3-100.0)
Other	31	95.1 (88.2-100.0)	91.2 (81.1-100.0)	85.4 (74.1-96.7)
Missing	14			
Birthweight (g)				
<2500	7	100.0	100.0	42.9 (0-100)
≥2500	413	97.6 (96.1-99.1)	95.1 (93.0-97.2)	83.7 (80.1-87.3)
Missing	7			
Method of Delivery				
Vaginal	242	98.3 (96.7-99.9)	95.4 (92.7-98.1)	87.6 (83.4-91.8)
Assisted	59	98.3 (94.8-100.0)	94.9 (89.1-100.0)	74.1 (62.5-85.8)
Caesarean	120	95.8 (92.2-94.5)	95.0 (90.1-99.0)	76.5 (69.0-84.3)
Missing	**6**			
TOTAL		**97.0**	**95.2**	**82.5**

Table 4.4: Percentage and Univariate Odds Ratios (95% CI) for Exclusive Breastfeeding at Hospital Discharge by Sample Characteristic (n=353)

Characteristics	Exclusive breastfeeding at discharge			
	n	%	OR	95% CI
SOCIODEMOGRAPHIC				
Maternal age				
<25 (ref)	45	78.9	1.00	-
25-29	114	82.6	1.09	0.48 - 2.44
30-34	125	87.4	1.38	0.71 - 2.68
35+	69	77.5	2.01	0.99 - 4.06
Income (AUD)				
<$72,800	42	87.5	1.14	0.67-1.94
≥ $72,800 (reference)	299	82.8	1.00	-
Mother's education level				
Didn't finish high school	46	80.7	0.73	0.33 – 1.60
Yr 12 / TAFE	163	82.3	0.81	0.46 – 1.43
Bachelor degree or higher (reference)	138	85.2	1.00	-
Marital status				
other	17	73.9	0.56	0.21 – 1.46
Married / de facto (reference)	332	83.6	1.00	-
ARIA category				
Highly Accessible (reference)	16	84.2	1.00	-
Accessible	216	83.4	0.94	0.26 – 3.37
Moderately Accessible	79	83.2	0.93	0.24 – 3.55
Remote	23	74.2	0.54	0.12 – 2.35
Very Remote	17	85.0	1.06	0.19 – 6.05
Mother's country of birth				
Australia / New Zealand (reference)	297	81.8	1.00	-
other	52	91.2	2.31	0.89 – 6.01
Employment in the previous six months				
Employed	215	84.6	0.76	0.40 – 1.47
Not employed (reference)	101	87.8	1.00	-
Mother intending to return to work /study by six months post-partum				
No (reference)	273	84.3	1.00	-
Yes	76	79.2	0.71	0.40 – 1.26
Mother returned to work/study by six months post-partum				
Yes	85	78.7	0.67	0.37 – 1.20
No (reference)	194	84.7	1.00	-

Paid maternity leave				
Yes (reference)	99	81.8	1.00	-
No	250	83.6	1.13	0.65 – 1.97
BIOMEDICAL				
Parity				
Primiparous (reference)	137	77.0	1.00	-
Multiparous	**213**	**86.6**	**1.93**	**1.16 – 3.20**
Delivery method				
Vaginal (reference)	259	85.2	1.00	-
Other	**93**	**76.9**	**0.58**	**0.34 – 0.98**
Sex of infant				
Male (reference)	189	79.7	1.00	-
Female	164	86.3	1.60	0.95 – 2.70
Infant's birthweight (g)				
<2500	**4**	**42.9**	**0.14**	**0.03 – 0.66**
≥2500 (reference)	348	83.9	1.00	-
Admission to Special Care Nursery				
Yes	**27**	**61.4**	**0.27**	**0.14 – 0.54**
No (reference)	325	85.3	1.00	-
Mother smoked during pregnancy				
Yes	25	73.5	0.55	0.25 – 1.24
No (reference)	322	83.4	1.00	-
Mother drank alcohol during pregnancy				
Yes	85	81.7	0.91	0.51 – 1.62
No (reference)	266	83.1	1.00	-
Maternal Body Mass Index (kg/m^2)				
<25 (reference)	196	84.5	1.00	-
25-29.99	93	85.3	1.07	0.56 – 2.02
30+	**47**	**73.4**	**0.51**	**0.26 – 0.98**
PSYCHOSOCIAL				
Mother attended antenatal classes				
Yes (reference)	291	84.3	1.00	-
No	61	76.2	0.60	0.33 – 1.08
Mother's Iowa Infant Feeding Attitude Score (IIFAS)				
<65	**131**	**77.1**	**0.53**	**0.32 – 0.88**
>65 (reference)	222	86.4	1.00	-
Mothers perception of fathers feeding preference				
Ambivalent or prefers bottle feeding	**143**	**76.1**	**0.43**	**0.26 – 0.72**

Prefers breastfeeding (reference)	208	88.1	1.00	-
Mother's perception of maternal grandmothers feeding				
Ambivalent or prefers bottle feeding	225	82.1	0.83	0.48 – 1.43
Prefers breastfeeding (reference)	127	84.7	1.00	-
Maternal grandmother breastfed one or more children				
Yes (reference)	306	85.5	1.00	-
No	**46**	**68.7**	**0.37**	**0.21 – 0.67**
Timing of infant feeding decision				
Before pregnancy (reference)	285	87.4	1.00	-
During / after pregnancy	**68**	**68.0**	**0.31**	**0.18 – 0.52**
Timing of pregnancy				
Planned (reference)	233	84.1	1.00	-
Unplanned/mistimed	118	80.3	0.77	0.46 – 1.29
HEALTH SERVICE				
Rooming in				
Yes (reference)	249	86.2	1.00	-
No	**104**	**75.9**	**0.51**	**0.30 – 0.85**
Early breast contact (<30mins)				
Yes (reference)	270	88.8	1.00	-
No	**80**	**70.8**	**0.31**	**0.18 – 0.52**
Demand feeding in hospital				
Yes (reference)	297	87.4	1.00	-
No	**55**	**64.7**	**0.27**	**0.15 – 0.46**
Staff encouragement to breastfeed at birth				
Yes (reference)	293	84.7	1.00	-
No	**57**	**74.0**	**0.52**	**0.29 – 0.93**
Given conflicting advice about feeding				
Yes	**77**	**70.6**	**0.36**	**0.21 – 0.61**
No (reference)	276	87.1	1.00	-

4.3 Univariate Analysis of Factors Associated with Early Breastfeeding Practice

4.3.1 Sociodemographic factors

There were few sociodemographic factors significantly associated with early breastfeeding practice in this study. A significant positive relationship was found

between marital status and breastfeeding, with women who were married or partnered having almost six times the odds of any breastfeeding at discharge (OR 5.8, 95% CI 1.48, 22.76). Marital status was not significantly associated with either breastfeeding initiation or exclusive breastfeeding at discharge.

Almost two thirds (65.6%) of women in the study lived in areas classified as Highly Accessible or Accessible under the ARIA classification methodology. A further 22.4% lived in Moderately Accessible locations and the remaining 12% lived in either Remote (7.3%) or Very Remote (4.7%) locations. Geographical remoteness was not significantly associated with any measure of early breastfeeding practice in this study.

Almost half of the women in this study (40.3%) indicated that they were employed in managerial or professional occupations, as were 30.3% of the infant's fathers (see Table 4.5). A further 40.3% of women were employed in clerical, sales or administration jobs and 7.2% indicated that they were unemployed or studying.

Table 4.5 Occupational classifications of RIFS participants

Occupation	Mother (n=414)		Father (n=409)	
	n	%	n	%
Manager / professional	167	40.3	124	30.3
Technician / Trade	31	7.5	135	33.0
Clerical / administration / sales / other	167	40.3	38	9.3
Labourer / machine operator	19	4.6	108	26.4
Unemployed / student	30	7.2	4	1.0
TOTAL	**414**	**100**	**409**	**100.0**

Just under two thirds of participants (59.8%) indicated that they had private health insurance. Women in professional or managerial occupations had more than twice the odds of having private health insurance than those in other occupations (OR 2.64, 95% CI 1.73, 4.04). No significant association between health insurance type and early breastfeeding practice was found in this study.

Approximately one third of the participants (28.8%) indicated that they were on paid maternity leave following the birth of their infant. Women who were

employed in managerial or professional occupations had almost five times greater odds of being on paid maternity leave than those in other occupations (OR 4.87, 95% CI 3.09, 7.68). Significant positive associations were also found between access to paid maternity leave and any breastfeeding at discharge (X^2=5.429, p=0.024).

One quarter of mothers (22.9%) reported an intention to return to work or study in the first six months after the birth of their baby, either full-time or part-time. Women employed in professional occupations had approximately half the odds of intending to return to work in the first six months (OR 0.59, 95% CI 0.36,0.96). An intention to return to work was not significantly associated with early breastfeeding practice in this study.

4.3.2 Biomedical Factors

Age and parity

Approximately half of the participants (42.4%). were first-time mothers. The number of children reported by participants ranged from 1-9, with a median of two. Primiparous mothers were slightly younger than multiparous mothers (28.7 vs 31.3 years) however the difference was not significant. Neither age nor parity were significantly associated with breastfeeding initiation or any breastfeeding at discharge, however multiparous women had almost twice the odds of exclusively breastfeeding at discharge (see Table 4.4).

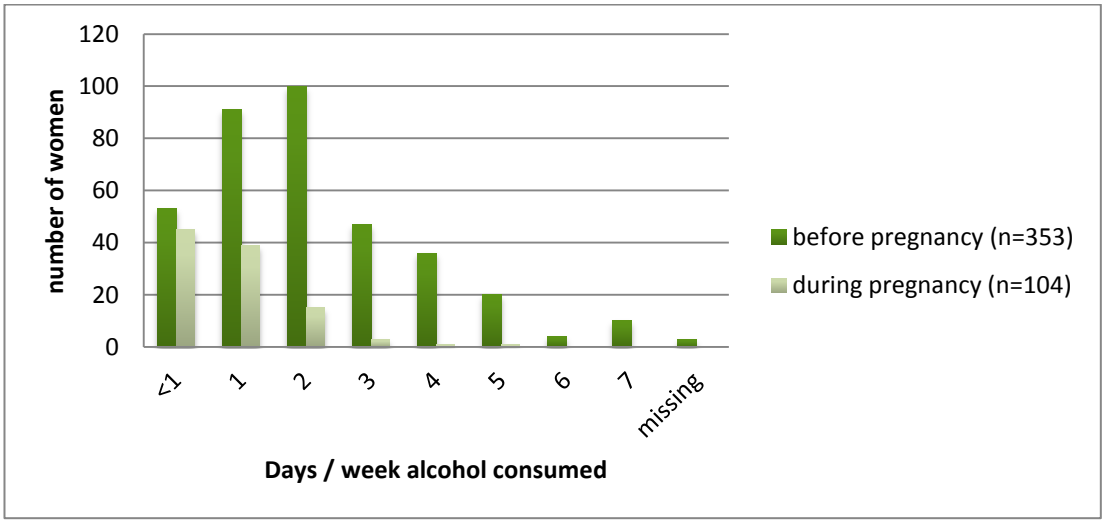
Alcohol Consumption

Women were asked about their alcohol consumption before and during their pregnancy. More than three quarters of women (85.2%, n=364) indicated that they drank alcohol prior to becoming pregnant. Of those that reported drinking prior to becoming pregnant, almost half (46.6%) said that they drank on two or fewer days per week, with a median alcohol intake of 2.0 standard drinks at each occasion of drinking (one standard drink is equal to 10 grams of alcohol) (see Figure 4.2). Less than one quarter of women (24.3%, n=104) reported that they drank alcohol during their pregnancy. Of those who did report consuming alcohol during pregnancy,

80.8% drank on one or less day per week, with a median intake of 1.0 standard drink on that occasion. The majority of women (96.7%) indicated that their baby's father consumed alcohol, and all but one who drank alcohol prior to the pregnancy continued to consume alcohol during pregnancy.

No significant relationships were found between alcohol consumption, either before or during pregnancy, and early breastfeeding practice in this study.

Figure 4.2: Frequency of alcohol consumption (days per week) before and during pregnancy



Smoking

Less than one fifth (16.2%) of women reported that they smoked prior to pregnancy, and 8.1% reported smoking during pregnancy. Of those who smoked prior to pregnancy, just over a half (57.5%) smoked 10 or more cigarettes per day. The number of women who reported smoking 10 more cigarettes per day during pregnancy fell to 25.7%. Three quarters of women indicated that they had received advice to quit smoking during pregnancy, primarily from their general practitioner (60.0%), midwife or obstetrician (16.7% respectively). Almost one third of women (29.7%) reported that the baby's father smoked prior to pregnancy, decreasing slightly to 26.5% during pregnancy. Breastfeeding initiation was not significantly associated with smoking by the baby's father.

There were no significant associations between smoking either prior to or during pregnancy and breastfeeding initiation. Similarly, no associations were found between smoking prior to or during pregnancy and breastfeeding at discharge.

Body Mass Index

Just under half of the participants (45.0%) were found to have a Body Mass Index (BMI) of between 20 and 25, and 9.4% had a BMI of <20. A further 25.5% had a BMI between 25 and 30 and 15.0% of the sample were categorised as obese (BMI >30) (see Table 4.2). Women who had a BMI ≥30 had half the odds of exclusively breastfeeding at discharge (see table 4.4). There was no significant relationship found between maternal pre-pregnancy obesity and breastfeeding initiation or any breastfeeding at discharge.

Onset of Lactogenesis II

The onset of lactogenesis II (copious milk production postpartum) was determined by asking mothers how long it was "before their milk came in". Almost three quarters (72.8%) of mothers responded that it was within 3 days (72 hours) of the birth. Women who experienced delayed onset of lactogenesis II (that is, more than 72 hours after birth) had approximately three times lower odds of exclusively breastfeeding at discharge (OR 0.37, 95% CI 0.21-0.64), however this was not significant for either breastfeeding initiation or any breastfeeding at discharge. Whilst a greater proportion of women with a pre-pregnancy BMI of ≥30 experienced delayed lactogenesis than women with a BMI <30 (31.1% vs. 23.3%), the association was not significant. No association was found between parity, delivery method, early breast contact or demand feeding and onset of lactogenesis.

Breastfeeding Problems in Hospital

When asked what problems they had experienced since beginning to breastfeed, 19.1% of mothers indicated that they had not experienced any problems (see Table 4.6). The most commonly reported problem was cracked or sore nipples (n=228), and breast engorgement (n=120). Almost a fifth of mothers (17.1%) felt that they were not doing well at breastfeeding, with almost two thirds (62.3%) being

primiparous. Primiparous women had more than two times the odds of experiencing breastfeeding problems in hospital than multiparous women (OR 2.37, 95% CI 1.36-4.13).

Table 4.6: Breastfeeding problems experienced in hospital (n=406)

Breastfeeding problem*	n	%
No problems	77	19.1
Cracked / sore nipples	228	56.4
Baby gets too much milk	32	7.9
Baby gets milk too fast	51	12.6
It takes a long time for milk to start flowing at the start of the feed	18	4.5
Baby too tired to feed	107	2.6
Difficulties expressing	16	4.0
Baby losing weight	31	7.7
Baby has problems with sucking	38	9.4
Engorged breasts	120	29.7
Mastitis	13	3.2
Baby not getting enough milk	36	8.9
Problems with positioning	125	3.1
Not doing well at breastfeeding	69	17.1
Not producing enough milk	29	7.2
Other	14	3.5

*multiple answers were permitted

Breastfeeding problems experienced in hospital were significantly negatively associated with exclusive breastfeeding at discharge. Women who reported experiencing one or more breastfeeding problems in hospital had almost five times lower odds of exclusively breastfeeding at discharge (OR 0.21, 95% CI 0.06-0.69).

4.3.3 Health Service-related factors

A number of health service-related factors were significantly associated with early breastfeeding practice in this study, and are grouped below as antenatal education, hospital practices, and perinatal professional support.

Antenatal Education and Information

The majority of women (81.2%) indicated that they had attended an antenatal class either for this or a previous pregnancy. Of those who attended a class, 91% recalled

that information about infant feeding was presented. Attendance at antenatal classes was not significantly associated with any measure of early breastfeeding practice in this study.

Women were also asked about sources of infant feeding information they had received antenatally. Almost half (40.8%) indicated that they had not received any information about infant feeding during their pregnancy, with primiparous women having almost four times greater odds of reporting not receiving information (OR 4.16, 95% CI 2.42, 7.15). However, there was no significant relationship between receiving antenatal infant feeding information and early breastfeeding practice.

The format of antenatal infant feeding information sources which women reported receiving about breastfeeding included pamphlets (n=270), lectures (n=120), DVDs (n=122) and individual consultations with health service staff (n=65). Other resources identified included books about pregnancy and breastfeeding (n=1), parenting groups (n=1) and community breastfeeding support groups (n=1). Two women reported that they received information from a "bounty bag" (a commercially sponsored sample bag provided to new mothers at some hospitals), however it was not clear if this was from this or a previous pregnancy. None of the participants reported seeking infant feeding information from online sources prior to the delivery of their infant. There were no significant relationships found between any of the sources of antenatal breastfeeding information and early breastfeeding practice.

Hospital practices

Women were asked about specific hospital practices related to supporting breastfeeding, such as rooming in, demand feeding, complementary or supplementary feeding by nursing staff and other staff practices.

Encouragement from maternity staff to breastfeed at birth and facilitating early breastfeeding (within 30 minutes of birth) were significant factors in all measures of early breastfeeding practice in this study. Women were asked to indicate how long

after birth their infant was put to the breast and approximately three quarters (74%) indicated that it was within 30 minutes (see Table 4.7). A further 21.5% said it occurred within a few hours (see Table 4.6). Women who breastfed within 30 minutes of birth had greater odds of exclusively breastfeeding at discharge (OR 3.28, 95% CI 1.91, 5.62) and those who were encouraged by staff to put their infant to the breast following delivery had almost twice the odds of exclusively breastfeeding at discharge (OR 1.94, 95% CI 1.08, 3.49).

There was a significant relationship between delivery method and early breast contact, with women who experienced a caesarean delivery having approximately five times lower odds of putting their infant to the breast within the recommended time of 30 minutes compared with women who had an unassisted vaginal delivery (OR= 0.15, 95% CI 0.09-0.24). Women who delivered their infant via caesarean had almost six times lower odds of initiating breastfeeding (OR 0.16, 95% CI 0.04, 0.64). The relationship between delivery method and early breastfeeding practice was also significant, with women who experienced a caesarean delivery having approximately half the odds of exclusively breastfeeding at discharge (see Table 4.4)

Table 4.7: Timing of first breastfeed after delivery (n=404)

Time before baby was put to the breast	n	%
Immediately	56	13.9
Within 15 minutes	133	32.9
15-30 minutes	110	27.2
Within a few hours	87	21.5
The next day	9	2.2
Other	9	2.2
TOTAL	**404**	**100.0**

More than two thirds of women practiced 24-hour rooming-in as recommended in the *10 Steps to Successful Breastfeeding* (see Table 4.8). Of those who indicated that their infant spent some time in the nursery, 79.3% said that the nursing staff brought their baby to them for feeding, and a further 3.3% said that they went to the nursery to feed after being informed by nursing staff. Nine women indicated that they did not know what staff did when the baby required feeding, and 13

women (7.3%) stated that the nursing staff provided formula. Of those women who indicated that staff fed their infant (including those who were being fed with expressed breastmilk), 86.0% said that staff sought their permission to feed the baby. Mothers who practiced 24-hour rooming-in had twice the odds of exclusively breastfeeding at discharge (see Table 4.4), however there was no significant relationship between rooming-in and breastfeeding initiation, or with any breastfeeding at discharge.

Table 4.8: Frequency of rooming-in

Time spent by infant in mother's room	n	%
all day and all night	289	67.8
all day and part of the night	117	27.4
all day but not overnight	3	0.7
all night and part of day	5	1.2
all night but not at all during day	4	0.9
part of day but not all of day	1	0.2
My baby is in the special care nursery (SCN) all of the time	7	1.6
Missing	1	0.2
TOTAL	**427**	**100.0**

Mothers were asked how often they were feeding their baby. Feeding frequency was defined as either demand feeding (that is, feeding whenever baby wanted to be fed), feeding to a time schedule (that is, feeding 'by the clock' rather than by baby's hunger cues) or a mixture of both (see Table 4.8). Almost three quarters of women (70.5%) indicated that they demand fed their infant, and 9.4% indicated that they used a mix of demand and scheduled feeding. Demand feeding was significantly positively associated with breastfeeding initiation and breastfeeding at discharge with mothers who demand-fed their infants having almost four times the odds of exclusively breastfeeding at discharge (See Table 4.4).

When asked if they had been encouraged by hospital staff to demand feed, 62% responded that they had. Ten women (2.3%) indicated that they had been instructed "…not to leave too long between feeds" and one woman was encouraged to feed 3-hourly as her infant had not gained sufficient weight.

Table 4.9: Breastfeeding Frequency in Hospital

Breastfeeding frequency	n	%
on demand	301	70.5
2 hourly	7	1.6
3 hourly	50	11.7
4 hourly	23	5.4
Other (combination of demand and scheduled feeding)	40	9.4
Missing	5	1.2
TOTAL	**427**	**100**

Perinatal Professional Support

Women were asked about the level of help and information they received about infant feeding from hospital staff, with almost all women (91.7%) indicating that they received sufficient assistance. For those who felt that they did not receive enough advice, help with positioning and attachment was the most commonly identified issue (n=8), followed by general breastfeeding information and assistance (n=5). Direct assistance was frequently identified with comments including:

" [the staff] assumed I knew what I was doing, but I needed more direct help"

"my first experience with breastfeeding was not successful, so I needed more assistance"

"more time spent with me to get breastfeeding started"

Satisfaction with the level of infant feeding advice provided by staff was not significantly associated with any measure of early breastfeeding practice in this study. No relationship was found between satisfaction with the level of advice and any other sociodemographic variable, including maternal age, education level, parity, or ARIA category.

Conflicting ideas and opinions about infant feeding were also examined, and women were asked if they felt that they had been given conflicting advice about feeding their baby. Approximately one quarter of women (25.6%) felt that they had received inconsistent advice from staff, although six women felt that receiving conflicting information was not necessarily negative:

"…not in a bad way. You need a bit of difference so you can suit your own situation."

Women who perceived that conflicting advice was provided were significantly more likely to be primiparous (X^2 = 20.049, p<0.0001) and have had an infant with a birth weight less than 2500g (X^2 = 8.083, p=0.013). Women living in locations classified by ARIA as Highly Accessible or Accessible had greater odds of reporting perceived conflicting advice (OR 1.6, 95% CI 1.1-2.5), however the effect was not significant for other sociodemographic variables such as age, level of education or level of health insurance. Women who reported that they had received conflicting advice from hospital staff had almost three times lower odds of exclusively breastfeeding at discharge (see Table 4.4).

Almost all women indicated that they were either satisfied or very satisfied with the advice given by hospital staff with respect to infant feeding (see Table 4.10). No significant relationships were found between satisfaction with feeding advice and sociodemographic variables, breastfeeding problems in hospital or with hospital practices such as rooming in. Satisfaction with infant feeding advice was not significantly associated with early breastfeeding practice in this study.

Table 4.10: Level of satisfaction with feeding advice provided by hospital staff

Level of satisfaction with feeding advice	n	%
Very satisfied	254	59.5
Satisfied	145	33.9
Slightly dissatisfied	21	4.9
Very dissatisfied	5	1.2
Missing	2	0.5
TOTAL	**427**	**100.0**

In general, women were satisfied with the amount of breastfeeding information provided by the hospital staff with 64.4% indicating that they received sufficient information (see Table 4.11). More than one in 10 women (11.4%) would have liked more information about breastfeeding and 4.5% indicated that they received more than they wanted.

Table 4.11: Breastfeeding information received in hospital

Amount of breastfeeding information given by hospital staff	n	%
None or very little	29	7.2
Some but I would have liked more	46	11.4
Enough	260	64.4
More than wanted	18	4.5
I didn't need any information	51	12.6
Total	**404**	**100.0**

Nearly 80% of mothers received pamphlets or booklets about breastfeeding in hospital, and 81.5% indicated that they had received an individual consultation or demonstration about breastfeeding from maternity staff. Just under one fifth (18.6%) said that they did not receive any information about infant feeding whilst in hospital. Of these women, 60% indicated that they had not received any infant feeding information before coming to hospital, a total of 6% of the sample. Women who indicated that they did not receive any advice about infant feeding either before or after the birth of their infant were more likely to be multiparous (p=0.001).

Attachment and Positioning

When asked if a hospital staff member had checked their infant's attachment to the breast, approximately three quarters of mothers (76.5%) said yes, 15.5% said that they did not need a staff member to check, and 8.3% said that nobody had checked their infant's attachment. Whilst a greater proportion of multiparous women reported that no staff member had checked their infant's attachment than primiparous women (10.3% vs. 5.4%), the association was not significant. No significant associations were found between staff assessment of attachment and exclusive breastfeeding at discharge.

Mothers were also asked if a staff member had instructed them about correct positioning of their infant when breastfeeding in hospital. Approximately two thirds (64.3%) of mothers indicated that they had received advice about positioning, while 29.3% said that they did not need to be taught positioning. The remaining 6.5% said that they did not receive advice about positioning from a staff member. No

significant associations were found between staff instruction about positioning and exclusive breastfeeding at discharge.

4.3.4 Psychosocial factors

A number of psychosocial factors were significantly associated with early breastfeeding practice in this study, including the timing of, and influences on, the infant feeding decision.

Infant feeding decisions –timing and influences

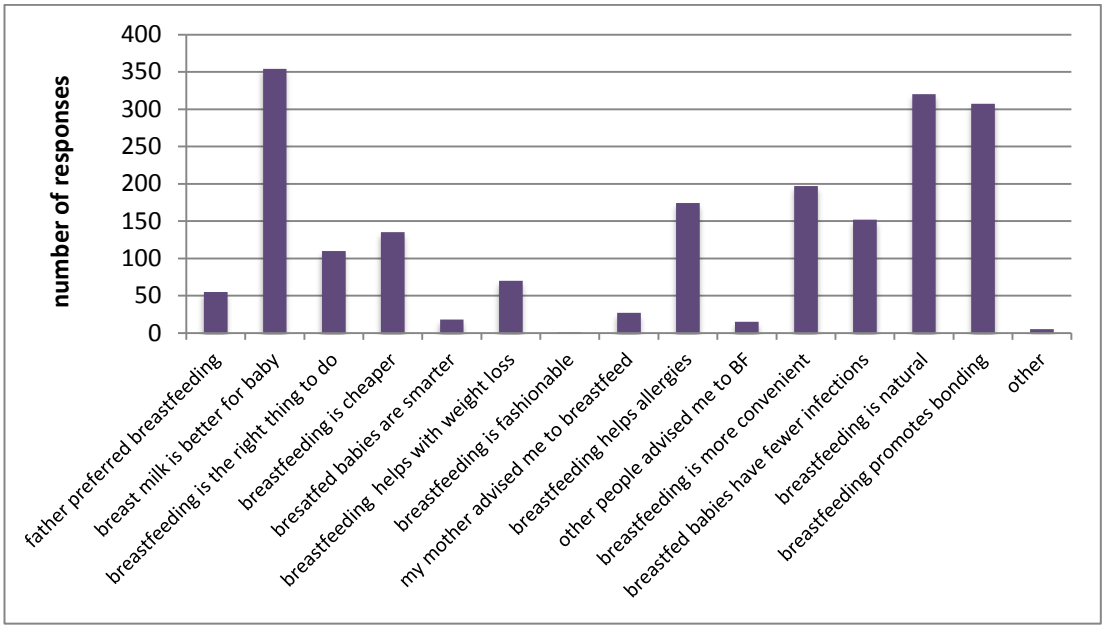
Over three quarters of women (76.5%) decided how they were going to feed their infant prior to pregnancy, and a further 18.8% said that they decided during their pregnancy. Women who decided on their method of infant feeding before pregnancy had more than three times the odds of exclusively breastfeeding at discharge (OR 3.3, 95% CI 1.9,5.6). Women who were married or partnered (p=0.038), women aged 25 or older (X^2=6.068, p=0.024), women with a tertiary education (X^2=8.698, p=0.024), and women who had a positive attitude towards breastfeeding (X^2 = 22.564, p<0.0001) had greater odds of deciding their method of infant feeding before pregnancy.

When asked who had helped them with deciding how they would feed their baby, 83.8% of women indicated that no one else was involved in the decision. Of those who did identify someone, almost all identified the baby's father as being involved (20.4%). Other responses included maternal and paternal grandmothers (10.8% and 5.6% respectively), friends (9.4%) and a midwife (8.4%). Antenatal classes (n=2), media (n=6) and past experiences (n=1) were also identified.

Reasons for choice of feeding method

When asked why they decided to breastfeed their infant, the most commonly reported reason was that "breastmilk is better for the baby" (n=354) (see Figure 4.3). Other frequently reported reasons included "breastfeeding is natural" (n=320), and "breastfeeding promotes bonding" (n=307). One mother stated that she chose to breastfeed, as "it is the reason I have breasts."

Figure 4.3: Reasons for choosing breastfeeding



Of the 10 women who indicated that they did not attempt to breastfeed from the beginning, all reported that the chose formula feeding as it allowed the baby's father to assist with feeding (see Table 4.12). Other frequently reported reasons included advice from a health professional (n=9), negative previous breastfeeding experiences (n=8), a belief that formula feeding was easier than breastfeeding (n=8) and the ability to determine the amount of milk consumed by the infant at each feed (n=8).

Table 4.12: Reasons for choosing formula feeding from birth (n=10)

Reason	n
Formula feeding is better	0
Formula feeding is easier	8
I don't like breastfeeding	3
I am going back to work	4
Breastfeeding will make my breasts sag	1
The baby's father prefers formula feeding	1
Formula feeding is as good as breastfeeding	4
The baby's father can help with formula feeding	10
I want to know how much milk my baby has at each feed	8
I want to continue smoking	1
I want to continue to drink alcohol	0
I want to play sport	2

Breastfeeding is embarrassing	1
My mother suggested formula feeding	2
My friend / relative suggested formula feeding	2
A health worker (e.g. doctor or nurse) suggested formula feeding	9
I had a negative first experience (with breastfeeding)	8
It is easier to bottle feed with other children at home	2
I found breastfeeding stressful	1
I have had previous breastfeeding problems	3
I have a low BM supply	2
My baby was premature and has problems with suck reflex	2
My baby had low blood sugar level at birth a top-up with formula was recommended	3
My baby was formula fed while I was in surgery	1

Feeding Preferences of Significant Others

Women were asked about the infant feeding opinions and practices of social supports in their lives, such as their partner, mother and friends (see Table 4.13). Almost all women (84.2%) reported that their mother had breastfed at least one of her children and 3.1% were not sure. There was a significant positive association between maternal grandmothers breastfeeding practice and exclusive breastfeeding at discharge (X^2 = 11.221, *p*=0.001).

Table 4.13: Infant feeding preferences of significant social supports

Feeding preference	Father		Maternal grandmother	
	n	%	n	%
Prefers formula feeding	6	1.4	5	1.2
Prefers breastfeeding	234	54.8	149	34.9
Doesn't mind	154	36.1	172	40.3
I haven't discussed it	29	6.8	97	22.7
Other	4	0.9	4	0.9
TOTAL	**427**	**100**	**427**	**100**

Just over one half of mothers (54.8%) indicated that their infant's father had a preference for breastfeeding and a further 36.1% said that they didn't mind how the infant was fed. Just over one third (34.9%) said that their mother expressed a preference for breastfeeding and 40.3% indicated that there was not preference. Almost one quarter of mothers reported that they had not discussed feeding with their mother, compared with 6.8% who reported that they had not discussed feeding with the infant's father. There was a significant positive association between father's feeding preference and exclusive breastfeeding at discharge (X^2 =

10.669, *p*=0.001), but not with the feeding preference of maternal grandmother.

When asked about how their friends had fed their babies, just under one half of mothers (47.5%) indicated that their friends chose to breastfeed (see Table 4.14). There was a significant positive association between exclusive breastfeeding at discharge and having friends who has chosen to breastfeed their infants (X^2 = 3.876, *p*=0.049).

Table 4.14: Infant feeding choices of mother's friends

Infant feeding method	n	%
Chose to formula feed	24	5.6
Chose to breastfeed	203	47.5
Chose to breastfeed AND formula feed	86	20.1
Initially chose to breastfeed then changed to formula feeding	77	18.0
My friends don't have babies	11	2.6
Don't know / missing	26	6.3
TOTAL	**427**	**100.0**

Infant feeding attitudes

Breastfeeding attitudes were measured using the Iowa Infant Feeding Attitudes Scale (IIFAS). The mean IIFAS score for all mothers participating in the study was 66 (range 39-84, ± SD 8.3). Further grouping of the responses to each of the 17 items in the IIFAS as positive (agreement), negative (disagreement) or neutral responses is presented in Table 4.12. The Cronbach's α score of 0.75 indicates good internal reliability of the scale in this sample.

The majority of mothers (94.1%) agreed that breastmilk was less expensive than formula, and 72.4% agreed that breastfeeding was more convenient that formula feeding (see Table 4.15). A third of mothers (33.3%) disagreed that formula feeding meant missing one of the great joys of motherhood, and a further 24.6% had neutral feelings about this. Almost two thirds (62.1%) disagreed that breastfeeding increased mother-infant bonding, and one quarter (25.3%) disagreed that babies who were breastfed were healthier than formula-fed babies. More than half of mothers (54.7%) either agreed that infant formula was as healthy as breastmilk (15.7%) or expressed neutral feelings about the difference (39%).

Women with a negative IIFAS score (<65) had over six times lower odds of initiating breastfeeding (OR 0.16, 95% CI 0.03-0.76) and two times lower odds of exclusively breastfeeding at discharge (OR= 0.53, 95% CI 0.32 – 0.88).

Compared with PIFS II participants, a greater proportion of mothers in the rural sample had a positive IIFAS score (60.2% vs. 50.9%, *p*=0.003). The mean IIFAS score for mothers in PIFS II was 64 (range 36-85, ± SD 8.3).

Table 4.15: Mother's Infant Feeding Knowledge and Attitudes

IIFAS Scale item	Disagree† (%)	Neutral (%)	Agree‡ (%)
1. The nutritional benefits of breastmilk last only until the baby is weaned from breastmilk	71.6	17.7	10.7
2. Formula-feeding is more convenient than breast-feeding	72.4	17.3	10.2
3. Breast-feeding increases mother-infant bonding	62.1	32.3	5.6
4. Breastmilk is lacking in iron	63.2	31.5	5.3
5. Formula-fed babies are more likely to be overfed than breast-fed babies	26.9	41.7	31.4
6. Formula-feeding is the better choice if the mother works outside the home	51.8	32.2	16.0
7. Mothers who formula-feed miss one of the great joys of motherhood	33.3	24.6	42.2
8. Women should not breast-feed in public places such as restaurants	91.2	5.2	3.6
9. Babies who are fed breastmilk are healthier than babies who are fed formula	25.3	31.6	43.1
10. Breast-fed babies are more likely to be overfed than formula-fed babies	66.1	30.5	3.3
11. Fathers feel left out if a mother breast-feeds	68	21.4	10.5
12. Breastmilk is the ideal food for babies	4.4	8.0	87.6
13. Breastmilk is more easily digested than formula	4.9	22.2	72.8
14. Formula is as healthy for an infant as breastmilk	45.2	39.0	15.7
15. Breast-feeding is more convenient than formula-feeding	9.8	17.8	72.4
16. Breastmilk is less expensive than formula	3.0	2.8	94.1
17. A mother who occasionally drinks alcohol should not breast-feed her baby	46.9	28.6	24.5

Note: The items 1, 2, 4, 6, 8, 10, 11, 14, and 17 were reversed when calculating the score

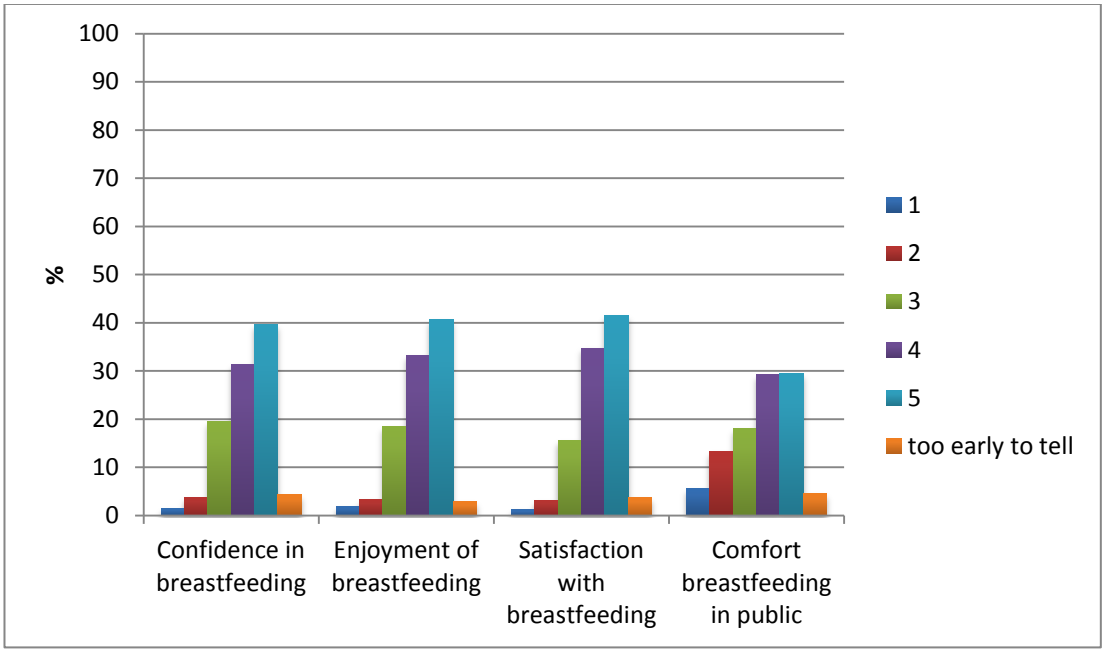
† Disagree includes 'strongly disagree' and 'disagree'

‡ Agree includes 'strongly agree' and 'agree'

Feelings about Breastfeeding

Women were asked to rate their confidence, enjoyment, satisfaction and comfort in breastfeeding whilst in hospital on a scale from 1 to 5, with 5 representing the most positive feeling (see Figure 4.4). When asked about their confidence in breastfeeding whilst in hospital, 73.8% of women who were exclusively breastfeeding their infant reported that they were confident, compared with 56.6% of women who were breastfeeding less than exclusively, that is having introduced formula or other fluids. Approximately 71% of women indicated that they were either confident or very confident with breastfeeding, and a similar proportion reported positive levels of enjoyment and satisfaction with breastfeeding (73.8% and 76.1%). Less than two thirds of women (58.8%) indicated that they were either comfortable or very comfortable breastfeeding in public. Primiparous women had significantly lower odds of expressing comfort in breastfeeding in front of others than multiparous women (OR=0.40, 95% CI 0.27-0.60, p<0.001).

Figure 4.4: Reported breastfeeding confidence, enjoyment, satisfaction and comfort in breastfeeding before hospital discharge



4.4 Multivariate Analysis of Factors Associated with Early Breastfeeding Practice

All factors from the univariate analyses found to have significant associations with breastfeeding initiation, any breastfeeding at discharge and exclusive breastfeeding at discharge were entered into separate logistic regression models to determine independent associations for each measure of breastfeeding practice. In addition, variables previously identified in the literature as significant influences, but not found to be significant in this study, were included in the models to ensure that any potentially significant relationships were accounted for. The full list of variables included in the three models is provided in Table 4.16.

There were a number of factors determined to have significant associations with breastfeeding initiation in univariate analysis, however none of these remained significant predictors in the multivariate regression analysis model. The lack of significant independent predictors is most likely due to the near-universal rate of breastfeeding initiation in this study, and more widely in Australia, and therefore would require a much larger sample size to detect differences.

Univariate analysis found significant associations between any breastfeeding at discharge and a number of variables, including mothers' marital status, mother's perception of fathers' feeding preference, staff encouragement to breastfeed at birth, mothers' infant feeding attitude score (IIFAS), delivery method, demand feeding whilst in hospital and early breast contact (<30 minutes after birth). These variables however failed to remain significant predictors in the multivariate regression analysis model. This is most likely due to the small numbers of women who were not breastfeeding in any form at discharge, therefore making detection of differences difficult.

The strongest predictors of exclusive breastfeeding at discharge in this study were health-service related (see Table 4.16). Mothers whose infants who did not require admission to the Special Care Nursery had more than four times the odds of

exclusively breastfeeding at discharge (aOR 4.43, 95% CI 1.98-9.99). Mothers had greater odds of exclusive breastfeeding at discharge if they perceived that the advice given by hospital staff was consistent (aOR 3.99, 95% CI 1.94-8.22) or if they fed their infant on demand in hospital (aOR 3.33, 95% CI 1.59-6.95). The breastfeeding practice of maternal grandmothers was also a significant predictor, and women whose own mothers had breastfed had more than four times greater odds of exclusively breastfeeding at discharge (aOR 4.14, 95% CI 1.87-9.16). Additionally, mothers who perceived their partner to prefer breastfeeding had greater odds of exclusively breastfeeding at discharge than those mothers who perceived their partner to be ambivalent about breastfeeding or to prefer bottle-feeding (aOR 2.51, 95% CI 1.23-5.09).

Table 4.16: Determinants of Exclusive Breastfeeding at Discharge from Hospital (n=353)

Variable[a]	n	Adjusted OR[b]	95% CI
Admission to Special Care Nursery (SCN)			
Yes (ref)	35	1.00	
No	265	4.43	(1.98-9.99)
Maternal grandmother breastfed one or more children			
No/unsure (ref)	48	1.00	
Yes	252	4.14	(1.87-9.16)
Mother's perception of father's feeding preference			
Prefers bottle-feeding or ambivalent (ref)	124	1.00	
Prefers breastfeeding	176	2.51	(1.23-5.09)
Received conflicting feeding advice in hospital			
Yes (ref)	83	1.00	
No	217	3.99	(1.94-8.22)
Feeding frequency in hospital			
Scheduled feeding (ref)	55	1.00	
Demand feeding	245	3.33	(1.59-6.95)
Infant roomed-in with mother			
Yes, at all times	243	2.31	(1.15-4.62)
No (ref)	119	1.00	
-2log likelihood ratio=191.820, df = 5			
Hosmer-Lemeshow Goodness of Fit: χ^2 = 5.79, df = 8, p = 0.671			

[a] *Variables entered into the initial model were maternal age, marital status, parity, mother's country of birth, when feeding method was decided, mothers infant feeding attitude and knowledge score, mother's perception of father's feeding preference, whether mother attended antenatal classes, maternal pre-pregnancy obesity, delivery method, infant admitted to Special Care Nursery (SCN), babies gender, infant*

birth weight, whether maternal grandmother had ever breastfed, baby in mothers room, early breast contact, demand feeding in hospital, direct assessment of attachment, explicit teaching of positioning, encouragement from staff to breastfeed at birth, conflicting feeding advice from hospital staff, satisfaction with feeding advice, mother's occupation, mother's education, father's occupation, grandmothers feeding preference, whether mother smoked during pregnancy. All variables of interest were included in the full model in the initial step and then backward elimination procedure was applied to obtain the final model, using 5% critical value of χ2 test for the appropriate degrees of freedom.
[b] *Adjusted odds ratios were derived as the exponentiations of the logistic regression coefficients*

As exclusive breastfeeding at discharge was the only outcome of interest with independent predictors after multivariate analysis, the results were compared with the determinants of exclusive breastfeeding found in the previous Perth Infant Feeding Studies (PIFSI and PIFSII). The only common significant independent determinant of exclusive breastfeeding at discharge between the PIFS I and II studies and the RIFS was admission to a Special Care Nursery (SCN) (See Table 4.17).

Table 4.17: Comparison of Determinants of Exclusive Breastfeeding at Discharge between RIFS, PIFSI and PIFSII

Variable[a]	RIFS[a]		PIFS I[b]		PIFS II[c]	
	aOR[d]	95% CI	aOR	95% CI	aOR	95% CI
Mother's country of birth	NS					
Australia / New Zealand			1.00		1.00	
UK/Ireland			0.38	(0.18-0.76)	0.73	(0.32-1.67)
Other			0.31	(0.13-0.74)	0.33	(0.18-0.59)
Parity	NS		NS			
Primiparous					1.00	
Multiparous					1.71	(1.04-2.79)
Delivery method	NS		NS			
Vaginal					1.00	
Other					0.42	(0.26-0.68)
Maternal BMI (kg/m^2)	NS		Not measured			
<25					1.00	
25-29.9					0.50	(0.28-0.89)
30+					0.63	(0.33-1.20)
Infant birthweight (g)	NS					
<2500			1.00		NS	
≥2500			6.99	(2.18-22.43)		
Mothers IIFAS						
<65	NS		Not measured		1.00	
≥65					1.10	(1.06-4.26)
Admission to Special Care Nursery (SCN)						
Yes	0.24	(0.11-0.54)	0.47	(0.23-0.91)	0.30	(0.15-0.59)
No (ref)	1.00		1.00		1.00	
Maternal grandmother breastfed one or more			NS		NS	

children						
No/unsure (ref)	1.00					
Yes	4.14	(1.87-9.16)				
Mother's perception of father's feeding preference						
Prefers bottle-feeding or ambivalent (ref)	1.00		1.00		NS	
Prefers breastfeeding	2.51	(1.23-5.09)	4.63	(2.48-8.62)		
Received conflicting feeding advice in hospital						
Yes (ref)	1.00		Not in model		Not in model	
No	3.99	(1.94-8.22)				
Feeding frequency in hospital			Not in model		Not in model	
Scheduled feeding (ref)	1.00					
Demand feeding	3.33	(1.59-6.95)				
Infant roomed-in with mother			Not in model		Not in model	
Yes, at all times	2.31	(1.15-4.62)				
No (ref)	1.00					
-2log likelihood ratio	191.820		337.652		442.47	

[a] *Variables entered into the RIFS model were maternal age, marital status, parity, mother's country of birth, when feeding method was decided, mothers infant feeding attitude and knowledge score, mother's perception of father's feeding preference, whether mother attended antenatal classes, maternal pre-pregnancy obesity, delivery method, infant admitted to Special Care Nursery (SCN), babies gender, infant birth weight, whether maternal grandmother had ever breastfed, baby in mothers room, early breast contact, demand feeding in hospital, direct assessment of attachment, explicit teaching of positioning, encouragement from staff to breastfeed at birth, conflicting feeding advice from hospital staff, satisfaction with feeding advice, mother's occupation, mother's education, father's occupation, grandmothers feeding preference, whether mother smoked during pregnancy.*

[b] *Variables entered into the PIFS I model were maternal age, marital status, mother's occupation, parity, mother's country of birth, when feeding method was decided, mother's perception of father's feeding preference, whether mother attended antenatal classes, delivery method, infant admitted to Special Care Nursery (SCN), infant birthweight, whether maternal grandmother had ever breastfed, and maternal grandmothers feeding preference.*

[c] *Variables entered into the PIFS II model included those in the PIFS I model plus whether mother smoked during pregnancy. maternal pre-pregnancy obesity and mothers infant feeding attitude and knowledge score. All variables of interest were included in the full model in the initial step and then backward elimination procedure was applied to obtain the final model, using 5% critical value of $\chi 2$ test for the appropriate degrees of freedom.*

[d] *Adjusted odds ratios were derived as the exponentiations of the logistic regression coefficients*

4.5 Factors Associated with Breastfeeding Duration

At discharge from hospital, 97% of infants were receiving some breast milk, decreasing to 67.9% at 6 months. More than one third of infants (36.4%) were still receiving some breast milk at 12 months. Breastfeeding was more prevalent at all time points in the RIFS cohort compared with the PIFS II, National Health Survey and Australian National Infant Feeding Survey (ANIFS), excluding breastfeeding at 12 months in the ANIFS. Table 4.18 provides comparison of the RIFS with the PIFS II and national breastfeeding survey data.

Table 4.18: Breastfeeding prevalence (%) in RIFS compared with PIFS II and National Health Surveys

Time	RIFS (2010-12)	PIFS II (2002-03)	NHS (2001)	ANIFS (2010)
At discharge	97.0	93.8	83.0	95.9
1 month	89.1	78.2	N/A	74.6
3 months	77.7	62.1	N/A	70.3
6 months	67.9	45.8	48.0	60.1
12 months	36.4	19.2	23.0	42.2

The prevalence of exclusive breastfeeding decreased from 82.7% at discharge from hospital to 35.6% at 4 months and was less than 6% at 6 months (26 weeks). Table 4.19 provides comparison between RIFS, PIFS II and ANIFS data.

Table 4.19: Proportion of infants exclusively breastfed, by age

	RIFS 2010-12 (%)	PIFS II 2003-03 (%)	ANIFS 2010 (%)
At discharge	82.7	75.6	90.4
4 months	35.6	9.5	27.0
6 months	5.7	0.7	2.1

The median duration of exclusive breastfeeding for the RIFS cohort was 10.0 weeks (95% CI 7.1 – 12.9) and median duration of any breastfeeding was 37.0 weeks (95% CI 32.1 – 41.9). The median duration of exclusive breastfeeding for the PIFS II cohort was 4.0 weeks (95% CI 3.9 - 4.1) and median duration of any breastfeeding was 24.0 weeks (95% CI 20.4 – 27.6).

The breastfeeding prevalence (exclusive and any) at specified time points by sample characteristic is given in Table 4.20.

Table 4.20: Breastfeeding practice by selected sample characteristic at specified time points

	Exclusive Breastfeeding (%± half 96% CI)					Any Breastfeeding (%± half 95% CI)				
Variable	n	Discharge	4 months	6 months		n	Discharge	4 months	6 months	12 months
All mothers	353	82.7±3.6	35.6±4.9	5.7±2.4		414	97.0±1.6	75.8±4.3	67.9±4.7	36.4±4.9
Sociodemographic										
Mothers age (years)										
• <25 (ref)	9	81.8±22.8	0	0		11	90.9±17.0	37.5±33.5	37.5±33.5	0
• ≥25	344	82.7±3.6	36.3±5.0[a]	5.8±2.4		416	97.1±1.6	76.6±4.3[a]	68.5±4.7	37.2±4.9[a]
Education level										
• Bachelor degree	138	85.2±5.4	52.4±8.1	7.5±4.3		158	97.5±2.4	85.9±5.6[a]	81.2±6.3[a]	48.0±8.1[a]
• High school / trade qualification	163	82.3±5.3	26.9±6.6[a]	4.7±3.2		192	97.0±2.4	70.6±6.7	61.6±7.2	30.3±6.8
• Didn't complete high school (ref)	57	80.7±10.2	14.6±10.8[a]	2.4±4.7		54	94.7±5.8	64.4±14.0	51.1±14.6	20.5±11.9
Infants age when mother returned to work										
• <6mo (ref)	93	78.8±7.4	31.0±8.5	3.5±3.4		112	94.9±4.0	70.0±8.6	58.2±9.2	23.6±7.9
• 6-12mo	79	85.9±7.1	43.5±10.5	9.4±6.2		91	98.9±2.1	84.4±7.5[a]	80.0±8.3[a]	40.9±10.3
• >12mo	122	83.6±6.0	42.6±8.5	7.0±4.4		142	97.3±2.6	81.4±6.3	73.8±7.2	47.6±8.1[a]
ARIA Category										
• Accessible[b] (ref)	232	83.5±3.5	37.9±4.6	5.1±2.1		268	96.4±1.8	76.4±4.0	69.1±4.4	34.6±4.5
• Remote[c]	119	81.5±3.7	32.1±4.4	6.9±2.4		143	97.9±1.4	75.0±4.1	65.9±4.5	40.5±4.7
Marital Status										
• Single (ref)	17	73.9±18.0	13.3±17.2	6.7±12.7		20	87.0±13.7	64.7±22.7	64.7±22.7	17.6±18.1

• Partnered	332	83.6±3.6	36.6±5.1	5.5±2.4		387	94.2±±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Biomedical										
Parity										
• Primiparous (ref)	137	77.0±6.2	22.5±6.8	1.9±2.1		178	97.8±2.2	74.1±6.8	64.6±7.5	33.1±7.4
• Multiparous	213	86.6±4.3[a]	43.5±6.7[a]	8.6±3.8[a]		246	96.3±2.4	76.8±5.6	70.0±6.1	39.2±6.5
Delivery method										
• Vaginal	259	85.2±4.0[a]	38.3±5.9	6.1±2.9		298	98.0±1.6[a]	78.7±4.9[a]	71.0±5.4[a]	36.8±5.8
• Caesarean (ref)	93	76.9±7.5	29.2±8.7	4.7±4.0		114	94.2±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Mothers pre=pregnancy BMI (kg/m^2)										
• <30	290	84.8±3.8[a]	39.4±5.6[a]	7.1±2.9[a]		342	97.1±1.8	79.2±4.6[a]	72.3±5.0[a]	39.1±5.5[a]
• ≥30 (ref)	47	73.4±10.8	23.2±11.1	0		64	94.2±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Mother smoked during pregnancy										
• Yes (ref)	25	73.5±14.8	14.3±13.0	3.6±6.9		31	91.2±9.5	59.3±18.5	55.6±18.7	18.5±14.6
• No	386	83.4±3.7	37.3±5.2[a]	6.0±2.5[a]		376	97.4±1.6[a]	76.9±4.4[a]	68.5±4.9	38.0±5.1[a]
Infant gender										
• Male (ref)	189	79.7±5.1	30.0±6.2	4.3±2.8		237	96.2±2.4	72.9±6.0	63.8±6.5	33.5±6.4
• Female	161	86.3±4.9[a]	42.9±7.6[a]	7.5±4.1		190	97.9±2.0	79.4±6.1	72.9±6.7	40.0±7.4
Infant admitted to SCN										
• Yes (ref)	27	61.4±14.4	14.0±10.4	2.3±4.5		43	95.8±3.0	72.3±7.0	61.3±7.7	26.1±7.0
• No	325	85.3±3.6[a]	38.6±5.3[a]	6.2±2.6		177	96.9±1.7	75.3±4.6	67.9±5.0	36.4±5.2
Pacifier introduced before 4 weeks of										

age										
• Yes (ref)	142	84.5±5.5	28.8±7.1	3.8±3.0		161	95.8±3.0	72.3±7.0	61.3±7.7	26.1±7.0
• No	147	81.7±5.6	42.4±7.4[a]	7.1±3.9		177	98.3±1.9	80.1±6.0	73.7±6.6[a]	45.9±7.5[a]
Breastfeeding problems before 4 weeks										
Yes (ref)	288	82.8±4.0	35.3±5.4	5.6±2.6		343	98.6±1.2[a]	76.7±4.7	69.0±5.1	36.5±5.4
No	65	82.3±8.4	37.1±12.0	6.5±6.1		71	89.9±6.6	71.6±10.8	62.7±11.6	36.4±11.6
Hospital Practices										
24-hour rooming in										
• Yes	249	86.2±3.4[a]	38.1±6.1	6.1±3.0		280	96.9±2.9	76.7±5.2	69.2±5.7	39.2±6.1
• No (ref)	104	75.9±7.2	30.9±8.2	4.9±3.8		133	97.1±2.8	74.6±7.6	65.9±8.3	31.2±8.1
Infant demand fed										
• Yes	297	87.4±3.5[a]	40.9±5.6[a]	6.9±2.9		335	98.5±1.3[a]	78.4±4.6[a]	70.3±5.1[a]	39.4±5.5[a]
• No (ref)	55	64.7±10.2	16.0±8.3	1.3±2.6		77	90.6±6.2	65.3±11.0	59.7±11.3	25.0±10.0
Early breast contact										
• <30 mins	270	88.8±3.5[a]	40.9±6.0[a]	6.9±2.9		303	99.7±0.6[a]	78.9±4.9	71.8±5.4	38.0±5.9
• ≥30mins (ref)	80	70.8±8.4	25.0±8.5	2.0±2.7		105	92.9±4.7	72.1±8.6	61.5±9.3	34.0±9.2
Psychosocial										
Intended pregnancy										
• Yes	233	84.1±4.3	42.2±6.1[a]	5.2±2.8		274	98.9±1.2[a]	79.3±5.0[a]	69.9±5.6	37.5±6.0
• No (ref)	118	80.3±6.4	22.2±7.5	6.8±4.6		137	93.2±4.1	68.6±8.3	63.6±8.6	34.2±8.5
Attended antenatal classes										
• Yes	291	84.3±3.8	40.0±5.5[a]	6.3±2.7		337	97.7±1.6	80.6±4.4[a]	72.8±5.0[a]	38.9±5.5[a]

• No (ref)	61	76.3±9.3	16.4±8.9	3.0±4.1		75	93.8±5.3	55.1±11.7	46.4±11.8	25.0±10.3
IIFAS score										
• <65 (ref)	131	77.1±6.3	20.1±6.4	2.0±2.2		159	93.5±3.7	61.4±7.7	72.8±5.0	21.9±6.6
• ≥65	222	86.4±4.2[a]	46.1±6.6[a]	8.2±3.6[a]		255	99.2±1.1	85.5±4.6[a]	80.2±5.2[a]	46.2±6.5[a]
Father prefers breastfeeding										
• No / ambivalent (ref)	143	76.1±6.1	26.8±6.9	2.5±2.4		188	94.1±3.4	68.5±7.1	58.2±7.5	26.7±6.8
• Yes	208	88.1±4.1[a]	42.6±6.7[a]	8.1±3.7[a]		236	99.2±1.1[a]	82.2±5.1[a]	76.1±5.7[a]	44.5±6.7[a]
Maternal grandmother prefers breastfeeding										
• No / ambivalent (ref)	225	82.1±4.5	30.6±5.9	4.3±2.6		283	96.0±2.3	70.4±5.7	62.0±6.0	29.6±5.7
• Yes	127	84.7±5.8	44.4±8.4[a]	8.3±4.7		148	98.7±1.8	86.7±5.9[a]	79.7±7.0[a]	50.4±8.7[a]
Maternal grandmother breastfed										
• Yes	306	85.5±3.6[a]	38.0±5.4[a]	5.9±2.6		347	96.9±1.8	77.4±4.6	69.9±5.0	38.7±5.4
• No (ref)	46	68.7±11.1	24.6±10.8	4.9±5.4		65	97.0±4.1	69.5±11.7	59.3±12.5	25.4±11.1
When infant feeding method was decided										
• Before pregnancy	285	87.4±3.6[a]	40.5±5.7[a]	7.0±3.0[a]		326	99.1±1.0[a]	81.8±4.4[a]	74.3±5.0[a]	40.3±5.7[a]
• During / after pregnancy (ref)	68	68.0±9.1	19.3±8.5	1.2±2.3		100	90.0±5.9	56.3±10.4	47.1±10.5	24.1±9.0

[a] *Significantly different from reference level (ref) at p<0.05*

[b] *Accessible = Highly Accessible + Accessible ARIA categories*

[c] *Remote = Moderately Accessible + Remote + Very Remote ARIA categories*

4.6 Univariate Analysis of Factors Associated with Breastfeeding Duration

4.6.1 Sociodemographic Factors

Maternal Age and Marital Status

Whilst there was no association between maternal age and exclusive breastfeeding to six months, women aged ≥ 25 years had more than three times lower odds of ceasing breastfeeding before 12 months (OR 0.28, 95% CI 0.12-0.64). Exclusive breastfeeding to six months was positively associated with maternal age ≥30 years. No significant association was found between marital status and breastfeeding duration of any intensity.

Geographical Remoteness

No significant association was found between ARIA category and breastfeeding duration of any intensity.

Occupation and Level of Education

There were no significant associations between maternal occupational group and exclusive breastfeeding to six months, however women employed in managerial or professional occupations had approximately half the odds of ceasing any breastfeeding before 12 months compared to other occupational groups (OR 0.52, 95% CI 0.34-0.80). No significant association was found between paternal occupational group and breastfeeding duration of any intensity.

A higher level of education was positively associated with duration of any breastfeeding to both six and 12 months, however maternal education was not significantly associated with exclusive breastfeeding to six months. Women with a tertiary education had approximately one third the odds of ceasing any breastfeeding at six months (OR 0.34, 95% CI 0.21-0.55) and approximately half the odds of ceasing any breastfeeding by 12 months (OR 0.43, 95% CI 0.28-0.66).

Income

No significant associations were found between reported family income and exclusive breastfeeding to six months, however women with a reported family income of <$72,800 had almost two times higher odds of ceasing any breastfeeding before six months (OR 1.76, 95% CI 1.12-2.75). No associations were found between income and breastfeeding duration to 12 months.

Return to Work

Approximately one third of mothers (33.6%) returned to paid employment or study in the first six months after the birth of their infant, and a further 28.8% returned in the second six months. The remainder of mothers did not return to employment in the first 12 months. There was a significant negative association between employment and cessation of any breastfeeding, with mothers returning to work in the first six months having less than half the odds of exclusively breastfeeding at six months (OR 0.44, 95% CI 0.27, 0.72) and approximately a third of the odds of breastfeeding at 12 months (OR 0.39, 95% CI 0.23, 0.65).

4.6.2 Biomedical Factors

A number of biomedical variables determined at baseline and used to determine relationships with early breastfeeding practice were also examined in relation to breastfeeding duration. In addition, variables measured at subsequent follow-up timepoints, such as experiencing breastfeeding problems, were included in univariate analysis to determine if significant relationships existed.

Parity

Parity and breastfeeding duration were significantly associated (X^2 7.445, p=0.006), with multiparous women having almost five times lower odds of ceasing exclusive breastfeeding before six months (OR 0.21, 95% CI 0.06-0.72). The effect was not significant for any breastfeeding to 12 months however.

Infant birthweight

No significant associations were found between birthweight and duration of breastfeeding at any intensity to 12 months.

Smoking and Alcohol

Smoking during pregnancy was significantly negatively associated with breastfeeding duration to 12 months (X^2=4.099, p=0.043), but not with breastfeeding at any intensity to six months. There was no significant association with current smoking and breastfeeding at either six or 12 months. Alcohol consumption prior to or during pregnancy was not significantly associated with breastfeeding at any intensity to 12 months. There was no significant association with current alcohol consumption and breastfeeding at either six or 12 months.

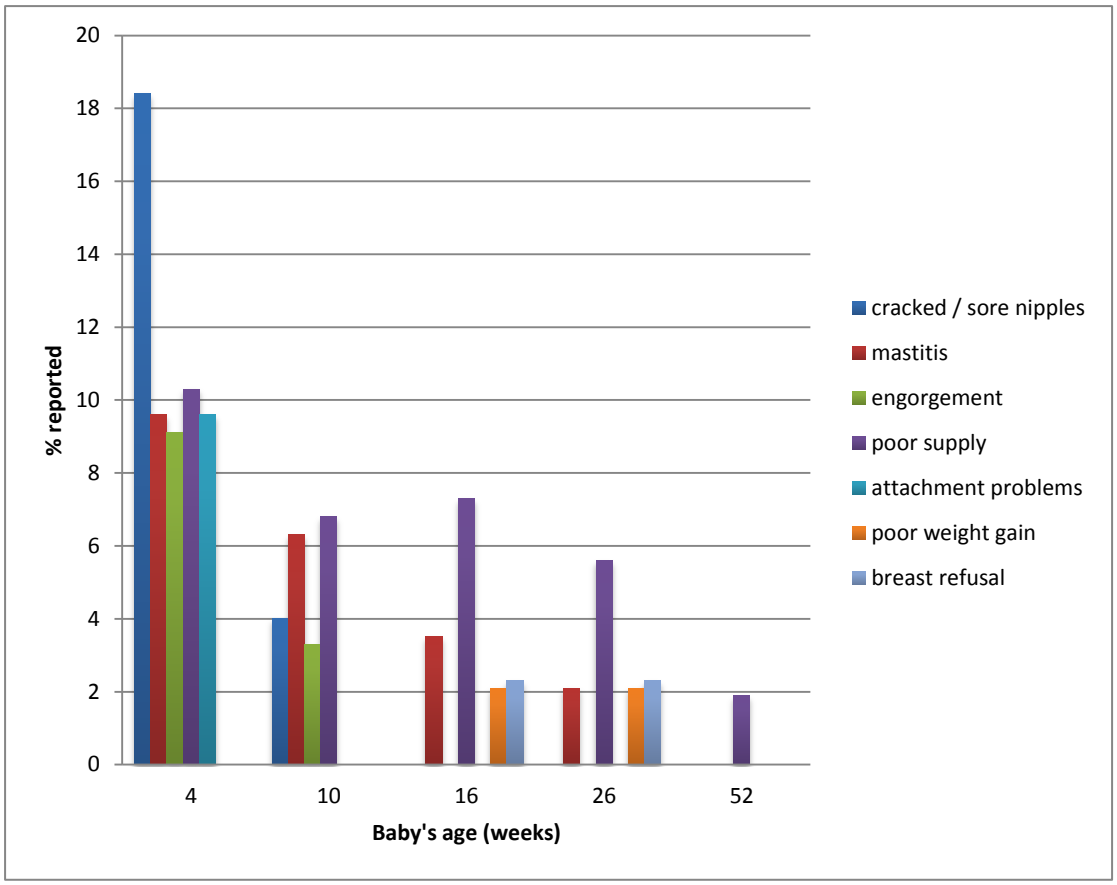
Maternal Pre-Pregnancy Obesity

There was a strong negative association between maternal pre-pregnancy obesity and breastfeeding duration. Women with a BMI >30 had almost three times the odds of ceasing any breastfeeding by 6 months (OR=0.4, 95% CI 0.19,0.59) and approximately twice the odds of ceasing any breastfeeding at 12 months (OR=0.52, 95% CI 0.28, 0.97).

Breastfeeding problems Experienced after Discharge

At four weeks, a third of mothers (33.7%) reported that they had experienced at least one breastfeeding problem since discharge from hospital (see Figure 4.5). Whilst breastfeeding problems were commonly reported, no significant association was found between breastfeeding problems and breastfeeding duration at any intensity to six months. Just over one in ten mothers (10.2%) indicated that they had experienced one or more problems with breastfeeding at 16 and at 26 weeks.

Figure 4.5: Breastfeeding problems experienced in the first 12 months



4.6.3 Health service-related Factors

Health service-related factors determined at baseline were also examined in relation to breastfeeding duration. In addition, variables measured at subsequent follow-up timepoints, such as seeking assistance for breastfeeding problems from community or primary care providers, were included in univariate analysis to determine if significant relationships existed. As with early breastfeeding practice, there were a number of significant relationships between health service-related factors and breastfeeding duration.

Delivery method

Delivery method was significantly associated with breastfeeding duration. Women who had experienced a vaginal delivery had lower odds of ceasing any breastfeeding before six months compared to women who experienced a caesarean

delivery (OR 0.62, 95% CI 0.39-0.99). The association was not significant for exclusive breastfeeding to six months or for any breastfeeding to 12 months.

Admission to Special Care Nursery

No significant associations were found between admission to SCN and duration of breastfeeding at any intensity.

Professional help and advice

Attendance at antenatal classes remained a significant factor in breastfeeding duration. Women who attended antenatal classes had more than three times the odds of breastfeeding at any intensity at six months (OR 3.10, 95% CI 1.81, 5.29) almost twice the odds of breastfeeding at 12 months (OR 1.91, 95% CI 1.05, 3.46). There was no significant relationship between antenatal classes and exclusive breastfeeding at six months.

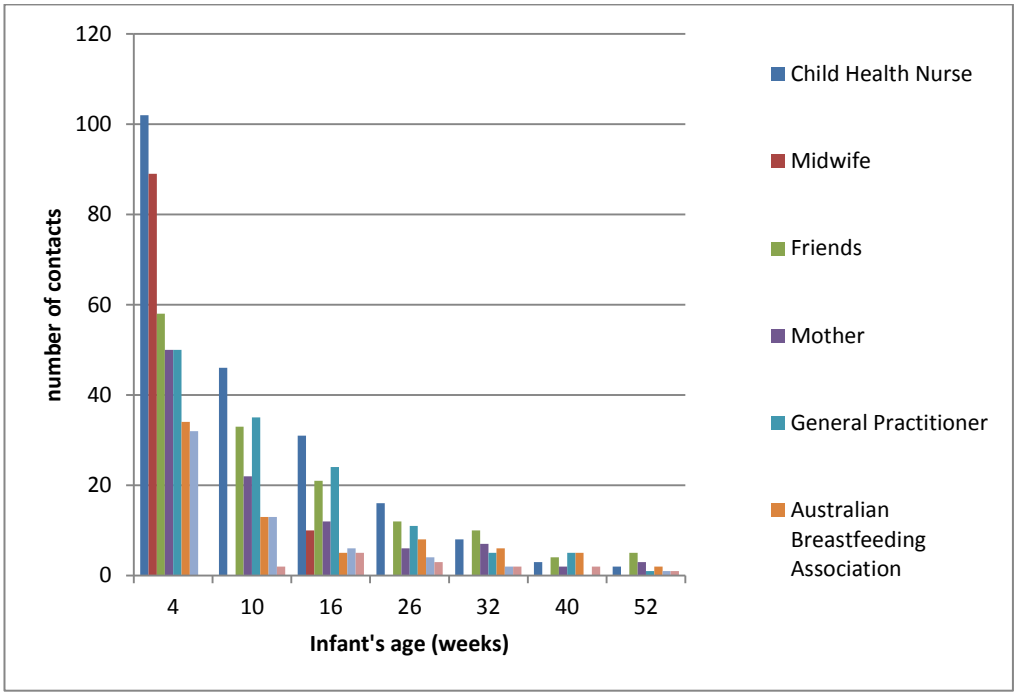
There was no significant association between instruction received about correct positioning or staff checking attachment while in hospital where required and the duration of breastfeeding (exclusive or any) to six months. Satisfaction with feeding advice provided in hospital however, was strongly associated with exclusive breastfeeding at 4 weeks (X^2=6.616, p=0.010), (p=0.016), 10 weeks (X^2=7.607, p=0.006), and 16 weeks (X^2=5.223, p=0.022).

The child health nurse and GP were common sources of advice or support for mothers with breastfeeding problems in the first six months, however other social and family sources were also frequently contacted including friends and the woman's mother (see Figure 4.6). Seeking help from professional supports was not significantly associated with breastfeeding (ABF or EBF) to six months. There were no significant associations between receiving postnatal infant feeding information and duration of breastfeeding at any intensity.

Baby Friendly Practices

Encouragement of demand feeding was significantly associated with duration of any breastfeeding to 12 months of age (see Table 4.20). Women who demand-fed their infant in hospital had almost twice the odds of breastfeeding at 12 months (OR 1.95, 95% CI 10.9, 3.49). There was not significant relationship between demand feeding in hospital and exclusive breastfeeding to six months.

Figure 4.6: Sources of Help and Advice for Breastfeeding Problems to 12 months



Access to online infant feeding information

Questions about access to infant feeding websites were included in the follow-up questionnaires for women participating in the intervention study. From Week 10, women were asked whether they had accessed infant feeding websites in the time since the last questionnaire. Responses were grouped into seven categories; (1) Australian Breastfeeding Association (ABA), a not-for-profit organisation supporting breastfeeding women; (2) NurturingTogether, the intervention website; (3) other government sites, which are not-for-profit and provide a range of parenting and infant feeding information (e.g. Ngala); (4) commercial websites, hosted by an organisation and/or containing commercial advertisements (e.g. baby food or nappy(diaper) manufacturers; (5) individual and not-for-profit websites, which are

sites primarily developed by an individual and/or small organisation (e.g., Pinky McKay); (6) Google Web search; and (7) don't know, where mothers could not remember the name of the website(s) visited.

Commercial websites were most commonly and consistently visited by mothers in the study, with 33-48% indicating that they had accessed at least one commercial site in the 12 month period (see Figure 4.7). The ABA site was the second most frequently visited site, particularly in the first six months. There was a significant positive relationship between accessing online information and experiencing breastfeeding problems up to 26 weeks and at 40 weeks, however no association was found at either 32 weeks or 52 weeks (see Table 4.21).

Figure 4.7: Access to parenting websites by intervention group participants (n=207)

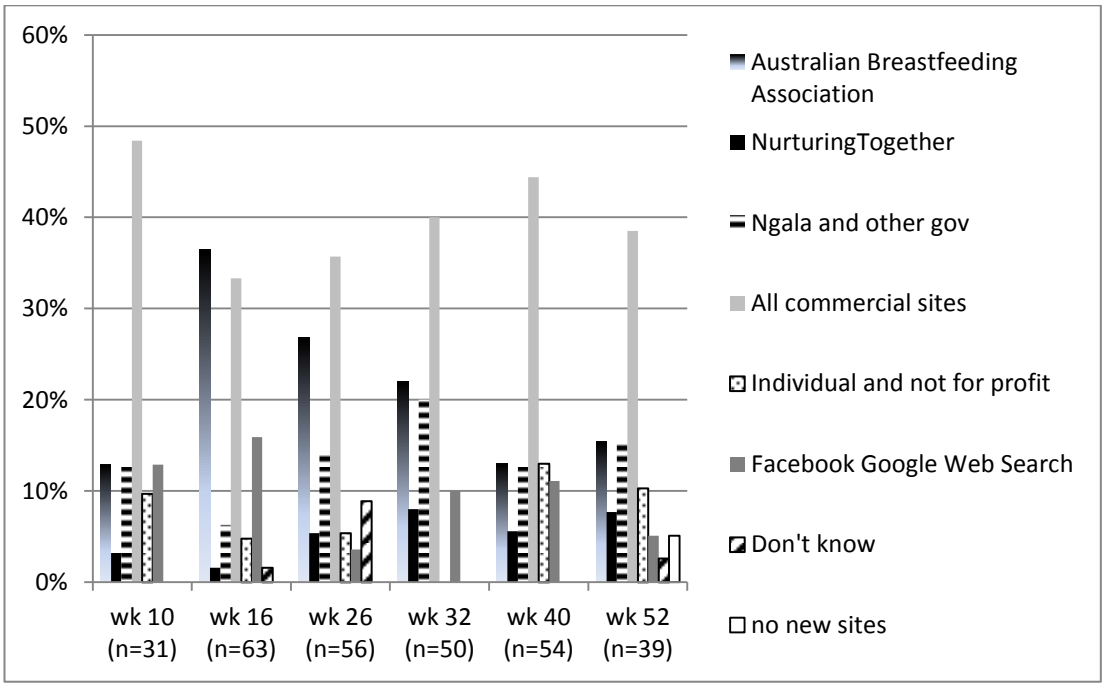


Table 4.21: Access to parenting websites by mothers who experienced breastfeeding problems

Period during which a mother accessed a parenting website	Period during which a mother experienced breastfeeding problems[a]	Accessed website		
		Yes (%)	No (%)	*p* value[b]
Previous 10 weeks	Week 4-10 (n=83)	52 (62.7)	31 (37.3)	<0.001
Previous 16 weeks	Week 11-16 (n=61)	38 (62.3)	23 (37.7)	<0.001
Previous 26 weeks	Week 17-26 (n=39)	27 (69.2)	12 (30.8)	0.001
Previous 32 weeks	Week 27-32 (n=28)	17 (60.7)	11 (39.3)	0.068
Previous 40 weeks	Week 33-40 (n=25)	17 (68.0)	8 (32.0)	0.003
Previous 52 weeks	Week 41-52 (n=13)	5 (38.5)	8 (61.5)	0.361

[a]Where n= the total number of women experiencing breastfeeding problems
[c]Chi-square test

A greater proportion of women who participated in the intervention study overall were exclusively breastfeeding at 26 weeks compared with those in the control group 5.9% vs. 0.6%, $p = 0.030$). Of the women living in areas categorised as remote or very remote, 10.9% (n=6) of the intervention group were still exclusively breastfeeding at 26 weeks, compared to the control group where none of the participants were exclusive breastfeeding at this point (95% CI 0.03-0.19, $p = 0.030$).

4.6.4 Psychosocial Factors Associated with Breastfeeding Duration

Infant Feeding Attitudes

The feelings that mothers expressed at birth about breastfeeding, including their confidence, satisfaction and enjoyment of breastfeeding whilst in hospital were associated with increased breastfeeding duration. Mothers with a positive score for breastfeeding enjoyment from the baseline survey were more likely to be exclusively breastfeeding at six months (X^2=6.346, p=0.012) and breastfeeding at 12 months (X^2=23.167, p<0.0001). Median duration of breastfeeding was determined by Kaplan-Meier survival analysis. The median duration of exclusive breastfeeding for mothers who indicated in hospital that they were confident breastfeeding in front of others was 16 weeks, while mothers who felt uncomfortable breastfeeding in public exclusively breastfed for only 5 weeks (p<0.0001). Mothers who did not find breastfeeding satisfying had a median duration of exclusive breastfeeding of

one week compared to 16 weeks for those who expressed satisfaction with their breastfeeding experience ($p<0.0001$).

The median duration of exclusive breastfeeding for mothers with an IIFAS score of ≥65 was 16 weeks (95% CI 13.5-18.5) compared with 5 weeks for those with a score <65 (95% CI 3.2-6.8, $p<0.0001$) (see Figure 4.8). The median duration of any breastfeeding to 12 months was more than twice as long for mothers with an IIFAS score>65 (48 vs. 22 weeks, $p<0.001$) (see Figure 4.9). After adjusting for potential confounders, mothers infant feeding attitude remained a strong predictor of exclusive breastfeeding to six months, where those with more positive attitudes were less likely to discontinue (aHR =0.55, 95% CI 0.40-0.77). Similarly, any breastfeeding to 12 months was also associated with a higher IIFAS score (aHR 0.42, 95% CI 0.29-0.62).

Figure 4.8: Duration of exclusive breastfeeding duration to 26 weeks by IIFAS score

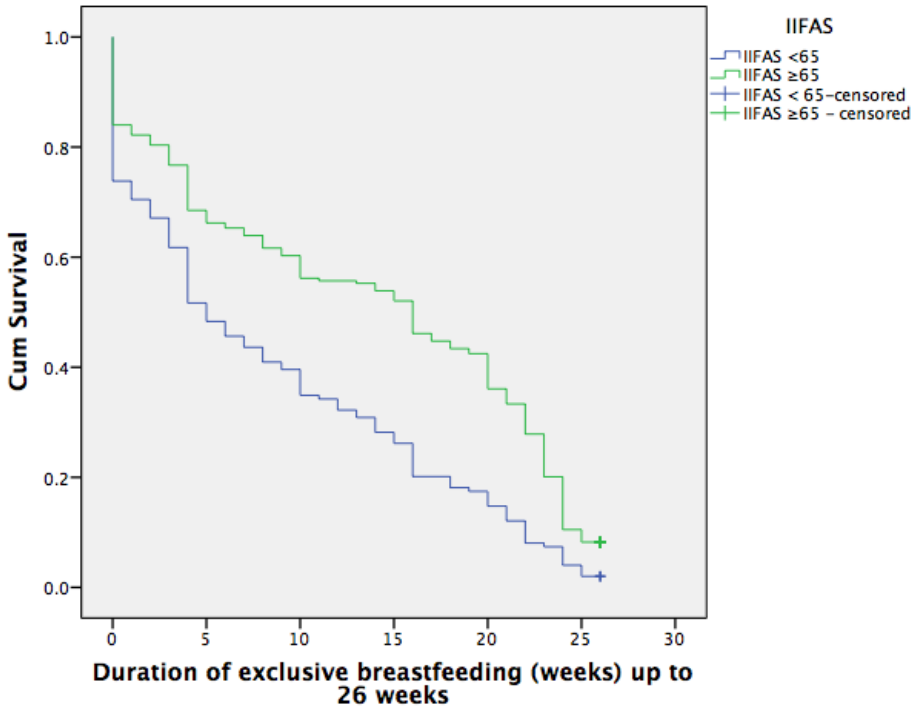
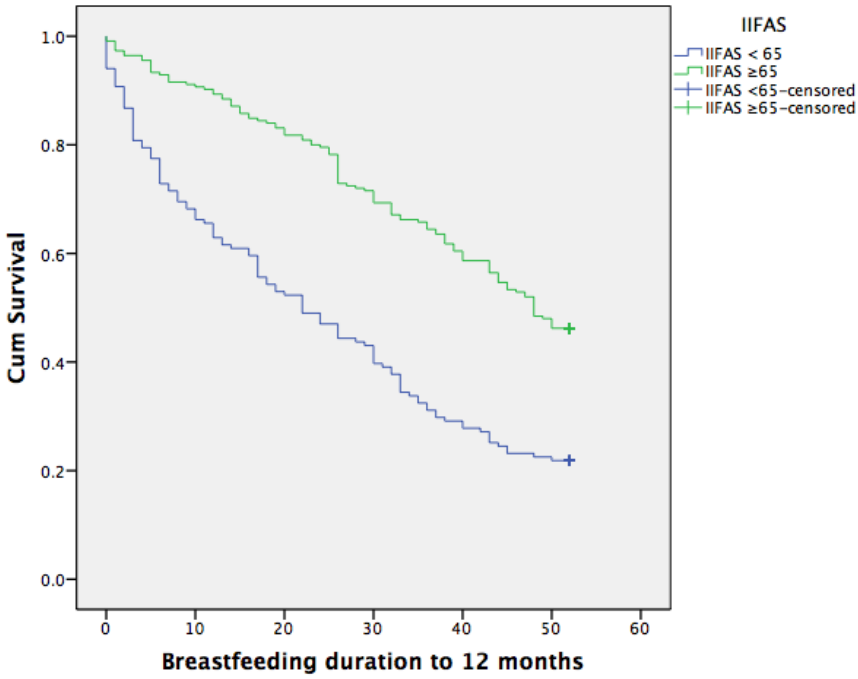


Figure 4.9: Duration of any breastfeeding to 12 months by IIFAS score



Infant Feeding Intentions

Approximately one in five mothers (21%) intended to give their infants formula or had already given it whilst in hospital. While fewer mothers who indicated that they intended to give formula were exclusively breastfeeding at six months, the association was not significant. Similarly there were no significant associations between intended age of formula introduction and exclusive breastfeeding to six months.

Social Support

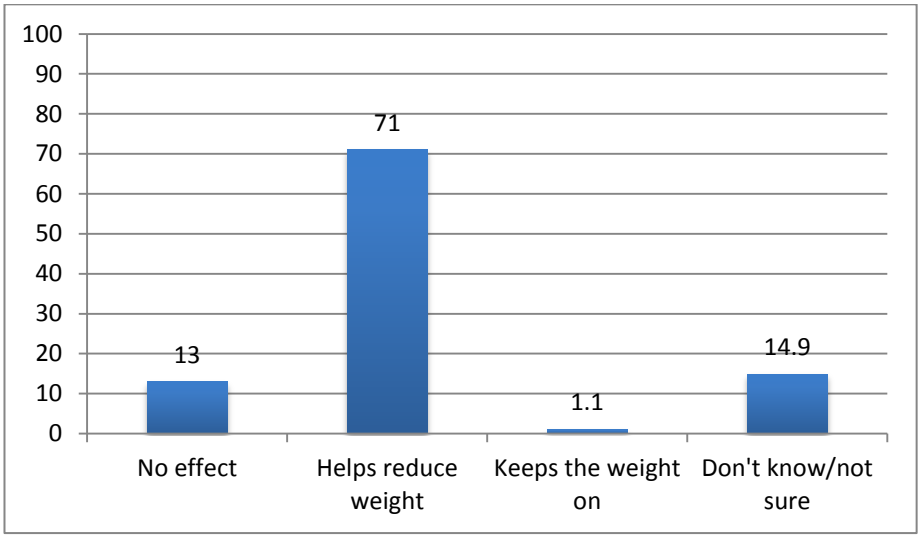
There was a significant positive association between the duration of any breastfeeding to 26 weeks and having friends that chose to breastfeed their infants (X^2=7.716, *p*=0.005), however the effect was not significant for exclusive breastfeeding to 26 weeks.

Effect of breastfeeding on maternal weight, breast shape and size

At four weeks, mothers were asked about the effect that breastfeeding had on body weight and breast shape. Nearly three quarters of mothers (71%) thought that breastfeeding helped to reduce weight after birth, and 13% believed that it had no

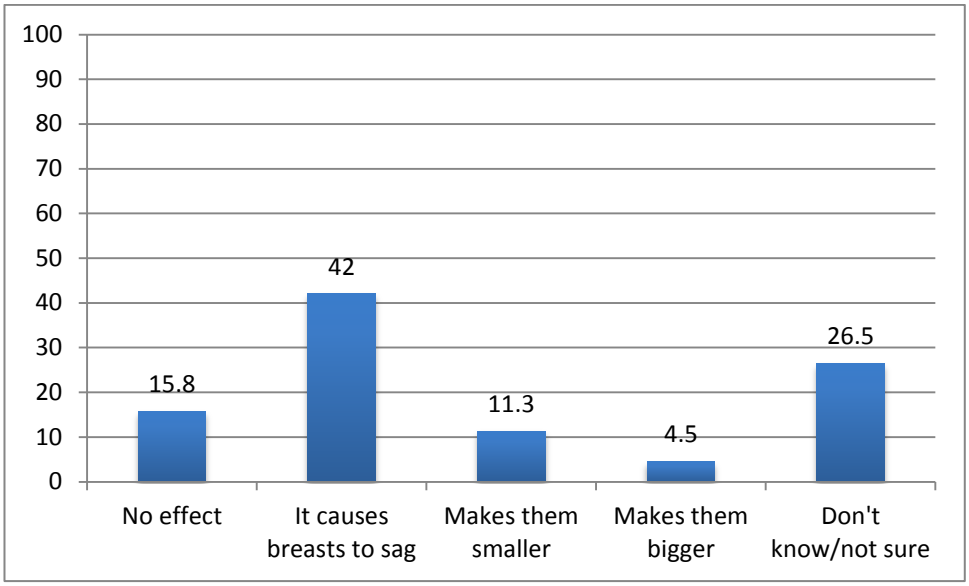
effect (see Figure 4.10). The median duration of exclusive breastfeeding for mothers who indicated that they thought it resulted in weight gain was 3 weeks (95% CI 1.0 – 5.0) compared with 10 weeks for the cohort overall.

Figure 4.10: Effect of breastfeeding on mothers' weight after birth



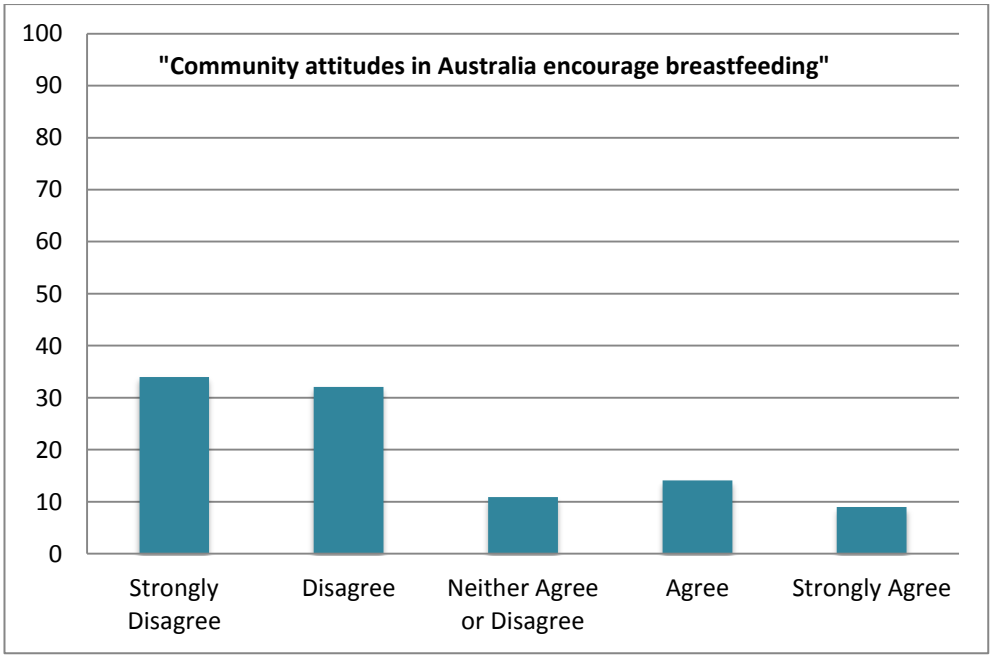
When asked about the effect of breastfeeding on breast shape and size, 42% indicated that they believed it caused breasts to sag and a further 11.3% believed it made them smaller (see Figure 4.11). More than one quarter of women (26.5%) were not sure and 11.3% believed it made no difference. Multiparous women were significantly more likely to indicate that breastfeeding caused breasts to sag. There were no significant differences in median duration of exclusive breastfeeding between mothers who believed that breastfeeding had negative effects on breast shape or size.

Figure 4.11: Effect of breastfeeding on breast shape and size



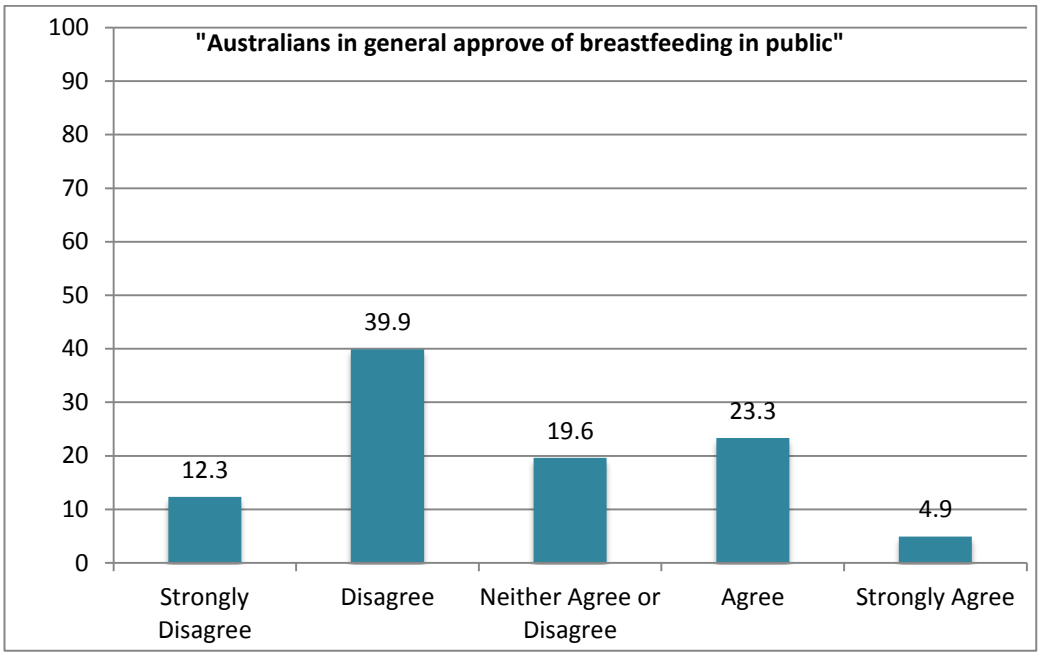
When mothers ceased breastfeeding, they were asked whether they perceived Australians in general to be supportive of breastfeeding. Almost two thirds of mothers (66.1%) felt that in general, Australians were not supportive and a further 10.0% were ambivalent (see Figure 4.12). Only 23.1% felt that the community attitude towards breastfeeding in Australia was supportive.

Figure 4.12: Perception of support for breastfeeding from the Australian community



Similarly, when asked whether Australians in general approve of mothers breastfeeding in public, over half (52.2%) indicated that they disagreed and a further 19.6% were ambivalent (see Figure 4.13). Just over one quarter (28.2%) believed that breastfeeding in public was supported by the Australian community.

Figure 4.13: Perception of support for breastfeeding in public from the Australian community



4.7 Multivariate Analysis of Factors Associated with Breastfeeding Duration

All factors from the univariate analyses found to have significant associations with breastfeeding duration, including exclusive and any breastfeeding to six months and any breastfeeding to 12 months, were entered into separate logistic regression models to determine independent associations for each measure of breastfeeding practice. In addition, variables previously identified in the literature as significant influences, but not found to be significant in this study, were included in the models to ensure that any potentially significant relationships were accounted for. The full list of variables included in the three models is provided in Table 4.23.

The Cox's proportional hazards model was used to determine significant factors as outlined in Chapter 3, as it allows joint estimation of the effects of predictor variables on the 'hazard', or the cessation of breastfeeding at identified timepoints. Three separate models were constructed for determining factors influencing the cessation of exclusive and any breastfeeding before six months, and for cessation of any breastfeeding at 12 months postpartum.

4.7.1 Factors Independently Associated with Exclusive Breastfeeding Duration

Smoking during pregnancy was the strongest predictor of exclusive breastfeeding cessation before six months (aHR 3.21, 95% CI 1.89, 5.46) (see Table 4.23). Pre-pregnancy obesity, a return to work before their infant was six months old, primiparity and infant admission to the Special Care Nursery also increased the risk for ceasing exclusive breastfeeding before 26 weeks.

Women who had attended antenatal classes and women whose own mother had breastfed at least one child had significantly lower risk of ceasing exclusive breastfeeding before six months. A positive maternal infant feeding attitude, a perceived positive attitude towards breastfeeding by the infant's father and baby-

friendly practices such as rooming in and encouragement of demand feeding also reduced the risk of ceasing exclusive breastfeeding before six months.

4.7.2 Factors Independently Associated with Any Breastfeeding Duration

Women who returned to work before six months had 2.5 times greater risk of ceasing breastfeeding before 12 months than those who did not (see Table 4.23). Pre-pregnancy obesity remained a significant predictor, with mothers with a BMI of ≥30 having twice the risk of ceasing any breastfeeding before 12 months. Similarly, mothers who smoked during pregnancy had more than twice the risk of ceasing any breastfeeding before 12 months.

Hospital practices such as rooming in and demand feeding were also significant positive predictors of breastfeeding to 12 months, as were mothers' and maternal grandmothers' infant feeding attitudes. The use of a pacifier before four weeks of age also increased the risk of breastfeeding cessation before 12 months.

Whilst infant gender was not a significant predictor of breastfeeding practice at any other time point, women had increased risk of ceasing breastfeeding their male infant by 12 months.

Results of the multivariate analysis were compared with the Perth Infant Feeding Study (PIFS) I and II in order to determine differences in influences between rural and metropolitan areas. Breastfeeding duration data was only collected to six months for PIFS I and full breastfeeding rather than exclusive breastfeeding was measured at six months in PIFS II; therefore comparisons of all outcomes of interest were not possible between all studies. Comparison of the RIFS and PIFS II cohorts found that common predictors of breastfeeding duration to 12 months included return to employment before six months, maternal infant feeding attitude, grandmothers' infant feeding preference and smoking during pregnancy (see Table 4.24).

Table 4.22: Factors Independently Associated with the Risk of Discontinuing Breastfeeding at 26 weeks and 52 weeks

Characteristic	EBF (26 weeks)		ABF (26 weeks)		ABF (52 weeks)	
	HR	95% CI	HR	95% CI	HR	95% CI
Parity						
Multiparous (ref)	1.00		NS		NS	
Primiparous	1.59	1.19-2.13				
Mother's education level						
Other qualification (high school / trade)	NS		NS		1.47	1.01-2.13
Degree or higher (ref)					1.00	
Infant's gender						
Male	NS		NS		1.58	1.09-2.30
Female (ref)					1.00	
Maternal pre-pregnancy obesity (BMI – kg/m^2)						
<30 (ref)	1.00		1.00		1.00	
≥30	1.54	1.04-2.30	2.83	1.60-5.00	2.12	1.33-3.40
Mother's perception of father's feeding preference						
Ambivalent or prefers bottle-feeding	1.48	1.11-1.97	1.71	1.02-2.85	NS	
Prefers breastfeeding (ref)	1.00		1.00			
Age of baby at mother's return to work						
Before 6 months	1.68	1.25-2.27	2.01	1.25-3.25	2.51	1.75-3.60
After 6 months (ref)	1.00		1.00		1.00	
Mother's Iowa Infant Feeding Attitude Score (IIFAS)						
≤65	1.81	1.30-2.51	3.45	2.05-5.81	2.38	1.63-3.49
>65 (ref)	1.00		1.00		1.00	

Maternal grandmother's breastfeeding history								
Breastfed one or more children (ref)	1.00			NS			NS	
Did not breastfeed	1.63	1.10-2.40						
Mother's perception of maternal grandmother's feeding preference								
Ambivalent or prefers bottle-feeding	NS			1.96	1.08-3.54		2.05	1.37-3.08
Prefers breastfeeding (ref)				1.00			1.00	
Attended antenatal classes								
Yes, for this or a previous pregnancy (ref)	1.00			1.00				
No	1.64	1.10-2.44		2.51	1.43-4.39			
Infant was demand-fed in hospital								
Yes (ref)	1.00			NS			1.00	
No	1.58	1.05-2.37					1.70	1.08-2.68
24 hour rooming-in in hospital								
Yes (ref)	1.00			NS			1.00	
No	1.69	1.24-2.32					1.85	1.25-2.73
Use of pacifier before 4 weeks of age								
Yes							1.67	1.15-2.37
No (ref)							1.00	
Admission to Special Care Nursery (SCN)								
Yes	1.66	1.02-2.70		NS				
No (ref)	1.00							
Mother smoked during pregnancy								
Yes	3.21	1.89-5.46		3.42	1.58-7.37		2.18	1.15-4.11
No (ref)	1.00			1.00			1.00	

Table 4.23: Comparison of factors independently associated with duration of 'any breastfeeding' to 12 months – RIFS and PIFS II

Variable	RIFS		PIFS II	
	aHR	95% CI	aHR	95% CI
Maternal age				
<20	NS		0.57	0.23-1.41
20-29			1.55	1.21-1.98
≥30 (ref)			1.00	
Infant's gender				
Male (ref)	1.00		NS	
Female	0.63	0.44-0.92		
Mother's education level				
Other qualification (high school / trade)	1.47	1.01-2.13	NS	
Degree or higher (ref)	1.00			
Age of baby at mother's return to work				
Before 6 months	2.51	1.75-3.60	1.69	1.28-2.34
After 6 months (ref)	1.00		1.00	
Mother's Iowa Infant Feeding Attitude Score				
≤65 (ref)	1.00			
>65	0.42	0.29-0.62	0.96	0.94-0.98
Breastfeeding problems at or before 4 weeks				
Yes	NS		1.64	1.29-2.10
No			1.00	
Age of infant when pacifier first introduced				
<4 weeks	N/A		1.92	1.40-2.64
4-10 weeks			1.97	1.13-3.46
>10 weeks			1.61	0.86-3.00
Not using a pacifier at 12 months			1.00	
Mother's perception of maternal grandmother's				
Ambivalent or prefers bottle-feeding	1.00		1.00	
Prefers breastfeeding	0.49	0.33-0.73	0.71	0.55-0.20
Infant was demand-fed in hospital				
Yes	0.59	0.37-0.93	NS	
No (ref)	1.00			
24 hour rooming-in in hospital				
Yes	0.54	0.37-0.80	NS	
No (ref)				
Maternal pre-pregnancy obesity (BMI – kg/m^2)				
<30 (ref)	1.00		N/A	

≥30	2.12	1.33-3.40		
Use of pacifier before 4 weeks of age				
Yes (ref)	1.00		N/A	
No	0.61	0.42-0.87		
Mother smoked during pregnancy				
No (ref)	1.00			
Yes	2.18	1.15-4.11	1.35	1.05-1.73

Variables entered into full models included: maternal age, mother perception of father's feeding preference, infant's gender, parity, infant's birth weight (<2500g), whether infant was admitted to SCN, whether mother received conflicting advice in hospital , attended antenatal classes, mothers level of education, demand feeding in hospital, fathers occupation, early breast contact, rooming in in hospital, delivery method, grandmothers feeding preference, grandmother's breastfeeding history, when feeding method was decided, mothers employment in the previous 6 months, marital status, time to regional centre, mother's IIAFAS score, age of infant when pacifier introduced, mother's smoking during pregnancy, planned pregnancy, household income, breastfeeding problems experienced by week 4, age of infant when mother returned to work, maternal pre-pregnancy obesity.

All variables in the final model were those for which the change in deviance compared with the corresponding X^2 test when excluded.

Chapter 5 - Breastfeeding at Discharge from Hospital in Rural Western Australia

This chapter is a published peer-reviewed journal article, reprinted as it appears in publication.

Cox, K., Giglia, R., Zhao, Y., & Binns, C. W. (2014). Factors associated with exclusive breastfeeding at hospital discharge in rural Western Australia. Journal of Human Lactation, 30(4), 488-497. doi: 10.1177/0890334414547274

Author contributions:

Kylee Cox was responsible for administration of the study, collection of data, data analysis and interpretation, and preparation of the draft and final manuscripts.

Signature:_____ _____

Dr Roslyn Giglia provided advice and guidance on study administration, data analysis and critical review of the manuscript.

Signature:_____ _____

Dr Yun Zhao provided advice and guidance on statistical analysis and interpretation of results

Signature:_____ _____

Professor Colin Binns provided oversight of the study design and administration, advice on statistical analysis and critical review of the manuscript

Signature:_____ _____

Factors Associated with Exclusive Breastfeeding at Hospital Discharge in Rural Western Australia

Background: Breastfeeding is accepted as the best way of feeding infants and health authorities recommend exclusive breastfeeding to around six months of age, but despite the evidence of its benefits, few mothers meet this goal. Infants who are exclusively breastfed in the early post-partum period are more likely to continue breastfeeding at 6 and 12 months, reinforcing the role that baby-friendly hospital practices play in supporting exclusive breastfeeding.

Objectives: to determine the rate of breastfeeding initiation and identify the factors associated with exclusive breastfeeding at discharge from hospital for rural mothers.

Methods: The prospective cohort study recruited 489 women from hospitals in regional Western Australia following the birth of their infant. Breastfeeding exclusivity at discharge was assessed based on mothers' self-reported infant feeding behaviour during her hospital stay. The self-administered baseline questionnaire was completed by 427 mothers.

Results: Breastfeeding was initiated by 97.7% of the mothers in this cohort, with 82.7% exclusively breastfeeding at hospital discharge. The odds of exclusive breastfeeding at discharge were more than four times higher for women whose infants did not require admission to the Special Care Nursery (aOR 4.43, 95% CI 1.98-9.99). Demand feeding (aOR 3.33, 95% CI 1.59-6.95) and 24-hour rooming-in (aOR 2.31, 95% CI 1.15-4.62) were also significant positive factors.

Conclusion: The findings suggest that hospital practices are strong predictors of exclusive breastfeeding. Greater emphasis on baby-friendly hospital practices in the early postpartum period may help the establishment of exclusive breastfeeding,

assisting rural mothers to reach established international breastfeeding recommendations.

Well Established

Breastfeeding exclusively for the first six months is recommended, but few mothers meet this goal. Establishment of exclusive breastfeeding in the early postpartum period increases the likelihood of continued breastfeeding.

Newly Expressed

Health service-related factors such as encouragement of demand feeding and 24-hour rooming-in were found to be significantly associated with exclusive breastfeeding at discharge. Increased uptake of baby-friendly practices by rural health services may contribute to improved breastfeeding outcomes in rural Australia.

Background

Breastfeeding is the optimal method of feeding infants and strong evidence from both developed and developing countries has shown that infants benefit from breastfeeding in the short- and long-term.[1-4] Evidence of its public health benefits has seen breastfeeding supported and promoted at a policy level in Australia[5] and reiterated in breastfeeding messages for health professionals and the community through the Infant Feeding Guidelines for Health Workers and the Australian Dietary Guidelines.[6-9] Despite this high level endorsement however, few mothers in Australia meet the recommendation of the World Health Organization (WHO) to exclusively breastfeed to six months of age.[10]

Breastfeeding rates in Australia have increased from the 1970s when it was estimated that only 40-45% of infants were breastfed after discharge from hospital.[11] Analysis of data from the 1995 National Health Survey found that 86% of Australian mothers initiated breastfeeding [12] and the 2010 Australian National Infant Feeding Survey reported that breastfeeding had been initiated for 96% of all children aged 0-2.[13] Rates of breastfeeding initiation in Australia compare

favourably with other developed countries such as Norway (99%), Denmark (98.7%) and Japan (98.3%) and are substantially higher than those observed in the US (76.5%) and France (62.6%).[14, 15]

While breastfeeding initiation in Australia is near-universal, there are a number of women who cease exclusive breastfeeding in the early postpartum period. A study of infant feeding practices in the first 24-48 hours from three Melbourne maternity hospitals found that 77.5% of mothers were exclusively breastfeeding[16], while analysis of data from a clinical trial in two Sydney hospitals showed that 86% of women were exclusively breastfeeding at discharge from hospital.[17] In addition to identified sociodemographic, psychosocial and biomedical factors, [14, 18-27], the policies and practices of health services and health care professionals have been shown to influence breastfeeding outcomes. [28, 29] Evidence suggests that infants who are exclusively breastfed in the early postpartum period are more likely to continue to breastfeed to 6 and 12 months[30], highlighting the potential for health services to positively influence breastfeeding. The launch of the Baby Friendly Hospital Initiative (BFHI) in 1991 was developed in response to the 1990 Innocenti Declaration and sought to protect, support and promote breastfeeding.[31] The BFHI encourages the adoption of 10 key hospital practices that positively impact on breastfeeding rates and since its inception, more than 152 countries have adopted the initiative.[31]

Although demography varies, rural areas across industrialised countries are commonly characterised by lower levels of education and income, geographical isolation, lower population density and reduced access to health services.[32] Additionally, increased exposure to occupational hazards in rural industries and a greater rate of less healthy behaviours contribute to poorer health outcomes in rural communities.[32] In the United States, national data suggest that fewer mothers initiate breastfeeding in rural areas (56.6%) compared with urban areas (71.4%), [19] and initiation rates as low as 18% have been reported.[33] In rural areas of the United Kingdom, studies have reported breastfeeding initiation at both lower[34] and higher[35] levels than the average national rates. In rural and regional Australia,

geographical distance from health services, fewer health care options and community breastfeeding support services have been identified as contributing to a lower rate of breastfeeding compared with metropolitan areas,[19, 36, 37] however the 2010 Australian National Infant Feeding Survey found that the rate of breastfeeding initiation ranged from 94.4% in inner regional areas to 97.8% in remote/very remote locations, compared with 96.2% in major cities.[13]

The Rural Infant Feeding Study (RIFS) aimed to determine the factors associated with breastfeeding practices from birth to 12 months of age in rural Western Australia. The objective of this paper is to identify the factors associated with exclusive breastfeeding at discharge from hospital for women in rural Western Australia.

Methods

Sample Selection

Baseline data from the prospective cohort study (RIFS) was used to inform this paper. A sample of 489 mothers and their infants were recruited to RIFS between April 2010 and November 2011 from hospitals with maternity service capacity in four non-metropolitan health regions of Western Australia (WA) and followed for 12 months from birth. Women who had delivered an infant without serious illness, who read and understood English and who resided in a regional area of WA were eligible to take part in the study. Mothers were contacted and invited to participate in the study by research staff with assistance from midwives at each hospital. To detect a prevalence of "any breastfeeding" at six months of 50%, a final sample size of 400 was calculated using the StatCalc program of Epi Info™[38], assuming power of 0.80 and significance of 0.05. Allowing for approximately 20% loss to follow-up, an initial sample of 500 was estimated.

Data Collection

The data collection tool was based on that used in the Perth Infant Feeding Study Mark II (PIFS II)[39] with additional questions included to ascertain geographical location and access to sources of information about infant feeding. Geographical

location was used to ascribe a "remoteness score" using the Accessibility/Remoteness Index of Australia (ARIA) classification.[40] The score is based on road distance to regional service centres, using service centre population size as a proxy for availability of services. Breastfeeding terms and definitions used were consistent with those used by the World Health Organization, and defined "exclusive breastfeeding" as infants who received only breast milk with the exception of drops or syrups consisting of vitamins, mineral supplements or medications.[41] The modified tools were pilot tested with a small group of rural mothers (n=4) to assess suitability prior to use in the regional setting.

Once consent to participate was received, mothers were provided with a questionnaire booklet and were asked to complete a series of questions to determine demographics and feeding practices whilst still in hospital and prior to discharge. Mothers who indicated that they had breastfed their infant at least once in hospital were classified as having initiated breastfeeding. Breastfeeding exclusivity at discharge was assessed based on mothers' self-reported infant feeding behaviour during her hospital stay. If mothers indicated that their infant had received only breast milk in this time, the infant was classified as exclusively breastfed at discharge. If the infant received food or liquids other than breast milk, vitamins, mineral supplements or medications at any time during the hospital stay they were no longer considered exclusively breastfed. Mothers were encouraged to complete the questionnaire before they left hospital, but were provided with a reply-paid envelope or access to an online repository to allow completion after discharge.

Data Analysis

Data were entered into and analysed using the IBM SPSS Statistics for Windows (SPSS) Version 21.[42] Descriptive summary statistics were produced to describe the sample and are given in Table 1. Univariate logistic regression analysis was used to screen for potentially significant factors associated with exclusive breastfeeding at hospital discharge (see Table 2) and the significant factors reported in univariate logistic regression analysis were then examined using multiple logistic regression,

controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. Backward elimination procedure was applied to obtain the final model in the regression analysis (see Table 3). All tests were two sided and a *p* value of less than 0.05 was considered statistically significant.

Ethics

Ethics approval for this study was granted by the Curtin University Human Research Ethics Committee, the WA Country Health Service Ethics Committee and the St John of God Healthcare Ethics Committee.

Results

Sample Characteristics

Selected demographics of the participants are given in Table 1. Of the 1170 women eligible to participate in the study, 819 were contacted and 489 women gave consent to participate. Of those women, 427 completed the baseline survey, representing 52% of women contacted. Women who had been discharged from hospital in the first 24 hours, women who were not on the ward at the times that the researcher visited, or who had been identified as not appropriate to contact by midwifery or medical staff (for example, those mothers who had developed post-delivery complications) accounted for those not contacted.

Compared with the overall Western Australian birth cohort, mothers in this study were older (mean age 30.2 years (±5.2) vs. 29.6 years (±5.7), p=0.02), and the mean birth weight of their infants was greater (3523g (±471), vs. 3337g (±601), p<0.001). There was a significantly lower proportion of babies delivered via caesarean section (28.3% vs. 33.6%, p=0.026) and a greater proportion of mothers in the study were born in Australia or New Zealand (85.0% vs. 72.0%, p<0.001).

Table 1: Selected demographics of Rural Infant Feeding Study (RIFS) participants (n=427)

Demographic Characteristic[a]	n	%
Remoteness Classification (ARIA)[b] (*n*=424)		
HA (Highly Accessible)	19	4.5
A (Accessible)	259	61.1
MA (Moderately Accessible)	95	22.4
R (Remote)	31	7.3
VR (Very Remote)	20	4.7
Maternal age (years) (*n*=427)		
<20	11	2.6
20-29	184	43.1
≥30	232	54.3
Parity (*n*=424)		
Primiparous	178	42.0
Multiparous	246	58.0
Maternal education (*n*=417)		
Did not complete high school	57	13.7
Completed Yr 12 / technical / trade qualification	198	47.5
Bachelor degree or higher	162	38.8
Mother's country of birth (*n*=420)		
Australia / New Zealand	363	86.4
UK/Ireland	26	6.2
Other	31	7.4
Household Income (AUD)(*n*=409)		
<72,800	167	40.8
≥72,800	242	59.2
Birth weight (g) (*n*=422)		
<2500	7	1.7
≥2500	415	98.3
Method of Delivery (*n*=425)		
Vaginal	244	57.4
Assisted (forceps/suction)	60	14.1
Caesarean	121	28.5

[a] The number of missing values differs for each variable. The percentages presented are valid percentages.

[b] Australian Institute of Health and Welfare. *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare; 2004.

Breastfeeding practice in hospital

Breastfeeding was initiated by almost all of the mothers participating in the study with 97.7% of infants having received some breast milk after birth. By time of discharge from hospital, 82.7% of mothers were exclusively breastfeeding.

Factors associated with exclusive breastfeeding at discharge from hospital

Results of the univariate analysis of factors associated with exclusive breastfeeding at discharge are presented in Table 2. Health service-related factors such as receiving consistent feeding advice, being encouraged by maternity staff to breastfeed at birth, delivery method, rooming-in, demand feeding whilst in hospital and early breast contact (<30 minutes after birth) were significantly associated with EBF at hospital discharge.

The strongest predictors of exclusive breastfeeding at discharge in this study were health-service related (see Table 3). The odds of exclusive breastfeeding at discharge were more than four times higher for mothers whose infants who did not require admission to the Special Care Nursery (adjusted odds ratio (aOR) 4.43, 95% CI 1.98-9.99). Mothers who perceived that the advice given by hospital staff was consistent (aOR 3.99, 95% CI 1.94-8.22), who fed their infant on demand in hospital (aOR 3.33, 95% CI 1.59-6.95) or practiced 24 hour rooming-in with their infant (aOR 2.31, 95% CI 1.15-4.62) had greater odds of exclusively breastfeeding at discharge.

In addition to factors related to hospital practices, the breastfeeding history of maternal grandmothers was also a significant predictor, and the odds of exclusively breastfeeding at discharge women for whose own mothers had breastfed were more than four times higher (aOR 4.14, 95% CI 1.87-9.16). Additionally, the odds of exclusive breastfeeding at discharge were more than two times higher for mothers who perceived their partner to prefer breastfeeding compared with those mothers who perceived their partner to be ambivalent about breastfeeding or to prefer bottle-feeding (aOR 2.51, 95% CI 1.23-5.09).

Table 2: Percentage and Univariate Odds Ratios (95% CI) for Exclusive Breastfeeding at Hospital Discharge by Sample Characteristic

	Exclusive breastfeeding at discharge (n=353)			
Characteristics	*n*	%	OR	95% CI
SOCIODEMOGRAPHIC				
Maternal age				
<25 (ref)	45	78.9	1.00	-
25-29	114	82.6	1.09	0.48 - 2.44
30-34	125	87.4	1.38	0.71 - 2.68
35+	69	77.5	2.01	0.99 - 4.06
Income (AUD)				
<33,800	42	87.5	1.45	0.59 – 3.56
>33,800 (ref)	299	82.8	1.00	-
Mother's education level				
Didn't finish high school	46	80.7	0.73	0.33 – 1.60
Yr 12 / TAFE	163	82.3	0.81	0.46 – 1.43
Bachelor degree or higher (ref)	138	85.2	1.00	-
Marital status				
other	17	73.9	0.56	0.21 – 1.46
Married / de facto (ref)	332	83.6	1.00	-
ARIA category				
Highly Accessible (ref)	16	84.2	1.00	-
Accessible	216	83.4	0.94	0.26 – 3.37
Moderately Accessible	79	83.2	0.93	0.24 – 3.55
Remote	23	74.2	0.54	0.12 – 2.35
Very Remote	17	85.0	1.06	0.19 – 6.05
Mother's country of birth				
Australia / New Zealand (ref)	297	81.8	1.00	-
other	52	91.2	2.31	0.89 – 6.01
Employment in the previous six months				
Employed	215	84.6	0.76	0.40 – 1.47
Not employed (ref)	101	87.8	1.00	-
Mother intending to return to work /study by 6 months post-partum				
No (ref)	273	84.3	1.00	-
Yes	76	79.2	0.71	0.40 – 1.26
Mother returned to work/study by six months post-partum				
Yes	85	78.7	0.67	0.37 – 1.20
No (ref)	194	84.7	1.00	-
Paid maternity leave				
Yes (ref)	99	81.8	1.00	-
No	250	83.6	1.13	0.65 – 1.97
BIOMEDICAL				
Parity				

Primiparous (ref)	137	77.0	1.00	-
Multiparous	213	86.6	1.93	1.16 – 3.20
Delivery method				
Vaginal (ref)	259	85.2	1.00	-
Other	93	76.9	0.58	0.34 – 0.98
Sex of infant				
Male (ref)	189	79.7	1.00	-
Female	164	86.3	1.60	0.95 – 2.70
Infant's birthweight (g)				
<3500	163	80.7	0.73	0.44 – 1.21
≥3500 (ref)	189	85.1	1.00	-
Admission to Special Care Nursery				
Yes	27	61.4	0.27	0.14 – 0.54
No (ref)	325	85.3	1.00	-
Mother smoked during pregnancy				
Yes	25	73.5	0.55	0.25 – 1.24
No (ref)	322	83.4	1.00	-
Mother drank alcohol during pregnancy				
Yes	85	81.7	0.91	0.51 – 1.62
No (ref)	266	83.1	1.00	-
Maternal Body Mass Index (kg/m^2)				
<25 (ref)	196	84.5	1.00	-
25-29.99	93	85.3	1.07	0.56 – 2.02
30+	47	73.4	0.51	0.26 – 0.98
PSYCHOSOCIAL				
Mother attended antenatal classes				
Yes (ref)	291	84.3	1.00	-
No	61	76.2	0.60	0.33 – 1.08
Mother's Iowa Infant Feeding Attitude Score(IIFAS)				
<65	131	77.1	0.53	0.32 – 0.88
>65 (ref)	222	86.4	1.00	-
Mothers perception of fathers feeding preference				
Ambivalent or prefers bottle feeding	143	76.1	0.43	0.26 – 0.72
Prefers breastfeeding (ref)	208	88.1	1.00	-
Mother's perception of maternal grandmothers feeding preference				
Ambivalent or prefers bottle feeding	225	82.1	0.83	0.48 – 1.43
Prefers breastfeeding (ref)	127	84.7	1.00	-
Maternal grandmother breastfed one or more children				
Yes (ref)	306	85.5	1.00	-
No	46	68.7	0.37	0.21 – 0.67
Timing of infant feeding decision				
Before pregnancy (ref)	285	87.4	1.00	-
During / after pregnancy	68	68.0	0.31	0.18 – 0.52

Timing of pregnancy				
Planned (ref)	233	84.1	1.00	-
Unplanned/mistimed	118	80.3	0.77	0.46 – 1.29
HEALTH SERVICE				
Rooming in				
Yes (ref)	249	86.2	1.00	-
No	104	75.9	0.51	0.30 – 0.85
Early breast contact (<30mins)				
Yes (ref)	270	88.8	1.00	-
No	80	70.8	0.31	0.18 – 0.52
Demand feeding in hospital				
Yes (ref)	297	87.4	1.00	-
No	55	64.7	0.27	0.15 – 0.46
Staff encouragement to breastfeed at birth				
Yes (ref)	293	84.7	1.00	-
No	57	74.0	0.52	0.29 – 0.93
Given conflicting advice about feeding				
Yes	77	70.6	0.36	0.21 – 0.61
No (ref)	276	87.1	1.00	-

Discussion

This study provides contemporary data on breastfeeding for rural Western Australia and contributes to the evidence base for breastfeeding in rural and regional areas of developed countries. Our finding that initiation of breastfeeding in this study was near-universal mirrors the results of Australian research over the previous two decades. However, while the evidence suggests that almost all Australian mothers initiate breastfeeding, less is known about the rate of exclusive breastfeeding at discharge from hospital. In 1993, as part of a set of national health goals and targets for Australia, targets for breastfeeding were set in order to highlight breastfeeding as a national public health issue and begin the process of monitoring breastfeeding practice.[43] The target of 90% for breastfeeding at discharge recognised the importance of the early postpartum period as an opportunity for health services to support the establishment of breastfeeding. The subsequent development of indicators for monitoring breastfeeding practice in Australia was based on the global indicators recommended by WHO, including the reporting of breastfeeding initiation, exclusivity and duration.[44, 45] Whilst the WHO indicators were important to determine breastfeeding practice at a population level, the

Table 3: Determinants of Exclusive Breastfeeding at Discharge from Hospital (n=353)

Variable[a]	n	Adjusted OR[b]	95% CI
Admission to Special Care Nursery (SCN)			
Yes (ref)	35	1.00	
No	265	4.43	(1.98-9.99)
Grandmother breastfed one or more children			
No/unsure (ref)	48	1.00	
Yes	252	4.14	(1.87-9.16)
Mother's perception of father's feeding preference			
Prefers bottle-feeding or ambivalent (ref)	124	1.00	
Prefers breastfeeding	176	2.51	(1.23-5.09)
Received conflicting feeding advice in hospital			
Yes (ref)	83	1.00	
No	217	3.99	(1.94-8.22)
Feeding frequency in hospital			
Scheduled feeding (ref)	55	1.00	
Demand feeding	245	3.33	(1.59-6.95)
Infant roomed-in with mother			
Yes, at all times	243	2.31	(1.15-4.62)
No (ref)	119	1.00	
-2log likelihood ratio=191.820, df = 5			
Hosmer-Lemeshow Goodness of Fit: χ^2 = 5.79, df = 8, p = 0.671			

[a] *Variables entered into the initial model were maternal age, marital status, parity, mother's country of birth, when feeding method was decided, mothers infant feeding attitude and knowledge score, mother's perception of father's feeding preference, whether mother attended antenatal classes, maternal pre-pregnancy obesity, delivery method, infant admitted to Special Care Nursery (SCN), babies gender, infant birth weight, whether maternal grandmother had ever breastfed, baby in mothers room, early breast contact, demand feeding in hospital, direct assessment of attachment, explicit teaching of positioning, encouragement from staff to breastfeed at birth, conflicting feeding advice from hospital staff, satisfaction with feeding advice, mother's occupation, mother's education, father's occupation, grandmothers feeding preference, whether mother smoked during pregnancy. All variables of interest were included in the full model in the initial step and then backward elimination procedure was applied to obtain the final model, using 5% critical value of χ2 test for the appropriate degrees of freedom.*

[b] *Adjusted odds ratios were derived as the exponentiations of the logistic regression coefficients*

collection of data regarding breastfeeding at discharge was more suitable for purpose-specific research in the assessment of institutional performance with regards to supporting, protecting and promoting breastfeeding.[44] Given the importance of early success in establishing exclusive breastfeeding, greater emphasis on the collection of this data would contribute to our knowledge of factors associated with breastfeeding exclusivity at discharge.

Admission to the Special Care Nursery (SCN) was negatively associated with exclusive breastfeeding at discharge in this study. Biomedical factors such as surgical delivery and infant's admission to the SCN have been previously reported as negative influences on exclusive breastfeeding[24, 46] and these findings are reflected in the results of this study. Birth interventions and subsequent procedures invariably separate mother and infant, resulting in reduced opportunities to initiate early breast contact. In a Canadian study of 6,421 women comparing birth outcomes for vaginal and caesarean births, mothers who experienced a surgical delivery were significantly less likely to hold their baby in the first five minutes following birth and were also less likely to initiate breastfeeding in the first two hours following birth.[47] Additionally, infants who are admitted to a special care nursery after birth are at greater risk of medical and developmental problems, increasing the likelihood of receiving infant formula and impacting on breastfeeding exclusivity.[46] Of the 10% of infants admitted to the SCN in this study, 78% stayed for two days or less; however we were unable to determine if there was a relationship between SCN admission, length of SCN stay and overall length of hospital stay as this data was not collected. Identifying and minimizing interventions that result in the separation of mothers and their infants, particularly those which impact on early breast contact, will support the establishment of exclusive breastfeeding in hospital.

Health service influences on breastfeeding are not limited to clinical interventions and the findings that baby-friendly practices such as rooming-in, encouraging demand feeding and provision of consistent feeding advice were positively associated with exclusive breastfeeding in this study are supported by the literature.[48-50] As two of the Baby Friendly Health Initiative's "Ten Steps to Successful Breastfeeding", rooming-in and demand feeding are key practices in supporting breastfeeding.[20, 50, 51] Rooming-in provides a mother the opportunity to respond to her infant's need to be fed, assisting in the establishment of breast milk supply. Keeping mother and infant together through rooming-in is associated with increased frequency of breastfeeding, higher rates of exclusive breastfeeding and longer breastfeeding duration. [52] Demand feeding, led by the infant's cues for

feeding, is best supported through 24-hour rooming in. Demand feeding can assist in establishing breastfeeding in hospital through increased feeding frequency and confidence, resulting in longer duration of breastfeeding. The impact of any individual baby friendly practice on breastfeeding outcomes however is limited, highlighting the need for a coordinated approach to addressing the barriers to breastfeeding. The introduction of the BFHI to Australia in 1993 has influenced the policies and practices of maternity services in promoting and supporting breastfeeding, but the uptake of formal assessment is low, with only 21% of services accredited.[53] In Western Australia, only five out of a total of 37 maternity services are currently certified as Baby Friendly (two of which are in rural areas) [54], and although policies exist to encourage health services to support and protect breastfeeding, it is difficult to determine how non-accredited maternity units and their staff approach breastfeeding. In rural areas, recruitment and training of staff with specific skills and knowledge in breastfeeding varies widely, impacting on the capacity to deliver a comprehensive breastfeeding support service, and may influence the proportion of mothers who start and continue to breastfeed their infants.

The breastfeeding practice of maternal grandmothers was also positively associated with exclusive breastfeeding at discharge. Women who have breastfed their children impart both practical knowledge about breastfeeding to their daughters as well as the inference that breastfeeding a baby is both normal and desirable.[55] This can increase mothers' confidence in her ability to breastfeed, as well as offer a source of advice about breastfeeding problems. Several studies have examined the role of breastfeeding advice and support from grandmothers and have found positive association with breastfeeding initiation,[56, 57] suggesting that role modelling, cultural norms and social supports are key factors of this interaction. Identification of women in rural areas who are geographically isolated from their own mothers may be a useful strategy for health professionals in order to increase other supports for exclusive breastfeeding.

Maternal perception of father's feeding preference was also a significant predictor of exclusive breastfeeding in this study, with the odds of exclusive breastfeeding at discharge 2.5 times higher for mothers who perceived their infant's father to be supportive of breastfeeding. The role of fathers in supporting breastfeeding has been extensively documented as a significant influence across cultures[21, 48, 58-62] and preferences appear to be mediated by cultural experience. Although this study did not directly measure paternal feeding preference, maternal perception of preference has been previously used as a proxy measure.[24] Partners play a key role in providing emotional and practical support for new mothers, although it has been suggested that many expectant fathers feel decisions regarding infant feeding are not theirs to make. Interventions that focus on education about the benefits of breastfeeding, the role of fathers in the decision making process, and practical strategies for supporting breastfeeding have found to be effective in increasing breastfeeding initiation and duration.[21, 22] In the absence of other family and social supports, fathers in regional areas may play a particularly significant role in supporting breastfeeding.

Limitations

Whilst this study provides useful insights into the factors associated with the successful establishment of exclusive breastfeeding in the hospital period, there are limitations that need to be considered when interpreting the results. Firstly, only 52% of eligible women who were contacted agreed to participate in the study, introducing a potential response bias, although analysis of key demographic variables suggests that the sample was representative of the study population. Secondly, although the participants were representative of the regions under study, the demography of rural Australia is diverse; therefore the results may not be generalisable to other regional areas of Australia, or to other rural or regional areas of other countries.

Conclusion

As the most contemporary data on breastfeeding in rural Western Australia, this study highlights the role of systematic, professional and personal support in establishing exclusive breastfeeding prior to discharge for women in rural WA. It appears that mothers and maternity service providers agree that breastfeeding is the best way to feed infants based on the near-universal initiation rates found in this study. The collection of data on breastfeeding practices prior to discharge should be encouraged in order to capture health service performance in supporting the establishment of exclusive breastfeeding, in turn assisting rural mothers to meet the recommendation for exclusive breastfeeding to six months.

References

1. Dewey KG. Is breastfeeding protective against child obesity? *J Hum Lact.* Feb 2003;19(1):9-18.

2. Arenz S, Ruckerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity - a systematic review. *Int J Obes Relat Metab Disord.* Oct 2004;28(10):1247-1256.

3. Monasta L, Batty GD, Cattaneo A, et al. Early-life determinants of overweight and obesity: a review of systematic reviews. *Obes Rev.* Mar 16 2010.

4. Horta BL, Bahl, R., Martines, J.L., Victora C.G. *Evidence of the long-term effects of breastfeeding: Systematic reviews and meta-analyses.* Geneva: World Health Organization; 2007.

5. Australian Health Ministers' Conference. Australian National Breastfeeding Strategy 2010-2015; 2009, 2009; Canberra, ACT.

6. Commonwealth Department of Health and Ageing. *Dietary Guidelines for Australian Adults.* Canberra, Australia 2003.

7. National Health and Medical Research Council. *Dietary Guidelines for Children and Adolescents in Australia, incorporating the Infant Feeding Guidelines for Health Workers.* Canberra: Commonwealth of Australia; 2003.

8. National Health and Medical Research Council. *Infant feeding guidelines : information for health workers, 2012*. Canberra, A.C.T.: National Health and Medical Research Council; 2012.

9. National Health and Medical Research Council. *Australian dietary guidelines providing the scientific evidence for healthier Australian diets*. Canberra: National Health and Medical Research Council; 2013.

10. World Health Organization. *Report of the Expert Consultation on the optimal duration of breastfeeding, 28-30 March 2001.* Geneva: WHO; 2001.

11. Australian Bureau of S. *Breastfeeding in Australia.* [Canberra]: Australian Bureau of Statistics; 2003.

12. Donath S, Amir L. Rates of breastfeeding in Australia by State and socio-economic status: evidence from the 1995 National Health Survey. *J Paediatr Child Health.* Apr 2000;36(2):164-168.

13. Australian Institute of Health and Welfare. *Australian National Infant Feeding Survey: indicator results.* Canberra: AIHW; 2011.

14. Ibanez G, Martin N, Denantes M, Saurel-Cubizolles MJ, Ringa V, Magnier AM. Prevalence of breastfeeding in industrialized countries. *Rev Epidemiol Sante Publique.* Aug 2012;60(4):305-320.

15. Centers for Disease Control and Prevention. Breastfeeding Among U.S. Children Born 2000–2010,CDC National Immunization Survey. Available at: http://www.cdc.gov/breastfeeding/data/nis_data/index.htm.

16. Johns HM, Forster DA, Amir LH, Moorhead AM, McEgan KM, McLachlan HL. Infant feeding practices in the first 24-48 h of life in healthy term infants. *Acta Paediatr.* Jul 2013;102(7):e315-320.

17. Dahlen HG, Homer CS. Infant feeding in the first 12 weeks following birth: a comparison of patterns seen in Asian and non-Asian women in Australia. *Women Birth.* Mar 2010;23(1):22-28.

18. Craig PL, Knight J, Comino E, Webster V, Pulver LJ, Harris E. Initiation and Duration of Breastfeeding in an Aboriginal Community in South Western Sydney. *Journal of Human Lactation.* August 1, 2011 2011;27(3):250-261.

19. Sparks PJ. Rural-urban differences in breastfeeding initiation in the United States. *J Hum Lact.* May 2010;26(2):118-129.

20. Scott JA, Landers MC, Hughes RM, Binns CW. Factors associated with breastfeeding at discharge and duration of breastfeeding. *J Paediatr Child Health.* Jun 2001;37(3):254-261.

21. Maycock B, Binns CW, Dhaliwal S, et al. Education and support for fathers improves breastfeeding rates: a randomized controlled trial. *J Hum Lact.* Nov 2013;29(4):484-490.

22. Mitchell-Box KM, Braun KL. Impact of male-partner-focused interventions on breastfeeding initiation, exclusivity, and continuation. *J Hum Lact.* Nov 2013;29(4):473-479.

23. Li R, Jewell S, Grummer-Strawn L. Maternal obesity and breast-feeding practices. *Am J Clin Nutr.* Apr 2003;77(4):931-936.

24. Scott JA, Binns CW, Graham KI, Oddy WH. Temporal changes in the determinants of breastfeeding initiation. *Birth.* Mar 2006;33(1):37-45.

25. Kitsantas P, Pawloski LR. Maternal obesity, health status during pregnancy, and breastfeeding initiation and duration. *J Matern Fetal Neonatal Med.* Feb 2010;23(2):135-141.

26. Amir LH, Donath SM. Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. *Birth.* Jun 2002;29(2):112-123.

27. Bailey BA, Wright HN. Breastfeeding initiation in a rural sample: predictive factors and the role of smoking. *J Hum Lact.* Feb 2011;27(1):33-40.

28. Kramer MS, Chalmers B, Hodnett ED, et al. Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. *JAMA.* Jan 24-31 2001;285(4):413-420.

29. Merten S, Dratva J, Ackermann-Liebrich U. Do Baby-Friendly Hospitals Influence Breastfeeding Duration on a National Level? *Pediatrics.* November 1, 2005 2005;116(5):e702-e708.

30. Kruse L, Denk CE, Feldman-Winter L, Mojta Rotondo F. Comparing sociodemographic and hospital influences on breastfeeding initiation. *Birth: Issues in Perinatal Care.* 2005;32(2):81-85.

31. World Health Organization. Baby Friendly Hospital Initiative. Available at: http://www.who.int/nutrition/topics/bfhi/en/. Accessed 01/05/2014.

32. Smith KB, Humphreys JS, Wilson MG. Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research? *Aust J Rural Health.* Apr 2008;16(2):56-66.

33. Zaghloul S, Harrison GG, Fendley HF, Pierce R, Morrisey C. Correlates of breastfeeding initiation in southeast Arkansas. *South Med J.* May 2004;97(5):446-450.

34. Hoddinott P, Lee AJ, Pill R. Effectiveness of a breastfeeding peer coaching intervention in rural Scotland. *Birth.* Mar 2006;33(1):27-36.

35. Department of Health Social Services and Public Safety. Breastfeeding - A Great Start: A Strategy for Northern Ireland 2013-2023. Available at: http://www.dhsspsni.gov.uk/index/breastfeeding-strategy-2013/bfs-appendices/bfs-appendixc/bfs-appendixc-b.htm. Accessed 03/03/2014.

36. Hector D, Webb K, Lymer S. Describing breastfeeding practices in New South Wales using data from the NSW Child Health Survey, 2001. *New South Wales public health bulletin.* Mar-Apr 2005;16(3-4):47-51.

37. Stamp GE, Casanova HT. A breastfeeding study in a rural population in South Australia. *Rural Remote Health.* Apr-Jun 2006;6(2):495.

38. *Epi Info* [computer program]. Version 3.5.1; 2008.

39. Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. *Acta Paediatr.* Mar 2005;94(3):352-356.

40. Australian Institute of Health and Welfare. *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare; 2004.

41. WHO U, USAID, AED, UCDAVIS, IFPRI. *Indicators for assessing infant and young child feeding practices. Part 1: definitions.* 2008.

42. *IBM SPSS Statistics* [computer program]. Version 21; 2011.

43. Nutbeam D, University of Sydney Department of Public Health, Department of Health Housing and Community Services. *Goals and targets for Australia's health in the year 2000 and beyond : report prepared for the Commonwealth Department of Health, Housing & Community Services*. Sydney: Public Health Dept., University of Sydney; 1993.

44. Webb K MG, Lund-Adams M, Rutishauser IHE, Abraham B. . Towards a national system for monitoring breastfeeding in Australia: recommendations for national population indicators, definitions and next steps. . In: Australian Food and Nutrition Monitoring Unit, ed. Canberra; 2001.

45. Australian Institute of Health and Welfare. *National breastfeeding indicators : workshop report.* Canberra: Australian Institute of Health and Welfare; 2011. 9781742491899 1742491898.

46. Biro MA, Sutherland GA, Yelland JS, Hardy P, Brown SJ. In-hospital formula supplementation of breastfed babies: a population-based survey. *Birth.* Dec 2011;38(4):302-310.

47. Chalmers B, Kaczorowski J, Darling E, et al. Cesarean and vaginal birth in canadian women: a comparison of experiences. *Birth.* Mar 2010;37(1):44-49.

48. Scott JA, Binns CW. Factors associated with the initiation and duration of breastfeeding: a review of the literature. *Breastfeed Rev.* Mar 1999;7(1):5-16.

49. Broadfoot M, Britten J, Tappin DM, MacKenzie JM. The Baby Friendly Hospital Initiative and breast feeding rates in Scotland. *Arch Dis Child Fetal Neonatal Ed.* Mar 2005;90(2):F114-116.

50. DiGirolamo AM, Grummer-Strawn LM, Fein SB. Effect of Maternity-Care Practices on Breastfeeding. *Pediatrics.* October 2008 2008;122(Supplement 2):S43-S49.

51. Forster DA, McLachlan HL. Breastfeeding Initiation and Birth Setting Practices: A Review of the Literature. *The Journal of Midwifery & Women's Health.* 2007;52(3):273-280.

52. Jaafar SH, Lee KS, Ho JJ. Separate care for new mother and infant versus rooming-in for increasing the duration of breastfeeding. *Cochrane Database Syst Rev.* 2012;9:CD006641.

53. Walsh AD, Pincombe J, Henderson A. An examination of maternity staff attitudes towards implementing Baby Friendly Health Initiative (BFHI) accreditation in Australia. *Matern Child Health J.* Jul 2011;15(5):597-609.

54. Baby Friendly Hospital Initiative Australia. Available at: http://www.babyfriendly.org.au/health-professionals/find-a-bfhi-hospital/#wa. Accessed 01/11/2013.

55. Grassley J, Eschiti V. Grandmother breastfeeding support: what do mothers need and want? *Birth.* Dec 2008;35(4):329-335.

56. Meyerink RO, Marquis GS. Breastfeeding initiation and duration among low-income women in Alabama: the importance of personal and familial experiences in making infant-feeding choices. *J Hum Lact.* Feb 2002;18(1):38-45.

57. Libbus MK, Kolostov LS. Perceptions of breastfeeding and infant feeding choice in a group of low-income mid-Missouri women. *J Hum Lact.* Mar 1994;10(1):17-23.

58. Tohotoa J, Maycock B, Hauck YL, Howat P, Burns S, Binns CW. Dads make a difference: an exploratory study of paternal support for breastfeeding in Perth, Western Australia. *Int Breastfeed J.* 2009;4:15.

59. Scott JA, Binns CW, Aroni RA. The influence of reported paternal attitudes on the decision to breast-feed. *J Paediatr Child Health.* Aug 1997;33(4):305-307.

60. Binns C, Gilchrist D, Gracey M, Zhang M, Scott J, Lee A. Factors associated with the initiation of breast-feeding by Aboriginal mothers in Perth. *Public Health Nutr.* Oct 2004;7(7):857-861.

61. Inoue M, Binns CW, Otsuka K, Jimba M, Matsubara M. Infant feeding practices and breastfeeding duration in Japan: A review. *Int Breastfeed J.* Oct 25 2012;7(1):15.

62. Li L, Zhang M, Scott JA, Binns CW. Factors associated with the initiation and duration of breastfeeding by Chinese mothers in Perth, Western Australia. *J Hum Lact.* May 2004;20(2):188-195.

Chapter 6 - Predictors of Breastfeeding Duration

This chapter is a published peer-reviewed journal article, reprinted as it appears in publication.

Cox, K., Binns, C. W., & Giglia, R. (2015). Predictors of breastfeeding duration for rural women in a high-income country: evidence from a cohort study. *Acta Paediatrica*. doi: 10.1111/apa.12999

Author contributions:

Kylee Cox was responsible for administration of the study, collection of data, data analysis and interpretation, and preparation of the draft and final manuscripts.

Signature:___ _____

Dr Roslyn Giglia provided advice and guidance on study administration, data analysis and critical review of the manuscript.

Signature:___ _____

Professor Colin Binns provided oversight of the study design and administration; advice on statistical analysis and interpretation; and critical review of the manuscript.

Signature:___ _____

Predictors of Breastfeeding Duration for Rural Women in a High Income Country: Evidence from a Cohort Study

Abstract

Objectives: To determine the prevalence of exclusive and any breastfeeding at six months in rural Western Australia and to identify the predictors of exclusive and any breastfeeding duration up to 12 months.

Methodology: A total of 427 mothers (52% of those contacted) were recruited from maternity services in rural WA and asked to complete a baseline questionnaire. Mothers were re-contacted at 4, 6, 10, 16, 26, 32, 40 and 52 weeks to determine factors associated with feeding practices.

Results: Smoking during pregnancy was the strongest predictor of exclusive breastfeeding cessation before six months (aHR 3.21, 95% CI 1.89, 5.46). A favourable attitude towards breastfeeding, a Body Mass Index of <30 and a return to work after six months were associated with reduced risk of breastfeeding cessation before both six and 12 months.

Conclusion: Breastfeeding duration in rural Western Australia is influenced by modifiable factors such as smoking during pregnancy and pre-pregnancy obesity, therefore strategies to address these risk factors in rural women prior to delivery may contribute to improved breastfeeding rates.

Key Words: Australia, breastfeeding duration, obesity, rural, smoking

Key Notes:

- Despite high breastfeeding initiation rates in Australia, few mothers exclusively breastfeed their infants to six months.

- This study found that women who smoked during pregnancy, were obese or returned to work before six months, were at greater risk of ceasing breastfeeding before six months.
- Assisting rural mothers to quit smoking and achieve a healthy weight prior to pregnancy may improve the proportion of infants exclusively breastfed to six months.

Introduction

The benefits of breastfeeding for both infant and mother are well documented and supported by health authorities globally. Such is the evidence for breast milk in reducing the risk of infant mortality and morbidity that the World Health Organization recommends mothers exclusively breastfeed their babies for the first six months of life (1). While health authorities in developing and industrialised countries alike promote this goal, and in many instances initiation is high, few mothers reach this target. In order to protect and support breastfeeding as an effective public health measure continued monitoring of breastfeeding practice and its associated determinants is required.

In Australia, breastfeeding initiation is near-universal, with almost 96% of infants receiving some breast milk after birth (2). While this is a positive achievement, the rate of exclusive breastfeeding decreases after discharge from hospital and highlights the need to address factors associated with cessation of exclusive breastfeeding before the recommended time of six months.

Predictors of breastfeeding duration previously identified in the literature are multifactorial and include socio-demographic, psychosocial and health system-related factors. Breastfeeding duration has been positively associated with increased maternal age and higher level of education (3). Additionally psychosocial factors such as support from significant others (4) as well as favourable attitudes towards breastfeeding (5) have also shown to be positively associated with breastfeeding duration.

Compared to the body of evidence for breastfeeding in rural areas of developing countries, there are few studies of breastfeeding behaviour in rural and regional areas of industrialised countries from which to draw conclusions. Additionally, variations in demography and study methodology mean that findings may not be generalizable to other populations. Rural populations share some common characteristics however, such as lower levels of education and income in addition to lower population density and inequities in access to health and social services

compared to urban areas, which may contribute to disparities in breastfeeding prevalence. Australian data provides some evidence for differences in breastfeeding duration based on geographical location. The 2010 National Infant Feeding Survey (ANIFS) reported that 1.0% of infants in remote or very remote locations were exclusively breastfed to six months compared with 2.5% in outer regional areas and 2.2% in inner regional areas (2).

Western Australia (WA) is a vast state, with a landmass of 2.5 million square kilometres covering one third of Australia. Whilst it is larger than Western Europe in size, approximately 75% of the 2.35 million residents of WA live in the Perth metropolitan area (6). The remainder of the state is sparsely populated, with resultant variations in access to services such as health care, including maternity services. Of the 30,843 births in WA in 2010, 7,153 were to women who resided in non-metropolitan locations (7).

The objective of this paper was to determine the prevalence of breastfeeding at six months and 12 months in rural and regional WA and to identify the predictors of breastfeeding duration to six and 12 months.

Methods

Sample Selection

A sample of 489 mothers and their infants were recruited between April 2010 and November 2011 from 10 hospitals with maternity service capacity in four non-metropolitan health regions of WA and followed for 12 months from birth. Women who had delivered an infant without serious illness, who read and understood English and who resided in a regional area of WA were eligible to take part in the study. Mothers were contacted and invited to participate in the study by research staff with assistance from midwives at each hospital. Based on breastfeeding prevalence determined in the Perth Infant Feeding Study Mark II (PIFS II) (8), a prevalence of 'any breastfeeding' at six months of 50% was used to calculate the final sample size of 400 using the StatCalc program of Epi Info™, assuming power of 0.80 and significance of 0.05. Allowing for approximately 20% loss to follow-up, an initial sample of 500 was estimated.

Data Collection

The data collection tools were based on those used in the Perth Infant Feeding Study Mark II (PIFS II) (8) with additional questions included to ascertain geographical location and access to sources of information about infant feeding. The modified tools were pilot tested with a small group of rural mothers (n=4) to assess suitability prior to use in the regional setting. Geographical location was used to ascribe a "remoteness score" using the Accessibility/Remoteness Index of Australia (ARIA) classification (9). The score is based on road distance to regional service centres, using service centre population size as a proxy for availability of services. Breastfeeding terms and definitions in this study were consistent with those recommended by the World Health Organization (10) and adopted for use in Australia. An infant was considered to be exclusively breastfed if they had received only breast milk since birth, with the exception of drops or syrups consisting of vitamins, mineral supplements or medications. If an infant had received food or fluids other than breastmilk at any point after birth, they were no longer considered exclusively breastfed. Infants who had received breast milk in addition to other fluids such as water, juice or oral rehydration fluids at any point after birth were considered to be fully (or predominantly) breastfed. All infants who had received breast milk with or without other solids or liquids, including formula, were included in calculations of 'any breastfeeding'.

Once consent to participate was received, mothers were asked to complete a baseline questionnaire to determine demographics and feeding practices whilst in hospital. For those mothers with Internet access (87%), a login and password were provided to enable the completion of the baseline and follow-up questionnaires online. The follow-up questionnaires contained questions related to current infant feeding practice, particularly the age at which feeding practices changed (for example, cessation of breastfeeding, or introduction of solids). In addition to feeding behaviours, mothers were also asked about breastfeeding difficulties encountered in the preceding time period, sources of information or support relating to infant feeding, their return to work or study, and their confidence and

comfort while breastfeeding in specific environments. Attitudes towards infant feeding were assessed using the Iowa Infant Feeding Attitudes Scale (IIFAS)(11), a 17-item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes among women in a range of settings. Each item is measured on a 5-point scale and items more favourable to formula feeding are reverse-scored to give an overall score. Potential scores range from 17 (reflecting positive formula feeding attitudes) to 85 (indicating attitudes that favour breastfeeding). Scores greater than 65 (median score) were considered indicative of a positive attitude towards breastfeeding.

Data Analysis

Data were entered into and analysed using the IBM SPSS Statistics for Windows (SPSS) Version 22. Descriptive summary statistics were produced to describe the sample and are given in Table 1. The proportion of women breastfeeding at specified time points was identified and 95% CI were calculated (see Table 2). Survival analysis to determine duration of breastfeeding practices was conducted using the Kaplan Meier technique, as it allows for the presence of censored data, including participants who continued to breastfeed beyond the study period or who have discontinued in the study.

Determinants of breastfeeding duration were identified using Cox's proportional hazards model, to determine the effect of predictor variables on the risk for cessation of breastfeeding. Univariate logistic regression analysis was used to screen for potentially significant factors influencing breastfeeding duration. The factors found to be significant from univariate logistic regression analysis were then examined using Cox's proportional hazards model, in addition to predictors of breastfeeding practice identified in the literature, to determine associations with breastfeeding duration ('any' and 'exclusive' breastfeeding). A p value of <0.10 was used for initial inclusion into the model to ensure that all confounders were adequately controlled for. Backward elimination procedure was applied to obtain

the final model in the regression analysis (see Table 3). All tests were two sided and a final *p* value of <0.05 was considered statistically significant.

The dependant variables of interest in this study were the cessation of exclusive breastfeeding by six months and any breastfeeding by six and 12 months.

Ethics

Ethics approval for this study was granted by the Curtin University Human Research Ethics Committee, the WA Country Health Service Ethics Committee and the St John of God Healthcare Ethics Committee.

Results

Sample Characteristics

Of the 1170 women eligible to participate in the study, 819 were contacted and 489 women gave consent to participate. Of those women, 427 completed the baseline survey, representing 52% of women contacted. Women who had been discharged from hospital in the first 24 hours, women who were not on the ward at the times that the researcher visited, or who had been identified as not appropriate to contact by midwifery or medical staff (for example if they had developed post-delivery complications) accounted for those not contacted.

The demographic characteristics of the sample are shown in Table 1. Compared with births in Western Australia overall, mothers in this study were similar in age (30.2 years (±5.2) vs. 29.6 years

Table 1: Selected demographics of Rural Infant Feeding Study (RIFS) participants

Demographic characteristic (*n*=427)		n	%
	(Mean ± SD)		
Mean maternal age (yrs):	30.2 ± 5.2		
Mean birth weight (g):	3523 ± 471		
Mean gestational age (wks):	39.5± 1.4		
Health Service Region[3] (*n*=427)			
Midwest		291	68.1
South West		100	23.4
Wheatbelt		19	4.4
Goldfields		15	3.5
Pilbara		2	0.5
Remoteness Classification (ARIA) (*n*=424)			
HA (Highly Accessible)		19	4.4
A (Accessible)		259	60.7
MA (Moderately Accessible)		95	22.2
R (Remote)		31	7.3
VR (Very Remote)		20	4.7
Maternal age (yrs) (*n*=427)			
<20		11	2.6
20-29		184	43.1
≥30		232	54.3
Parity (*n*=424)			
Primiparous		178	41.7
Multiparous		246	57.6
Maternal education (*n*=417)			
Did not complete high school		57	13.3
Completed Yr 12 / technical / trade qualification		198	46.4
Bachelor degree or higher		162	37.9
Mother's country of birth (*n*=420)			
Australia / New Zealand		363	85.0
UK/Ireland		26	6.1
Other		31	7.3
Household Income (AUD)(*n*=409)			
<72,800		167	39.1
≥72,800		242	56.7
Birth weight (g) (*n*=422)			
<2500		7	1.6
≥2500		415	97.2
Method of Delivery (*n*=425)			
Vaginal		244	57.1
Assisted (forceps/suction)		60	14.1
Caesarean		121	28.3

[3] WA Country Health Service region

(±5.7), p=0.02), however the mean birth weight of their infants was greater (3523g (±471), vs. 3337g (±601), p<0.001). Fewer infants were delivered via caesarean section (28.3% vs. 33.6%, p=0.026) and a greater proportion of mothers in the study were born in Australia or New Zealand (85.0% vs. 72.0%, p<0.001). Compared with births in the regions under study, mothers in the study were older (*p*<0.001), and more likely to be married (*p*= 0.02). There were also fewer women born in countries other than Australia or New Zealand (*p*<0.001).

A total of 178 (41.6%) mothers had incomplete data sets, having failed to complete all of the surveys at the specified time points after completion of the baseline questionnaire. Compared with the women who remained in the study, women lost to follow-up were more likely to be younger (*p*=0.005), single (*p*=0.005), and have public health insurance (Medicare) only (*p*=0.005). They were also less likely to have a tertiary education (*p*=0.006) and be employed in higher-level occupations (*p*=0.037).

Breastfeeding prevalence

Table 3 shows the proportion of women who were breastfeeding at key time points in the study. Almost all mothers (97.7%) in this cohort initiated breastfeeding, with 82.7% exclusively breastfeeding at discharge from hospital. By the age of four months, approximately one third (35.6%) of infants were exclusively breastfed, although 75.8% were still receiving some breast milk, and by six months, only 5.7% of infants were still exclusively breastfed. At 12 months just over one third (36.4%) of infants were still receiving any breast milk.

Table 2: Breastfeeding prevalence by age of infant

	Breastfeeding Intensity (%)	
Age of infant (n)	Exclusive Breastfeeding	Any Breastfeeding (n)
Hospital discharge	82.7 (353)	97.0 (414)
4 months	35.6 (131)	75.8 (288)
6 months	5.7 (21)	67.9 (258)
12 months	-	36.4 (137)

Breastfeeding duration

The median duration of exclusive breastfeeding in this cohort was 10 weeks (95% CI 7.1, 12.9) and the median duration of any breastfeeding was 37 weeks (95% CI 32.1, 41.9). The median duration of exclusive breastfeeding was greater for mothers who were not obese prior to pregnancy (13 vs. 4 weeks, $p<0.001$), those who did not return to work before their infant was 6 months old (10 vs. 14 weeks, $p=0.029$), those with positive attitudes towards breastfeeding (16 vs. 5 weeks, $p<0.001$), and those who did not smoke during pregnancy (3 vs.10 weeks, $p=0.001$) (see Figure 1).

The median duration of "any breastfeeding' to 12 months for women who were obese prior to pregnancy was almost half that of other women (22 vs. 40 weeks, $p=0.001$) (see Figure 2). Overall breastfeeding duration was lower for women who smoked during pregnancy (25 vs. 39 weeks, $p=0.005$), those who had less favourable attitudes towards breastfeeding (22 vs. 48 weeks, $p<0.001$) and those who perceived their partner to have less favourable attitudes towards breastfeeding (27 vs. 47 weeks, $p= <0.001$).

Factors associated with risk of cessation

Factors identified from the unadjusted analysis as significantly associated with risk of breastfeeding cessation are presented in Table 4. Maternal pre-pregnancy obesity was a significant predictor of cessation of exclusive and overall breastfeeding at all specified time points, as was deciding on infant feeding method during pregnancy or after birth. Women younger than 30 years were significantly less likely to be breastfeeding at any time point and at any intensity after discharge than those aged over 30. A significantly greater proportion of women with tertiary qualifications were breastfeeding at any intensity at all time points after discharge,

but the association was not significant for risk of cessation of exclusive breastfeeding.

Factors independently associated with exclusive and any breastfeeding are presented in Table 4. Factors significantly associated with increased risk of breastfeeding cessation (‘exclusive’ and ‘any’) at six months and ‘any breastfeeding’ at 12 months included mothers smoking during pregnancy, pre-pregnancy obesity, less favourable maternal attitudes to breastfeeding and a return to work before six months. Negative paternal attitudes towards breastfeeding were associated with increased risk of ceasing ‘exclusive’ and ‘any’ breastfeeding before six months, but not with ceasing ‘any breastfeeding’ before 12months. Parity, maternal grandmothers breastfeeding history and infants admission to SCN were associated with increased risk of ceasing exclusive breastfeeding before six months, but were not significant for ‘any breastfeeding’ cessation at 12 months. Hospital factors such as rooming-in and demand feeding were associated with reduced risk of cessation of exclusive breastfeeding before six months and cessation of any breastfeeding before 12 months. Infant gender was associated with increased risk of ceasing breastfeeding before 12 months.

Table 3: Breastfeeding practice by selected sample characteristics

	Exclusive Breastfeeding (% ± half 95% CI)					Any Breastfeeding (% ± half 95% CI)				
Variable	n	Discharge	4 months	6 months		n	Discharge	4 months	6 months	12 months
All mothers (n=427)		82.7±3.6	35.6±4.9	5.7±2.4			97.0±1.6	75.8±4.3	67.9±4.7	36.4±4.9
Sociodemographic										
Mothers age (years)										
• <30 (ref)	159	81.5 ±4.1	26.1 ±4.6	2.5 ±1.6		188	96.4 ±1.8	40.6 ±4.7	37.6 ±4.7	34.3 ±4.6
• ≥30	194	83.6 ±3.7	42.7 ±5.2[a]	8.1 ±2.8[a]		226	97.4 ±1.5	59.4 ±4.7[a]	62.4 ±4.7[a]	65.7 ±4.6[a]
Education level										
• Bachelor degree	138	85.2±5.4	52.4±8.1	7.5±4.3		158	97.5±2.4	85.9±5.6[a]	81.2±6.3[a]	48.0±8.1[a]
• High school / trade qualification	163	82.3±5.3	26.9±6.6[a]	4.7±3.2		192	97.0±2.4	70.6±6.7	61.6±7.2	30.3±6.8
• Didn't complete high school (ref)	57	80.7±10.2	14.6±10.8[a]	2.4±4.7		54	94.7±5.8	64.4±14.0	51.1±14.6	20.5±11.9
Infants age when mother returned to work										
• <6mo (ref)	93	78.8±7.4	31.0±8.5	3.5±3.4		112	94.9±4.0	70.0±8.6	58.2±9.2	23.6±7.9
• 6-12mo	79	85.9±7.1	43.5±10.5	9.4±6.2		91	98.9±2.1	84.4±7.5[a]	80.0±8.3[a]	40.9±10.3
• >12mo	122	83.6±6.0	42.6±8.5	7.0±4.4		142	97.3±2.6	81.4±6.3	73.8±7.2	47.6±8.1[a]
ARIA Classification										
• Highly Accessible (HA) (ref)	16	84.2±3.5	28.6±4.6	7.1± 2.6		18	94.7 ± 2.1	52.9 ± 4.8	52.9 ± 4.8	17.6 ± 3.6
• Accessible (A)	216	83.4±3.5	38.5± 5.0	5.0± 2.2		250	96.5 ± 1.8	78.2 ± 3.9	70.3 ± 4.4	35.8 ± 4.6
• Moderately Accessible (MA)	79	83.2±3.6	36.1± 4.9	6.0± 2.4		94	98.9 ± 1.0	74.1 ± 4.2	65.9 ± 4.5	40.0 ± 4.7
• Remote (R)	23	74.2±4.2	20.7± 4.2	6.9± 4.7		29	93.5 ± 2.4	75.0 ± 4.1	64.3 ± 4.6	40.7 ± 4.7
• Very Remote (VR)	17	85.0±4.0	31.6± 4.8	10.5± 3.1		20	100.0	78.9 ± 3.9	68.4 ± 4.4	42.1 ± 4.7

Marital Status										
• Single (ref)	17	73.9±18.0	13.3±17.2	6.7±12.7		20	87.0±13.7	64.7±22.7	64.7±22.7	17.6±18.1
• Partnered	332	83.6±3.6	36.6±5.1	5.5±2.4		387	94.2±±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Biomedical										
Parity										
• Primiparous (ref)	137	77.0±6.2	22.5±6.8	1.9±2.1		178	97.8±2.2	74.1±6.8	64.6±7.5	33.1±7.4
• Multiparous	213	86.6±4.3[a]	43.5±6.7[a]	8.6±3.8[a]		246	96.3±2.4	76.8±5.6	70.0±6.1	39.2±6.5
Delivery method										
• Vaginal	259	85.2±4.0[a]	38.3±5.9	6.1±2.9		298	98.0±1.6[a]	78.7±4.9[a]	71.0±5.4[a]	36.8±5.8
• Caesarean (ref)	93	76.9±7.5	29.2±8.7	4.7±4.0		114	94.2±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Mothers pre=pregnancy BMI (kg/m^2)										
• <30	290	84.8±3.8[a]	39.4±5.6[a]	7.1±2.9[a]		342	97.1±1.8	79.2±4.6[a]	72.3±5.0[a]	39.1±5.5[a]
• ≥30 (ref)	47	73.4±10.8	23.2±11.1	0		64	94.2±4.2	68.9±8.8	60.4±9.3	35.2±9.1
Mother smoked during pregnancy										
• Yes (ref)	25	73.5±14.8	14.3±13.0	3.6±6.9		31	91.2±9.5	59.3±18.5	55.6±18.7	18.5±14.6
• No	386	83.4±3.7	37.3±5.2[a]	6.0±2.5[a]		376	97.4±1.6[a]	76.9±4.4[a]	68.5±4.9	38.0±5.1[a]
Infant gender										
• Male (ref)	189	79.7±5.1	30.0±6.2	4.3±2.8		237	96.2±2.4	72.9±6.0	63.8±6.5	33.5±6.4
• Female	161	86.3±4.9[a]	42.9±7.6[a]	7.5±4.1		190	97.9±2.0	79.4±6.1	72.9±6.7	40.0±7.4
Infant admitted to SCN										
• Yes (ref)	27	61.4±14.4	14.0±10.4	2.3±4.5		43	95.8±3.0	72.3±7.0	61.3±7.7	26.1±7.0
• No	325	85.3±3.6[a]	38.6±5.3[a]	6.2±2.6		177	96.9±1.7	75.3±4.6	67.9±5.0	36.4±5.2

Pacifier introduced before 4 weeks of age										
• Yes (ref)	142	84.5±5.5	28.8±7.1	3.8±3.0		161	95.8±3.0	72.3±7.0	61.3±7.7	26.1±7.0
• No	147	81.7±5.6	42.4±7.4[a]	7.1±3.9		177	98.3±1.9	80.1±6.0	73.7±6.6[a]	45.9±7.5[a]
Breastfeeding problems before 4 weeks										
Yes (ref)	288	82.8±4.0	35.3±5.4	5.6±2.6		343	98.6±1.2[a]	76.7±4.7	69.0±5.1	36.5±5.4
No	65	82.3±8.4	37.1±12.0	6.5±6.1		71	89.9±6.6	71.6±10.8	62.7±11.6	36.4±11.6
Hospital Practices										
24-hour rooming in										
• Yes	249	86.2±3.4[a]	38.1±6.1	6.1±3.0		280	96.9±2.9	76.7±5.2	69.2±5.7	39.2±6.1
• No (ref)	104	75.9±7.2	30.9±8.2	4.9±3.8		133	97.1±2.8	74.6±7.6	65.9±8.3	31.2±8.1
Infant demand fed										
• Yes	297	87.4±3.5[a]	40.9±5.6[a]	6.9±2.9		335	98.5±1.3[a]	78.4±4.6[a]	70.3±5.1[a]	39.4±5.5[a]
• No (ref)	55	64.7±10.2	16.0±8.3	1.3±2.6		77	90.6±6.2	65.3±11.0	59.7±11.3	25.0±10.0
Early breast contact										
• <30 mins	270	88.8±3.5[a]	40.9±6.0[a]	6.9±2.9		303	99.7±0.6[a]	78.9±4.9	71.8±5.4	38.0±5.9
• ≥30mins (ref)	80	70.8±8.4	25.0±8.5	2.0±2.7		105	92.9±4.7	72.1±8.6	61.5±9.3	34.0±9.2
Psychosocial										
Intended pregnancy										
• Yes	233	84.1±4.3	42.2±6.1[a]	5.2±2.8		274	98.9±1.2[a]	79.3±5.0[a]	69.9±5.6	37.5±6.0
• No (ref)	118	80.3±6.4	22.2±7.5	6.8±4.6		137	93.2±4.1	68.6±8.3	63.6±8.6	34.2±8.5

Attended antenatal classes										
• Yes	291	84.3±3.8	40.0±5.5[a]	6.3±2.7		337	97.7±1.6	80.6±4.4[a]	72.8±5.0[a]	38.9±5.5[a]
• No (ref)	61	76.3±9.3	16.4±8.9	3.0±4.1		75	93.8±5.3	55.1±11.7	46.4±11.8	25.0±10.3
IIFAS score										
• <65 (ref)	131	77.1±6.3	20.1±6.4	2.0±2.2		159	93.5±3.7	61.4±7.7	72.8±5.0	21.9±6.6
• ≥65	222	86.4±4.2[a]	46.1±6.6[a]	8.2±3.6[a]		255	99.2±1.1	85.5±4.6[a]	80.2±5.2[a]	46.2±6.5[a]
Father prefers breastfeeding										
• No / ambivalent (ref)	143	76.1±6.1	26.8±6.9	2.5±2.4		188	94.1±3.4	68.5±7.1	58.2±7.5	26.7±6.8
• Yes	208	88.1±4.1[a]	42.6±6.7[a]	8.1±3.7[a]		236	99.2±1.1[a]	82.2±5.1[a]	76.1±5.7[a]	44.5±6.7[a]
Maternal grandmother prefers breastfeeding										
• No / ambivalent (ref)	225	82.1±4.5	30.6±5.9	4.3±2.6		283	96.0±2.3	70.4±5.7	62.0±6.0	29.6±5.7
• Yes	127	84.7±5.8	44.4±8.4[a]	8.3±4.7		148	98.7±1.8	86.7±5.9[a]	79.7±7.0[a]	50.4±8.7[a]
Maternal grandmother breastfed										
• Yes	306	85.5±3.6[a]	38.0±5.4[a]	5.9±2.6		347	96.9±1.8	77.4±4.6	69.9±5.0	38.7±5.4
• No (ref)	46	68.7±11.1	24.6±10.8	4.9±5.4		65	97.0±4.1	69.5±11.7	59.3±12.5	25.4±11.1
When infant feeding method was decided										
• Before pregnancy	285	87.4±3.6[a]	40.5±5.7[a]	7.0±3.0[a]		326	99.1±1.0[a]	81.8±4.4[a]	74.3±5.0[a]	40.3±5.7[a]
• During / after pregnancy (ref)	68	68.0±9.1	19.3±8.5	1.2±2.3		100	90.0±5.9	56.3±10.4	47.1±10.5	24.1±9.0

[a] *Significantly different from reference level (ref) at P<0.05*

Table 4: Factors Associated with the Risk of Discontinuing Breastfeeding at 26 weeks and 52 weeks

Variable	EBF (26 weeks)			ABF (26 weeks)			ABF (52 weeks)	
	HR	95% CI		HR	95% CI		HR	95% CI
Parity								
Multiparous (ref)	1.00			NS			NS	
Primiparous	1.59	1.19-2.13						
Mother's education level								
Other qualification (high school / trade)	NS			NS			1.47	1.01-2.13
Degree or higher (ref)							1.00	
Infant's gender								
Male	NS			NS			1.58	1.09-2.30
Female (ref)							1.00	
Maternal pre-pregnancy obesity (BMI – kg/m^2)								
<30 (ref)	1.00			1.00			1.00	
≥30	1.54	1.04-2.30		2.83	1.60-5.00		2.12	1.33-3.40
Mother's perception of father's feeding preference								
Ambivalent or prefers bottle-feeding	1.48	1.11-1.97		1.71	1.02-2.85		NS	
Prefers breastfeeding (ref)	1.00			1.00				
Age of baby at mother's return to work								
Before 6 months	1.68	1.25-2.27		2.01	1.25-3.25		2.51	1.75-3.60
After 6 months (ref)	1.00			1.00			1.00	
Mother's Iowa Infant Feeding Attitude Score (IIFAS)								
≤65	1.81	1.30-2.51		3.45	2.05-5.81		2.38	1.63-3.49
>65 (ref)	1.00			1.00			1.00	

Maternal grandmother's breastfeeding history								
Breastfed one or more children (ref)	1.00			NS			NS	
Did not breastfeed	1.63	1.10-2.40						
Mother's perception of maternal grandmother's feeding preference								
Ambivalent or prefers bottle-feeding	NS			1.96	1.08-3.54		2.05	1.37-3.08
Prefers breastfeeding (ref)				1.00			1.00	
Attended antenatal classes								
Yes, for this or a previous pregnancy (ref)	1.00			1.00				
No	1.64	1.10-2.44		2.51	1.43-4.39			
Infant was demand-fed in hospital								
Yes (ref)	1.00			NS			1.00	
No	1.58	1.05-2.37					1.70	1.08-2.68
24 hour rooming-in in hospital								
Yes (ref)	1.00			NS			1.00	
No	1.69	1.24-2.32					1.85	1.25-2.73
Use of pacifier before 4 weeks of age								
Yes							1.67	1.15-2.37
No (ref)							1.00	
Admission to Special Care Nursery (SCN)								
Yes	1.66	1.02-2.70		NS				
No (ref)	1.00							
Mother smoked during pregnancy								
Yes	3.21	1.89-5.46		3.42	1.58-7.37		2.18	1.15-4.11
No (ref)	1.00			1.00			1.00	

ABF= Any breastfeeding

EBF = Exclusive breastfeeding

Variables entered into full model included: maternal age, mother perception of father's feeding preference, infant's gender, parity, infant's birth weight (<2500g), whether infant was admitted to SCN, whether mother received conflicting advice in hospital , attended antenatal classes, mothers level of education, demand feeding in hospital, fathers occupation, early breast contact, rooming in in hospital, delivery method, grandmothers feeding preference, grandmother's breastfeeding history, when feeding method was decided, mothers employment in the previous 6 months, marital status, time to regional centre, mother's IIAFAS score, age of infant when pacifier introduced, mother's smoking during pregnancy, planned pregnancy, household income, breastfeeding problems experienced by week 4, age of infant when mother returned to work, maternal pre-pregnancy obesity.

Discussion

This study is the first to provide longitudinal infant feeding data for rural Western Australia and contributes to the contemporary evidence on determinants of breastfeeding duration in rural and regional areas of developed countries. This study found that breastfeeding prevalence was similar to results reported in national surveys for women in rural areas. Our results show that breastfeeding initiation in this sample was high (97.7%) in this sample and compared favourably to the evidence from the ANIFS, where initiation rates ranged from 95.9% of all Australian women to 97.8% of women in remote or very remote regions. The proportion of in this rural cohort who were still breastfeeding at six (67.9%) and 12 (36.4%) months was similar to that reported for the national cohort (60.1% and 42.2% respectively). Furthermore, few infants were meeting the WHO recommendation of exclusive breastfeeding at six months, a finding that mirrors those of other studies, both in Australia and internationally. (2, 3)

Smoking

The strongest predictor of exclusive breastfeeding cessation in this study was smoking during pregnancy and its negative association with breastfeeding duration has been reported in other studies (8, 12). Reasons for lower rates of breastfeeding and shorter duration amongst smoking mothers have been postulated to include physiological suppression of prolactin, misinterpretation of crying signals as hunger, confounding by other socio-demographic variables, and concern about combining breastfeeding with smoking (13). Epidemiological evidence suggests however that the barriers are more psychosocial than physiological, with women who smoke being less likely to intend to breastfeed, less likely to initiate breastfeeding and less likely to seek assistance with breastfeeding problems (14). Additionally, some studies have shown high rates of both breastfeeding initiation and duration amongst mothers who smoke, further supporting this hypothesis (14). It has been argued that smoking as a risk factor for breastfeeding cessation is affected by socio-demographic factors, although the risk remained significant in this analysis after controlling for other potential confounders.

Studies of rural women have also found an association between smoking and lower breastfeeding initiation and duration (12, 15), independent of other sociodemographic factors. Despite the evidence that breastfeeding is still the best choice regardless of smoking status, a belief that a smoking mother's breast milk is harmful to their infant is a persistent finding in the research (16). As with other health behaviours that are considered socially undesirable, cigarette smoking tends to be under-reported, therefore the influence on breastfeeding may be even greater than that suggested by these results. Although smoking continues to decline in Western Australia, rates remain higher in rural areas, including higher rates of smoking during pregnancy than the state average (12.1% in 2010) (7). In rural areas, exposure to public health campaigns for smoking cessation in the absence of reassurances from health care providers that breastfeeding is protective against exposure to smoke may explain lower breastfeeding initiation. Given pregnant women, particularly first time mothers, are often motivated to improve their health and that of their unborn foetus, antenatal smoking cessation programs specific to women in regional areas may be beneficial.

Maternal pre-pregnancy obesity

Maternal obesity and its increased risk of adverse obstetric outcomes and associated health care costs is a growing public health issue. A recent Australian study estimated that approximately one third of women were overweight or obese prior to pregnancy (17). In addition to antenatal and postnatal complications, maternal obesity has a negative impact on breastfeeding duration and our finding that pre-pregnancy obesity was a reliably strong predictor of risk for breastfeeding cessation in this cohort is consistent with the literature. Obese women are less likely to commence breastfeeding, more likely to experience delayed lactogenesis, and less likely to be breastfeeding at six months compared with normal weight women (18). In addition to physiological factors, shorter duration of breastfeeding amongst obese women may be due anatomical difficulties such as breast size and nipple shape; medical conditions such as polycystic ovary syndrome (PCOS); or sociocultural factors such as lower socio-economic status, poor body image and smoking (18). Although definitive data on maternal obesity is not available for

regional WA, approximately 24% of Western Australian women aged 16-44 years old are classified as obese, and rates of obesity are higher than in non-metropolitan areas (19). Additionally, specialist services to assist with pre-pregnancy weight loss and manage obese pregnant women are rarely available outside of metropolitan areas or very large regional centres.

Positive breastfeeding attitude

Favourable attitudes towards breastfeeding have been shown to have positive effect on breastfeeding duration regardless of culture or socio-economic background (11). A mother's amenity towards breastfeeding and her appreciation of the benefits of breast milk help to shape her commitment to breastfeeding as the preferred method of feeding her infant. In addition to a positive attitude towards breastfeeding, a mother's confidence in her ability to undertake the task of breastfeeding, or her breastfeeding self-efficacy, is a strong predictor of duration. In a study of breastfeeding intention and self-efficacy for mothers in rural Midwest USA, the authors found that those mothers with higher levels of confidence at 2 weeks post-partum were more likely to breastfeed to six months than those who were less confident (20). Similarly in a study of 375 women from regional Queensland, self –efficacy was a significant predictor of breastfeeding duration, with every one-point increase in the measured breastfeeding self-efficacy score associated with a 5% increase in likelihood of continuing breastfeeding to 6 months (21).

Positive attitudes towards breastfeeding from a woman's close supporters, particularly her partner (4) and own mother (8), have also been associated with longer duration of breastfeeding. Those women who perceived that their partner was in favour of breastfeeding were 50% less likely to cease exclusive breastfeeding before six months in this study. Additionally, mothers who perceived that their own mothers were in favour of breastfeeding were significantly less likely to have ceased breastfeeding at both six and 12 months, findings supported by other research in various settings. Increasing the breastfeeding knowledge and skills of both fathers and grandmothers in rural and regional Western Australia may be beneficial in

developing favourable breastfeeding attitudes, particularly where strategies include strengthening skills in practical support of breastfeeding.

Baby Friendly Practices (Rooming-in and Demand Feeding)

Supporting practices that encourage the establishment of breastfeeding in hospital are the basis of the Baby Friendly Health Initiative (BFHI). Recognition of the importance of practices that support breastfeeding establishment has seen rooming-in become commonplace in Australian maternity services and as such it is difficult to demonstrate differences in breastfeeding initiation and duration rates compared with other practices (22), however this study found that women who practiced 24-hour rooming-in were significantly less likely to have ceased exclusive breastfeeding before six months. Comparable evidence around the practice of rooming-in in rural areas is limited; Scott et al reported a non-significant positive association between rooming-in and breastfeeding duration (23), although it has been suggested that the association is more indicative of a parenting attitude than a cause-effect relationship.

Feeding an infant on demand has been established as a significant predictor of breastfeeding duration (24), assists in the establishment of milk supply and supports the process of bonding with the infant. As with rooming-in, demand feeding is considered routine practice for Australian maternity services, although evidence suggests that staff understanding and personal views can be discordant with these practices (25). The significant association between demand feeding and breastfeeding duration in this study highlights the need for rural maternity services to ensure that staff consistently promote the BFHI principles to women in their care.

Use of pacifiers

Early introduction of pacifiers before the establishment of breastfeeding has been associated with early cessation of breastfeeding, the result of reduced sucking capacity of the infant and resultant reduction in breast stimulation (22). Whilst there was no significant independent association between pacifier use and duration of exclusive breastfeeding to six months, infants in this rural cohort who were given

a pacifier before four weeks of age were 67% more likely to have ceased breastfeeding before 12 months of age. Whilst there is little published evidence about pacifier use and breastfeeding duration in rural areas, the finding is consistent with the evidence from other settings (2, 8), therefore it would be prudent to recommend that rural health services continue to support the principles of BFHI and discourage the use of pacifiers before the establishment of breastfeeding.

Return to work

A woman's return to work is consistently cited in the literature as a negative influence on breastfeeding duration (8, 26), with full-time employment the least supportive of breastfeeding. An analysis of data from the Longitudinal Study of Australian Children (LSAC) found that participation in full-time employment had a strong negative effect on the likelihood of continuing breastfeeding for 6 months, and the authors concluded that that employment in the first 6 months of life contributes to premature cessation of breastfeeding, after controlling for other risk factors (27).

The finding that any form of employment has a negative impact on breastfeeding has particular implications for women in rural and regional areas of Australia. Although there have been shifts towards support of breastfeeding in the workplace, these strategies have traditionally been slow to reach rural areas. It is estimated that approximately 40% of Australian women employed prior to childbirth return to work in the following 12 months and 79% of women use "informal child care" (ie grandparent or other family member) to care for their infant whilst at work (28). Employer-provided childcare is rare in rural Australia and for women without extended families or other support networks, formal care, often with limited availability, is the only option. Australia has recently introduced a national paid maternity leave scheme in Australia, with provision for a minimum of 18 weeks paid leave. Interestingly, the scheme's introduction coincided with the collection of data for this study, but we found no significant association between breastfeeding duration and paid maternity leave for this cohort. It has been suggested that a

period of 18 weeks is insufficient to protect the establishment and continuation of exclusive breastfeeding to 6 months (29), although further investigation of the impact of the scheme in regional areas would be beneficial to determine effects.

The significant association between infant gender and breastfeeding duration to 12 months was an unexpected finding and whilst this relationship has been reported previously (30), the evidence is inconclusive. It has been postulated that mothers and health workers may perceive the nutritional requirements of male infants to be higher than female infants, therefore receive food or fluids other than breast milk earlier than female infants (30). This hypothesis may be partially supported by the fact that the mean birth weight of male infants in this study was significantly higher than that of female infants (with the resultant expectation that heavier babies have a greater nutritional need), however the influence of cultural constructs in infant feeding decisions and gender would need to be further explored.

Limitations

Although the results of this study are promising, we acknowledge that there are limitations. Regional areas of Australia are diverse in demography, so whilst the findings of this study may be reflective of the rural areas of WA under study, they may not be generalizable to other parts of non-metropolitan Australia. Additionally, just over one half of eligible women participated in the study and significant differences in sociodemographics between women who completed the study and those who were lost to follow up may have contributed to selection bias in the results. Caution should therefore be used to extrapolate these findings to all rural women. Finally, as the data relied on self-reported behaviours, there is the possibility that more desirable behaviours (such as continuation of breastfeeding or delayed introduction of formula) were over-reported and the less desirable behaviours (such as smoking or alcohol consumption) were under-reported.

Recommendations

Women living in regional areas of Australia face numerous challenges in meeting the guidelines for infant feeding, and although these may not differ significantly

from those facing women in metropolitan areas, there are additional barriers to achievement. Rural maternity services should continue to strengthen their support of baby-friendly practices such as rooming in and demand feeding, as well as consider strategies to support prospective fathers and grandmothers in their skills and knowledge about breastfeeding. Helping rural women to address risk factors such as healthy pre-pregnancy body weight and smoking cessation should also be considered by health services in rural areas. Finally, extending the supports available to mothers in order to establish and maintain exclusive breastfeeding to six months, including antenatal education and employer support for return to paid employment may help to improve the proportion of infants who receive breast milk in accordance with the WHO recommendation.

Acknowledgements:

The authors wish to thank the maternity and child health staff involved in data collection, and the mothers who participated so willingly in the study. Without them, this research would not be possible.

Abbreviations:

aHR – adjusted Hazard Ratio

ARIA - Accessibility/Remoteness Index of Australia

BMI – body mass index

CI – confidence interval

IIFAS - Iowa Infant Feeding Attitudes Scale

LSAC – Longitudinal Study of Australian Children

PIFS II – Perth Infant Feeding Study Mark II

PCOS - polycystic ovary syndrome

RIFS – Rural Infant Feeding Study

USA – United States of America

WA – Western Australia

WHO - World Health Organization

REFERENCES

1. World Health Organization. Report of the Expert Consultation on the optimal duration of breastfeeding, 28-30 March 2001. In: World Health Organization, editor. Geneva: WHO; 2001
2. Australian Institute of Health and Welfare. Australian National Infant Feeding Survey: indicator results. Canberra: AIHW; 2011
3. Ibanez G, Martin N, Denantes M, Saurel-Cubizolles MJ, Ringa V, Magnier AM. Prevalence of breastfeeding in industrialized countries. *Rev Epidemiol Sante Publique* 2012; 305-20
4. Maycock B, Binns CW, Dhaliwal S, Tohotoa J, Hauck Y, Burns S, et al. Education and support for fathers improves breastfeeding rates: a randomized controlled trial. *J Hum Lact* 2013; 484-90
5. Jessri M, Farmer AP, Maximova K, Willows ND, Bell RC. Predictors of exclusive breastfeeding: observations from the Alberta pregnancy outcomes and nutrition (APrON) study. *BMC Pediatr* 2013; 77
6. Statistics ABo. 3218.0 - Regional Population Growth, Australia, 2010-11. 2012
7. Joyce A HM. Western Australia's Mothers and Babies, 2010: Twenty-eighth Annual Report of the Western Australian Midwives' Notification System. Western Australia: Department of Health; 2012
8. Scott JA, Binns CW, Oddy WH, Graham KI. Predictors of breastfeeding duration: evidence from a cohort study. *Pediatrics* 2006; e646-55
9. Australian Institute of Health and Welfare. Rural, regional and remote health : a guide to remoteness classifications. Canberra: Australian Institute of Health and Welfare; 2004
10. World Health Organization. Division of Diarrhoeal Acute Respiratory Disease Control - Indicators for assessing breast-feeding practices : report of an informal meeting, 11-12 June 1991, Geneva, Switzerland. In: World Health Organization Working Group on Infant Feeding, editor. Geneva: World Health Organization; 1991

11. De la Mora A, Russell DW. The Iowa Infant Feeding Attitude Scale: Analysis of reliability and validity. *Journal of Applied Social Psychology* 1999; 2362-80
12. Bailey BA, Wright HN. Breastfeeding initiation in a rural sample: predictive factors and the role of smoking. *J Hum Lact* 2011; 33-40
13. Giglia R, Binns CW, Alfonso H. Maternal cigarette smoking and breastfeeding duration. *Acta Paediatr* 2006; 1370-4
14. Amir LH, Donath SM. Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. *Birth* 2002; 112-23
15. Flower KB, Willoughby M, Cadigan RJ, Perrin EM, Randolph G, Family Life Project Investigative T. Understanding breastfeeding initiation and continuation in rural communities: a combined qualitative/quantitative approach. *Matern Child Health J* 2008; 402-14
16. Bogen DL, Davies ED, Barnhart WC, Lucero CA, Moss DR. What do mothers think about concurrent breast-feeding and smoking? *Ambul Pediatr* 2008; 200-4
17. McIntyre HD, Gibbons KS, Flenady VJ, Callaway LK. Overweight and obesity in Australian mothers: epidemic or endemic? *Med J Aust* 2012; 184-8
18. Amir LH, Donath S. A systematic review of maternal obesity and breastfeeding intention, initiation and duration. *BMC Pregnancy & Childbirth* 2007; 9
19. Tomlin S, Joyce S. Health and Wellbeing of Adults in Western Australia 2012, Overview and Trends. Western Australia: Department of Health; 2013
20. Wilhelm SL, Rodehorst TK, Stepans MBF, Hertzog M, Berens C. Influence of intention and self-efficacy levels on duration of breastfeeding for midwest rural mothers. *Applied Nursing Research* 2008; 123-30
21. O'Brien M, Buikstra E, Hegney D. The influence of psychological factors on breastfeeding duration. *Journal of advanced nursing* 2008; 397-408
22. National Health and Medical Research Council. Infant Feeding Guidelines 2012. Canberra: Comonwealth of Australia; 2012
23. Scott JA, Landers MC, Hughes RM, Binns CW. Factors associated with breastfeeding at discharge and duration of breastfeeding. *Journal of Paediatrics & Child Health* 2001; 254-61

24. Merten S, Dratva J, Ackermann-Liebrich U. Do Baby-Friendly Hospitals Influence Breastfeeding Duration on a National Level? *Pediatrics* 2005; e702-e8

25. Walsh AD, Pincombe J, Henderson A. An examination of maternity staff attitudes towards implementing Baby Friendly Health Initiative (BFHI) accreditation in Australia. *Matern Child Health J* 2011; 597-609

26. Skafida V. Juggling work and motherhood: the impact of employment and maternity leave on breastfeeding duration: a survival analysis on Growing Up in Scotland data. *Maternal and Child Health Journal* 2012; 519-27

27. Cooklin AR, Donath SM, Amir LH. Maternal employment and breastfeeding: results from the longitudinal study of Australian children. *Acta Paediatr* 2008; 620-3

28. Australian Bureau of Statistics. Pregnancy and employment transitions, Australia, November 2011. [Canberra, A.C.T.]: Australian Bureau of Statistics; 2012

29. Cooklin AR, Rowe HJ, Fisher JR. Paid parental leave supports breastfeeding and mother-infant relationship: a prospective investigation of maternal postpartum employment. *Australian & New Zealand Journal of Public Health* 2012; 249-56

30. Scott JA, Aitkin I, Binns CW, Aroni RA. Factors associated with the duration of breastfeeding amongst women in Perth, Australia. *Acta Paediatr* 1999; 416-21

Chapter 7 - Breastfeeding Attitudes and Knowledge

This chapter is a published peer-reviewed journal article, reprinted as it appears in publication.

Cox, K. N., Giglia, R. C., & Binns, C. W. (2015). The influence of infant feeding attitudes on breastfeeding duration: evidence from a cohort study in rural Western Australia. *Int Breastfeed J, 10*, 25. doi:10.1186/s13006-015-0048-3

Author contributions:

Kylee Cox was responsible for administration of the study, collection of data, data analysis and interpretation, and preparation of the draft and final manuscripts.

Signature:_____

Dr Roslyn Giglia provided advice and guidance on study administration, data analysis and critical review of the manuscript.

Signature:_____

Professor Colin Binns provided oversight of the study design and administration, advice on statistical analysis and critical review of the manuscript.

Signature:___ _____

The Influence of Infant Feeding Attitudes on Breastfeeding Duration: Evidence from a Cohort Study in Rural Western Australia

Abstract:

Background: Breast milk is the only nutrition required by an infant in the first six months of life. Promoting and protecting breastfeeding is reflected in public health policy across the globe, but breastfeeding rates in both developing and industrialised countries continue to demonstrate that few mothers meet these recommendations. In addition to socio-demographic factors such as age, education and income, modifiable factors such as maternal breastfeeding knowledge and attitudes have been shown to influence breastfeeding duration. The objective of this paper was to describe the influence of knowledge and attitudes on breastfeeding duration in rural and regional Western Australia.

Methods: A cohort of 427 women and their infants were recruited from hospitals in regional Western Australia and followed for a period of 12 months. Information about feeding methods was gathered in hospital and at a further seven follow-up contacts. Infant feeding attitude was measured using the Iowa Infant Feeding Attitude Scale (IIFAS).

Results: Mothers in this cohort had a generally poor understanding of the physiology of breast milk production, with 59.7% believing that many women needed to supplement with formula. The median duration of exclusive breastfeeding for mothers with an IIFAS score of >65 was 16 weeks (95% CI 13.5-18.5) compared with 5 weeks for those with a score <65 (95% CI 3.2-6.8) ($p<0.0001$). The median duration of any breastfeeding to 12 months was more than twice as long for mothers with an IIFAS score >65 (48 vs. 22 weeks, $p<0.001$).

Conclusions: Women in this rural cohort who had better breastfeeding knowledge and a more positive attitude towards breastfeeding had a longer duration of exclusive breastfeeding. Delivery of antenatal breastfeeding education in a range of

modalities for rural women is required in order to ensure that mothers are better equipped to manage breastfeeding in the early postnatal period. Further research examining the breastfeeding knowledge, attitudes and intentions of adolescents in rural areas will contribute to the evidence base and help to ensure that breastfeeding is seen as the normal method of infant feeding.

Key words:
Breastfeeding, rural, attitudes, knowledge, breastfeeding duration, exclusive breastfeeding

Introduction:

Breast milk is the only nutrition required by an infant in the first six months of life (Kramer & Kakuma, 2012). Promoting and protecting breastfeeding is reflected in public health policy across the globe, but breastfeeding rates in both developing and industrialised countries continue to demonstrate that few mothers meet these recommendations (Ibanez et al., 2012; Ip et al., 2007; World Health Organization, 2013). In Australia, despite near-universal breastfeeding initiation rates, it is estimated that less than 5% of infants are still exclusively breastfed by the time they reach six months of age (Australian Institute of Health and Welfare, 2011).

Influences on infant feeding are varied, but include socio-demographic factors such as maternal age, level of education and family income. Whilst these variables are strong predictors of breastfeeding practice, they are not amenable to modification and are therefore difficult to address through breastfeeding promotion interventions. It has been suggested that continued focus on modifiable factors such as increasing breastfeeding knowledge and positive attitude to breastfeeding may help to increase breastfeeding duration (Dungy et al., 2008; Inoue et al., 2013; Li et al., 2003; Scott et al., 2004; Sittlington et al., 2007).

Breastfeeding Knowledge

A mother's understanding of the benefits that breastfeeding provides for both herself and her infant is important in evaluating the infant feeding method that she

chooses. Conversely the risks associated with formula feeding need to be understood in order to make an informed decision. Provision of antenatal education has been shown to positively influence both initiation and duration of breastfeeding (Chezem et al., 2003; Rosen et al., 2008; Susin et al., 1999; Zimmerman, 1999) and is one of the criteria for health services seeking accreditation under the Baby Friendly Hospital Initiative (BFHI) (World Health Organization, 2014). Effective antenatal breastfeeding education provides women with information about the benefits of breastfeeding; increases confidence in breastfeeding through developing skills and technique; and allows the physical examination of breasts and preparation of nipples prior to birth (Vallenas, 1998).

As the primary source of information about infant feeding for many new mothers, health professionals such as midwives, child health nurses and general practitioners have the potential to provide high quality breastfeeding information at a time when information uptake is most pertinent. Not only is the level of individual knowledge of health professionals important, but the consistency of their information is integral to improving breastfeeding rates. Even a modest investment in training and education has been shown to improve breastfeeding rates and contribute to adherence to policies that protect breastfeeding such as the Baby Friendly Hospital Initiative(Cattaneo & Buzzetti, 2001).

Rural and regional areas of developed countries, whilst not demographically homogenous, often share common characteristics including dispersed population densities and reduced access to health care services(Smith et al., 2008). In Australia, the progressive closure of small maternity units, from 325 in 1991 to 156 in 2007, has had a significant impact on the availability of antenatal and postnatal care for women residing outside metropolitan areas(National Rural Health Alliance Inc., 2012a). Workforce issues, including the shortage of skilled GPs and midwives in rural areas and their subsequent access to training, have contributed to the lower level of maternity services available to rural women.

Breastfeeding Attitudes

Mothers' attitudes towards breastfeeding as the choice of infant feeding method have been shown to influence the likelihood of her initiating and continuing to breastfeed, more so than sociodemographic factors such as age and education (Scott et al., 2004). In addition to her own feelings about infant feeding, mothers have been shown to be influenced by the attitudes of her social networks , including her mother, other close family members and friends(Dungy et al., 2008). Partners with supportive and positive attitudes towards breastfeeding have been shown to be highly influential on both mothers feeding choice and duration of breastfeeding (Maycock et al., 2013; Mitchell-Box & Braun, 2013; Scott et al., 1997; Scott, Binns, Oddy, et al., 2006).

Community knowledge, attitudes and social norms also play a role in the support of breastfeeding. In their analysis of community perceptions and knowledge about breastfeeding, Daly et al (2014) suggested that…

> "*If the general public do not know the benefits of breastfeeding, messages about the importance of breastfeeding are likely to be less compelling and effective in facilitating exclusive breastfeeding for the recommended six months. Without knowledge*
> *of the potential benefits and barriers, complying with the breastfeeding guidelines may be difficult for mothers* (p2)." (Daly et al., 2014)

Breastfeeding attitudes may be shaped by cultural or personal experiences, although there is limited evidence regarding differences in attitudes between urban and rural areas of developed countries. In a study of factors associated with breastfeeding initiation and duration in rural USA, the lack of role models and a perception that breastfeeding was not the normal infant feeding method for women of particular cultural backgrounds were identified as potentially contributing factors (Flower et al., 2008). Other evidence suggests that economic factors in rural communities such as the need to women to return to work, or limited community facilities to support continued breastfeeding are also significant barriers (Sparks, 2010).

The Rural Infant Feeding Study (RIFS) aimed to determine the factors associated with breastfeeding practices from birth to 12 months of age in rural Western Australia. The objective of this paper is to describe the role of mothers' infant feeding attitudes and knowledge in breastfeeding practice in regional Western Australia.

Methods:

Sample Selection

The Rural Infant Feeding Study (RIFS) was conducted in regional Western Australia between April 2010 and November 2012, and gathered information about infant feeding practices from women who lived in non-metropolitan communities (including regional centres, smaller towns and remote areas of the state). A sample of 489 mothers and their infants were recruited between April 2010 and November 2011 from hospitals with maternity service capacity in four non-metropolitan health regions of Western Australia (WA) and followed for 12 months from birth. Women who had delivered an infant without serious illness, who read and understood English and who resided in a regional area of WA were eligible to take part in the study. Mothers were contacted and invited to participate in the study by research staff with assistance from midwives at each hospital. To detect a prevalence of "any breastfeeding" at six months of 50%, a required final sample size of 400 was calculated using the StatCalc program of Epi Info 2000 (Centers for Disease Control and Prevention, 2008) using a power of 0.80, 95% confidence, $p<0.05$. Allowing for approximately 20% loss to follow-up, an initial sample of 500 was estimated.

Data Collection

The data collection tool was based on that used in the Perth Infant Feeding Study Mark II (PIFS II) (Graham et al., 2005) with additional questions included to ascertain geographical location and access to sources of information about infant feeding. Breastfeeding terms and definitions used were consistent with those used by the World Health Organization, and defined "exclusive breastfeeding" as infants who received only breast milk with the exception of drops or syrups consisting of

vitamins, mineral supplements or medications. Infants who received breast milk with or without other food or liquids including formula were used to calculate "any breastfeeding". The modified tool was pilot tested with a group of rural mothers prior to its use in the regional setting.

Once consent to participate was received, mothers were asked to complete a baseline questionnaire to determine demographics and feeding practices whilst in hospital. For those mothers with internet access (87%), a login and password were provided to enable the completion of the baseline and follow-up questionnaires online. Mothers without internet access (13%) were contacted via telephone to complete the follow-up interviews. Over the 12 month period, mothers were contacted eight times (at birth, then at 4, 10, 16, 26, 32, 40 and 52 weeks) to determine changes to feeding methods, as well as factors that influenced their feeding decisions, including access to websites specifically designed to support breastfeeding.

Included in the baseline questionnaire was the Iowa Infant Feeding Attitudes Scale (IIFAS)(De la Mora & Russell, 1999), a 17-item scale which measures attitudes towards both breast and formula feeding with regards to the health and nutritional benefits, and the cost and convenience of each method. It has been shown previously to be a valid and reliable measure of infant feeding attitudes among women in the USA (Flower et al., 2008), Scotland (Dungy et al., 2008; Shaker et al., 2004) and Japan (Inoue et al., 2013). Each item is measured on a 5-point scale and items more favourable to formula feeding are reverse-scored to give an overall score. Potential scores range from 17 (reflecting positive formula feeding attitudes) to 85 (indicating attitudes that favour breastfeeding). The IIFAS has been used extensively in cohort studies to determine maternal attitudes to breastfeeding (Scott et al., 1999; Scott, Binns, Oddy, et al., 2006; Scott et al., 2004; Wilkins et al., 2012) although there is limited evidence of its use in regional or rural subjects.

Data Analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) Version 22 (IBM, 2013). Univariate summary statistics were produced to describe the characteristics of the study sample. Chi-square tests were used to determine associations between variables of interest (maternal age, parity, maternal education, household income, maternal country of birth, birth weight and method of delivery).

Cox's proportional hazards model was used to determine the effect of breastfeeding knowledge and attitude on duration of breastfeeding. Univariate logistic regression analysis was used to screen for potentially significant factors influencing breastfeeding duration. Association between breastfeeding practice ("any" and "exclusive" breastfeeding) and the significant factors reported in univariate logistic regression analysis were then examined using Cox's proportional hazards model, controlling for those significant predictors of breastfeeding practice determined in the literature and other potential demographic confounders. Backward elimination procedure was applied to obtain the final model in the regression analysis (see Table 3). All tests were two sided and a p value of less than 0.05 was considered statistically significant. Survival analysis using the Kaplan Meier technique was conducted to determine median duration of breastfeeding and Cronbach's α was used to determine internal consistency of the scale in the study.

Ethics

Ethics approval for this study was granted by the Curtin University Human Research Ethics Committee (SPH-0005-2008), the WA Country Health Service Ethics Committee (2009:25) and the St John of God Healthcare Ethics Committee (392).

Results:

Participant Characteristics

Of the 489 women who gave consent to participate in the study, 427 completed the baseline survey. The demographic characteristics of the participants are given in

Table 1. The majority of mothers (82.6%) were Australian-born, and 94.5% indicated that they were partnered (married or de facto). More than half of the participants (56.3%) had an annual family income of $72,800 or more, and 59.9% indicated that they had private health insurance. Around one third of women (31.2%) were not in the paid workforce in the six months prior to the study and 28.8% indicated that they were on paid parental leave.

Table 1: Selected demographics of Rural Infant Feeding Study (RIFS) participants

Demographic characteristic (*n*=427)		n	%
	(Mean ± SD)		
Mean maternal age (yrs):	30.2 ± 5.2		
Mean birth weight (g):	3523 ± 471		
Mean gestational age (wks):	39.5± 1.4		
Health Service Region[4] (*n*=427)			
Midwest		291	68.1
South West		100	23.4
Wheatbelt		19	4.4
Goldfields		15	3.5
Pilbara		2	0.5
Remoteness Classification (ARIA) (*n*=424)			
HA (Highly Accessible)		19	4.4
A (Accessible)		259	60.7
MA (Moderately Accessible)		95	22.2
R (Remote)		31	7.3
VR (Very Remote)		20	4.7
Maternal age (yrs) (*n*=427)			
<20		11	2.6
20-29		184	43.1
≥30		232	54.3
Parity (*n*=424)			
Primiparous		178	41.7
Multiparous		246	57.6
Maternal education (*n*=417)			
Did not complete high school		57	13.3
Completed Yr 12 / technical / trade qualification		198	46.4
Bachelor degree or higher		162	37.9
Mother's country of birth (*n*=420)			

[4] WA Country Health Service region

Australia / New Zealand	363	85.0
UK/Ireland	26	6.1
Other	31	7.3
Household Income (AUD)(*n*=409)		
<72,800	167	39.1
≥72,800	242	56.7
Birth weight (g) (*n*=422)		
<2500	7	1.6
≥2500	415	97.2
Method of Delivery (*n*=425)		
Vaginal	244	57.1
Assisted (forceps/suction)	60	14.1
Caesarean	121	28.3

The mothers who participated in this study were of similar age to mothers giving birth in WA (mean age 30.2 years (±5.2) vs. 29.6 years (±5.7)). Babies born in the rural area were slightly heavier (3523g (±471), vs. 3337g (±601), p<0.001). Fewer infants were delivered via caesarean section (28.3% vs. 33.6%, p=0.026) and a greater proportion of mothers in the study were born in Australia or New Zealand (85.0% vs. 72.0%, p<0.001).

Breastfeeding Knowledge

Breastfeeding knowledge, as assessed at four weeks post-partum, is presented in Table 2. Almost all mothers (93.8%) correctly identified that babies required more frequent feeding during times of increased growth, but only one third (37.1%) believed that formula did not result in infants sleeping longer at night. Two thirds (66.3%) of mothers recognised that breast milk supply was improved with sufficient rest, and 58% understood that use of formula in the early stages of breastfeeding establishment would affect supply. Almost two thirds (59.7%) of mothers believed that insufficient breast milk supply was a common problem amongst breastfeeding mothers.

Table 2: Breastfeeding knowledge at 4 weeks post-partum

	True		False		Don't know	
	n	%	n	%	n	%
Babies naturally know how to breastfeed correctly (n=356)	128	35.9	206	57.9	22	6.2
Formula fed babies sleep longer at night (n=353)	116	32.9	131	37.1	106	30.0
Feeding more often increases breastmilk supply (n=355)	332	93.5	14	4.0	9	2.5
Babies need to feed more when they are having a growth spurt (n=355)	333	93.8	7	2.0	15	4.2
There are lots of women who need to give their babies formula because they can't make enough breastmilk (n=355)	212	59.7	76	21.4	67	18.9
Birth control pills reduce breastmilk supply (n=354) *(Mini-pill won't but normal pill will)*	58 *(14)*	16.4 *(4.0)*	76	21.5	220	62.1
Getting extra rest and relaxation is necessary to ensure a good breastmilk supply (n=355)	283	66.3	24	5.6	48	11.2
Feeding formula to a one month old baby will not reduce the amount of breastmilk produced by the mother (n= 355)	34	9.6	206	58.0	115	32.4

Mothers with greater levels of breastfeeding knowledge, specifically about supply, had a significantly longer median duration of exclusive breastfeeding (see Table 3). Mothers who correctly identified that feeding more often increased breast milk supply had a median duration of exclusive breastfeeding of 12 weeks (95% CI 9.5-14.5) compared to 5 weeks (95% CI 0.0-11.0, p= 0.020). Mothers who felt that many mothers needed to supplement breastfeeding formula due to breast milk insufficiency had a median exclusive breastfeeding duration of 9 weeks (95% CI 5.6-12.4) compared to 20 weeks for those who did not believe this was correct (95% CI 17.5-22.6, *p*=0.020). Those mothers who believed that feeding formula to a one-month old infant did not affect breast milk supply had a median exclusive breastfeeding duration of 8 weeks (95% CI 5.2-10.8) compared with 15 weeks for those who did not believe that this was true (95% CI 12.1-17.9, *p*= 0.005).

Table 3: Median Duration of Exclusive Breastfeeding by Breastfeeding Knowledge

	Median Duration of EBF (weeks)		
	Correct	Incorrect	*p*
Feeding more often increases breastmilk supply (n=355)	12.0 (9.5-14.5)	5.0 (0.0-11.0)	0.020
There are lots of women who need to give their babies formula because they can't make enough breastmilk (n=355)	20.0 (17.5-22.6)	9.0(5.6-12.4)	0.020
Feeding formula to a one month old baby will not reduce the amount of breastmilk produced by the mother (n= 355)	15 (12.1-17.9)	8.0 (5.2-10.8)	0.005

Breastfeeding attitudes

Breastfeeding attitudes were measured using the IIFAS scale as described above. The mean IIFAS score for all mothers participating in the study was 66 (39-84±8.3). Further grouping of the responses to each of the 17 items in the IIFAS as positive (agreement), negative (disagreement) or neutral responses is presented in Table 4. The Cronbach's α score of 0.75 indicates good internal reliability of the scale in this sample (DeVellis, 2012).

Table 4: Iowa Infant Feeding Attitude Score (IIFAS) score

IIFAS Scale item	Disagree†	Neutral	Agree‡
18. The nutritional benefits of breastmilk last only until the baby is weaned from breastmilk	71.6	17.7	10.7
19. Formula-feeding is more convenient than breast-feeding	72.4	17.3	10.2
20. Breast-feeding increases mother-infant bonding	62.1	32.3	5.6
21. Breastmilk is lacking in iron	63.2	31.5	5.3
22. Formula-fed babies are more likely to be overfed than breast-fed babies	26.9	41.7	31.4
23. Formula-feeding is the better choice if the mother works outside the home	51.8	32.2	16.0
24. Mothers who formula-feed miss one of the great joys of motherhood	33.3	24.6	42.2
25. Women should not breast-feed in public places such as restaurants	91.2	5.2	3.6
26. Babies who are fed breastmilk are healthier than babies who are fed formula	25.3	31.6	43.1
27. Breast-fed babies are more likely to be overfed than formula-fed babies	66.1	30.5	3.3

28. Fathers feel left out if a mother breast-feeds	68	21.4	10.5
29. Breastmilk is the ideal food for babies	4.4	8.0	87.6
30. Breastmilk is more easily digested than formula	4.9	22.2	72.8
31. Formula is as healthy for an infant as breastmilk	45.2	39.0	15.7
32. Breast-feeding is more convenient than formula-feeding	9.8	17.8	72.4
33. Breastmilk is less expensive than formula	3.0	2.8	94.1
34. A mother who occasionally drinks alcohol should not breast-feed her baby	46.9	28.6	24.5

Note: The items 1, 2, 4, 6, 8, 10, 11, 14, and 17 were reversed when calculating the score

† Disagree includes 'strongly disagree' and 'disagree'

‡ Agree includes 'strongly agree' and 'agree'

The majority of mothers (94.1%) agreed that breast milk was less expensive than formula, and 72.4% agreed that breastfeeding was more convenient that formula feeding. A third of mothers (33.3%) disagreed that formula feeding meant missing one of the great joys of motherhood, and a further 24.6% had neutral feelings about this. Almost two thirds (62.1%) disagreed that breastfeeding increased mother-infant bonding, and one quarter (25.3%) disagreed that babies who were breastfed were healthier than formula-fed babies. More than half of mothers either agreed that infant formula was as healthy as breast milk (15.7%) or expressed neutral feelings about the difference (39%).

Feelings about breastfeeding

Mothers were asked to rate their feelings about breastfeeding whilst in hospital, specifically their confidence, enjoyment, satisfaction and comfort in breastfeeding. When asked about their confidence in breastfeeding whilst in hospital, 73.8% of women who were exclusively breastfeeding their infant reported that they were confident, compared with 56.6% of women who were breastfeeding less than exclusively, that is having introduced formula or other fluids.

Mothers with a positive score for breastfeeding enjoyment were more likely to be breastfeeding at both six and 12 months (p=0.048 and p<0.0001, respectively). Mothers who were more satisfied with breastfeeding were more likely to be breastfeeding at 12 months (p=0.015), and mothers who indicated that they were comfortable breastfeeding in front of others were more likely to be exclusively breastfeeding at 6 months (p=0.030) as well as breastfeeding to any intensity at both six and 12 months (p=0.001 and p=0.002, respectively). The median duration of exclusive breastfeeding for mothers who indicated that they were confident breastfeeding in front of others was 16 weeks, while mothers who felt uncomfortable breastfeeding in public exclusively breastfed for only 5 weeks (p<0.0001). Mothers who did not find breastfeeding satisfying had a median duration of exclusive breastfeeding of one week compared to 16 weeks for those who expressed satisfaction with their breastfeeding experience (p<0.0001).

The median duration of exclusive breastfeeding for mothers with an IIFAS score of >65 was 16 weeks (95% CI 13.5-18.5) compared with 5 weeks for those with a score <65 (95% CI 3.2-6.8) (p<0.0001). The median duration of any breastfeeding to 12 months was more than twice as long for mothers with an IIFAS score >65 (48 vs. 22 weeks, p<0.001). After adjusting for potential confounders, mothers infant feeding attitude remained a strong predictor of exclusive breastfeeding to six months, where those with more positive attitudes were less likely to discontinue (aHR =0.55, 95% CI 0.40-0.77). Similarly, any breastfeeding to 12 months was also associated with a higher IIFAS score (aHR 0.42, 95% CI 0.29-0.62).

Discussion:

Although studies documenting breastfeeding attitudes and knowledge have been reported previously, this is the first time to our knowledge that the attitudes of women residing in rural areas of Australia have been assessed using the validated IIFAS scale. The finding that women who had a more favourable attitude towards breastfeeding were less likely to cease exclusively breastfeeding before the recommended time of six months concurs with the literature both in Australia and

internationally.(Inoue et al., 2013; Scott, Binns, Graham, et al., 2006; Sittlington et al., 2007; Yen-Ju & McGrath, 2011)

Knowledge

Breastfeeding knowledge has been positively associated with increased rates of initiation and duration of breastfeeding.(Chezem et al., 2003; Dungy et al., 2008) While a woman may have traditionally learned breastfeeding skills and knowledge from her own or other mothers, this learning is now primarily gained from other sources such as the internet, friends and other family members (Craig & Dietsch, 2010). Provision of accurate antenatal breastfeeding information from qualified lactation professionals in group and individual settings has been found to be effective in positively influencing both breastfeeding initiation and duration.(Blyth et al., 2004; Lumbiganon et al., 2012)

The finding that almost half of mothers did not believe that introduction of infant formula in the early stages of breastfeeding establishment affected supply may suggest that there is poor understanding of the physiology of breast milk production, or that this aspect of breastfeeding is not well explained by health professionals. Additionally, there appears to be a prevailing belief amongst this cohort that many women need to use formula as they do not produce enough breast milk. The notion that breast milk supply insufficiency is a common problem amongst breastfeeding mothers has been noted previously, yet it has been estimated that less than 5% of women experience true milk production and supply problems (Dennis, 2002). Perceived insufficiency is one of the most cited reasons for ceasing breastfeeding (Cameron et al., 2010). Antenatal classes provide an opportunity to promote breastfeeding as the normal and desirable method of infant feeding and to address common breastfeeding misconceptions prior to birth, but in rural Australia, access to antenatal classes may be limited by geographical distance and availability of suitably trained and knowledgeable staff.

In addition to knowledge of the specific benefits of breastfeeding, evidence suggests awareness of breastfeeding recommendations is positively associated with

breastfeeding duration. (Stuebe & Bonuck, 2011; Wen et al., 2012) This finding further reinforces the importance of providing consistent, evidence based information around optional duration of exclusive breastfeeding to women both antenatally and postnatally.

Attitude

Mothers who are predisposed towards breastfeeding are consistently found to have greater duration of breastfeeding regardless of intensity (Bertino et al., 2012; Scott, Binns, Oddy, et al., 2006). Those mothers who believe that breastfeeding is more convenient, healthier and cheaper are less likely to introduce formula to their infant than those who find breastfeeding to be embarrassing, restrictive or uncomfortable (Dennis, 2002).

Neutrality or ambivalence towards breastfeeding has been shown to be associated with shorter mean breastfeeding duration. It has been suggested that ambivalence towards feeding method antenatally provides opportunities to influence feeding choice, although in this study the vast majority (77%) had decided on their feeding method prior to pregnancy. Previous research has indicated that an IIFAS score of 65 or greater is indicative of positive breastfeeding opinion. The recent Australian National Infant Feeding Survey reported that 26% of women who had chosen not to breastfeed their infant perceived infant formula to be as healthy as breast milk(Australian Institute of Health and Welfare, 2011). Whilst Australia has a voluntary system of self-regulation for infant formula manufacturers, governed by the World Health Organization's International Code of Marketing of Breast Milk Substitutes, the rise of social media and networking sites present new challenges in monitoring the pervasiveness of messages promoting infant formula at the expense of the benefits of breastfeeding.(Abrahams, 2012)

The association between seeing breastfeeding and reporting a positive attitude towards breastfeeding has been reported in the literature. A study in rural Scotland examining the role of seeing breastfeeding in the infant feeding decision found that women who expressed positive attitudes towards seeing breastfeeding were more

likely to intend to breastfeed. (Hoddinott et al., 2010) Exposure to breastfeeding in a community increases the acceptance of breastfeeding as the normal way of infant feeding, but residing in a rural area may limit the opportunity to see breastfeeding in public or within the family unit. This lack of exposure may compound negative attitudes towards breastfeeding for young people who may view formula feeding as more socially acceptable (Dyson et al., 2010). Promotion of breastfeeding targeting adolescents and young adults in rural and regional areas through education curriculum and social media campaigns may assist in re-framing breastfeeding in these settings.

Breastfeeding self-efficacy, as measured by a woman's level of confidence and skill in breastfeeding, has been cited as a strong independent indicator of breastfeeding success.(Baghurst et al., 2007; Blyth et al., 2002; de Jager et al.) Although self-efficacy was not measured directly in this cohort, the finding that mothers who enjoyed breastfeeding and felt comfortable breastfeeding in front of others were more likely to continue to breastfeed concurs with the literature.

Limitations

The results of this study suggest that the IIFAS is a robust predictor of breastfeeding intention in regional areas of Australia; however some caution should be exercised in generalising these findings. Firstly, few mothers in the sample were from culturally or linguistically diverse backgrounds, however the tool has been used and validated in a number of cultural groups, lending support to its use in non-homogenous settings. In addition to cultural homogeneity, the women in this sample were relatively socioeconomically advantaged which may limit the applicability of the findings. Finally, further exploration of the influence of attitudes and knowledge with a larger sample size would be beneficial to confirm the results.

Conclusions:

Women in rural and regional Western Australia who are more knowledgeable about the benefits of breastfeeding and who have a more positive attitude towards breastfeeding are more likely to start and continue to breastfeed. Whilst this finding is not dissimilar to that in metropolitan areas of Australia or indeed in other developed countries, there are unique challenges in ensuring that rural women are provided with consistent, evidence-based breastfeeding information, are presented with positive and supportive community attitudes and are encouraged to begin and continue to breastfeed in order to meet the current WHO recommendations. There should be continued emphasis on the delivery of antenatal breastfeeding education in a range of modalities for rural women. Further research examining the breastfeeding knowledge, attitudes and intentions of adolescents in rural areas will contribute to the evidence base and help to ensure that breastfeeding is seen as the normal method of infant feeding.

Abbreviations:

IIFAS, Iowa Infant Feeding Attitude Scale; WHO, World Health Organization; BFHI, Baby Friendly Hospital Initiative; aHR, adjusted hazard ratio; CI, confidence interval

Competing Interests:

This study was partly funded by a WA Health Promotion Foundation (Healthway) Research Starter Grant. Kylee Cox was the recipient of an Australian Postgraduate Award scholarship for her PhD study. Roslyn Giglia was the recipient of a Healthway Health Promotion Research Fellowship. There are no other relevant financial arrangements or potential conflicts of interest to be reported.

Acknowledgements:

The authors wish to thank the maternity and child health staff of the regional hospitals involved in the study for their assistance with data collection. Foremost, they wish to thank the mothers who gave up their time to participate in the study. Without them, this research would not have been possible.

Authors' contribution:

KC had primary responsibility for administering the study and collecting data, searching and analysing literature and drafting the manuscript. RG provided guidance on preparation of the manuscript and data analysis, and revised the manuscript. CB provided guidance on the study design and critical advice on data analysis and findings. All authors have given final approval of the version to be published. All authors read and approved the final manuscript.

Chapter 8 - Sources of Breastfeeding Help and Advice

This paper has been submitted for publication in the Australian Journal of Rural Health. Publication access details will be provided when available.

Author contributions:

Kylee Cox was responsible for administration of the study, collection of data, data analysis and interpretation, and preparation of the draft and final manuscripts.

Signature:_____

Dr Roslyn Giglia provided advice and guidance on study administration, data analysis and critical review of the manuscript.

Signature:___ _____

Professor Colin Binns provided oversight of the study design and administration, advice on statistical analysis and critical review of the manuscript.

Signature:___ _____

Breastfeeding beyond the Big Smoke: Who provides support for mothers in rural Western Australia?

Abstract

Introduction: Despite strong and growing evidence for the benefits of exclusive breastfeeding to six months of age, few infants in developed countries reach this milestone. Although breastfeeding practice and its determinants are well described for women in metropolitan areas, there is limited evidence for rural and regional areas of Australia. This paper describes the influence of advice and support on breastfeeding duration for women in rural areas of Western Australia in the first six months of their infants' lives.

Methods: A cohort of 427 women and their infants were recruited from hospitals in regional Western Australia and followed for a period of 12 months. Information about feeding methods was gathered in hospital and at a further seven follow-up contacts.

Results: Women who had attended antenatal classes were less likely to have ceased exclusively breastfeeding before six months than those who had not attended classes (aHR 0.61, 95% CI 0.41-0.91). No significant associations were found between provision of information alone and duration of breastfeeding. Breastfeeding advice and support in the first six months was most commonly sought from Child Health Nurses, General Practitioners and friends.

Conclusions: Antenatal group education is effective in supporting breastfeeding duration for rural women and should be a key priority for rural health service providers. Health professionals are common sources of breastfeeding support postnatally, however creating and maintaining positive and supportive social networks for mothers may also contribute to increasing the proportion of rural infants who meet the WHO guidelines for exclusive breastfeeding.

Keywords:

Professional support, social networks, antenatal education, exclusive breastfeeding,

What is already known on this subject:

- Few women globally meet the WHO guideline for exclusive breastfeeding to six months of age
- Provision of breastfeeding support has been shown to improve exclusive breastfeeding duration
- There is limited evidence regarding the influence of support on breastfeeding duration for women in rural areas of developed countries.

What this study adds:

- General Practitioners (GPs) and Child Health Nurses (CHNs) are commonly cited sources of breastfeeding support for women in rural Western Australia
- Social supports are also significant influences on breastfeeding practice for rural women
- Strategies to engage rural women's social networks in breastfeeding support may increase the proportion of rural infants exclusively breastfed to six months.

Introduction

Breastfeeding is acknowledged globally as the optimum way to feed infants, providing health benefits for infant and mother.(1-4) Extensive evidence exists to recommend exclusive breastfeeding to six months of age,(5) however few mothers reach this goal.(6)

From historic low levels in the 1970's, breastfeeding initiation in Australia has reached near-universal levels, with the 2010 Australian National Infant Feeding Survey (ANIFS) 2010 reporting that breastfeeding was initiated for 96% of children between 0-2 years.(7)

Despite positive breastfeeding initiation rates in Australia and other developed countries, many women discontinue breastfeeding in the early postnatal period (8-11) and recent evidence suggests that only 15.4% of Australian infants are exclusively breastfed up to six months of age.(7)

Quantifying the influences on breastfeeding behaviour for rural women in developed countries is challenging because little evidence exists. In Australia, the ANIFS reported differences in breastfeeding initiation and duration rates across classifications of remoteness, however the gradient was not consistent.(7) Evidence from other developed countries is also difficult to compare as it is based on a variety of classifications of rurality and breastfeeding definitions. Whilst some studies have found that rural women are less likely to both start and continue to breastfeed,(12-14), the use of samples drawn from financial assistance programs such as the United State's Special Supplemental Nutrition Program for Women, Infants and Children (WIC) contributes a level of bias, due to the provision of free infant formula.(15) The cross-sectional and retrospective nature of the published evidence further limits the ability to determine causation from the studies.

The provision of advice and support from both health professionals and peers has been shown to increase the duration of exclusive breastfeeding.(16) Breastfeeding support is a multifaceted and complex set of interventions designed to improve

breastfeeding outcomes and can be offered in a variety of ways,(16) however the provision of breastfeeding information alone is not considered support.

In 2011, approximately 29% of births were outside major cities in Australia, (17) however women in regional, rural and remote Australia do not have the same level of access to professional, community or personal breastfeeding support services as their metropolitan peers.(18)

The Rural Infant Feeding Study (RIFS) aimed to determine the factors associated with breastfeeding practices from birth to 12 months of age in regional and rural Western Australia. The aim of this paper is to describe the sources of breastfeeding advice and support and the influence of these sources on breastfeeding practice for women in the first six months of their infants' lives.

Methods

Sample Selection

The RIFS was a prospective cohort study of 427 mothers and their infants who had delivered in a hospital with maternity service capacity in four non-metropolitan health regions of Western Australia (WA) between April 2010 and November 2011. Women who had delivered an infant without serious illness, who read and understood English and who resided in a regional area of WA were eligible to take part in the study. Women were contacted and invited to participate in the study by research staff with assistance from midwives at each hospital and participants were followed for 12 months from birth. A final sample size of 400 was calculated to detect a prevalence of "any breastfeeding" at six months of 50%, assuming power of 0.80 and significance of 0.05.

Data Collection

A previously validated data collection tool (19-22) developed for the Perth Infant Feeding Study Mark II (PIFS II) were used in the RIFS. Specific to this cohort study were additional questions included to ascertain geographical location and access to

sources of information about infant feeding (see Appendix 1). The modified tools were pilot tested with a small group of rural mothers (n=4) to assess readability prior to use in the regional setting.

Over the 12 month period of the study, mothers were asked to complete eight surveys (the baseline survey at birth; then subsequent surveys at 4, 10, 16, 26, 32, 40 and 52 weeks) to determine changes to feeding methods, as well as factors that influenced their feeding decisions, including access to websites specifically designed to support breastfeeding. The data from the first five contact points has been reported here specific to exclusive breastfeeding outcomes.

Breastfeeding terms and definitions used were consistent with those used by the World Health Organization, and defined exclusive breastfeeding as infants who received only breast milk with the exception of drops or syrups consisting of vitamins, mineral supplements or medications.(23) Infants who received breast milk with or without other food or liquids including formula were used to calculate "any breastfeeding". ENREF_28

Data Analysis

Data were entered and analysed using the IBM SPSS Statistics for Windows (SPSS) Version 21.(24) Descriptive summary statistics were created to describe the sample and univariate logistic regression analysis using the chi-square test was conducted to determine significant associations between explanatory variables. Multivariate analysis was then conducted using Cox's proportional hazards model, controlling for known and potential confounders identified in both the literature and univariate analyses (see Table 1). Survival analysis using the Kaplan Meier technique was used to determine breastfeeding duration. All tests were two sided and a *p* value of less than 0.05 was considered statistically significant.

Ethics

Ethics approval for this study was granted by the Curtin University Human Research Ethics Committee (SPH-0005-2008); the WA Country Health Service Ethics Committee (2009:25); and the St John of God Healthcare Ethics Committee (392).

Results

Most mothers (85.0%) were Australian-born, and 93.0% were partnered (married or de facto) (see Table 1). More than half of the participants (56.7%) had an annual family income of $72,800 or more, and 59.9% had private health insurance. Around one third of women (31.2%) were not in the paid workforce in the six months prior to the study and 28.8% were on paid parental leave.

Table 1: Selected demographics of Rural Infant Feeding Study participants

Characteristic	n	%
Maternal age (years)		
<25	57	13.3
25-29	138	32.3
29-34	143	33.5
35+	89	20.8
Marital status		
Single	23	5.4
Married / de facto	397	93.0
Missing	7	1.6
Maternal education		
Did not complete high school	57	13.4
Completed high school /trade	198	46.4
Bachelor degree or higher	162	37.9
Missing	10	2.3
Mother's country of birth		
Australia / New Zealand	363	85.0
UK/Ireland	26	6.1
Other	31	7.3
Missing	7	1.6
Annual household income (AUD)		
<$72,800	167	39.1
≥$72,800	242	56.7
Missing	18	4.2
Mothers occupation		
Managerial / professional	167	39.1
Technical / trades	31	7.3

Clerical / admin	167	39.1
Labourer	19	4.4
Unemployed	30	7.0
Missing	13	3.0
Remoteness Classification (ARIA)[5]		
HA (Highly Accessible)	19	4.4
A (Accessible)	259	60.7
MA (Moderately Accessible)	95	22.2
R (Remote)	31	7.3
VR (Very Remote)	20	4.7
Missing	3	0.7
Parity		
Primiparous	178	41.7
Multiparous	246	57.6
Missing	3	0.7
Maternal pre-pregnancy Body Mass Index (BMI) (kg/m^2)		
<19.99	40	9.4
20.00-24.99	192	45.0
25.00-29.99	109	25.5
≥30.00	64	15.0
Missing	22	5.2
Infants birth weight (g)		
<2500	7	1.6
2500-3999	353	82.7
≥4000	64	15.0
Missing	3	0.7
Method of Delivery		
Vaginal	244	57.1
Assisted (forceps/suction)	60	14.1
Caesarean	121	28.3
Missing	2	0.5

[1] Australian Institute of Health and Welfare. *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare; 2004.

Variables entered into mulitvariate models included: maternal age, mother perception of father's feeding preference, infant's gender, parity, infant's birth weight (<2500g), whether infant was admitted to SCN, whether mother received conflicting advice in hospital , attended antenatal classes, mothers level of education, demand feeding in hospital, fathers occupation, early breast contact, rooming in in hospital, delivery method, grandmothers feeding preference, grandmother's breastfeeding history, when feeding method was decided, mothers employment in the previous 6 months, marital status, time to regional centre, mother's IIAFAS score, age of infant when pacifier introduced, mother's smoking during pregnancy, planned pregnancy, household income, breastfeeding problems experienced by week 4, age of infant when mother returned to work, maternal pre-pregnancy obesity.

Almost all mothers (97.7%) in this cohort initiated breastfeeding, with 82.7% exclusively breastfeeding at discharge from hospital. Approximately one third (35.6%) of infants were still exclusively breastfed at four months, although 75.8% were still receiving some breastmilk. At six months, only 5.7% of infants were still exclusively breastfed. There was no significant association between geographical location and breastfeeding duration at any intensity.

Antenatal

A total of 81.2% of women attended antenatal classes either for this or a previous pregnancy. Of these women, almost all (90.7%) indicated that information about feeding their baby was presented during the sessions. Women who had attended antenatal classes for either this or a previous pregnancy were 60% less likely (aHR 0.61, 95% CI 0.41-0.91) to have ceased exclusively breastfeeding at six months and 40% less likely (aHR 0.40, 95% CI 0.23-0.70) to have ceased any breastfeeding at six months. The median duration of exclusive breastfeeding for women who had attended antenatal classes was 12 weeks (95% CI 9.1 – 14.9), compared to four weeks for those who had not attended classes (95% CI 2.7 – 5.3, χ^2=11.375, df=1, p=0.001). There were no significant associations between breastfeeding duration and receiving antenatal infant feeding information in the form of pamphlets, DVDs or individual consultations.

Birth to Six Months

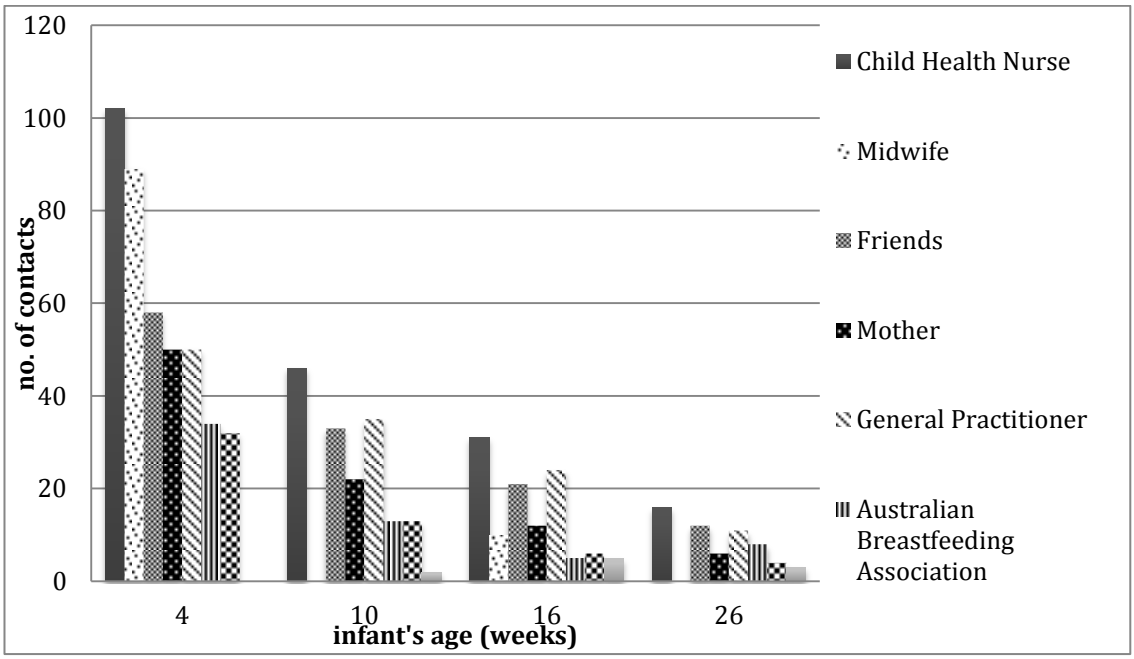
Most women (81.5%) had received at least one source of infant feeding information while in hospital, although 18.6% did not receive any information. There were no significant associations between receiving postnatal infant feeding information in any format and duration of breastfeeding.

Prior to discharge from hospital, women were asked to indicate their personal sources of postnatal support and encouragement for breastfeeding. The most common sources of support were the baby's father (84.5%), maternal grandmother

(68.1%) and friends (61.6%). As a further indicator of breastfeeding support within their close social circle, women were asked how their friends were feeding their babies. There was a significant positive association at the univariate level only between any breastfeeding to six months and having friends who breastfed at any intensity (χ^2=7.716, df=1, *p*=0.005). There was no significant independent relationship between friends feeding method and exclusive breastfeeding to six months.

At four weeks, a third of women (33.7%) had experienced at least one breastfeeding problem since discharge from hospital. Whilst breastfeeding problems were commonly reported, no significant association was found with breastfeeding duration to six months. Just over one in ten women (10.2%) indicated that they had experienced one or more problems with breastfeeding at 16 and at 26 weeks.

Figure 1: Sources of Breastfeeding Support – birth to six months



In the first month following discharge from hospital, the most common source of advice and support for breastfeeding problems was the Child Health Nurse (CHN), followed by the hospital midwife and the mother's friends. The CHN remained a frequently contacted source of advice and support in the first six months, however

other sources were also cited, including General Practitioners (GPs), friends and the woman's mother. Despite being commonly contacted, breastfeeding support from either a CHN or GP in the first six months was not significantly associated with exclusive breastfeeding duration.

The influence of friends as breastfeeding supports produced mixed results. Where women indicated that their friends were breastfeeding, advice from friends was significantly positively associated with exclusive breastfeeding at 4 weeks (χ^2=5.231, df=1, *p*=0.022), and 16 weeks (χ^2=5.080, df=1, *p*=0.024). Overall however, women who sought breastfeeding advice from their friends in the first month were significantly more likely to have ceased exclusive breastfeeding by six months (aHR 1.61, 95% CI 1.09-2.37). The association was not significant for support provided past this time.

Discussion

The finding that group antenatal education significantly influences breastfeeding behaviour in rural Western Australia reflects the evidence from the Australian and international literature.(11, 25-29) Antenatal classes provide opportunities to create support networks for new parents and build the social norms around breastfeeding; an important function for regional women who may be socially isolated. Novel and innovative support strategies to connect isolated women, such as online antenatal education or virtual consultations with health professionals, may be effective in improving breastfeeding outcomes for this group. (30)

Health professionals such as Child Health Nurses (CHNs) and General Practitioners (GPs) appear to be important sources of breastfeeding support for rural women, however there was no significant independent association with breastfeeding duration. As breastfeeding support is a complex and multifaceted intervention (16), further research is required to identify the effective elements of breastfeeding support provided by rural health professionals. Given the enhanced role for both CHNs and GPs in antenatal and postnatal care in rural areas, increasing

breastfeeding knowledge and skills should form a core part of ongoing professional development.

In addition to professional sources of support and advice, rural women also seek breastfeeding support from their family and friends. Positive attitudes towards breastfeeding are highly influential on breastfeeding outcomes in rural settings.(31) As with antenatal education groups, early parenting groups may provide opportunities for new parents to share experiences and gain support for issues including breastfeeding. While this setting can positively influence breastfeeding outcomes, if the existing social norm within the group does not support breastfeeding, mothers may be at greater risk of cessation.(32) Strategies to build social networks that promote breastfeeding as the normal and desirable way to feed infants may contribute to improved breastfeeding duration amongst rural women.

Again, while it was beyond the scope of this study to determine if the advice and support offered by family members was consistent with the WHO recommendations, any strategy to improve community-wide knowledge and support for breastfeeding needs to target this network.

This study provides contemporary longitudinal breastfeeding data for regional Western Australia and contributes to the body of evidence for factors influencing breastfeeding practices in these settings, however we acknowledge that there are limitations to the application of these findings to other populations. Regional areas of Australia are diverse in demography; therefore, caution should be used before extrapolating these findings to all women in regional Australia. Additionally, as the study relied on self-reported behaviours, there is the possibility that a preference to report more desirable behaviours (such as continuation of exclusive breastfeeding) may have contributed to an over-estimation of breastfeeding duration.

Conclusion

Women in rural areas seek and receive support for breastfeeding from a variety of sources, both professional and personal. This study suggests that antenatal group education, as distinct from the provision of breastfeeding information alone, is effective in increasing the duration of exclusive breastfeeding. Developing innovative ways to connect rural women to provide high quality antenatal breastfeeding information is a critical role for rural health service providers in improving breastfeeding outcomes. GPs and CHNs should continue to provide support for breastfeeding mothers using a variety of strategies and interventions that move beyond the early postnatal period may result in more rural women continuing to breastfeed exclusively for the first six months.

Finally, whilst professional breastfeeding support is commonly sought by rural women, social networks are also influential. The creation of informed communities in which a woman's friends, family and other social networks encourage and support breastfeeding will contribute to increasing the proportion of infants who meet the WHO guidelines for exclusive breastfeeding.

References

1. Horta B, Victora C. Long-term effects of breastfeeding: a systematic review. Geneva, Switzerland: World Health Organization; 2013.
2. Ajetunmobi OM, Whyte B, Chalmers J, Tappin DM, Wolfson L, Fleming M, et al. Breastfeeding is associated with reduced childhood hospitalization: evidence from a Scottish Birth Cohort (1997-2009). J Pediatr. 2015;166(3):620-5 e4.
3. Patel R, Oken E, Bogdanovich N, Matush L, Sevkovskaya Z, Chalmers B, et al. Cohort profile: The promotion of breastfeeding intervention trial (PROBIT). Int J Epidemiol. 2014;43(3):679-90.
4. Monasta L, Batty GD, Cattaneo A, Lutje V, Ronfani L, Van Lenthe FJ, et al. Early-life determinants of overweight and obesity: a review of systematic reviews. Obes Rev. 2010;11(10):695-708.
5. Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. Cochrane Database Syst Rev. 2012;8(8):CD003517.
6. World Health Organization. World Health Statistics 2013. Geneva: World Health Organization; 2013. Report No.: 9789240690806 9240690808.
7. Australian Institute of Health and Welfare. Australian National Infant Feeding Survey: indicator results. Canberra: AIHW; 2011.
8. Dennis CL. Breastfeeding initiation and duration: a 1990-2000 literature review. J Obstet Gynecol Neonatal Nurs. 2002;31(1):12-32.
9. Meedya S, Fahy K, Kable A. Factors that positively influence breastfeeding duration to 6 months: a literature review. Women Birth. 2010;23(4):135-45.
10. Liu P, Qiao L, Xu F, Zhang M, Wang Y, Binns CW. Factors associated with breastfeeding duration: a 30-month cohort study in northwest China. J Hum Lact. 2013;29(2):253-9.
11. Leahy-Warren P, Mulcahy H, Phelan A, Corcoran P. Factors influencing initiation and duration of breast feeding in Ireland. Midwifery. 2014;30(3):345-52.
12. Sparks PJ. Rural-urban differences in breastfeeding initiation in the United States. J Hum Lact. 2010;26(2):118-29.
13. Li R, Ogden C, Ballew C, Gillespie C, Grummer-Strawn L. Prevalence of exclusive breastfeeding among US infants: The Third National Health and Nutrition Examination Survey (Phase II, 1991-1994). Am J Public Health. 2002;92(7):1107-10.
14. Flower KB, Willoughby M, Cadigan RJ, Perrin EM, Randolph G, Family Life Project Investigative T. Understanding breastfeeding initiation and continuation in rural communities: a combined qualitative/quantitative approach. Maternal and child health journal. 2008;12(3):402-14.
15. Kent G. WIC's promotion of infant formula in the United States. International breastfeeding journal. 2006;1(1):8.
16. Renfrew MJ, McCormick FM, Wade A, Quinn B, Dowswell T. Support for healthy breastfeeding mothers with healthy term babies. Cochrane Database Syst Rev. 2012;5:CD001141.
17. Li Z, Zeki R, Hilder L, Sullivan EA. Australia's mothers and babies 2011. Canberra: National Perinatal Statistics Unit, Australian Institute of Health and Welfare; 2013.
18. House of Representatives Standing Committee on Health and Ageing PotCoA. The best start: Report on the inquiry into the health benefits of breastfeeding. Canberra: Commonwealth of Australia; 2007.
19. Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. Acta Paediatr. 2005;94(3):352-6.

20. Xu F, Binns C, Lee A, Wang Y, Xu B. Introduction of complementary foods to infants within the first six months postpartum in Xinjiang, PR China. Asia Pac J Clin Nutr. 2007;16 Suppl 1:462-6.
21. Lakati A, Binns C, Stevenson M. Breast-feeding and the working mother in Nairobi. Public Health Nutr. 2002;5(6):715-8.
22. Duong DV, Lee AH, Binns CW. Determinants of breast-feeding within the first 6 months post-partum in rural Vietnam. J Paediatr Child Health. 2005;41(7):338-43.
23. WHO U, USAID, AED, UCDAVIS, IFPRI. Indicators for assessing infant and young child feeding practices. Part 1: definitions.; 2008.
24. IBM. IBM SPSS Statistics. 21 ed2011.
25. Pannu PK, Giglia RC, Binns CW, Scott JA, Oddy WH. The effectiveness of health promotion materials and activities on breastfeeding outcomes. Acta Paediatr. 2011;100(4):534-7.
26. Oakley LL, Henderson J, Redshaw M, Quigley MA. The role of support and other factors in early breastfeeding cessation: an analysis of data from a maternity survey in England. BMC Pregnancy Childbirth. 2014;14:88.
27. Hauck YL, Fenwick J, Dhaliwal SS, Butt J, Schmied V. The association between women's perceptions of professional support and problems experienced on breastfeeding cessation: a Western Australian study. J Hum Lact. 2011;27(1):49-57.
28. Blyth RJ, Creedy DK, Dennis C-L, Moyle W, Pratt J, De Vries SM, et al. Breastfeeding Duration in an Australian Population: The Influence of Modifiable Antenatal Factors. J Hum Lact. 2004;20(1):30-8.
29. Lumbiganon P, Martis R, Laopaiboon M, Festin MR, Ho JJ, Hakimi M. Antenatal breastfeeding education for increasing breastfeeding duration. Cochrane Database Syst Rev. 2012;9:CD006425.
30. Giglia R, Cox K, Zhao Y, Binns CW. Exclusive breastfeeding increased by an internet intervention. Breastfeed Med. 2015;10:20-5.
31. Cox K, Giglia R, Zhao Y, Binns CW. Factors associated with exclusive breastfeeding at hospital discharge in rural Western australia. J Hum Lact. 2014;30(4):488-97.
32. Cameron AJ, Hesketh K, Ball K, Crawford D, Campbell KJ. Influence of Peers on Breastfeeding Discontinuation Among New Parents: The Melbourne InFANT Program. Pediatrics. 2010;126(3):e601-7.

Chapter 9 - Online Sources of Breastfeeding Information

This chapter is a published peer-reviewed journal article, reprinted as it appears in publication.

Giglia, R., Cox, K., Zhao, Y., & Binns, C. W. (2014). Exclusive Breastfeeding Increased by an Internet Intervention. Breastfeeding Medicine. doi: 10.1089/bfm.2014.0093

Author contributions:

Dr Roslyn Giglia provided advice and guidance on study administration, conducted the data analysis and interpretation and critical review of the manuscript.

Signature:_____ _____

Kylee Cox was responsible for administration of the study, collection of data, contributed to data analysis and interpretation, and review of the manuscript.

Signature:_____ _____

Dr Yun Zhao provided advice and guidance on statistical analysis and interpretation of results.

Signature:_____ _____

Professor Colin Binns provided oversight of the study design and administration, advice on statistical analysis and critical review of the manuscript.

Signature:_____ _____

Abstract

Background: Exclusive breastfeeding for six months is acknowledged universally as the optimum feeding method for infants in order to provide the greatest health and well-being gains for the infant and mother. Despite this many women stop short of attaining this desired outcome for their infant. With the permeation of the internet into most of society the aim of this study was to evaluate the effect of a breastfeeding support internet intervention on breastfeeding outcomes on women living in regional Western Australia (WA).

Materials and Methods: A nested intervention design within a longitudinal cohort titled the 'Regional Infant Feeding Study' (RIFS) examined the effect of an internet support website on the infant feeding practices of women living in regional Western Australia (WA).

Results: A total of 414 women participated in the internet study and were randomly assigned to the control group (207) and intervention group (207). Women enrolled in the intervention were significantly more likely to be exclusively breastfeeding at six months postpartum compared to control group participants. Those women experiencing breastfeeding problems were more likely to access the internet.

Conclusions: This breastfeeding support intervention study demonstrated a positive effect on longer term exclusive breastfeeding enrolled in the intervention group. Together with more traditional methods of support the internet provides another possible method for promoting positive long term breastfeeding outcomes.

Introduction

Supporting and providing breastfeeding education in the early postpartum days to help extend breastfeeding duration is paramount. Difficulty with breastfeeding in the early postpartum period is a significant risk factor for the early cessation of breastfeeding, particularly in the first four weeks.[1] The best and most effective way of supporting new mothers to achieve long term exclusive breastfeeding and minimise cessation is often debated. Outcomes of a 2012 Cochrane review examining the provision of extra support for breastfeeding mothers (when compared with providing standard maternity care breastfeeding support) found that all forms of extra support analysed together showed an increase in the length of time women continued to breastfeed and the length of time women breastfed without introducing any other types of liquids or foods. Both professional and lay support had a positive effect on breastfeeding outcomes and face-to-face support was associated with a larger treatment effect than telephone support.[2] This is not dissimilar to findings of previous research conducted by our team which also found that receiving individualised breastfeeding support positively impacted on breastfeeding outcomes.[3] More recently a systematic review has shown that an extended period of postnatal contact with support persons (e.g. lactation consultant) were the most successful interventions for promoting exclusive duration of breastfeeding.[4]

The internet has the possibility of providing personalised support to breastfeeding mothers in the early postnatal period, particularly given that one-to-one breastfeeding support is time consuming, costly and unavailable, particularly in rural and remote areas. The advent of the internet in the early 1990s has provided this additional domain for the delivery of health professional services which has been able to overcome the barriers of cost and isolation.[5] The internet provides support and education through “information provision”, “peer support”, “expert advice” and “activities to help the participants make decisions and plan behaviour”[6](p714) and an internet intervention is often a mixture of these facets.

The objective of this research was to evaluate the effect of a breastfeeding support internet intervention on breastfeeding outcomes on women living in regional Western Australia (WA).

Subjects and Methods

Design

A nested intervention design within a longitudinal cohort titled the 'Regional Infant Feeding Study' (RIFS) examined the effect of an internet support website on infant feeding practices of women living in regional Western Australia (WA).[7]

Sample Selection

A sample of 489 mothers and their infants were recruited from hospitals with maternity service capacity from four regional areas of WA and followed for 12 months from birth. Women were recruited face-to-face at the maternity ward level by midwives and/or research staff, or through regional Child Health Nurses during a universal home visit to new mothers within the first week post discharge from the hospital. Further details are reported elsewhere.[7]

Intervention

Participants in the study were randomly assigned to the intervention or control group. The intervention was designed to provide best practice infant feeding information and the content of the website was developed using formative research with the target group,[8] and the current evidence based infant feeding recommendations at the time [9,10] The intervention group were able to 'post' on the discussion forums, initiate email conversations with other group members, and contact a certified lactation consultant or the chief investigator online (and using webcam) with any questions.

The intervention group had access to the study website and control mothers accessed a website which redirected them to helpful parenting and infant feeding websites which had been assessed for accuracy of information. The allocation to

control or intervention group was “without prejudice” and all mothers received normal postpartum maternity services available in the community.

Data Collection

Once consent to participate was received, mothers were asked to complete a baseline questionnaire to determine demographics and feeding practices whilst in hospital. For those mothers with internet access (87%), the provided login and password enabled them to complete the follow-up questionnaires online.

Mothers were recruited for a period of 21 months from March 2010 to December 2011 in an effort to obtain the required sample size. The data collection tool was based on that used in the Perth Infant Feeding Study Mark II[11] with additional questions included to ascertain geographical location, child health resources available in the regional area, and access to sources of information about infant feeding. The primary outcome measure was breastfeeding initiation and duration. Breastfeeding terms and definitions used were consistent with those used by the World Health Organization.[12] The modified tool was converted to an online survey and pilot tested with a group of rural mothers prior to it going live. Mothers were asked to complete an online survey at eight time points (at birth [baseline], then at 4, 10, 16, 26, 32, 40 and 52 weeks). Questions relating to accessing websites and the intervention website were introduced at the week 10 survey.

Data Analysis

Univariate summary statistics were produced to describe the characteristics of the study sample. Chi-square test ($\chi 2$) (Fisher’s exact test if applicable) were used to investigate the association between two categorical variables of interest; with emphasis on exploring the significant effect of intervention (access to study website) on exclusive breastfeeding outcomes. The proportion of women from the control and intervention groups exclusively breastfeeding at specified time points were identified and *P* values are presented.

Presented *P* values are two-sided, and a 10% significance level was used.

Ethics

Ethics approval for this study was granted by the Curtin University Human Research Ethics Committee, the WA Country Health Service Ethics Committee and the St John of God Healthcare Ethics Committee. This study is registered with Australian New Zealand Clinical Trials Registry (ANZCTR); Trial Id: ACTRN12610000062022.

Results

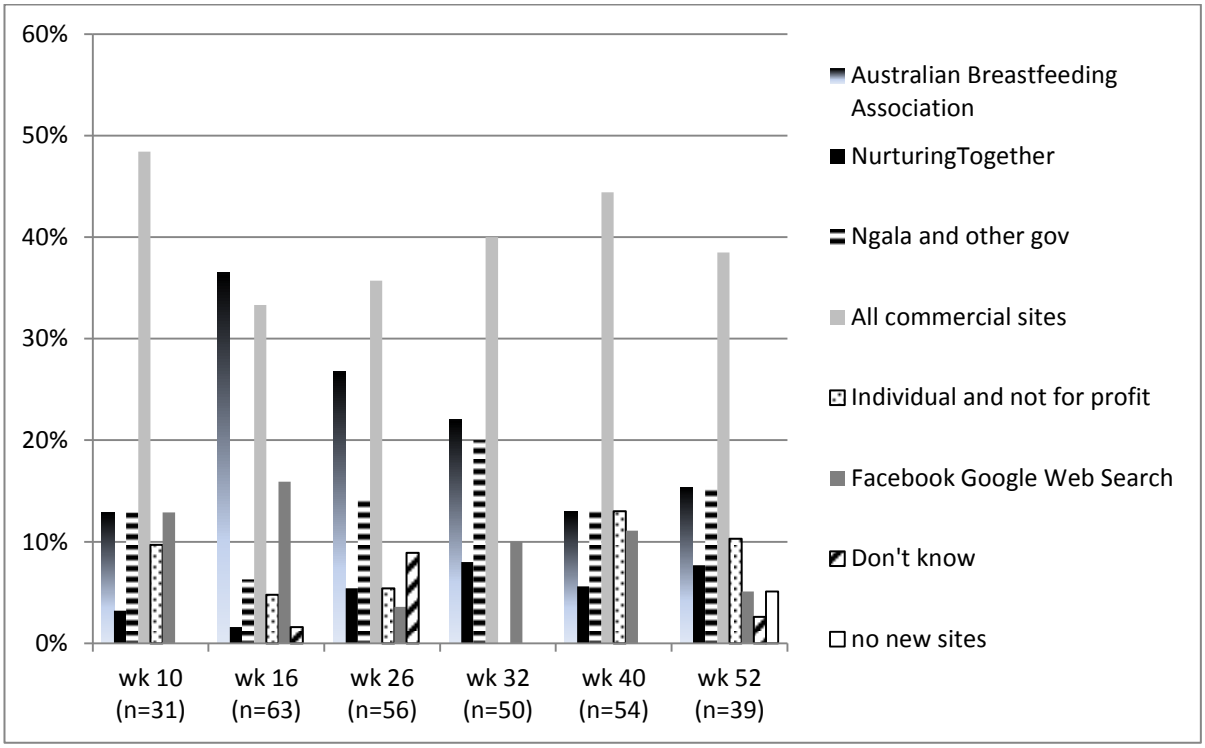
Of the 489 women who gave consent to participate in the study, 427 (88%) completed the baseline survey. A total of 414 (85%) women were enrolled in the internet study; 207 in the control group and 207 in the intervention group.

Participant demographic characteristics for each group did not differ significantly from each other. The majority of mothers were from the Midwest region (67%), were over thirty years of age (54.8%) and 61.1% were considered to be living in an 'accessible' area, as deemed using the Accessibility/Remoteness Index of Australia (ARIA) classification. The ARIA methodology produces index values**,** between 0 and 12, with index values of 0 having the highest levels of access to goods and services, and areas with an ARIA index value of 12 having the highest level of remoteness. The score is based on road distance to regional service centres, using service centre population size as a proxy for availability of services (i.e. retail, health and education).[13]

Figures 1 outline the website utilisation of the intervention group throughout the 12 months of the study. From week 10 onwards mothers were asked to list the top five websites they had mostly accessed since completing the last survey. The first listed websites were grouped into seven categories; (i) Australian Breastfeeding Association (ABA). Not for profit organisation supporting breastfeeding women; (ii) NurturingTogether. The intervention website; (iii) Ngala and other government sites. Not for profit, providing a range of parenting and infant feeding information; (iv) Commercial websites. Hosted by an organisation and/or containing commercial advertisements e.g. Huggies; (v) Individual and not for profit websites. Sites

primarily developed by an individual and or small organisation e.g. Pinky McKay; (vi) Google web search; and (vii) Don't know. Where mothers could not remember the name of the website(s) visited.

Figure 1. Websites accessed by the intervention group during the study



The majority of women from both groups visited the commercial websites most often and consistently throughout the duration of the study. The ABA website was the second most visited website, however this was more popular in the early postpartum stage whereas the commercial sites maintained their popularity with all the participants. There was no significant differences between the websites visited by the intervention group or the control group with the exception of week 32 when the intervention group reported visiting the ABA website more often than the control group; and the control group visited commercial sites more often than the intervention group (*Fisher's exact test*, p=0.090).

Table 1 indicates the proportion of women from each group exclusively breastfeeding at each time point and includes a sub-analysis of women only living in an area classified as moderately remote, remote and very remote. There was a significant difference between the number of women in the intervention group who

were continuing to exclusively breastfeed at week 26 (p=0.01) compared to the control group. For week 16, the difference in the exclusively breastfeeding rate between the intervention and control groups is 10% with a *p*-value of 0.054, which falls slightly short of the conventional statistical significance level of 5%. Of all the women living in a remote area a higher proportion of those in the intervention group were exclusively breastfeeding at week 4, 10, 16 and 26 compared to the control group. The difference was statistically significant only for week 26 (*p*=0.030).

Table 1. Percentage of women exclusive breastfeeding in the intervention and control groups at discharge, 4, 10, 16 and 26 weeks

Participant group					Remote participants[a]			
Time point	n	Intervention	Control	*p* value[b]	n	Intervention	Control	*p* value[b]
Discharge	345	82.1	84.5	0.510	116	79.4	84.9	0.317
4 weeks	233	66.9	61.5	0.291	76	61.9	56.4	0.771
10 weeks	187	57.8	50	0.145	58	49.2	44.4	0.866
16 weeks	142	48.5	38	0.054	42	37.5	34.4	0.865
26 weeks	10	5.9	0.6	0.010	6	10.9	0	0.030

[a]In ARIA classification of moderately remote, remote and very remote mothers only
[b]χ^2 test

Mothers were asked at each survey time point commencing at week 10 if in the previous weeks they had 'accessed any online websites about infant feeding or parenting in an effort to find information to help support them in their new role as a parent'. There was a significant difference in the number of women accessing websites who had experienced breastfeeding problems at each time point with the exception of week 52, compared to women who had not experienced any problems with breastfeeding (see Table 2).

Table 2. Mothers who had experienced breastfeeding problems and accessed a parenting website in this time (%)

Period during which mother accessed a parenting website	Period during which mother experienced breastfeeding problems (n=total no of women experiencing breastfeeding problems)	Accessed website		
		Yes	No	*p* value[a]
Previous 10 weeks	Week 4 – 10 (n=83)	52 (62.7)	31 (37.3)	<0.001
Previous 16 weeks	Week 11 – 16 (n=61)	38 (62.3)	23 (37.7)	<0.001
Previous 26 weeks	Week 17 – 26 (n=39)	27 (69.2)	12 (30.8)	0.001
Previous 32 weeks	Week 27 – 32 (n=28)	17 (60.7)	11 (39.3)	0.068
Previous 40 weeks	Week 33 – 40 (n=25)	17 (68)	8 (32)	0.003
Previous 52 weeks	Week 32 – 40 (n=13)	5 (38.5)	8 (61.5)	0.361

[a]χ^2 test

Discussion

This study is the first to provide information about the effectiveness of an internet intervention intended solely for the support of breastfeeding mothers living in regional WA. In rural areas of WA health services are often less than those provided to metropolitan areas[14] and it was proposed that the internet intervention may bridge the gap in maternal health services supporting breastfeeding outcomes.

This study positively demonstrated that an internet intervention specific to breastfeeding has the capacity to support regional women in their breastfeeding practice. Mothers enrolled in the internet intervention, and particularly those mothers living in a remote regional area were more likely to exclusively breastfeed than mothers in the control group. Maintaining exclusive breastfeeding to the recommended six months postpartum has been difficult to achieve in many populations[15,16] however this intervention demonstrated the potential of the internet to provide support for the desired period of breastfeeding in a rural population. The internet in general was potentially able to provide support to

those women experiencing breastfeeding problems as they were more likely to access the internet. Furthermore it appears that support is warranted throughout the entire period of lactation and up to the first year of life as women reported experiencing breastfeeding problems throughout this continuum. The univariate analysis conducted in this study gives rise to results supported by other research investigations[17] and the strength of potential confounders is considered for future research.

In a systematic review of breastfeeding intervention delivery methods, Pate investigated the impact of *e*-based interventions compared to provider-based interventions[18]. A lack of face-to-face interaction and access to suitable technology to be enrolled in the intervention were some of the associated disadvantages reported by participants in the intervention studies. The providers of the internet based interventions reported the regular professional maintenance and monitoring of the intervention to ensure the appropriateness of the content as disadvantages to delivering education and support through this medium.

It is evidenced from this intervention study that the commercial websites which contained breastfeeding information (amongst other topics) were the more popular sites and were accessed on a regular basis throughout the 12 month postpartum period. Commercial sites have the advantage of being corporately funded which enables the website to be dynamic and inviting with regular updates, competitions and giveaways. It is possible that an even greater effect from the intervention site could have been demonstrated if it had not been in competition with the abundance of commercial websites with all their 'bells and whistles'. Concurrently at the time of recruitment to this study in March 2010, Facebook was taking to the world internet stage, and in the week ending March 13, 2010 more people visited Facebook than Google.[19] Competition with Facebook and commercial websites, and being busy with a new baby and with the household (frequency analysis not reported) may all be factors limiting access to the intervention website and therefore reducing the effectiveness of the intervention. It is possible that breastfeeding education, support and advocacy through social

media where information is 'pushed' out to users is more appealing to the younger generation of mothers than 'pulling' the information you require. Having breastfeeding information arrive in a social media 'push' maybe the way of the future.[20]

In addition to these competing elements, is the effect of the many other factors that affect breastfeeding duration. Including but not limited to are fathers feeding preference[21] and mothers attitude towards breastfeeding.[22] There were opportunities for women in this study to utilise webcam technology to discuss or demonstrate their breastfeeding problems being experienced. However despite the reporting of problems at each time point no women chose to take up this more personal option of interaction. This reluctance to use video technology has been reported by other researchers in a rural setting in Scotland who found that women were more likely to prefer face-to-face, telephone, email and text messaging support.[23]

Limitations

In the small number of studies previously conducted in this area, the lack of scientific rigour in study designs, the lack of homogeneous interventions and outcomes; specifically the lack in defining breastfeeding outcomes, have been limitations which make it difficult to recommend internet interventions as the sole source of breastfeeding support.[24] This intervention study is the first to rigorously examine the role of a breastfeeding specific internet intervention on breastfeeding outcomes using clearly defined breastfeeding indicators.[25] Despite this rigor there were limitations to this research. First the long data collection period of 21 months as a result of a lower birth rate in regional areas contributed to the static nature of the website to ensure that all mothers were exposed to the same content at some time during their enrolment period. Utilisation of the intervention website by participants was not assessed and therefore the intensity of the effect of the intervention, that is true intervention fidelity could not be ascertained. Given the competing demands of Facebook and new baby it is likely that utilisation of the website was limited. A low response to questions relating to website access was

problematic and coupled with breastfeeding cessation limited the data analysis. Future studies should consider making all questions relating to the intervention mandatory for all participants.

Conclusion

This intervention study is the first to methodically evaluate the effect of a breastfeeding internet intervention using clearly defined breastfeeding outcomes. This breastfeeding support internet intervention demonstrated a positive effect on longer term exclusive breastfeeding (5.9% versus 0.6%, p=0.010) of women enrolled in the intervention group. In combination with more traditional methods of breastfeeding education and support, the internet can play a role in supporting positive breastfeeding outcomes, particularly in regional areas. It is possible that the internet can favourably support the recommendation for exclusive breastfeeding for six months. Further research into other areas of online support is warranted to assess the effectiveness of online media in promoting positive breastfeeding outcomes and to achieve this important outcome.

References

1. Gerd A-T, Bergman S, Dahlgren J, Roswall J, Alm B. Factors associated with discontinuation of breastfeeding before 1 month of age. *Acta Paediatr* 2012;101:55-60.

2. Renfrew MJ, McCormick FM, Wade A, Quinn B, Dowswell T. Support for healthy breastfeeding mothers with healthy term babies. *Cochrane Database of Systematic Reviews* 2012; Art. No: CD001141.(Issue 5). http://onlinelibrary.wiley.com.dbgw.lis.curtin.edu.au/doi/10.1002/14651858.CD001141.pub4/abstract (accessed 11 July 2013).

3. Pannu P, Giglia R, Binns C, Scott J, Oddy W. The effectiveness of health promotion materials and activities on breastfeeding outcomes *Acta Paediatr* 2011;100:534-537.

4. Skouteris H, Nagle C, Fowler M, Kent B, Sahota P, Morris H. Interventions designed to promote exclusive breastfeeding in high-income countries: a systematic review. *Breastfeed Med* 2014;9:113-127.

5. Daneback K, Plantin L. Research on parenthood and the internet: themes and trends. *Journal of Psychosocial Research on Cyberspace.* 2008;2:article 2. www.cyberpsychology.eu/view.php?cisloclanku=2008110701 (accessed 18 April 2012).

6. Herman J, Mock K, Blackwell D, Hulsey T. Use of a Pregnancy Support Web Site by Low-Income African American Women. *J Obst Gynecol Neonatal Nurs* 2005;34:713–720.

7. Cox K, Giglia R, Binns C, Ym Z. Exclusive Breastfeeding at Discharge from Hospital in Regional Western *J Hum Lact* 2014 *in press*.

8. Giglia RC, Binns CW. Adopting and adapting an Internet intervention to support breastfeeding duration and breastfeeding research throughout regional Western Australia. 11th National Rural Health Conference; 13-16 March, 2011; Perth, Western Australia.

9. National Health and Medical Research Council. *Dietary Guidelines for Children and Adolescents in Australia.* Canberra, Commonwealth of Australia, 2003.

10. World Health Organization. *The optimal duration of exclusive breastfeeding. Report of an expert consultation.* World Health Organization, Geneva, 2001.

11. Graham KI, Scott JA, Binns CW, Oddy WH. National targets for breastfeeding at hospital discharge have been achieved in Perth. *Acta Paediatr* 2005;94:352-356.

12. World Health Organization. *Indicators for assessing infant and young child feeding practices. Part 1: definitions.* World Health Organization, Geneva, 2008.

13. Australian Institute of Health and Welfare. *Rural, regional and remote health: a guide to remoteness classifications.* Australian Institute of Health and Welfare, Canberra, 2004.

14. Australian Bureau of Statistics. Australian Social Trends, April 2013. *Catalgoue No. 4102.0* http://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/4102.0Main%20Features1April%202013?opendocument&tabname=Summary&prodno=4102.0&issue=April%202013&num=&view= (accessed 5 December, 2013).

15. Dennis C-L. Breastfeeding initiation and duration: A 1990-2000 literature review *J Obst Gynecol Neonatal Nurs* 2002;31:12-32.

16. Australian Institute of Health and Welfare. *2010 Australian National Infant Feeding Survey: indicator results.* Australian Institute of Health and Welfare, Canberra, 2011.

17. Huang M, Kuo S, Avery M, Chen W, Lin K, Gau M. Evaluating effects of a prenatal web-based breastfeeding education programme Taiwan *Journal of Clinical Nursing.* 2007;16:1571-1579.

18. Pate B. A Systematic Review of the Effectiveness of Breastfeeding Intervention Delivery Methods *J Obstet Gynecol Neonatal Nurs* 2009;38:642-653.

19. Dougherty H. Facebook reaches top ranking in US. 2010. www.experian.com/hitwise/ (accessed 5 December, 2013).

20. Thaker D, Monypenny R, Olver I, Sabesan S. Cost savings from a telemedicine model of care in northern Queensland, Australia *Med J Aust* 2013;199:414-417.

21. Tohotoa J, Maycock B, Hauck YL, Howat P, Burns S, Binns CW. Dads make a difference: an exploratory study of paternal support for breastfeeding in Perth, Western Australia *Int Breastfeed J.* 2009;4:15.

22. Inoue M, Binns C, Katsuki Y, Ouchi M. Japanese mothers' breastfeeding knowledge and attitudes assessed by the Iowa Infant Feeding Attitudes Scale. *Asia Pacific Journal of Clinical Nutrition.* 2013;22:261-265.

23. Roberts A, Hoddinott P, Heaney D, Bryers H. The use of video support for infant feeding after hospital discharge: a study in remote and rural Scotland. *Matern Child Nutr.* 2009;5:347-357.

24. Giglia R, Binns C. The effectiveness of the internet in improving breastfeeding outcomes; a systematic review. *J Hum Lact* 2014;30:156-160.

25. Binns CW, Fraser ML, Lee AH, Scott J. Defining exclusive breastfeeding in Australia. *J Paediatr Child Health* 2009;45:174-180.

Corresponding Author / contact for reprints:

Dr Roslyn Giglia

School of Public Health, Curtin University,

GPO Box U1987,

Perth Western Australia 6845

School of Public Health, Curtin University Kent Street, Bentley, Perth, Western Australia 6102

T +61 8 9266 9592

F +61 8 9266 2958

R.Giglia@exchange.curtin.edu.au

Chapter 10 - Conclusions and Recommendations

This study provides contemporary longitudinal rural breastfeeding data that complements previous breastfeeding studies conducted in non-rural areas of Australia. Breastfeeding in rural Western Australia appears to be influenced by many of the same factors identified in the literature for urban women in developed countries, although the implications of these findings for rural areas will need to be considered in the range of contexts that rural communities exist in. The following is a summary of the findings, conclusions and recommendations for practice.

Conclusions and Recommendations – Early Breastfeeding Practice

Almost all women in rural Western Australia initiate breastfeeding

Breastfeeding initiation was near-universal for mothers in this cohort, with more than four in five women exclusively breastfeeding at hospital discharge. There were no significant associations between breastfeeding initiation and any sociodemographic variables studied, a finding supported by the literature as a result of near-universal prevalence. The rates found in this study compare favourably with results from both the previous PIFS I and II studies and national data. Continued support for the promotion of breastfeeding as the normal and desirable infant feeding method should ensure that breastfeeding continues to be the first choice for mothers in rural areas.

Hospital practices are significant influences on breastfeeding practices in rural areas in the early post-partum period, prior to discharge

Health service policies and practices in rural areas can either support or hinder the establishment of breastfeeding, particularly exclusive breastfeeding, in the early post-partum period. This study found that receiving consistent infant feeding information, as well as encouraging mothers to feed on demand and room in with their infant were positive predictors of breastfeeding practice. Admission to a Special Care Nursery was a negative influence on breastfeeding practice, and was a

common independent factor influencing exclusive breastfeeding at discharge across the RIFS, PIFS I and II studies. Continued support for the uptake of the principles and practices of the Baby Friendly Health Initiative (BFHI) by rural health services will assist mothers to establish and maintain exclusive breastfeeding post hospital discharge. Ensuring that all staff who provide care to women of childbearing age (including GPs, Obstetricians, Midwives, and Child Health Nurses) have access to high quality and evidence-based breastfeeding information will also contribute to consistent advice and support in the establishment of breastfeeding.

The infant feeding attitudes of social supports, including partners and maternal grandmothers, are significant influences on the establishment of exclusive breastfeeding

Women who perceived their infant's father to be supportive of breastfeeding were more likely to be exclusively breastfeeding at discharge, consistent with the Australian and international evidence. Additionally, support for breastfeeding from the infant's maternal grandmother has been shown to positively influence breastfeeding practice, a finding supported by this study. Women whose own mother had breastfed an infant were more than four times as likely to be exclusively breastfeeding at discharge than those who had not.

In terms of investment of resources, rural health services should seek to actively engage rural women's social supports, such as partners and grandmothers, in antenatal education programs. Active inclusion of fathers and grandmothers in antenatal education as well as development of targeted interventions to promote the risks associated with formula feeding as well as the advantages of breastfeeding may be useful strategies to increase rural communities' support for breastfeeding.

Conclusions and Recommendations - Breastfeeding Duration

Women in regional Western Australia do not meet the WHO goal for exclusive breastfeeding to six months

At six months (26 weeks), only a small proportion of this rural cohort were still being exclusively breastfed, although around two thirds were still receiving some breast milk. At 12 months, only one third of infants were still receiving some breast milk. Whilst the cohort did not meet the WHO recommendation for exclusive breastfeeding to six months, the prevalence compares favourably with other Australian evidence, including the PIFS I and II studies and national data.

Health service factors, including antenatal education, continue to influence breastfeeding duration up to 12 months in rural Western Australia

Participation in antenatal education classes had a positive impact on breastfeeding practice, reducing the risk of early cessation of both exclusive breastfeeding and any breastfeeding before six months. Not only did baby-friendly practices such as rooming-in and encouragement of demand feeding positively influence exclusive breastfeeding at discharge, but these practices were also found to be independent predictors of both exclusive and overall breastfeeding duration.

Investment in high quality breastfeeding education for all rural health professionals will contribute to the consistent provision of evidence-based breastfeeding advice and support. Antenatal classes as a medium for providing information about breastfeeding have been shown to be effective in promoting greater breastfeeding duration. This strategy could be strengthened with the active and targeted inclusion of fathers and grandmothers, focusing on building positive attitudes and skills to support breastfeeding. Strategies that build self-efficacy have also shown promise and should be further investigated in this setting as a way to minimise the barriers of geographical isolation from services. Consistent advice and support at all stages of a woman's breastfeeding journey will also contribute to positive personal and community attitudes towards breastfeeding, further supporting breastfeeding practice.

The principles of the BFHI, specifically the elements that minimise the separation of mothers and their infants, support positive breastfeeding outcomes long after discharge from hospital and should continue to be a focus for rural health services and staff. Rooming-in, promotion of demand feeding and discouraging the use of pacifiers in hospital are practical and achievable strategies for all maternity facilities in rural areas of Australia and should be routinely supported and practiced.

Positive infant feeding attitudes increase the likelihood of breastfeeding to 12 months

In line with findings in other settings, rural women who are positive about breastfeeding and believe that it is a superior feeding method to formula feeding are more likely to be breastfeeding at all time points. Additionally, women who are supported in their views that breastfeeding is the better choice by partners and other significant social supports have better breastfeeding outcomes than those who do not receive this support. Positive maternal infant feeding attitudes, as well as support for breastfeeding from the infant's maternal grandmother, were common independent predictors of breastfeeding duration to 12 months between this study and earlier findings from the PIFS II, highlighting the importance of continued support for positive breastfeeding promotion.

Ongoing investment should be made in messages that support breastfeeding as the normal and preferable method of infant feeding to increase the likelihood of community support. Ensuring that rural women have support from their social networks including partners and grandmothers is required to improve the rate of exclusive breastfeeding in rural areas. Identification of women in rural areas who are geographically isolated from their own mothers may be a useful strategy for health professionals in order to identify and connect other supports for exclusive breastfeeding.

Lifestyle risk factors in pregnancy such as obesity and smoking are significant predictors of breastfeeding duration to both six and 12 months

Women who had a BMI of 30 or more were significantly more likely to have ceased exclusive breastfeeding before six months and any breastfeeding by 12 months Similarly, women who smoked during pregnancy were less likely to be breastfeeding at six or 12 months. Smoking during pregnancy was a common predictor of breastfeeding duration to 12 months between this study and the PIFS II.

Whilst no causation can be inferred from these results, all rural and regional health services can continue to make a significant contribution to the health status of women and support increased breastfeeding duration by strengthening their activity in strategies that address smoking cessation and achievement of healthy weight for women of childbearing age. Regardless of their capacity to support breastfeeding directly, addressing these lifestyle factors is within the capacity of all health professionals in rural areas. Strategies ranging from brief interventions for smoking cessation to targeted weight control programs for women identified as at-risk could be considered as cost-effective interventions for this target group.

Return to employment before six months is a risk factor for cessation of breastfeeding at any intensity up to 12 months of age

Mothers who returned to work in the first six months of their infants' lives were more likely to have ceased exclusive breastfeeding by six months and more likely to have ceased any breastfeeding by 12 months. This finding was supported by those of the PIFS II and was a common independent predictor of cessation of any breastfeeding by 12 months between the two studies. There were no significant differences between occupational classifications and duration of breastfeeding in this study, therefore further research is required to determine the elements of employer support that may be most supportive of continued breastfeeding for women in rural areas who return to work.

Support for rural women who return to work and wish to continue breastfeeding needs to be strengthened in order to realise improved breastfeeding outcomes. Further research into the nature of rural employment, structural and environmental supports and rural community attitudes to employment and breastfeeding is required to determine appropriate strategies in this setting.

Early use of pacifiers (before four weeks) increases the risk of breastfeeding cessation before 12 months

The finding that early pacifier use (prior to four weeks of age) negatively influences breastfeeding duration in this rural cohort is supported by the literature and reinforces the need for health services to support baby-friendly practices as recommended in the *10 Steps to Successful Breastfeeding*. Limiting the use of pacifiers before breastfeeding is well established should continue to be supported by rural health service providers, and consistent messages about the risk for breastfeeding cessation should be routinely communicated.

Online sources of support have the potential to support longer-term exclusive breastfeeding duration

Online breastfeeding support demonstrated a positive effect on exclusive breastfeeding to six months and in combination with more traditional methods of breastfeeding education and support, may play a role in achieving positive breastfeeding outcomes, particularly in rural areas. The use of online support for breastfeeding showed promise for supporting geographically isolated women and should be further investigated as a cost-effective strategy in this setting. Further research into other areas of online support is warranted to assess the effectiveness of online media in promoting positive breastfeeding outcomes and to achieve this important outcome.

Chapter 11 - References

Abrahams, S. W. (2012). Milk and social media: online communities and the International Code of Marketing of Breast-milk Substitutes. *Journal of Human Lactation, 28*(3), 400-406. doi: 10.1177/0890334412447080

Academy of Nutrition and Dietetics. (2012). *Evidence Analysis Manual: Steps in the Academy Evidence Analysis Process*. Chicago: Academy of Nutrition and Dietetics.

Ajetunmobi, O. M., Whyte, B., Chalmers, J., Tappin, D. M., Wolfson, L., Fleming, M. Glasgow Centre for Population Health Breastfeeding Project Steering Group. (2015). Breastfeeding is associated with reduced childhood hospitalization: evidence from a Scottish Birth Cohort (1997-2009). *Journal of Pediatrics, 166*(3), 620-625 e624. doi: 10.1016/j.jpeds.2014.11.013

Akter, S., & Rahman, M. M. (2010). The determinants of early cessation of breastfeeding in Bangladesh. *World Health Popul, 11*(4), 5-12.

Amir, L. H., & Donath, S. (2007). A systematic review of maternal obesity and breastfeeding intention, initiation and duration. *BMC Pregnancy and Childbirth, 7*, 9. doi: 1471-2393-7-9 [pii] 10.1186/1471-2393-7-9

Amir, L. H., & Donath, S. M. (2002). Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence. *Birth, 29*(2), 112-123.

Arora, S., McJunkin, C., Wehrer, J., & Kuhn, P. (2000). Major factors influencing breastfeeding rates: Mother's perception of father's attitude and milk supply. *Pediatrics, 106*(5), E67.

Atchan, M., Davis, D., & Foureur, M. (2013). The impact of the Baby Friendly Health Initiative in the Australian health care system: a critical narrative review of the evidence. *Breastfeeding Review, 21*(2), 15-22.

Australian Bureau of Statistics. (2003). Breastfeeding in Australia. Canberra, Australia: Australian Bureau of Statistics.

Australian Bureau of Statistics. (2011). 8146.0 Household Use of Information Technology, Australia, 2010-2011. Retrieved 16 December, 2013, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/D11394A54F8B9ED1CA25796600152C62?opendocument

Australian Bureau of Statistics. (2012). 3218.0 - Regional Population Growth, Australia, 2010-11. Retrieved 18/01/2015

Australian Bureau of Statistics. (2013a, 3 October 2013). 1220.0 - ANZSCO - Australian and New Zealand Standard Classification of Occupations, First Edition, Revision 1 from http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/E8A05691E35F4376CA257B9500138A52?opendocument

Australian Bureau of Statistics. (2013b). Australian Health Survey: Updated Results, 2011-2012. Canberra.

Australian Health Ministers' Conference. (2009). *Australian National Breastfeeding Strategy 2010-2015*. Canberra, Australia: Dept. of Health and Ageing.

Australian Institute of Health and Welfare. (2004). *Rural, regional and remote health : a guide to remoteness classifications*. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2011). Australian National Infant Feeding Survey: indicator results. Canberra: AIHW.

Avery, A. B., & Magnus, J. H. (2011). Expectant Fathers' and Mothers' Perceptions of Breastfeeding and Formula Feeding: A Focus Group Study in Three US Cities. *Journal of Human Lactation, 27*(2), 147-154. doi: 10.1177/0890334410395753

Baby Friendly Hospital Initiative Australia. (2011). Retrieved 01/11/2013, from http://www.babyfriendly.org.au/health-professionals/find-a-bfhi-hospital/#wa

Baghurst, P., Pincombe, J., Peat, B., Henderson, A., Reddin, E., & Antoniou, G. (2007). Breast feeding self-efficacy and other determinants of the duration of breast

feeding in a cohort of first-time mothers in Adelaide, Australia. *Midwifery, 23*(4), 382-391. doi: 10.1016/j.midw.2006.05.004

Bai, Y., Middlestadt, S. E., Peng, C.-Y. J., & Fly, A. D. (2010). Predictors of Continuation of Exclusive Breastfeeding for the First Six Months of Life. *Journal of Human Lactation, 26*(1), 26-34. doi: 10.1177/0890334409350168

Bailey, B. A., & Wright, H. N. (2011). Breastfeeding initiation in a rural sample: predictive factors and the role of smoking. *Journal of Human Lactation, 27*(1), 33-40. doi: 10.1177/0890334410386955

Bartick, M., & Reinhold, A. (2010). The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. *Pediatrics, 125*(5), e1048-1056.

Barton, S. J. (2001). Infant feeding practices of low-income rural mothers. *MCN: American Journal of Maternal Child Nursing, 26*(2), 93-97.

Beake, S., Pellowe, C., Dykes, F., Schmied, V., & Bick, D. (2012). A systematic review of structured compared with non-structured breastfeeding programmes to support the initiation and duration of exclusive and any breastfeeding in acute and primary health care settings. *Maternal & Child Nutrition, 8*(2), 141-161. doi: 10.1111/j.1740-8709.2011.00381.x

Benoit, B., & Semenic, S. (2014). Barriers and facilitators to implementing the Baby-Friendly hospital initiative in neonatal intensive care units. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 43*(5), 614-624. doi: 10.1111/1552-6909.12479

Berry, N. J., Jones, S., & Iverson, D. (2010). It's all formula to me: women's understandings of toddler milk ads. *Breastfeeding Review, 18*(1), 21-30.

Bertino, E., Varalda, A., Magnetti, F., Di Nicola, P., Cester, E., Occhi, L., . . . Prandi, G. (2012). Is breastfeeding duration influenced by maternal attitude and knowledge? A longitudinal study during the first year of life. *Journal of Maternal-Fetal & Neonatal Medicine, 25 Suppl 3*, 32-36. doi: 10.3109/14767058.2012.712341

Binns, C., Gilchrist, D., Gracey, M., Zhang, M., Scott, J., & Lee, A. (2004). Factors associated with the initiation of breast-feeding by Aboriginal mothers in Perth. *Public Health Nutrition, 7*(7), 857-861. doi: S1368980004001077 [pii]

Binns, C., & Lee, S. W. (2012). Commentary on: 'Pacifiers use in term infants and breastfeeding: caution with the Cochrane results'. *Evidence-Based Child Health: A Cochrane Review Journal, 7*(3), 1180-1181. doi: 10.1002/ebch.1854

Binns, C. W., Fraser, M. L., Lee, A. H., & Scott, J. (2009). Defining exclusive breastfeeding in Australia. *Journal of Paediatrics and Child Health, 45*(4), 174-180. doi: JPC1478 [pii] 10.1111/j.1440-1754.2009.01478.x

Binns, C. W., & Scott, J. A. (2002). Using pacifiers: what are breastfeeding mothers doing? *Breastfeeding Review, 10*(2), 21-25.

Biro, M. A., Yelland, J. S., & Brown, S. J. (2014). Why are Young Women Less Likely to Breastfeed? Evidence From an Australian Population-Based Survey. *Birth, 41*(3), 245-253. doi: 10.1111/birt.12112

Blyth, R., Creedy, D. K., Dennis, C., Moyle, W., Pratt, J., & De Vries, S. M. (2002). Effect of maternal confidence on breastfeeding duration: an application of breastfeeding self-efficacy theory. *Birth: Issues in Perinatal Care, 29*(4), 278-274.

Blyth, R. J., Creedy, D. K., Dennis, C.-L., Moyle, W., Pratt, J., De Vries, S. M., & Healy, G. N. (2004). Breastfeeding Duration in an Australian Population: The Influence of Modifiable Antenatal Factors. *Journal of Human Lactation, 20*(1), 30-38. doi: 10.1177/0890334403261109

Burnham, L., Buczek, M., Braun, N., Feldman-Winter, L., Chen, N., & Merewood, A. (2014). Determining length of breastfeeding exclusivity: validity of maternal report 2 years after birth. *Journal of Human Lactation, 30*(2), 190-194. doi: 10.1177/0890334414525682

Callaway, L. K., Prins, J. B., Chang, A. M., & McIntyre, H. D. (2006). The prevalence and impact of overweight and obesity in an Australian obstetric population. *Medical Journal of Australia, 184*(2), 56-59.

Callen, J., & Pinelli, J. (2004). Incidence and duration of breastfeeding for term infants in Canada, United States, Europe, and Australia: a literature review. *Birth, 31*(4), 285-292. doi: 10.1111/j.0730-7659.2004.00321.x

Cameron, A. J., Hesketh, K., Ball, K., Crawford, D., & Campbell, K. J. (2010). Influence of Peers on Breastfeeding Discontinuation Among New Parents: The Melbourne InFANT Program. *Pediatrics, 126*(3), e601-607. doi: 10.1542/peds.2010-0771

Castilho, S. D., & Rocha, M. A. (2009). Pacifier habit: history and multidisciplinary view. *Jornal de Pediatría, 85*(6), 480-489. doi: doi:10.2223/JPED.1951

Cattaneo, A., Burmaz, T., Arendt, M., Nilsson, I., Mikiel-Kostyra, K., Kondrate, I., . . . Fallon, M. (2010). Protection, promotion and support of breast-feeding in Europe: progress from 2002 to 2007. *Public Health Nutrition, 13*(6), 751-759.

Cattaneo, A., & Buzzetti, R. (2001). Effect on rates of breast feeding of training for the baby friendly hospital initiative. *BMJ, 323*(7325), 1358-1362.

Centers for Disease Control and Prevention. (2006). Racial and socioeconomic disparities in breastfeeding--United States, 2004. *MMWR: Morbidity and Mortality Weekly Report, 55*(12), 335-339.

Centers for Disease Control and Prevention. (2008). Epi Info (Version 3.5.1).

Centers for Disease Control and Prevention. (2011). Breastfeeding Report Card - United States, 2011: Department of Health and Human Services.

Centers for Disease Control and Prevention. (2015). National Immunization Survey (NIS) - NIS Survey Methods. from http://www.cdc.gov/breastfeeding/data/nis_data/survey_methods.htm

Centres for Disease Control and Prevention. (2015). CDC National Immunization Surveys 2011 and 2012, Provisional Data, 2010 births. . from http://www.cdc.gov/breastfeeding/data/NIS_data/index.htm

Chen, S., Binns, C. W., Zhao, Y., Maycock, B., & Liu, Y. (2013). Breastfeeding by Chinese mothers in Australia and China: the healthy migrant effect. *Journal of Human Lactation, 29*(2), 246-252. doi: 10.1177/0890334413475838

Chezem, J., Friesen, C., & Boettcher, J. (2003). Breastfeeding Knowledge, Breastfeeding Confidence, and Infant Feeding Plans: Effects on Actual Feeding Practices. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 32*(1), 40-47. doi: 10.1177/0884217502239799

Chezem, J. C. (2012). Breastfeeding attitudes among couples planning exclusive breastfeeding or mixed feeding. *Breastfeeding medicine : the official journal of the Academy of Breastfeeding Medicine, 7*(3), 155-162. doi: 10.1089/bfm.2011.0024

Chiou, S. T., Chen, L. C., Yeh, H., Wu, S. R., & Chien, L. Y. (2014). Early skin-to-skin contact, rooming-in, and breastfeeding: a comparison of the 2004 and 2011 National Surveys in Taiwan. *Birth, 41*(1), 33-38. doi: 10.1111/birt.12090

Chu, S. Y., Bachman, D. J., Callaghan, W. M., Whitlock, E. P., Dietz, P. M., Berg, C. J., . . . Hornbrook, M. C. (2008). Association between Obesity during Pregnancy and Increased Use of Health Care. *New England Journal of Medicine, 358*(14), 1444-1453. doi: doi:10.1056/NEJMoa0706786

Cooklin, A. R., Donath, S. M., & Amir, L. H. (2008). Maternal employment and breastfeeding: results from the longitudinal study of Australian children. *Acta Paediatrica, 97*(5), 620-623. doi: 10.1111/j.1651-2227.2008.00740.x

Cooklin, A. R., Rowe, H. J., & Fisher, J. R. (2012). Paid parental leave supports breastfeeding and mother-infant relationship: a prospective investigation of maternal postpartum employment. *Australian and New Zealand Journal of Public Health, 36*(3), 249-256. doi: 10.1111/j.1753-6405.2012.00846.x

Craig, H. J., & Dietsch, E. (2010). 'Too scary to think about': First time mothers' perceptions of the usefulness of antenatal breastfeeding education. *Women and Birth, 23*(4), 160-165. doi: http://dx.doi.org/10.1016/j.wombi.2010.04.004

Craig, P. L., Knight, J., Comino, E., Webster, V., Pulver, L. J., & Harris, E. (2011). Initiation and Duration of Breastfeeding in an Aboriginal Community in South Western Sydney. *Journal of Human Lactation, 27*(3), 250-261. doi: 10.1177/0890334411402998

Cromie, E. A. S., Shepherd, C. C. J., Zubrick, S. R., & Oddy, W. H. (2012). Breastfeeding Duration and Residential Isolation amid Aboriginal Children in Western Australia. *Nutrients, 4*(12), 2020-2034. doi: 10.3390/nu4122020

da Silva Mda, C., Oliveira Assis, A. M., Pinheiro, S. M., de Oliveira, L. P., & da Cruz, T. R. (2015). Breastfeeding and maternal weight changes during 24 months post-partum: a cohort study. *Matern Child Nutr, 11*(4), 780-791. doi: 10.1111/mcn.12071

Daly, A., Pollard, C. M., Phillips, M., & Binns, C. W. (2014). Benefits, barriers and enablers of breastfeeding: factor analysis of population perceptions in Western Australia. *PloS One, 9*(2), e88204. doi: 10.1371/journal.pone.0088204

Daniels, Z. M., Vanleit, B. J., Skipper, B. J., Sanders, M. L., & Rhyne, R. L. (2007). Factors in recruiting and retaining health professionals for rural practice. *Journal of Rural Health, 23*(1), 62-71. doi: 10.1111/j.1748-0361.2006.00069.x

de Jager, E., Broadbent, J., Fuller-Tyszkiewicz, M., & Skouteris, H. (2014). The role of psychosocial factors in exclusive breastfeeding to six months postpartum. *Midwifery, 30*(6), 657-666. doi: 10.1016/j.midw.2013.07.008

De la Mora, A., & Russell, D. W. (1999). The Iowa Infant Feeding Attitude Scale: Analysis of reliability and validity. *Journal of Applied Social Psychology, 29*(11), 2362-2380.

Dennis, C. L. (1999). Theoretical underpinnings of breastfeeding confidence: a self-efficacy framework. *Journal of Human Lactation, 15*(3), 195-201.

Dennis, C. L. (2002). Breastfeeding initiation and duration: a 1990-2000 literature review. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 31*(1), 12-32. doi: 10.1111/j.1552-6909.2002.tb00019.x

Dennis, C. L. (2003). The breastfeeding self-efficacy scale: psychometric assessment of the short form. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 32*(6), 734-744.

Dennis, C. L. (2006). Identifying predictors of breastfeeding self-efficacy in the immediate postpartum period. *Research in Nursing and Health, 29*(4), 256-268. doi: 10.1002/nur.20140

Department of Health. (2009). Baby Friendly Hospital Initiative: hospital breastfeeding policy. Perth, Western Australia.

DeVellis, R. F. (2012). *Scale development : theory and applications*. Thousand Oaks, California: Sage Publications, Inc.

Dewey, K. G., Nommsen-Rivers, L. A., Heinig, M. J., & Cohen, R. J. (2003). Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss. *Pediatrics, 112*(3 Pt 1), 607-619.

DiGirolamo, A., Thompson, N., Martorell, R., Fein, S., & Grummer-Strawn, L. (2005). Intention or experience? Predictors of continued breastfeeding. *Health Education and Behavior, 32*(2), 208-226. doi: 10.1177/1090198104271971

DiGirolamo, A. M., Grummer-Strawn, L. M., & Fein, S. B. (2003). Do perceived attitudes of physicians and hospital staff affect breastfeeding decisions? *Birth: Issues in Perinatal Care, 30*(2), 94-100.

DiGirolamo, A. M., Grummer-Strawn, L. M., & Fein, S. B. (2008). Effect of Maternity-Care Practices on Breastfeeding. *Pediatrics, 122*(Supplement 2), S43-S49. doi: 10.1542/peds.2008-1315e

Donath, S. M., & Amir, L. H. (2008). Maternal obesity and initiation and duration of breastfeeding: data from the longitudinal study of Australian children. *Matern Child Nutr, 4*(3), 163-170. doi: 10.1111/j.1740-8709.2008.00134.x

Donath, S. M., Amir, L. H., & The, A. S. T. (2003). Relationship between prenatal infant feeding intention and initiation and duration of breastfeeding: a cohort study. *Acta pædiatrica, 92*(3), 352-356. doi: 10.1111/j.1651-2227.2003.tb00558.x

Dubois, L. L., & Girard, M. M. (2003). Social determinants of initiation, duration and exclusivity of breastfeeding at the population level: the results of the Longitudinal Study of Child Development in Quebec (ELDEQ 1998-2002). *Canadian Journal of Public Health. Revue Canadienne de Santé Publique, 94*(4), 300-305.

Dungy, C. I., McInnes, R. J., Tappin, D. M., Wallis, A. B., & Oprescu, F. (2008). Infant feeding attitudes and knowledge among socioeconomically disadvantaged women in Glasgow. *Matern Child Health J, 12*(3), 313-322. doi: 10.1007/s10995-007-0253-9

Duong, D. V., Lee, A. H., & Binns, C. W. (2005). Determinants of breast-feeding within the first 6 months post-partum in rural Vietnam. *Journal of Paediatrics and Child Health, 41*(7), 338-343. doi: JPC627 [pii] 10.1111/j.1440-1754.2005.00627.x

Dyson, L., Green, J. M., Renfrew, M. J., McMillan, B., & Woolridge, M. (2010). Factors influencing the infant feeding decision for socioeconomically deprived pregnant teenagers: the moral dimension. *Birth: Issues in Perinatal Care, 37*(2), 141-149. doi: 10.1111/j.1523-536X.2010.00394.x

Dyson, L., McCormick, F., & Renfrew, M. J. (2005). Interventions for promoting the initiation of breastfeeding. *Cochrane Database Syst Rev*(2), CD001688. doi: 10.1002/14651858.CD001688.pub2

Ekstrom, A., Widstrom, A. M., & Nissen, E. (2003). Duration of breastfeeding in Swedish primiparous and multiparous women. *Journal of Human Lactation, 19*(2), 172-178.

Elliott-Rudder, M., Pilotto, L., McIntyre, E., & Ramanathan, S. (2014). Motivational interviewing improves exclusive breastfeeding in an Australian randomised controlled trial. *Acta Paediatrica, 103*(1), e11-16. doi: 10.1111/apa.12434

Flacking, R., Wallin, L., & Ewald, U. (2007). Perinatal and socioeconomic determinants of breastfeeding duration in very preterm infants. *Acta Paediatrica, 96*(8), 1126-1130. doi: 10.1111/j.1651-2227.2007.00386.x

Flower, K. B., Willoughby, M., Cadigan, R. J., Perrin, E. M., Randolph, G., & Family Life Project Investigative, T. (2008). Understanding breastfeeding initiation and

continuation in rural communities: a combined qualitative/quantitative approach. *Matern Child Health J, 12*(3), 402-414. doi: 10.1007/s10995-007-0248-6

Ford, R. P., Mitchell, E. A., Scragg, R., Stewart, A. W., Taylor, B. J., & Allen, E. M. (1994). Factors adversely associated with breast feeding in New Zealand. *Journal of Paediatrics and Child Health, 30*(6), 483-489.

Forste, R., & Hoffmann, J. P. (2008). Are US mothers meeting the Healthy People 2010 breastfeeding targets for initiation, duration, and exclusivity? The 2003 and 2004 National Immunization Surveys. *Journal of Human Lactation, 24*(3), 278-288. doi: 10.1177/0890334408317617

Forster, D. A., McLachlan, H. L., & Lumley, J. (2006). Factors associated with breastfeeding at six months postpartum in a group of Australian women. *Int Breastfeed J, 1*, 18. doi: 10.1186/1746-4358-1-18

Gage, H., Williams, P., Von Rosen-Von Hoewel, J., Laitinen, K., Jakobik, V., Martin-Bautista, E., . . . Raats, M. (2012). Influences on infant feeding decisions of first-time mothers in five European countries. *European Journal of Clinical Nutrition, 66*(8), 914-919. doi: 10.1038/ejcn.2012.56

Galtier-Dereure, F., Boegner, C., & Bringer, J. (2000). Obesity and pregnancy: complications and cost. *The American Journal of Clinical Nutrition, 71*(5), 1242s-1248s.

Giglia, R., & Binns, C. (2014). The effectiveness of the internet in improving breastfeeding outcomes: a systematic review. *Journal of Human Lactation, 30*(2), 156-160. doi: 10.1177/0890334414527165

Giglia, R., Cox, K., Zhao, Y., & Binns, C. W. (2015). Exclusive breastfeeding increased by an internet intervention. *Breastfeeding Medicine, 10*, 20-25. doi: 10.1089/bfm.2014.0093

Giglia, R. C. (2010). Alcohol and lactation: An updated systematic review. *Nutrition & Dietetics, 67*(4), 237-243. doi: 10.1111/j.1747-0080.2010.01469.x

Giglia, R. C., Binns, C. W., Alfonso, H. S., Scott, J. A., & Oddy, W. H. (2008). The effect of alcohol intake on breastfeeding duration in Australian women. *Acta Paediatrica, 97*(5), 624-629. doi: APA760 [pii] 10.1111/j.1651-2227.2008.00760.x

Giugliani, E. R., Caiaffa, W. T., Vogelhut, J., Witter, F. R., & Perman, J. A. (1994). Effect of breastfeeding support from different sources on mothers' decisions to breastfeed. *Journal of Human Lactation, 10*(3), 157-161.

Gracey, M. (2000). Historical, cultural, political, and social influences on dietary patterns and nutrition in Australian Aboriginal children. *American Journal of Clinical Nutrition, 72*(5 Suppl), 1361S-1367S.

Graham, K. I., Scott, J. A., Binns, C. W., & Oddy, W. H. (2005). National targets for breastfeeding at hospital discharge have been achieved in Perth. *Acta Paediatrica, 94*(3), 352-356.

Grassley, J., & Eschiti, V. (2008). Grandmother breastfeeding support: what do mothers need and want? *Birth, 35*(4), 329-335. doi: 10.1111/j.1523-536X.2008.00260.x

Greiner, T. (2014). Exclusive breastfeeding: measurement and indicators. *Int Breastfeed J, 9*, 18. doi: 10.1186/1746-4358-9-18

Guise, J. M., Palda, V., Westhoff, C., Chan, B. K., Helfand, M., Lieu, T. A., & Force, U. S. P. S. T. (2003). The effectiveness of primary care-based interventions to promote breastfeeding: systematic evidence review and meta-analysis for the US Preventive Services Task Force. *Annals of Family Medicine, 1*(2), 70-78.

Hanson, M. B., Hellerstedt, W. L., Desvarieux, M., & Duval, S. J. (2003). Correlates of breast-feeding in a rural population. *American Journal of Health Behavior, 27*(4), 432-444.

Hauck, Y., Hall, W., & Jones, C. (2007). Prevalence, self-efficacy and perceptions of conflicting advice and self-management: effects of a breastfeeding journal. *Journal of Advanced Nursing, 57*(3), 306-317.

Hauck, Y. L., Fenwick, J., Dhaliwal, S. S., Butt, J., & Schmied, V. (2011). The association between women's perceptions of professional support and problems experienced on breastfeeding cessation: a Western Australian study. *Journal of Human Lactation, 27*(1), 49-57. doi: 10.1177/0890334410386956

Hector, D., & King, L. (2005). Interventions to encourage and support breastfeeding. *N S W Public Health Bull, 16*(3-4), 56-61.

Hilson, J. A., Rasmussen, K. M., & Kjolhede, C. L. (1997). Maternal obesity and breast-feeding success in a rural population of white women. *American Journal of Clinical Nutrition, 66*(6), 1371-1378.

Hilson, J. A., Rasmussen, K. M., & Kjolhede, C. L. (2004). High Prepregnant Body Mass Index is Associated With Poor Lactation Outcomes Among White, Rural Women Independent of Psychosocial and Demographic Correlates. *Journal of Human Lactation, 20*(1), 18-29. doi: 10.1177/0890334403261345

Hoddinott, P., Kroll, T., Raja, A., & Lee, A. J. (2010). Seeing other women breastfeed: how vicarious experience relates to breastfeeding intention and behaviour. *Maternal and Child Nutrition, 6*(2), 134-146. doi: 10.1111/j.1740-8709.2009.00189.x

Hoddinott, P., Lee, A. J., & Pill, R. (2006). Effectiveness of a breastfeeding peer coaching intervention in rural Scotland. *Birth, 33*(1), 27-36. doi: 10.1111/j.0730-7659.2006.00071.x

Horta, B., & Victora, C. (2013). Long-term effects of breastfeeding: a systematic review. Geneva, Switzerland: World Health Organization.

Horta, B. L., Bahl, R., Martines, J. L., & C.G., V. (2007). Evidence of the long-term effects of breastfeeding: Systematic reviews and meta-analyses. Geneva: World Health Organization.

House of Representatives Standing Committee on Health and Ageing, Parliament of the Commonwealth of Australia (2007). The best start: Report on the inquiry into the health benefits of breastfeeding. Canberra: Commonwealth of Australia.

Ibanez, G., Martin, N., Denantes, M., Saurel-Cubizolles, M. J., Ringa, V., & Magnier, A. M. (2012). Prevalence of breastfeeding in industrialized countries. *Revue d'Épidémiologie et de Santé Publique, 60*(4), 305-320. doi: 10.1016/j.respe.2012.02.008

IBM. (2011). IBM SPSS Statistics Version 21. New York: IBM Corporation Software Group.

IBM. (2013). IBM SPSS Statistics Version 22. New York: IBM Corporation Software Group.

Inoue, M., Binns, C., Katsuki, Y., & Ouchi, M. (2013). Japanese mothers' breastfeeding knowledge and attitudes assessed by the Iowa Infant Feeding Attitudes Scale. *Asia Pacific Journal of Clinical Nutrition, 22*(2), 261-265.

Ip, S., Chung, M., Raman, G., Chew, P., Magula, N., DeVine, D., . . . Lau, J. (2007). Breastfeeding and maternal and infant health outcomes in developed countries. *Evidence report/technology assessment*(153), 1-186.

Jaafar, S. H., Jahanfar, S., Angolkar, M., & Ho, J. J. (2012). Effect of restricted pacifier use in breastfeeding term infants for increasing duration of breastfeeding. *Cochrane Database Syst Rev, 7*, CD007202. doi: 10.1002/14651858.CD007202.pub3

Jirojwong, S., Rossi, D., Walker, S., & Ritchie, B. (2005). What were the outcomes of home follow-up visits after postpartum hospital discharge? *Australian Journal of Advanced Nursing, 23*(1), 22-30.

Joanna Briggs Institute. (2012). Best Practice Information Sheet: Women's perceptions and experiences of breastfeeding support. *Nursing & Health Sciences, 14*(1), 133-135. doi: 10.1111/j.1442-2018.2012.00679.x

Joyce, A., & Hutchinson, M. (2012). Western Australia’s Mothers and Babies, 2010: Twenty-eighth Annual Report of the Western Australian Midwives’ Notification System. Western Australia: Department of Health.

Kellams, A. L., Gurka, K. K., Hornsby, P. P., Drake, E., Riffon, M., Gellerson, D., . . . Coleman, V. (2016). The Impact of a Prenatal Education Video on Rates of

Breastfeeding Initiation and Exclusivity during the Newborn Hospital Stay in a Low-income Population. *Journal of Human Lactation, 32*(1), 152-159. doi: 10.1177/0890334415599402

Kelly, Y. J., Watt, R. G., & Nazroo, J. Y. (2006). Racial/ethnic differences in breastfeeding initiation and continuation in the United kingdom and comparison with findings in the United States. *Pediatrics, 118*(5), e1428-1435. doi: 10.1542/peds.2006-0714

Kent, G. (2006). WIC's promotion of infant formula in the United States. *Int Breastfeed J, 1*(1), 8. doi: 10.1186/1746-4358-1-8

Kervin, B. E., Kemp, L., & Pulver, L. J. (2010). Types and timing of breastfeeding support and its impact on mothers' behaviours. *Journal of Paediatrics and Child Health, 46*(3), 85-91. doi: 10.1111/j.1440-1754.2009.01643.x

Kramer, M. S., & Kakuma, R. (2001). The optimal duration of breastfeeding: A systematic review. Geneva: World Health Organization.

Kramer, M. S., & Kakuma, R. (2012). Optimal duration of exclusive breastfeeding. *Cochrane Database Syst Rev, 8*(8), CD003517. doi: 10.1002/14651858.CD003517.pub2

Kum-Nji, P., Mangrem, C. L., Wells, P. J., White, P., & Herrod, H. G. (1999). Breast-feeding initiation: predictors, attitudes, and practices among blacks and whites in rural Mississippi. *Southern Medical Journal, 92*(12), 1183-1188.

Labbok, M. H. (1999). Health sequelae of breastfeeding for the mother. *Clinics in Perinatology, 26*(2), 491-503, viii-ix.

Labbok, M. H. (2001). Effects of breastfeeding on the mother. *Pediatric Clinics of North America, 48*(1), 143-158.

Lagan, B. M., Sinclair, M., & Kernohan, W. G. (2010). Internet use in pregnancy informs women's decision making: a web-based survey. *Birth, 37*(2), 106-115. doi: 10.1111/j.1523-536X.2010.00390.x

Lagan, B. M., Sinclair, M., & Kernohan, W. G. (2011). What is the impact of the Internet on decision-making in pregnancy? A global study. *Birth, 38*(4), 336-345. doi: 10.1111/j.1523-536X.2011.00488.x

Lakati, A., Binns, C., & Stevenson, M. (2002). Breast-feeding and the working mother in Nairobi. *Public Health Nutrition, 5*(6), 715-718. doi: 10.1079/PHN2002349

Lawson, K., & Tulloch, M. I. (1995). Breastfeeding duration: prenatal intentions and postnatal practices. *Journal of Advanced Nursing, 22*(5), 841-849.

Lehmann, U., Dieleman, M., & Martineau, T. (2008). Staffing remote rural areas in middle- and low-income countries: a literature review of attraction and retention. *BMC Health Services Research, 8*, 19. doi: 10.1186/1472-6963-8-19

Li, L., Zhang, M., & Binns, C. W. (2003). Chinese mothers' knowledge and attitudes about breastfeeding in Perth, Western Australia. *Breastfeeding review : professional publication of the Nursing Mothers' Association of Australia, 11*(3), 13-19.

Li, R., Darling, N., Maurice, E., Barker, L., & Grummer-Strawn, L. M. (2005). Breastfeeding rates in the United States by characteristics of the child, mother, or family: the 2002 National Immunization Survey. *Pediatrics, 115*(1), e31-37. doi: 10.1542/peds.2004-0481

Li, R., Scanlon, K. S., & Serdula, M. K. (2005). The validity and reliability of maternal recall of breastfeeding practice. *Nutrition Reviews, 63*(4), 103-110.

Li, Z., Zeki, R., Hilder, L., & Sullivan, E. A. (2012). Australia's mothers and babies 2010 *Perinatal statistics series no. 27* (Vol. Cat. no. PER 57). Canberra: AIHW National Perinatal Epidemiology and Statistics Unit.

Lind, J. N., Perrine, C. G., & Li, R. (2014). Relationship between use of labor pain medications and delayed onset of lactation. *Journal of Human Lactation, 30*(2), 167-173. doi: 10.1177/0890334413520189

Lumbiganon, P., Martis, R., Laopaiboon, M., Festin, M. R., Ho, J. J., & Hakimi, M. (2012). Antenatal breastfeeding education for increasing breastfeeding duration. *Cochrane Database Syst Rev, 9*, CD006425. doi: 10.1002/14651858.CD006425.pub3

Lynch, S., Bethel, J., Chowdhury, N., & Moore, J. B. (2012). Rural and urban breastfeeding initiation trends in low-income women in North Carolina from 2003 to 2007. *Journal of Human Lactation, 28*(2), 226-232. doi: 10.1177/0890334411430086

Mauch, C. E., Scott, J. A., Magarey, A. M., & Daniels, L. A. (2012). Predictors of and reasons for pacifier use in first-time mothers: an observational study. *BMC Pediatrics, 12*, 7. doi: 10.1186/1471-2431-12-7

Maycock, B., Binns, C. W., Dhaliwal, S., Tohotoa, J., Hauck, Y., Burns, S., & Howat, P. (2013). Education and support for fathers improves breastfeeding rates: a randomized controlled trial. *Journal of Human Lactation, 29*(4), 484-490. doi: 10.1177/0890334413484387

McAndrew, F., Thompson, J., Fellows, L., Large, A., Speed, M., & Renfrew, M. J. (2012). Infant Feeding Survey 2010. In I. Research (Ed.). Leeds, England: National Health Service.

McInnes, R. J., & Chambers, J. (2008). Infants admitted to neonatal units--interventions to improve breastfeeding outcomes: a systematic review 1990-2007. *Matern Child Nutr, 4*(4), 235-263. doi: 10.1111/j.1740-8709.2008.00150.x

McIntyre, H. D., Gibbons, K. S., Flenady, V. J., & Callaway, L. K. (2012). Overweight and obesity in Australian mothers: epidemic or endemic? *Medical Journal of Australia, 196*(3), 184-188.

McLachlan, H. L., & Forster, D. A. (2006). Initial breastfeeding attitudes and practices of women born in Turkey, Vietnam and Australia after giving birth in Australia. *Int Breastfeed J, 1*, 7. doi: 10.1186/1746-4358-1-7

McNiel, M. E., Labbok, M. H., & Abrahams, S. W. (2010). What are the risks associated with formula feeding? A re-analysis and review. *Birth, 37*(1), 50-58. doi: 10.1111/j.1523-536X.2009.00378.x

Meedya, S., Fahy, K., & Kable, A. (2010). Factors that positively influence breastfeeding duration to 6 months: a literature review. *Women Birth, 23*(4), 135-145. doi: 10.1016/j.wombi.2010.02.002

Meng, X., Daly, A., Pollard, C. M., & Binns, C. W. (2013). Community attitudes toward breastfeeding in public places among Western Australia Adults, 1995-2009. *Journal of Human Lactation, 29*(2), 183-189. doi: 10.1177/0890334413478835

Merten, S., Dratva, J., & Ackermann-Liebrich, U. (2005). Do Baby-Friendly Hospitals Influence Breastfeeding Duration on a National Level? *Pediatrics, 116*(5), e702-e708. doi: 10.1542/peds.2005-0537

Mezzacappa, E. S. (2004). Breastfeeding and maternal stress response and health. *Nutrition Reviews, 62*(7 Pt 1), 261-268.

Mitchell-Box, K., Braun, K. L., Hurwitz, E. L., & Hayes, D. K. (2013). Breastfeeding attitudes: association between maternal and male partner attitudes and breastfeeding intent. *Breastfeeding Medicine, 8*(4), 368-373. doi: 10.1089/bfm.2012.0135

Mitchell-Box, K. M., & Braun, K. L. (2013). Impact of male-partner-focused interventions on breastfeeding initiation, exclusivity, and continuation. *Journal of Human Lactation, 29*(4), 473-479. doi: 10.1177/0890334413491833

Monasta, L., Batty, G. D., Cattaneo, A., Lutje, V., Ronfani, L., Van Lenthe, F. J., & Brug, J. (2010). Early-life determinants of overweight and obesity: a review of systematic reviews. *Obesity Reviews, 11*(10), 695-708. doi: 10.1111/j.1467-789X.2010.00735.x

Moore, E. R., Anderson, G. C., Bergman, N., & Dowswell, T. (2012). Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database Syst Rev, 5*, CD003519. doi: 10.1002/14651858.CD003519.pub3

Mulready-Ward, C., & Hackett, M. (2014). Perception and attitudes: breastfeeding in public in New York City. *Journal of Human Lactation, 30*(2), 195-200. doi: 10.1177/0890334414524988

Murimi, M., Dodge, C. M., Pope, J., & Erickson, D. (2010). Factors that Influence Breastfeeding Decisions among Special Supplemental Nutrition Program for Women, Infants, and Children Participants from Central Louisiana. *Journal of the American Dietetic Association, 110*(4), 624-627. doi: 10.1016/j.jada.2009.12.019

National Health and Medical Research Council. (2000). *How to use the evidence assessment and application of scientific evidence*. Canberra: NHMRC.

National Health and Medical Research Council. (2009). *Australian guidelines to reduce health risks from drinking alcohol*. Canberra: National Health and Medical Research Council.

National Health and Medical Research Council. (2012). Infant Feeding Guidelines 2012. Canberra: Comonwealth of Australia.

National Health and Medical Research Council, the Australian Research Council, & the Australian Vice-Chancellors' Committee. (2007 (updated December 2013)). *National statement on ethical conduct in human research*. Canberra: National Health and Medical Research Council.

National Rural Health Alliance Inc. (2012a). Rural Maternity Services: Investing in the Future. Fact Sheet 25 - May 2012. Retrieved 01/06/2014, from http://ruralhealth.org.au/sites/default/files/publications/fact-sheet-25-maternity-services.pdf

National Rural Health Alliance Inc. (2012b). Women's Health in Rural Australia - Fact Sheet 31 - March 2012. from http://ruralhealth.org.au/sites/default/files/publications/fact-sheet-31-womens-health-rural-australia.pdf

Nelson, E. A., Yu, L. M., Williams, S., & International Child Care Practices Study Group, M. (2005). International Child Care Practices study: breastfeeding and pacifier use. *Journal of Human Lactation, 21*(3), 289-295. doi: 10.1177/0890334405278489

Newby, R., Brodribb, W., Ware, R. S., & Davies, P. S. (2014). Infant feeding knowledge, attitudes, and beliefs predict antenatal intention among first-time mothers in Queensland. *Breastfeeding Medicine, 9*(5), 266-272. doi: 10.1089/bfm.2014.0012

Newby, R., Brodribb, W., Ware, R. S., & Davies, P. S. (2015). Internet Use by First-Time Mothers for Infant Feeding Support. *Journal of Human Lactation, 31*(3), 416-424. doi: 10.1177/0890334415584319

Nicholson, W., & Yuen, H. P. (1995). A study of breast feeding rates at a large Australian obstetric hospital. *Australian and New Zealand Journal of Obstetrics and Gynaecology, 35*(4), 393-397.

Novotny, R., Hla, M. M., Kieffer, E. C., Park, C. B., Mor, J., & Thiele, M. (2000). Breastfeeding duration in a multiethnic population in Hawaii. *Birth, 27*(2), 91-96.

O'Brien, M., Buikstra, E., Fallon, T., & Hegney, D. (2009a). Exploring the influence of psychological factors on breastfeeding duration, phase 1: perceptions of mothers and clinicians. *Journal of Human Lactation, 25*(1), 55-63. doi: 0890334408326071 [pii] 10.1177/0890334408326071

O'Brien, M., Buikstra, E., & Hegney, D. (2008). The influence of psychological factors on breastfeeding duration. *Journal of Advanced Nursing, 63*(4), 397-408. doi: 10.1111/j.1365-2648.2008.04722.x

O'Brien, M. L., Buikstra, E., Fallon, T., & Hegney, D. (2009b). Strategies for success: a toolbox of coping strategies used by breastfeeding women. *Journal of Clinical Nursing, 18*(11), 1574-1582. doi: 10.1111/j.1365-2702.2008.02667.x

O'Mahony, F., Hofmeyr, G. J., & Menon, V. (2010). Choice of instruments for assisted vaginal delivery. *Cochrane Database Syst Rev*(11), CD005455. doi: 10.1002/14651858.CD005455.pub2

Patel, R., Oken, E., Bogdanovich, N., Matush, L., Sevkovskaya, Z., Chalmers, B., . . . Martin, R. M. (2014). Cohort profile: The promotion of breastfeeding intervention

trial (PROBIT). *International Journal of Epidemiology, 43*(3), 679-690. doi: 10.1093/ije/dyt003

Peat, J. K., Allen, J., Nguyen, N., Hayen, A., Oddy, W. H., & Mihrshahi, S. (2004). Motherhood meets epidemiology: measuring risk factors for breast-feeding cessation. *Public Health Nutrition, 7*(8), 1033-1037. doi: 10.1079/PHN2004640

Pinelli, J., Atkinson, S. A., & Saigal, S. (2001). Randomized trial of breastfeeding support in very low-birth-weight infants. *Archives of Pediatrics and Adolescent Medicine, 155*(5), 548-553.

Prior, E., Santhakumaran, S., Gale, C., Philipps, L. H., Modi, N., & Hyde, M. J. (2012). Breastfeeding after cesarean delivery: a systematic review and meta-analysis of world literature. *American Journal of Clinical Nutrition, 95*(5), 1113-1135. doi: 10.3945/ajcn.111.030254

Pugin, E., Valdes, V., Labbok, M. H., Perez, A., & Aravena, R. (1996). Does prenatal breastfeeding skills group education increase the effectiveness of a comprehensive breastfeeding promotion program? *Journal of Human Lactation, 12*(1), 15-19.

Renfrew, M. J., McCormick, F. M., Wade, A., Quinn, B., & Dowswell, T. (2012). Support for healthy breastfeeding mothers with healthy term babies. *Cochrane Database Syst Rev, 5*, CD001141. doi: 10.1002/14651858.CD001141.pub4

Rosen, I. M., Krueger, M. V., Carney, L. M., & Graham, J. A. (2008). Prenatal breastfeeding education and breastfeeding outcomes. *MCN: American Journal of Maternal Child Nursing, 33*(5), 315-319. doi: 0.1097/01.NMC.0000334900.22215.ec

Rossiter, M. D., Colapinto, C. K., Khan, M. K., McIsaac, J. L., Williams, P. L., Kirk, S. F., & Veugelers, P. J. (2015). Breast, Formula and Combination Feeding in Relation to Childhood Obesity in Nova Scotia, Canada. *Matern Child Health J, 19*(9), 2048-2056. doi: 10.1007/s10995-015-1717-y

Ryan, A. S., & Zhou, W. (2006). Lower breastfeeding rates persist among the Special Supplemental Nutrition Program for Women, Infants, and Children participants, 1978-2003. *Pediatrics, 117*(4), 1136-1146. doi: 10.1542/peds.2005-1555

Schafer, E., Vogel, M. K., Viegas, S., & Hausafus, C. (1998). Volunteer peer counselors increase breastfeeding duration among rural low-income women. *Birth-Issues in Perinatal Care, 25*(2), 101-106. doi: 10.1046/j.1523-536x.1998.00101.x

Scott, J. A., Aitkin, I., Binns, C. W., & Aroni, R. A. (1999). Factors associated with the duration of breastfeeding amongst women in Perth, Australia. *Acta Paediatrica, 88*(4), 416-421.

Scott, J. A., & Binns, C. W. (1999). Factors associated with the initiation and duration of breastfeeding: a review of the literature. *Breastfeeding Review, 7*(1), 5-16.

Scott, J. A., Binns, C. W., & Aroni, R. A. (1997). The influence of reported paternal attitudes on the decision to breast-feed. *Journal of Paediatrics and Child Health, 33*(4), 305-307.

Scott, J. A., Binns, C. W., Graham, K. I., & Oddy, W. H. (2006). Temporal changes in the determinants of breastfeeding initiation. *Birth, 33*(1), 37-45. doi: BIR072 [pii] 10.1111/j.0730-7659.2006.00072.x

Scott, J. A., Binns, C. W., & Oddy, W. H. (2007). Predictors of delayed onset of lactation. *Matern Child Nutr, 3*(3), 186-193. doi: MCN096 [pii] 10.1111/j.1740-8709.2007.00096.x

Scott, J. A., Binns, C. W., Oddy, W. H., & Graham, K. I. (2006). Predictors of breastfeeding duration: evidence from a cohort study. *Pediatrics, 117*(4), e646-655. doi: 10.1542/peds.2005-1991

Scott, J. A., Landers, M. C., Hughes, R. M., & Binns, C. W. (2001). Factors associated with breastfeeding at discharge and duration of breastfeeding. *Journal of Paediatrics and Child Health, 37*(3), 254-261.

Scott, J. A., Shaker, I., & Reid, M. (2004). Parental attitudes toward breastfeeding: their association with feeding outcome at hospital discharge. *Birth: Issues in Perinatal Care, 31*(2), 125-131.

Shaker, I., Scott, J. A., & Reid, R. (2004). Infant feeding attitudes of expectant parents: breastfeeding and formula feeding. *Journal of Advanced Nursing, 45*(3), 260-268. doi: 10.1046/j.1365-2648.2003.02887.x

Shaw, E., & Kaczorowski, J. (1999). The effect of a peer counseling program on breastfeeding initiation and longevity in a low-income rural population. *Journal of Human Lactation, 15*(1), 19-25.

Sittlington, J., Stewart-Knox, B., Wright, M., Bradbury, I., & Scott, J. A. (2007). Infant-feeding attitudes of expectant mothers in Northern Ireland. *Health Education Research, 22*(4), 561-570. doi: 10.1093/her/cyl113

Sjostrom, K., Welander, S., Haines, H., Andersson, E., & Hildingsson, I. (2013). Comparison of breastfeeding in rural areas of Sweden and Australia - a cohort study. *Women Birth, 26*(4), 229-234. doi: 10.1016/j.wombi.2013.08.159

Smith, J. P., Thompson, J. F., & Ellwood, D. A. (2002). Hospital system costs of artificial infant feeding: estimates for the Australian Capital Territory. *Australian and New Zealand Journal of Public Health, 26*(6), 543-551.

Smith, K. B., Humphreys, J. S., & Wilson, M. G. (2008). Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research? *Australian Journal of Rural Health, 16*(2), 56-66. doi: 10.1111/j.1440-1584.2008.00953.x

Sparks, P. J. (2010). Rural-urban differences in breastfeeding initiation in the United States. *Journal of Human Lactation, 26*(2), 118-129. doi: 0890334409352854 [pii] 10.1177/0890334409352854

Stamp, G. E., & Casanova, H. T. (2006). A breastfeeding study in a rural population in South Australia. *Rural Remote Health, 6*(2), 495. doi: 495 [pii]

Statistics Canada. (2013, 25 November 2013). Health at a glance - Breastfeeding trends in Canada. Retrieved 21 November 2015, from http://www.statcan.gc.ca/pub/82-624-x/2013001/article/11879-eng.htm

Stevens, E. E., Patrick, T. E., & Pickler, R. (2009). A history of infant feeding. *J Perinat Educ, 18*(2), 32-39. doi: 10.1624/105812409X426314

Stuebe, A. (2009). The risks of not breastfeeding for mothers and infants. *Reviews in Obstetrics and Gynecology, 2*(4), 222-231.

Stuebe, A., & Bonuck, K. (2011). What predicts intent to breastfeed exclusively? Breastfeeding knowledge, attitudes, and beliefs in a diverse urban population. *Breastfeeding Medicine, 6*(6), 413-420.

Su, L. L., Chong, Y. S., Chan, Y. H., Chan, Y. S., Fok, D., Tun, K. T., . . . Rauff, M. (2007). Antenatal education and postnatal support strategies for improving rates of exclusive breast feeding: randomised controlled trial. *BMJ, 335*(7620), 596. doi: 10.1136/bmj.39279.656343.55

Susin, L. R., Giugliani, E. R., Kummer, S. C., Maciel, M., Simon, C., & da Silveira, L. C. (1999). Does parental breastfeeding knowledge increase breastfeeding rates? *Birth, 26*(3), 149-156.

Taki, S., Campbell, K. J., Russell, C. G., Elliott, R., Laws, R., & Denney-Wilson, E. (2015). Infant Feeding Websites and Apps: A Systematic Assessment of Quality and Content. *Interact J Med Res, 4*(3), e18. doi: 10.2196/ijmr.4323

Tang, L., Binns, C. W., & Lee, A. H. (2015). Infant formula crisis in china: a cohort study in sichuan province. *J Health Popul Nutr, 33*(1), 117-122.

Thulier, D., & Mercer, J. (2009). Variables associated with breastfeeding duration. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing, 38*(3), 259-268. doi: 10.1111/j.1552-6909.2009.01021.x

Tohotoa, J., Maycock, B., Hauck, Y. L., Howat, P., Burns, S., & Binns, C. W. (2009). Dads make a difference: an exploratory study of paternal support for breastfeeding in Perth, Western Australia. *Int Breastfeed J, 4*, 15. doi: 10.1186/1746-4358-4-15

United Nations (Statistics Division). (2013). Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other

groupings Retrieved 27/12/2013, from http://unstats.un.org/unsd/methods/m49/m49regin.htm#developed

United States Department of Agriculture Food and Nutrition Service. (2014). Women, Infants, and Children (WIC). Retrieved 21/02/2014, from http://www.fns.usda.gov/wic/women-infants-and-children-wic

United States Department of Health and Human Services. (2010). *Healthy people 2020*. Washington, DC: U.S. Dept. of Health and Human Services.

United States Department of Health and Human Services. (2011). The Surgeon General's call to action to support breastfeeding. Washington, DC: U.S. Department of Health and Human Services, U.S. Public Health Service, Office of the Surgeon General.

Vallenas, C. S., Felicity. (1998). *Evidence for the ten steps to successful breastfeeding*. Geneva, Switzerland: World Health Organization.

Vandenbroucke, J. P., von Elm, E., Altman, D. G., Gotzsche, P. C., Mulrow, C. D., Pocock, S. J., . . . Initiative, S. (2007). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *PLoS Medicine, 4*(10), e297. doi: 10.1371/journal.pmed.0040297

WA Country Health Service. (2011). WA Country Health Service - Our Structure. from http://www.wacountry.health.wa.gov.au/index.php?id=456

Wagner, C. L., Wagner, M. T., Ebeling, M., Chatman, K. G., Cohen, M., & Hulsey, T. C. (2006). The role of personality and other factors in a mother's decision to initiate breastfeeding. *Journal of Human Lactation, 22*(1), 16-26. doi: 10.1177/0890334405283624

Walsh, A. D., Pincombe, J., & Henderson, A. (2011). An examination of maternity staff attitudes towards implementing Baby Friendly Health Initiative (BFHI) accreditation in Australia. *Matern Child Health J, 15*(5), 597-609. doi: 10.1007/s10995-010-0628-1

Watt, S., Sword, W., Sheehan, D., Foster, G., Thabane, L., Krueger, P., & Landy, C. K. (2012). The effect of delivery method on breastfeeding initiation from the The Ontario Mother and Infant Study (TOMIS) III. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 41*(6), 728-737. doi: 10.1111/j.1552-6909.2012.01394.x

Webb, K., Marks, G., Lund-Adams, M., Rutishauser, I., & Abraham, B. (2001). Towards a national system for monitoring breastfeeding in Australia: recommendations for national population indicators, definitions and next steps. Canberra, Australia: Australian Food and Nutrition Monitoring Unit.

Weimer, J. P. (2001). The economic benefits of breastfeeding a review and analysis. [Washington, D.C.]: Food and Rural Economics Division, Economic Research Service, U.S. Dept. of Agriculture.

Wen, L. M., Simpson, J. M., Rissel, C., & Baur, L. A. (2012). Awareness of breastfeeding recommendations and duration of breastfeeding: findings from the Healthy Beginnings Trial. *Breastfeeding Medicine, 7*, 223-229. doi: 10.1089/bfm.2011.0052

Wiener, R. C., & Wiener, M. A. (2011). Breastfeeding prevalence and distribution in the USA and Appalachia by rural and urban setting. *Rural Remote Health, 11*(2), 1713.

Wilhelm, S. L., Stepans, M. B., Hertzog, M., Rodehorst, T. K., & Gardner, P. (2006). Motivational interviewing to promote sustained breastfeeding. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 35*(3), 340-348. doi: 10.1111/j.1552-6909.2006.00046.x

Wilkins, C., Ryan, K., Green, J., & Thomas, P. (2012). Infant feeding attitudes of women in the United Kingdom during pregnancy and after birth. *Journal of Human Lactation, 28*(4), 547-555. doi: 10.1177/0890334412456602

World Health Organization. (1991, 1991). *Division of Diarrhoeal Acute Respiratory Disease Control - Indicators for assessing breast-feeding practices : report of an informal meeting, 11-12 June 1991, Geneva, Switzerland*, Geneva.

World Health Organization. (2001). Report of the Expert Consultation on the optimal duration of breastfeeding, 28-30 March 2001. In World Health Organization (Ed.). Geneva: WHO.

World Health Organization. (2009). Infant and young child feeding : model chapter for textbooks for medical students and allied health professionals.

World Health Organization. (2013). World Health Statistics 2013. Geneva: World Health Organization.

World Health Organization. (2014). Baby Friendly Hospital Initiative. Retrieved 01/05/2014, from http://www.who.int/nutrition/topics/bfhi/en/

World Health Organization. (2015). Water Sanitation and Health - Microbial Fact Sheet 11. Retrieved 6/12/2015, from http://www.who.int/water_sanitation_health/dwq/GDW11rev1and2.pdf

Xu, F., Binns, C., Lee, A., Wang, Y., & Xu, B. (2007). Introduction of complementary foods to infants within the first six months postpartum in Xinjiang, PR China. *Asia Pacific Journal of Clinical Nutrition, 16 Suppl 1*, 462-466.

Yen-Ju, H., & McGrath, J. M. (2011). Predicting Breastfeeding Duration Related to Maternal Attitudes in a Taiwanese Sample. *Journal of Perinatal Education, 20*(4), 188-199. doi: 10.1891/1058-1243.20.4.188

Zaghloul, S., Harrison, G. G., Fendley, H. F., Pierce, R., & Morrisey, C. (2004). Correlates of breastfeeding initiation in southeast Arkansas. *Southern Medical Journal, 97*(5), 446-450.

Zimmerman, D. R. (1999). You can make a difference: increasing breastfeeding rates in an inner-city clinic. *Journal of Human Lactation, 15*(3), 217-220.

Appendix 1- RIFS Baseline Survey

Curtin University

Regional Infant Feeding and Parenting Support
Research Project
2010-2012

Mothers' 'In-Hospital' Questionnaire

CURTIN UNIVERSITY

Regional Infant Feeding and Parenting Support Research Project 2010-2012

Please circle numbers corresponding to your responses or complete the spaces as indicated below.

Date your baby was born (DD/MM/YY)	___ ___/___ ___/___ ___	
Sex of baby	Male	1
	Female	2
Baby's given name:	_____	
Birth weight (gm)	___ ___ ___ ___	
Birth length (cm)	___ ___.___	
Gestational age of baby at birth (weeks)	___ ___.___	
Hospital	Geraldton Hospital	1
	St John of God Hospital	2
	Other _____	3
Early discharge program	Yes	1
	No	2
Total number of children (including this baby)		
Your name	_____	
Address	_____	
	_____	
Telephone number	_____	
E-mail address (if applicable)	_____	

Office use only

ID	__ __ __ __
Recruitment date	__ __/__ __/__ __

office use only

SECTION 1

In this section we are interested in finding out about how you are feeding your new baby while in hospital.

1 How are you feeding your baby in hospital?

Exclusively breastfed: *your baby is only receiving breastmilk from you the mother or expressed breastmilk but no other liquids or solids with the exception of drops or syrups containing vitamins, mineral supplements or medicines* .....GO TO Q4 1

Fully breastfed: *your baby is receiving mainly breastmilk but also received other liquids such as water, water-based drinks, oral rehydration fluids, and drops or syrups. Your baby does not receive any artificial milk (e.g. infant formula)* .....GO TO Q4 2

Complementary (mixed) feeds: *your baby is receiving both breastmilk And other fluids such as artificial milk (e.g. infant formula)*GO TO Q3 .. 3 (q1)

Bottle-fed using infant formula: *your baby does not receive any breastmilk at all and is only receiving artificial milk (e.g. infant formula)*..... 4

2a If you are ONLY bottle-feeding with infant formula, did you try to breastfeed your baby?

yes 1 (q2a)

no GO TO Q3 2

2b Why did you change to bottle-feeding?

_____

_____ (q2b.1)

_____

_____ (q2b.2)

3 If you decided to bottle-feed your baby from the start, what were the reasons for this choice? (Please choose **up to five** reasons, and number them from 1 -5, with 1 being the most applicable reason.)

formula is better for the baby..... __ (q3.1)

bottle-feeding is easier..... __ (q3.2)

I don't like breast-feeding ..... __ (q3.3)

I will go back to work soon after the birth ..... __ (q3.4)

breastfeeding will make my breasts sag ..... __ (q3.5)
the baby's father prefers bottle-feeding..... __ (q3.6)
formula is just as good as breast milk ..... __ (q3.7)
the baby's father can help with bottle-feeding ..... __ (q3.8)
I want to know how much milk my baby has at each feed..... __ (q3.9)
I want to continue smoking..... __ (q3.10)
I want to continue drinking alcohol..... __ (q3.11)
I play a lot of sport..... ..... __ (q3.12)
breastfeeding is too embarrassing ..... __ (q3.13)
my mother suggested bottle-feeding..... __ (q3.14)
friend or relative suggested bottle-feeding ..... __ (q3.15)
health worker (e.g. doctor, nurse) suggested bottle-feeding..... __ (q3.16)
other (please specify) _____ [ ][ ] (q3.17)
_____
_____ [ ][ ] (q3.18)

4 When did you **first** decide how you were going to feed your new baby?
before I became pregnant 1
during my pregnancy 2 (q4)
during labour 3
after my baby was born 4

5 Who helped you decide whether you would bottle-feed or breast-feed?
(Please circle **any answers** that apply. You can have more than one answer.)
no one..... 1 (q5.1)
the baby's father 2 (q5.2)
my mother 3 (q5.3)
my mother-in-law..... 4 (q5.4)
friends..... 5 (q5.5)
my doctor 6 (q5.6)
other health professionals e.g., nurse, dietitian 7 (q5.7)
midwife..... 8 (q5.8)
lactation consultant..... 9 (q5.9)
other (please specify)
_____ [ ][ ] (q5.10)
_____ [ ][ ] (q5.11)
_____ [ ][ ] (q5.12)

6 How much of the time have you kept your baby with you in your room?

all during the day and all of the night..... 1
all during the day and part of the night 2 (q6)
all during the day but not overnight..... 3
all during the night and part of the day..... 4
all during the night but not at all during the day 5
part of the day but not all of the day 6
baby has been in the Special Care Nursery all of the time..... 7

7a If your baby is in the nursery at night, what do the nursery staff **mainly** do when the baby gets hungry?

they bring the baby to me to feed 1
the nurse lets me know and I go to the nursery to feed baby..... 2
they give baby a bottle of formula..... 3
they give baby a bottle of my expressed breast milk 4 (q7a)
they give baby a bottle of glucose water 5
they give baby a bottle of plain water 6
my baby is never in the nursery at night..... 7
I don't know..... 8

7b Did the hospital staff ask you for your permission before they fed your baby?

yes 1 (q7b)
no..... 2
they aren't feeding my baby..... 3

8 How often are you feeding your baby?

on demand i.e. feeding whenever baby wants to be fed
(e.g., cries out in hunger) 1
by the clock – about every 2 hours 2
by the clock – about every 3 hours 3 (q8)
by the clock – about every 4 hours 4
other (please explain) _____
_____ (q8.1)

9 Have you been encouraged by hospital staff to 'demand feed'? ('demand feeding' is feeding whenever the baby wants to feed)?

yes 1
no..... 2 (q9)
other..... 3

If other, please explain:_____

10a In general, do you think you have had enough help and information about feeding your baby from hospital staff?

yes GO TO Q11a..... 1
no..... 2 (q10a)

10b What kind of help or information would you have liked?

_____ (q10b.1)
_____ (q10b.2)
_____

11a Hospital staff members sometimes have conflicting ideas and opinions about infant feeding. Do you feel you have been given conflicting advice by different members of this hospital staff about feeding your baby?

yes 1
no GO TO Q11c..... 2 (q11a)

11b If yes, please explain.

_____ (q11b.1)
_____ (q11b.2)
_____

11c How satisfied are you overall with the hospital's advice on feeding your baby?

very satisfied 1
satisfied 2 (q11c)
slightly dissatisfied 3
very dissatisfied..... 4

12 **Since** you have been **in hospital** have you received any of the following from hospital staff? (Please circle **all** that you have received. You can have more than one answer.)

pamphlets or booklets on **breastfeeding** your baby..... 1 (q12.1)
lectures or classes (with or without a demonstration) on **breastfeeding** your baby 2 (q12.2)
video / DVD on how to **breastfeed** your baby 3 (q15.3)
individual consultation, discussion or demonstration with anyof the staff about **breastfeeding** your baby 4 (q12.4)
pamphlets or booklets on **bottle-feeding** your baby..... 5 (q12.5)
lectures or classes (with or without a demonstration) on **bottle-feeding** your baby 6 (q12.6)
video / DVD on how to **bottle-feed** your baby..... 7 (q12.7)
individual consultation, discussion or demonstration with anyof the staff about **bottle-feeding** your baby 8 (q12.8)
pamphlets or booklets on **introducing solids** to your baby..... 9 (q12.9)
lectures or classes (with or without a demonstration) on **introducing solids** to your baby 10 (q12.10)
video / DVD on **introducing solids** to your baby..... 11 (q12.11)
individual consultation, discussion or demonstration with any of the staff about **introducing solids** to your baby 12 (q12.12)
did not receive any information at all 13 (q12.13)
other (please specify) _____ ☐☐ (q12.14)
_____ ☐☐ (q12.15)
_____

13 Did your mother breastfeed any of her children?

yes 1
no..... 2 (q13)
don't know 3

14 Does the baby's father have any preference for how you feed your baby?

yes, he prefers bottle-feeding..... 1
yes, he prefers breastfeeding..... 2
he doesn't mind how I feed my baby..... 3 (q14)
never really discussed the matter with him..... 4

15 Does your mother have any preference for how you feed your baby?

- yes, she prefers bottle-feeding 1
- yes, she prefers breastfeeding 2
- she doesn't mind how I feed my baby 3 (q15)
- never really discussed the matter with her 4

16 How have MOST of your friends fed their babies?

- chose to bottle-feed 1
- chose to breastfeed 2
- chose to breastfeed AND bottle-feed 3 (q16)
- initially chose to breastfeed, but changed to bottle feeding soon after 4
- friends don't have babies 5
- don't know how they fed their babies 6

17 For the next few weeks, how do you think you will feed your baby?

- continue bottle-feeding 1
- continue breastfeeding 2
- continue to combine breast- and bottle-feeding 3 (q17)
- stop breastfeeding and start bottle-feeding 4
- stop bottle-feeding and start breastfeeding 5
- other (please specify)_____ [ ][ ] (q17.1)

_____

18 When do you plan to first give your baby solids?

- before 2 months 1
- at approximately 3 months of age 2
- at approximately 4 months of age 3
- at approximately 5 months of age 4 (q18)
- at approximately 6 months of age 5
- at approximately 7 months of age 6
- after 8 months of age 7
- after 12 months of age 8
- I don't know 9
- other (please specify)_____ [ ][ ] (q18.1)

_____

19 How was your baby delivered?

- vaginal without forceps or suction 1
- vaginal with forceps or suction 2 (q19)
- caesarean 3

20a What was your baby's first feed?

formula 1
breast milk (or colostrum) 2
cow's milk 3 (q20a)
glucose water 4
plain water 5
other (please specify)_____ ☐☐ (q20a.1)
_____

20b Did any member of the hospital staff encourage you to put your baby to the breast right after the birth?

yes 1 (q20b)
no GO TO Q21a 2

21a Has your baby had any health problems, either since the birth or as a result of the birth?

yes 1 (q21a)
no GO TO Q22a 2

21b Has your baby had to see a doctor or health specialist as a result of this health problem?

yes 1 (q21b)
no GO TO Q22a 2

21c How many times has your baby seen the doctor or health specialist?

1 visit 1
2-4 visits 2
more than 4 visits 3 (q21c)

21d What was the reason for the visit/s? (Please choose any answers that apply. You may choose more than one answer)

Constipation 1
Respiratory / chest infection 2
Breastfeeding difficulties 3
Reflux 4
Eye condition (e.g. conjunctivitis) 5
Colic 6
Bottle feeding difficulties 7
Thrush 8
Fever / high temperature 9
Ear infection 10

Diarrhoea 11
Skin condition (e.g. eczema, dermatitis) 12
Vomiting in general 13 (q21d)
Influenza 14 (q21d.1)
Immunisation ..... 15 (q21.1 ☐☐
Other (please specify)_____

22a Has your baby spent any time in a Special Care Nursery?
yes 1
no GO TO Q23a 2 (q22a)

22b How long was your baby in the Special Care Nursery?
baby is still in the nursery 1
less than one day 2
between 1 and 2 days 3
between 3 and 4 days 4 (q22b)
between 5 and 7 days 5
more than 7 days 6

23a Have you breastfed a previous child?
yes 1
no GO TO Q24 ..... 2 (q23a)

23b How long did you breastfeed this child for? (please write your answer in weeks or months below)
_____ (q23b)

SECTION 2

Now we would like to ask you some questions about your pregnancy.

24 How would you describe the timing of this pregnancy?

I was actively trying to become pregnant.....1
I was planning to become pregnant at a later time 2 (q24)
I was not planning to have this child 3

25a Have you ever attended any antenatal classes?

yes, for this pregnancy 1
no GO TO Q25c 2 (q25a)
yes, for a previous pregnancy 3
yes, for this pregnancy and a previous pregnancy.....4

25b Did the antenatal classes include information on how to feed your baby?

yes, for this pregnancy 1
no 2 (q25b)
yes, for a previous pregnancy 3
yes, for this pregnancy and a previous pregnancy.....4

25c **Before coming to hospital** to have your baby did you receive any of the following materials or participate in any of the following activities? (Please circle **all** that apply. You can have more than one answer.)

pamphlets or booklets on **breastfeeding** your baby..... 1 (q25c.1)
lectures or classes (with or without a demonstration) on **breastfeeding** your baby 2 (q25c.2)
video / DVD on how to **breastfeed** your baby 3 (q25c.3)
individual consultation, discussion or demonstration with anyof the staff about **breastfeeding** your baby 4 (q25c.4)
pamphlets or booklets on **bottle-feeding** your baby..... 5 (q25c.5)
lectures or classes (with or without a demonstration) on **bottle-feeding** your baby 6 (q25c.6)
video / DVD on how to **bottle-feed** your baby..... 7 (q25c.7)
individual consultation, discussion or demonstration with anyof the staff about **bottle-feeding** your baby 8 (q25c.8)
pamphlets or booklets on **introducing solids** to your baby..... 9 (q25c.9)
lectures or classes (with or without a demonstration)

on **introducing solids** to your baby 10 (q25c.10)
video / DVD on **introducing solids** to your baby..... 11 (q25c.11)
individual consultation, discussion or demonstration
with any of the staff about **introducing solids** to your baby 12 (q25c.12)
did not receive any information at all 13 (q25c.13)
other (please specify) _____ ☐☐
_____ (q25c.14)
_____ ☐☐ (q25c.15)

26a **BEFORE** you became pregnant, did you smoke cigarettes?
yes 1 (q26a)
no GO TO Q26c 2

26b How many cigarettes did you smoke a day **BEFORE** you became pregnant?
Less than 10 cigarettes per day 1 (q26b)
10 or more cigarettes per day 2

26c **WHILE** you were pregnant, did you smoke cigarettes?
yes 1 (q26c)
no GO TO Q26g 2

26d How many cigarettes did you smoke a day **WHILE** you were pregnant?
Less than 10 cigarettes per day 1 (q26d)
10 or more cigarettes per day 2

26e Did you receive any advice or support about stopping smoking **WHILE** you were pregnant?
yes 1 (q26e)
no 2

26f Who provided advice or support about stopping smoking **WHILE** you were pregnant?
Obstetrician 1 (q26f)
GP 2
Midwife 3
Nurse ..... 4 ☐☐
Other (please specify)_____

26g Did the baby's father smoke **BEFORE** you were pregnant?
yes 1 (q26g)
no 2

26h Did the baby's father smoke **WHILE** you were pregnant?
yes 1 (q26h)
no 2

27a **BEFORE** you became pregnant, did you drink alcoholic drinks at all?
yes 1 (q27a)
no GO TO Q27e 2

27b How many days of the week did you have a drink **BEFORE** you were pregnant?..... _____ (q27b)

27c On those days when you did drink alcohol**BEFORE** you were pregnant, how many standard drinks did you have?(please see the standard drinks diagram)
..... _____ (q27c)

27d What type of alcoholic drink did you mostly drink **BEFORE** you were pregnant?
Champagne 1
Beer 2
Wine 3
Spirits, UDL, pre-mixed drinks 4
"alco-pops" 5
Other (please specify)_____..... (q27d)

27e **WHILE** you were pregnant, did you drink alcoholic drinks at all?
yes 1 (q27e)
no GO TO Q27i 2

27f How many days of the week did you have a drink **WHILE** you were pregnant?..... _____ (q27f)

27g On those days when you did drink alcohol **WHILE** you were pregnant, how many standard drinks did you have?(please see the standard drinks diagram)
..... _____ (q27g)

27h What type of alcoholic drink did you mostly drink **WHILE** you were pregnant?..... (q27h)
Champagne 1
Beer 2
Wine 3

Spirits, UDL, pre-mixed drinks 4
"alco-pops" 5
Other (please specify)_____

27i Does the baby's father drink alcoholic drinks at all?
yes 1 (q27i)
no GO TO Q28 2

27j Did the baby's father drink **BEFORE** you were pregnant?
yes 1 (q27j)
no 2

27k Did the baby's father drink **WHILE** you were pregnant?
yes 1 (q27k)
no 2

28 How much did you weigh when you were 18 years old?
_____ kilograms OR _____ stones & pounds (q28)

29 How much did you weigh **BEFORE** you became pregnant?
_____ kilograms OR _____ stones & pounds (q29)

30 How much weight did you gain during your pregnancy?
_____ kilograms OR _____ stones & pounds (q30)

31 How tall are you?
_____ centimetres OR _____ feet & inches (q31)

32a Just before you became pregnant or during your pregnancy, did you take an **iodine** supplement?
yes 1 (q32a)
no 2

32b Just before you became pregnant, or during your pregnancy, did you consume any food or drinks because they had **iodine** added to them?
yes 1 (q32b)
no 2

33 For each of the following statements, please indicate how much you agree or disagree by circling the number that most closely corresponds to your opinion. The number '1' indicates strong disagreement, whereas '5' indicates strong agreement.

	Strongly disagree				Strongly agree	
a) The nutritional benefits of breast milk last only until the baby is weaned from breast milk	1	2	3	4	5	(q33a)
b) Formula-feeding is more convenient than breast-feeding	1	2	3	4	5	(q33b)
c) Breast-feeding increases mother-infant bonding	1	2	3	4	5	(q33c)
d) Breast milk is lacking in iron	1	2	3	4	5	(q33d)
e) Formula-fed babies are more likely to be overfed than breast-fed babies	1	2	3	4	5	(q33e)
f) Formula-feeding is the better choice if the mother works outside the home	1	2	3	4	5	(q33f)
g) Mothers who formula-feed miss one of the great joys of motherhood	1	2	3	4	5	(q33g)
h) Women should not breast-feed in public places such as restaurants	1	2	3	4	5	(q33h)
i) Babies who are fed breast milk are healthier than babies who are fed formula	1	2	3	4	5	(q33i)
j) Breast-fed babies are more likely to be overfed than formula-fed babies	1	2	3	4	5	(q33j)
k) Fathers feel left out if a mother breast-feeds	1	2	3	4	5	(q33k)
l) Breast milk is the ideal food for babies	1	2	3	4	5	(q33l)
m) Breast milk is more easily digested than formula	1	2	3	4	5	(q33m)
n) Formula is as healthy for an infant as breast milk	1	2	3	4	5	(q33n)
o) Breast-feeding is more convenient than formula-feeding	1	2	3	4	5	(q33o)
p) Breast milk is less expensive than formula	1	2	3	4	5	(q33p)
q) A mother who occasionally drinks alcohol should not breast-feed her baby	1	2	3	4	5	(q33q)

34 Are you currently breastfeeding at all?

yes 1 (q34)

no GO TO Q50 2

SECTION 3

The following questions are for mothers who are breastfeeding. If you are not breastfeeding at all, please go to Section 4 which starts with question 50 on page 21.

35 How long after the birth was it before you put your new baby to the breast?

immediately after birth, cord still attached 1
within 15 minutes 2
between 15 and 30 minutes 3 (q35)
within a few hours..... 4
the next day 5
baby was given a bottle instead..... 6
other (please specify) _____ ☐☐ (q35.1)
_____

36 How long was it before your milk came in?

within one day of the birth..... 1
the second day after the birth..... 2
the third day after the birth 3 (q36)
still waiting for milk to come in 4
other (please specify)_____ ☐☐ (q36.1)
_____

37 How much information about breast-feeding were you given by the hospital staff?

none or very little 1
some, but I would have liked more 2
enough 3 (q37)
more than I wanted 4
didn't need any information..... 5

38 Did any staff member check how your baby's mouth was attached to your breast when you first started feeding?

yes 1
no..... 2 (q38)
didn't need to be checked 3

39 Did any staff member teach you how to position and attach your baby to the breast?

yes 1
no..... 2 (q39)
I didn't need to be taught 3

40 Why did you decide to breast-feed? (Please choose **up to five reasons and number them 1-5, with 1 being the most applicable**.)

the baby's father wanted me to breast-feed ..... __ (q40.1)
breast milk is better for the baby..... __ (q40.2)
breast-feeding is the right thing to do ..... __ (q40.3)
breast-feeding is cheaper..... __ (q40.4)
breast-fed babies are more intelligent..... __ (q40.5)
breast-feeding helps you lose weight ..... __ (q40.6)
breast-feeding is fashionable ..... __ (q40.7)
my mother advised me to breast-feed..... __ (q40.8)
breast-feeding helps prevent allergies..... __ (q40.9)
other people advised me to breast-feed..... __ (q40.10)
breast-feeding is more convenient ..... __ (q40.11)
breast-fed infants have fewer infections ..... __ (q40.12)
breast-feeding is natural ..... __ (q40.13)
breast-feeding promotes mother-infant bonding..... __ (q40.14)
other (please specify)_____
_____ [ ][ ] (q40.15)

41 At what age do you plan to stop breast-feeding your baby **COMPLETELY**?

before baby is 6 weeks old..... 1
between 6 weeks and 2 months 2
between 2 and 3 months 3
between 4 and 5months 4
between 5 and 6 months 5
between 6 and 7 months 6 (q41)
between 7 and 10 months 7
between 10 and 12 months 8
over 12 months 9
other (please specify)_____ [ ][ ] (q41.1)

42a Are you planning to start giving your baby formula-feeds?

yes..... 1
no GO TO Q43..... 2 (q42a)
I have already started my baby on formula GO TO Q43 3

42b At what age do you plan to start giving your baby formula-feeds?

before baby is 6 weeks old 1
between 6 weeks and 2 months 2
between 2 and 3 months 3
between 4 and 5months 4
between 5 and 6 months 5
between 6 and 7 months 6 (q42b)
between 7 and 10 months 7
between 10 and 12 months 8
over 12 months 9
other (please specify)_____ [ ][ ] (q42b.1)

43 Have you experienced any of the following since you started breast-feeding? (Please circle **any answers** that apply. You can have more than one answer.)

No problems experienced 1 (q43.1)
Cracked or sore nipples 2 (q43.2)
baby gets too much milk 3 (q43.3)
baby gets milk too fast 4 (q43.4)
takes a long time before milk starts flowing at start of feed 5 (q43.5)
baby too tired to feed / doesn't wake up for feeds 6 (q43.6)
difficulty expressing milk 7 (q43.7)
baby losing or not gaining enough weight 8 (q43.8)
baby has problems sucking 9 (q43.9)
breasts engorged (too full) 10 (q43.10)
mastitis 11 (q43.11)
baby not getting enough milk 12 (q43.12)
feeling that I'm not doing very well at breast-feeding 13 (q43.13)
trouble positioning and/or attaching the baby to the breast 14 (q43.14)
not enough milk / colostrum 15 (q43.15)
other (please specify) _____ [ ][ ] (q43.16)
_____ [ ][ ] (q43.17)
_____

44a Has any member of the hospital staff given you the name of anyone to contact if you have problems with breast-feeding after you leave hospital?

yes 1
no GO TO Q45 ..... 2 (q44a)

44b Who were you told to contact?

(Please circle **any answers** that apply. You can have more than one answer.)

doctor	1	(q44b.1)
clinic nurse/child health nurse / community health nurse	2	(q44b.2)
lactation consultant	3	(q44b.3)
Australian Breastfeeding Assoc. (Nursing Mothers Assoc.)	4	(q44b.4)
dietitian	5	(q44b.5)
hospital midwife	6	(q44b.6)
other (please specify)_____		
_____		(q44b.7)
_____		(q44b.8)

For the following questions, there are no right or wrong answers. Please circle the response that you first think of. For example, in question 48, if you feel very confident in breast-feeding, circle 5. If you don't feel confident, circle 1. If you fall somewhere in-between please circle the appropriate number between 1 and 5. If it is too early to tell, please circle 9.

45 How would you rate your confidence in breast-feeding?

not confident				*very confident*	*too early to tell*	
1	2	3	4	5	9	(q45)

46 How enjoyable do you find breast-feeding?

not enjoyable				*very enjoyable*	*too early to tell*	
1	2	3	4	5	9	(q46)

47 How satisfied are you with your breast-feeding experience?

not satisfied				*very satisfied*	*too early to tell*	
1	2	3	4	5	9	(q47)

48 In general, how comfortable do you feel while breast-feeding in front of other people?

not comfortable				*very comfortable*	*too early to tell*	
1	2	3	4	5	9	(q48)

49 Have any of the following people supported or encouraged you with breast-feeding? (Please circle **any answers** that apply. You can have more than one answer.)

your friends 1		(q49.1)
the baby's father 2		(q49.2)
your mother..... 3		(q49.3)
your mother-in-law 4		(q49.4)
other members of your family 5	☐☐	(q49.5)
please specify_____.....		
your clinic sister..... 6		(q49.6)
your doctor..... 7		(q49.7)
Australian Breastfeeding Assoc. (Nursing Mothers Assoc.)..... 8		(q49.8)
home-visiting midwife..... 9		(q49.9)
hospital midwife..... 10		(q49.10)
other (please specify)_____		
_____	☐☐	(q49.11)
_____		
_____	☐☐	(q49.12)

SECTION 5 .....

The following information about you will help us to analyse our data. We recognise that some of the questions are very personal. Please remember that your responses will remain strictly confidential.

53 What is your postcode? ☐☐☐☐ (q53)

If you don't know the postcode, what suburb do you live in?

. ..... _____

54 What is your age (years)?

. ..... _____ (q54)

55 What is the highest level of education you have completed?

left school before year 10 1
junior/achievement certificate/year 10 or equivalent 2
TEE/TAE/leaving (year 12 or equivalent) 3
trade, diploma or TAFE course e.g., hairdressing, secretarial..... 4 (q55)
bachelor degree or higher..... 5
other (please specify)_____
_____ ☐☐ (q55.1)

56 How many years of schooling have you completed?

. ... _____ (q56)

57 Were you employed outside the home or studying in the past 6 months?

no..... 1
yes, full-time employed..... 2
yes, part-time employed..... 3
yes, full-time student 4 (q57)
yes, part-time student..... 5

58 What is your occupation? (If currently unemployed, please give your occupation or job title prior to leaving the workforce. If you were self-employed, please give your occupation or job title e.g. hairdresser.)

. ... _____ ☐☐ (q58)

59 What do you plan to do in the next 6 months?

will still be at home with the baby 1
work full-time 2
work part-time 3
study full-time 4 (q59)
study part-time 5
work/study part-time or full-time from home 6
undecided 7

60 What is your marital status?

never married 1
married 2
defacto 3 (q60)
divorced or separated 4
widowed 5

61 What is your partner's occupation? (If your partner is self-employed, please give his occupation or job title e.g. plumber, electrician. If your partner is currently unemployed, please give your partner's occupation when he is working.)

. ... _____ (q61)

62a In what country were you born?

. ... _____ (q62a)

62b If not born in Australia, how many years have you lived in Australia?

. ... _____ (q62b)

63 Are you of Aboriginal and/or Torres Strait Islander descent?

no 1
yes, Aboriginal descent 2
yes, Torres Strait Islander descent 3 (q63)

64 What type of health insurance do you have?

public (Medicare) 1
private 2 (q64)

65a Approximately, what was your total family income for the past 12 months?

less than $18,200 1
$18,200 to 25,999 2
$26,000 to $33,799 3
$33,800 to $41,599 ..... 4 (q65a)
$41,600 to $51,999 5
$52,000 to $62,399 6
$62,400 to $72,799 7
$72,800 to $88,399 8
$88,400 to $103,999 9
$104,000 to $129,999 10
$130,000 or more..... 11

65b Are you on paid maternity leave from paid employment?

yes 1 (q65b)
please specify the number of weeks of paid leave_____ [ ][ ] (q65b.1)
no..... 2

66 Finally, how many days old was your baby when you completed this questionnaire? [ ][ ] days (q66)

67 Today's date (DD/MM/YY) when you completed this questionnaire:... (q67)
__ __/ __ __/ __ __

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Now that your questionnaire is complete please place it in the box in the Ward office or you can mail it directly in the envelope that was provided.

Appendix 2 – RIFS Follow-up Survey

Curtin University

healthway

MOTHER'S NAME:

BABY'S NAME:

PHONE NUMBER:

Married / Defacto / Single (circle)

Other children:

Address:

Preferred time/s to call:

Dates away:

Curtin University: Regional Infant Feeding and Parenting Support Project (RIFPS)
2010-2012

IDENTIFICATION CODE ☐☐☐

DURATION (WEEKS) ☐☐

COMPLETED STUDY ☐
OR
LOST TO FOLLOW-UP AFTER _____ WK INTERVIEW
☐ (cf)

	A 4 weeks	B 10 weeks	C 16 weeks	D 26 weeks	E 32 weeks	F 40 weeks	G 52 weeks
Date interview due							
Date interview completed							
Dates/times tried							
Notes							
Age of baby (weeks and days)							

1a. **How are you feeding your baby?**……..
1 = breast-feeding exclusively; **2** = breast-feeding fully (with occasional water and juice); **3** = combination of breast-feeding and formula-feeding GO TO Q2; **4**= formula-feeding only GO TO Q2; **5** = other GO TO Q2

other responses:……

A	B	C	D	E	F	G
☐	☐	☐	☐	☐	☐	☐
☐☐	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐

A _____

B _____

C _____

D _____

E _____

F _____

G _____

Other possibilities may include:
- cow's milk only/infant formula & cow's milk/breast-feeding & cow's milk
- solids & breast-feeding with or without cow's milk
- infant formula with or without cow's milk

Check the use of other 'milks' such as soy, rice etc.

IF MOTHER HAS STOPPED BREAST-FEEDING SINCE LAST INTERVIEW ENSURE BREAST-FEEDING TERMINATION QUESTIONS ARE COMPLETED AT THE END OF THE QUESTIONNAIRE

1b. **Have you changed your feeding method or given your baby any formula or other drinks or foods since his/her birth (or when we last spoke)?**

……

1 = yes; introduced formula; 2 = yes; introduced solids
3 = no; still feeding baby as before 4 = other

A	B	C	D	E	F	G

other responses:……

A _____
B _____
C _____
D _____
E _____
F _____
G _____

GO TO Q3a IF FEEDING METHOD HAS NOT CHANGED SINCE LAST INTERVIEW

2a. **Why did you change feeding methods?**……

A	B	C	D	E	F	G

A _____
B _____
C _____
D _____
E _____
F _____
G _____

2b. How old was your baby when you made this change? (weeks and / or days)……

A	B	C	D	E	F	G

A _____
B _____
C _____
D _____
E _____
F _____
G _____

GO TO Q6a IF NOT BR/FEEDG AT LAST I/V

3a. **Have you had any difficulties with breast-feeding since I spoke to you last (or you left hospital), so things like; - problems with your breasts or problems with the baby feeding?**

1= not BF GO TO 6a; 2 = yes; 3 = no GO TO Q6a……

3b **What difficulties experienced?** (unprompted, but probe for more than one answer)

Problems with breasts.....

1 = cracked or sore nipples; **2** = breasts engorged (too full); **3** = mastitis or breast infection; **4** = inverted nipples; **5** = breast-feeding is painful

Problems with baby feeding.....

6 = baby not gaining enough weight; **7** = baby has problems latching on; **8** = baby has difficulties sucking; **9** = baby gets too much milk or too fast; **10** = poor 'let-down'; 11 = baby refuses to breast-feed; **12** = baby too tired to feed i.e. falls asleep at breast; **13** = feeling that I'm not doing very well at breast-feeding; **14** = not enough milk for baby; **14** = others

Any others?

other responses:.....

A	B	C	D	E	F	G

A _____ E _____

B _____ F _____

C _____ G _____

D _____

Q4 – ASK AT THE 4 WEEK I/V ONLY.

4a. **Did you expect to have difficulties establishing breast-feeding?** 1 = yes; **2** = no.....

4b. **How easy did you think it would be to establish breastfeeding on a scale of 1 to 5 where 1 equals very easy and 5 equals very hard?**.....

4c. **In reality how easy has it been for you to establish breastfeeding on a scale of 1 to 5 where 1 equals very easy and 5 equals very hard?**.....

A				
very easy 1	2	3	4	very hard 5
very easy 1	2	3	4	very hard 5

5. **Have you asked for advice or help from anyone about your breast-feeding problem(s)?**.....

1 = no – GO TO Q24b; **2** = yes, doctor; **3** = yes, child health nurse; **4** = yes, hospital midwife;
5 = yes, friend/s; **6** = yes, mother; **7** = yes, other family member; **8** = yes, ABA / BF helpline (NMA)
9 = yes, pharmacist/chemist; **10** = yes, pharmacy assistant; 11 = yes, lactation consultant;
12 = yes, alternative practitioner; **13** = yes, health helpline/hotline (i.e. Health Direct / HBF);
14 = yes, other responses

other responses:.....

A	B	C	D	E	F	G

A _____ E _____

B _____ F _____

C _____ G _____

D _____

6a. **In general, do you feel you have had enough help and advice about feeding since you left hospital (or since we last spoke)?**.....

1 = yes - needed help and got it GO TO Q7;

2 = no - needed help but not available/or insufficient help GO TO Q6b; **3** = haven't needed any help GO TO Q7

6b. **What kind of help would you have liked?**

other types of help:.....

A

B

7a. **Have you had any general follow-up (e.g. baby's progress, or your post-delivery health) to see how you're going since leaving hospital/or since last time we spoke?**.....

1 = yes; **2** = no GO TO Q8

		C	D	E	F	G

7b. **Please specify the follow-up**

type of follow-up:.....

A	B	C	D	E	F	G

A

B

C

D

E

F

G

8a. **Have different people given you conflicting advice about feeding since we last spoke (or since you left hospital)?** 1 = yes; **2** = no GO TO Q9.....

8b. **Please explain - what type of conflicting advice have you been given?**.....

types of conflicting advice:

A

B

C

D

E

F

G

			C	D	E	F	G
9a. **Have you had any follow-up to see how you're going with feeding _____ since leaving hospital/or since last time we spoke?**…… 1 = yes; **2** = no GO TO Q10	☐	☐	☐	☐	☐	☐	☐
9b. **Please specify the type of follow-up.** 1 = CHN visited at home; **2**= took baby to child health clinic; **3** = took baby to GP; **4** = Midwife visited at home; **5** = lactation consultant; **6** = ABA; **7** = visited CHN at chemist; **8** = other (please specify)	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

A _____
B _____
C _____
D _____
E _____
F _____
G _____

	A ONLY						
10. **When you are introducing your baby to new foods and fluids over the next 12 months, the likely order that you will give these in is….** 1 = before breast/bottle feed; 2 = after breast/bottle feed; 3= not sure	☐						

A _____
B _____
C _____
D _____

E _____
F _____
G _____

11a. **Since we last spoke** (or **you left hospital**), **has your baby had any drinks other than breast milk or formula**? 1 = yes; **2** = no, GO TO Q12a……	☐	☐	☐	☐	☐	☐	☐
	A	B	C	D	E	F	G
11b. **What type of drink has your baby had?**…… 1 = cow's milk; **2** = plain tap, filtered or mineral water; **3** = fruit juice, fruit juice drink; **4** = ribena; **5** = cordial; **6** = softdrinks; **7** = herbal tea; **8** = other responses other responses:……	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐	☐☐ ☐☐ ☐☐ ☐☐ ☐☐

A _____
B _____
C _____
D _____
E _____
F _____
G _____

	A	B	C	D	E	F	G
GO TO Q11d IF NOT HAVING COW'S MILK 11c. **If baby is having cow's milk, is it**…… 1 = whole milk/full cream; **2** = semi-skimmed/2% fat/hilo; **3** = skimmed; **4** = other responses other responses:……	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐	☐☐ ☐☐

A
B
C
D
E
F
G

11d. **Do you give your baby drinks mainly** (may have more than one reason)..... 1 = because s/he is thirsty; **2** = to help his/her colic/wind; **3** = to give him/her extra vitamins; **4** = to help his/her constipation; **5** = to settle him/her; **6** = other reasons

other reasons:.....

A
B
C
D
E
F
G

NEXT FOUR QUESTIONS ARE NOT TO BE ASKED AGAIN ONCE THE BABY HAS STARTED ON SOLIDS

	A	B	C	D	E	F	G
12a. **Since we last spoke (or you left hospital) have you given your baby any solid foods**? 1 = yes; **2** = no GO TO Q13.....							
12b. **How old was your baby when you first tried him/her on solids**? (weeks and days).....							
12c. **Why did you start your baby on solids at this time**? (Do not prompt but may have more than one response) 1 = baby was hungry/wasn't satisfied with breast milk or formula; **2** = baby was old enough to have solids; **3** = baby reaching out for food; **4** = to help baby sleep through the night; **5** = advised to start by child health nurse; **6** = advised to start solids by GP/specialist; **7** = advised to start by mother/mother in-law; **8** = other reason for starting solids							

other reasons:.....

A
B
C
D
E
F
G

12d. **What was the first solid food that you gave your baby?**……

A	B	C	D	E	F	G

A _____ E _____
B _____ F _____
C _____ G _____
D _____

13a. **Is your baby using any of the following?** (main type only) 1 = dummy; **2** = bottle; **3** = feeding spoon; **4** = feeding cup; **5** = none of the above

A	B	C	D	E	F	G

ASK Q14 ONLY ONCE

14. **How would you describe a healthy baby? (you can have more than one answer)** (unprompted)……
1 = chubby; **2** = happy/smiling/contented; **3** = sleeps well; **4** = feeds well; **5** = settles well after feeding; **6** = alert; **7** = energetic; **8** = growing/gaining wt/ good wt; **7** = good skin colour/clear skin/rosy cheeks; **8** = not grizzly/ crying too much; **9** = good no. of wet/dirty nappies; **10** = bright clear eyes
other descriptions :……

A

15. **Has your baby experienced any health problems since I spoke to you last** (or **since leaving hospital**)?
1 = yes; **2** = no GO TO Q19……

16. **What type of problems?** ……
1 = constipation; **2** = respiratory / chest infection; **3** = Breastfeeding difficulties; **4** = Reflux; **5** = Eye cond. (e.g. conjunctivitis); **6** = colic; **7** = Bottle feeding difficulties **8** = Thrush; **9** = Fever / high temperature; **10** = Ear infection **11** = Diarrhoea; **12** = Skin condition (e.g. eczema, dermatitis) **13** = Vomiting in general; **14** = Influenza; **15** = Immunisation **16** = other (please specify)

A	B	C	D	E	F	G

other problems:……

A _____
B _____
C _____
D _____
E _____
F _____
G _____

17a **Did you take your baby to see anyone about this problem?** 1 = yes; **2** = no GO TO Q19……

17b. **How many times did your child visit the doctor / health specialist?**……

1 = 1 visit; **2** = 2-4 visits; **3** = 4 or more

other responses:……

A _____
B _____
C _____
D _____
E _____
F _____
G _____

18. **Was your child admitted for this problem?**
1 = yes; **2** = no……

19. **How many colds has your child had in the past (month, year, or since we last spoke)?**……

20. **Has anyone (ever) told you that your child has an allergy?** 1 = yes; **2** = no……
If yes, specify who……

21. **Has anyone (ever) told you that your child has asthma?** 1 = yes; **2** = no ……
If yes, specify who……

A _____
B _____
C _____
D _____
E _____
F _____
G _____

22. **How would you rate the overall health of your child?**
1 = excellent (nearly always well); **2** = good (mostly well) **3** = OK, could be better; **4**= so-so (he/she is ill as often as he/she is well); **5** = poor (seldom well)……

23a. **Have you returned to work or study since we last spoke (or you left hospital)?**
1 = no GO TO Q24; **2** = yes, full-time work or study; **3** = yes, part-time work or study……

23b. **How many hours a week are you away from home working and/or studying?**……

23c. **How many of these hours were in paid employment in the last week?**……

23d. **Does your work/study involve shift work** (i.e. **evening or weekend hours)?** 1 = yes; **2** = no……

23e. **What do you do about childcare for your baby while you're at work?**
1 = my relatives take care of the baby; **2** = my friends help to take care of the baby; **3** = the baby's father takes care of the baby; **4** = I use paid childcare; **5** = I work from home
If relatives, specify who:……

23f. **What support does your employer provide to mothers to help them continue breastfeeding?**……

1 = fulltime parental leave

2 = periodic leave over the work day to breast-feed
3 = there are facilities at work for feeding the baby
a) specify facilities……

	A	B	C	D	E	F	G
23d							
23e							
23f							

A _____ E _____
B _____ F _____
C _____ G _____
D _____

4 = promotes breast-feeding in the workplace
specify how:……

other responses for employer support:……
A _____
B _____
C _____
D _____
E _____
F _____
G _____

PROMPT FOR EACH OPTION IF THERE HASN'T BEEN A 'YES' PREVIOUSLY

24. **Are you aware of any of the following facilities or activities in your community since last time we spoke or since leaving hospital?**

	A	B	C	D	E	F	G
a) feeding rooms for mothers…… 1 = yes; **2** = no							
b) promotion of breast-feeding…… 1 = yes; **2** = no							
c) promotion of formula feeding…… 1 = yes; **2** = no							
d) other organised infant feeding support activities.. 1 = yes; **2** = no							
25a. **Have YOU** (the mother) **experienced any health problems since I spoke to you last** (or **since leaving hospital**)? 1 = yes; **2** = no GO TO Q26……							

	A	B	C	D	E	F	G
25b. **What type of problems?**……							

type of problems:

A _____

B _____

C _____

D _____

E _____

F _____

G _____

	A	B	C	D	E	F	G
25c. **Did you see anyone about this problem?**…… 1 = no; **2** = yes, local GP; **3** = yes, gynaecologist/ obstetrician; **4** = midwife; **5** = other responses other responses:……							

A _____ E _____

B _____ F _____

C _____ G _____

D _____

	A	B	C	D	E	F	G
26. **Have you experienced any major changes in your life since I spoke to you last (or since leaving hospital)?** 1 = no; **2**= yes, moved house; **3** = yes, death in the family; **4** = yes, divorce, separation; **5** = yes, sickness in the family; **6** = other (major change) other major changes:……							
27. **On average, how many hours of sleep in a day (24 hours) are you having (including naps)?**……							
28. **What is your current weight – i.e. within the last 2 weeks (in kg)**……							
29a. **Are you currently taking a birth control pill?** 1 =yes; **2** = no GO TO Q30……							
29b. **Which pill are you on?** 1 =regular pill; **2** = mini-pill……							

A _____
B _____
C _____
D _____
E _____
F _____
G _____

	A	B	C	D	E	F	G
30. **Are you taking any vitamin and or mineral supplements at the moment?** i.e. **within the last 2 weeks.** 1 = yes; **2** = no							
If yes, specify general type:……							

A _____
B _____
C _____
D _____
E _____
F _____
G _____

	A	B	C	D	E	F	G
31a. **Are you smoking at the moment?** 1 = yes; **2** = no GO TO Q31c;							
31b. **How many cigarettes do you smoke per day on average?** 1 = less than 5; **2** = 5 to 9; **3** = 10 to 19; **4** = 20 to 30; **5** = more than 30……							
31c. **Does anyone else who lives in your household smoke?** 1 = yes; **2** = no GO TO 32a……							
31d. **Who?** 1 = baby's father; **2** = other person……							
32a. **Do you drink alcoholic drinks at present?** …… 1 = yes; **2** = no GO TO Q33a……							
32b. **How many days would you drink alcohol in average week?**……							

32c. **When during the day do you have a drink?**.....
1 = just before feeding the baby; **2** = just after feeding the baby; **3** = in-between feeds; **4** = at no particular time; **5** = just before or with the evening meal; **6** = just before/with evening meal timed to coincide with feeding baby

32d. **On the days that you drink alcohol, how many standard drinks do you have ?** (read out standard drink equivalents).....

32e. **What type of alcoholic drink do you drink mostly?** .....

A _____ E _____
B _____ F _____
C _____ G _____
D _____

	A	B	C	D	E	F	G
33a. **How much does your baby weigh? (grams)**							
33b. **When was that weight taken?** Date: (DD/MM)...							
34a. **How long is your baby? (cms)**.....							
34b. **When was that length taken?** Date: (DD/MM)...							

35. **How do you feel about your baby's weight change since birth/ or since we last interviewed you?** (Read out options).....
1 = very satisfied; **2** = satisfied **3** =a little concerned; **4** = very worried or concerned; **5** = don't know

36. **How would you describe your baby's temperament?** (open ended).....
1 = placid/easy going; **2** =slightly irritable but mostly easy going; **3** = irritable/fussy very regularly; **4** = very irritable and fussy most of the time; **5** = don't know;

37. **In general, what effect do you think breast-feeding has on a woman's weight?**.....
1 = no effect; **2** = helps reduce weight; **3** = keeps the weight on; **4** = don't know/not sure

38. **In general, what effect do you think breast-feeding has on the shape or size of a woman's breasts after she has stopped feeding?**.....
1 = it doesn't make any difference; **2** = it causes breasts to sag ; **3** = makes them smaller; **4** = makes them bigger; **5** = don't know/not sure

	A	B	C	D	E	F	G
35.							
36.							
37.							
38.							

AT FOUR WEEKS ONLY I'm going to read out a few statements which are related to breast-feeding. Please just answer true, false or don't know. It really doesn't matter if you don't know.

39. Babies naturally know how to breast-feed correctly 1 = true; 2 = false; 3 = don't know……	☐
40. Formula-fed babies sleep longer at night 1 = true; 2 = false; 3 = don't know……	☐
41. Feeding more often increases breast-milk supply 1 = true; 2 = false; 3 = don't know……	☐
42. Babies need to feed more when they are having a growth spurt 1 = true; 2 = false; 3 = don't know……	☐
43. There are lots of women who need to give their babies formula because they can't make enough milk 1 = true; 2 = false; 3 = don't know……	☐
44. Birth control pills can reduce milk supply …… 1 = true; 2 = false; 3 = mini pill won't but normal pill will; 4 = don't know	☐
45. Getting extra rest and relaxation is necessary to ensure a good milk supply 1 = true; 2 = false; 3 = don't know……	A ☐
46. Feeding formula to a one month old baby will not reduce the amount of milk produced by the mother 1 = true; 2 = false; 3 = don't know……	☐

	A	B	C	D	E	F	G
47. How are you feeding your baby? 1 = any breastfeeding (exclusive, fully or complimentary) +/- solids 2 = bottle-feeding (infant formula) only +/- solids	☐	☐	☐	☐	☐	☐	☐

EXCLUSIVELY FORMULA-FEEDING MOTHERS FINISH HERE – GO TO TERMINATION OF B'FEEDING QTNS (Q 82+) IF HAD STOPPED B'FEEDING SINCE LAST INTERVIEW OR LEAVING HOSPITAL

BREAST-FEEDING MOTHERS ONLY FROM THIS POINT ONWARDS

The following questions are on your feelings about breast-feeding, so there are no right or wrong answers. For example, the first question is 'How would you rate your confidence in breast-feeding?' If you can imagine a ruler with five points on it, at one end of the ruler is 'not confident' and at the other end of the ruler is five which is 'very confident'. Can you give me a number from one to five after I read out the following questions?

	A	B	C	D	E	F	G
48. How would you rate your confidence in breast-feeding? 1 = not at all confident…2..3..4..5 = very confident……	☐	☐	☐	☐	☐	☐	☐
49. How enjoyable do you find breast-feeding?…… 1 = not at all enjoyable..2..3..4..5 = very enjoyable	☐	☐	☐	☐	☐	☐	☐
50. How satisfied are you with your breast-feeding experience?…… 1 = not at all satisfied..2..3..4..5 = very satisfied	☐	☐	☐	☐	☐	☐	☐

	A	B
51. **In general, how comfortable would you or do you feel while breast-feeding in front of other people**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
52. **In general, how comfortable would you or do you feel while breast-feeding in front of female friends**?…… 1 = not very comfortable..2..3..4..5 = very comfortable……	☐	☐
53. **In general, how comfortable would you or do you feel while breast-feeding in front of female relatives** e.g., mother, sister?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
54. **In general, how comfortable would you or do you feel while breast-feeding in front of male friends**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
55. **In general, how comfortable would you or do you feel while breast-feeding in front of male relatives** e.g., father, brother?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐

	A	B
56. **In general, how comfortable would you or do you feel while breast-feeding in someone else's house**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
57. **In general, how comfortable would you or do you feel while breast-feeding on public transport**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
58. **In general, how comfortable would you or do you feel while breast-feeding in a public eating place**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
59. **In general, how comfortable would you or do you feel while breast-feeding in a public place such as a park or the beach**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐
60a. **In general, how comfortable would you or do you feel while breast-feeding in a public place such as Hay Street Mall**?…… 1 = not very comfortable..2..3..4..5 = very comfortable	☐	☐

	A	B	C	D	E	F	G
60b. **Apart from when you were in hospital, have you ever tried to breast-feed your baby in a public place?** 1 = yes; 2 = no GO TO QUESTION 70d……	☐						
60c. **When you have breast-fed in public do you** (choose one only) ... 1 = prefer a mother and baby room; 2 = prefer to breast-feed without going to a special place; 3 = no preference……	☐						
60d. **Have you ever had problems finding somewhere to feed your baby when you were out in public places?** 1 =yes; 2 = no……	☐	☐	☐	☐	☐	☐	☐

TERMINATION OF BREAST-FEEDING ONLY

	T
61. **How old was _____ when you stopped breast-feeding**? Convert to weeks _____ ……	☐☐
62. **Why did you decide to stop breast- feeding**? (list 1 – 5, 1 = most applicable) *prolonged breast-feeding reasons*…… 1 = baby old enough to not be breast-fed; 2 = baby weaned itself; 3 = breastfed long enough to give the baby a good start	☐☐ ☐☐
problems/pain…… 1 = breast-feeding too painful; 2 = cracked or bleeding nipples; 3 = breast engorgement; 4 = breast infection/mastitis; 5 = inverted nipples; 6 = problem with nursing technique (ie baby not latching on)	☐☐ ☐☐
maternal psychological…… 1 = mother anxious or unsure about breast-feeding; 2 = breast-feeding requires too much motivation; 3 = breast-feeding too difficult; 4 = breast-feeding too inconvenient; 5 = mother has been under stress; 6 = mother too tired; 7 = dislike breast-feeding; 8 = concern about how breast-feeding will affect your figure	☐☐ ☐☐

insufficient milk/ other baby factors.....

1 = can't tell how much baby is drinking; **2** = my milk isn't good enough; **3** = not enough milk; **4** = baby not gaining enough weight; **5** = baby no longer interested in the breast; **6** = baby biting nipples; **7** =baby prefers a bottle; **8** = baby ready for solids; **9** =baby ill

other maternal factors.....

1 = mother ill; **2** = use of prescription medication; **3** = wanted to go onto oral contraceptive; **4** = return to work or study

paternal factors.....

1 = baby's father preferred formula-feeding; **2** = baby's father can help with formula-feeding; **3** = other responses

other reasons for deciding to stop breast-feeding:.....

A_____ E_____

B_____ F_____

C_____ G_____

D_____

63. Did anyone advise you to stop breast-feeding?.....

1 = no; **2** = yes, child health nurse; **3** = yes, local doctor; **5** = specialist; **6** = lactation consultant; **7** = ABA (Nursing Mothers Assoc); **8** = friend; **9** =mother; **10** = midwife specify (hospital/community); 11 = pharmacist/chemist; **12** = alternative health practitioner

specify specialist:.....

specify alternative practitioner:.....

specify midwife (hospital/community).....

other responses:.....

A_____ E_____

B_____ F_____

C_____ G_____

D_____

64a. **Did you plan to stop breast-feeding now (that is when you did)**? 1 = yes; **2** = no.....

64b. **Were you disappointed at not breast-feeding for longer**? 1 = yes; **2** = no

.....

64c. **Do you feel guilty for not breast-feeding for longer**? 1 = yes; **2** = no.....

64d. **Have other people made you feel guilty for not breast-feeding for longer**? 1 = yes; **2** = no.....

65a. **Would you breastfeed another child if you had another baby**? 1 = yes; **2** = yes, if I could; **3** = no GO TO Q65c.....

65b. **Why would you breastfeed another child**? (3 top reasons, prioritised).....

1 = better for baby; **2** = better for mother; **3** = more contented baby; **4** = natural; **5** = closer relationship with baby; **6** = convenience; **7** = enjoyment/satisfaction of mother; **8** = other responses (why would breast-feed another child) GO TO Q87

other responses:.....

A_____ E_____

B_____ F_____

C_____ G_____

D_____

65c. **Why wouldn't you breastfeed another child**? (3 top reasons, prioritised).....

1 = inconvenient; **2** = lack of enjoyment/satisfaction of mother; **3** = tied to the house; **4** = embarrassment; **5** = too emotionally taxing for mother; **6** = formula is just as good; **7** = baby's father feels left out; **8** = other

other responses:.....

A_____ E_____

B_____ F_____

C_____ G_____

D_____

65d. **Would your partner like you to breastfeed another child?** 1= yes; 2 = no; 3 = unsure

66. **Would you encourage a friend to breastfeed?**.....

1 = yes, definitely; **2** = yes, probably; **3** = perhaps GO TO QUESTION 67; **4** =if she wants to GO TO QUESTION 67; **5** = no GO TO QUESTION 67; **6** = other responses

other responses:.....

A_____ E_____

B_____ F_____

C_____ G_____

D_____

T

The following questions are on your feelings about breast-feeding. So there are no right or wrong answers.

On a scale of 1 to 5 where 1 equals "not very successful" and 5 equals "very successful", how successful would you say your breast-feeding experience has been?

67. **How would you describe your breast-feeding experience?** 1 = not very successful **2..3..4..5** = very successful .....

68. **How enjoyable did you find breast-feeding?** 1 = not very enjoyable **2..3..4..5** = very enjoyable.....

On a scale of 1 to 6 where 1 equals "not satisfied" and 6 equals "uncertain", how satisfied would you say you have been with your breast-feeding experience?

69. **How satisfied are you with you breast-feeding experience?** 1 = not very satisfied **2..3..4..5** = very satisfied..**6** = uncertain.....

On a scale of 1 to 5 where 1 equals 'strongly disagree' and 5 equals 'strongly agree', how much do you agree with each of the following statements?

70. **Community attitudes in Australia encourage breast-feeding** 1 = strongly disagree **2..3..4..5** = strongly agree.....

71. **Australians in general approve of mothers breast-feeding in public** 1 = strongly disagree **2..3..4..5** = strongly agree.....

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Appendix 3 – RIFS Participant Information and Consent Form

IMPORTANT – PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

Curtin University

healthway

STUDY OF INFANT FEEDING PRACTICES IN REGIONAL WESTERN AUSTRALIA
(Rural Infant Feeding and Parenting Support Project- RIFPS)

Congratulations on the birth of your new baby! We would really like to know a bit more about how you are feeding your baby and invite you to take part in a study looking at infant feeding practices in regional Western Australia.

What is the study?
The School of Public Health at Curtin University is studying how babies are fed in non-metropolitan areas of Western Australia (WA). Some sections of this study are funded by Healthway (WA Health Promotion Foundation) and the information collected will contribute to a Doctor of Philosophy (PhD) thesis called "A Cohort Study of Factors Influencing Breastfeeding in Regional Western Australia." By learning more about the ways that women in regional and rural areas feed their babies and what support they need, we may improve the information and advice that we provide to new mothers and their families in the future.

It is important for you to understand why the study is being done and what it will involve before you decide to take part. Please take time to read the following information carefully before making your decision. Please ask the study staff to explain anything that you do not clearly understand or if you want more information about the study.

Can I take part in the study?
As part of this project, 400 mothers of newborn babies in two hospitals in regional WA are being asked about their experiences and opinions about feeding babies. If you:

- Are over 18 years old
- Usually live in the Midwest region of WA
- Have a baby less than 2 weeks old
- Have a baby without any serious illness
- Speak English,

you are eligible to take part. Additionally, if you have access to the Internet at home and provide us with your e-mail address, you may receive information and assistance via a website.

It is up to you to decide whether or not to take part in this study. If you do decide to take part you will be asked to sign a consent form and will be given a copy of this signed information and consent form to keep. You will still be free to withdraw from the study at any time. If you decide to withdraw or decide not to take part in this study, there will be no penalty. Your decision will not affect your continuing medical care, including your relationship with your doctor or other staff.

What do I need to do?
If you agree to take part in the study, you will be asked to complete a 'Mothers' Questionnaire' while in hospital. Over the following year a Research Officer will contact you periodically either by telephone or via e-mail to ask you some further questions, as your baby gets older. It should take about 15 minutes to answer the questions each time you are contacted.

IMPORTANT – PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

Will my information be kept confidential?
The information that you provide to us in this study will be kept strictly confidential and will only be used by the researchers listed on this information sheet. Your name and personal details will not be used in any reports or published information about this research. Your information will be kept for a period of 7 years and then destroyed. If you have specific questions about how the information will be used, please contact Dr Roslyn Giglia (Principal Investigator) on 9266 7582 or Ms Kylee Cox (Research Officer / PhD candidate) on 9956 0200.

What will happen with the results of this study?
The results of this research will be published as a PhD thesis, as well as articles in professional journals and in local papers. Again, no individual names or personal details will be used in any published work. If you would like a copy of the final results of the study, you can ask the Research Officer (Kylee Cox) or the Principal Investigator (Dr Roslyn Giglia).

What if I have questions about the study?
The Curtin University of Technology Human Research Ethics Committee (Approval No SPH-005-2009), the St John of God Healthcare Ethics Committee (Approval No 392) and the WA Country Health Service Ethics Committee (Approval No 2009:25) have given ethical approval for this study, which will be conducted in accordance with National Health & Medical Research Council's National Statement on Ethical Conduct in Human Research (2007). If you have any complaints or concerns about the way the study is being conducted, you can contact the Secretary of the Curtin University Human Research Ethics Committee on 9266 2784, or e-mail hrec@curtin.edu.au , or mail c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth WA 6845. Your concerns will be dealt with confidentially.

If you have any questions about the study and the information that will be collected, please contact Dr Roslyn Giglia (Principal Investigator) on 9266 7382 or Ms Kylee Cox (Research Officer / PhD candidate) on 9956 0200.

If you are able to help us with our research, please sign the consent form below and provide us with your name and telephone number and e-mail address (if available).

Thank you in anticipation of your assistance.

Yours sincerely,

Dr Roslyn Giglia
Principal Investigator / Co-Supervisor
Curtin University of Technology
GPO Box U1987
Perth WA 6845
Tel: 9266-7382
Fax: 9266-2958
R.Giglia@exchange.curtin.edu.au

Ms Kylee Cox
Research Officer / PhD candidate
Combined Universities Centre for Rural Health
PO Box 109
Geraldton WA 6531
Tel: 9956-0200
Fax: 9964-2096
kylee.cox@cucrh.uwa.edu.au

September 2010

IMPORTANT – PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

Rural Infant Feeding and Parenting Support Project - Consent Form

- I agree to participate in the study of infant feeding practices in regional WA. I am over 18 years of age.
- I confirm that I have read and understand the Participant Information and Consent Form for the above study and have had the opportunity to ask questions and all of these have been answered in a way I understand. I have been given a copy of this information.
- I understand that my participation is completely voluntary and I may withdraw from the study at any time.
- I understand that my participation will be limited to completing an initial questionnaire and answering some follow-up phone calls during my baby's first year of life.
- I understand that all interviewers working on the study are qualified health professionals and that all individual data will be kept strictly confidential.

_____ _____
Signature Date

_____ _____
Name (please print) Telephone number

_____ _____
e-mail address

_____
Address

I, the undersigned have discussed the nature and purpose of the study and the possible risks and benefits of participation with the participant and/or legally authorised representative. I believe that the participant and/or his/her representative has been fully informed, using language which is understandable and appropriate, and has understood this explanation.

_____ _____
Name of Researcher/Person obtaining consent Date

_____
Signature

Revocation of Consent
I hereby WITHDRAW my consent to participate in the research project described above and understand that such withdrawal will not make any difference to my medical care or my relationship with my doctor or other staff.

_____ _____
Name of participant Date

_____
Signature

This Revocation of Consent should be forwarded to:
Dr Roslyn Giglia
Curtin University
GPO Box U1987
Perth WA 6845

IMPORTANT – PLEASE COMPLETE AND RETURN THIS FORM IF YOU CAN HELP US WITH THE STUDY

ACCESS TO THE NURTURING TOGETHER WEBSITE
http://nurturing.curtin.edu.au

Name	
e-mail address	
Username	
Password	

INSTRUCTIONS FOR ACCESS:

You have been registered on the **Nurturing Together** website using the username and e-mail address that you provided us. A password has been automatically generated to allow you to access the site. This password is temporary and you may reset the password once you have logged in.

If you have not completed the initial survey, there will be a message prompting you to do so. Up to two reminder e-mails will be sent to you to complete the surveys at 4, 10, 16, 26, 32, 40 and 52 weeks, and the Research Officer will contact you to complete the surveys if attempts to contact you via e-mail are unsuccessful.

If you experience problems with the website, such as difficulty logging in, please contact the Research Officer, (Kylee Cox) on 9956 0200.

Appendix 4 – Correspondence

Curtin University of Technology

healthway

{insert name}
{insert address 1}
{insert address 2}
{insert address 3}

{insert date}

Dear {insert name},

Re: Regional Infant Feeding and Parenting Support Study (RIFPS)

We know that life at home with your new baby can be pretty hectic and we understand that filling in forms and answering questions may not be your first priority, but we would really appreciate your help with our research.

We haven't been able to contact you by phone, but we still want to hear about your experiences in feeding your baby. If you would like to continue to be a part of our study, please contact the me on 9956 0200 as soon as possible.

We understand if you no longer wish to be a part of the study – if we do not hear from you by {insert date}, we will remove your name from our list of participants.

Kind regards,

Kylee Cox
Research Officer - RIFPS
Combined Universities Centre for Rural Health
PO Box 109
GERALDTON WA 6531

Appendix 5 – Ethics

MINUTE

Curtin
UNIVERSITY OF TECHNOLOGY

To	Ms Roslyn Giglia
From	Leslie Thompson
Subject	Protocol Approval – SPH – 0005 - 2008
Date	February 5th, 2008
Copy	Professor Colin Binns

SCHOOL OF PUBLIC HEALTH
TELEPHONE 9266 4346
FACSIMILE 9266 2555
EMAIL l.thompson@curtin.edu.au

Dear Roslyn

Thank you for your "Form C Application for Approval of Research with Minimal Risk (Ethical Requirements)" for the project titled "Evaluating the use of an Internet intervention to sustain breastfeeding duration in rural Western Australia (WA)". On behalf of the Human Research Ethics Committee I am authorised to inform you that the project has been approved.

Approval of this project is for a period from January 31st, 2008 to December 31st, 2009.

If at any time during the twelve months changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately. The approval number for your project is SPH – 0005 - 2008 *Please quote this number in any future correspondence.*

L Thompson

Leslie Thompson
Coordinator
Human Research Ethics Form C
School of Public Health

Please Note: The following standard statement must be included in the information sheet to participants:
This study has been approved by the Curtin University Human Research Ethics Committee. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.

Curtin
University of Technology

School of Public Health
GPO Box U1987 Perth
Western Australia 6845

Using the Internet to support breastfeeding in Western Australia

CONSENT FORM

I have read the Information Sheet and have had the details and purpose of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand I have the right to withdraw from the study at any time and to decline to answer any particular questions.

I agree to provide information to the researcher and participate in the Internet intervention on the understanding that my name will not be used without my permission and that the information I provide will be used only for this study and publications arising from it

I understand that the researcher will regularly require me to answer online surveys regarding my participation in the Internet intervention, and that I have the right to request a copy of this information

I agree to participate in this study under the conditions set out in the Information Sheet.

Name: .....

Signed: .....

Date: …….

Curtin
University of Technology

School of Public Health
GPO Box U1987 Perth
Western Australia 6845

Using the Internet to support breastfeeding in Western Australia

INFORMATION SHEET

The School of Public Health at Curtin University is studying the use of the Internet to support breastfeeding in Western Australia. As part of this research project mothers of newborn babies in Perth and regional Western Australia are being asked to participate in an Internet project designed to provide support for breastfeeding mothers. Mothers will be asked to provide feedback periodically (at 3, 6, 9 and 12 months) by way of online surveys about their experiences and opinions in being involved in the Internet project. These surveys should take no longer than 20 minutes to complete. Initially mothers will be asked to complete a 'Mothers' baseline Questionnaire' while in hospital to provide enrolment information for the study. This baseline survey will take up to 15 minutes.

Over the following year as a participating mother you will have access to breastfeeding information and support via the Internet project. You can access the Internet project site to receive online advice and support; to take part in face-to-face web camera discussions with a lactation consultant; to participate in an online chatroom with other mothers; and to attend scheduled online 'HealthChats' regarding infant health issues. You can be involved as little or as much as you like, it is up to you.

Your participation in this project is voluntary and you have the right to withdraw from the study at any time. All information you provide will remain confidential. Standard procedures for data collection will be employed to minimise the risk to subject confidentiality. These procedures include assigning a numerical code to each subject's data, removing names from all data, storage of data in secure files, and careful training of all personnel regarding the collection and storage of sensitive information. Data on computers will be protected by a password, and will only be accessible by the investigators. Subjects will not be identified by name in any publication or report. Reports describing the results of the research will not reveal the identity of any participant.

Your input will assist in the development of a comprehensive Internet support program for breastfeeding mothers. If you are able to help us with our research, please sign the consent form attached and provide us with your name and telephone number. Findings from this research will be disseminated in report format and published in relevant professional journals. Presentations will be made at appropriate professional conferences. Recommendations will be developed to direct the development of future interventions in this area.

This Internet intervention project has been approved by the Curtin University Human Research Ethics Committee (HREC: SPH – 0005 -2008). The Human Research Ethics Committee at Curtin University requires that all participants are informed that, if they have any complaint regarding the manner, in which a research project is conducted, it may be given to the Secretary, Human Research Ethics Committee, Curtin University, by telephone 08 9266 2784, or email hrec@curtin.edu.au or in writing C/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth WA 6845. All study participants will be provided with a copy of the Information Sheet and Consent Form for their personal records on request.

Your participation and involvement will be greatly appreciated and I thank you in anticipation of your assistance.

Yours sincerely
Roslyn Giglia
Healthway Health Promotion Research Fellow
Curtin University of Technology
GPO Box U1987
Perth WA 6845
Tel: 9266 4341
Fax: 9266 2958

Evaluating the use of an Internet Intervention to sustain breastfeeding duration in regional Western Australia (WA)

SPH – 0005 -2008
Dr Roslyn Giglia

Form B Application for Renewal (1B): Attachment

Currently this project is tracking well with regard to sample size recruitment and website development and maintenance.

Form B Application for Renewal; Amendment (2): Attachment

This project has changed from the protocol approval dated March 31st 2010. Since this time the pilot project has been completed and the project officer (Ms Kylee Cox) employed on the pilot project has enrolled in her doctorate degree and is now undertaking work on this project for her research study.

In the previous amendment it was stated that

1. Mothers will be recruited from one metro and two non-metro health regions of WA. Initially a pilot project was being conducted in the Midwest region of WA.
2. Mothers will be recruited by the research fellow (Dr Roslyn Giglia) or member of the research team
3. Online surveys of breastfeeding practices, psychosocial issues and perceptions of the website will take place at three, six, nine and 12 months.

Amendments to these protocols are listed below.

1. Since the completion of the pilot in the Midwest other centres have become involved in the recruitment of participants. Mothers are now being recruited from
    a. the Midwest; Geraldton Regional Hospital and St John of God Hospital (SJOG). See related ethics approval for WA Country Health Services (WACHS) and SJOG.
    b. Kalgoorlie Regional Hospital.
    c. Bunbury Regional Hospital
    d. Collie Regional Hospital.
    e. Other hospitals that have indicated their intent to become involved but as yet have not started recruiting include; Bridgetown, Warren (Manjimup), Busselton and Margaret River Hospital. In addition, Broome and Derby Hospital in the Kimberley have indicated their intent to become involved.
    f. A decision was made not to recruit mothers from one metro health region and this decision has been communicated and accepted by the funding body, Healthway. This decision was based on the abundance of available breastfeeding data available from metropolitan areas throughout Australia and the vast availability of resources to breastfeeding women in these areas. It was felt that resources were better allocated to recruiting women from regional areas.
2. The mothers are now being recruited by the PhD student (Ms Kylee Cox) and midwives in the Midwest region. In other regions mothers are recruited by maternity ward nursing staff (midwives), regional dietitians and child health nurses. In some instances dietetic students and graduate nurses on placement are involved in the recruitment of new mothers.
3. In an effort to ensure data is comparable to previous research in this area and to provide Ms Kylee Cox with additional data for her PhD research, the time points for data collection were amended to four, ten, 16, 26, 32, 40 and 52 weeks.

Form B Application for Renewal; Ethical Issues (4): Attachment

Western Australian Country Health Services
Ethics approval for WACHS regional hospitals has been approved and conduct approval at regional level for access to sites has also been approved. This is information is attached.

Western Australian Aboriginal Health Information And Ethics Committee (WAAHIEC)
The collection of data in the Kimberley area of Western Australia will necessitate the completion of a WAAHIEC application. Although this research is not directed at Indigenous Australians, the following points taken from the WAAHIEC application form require that this research seek WAAHIEC ethical approval.

Justice
(4.7.6) Where: (a) the geographic location of the research is such that a significant number of the population are likely to be Aboriginal and Torres Strait Islander.

And the possibility that 'Aboriginal peoples, as a group, will be examined in the results' (http://www.aboriginal.health.wa.gov.au/ethics/index.cfm).

MINUTE

Curtin
UNIVERSITY OF TECHNOLOGY

To	Dr Roslyn Giglia
From	Leslie Thompson
Subject	Protocol Approval – Extension – **SPH – 0005 - 2008**
Date	March 31st, 2010
Copy	

SCHOOL OF PUBLIC HEALTH

TELEPHONE 9266 4346
FACSIMILE 9266 2958
EMAIL l.thompson@curtin.edu.au

Dear Roslyn

Thank you for you for keeping me informed of the progress of your research and minor change to protocol. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project "Evaluating the use of an internet intervention to sustain breastfeeding duration in regional Western Australia (WA)".

Approval of this project is extended to December 31st, 2010. Please note the approval is on a yearly basis for a maximum of four years.

Thank you

L Thompson

Leslie Thompson
Coordinator
Human Research Ethics Form C
School of Public Health

Please Note: The following standard statement must be included in the information sheet to participants:
This study has been approved by the Curtin University Human Research Ethics Committee. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.

Appendix 6 – Copyright

Paper 1: **Factors associated with exclusive breastfeeding at hospital discharge in rural Western Australia.**

This article was published in the Journal of Human Lactation following peer review and can be viewed at the journal's website:

www.jhl.sagepub.com (doi: 10.1177/0890334414547274)

Paper 2: **Predictors of Breastfeeding Duration for Rural Women in Developed Countries: Evidence from a Cohort Study.**

This article was published in Acta Paediatrica following peer review and can be viewed at the journal's website:

http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1651-2227(doi: 0.1111/apa.12999)

Paper 3: **The Influence of Knowledge and Attitudes on Breastfeeding Duration: Evidence from a Cohort Study in Rural Western Australia**

This article was published in the International Breastfeeding Journal following peer review and can be viewed at the journal's website:

http://internationalbreastfeedingjournal.biomedcentral.com (doi: 10.1186/s13006-015-0048-3)

Paper 4: **Breastfeeding beyond the Big Smoke: Who provides support for mothers in regional Western Australia?**

This article has been submitted for publication in the Australian Journal of Rural Health and access details for the final published article will be provided when available.

Paper 5: **Exclusive Breastfeeding Increased by an Internet Intervention.**

This article was published in Breastfeeding Medicine following peer review and can be viewed on the journal's website:

www.liebertpub.com (doi: 10.1089/bfm.2014.0093)