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**KEY DETERMINANTS OF
BREASTFEEDING SUCCESS IN INFANTS BORN
BEFORE 30 WEEKS GESTATION**

A thesis presented in partial fulfilment of the requirements for the degree
of Master of Philosophy at Massey University, Auckland, New Zealand.

Carol Lesley Thomas

RN RM IBCLC

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ABSTRACT

Breastfeeding is promoted at a public health level by many agencies internationally and nationally. While there is an abundance of literature to guide practice regarding breastfeeding term healthy infants, there is little regarding premature infants, particularly those born before 30 weeks gestation. Data on breastfeeding outcomes in this population is limited in the New Zealand literature. The aims of the study were to identify the breastfeeding outcomes of premature infants born before 30 weeks gestation; to identify key determinants that may contribute to the success of breastfeeding outcomes; and to describe the feeding practices of this population during hospitalisation and post-discharge.

This audit used a non-experimental, cross-sectional, descriptive, correlational design using pre-existing medical records, to obtain variables of interest. Independent variables included maternal and infant characteristic and infant feeding characteristic. Key determinant variables were identified as maternal support, maternal milk supply, kangaroo care and bottle use. Feeding problems and growth were also considered as independent variables.

Breastfeeding outcomes are comparable to the New Zealand population of breastfed infants in duration but not intensity of breast milk received. Maori and Polynesian infants have poorer breastfeeding outcomes compared to Caucasian and Asian infants and have higher rates of feeding problems. Further research is required to identify the cause of increased feeding problems in these cultures.

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CHAPTER ONE

INTRODUCTION

Neonatal intensive care is a relatively new discipline in medicine. It developed as a specialty around 30 years ago with the introduction of neonatal intensive care units (NICUs). The care of neonates has dramatically changed over this time with advances in medicine and technology. Infants of lower gestation are not only surviving but morbidity has been greatly reduced (Darlow, Cust, Donoghue, & on behalf of the Australian and New Zealand Neonatal Network (ANZNN), 2003). Despite this there are many challenges to the care of the premature infant and breastfeeding is one of them. Backwell-Sachs and Blackburn (2003) suggest that the spectrum of care for premature infants is wide ranging. It includes the perinatal period, neonatal intensive care, transition to home, and the remaining first year of life. Breastfeeding premature infants also encompasses these periods and challenges remain in establishing evidence-based standards of care (Backwell-Sachs & Blackburn, 2003).

The breastfeeding outcomes of premature babies in New Zealand have been poorly documented and/or poorly defined in the literature. Internationally there is a gap in the literature regarding babies born before 30 weeks gestation. The determinants of breastfeeding success in this population have not been adequately assessed. In the New Zealand context, with its unique culture and high initiation rates of breastfeeding in general, there is little known of the breastfeeding outcomes in this population of infants. Data collection on breastfeeding outcomes for infants

hospitalised in neonatal intensive care units (NICUs) is not a requirement of the World Health Organisation (WHO), the New Zealand Ministry of Health (MOH) or the New Zealand Breastfeeding Authority (NZBA). Where data is collected there is a lack of consistency in the definitions of breastfeeding for term healthy infants as well as for NICU infants (Labbok, 2000; Labbok, Belsey, & Coffin, 1997; Nicoll & Williams, 2002). The data collection points suggested by several authors may also be inappropriate for the premature infant - this will be discussed further in chapter two.

Breastfeeding is the physiological norm for all infants (American Academy of Pediatrics, 2005; WHO/UNICEF, 2003). In particular breastfeeding is very important for infants born with very low birth weight (VLBW) because of their immaturity, increased risk of illness (including infection) and other benefits which have been scientifically shown to be advantageous in this group of infants (Brown, Meier, Spatz, Zukowsky, & Spitzer, 1996; Furman, Taylor, Minich, & Hack, 2003; Horwood, Darlow, & Mogridge, 2001). On the other hand, artificial baby milk (ABM) feeding may have serious consequences for these infants. It is fascinating that most scientists, when attempting to quantify the benefits of breastfeeding, tend not to regard breastfeeding and breast milk as the biological norms (Minchin, 1998). Despite this argument oral feeding may be difficult for VLBW and/or premature infants (Bartle, 2003a; Dawson & Benson, 2001; WHO/UNICEF, 1990, 2003).

Mothers who desire to breastfeed their premature or sick infants face many obstacles. Not only may they endure months of separation from their infant but they may also have to express breast milk for months before the infant even attempts to breastfeed (Morse & Bottorff, 1990). Neonatal intensive care units (NICUs) are

based on a medical paradigm and this conflicts with the intimate nature of breastfeeding, and indeed the mother and infant relationship (Levin, 1999). In the NICU an infant's feeding is often nurse driven and the power controls that surround this issue can be distressing and confusing for the mothers and infants (Spatz, 2004). Infant feeding practices in NICUs are often based on traditional beliefs from a bottle-feeding culture that is often in conflict with breastfeeding (Bartle, 2003a; Spatz, 2004). There is a strong movement nationally and internationally to support, promote and protect breastfeeding (MOH, 2002; NZBA, 2005; USA Department of Health and Human Services Office on Women's Health, 2000; WHO/UNICEF, 1990) and it has been stated that mothers of premature or sick infants should have skilled and appropriate lactation support during their postnatal care (American Academy of Pediatrics, 2005; California Perinatal Quality Care Collaborative, 2004; MOH, 2002; Morton, 2003; WHO/UNICEF, 2003).

The New Zealand Ministry of Health (MOH, 2002) equally acknowledges the special circumstances of infants who are admitted to neonatal intensive care units (NICUs). The MOH states that the lead maternity carer (LMC) and the specialist neonatal service are responsible for supporting breastfeeding. It also states that a woman who has complications may be referred to secondary maternity services and that breastfeeding issues that fall outside the usual breastfeeding problems are regarded as complications. Where there are complex breastfeeding problems the secondary maternity service is supposed to provide specialist breastfeeding advice to the LMC or directly to the woman (MOH, 2002). Anecdotally, while this is supported in theory, in practice it rarely occurs.

Establishing breastfeeding in the neonatal intensive care unit (NICU) is a complex issue and requires a holistic approach. Equal consideration must be given to the mother and the infant, which is not often the case in the NICU because of their physical separation. The literature around this topic is conflicting and difficult to interpret. Scientific research on breastfeeding term healthy infants may not necessarily apply to infants born prematurely. Conducting breastfeeding research in a bottle-feeding culture is also problematic. Attitudes of staff in the NICU will impact on breastfeeding outcomes. There are very strong beliefs (both negative and positive) held by NICU staff regarding breastfeeding. The most vulnerable of our infants, those born prematurely or sick, should not be disadvantaged just because they are born into a NICU environment.

STATEMENT OF THE PROBLEM

As a neonatal nurse and midwife working in the neonatal intensive care environment for over 20 years, I have been concerned about the mother-infant relationship. After qualifying as an International Board Certified Lactation Consultant (IBCLC) 10 years ago, it became apparent to me that breastfeeding was an important component in healing the grief associated with premature birth and restoring the mother-infant relationship. Breastfeeding in this population of infants appeared to be fraught with difficulties however. While there are many people who work within the NICU environment who promote and support breastfeeding, it appears that some of the embedded feeding practices may be contributing to the lack of *success* for many of these mother-infant dyads. There are conflicting messages that on the one hand promote breastfeeding with practices and advice that negatively support it.

The lack of evidence-based practice regarding infant feeding is a contentious issue (Minchin, 1998). While the message *breast is best* is the dominant discourse, it is not always supported in the clinical setting. During their time in the neonatal intensive care unit (NICU) infants are often exposed to several different types of milk and several different types of feeding methods. Mothers are given conflicting advice regarding establishing and maintaining a milk supply and may not feel like a mother at all because of separation from their vulnerable infant. There appear to be many factors that contribute to the success or failure of breastfeeding for these mothers.

The key concerns with studies to date are the lack of consistency in defining breastfeeding and data collection points, and the impact feeding problems and growth may have on breastfeeding outcomes. Breastfeeding definitions for this study can be found in appendix one. The definitions used include the proportion of breast milk feeding by the infant and the proportion of feeding at the breast. The issues of feeding problems and growth have also been addressed in the study by using them as variables for the research. These are rarely, if ever, addressed in the breastfeeding literature and appear to be significant problems for some infants born very premature.

The present study investigated the key determinants of breastfeeding outcomes in premature infants born before 30 weeks gestation in a large urban maternity facility. The conceptual framework that underpins this research is based on the Baby Friendly Hospital Initiative (BFHI) 'Ten Steps to Successful Breastfeeding' and is shown in appendix two (WHO/UNICEF, 1989). The background to the 'Ten Steps to Successful Breastfeeding' will be discussed in chapter two. All *ten steps* of the BFHI

have been validated in the literature (WHO, 1998a). The aim of the BFHI is to increase breastfeeding initiation and duration by reducing the hospital practices that have contributed to breastfeeding demise. Elements of the BFHI combined with an extensive review of the literature, have identified several key determinants that form the basis of the study hypothesis: maternal support, establishing an adequate milk supply, early and frequent skin-to-skin contact/kangaroo care (KC), and minimal use of bottles contribute to breastfeeding success in babies born before 30 weeks gestation.

STUDY AIMS

The main aims of the study are:

1. To identify the breastfeeding outcomes of premature infants born before 30 weeks gestation.
2. To identify key determinants that may contribute to the success of breastfeeding in this population of infants.
3. To describe the feeding practices of this population during hospitalisation and post-discharge.

It is assumed that the cultural and social influences of breastfeeding the term healthy infant will also be the same for the premature infant. So while some maternal demographic data was obtained, specific contributors such as maternal smoking, maternal education and socio-economic status were not addressed in this study. Rather, feeding practices and support variables were identified and outcomes determined at the time of discharge from hospital, discharge from homecare and first follow-up appointment with the neonatologist. Variables were obtained from the

neonatal database and the infant feeding charts.

CONCLUSION

The current chapter provides an overview of some of the issues concerning breastfeeding premature infants. Several of the key issues have been identified and form the basis of the research project. The research is underpinned by the Baby Friendly Hospital Initiative (BFHI) which will be elaborated upon in chapter two.

Chapter two provides a background to the study and a review of the literature on the topic of breastfeeding premature infants. An overview of the international and national situation regarding breastfeeding is explored. Justification for the active promotion of breastfeeding and how this relates to the NICU is discussed. Also within this chapter is the issue of defining breastfeeding. Several definitions will be explored and the definitions for this current study will be given. The issue of defining 'successful' breastfeeding is also explored.

Several key issues identified in the literature review will be addressed. Firstly an investigation into the breastfeeding outcomes of other NICUs internationally and nationally is undertaken. The issue of maternal support is also raised and while this is an enormous issue to discuss some key factors for the mother will be analysed. Establishing a milk supply is a key task that all mothers who wish to breastfeed their premature infants need to undertake and some of the issues around this will be discussed. Kangaroo care (KC) has been suggested to be helpful in establishing and improving a poor maternal milk supply. KC has also been suggested to be helpful for premature infants and their mothers in the transition to successful breastfeeding. The most suitable methods for transitioning premature infants to breastfeeding are

controversial and several novel methods have been investigated and will be elaborated on. Throughout the literature review analysis of the methods used for primary research and outcomes will be addressed.

Chapter three of this thesis is the methods chapter. Justification for the methods chosen to perform the study will be given and an overview of the study design. Participant selection is highlighted, encompassing exclusions and inclusions and the rationale for each. The next issue addressed is the procedure: how the data was collected and cleaned and how missing data was dealt with. Following this is an explanation of how the data was analysed. Ethical considerations are addressed along with the reliability and limitations of the study. Definitions of 'success' in terms of outcome variables are also discussed.

Chapter four is the results section and presents the results of the study including descriptions of the maternal and infant demographics. The breastfeeding outcomes at the various data collection points will be shown along with the results of the key determinants. Chapter five, the discussion, analyses the results within the context of the literature. The discussion is also centred on the breastfeeding outcomes and the key determinants. The last chapter, six is the conclusion. A summary of what was achieved by the study, limitations of the study, implications for practice and further research recommendations are presented.

CHAPTER TWO

BACKGROUND AND LITERATURE REVIEW

The previous chapter provided an introduction to the study and a statement of the problem. A brief overview was given with an introduction of the Baby Friendly Hospital Initiative (BFHI) as the conceptual framework for the study. Chapter two will discuss the international and national breastfeeding situation along with some of the key strategies that have been introduced to help protect, support and promote breastfeeding in generally. Defining breastfeeding and defining breastfeeding success will also be elaborated on in more detail. An insight into some of the issues surrounding breastfeeding in the neonatal intensive care unit (NICU) will be given with particular attention to the very premature infant.

The breastfeeding outcomes for premature infants reported in the literature will be discussed and key determinants identified that may contribute to successful breastfeeding in this vulnerable population. The issue of feeding problems and growth will also be discussed.

INTRODUCTION

Scientific evidence supports that breast milk has unique benefits for both the mother (Collaborative Group on Hormonal Factors in Breast Cancer, 2002; Cumming & Klineberg, 1993; Heining, 1997; Labbok, 1994) and the infant (American Academy of Pediatrics, 2005; Anderson, Johnstone, & Remtey, 1999; Clifford, 2003; Hanson, 1999; Howie, Forsyth, Ogstan, A, & du V Florey, 1990; Kull, Wickman, Lilja, Nordvall, & Pershagen, 2002; Oddy, 2001; The Bellagio Child Survival Study

Group, 2003). There is also mounting evidence to support that breast milk is unequalled in feeding premature and sick infants (Anthony, 2003; Horwood et al., 2001; Lucas et al., 1990; Lucas, Morley, Cole, Lister, & Leeson-Payne, 1992; Singhal, Cole, Fewtrell, & Lucas, 2004). Evidence regarding exclusive breastfeeding is beginning to show how valuable it is to the infant in the first six months of life (Arifeen et al., 2001; Bouwstra et al., 2003; Dewey, Cohen, Brown, & Rivera, 2001; Duncan et al., 1993; WHO, 2003).

Research also supports the benefits of the act of breastfeeding, that more is transferred during the mother-infant interaction than just breast milk (Dignam, 2001; Horwood et al., 2001; Widstrom, 2001; Widstrom et al., 1990). Because of the mounting evidence of the advantages of breastfeeding and the disadvantages of bottle-feeding, breastfeeding is being advocated at a national and international level (American Academy of Pediatrics, 2005; MOH, 2002; Unit for Health Services Research and International Health, 2003; USA Department of Health and Human Services Office on Women's Health, 2000; WHO/UNICEF, 2003).

THE INTERNATIONAL SITUATION

Improving breastfeeding outcomes is an important issue internationally. The Bellagio conference in Italy in February, 2003, suggested that 10 million children under the age of five will die in that year alone (The Bellagio Child Survival Study Group, 2003). Of these deaths, two thirds will be from preventable causes (data analysed from 42 countries accounting for 90% of under five deaths worldwide). It has been estimated that if universal coverage of exclusive breastfeeding (for around 6 months and into the second year of the infant's life) were attained, this strategy could prevent 13% of these deaths. The effect is phenomenal considering 90% of

women breastfeed in these countries, although not exclusively (Jones et al., 2003). World wide no more than 35% of infants are exclusively breastfed during the first four months of life (WHO/UNICEF, 2003) and currently there are no figures on the breastfeeding rate of infants born prematurely.

It is interesting to note that other more costly mortality prevention strategies combined prevent fewer deaths of children under five than breastfeeding. For example if universal coverage was achieved, measles vaccination could prevent 1% of deaths, tetanus toxoid vaccination could prevent 2% and improved water sanitation and hygiene could prevent 3% of deaths (Jones et al., 2003). A large amount of money and effort has gone into health promotion strategies that have a relatively small impact on child survival.

Human immunodeficiency virus and acquired immunodeficiency syndrome (HIV/AIDS) prevention is an example. In the under five years age group, 3% of children die every year from this disease. In contrast 33 % of deaths occur in the neonatal period (first 28 days of life) and it is estimated that a quarter of these (24%) are from severe infections. Diarrhoea accounts for 22% of child under five deaths and 21% are a result of pneumonia (Jones et al., 2003). Health prevention programmes should not be dismissed or trivialised. However, from a public health prevention and cost effectiveness point of view, breastfeeding promotion and its subsequent uptake saves more lives of children under the age of five years, in countries where child mortality is very high. Breastfeeding promotion is clearly an international public health issue.

Several international organizations have lent significant support to breastfeeding. These include the World Health Assembly (WHA), the World Health Organisation (WHO), the United Nations Children's Fund (UNICEF) and the International Labour Organisation (ILO, 2002). The Innocenti Declaration was adopted by the WHA in May 1992, in resolution WHA 45.34 (WHO, 1998a). The Innocenti Declaration set out four operational targets for breastfeeding for all governments to achieve by the year 1995. The first was that a national breastfeeding coordinator be appointed and that a multisectorial national breastfeeding committee be established. The second operational target was to ensure that every maternity facility fully practise all ten steps of the Baby Friendly Hospital Initiative (BFHI), 'Ten Steps to Successful Breastfeeding'. The third operational target was for governments to take action to give effect to the principles of the International Code of Marketing of Breast-milk Substitutes (ICMBS) and the WHA resolutions (see appendix 3), in their entirety (WHO, 1981). Finally, the last operational target is to enact legislation and establish means for its enforcement, and to protect the breastfeeding rights of working women (WHO/UNICEF, 1990). The WHO/UNICEF have contributed hugely to the supporting, protecting and promoting of breastfeeding in both developed and developing countries.

While the Bellagio Conference (The Bellagio Child Survival Study Group, 2003) focused on child and infant death prevention in developing countries, the benefits of breastfeeding have been identified in developed countries as well (Chen & Rogan, 2004; Howie et al., 1990; WHO/UNICEF, 1990; Williams, 1993). A recent epidemiological study from the United States of America (USA) suggests that 750 infant deaths (age 28 days to 12 months), could be delayed or prevented every year if

breastfeeding uptake was increased (Chen & Rogan, 2004). In this study infants who had ever breastfed were compared with those who were never breastfed. The results could be even greater with an increase in exclusivity and duration of breastfeeding (WHO/UNICEF, 2003).

The economic implications of breastfeeding have also been considered. A recent US government analysis estimated that an annual saving of US\$3.6 billion would accrue if the prevalence of breastfeeding in the USA increased from 64% to 75% in hospital and 29% to 50% at 6 months of age. In this analysis only three preventable conditions were used: gastroenteritis, otitis media, and necrotising enterocolitis (Weimer, 2001). It is predicted this cost saving would be even higher if other conditions were taken into account (for example, childhood cancer, diabetes mellitus and obesity). The BFHI's primary aim is to improve the outcomes of breastfeeding across all countries and cultures. It is hoped this will be achieved through the implementation of the 'Ten Steps to Successful Breastfeeding', the WHO Code of Marketing Breastmilk Substitutes (ICMBMS) and governments addressing socio-economic inequalities that impact on breastfeeding outcomes (WHO/UNICEF, 1990).

THE NEW ZEALAND SITUATION

New Zealand, like many other countries, has been slow to implement and or provide funding for the WHO recommendations. The first strategy that New Zealand was a signatory to was the International Code of Marketing Breast Milk Substitutes (ICMBMS), at the thirty-fourth WHA in May 1981, where the 'code' was adopted. In reality, it was not until 1997 that New Zealand had a voluntary and self-regulated code of practice in place when the New Zealand Infant Formula Marketer's

Association (NZIFMA) undertook responsibility for regulation (NZIFMA, 1997). Several countries have adopted a self-regulatory code (Minchin, 1998) and while the intention of the WHO ICMBMS was to have it enacted into law (WHO, 1981) this has not occurred in New Zealand. Many breastfeeding advocates felt from its inception that the New Zealand interpretation of the WHO *code* was weak and too supportive of the NZIFMA (Bartle, 2003b; MOH, 2004). The Ministry of Health (MOH) undertook a lengthy review of the New Zealand interpretation of the *code* that began in 2001. In 2004 the MOH released a document relating to the review although changes to the New Zealand interpretation of the *code* are still some way off (MOH, 2004). There remains controversy surrounding this issue and industry, consumers and key stakeholders hold strong views (MOH, 2004).

The Baby Friendly Hospital Initiative (BFHI) is another World Health Organisation (WHO) strategy that has been slow to be implemented in New Zealand and is not without controversy. The Innocenti Declaration was adopted by the World Health Assembly (WHA) in August, 1990 (WHO/UNICEF, 1990). It took 10 years of lobbying by breastfeeding advocates, including the New Zealand College of Midwives (NZCOM), New Zealand Lactation Consultants Association (NZLCA) and La Leche League New Zealand (LLLNZ), to mention a few, for some action to be taken by the New Zealand government (Vogel & Mitchell, 1998).

In 1998 the New Zealand Breastfeeding Authority (NZBA) was set-up by breastfeeding advocates which now has 30 stakeholder groups involved (NZBA, 2005). The New Zealand government did not provide funding for this initiative until 2000 when the NZBA was contracted with a mandate to determine current practices

in maternity facilities in regard to BFHI standards, to draft the BFHI documents and to train BFHI assessors (NZBA, 2005).

It took nine months, after consultation with interested parties including professional groups, consumer groups, Maori and overseas experts, for the documents to be completed (NZBA, 2005). The Baby Friendly Hospital Initiative (BFHI) Aotearoa was launched in August 2000. Since 2002 the NZBA has awarded 16 maternity facilities with the BFHI accreditation (NZBA, 2005). Wisely, the New Zealand government has acknowledged that improving breastfeeding outcomes will be achieved at the tertiary and secondary health level and also at the primary health care level (MOH, 2002).

In conjunction with the New Zealand Breastfeeding Authority (NZBA) the Ministry of Health (MOH) also released a document titled "Breastfeeding: A Guide to Action" (MOH, 2002). The document clearly outlines the problems with breastfeeding outcomes in New Zealand and has a seven-point plan to help overcome the issues that have been identified. While New Zealand's breastfeeding rates compare favourably with other countries of the Organisation for Economic Co-operation and Development (OECD), there has been little or no improvement in breastfeeding rates in the last 20 years (D'Souza & Wood, 2003) and the breastfeeding rates for Maori and Pacific peoples have been consistently lower (D'Souza & Wood, 2003; MOH, 2002). Data from the New Zealand MOH (2002) show initiation rates are high, over 90% of women start breastfeeding. This figure drops to around 65% fully breastfeeding at around six weeks, 55% by three months and 20% by six months. The "Breastfeeding: A Guide to Action" strategy aims to

increase breastfeeding rates in New Zealand and has specific targets to be reached by 2010.

The seven goals of the “Breastfeeding: A Guide to Action” (MOH, 2002, p.3) plan are:

1. To establish a national intersectorial breastfeeding committee
2. To achieve Baby Friendly Hospitals throughout New Zealand
3. To gain active participation of Maori and Pacific whanau/family to improve breastfeeding promotion, advocacy and support
4. To establish nationally consistent breastfeeding reporting and statistics
5. To increase breastfeeding promotion advocacy and co-ordination at both national and local levels
6. To ensure pregnant women can access antenatal education
7. To ensure high quality and ongoing postpartum care

The first goal of setting up an intersectorial breastfeeding committee to develop a cross-sector national breastfeeding strategy, acknowledges the impact of social, employment and other barriers to breastfeeding (MOH, 2002). “Breastfeeding: A Guide to Action” strategy was published in 2002 and up to the time of writing an intersectorial committee on breastfeeding has yet to be developed or funded. The second goal, of achieving Baby Friendly Hospital Initiative (BFHI) accredited hospitals throughout New Zealand is, on the other hand, well under way.

Public health policy on breastfeeding promotion assumes that the factors that impact

on breastfeeding outcomes are modifiable by the individual (Tipene-Leach, Abel, Finau, Park, & Lennan, 2000) and often fail to acknowledge the socio-economic factors that contribute to the low uptake of breastfeeding for some mothers. It is hoped that the intersectorial component of the New Zealand MOH strategy will be very relevant in addressing these issues. Despite this the introduction of the BFHI itself has seen improvement in national breastfeeding outcomes in other countries.

IMPACT OF THE BABY FRIENDLY HOSPITAL INITIATIVE

Countries that institute the Baby Friendly Hospital Initiative (BFHI) have seen rises in the rates of breastfeeding (Catteneo & Buzzetti, 2001; Kramer et al., 2001; UNICEF UK Baby Friendly Initiative, 2002). Since the accreditation of BFHI hospitals in Scotland, for example, breastfeeding initiation rates have increased by 8% from 1995 (55% initiation rate) to 2000 (63% initiation rate). Scotland not only has the highest number of BFHI accredited hospitals in the United Kingdom (UK) but at 40% also leads with the highest percentage of breastfeeding at four months of age. Compared to the UK, Scotland has higher rates amongst the socially disadvantaged with a 7% rise between 1995 and 2000.

Currently 48% of infants born in Scotland are born at BFHI hospitals. This compares to England where less than 10% of infants are born in BFHI accredited hospitals and the breastfeeding rates in England have only increased by 2% (UNICEF UK Baby Friendly Initiative, 2002). Scotland not only has impressive numbers of BFHI hospitals but also the Scottish government has been very supportive of breastfeeding (Nicoll & Williams, 2002). Since 1990 appropriate and standardised breastfeeding data collection has occurred (Nicoll & Williams, 2002). There have been national advertising campaigns that have included a highly regarded television campaign. The

Scottish parliament has now passed a law making it illegal to prevent a woman from breastfeeding in public (UNICEF UK Baby Friendly Initiative, 2002).

In a second example of the impact of the Baby Friendly Hospital Initiative (BFHI), a large cluster randomised control trial undertaken in Belarus, not only showed that the introduction of BFHI practices increased the duration and exclusivity of breastfeeding but also showed a reduced risk of gastrointestinal tract infection and atopic eczema in the first year of life (Kramer et al., 2001). Higher breastfeeding rates were also achieved in a developed country from a controlled non-randomised study (Cattaneo & Buzzetti, 2001). Most of the studies looking at outcomes of breastfeeding with the BFHI as an intervention still had breastfeeding rates below what are currently recommended (WHO, 1998b; WHO/UNICEF, 2003).

The main target of the Baby Friendly Hospital Initiative (BFHI) is maternity facilities because most mothers in many countries deliver their infants in hospital (Vogel & Mitchell, 1998). Maternity facilities have historically had practices that interfere with the establishment of breastfeeding. Two examples would be the rampant use of nurseries that separate the mother and infant, especially at night, and secondly the routine use of supplementation. This is most commonly done with either artificial baby milk (ABM) or glucose water, (WHO, 1998a). The BFHI acknowledges that establishing breastfeeding (and a milk supply) is critical in the first few weeks after the delivery of the infant (WHO/UNICEF, 1989) and the main thrust of the BFHI is targeted at this time.

According to breastfeeding statistics from the Baby Friendly Hospital Initiative, United Kingdom, 90% of mothers stop breastfeeding earlier than they wanted at one week, two weeks and six weeks post birth. The most common reason for stopping breastfeeding before six weeks was 'insufficient milk'/baby hungry (39%) and pain (25%), (UNICEF UK Baby Friendly Initiative, 2002). Insufficient milk was also an issue identified in a New Zealand study that reports 63% of women felt they did not have enough milk (Beasley et al., 1998). The BFHI has identified that maternity practices may impact on these common reasons for early weaning. A premise of the BFHI is that if breastfeeding is established early with appropriate advice and support then problems with breastfeeding are less likely to occur.

The constraints and influences on breastfeeding can be subtle and suppressed. Bartle (2004) suggests, "the heart and spirit of Baby Friendly Hospital Initiative (BFHI) may assist in ensuring that the support of women is paramount and that maternal autonomy is protected" (p. 3). Others would argue that maternal autonomy and maternal choice are difficult concepts to apply when many mothers are not given appropriate information and advice to make informed choices (Minchin, 1998; Palmer, 2004). Women are also trying to breastfeed in a bottle-feeding culture that complicates the issue further. As Gabrielle Palmer (2004, p. 93) so aptly writes, "you have to be an exceptionally confident woman to behave differently from your friends and your family". There also appears to be a culture of traditional feeding practices in some maternity facilities where the mother is not given a choice, and indeed may not even know what or how food is given to her infant (Minchin, 1998; Palmer, 1993). It appears that this is a common occurrence in neonatal intensive care units (NICUs) where infants are commonly given formula or prescribed human milk

fortifier (HMF) without the mother's knowledge (Bartle, 2003a).

Neonatal intensive care units (NICU) generally are an integral part of maternity facilities however there has been some criticism that they do not have to meet the same requirements of the Baby Friendly Hospital Initiative (BFHI) as the rest of the institution (Levin, 1999). 'The Ten Steps to Successful Breastfeeding' does not take into account the specific nature of NICUs. Most importantly step six appears to imply exemption. Step six states 'give newborn infants no food or drink other than breast milk unless medically indicated' (WHO/UNICEF, 1989). Given that all infants admitted to NICUs are admitted under the care of medical specialists, for medical reasons, it appears that this provides a loophole for infants to be prescribed human milk fortifier (HMF) or artificial baby milk (ABM) often without maternal consent or knowledge.

Despite this, statistics from a hospital in Northern Ireland showed that the breastfeeding initiation rates increased by 9% after the accreditation of the Baby Friendly Hospital Initiative (BFHI), correspondingly breastfeeding in the neonatal intensive care unit (NICU) increased by 17%. Merewood, Philipp, Chawla and Cimo (2003) report on a NICU in the United States of America (USA) that showed the initiation rates for breastfeeding doubled, and the proportion receiving any breastfeeding at two weeks increased from 28% to 66%, after the introduction of the BFHI into their hospital. The proportion of infants receiving breast milk exclusively rose from 9% to 39% (Merewood, Philipp, Chawla, & Cimo, 2003).

DEFINING BREASTFEEDING

Interpretation of breastfeeding literature is made difficult due to the lack of consistency in definitions of breastfeeding and differences in data collection points (Griggs, Spence, & Ellercamp, 2001; Labbok, 2000; McVeagh, 2002; Nicoll & Williams, 2002). The definition of breastfeeding may appear to be unquestionable, however the literature is neither well defined nor consistent (Hill, Ledbetter, & Kavanaugh, 1997; Labbok, 2000). It appears that breastfeeding experts also have difficulty in reaching a consensus (Labbok, 2000). Often the basic requirement for some studies is breastfed or bottle-fed. Most mothers experience both so this type of definition is rather simplistic (Carter, 1995). Some examples of breastfeeding definitions are: any breastfeeding in a 24 hour period; more than 50% of feeds as breastfeeds in 24 hours (Furman, Minich, & Hack, 2002); or any breast milk obtained by the infant regardless of delivery system (Hill et al., 1997). The New Zealand Ministry of Health (MOH) definitions can be seen in appendix four (MOH, 2002). Misinterpretation of data has occurred due to the lack of precision and consistency of breastfeeding definitions (Labbok & Krasovic, 1990). It is imperative that research studies include full definitions of breastfeeding terms used, as this will assist in the interpretation of breastfeeding research (Labbok, 2000).

The above problem led a group of national and international agencies to meet in 1988 to develop and agree on a set of breastfeeding definitions that would standardise terminology for the collection and description of breastfeeding data (Labbok & Krasovic, 1990). A schema and framework of breastfeeding definitions was eventually agreed upon (appendix 5) and considers the maternal and infant parameters that may affect health outcomes and management issues associated with breastfeeding (Labbok, 2000). One year later the World Health Organisation (WHO)

published their set of definitions that were based on the original design but dealing primarily with nutritional intake (Labbok, 2000). The WHO lists five categories for breastfeeding and defines 'breastfeeding' as any breast milk consumed by the infant and 'exclusive breastfeeding' as exclusively breast milk fed regardless of delivery system (WHO Nutrition Unit, 1996), these are shown in appendix 6. Labbok (2000) lists six categories for defining breastfeeding with the fifth category being exclusively formula fed. Along with this Labbok also includes a schema of breastfeeding behaviour.

Labbok (2000) argues that the World Health Organisation (WHO) definitions fail to address several issues including the impact of direct breastfeeding compared with indirect breastfeeding, on maternal physiology and maintenance of a milk supply. The WHO definition also fails to address the issue of the contrasting definitions used in research studies. Thirdly, there is lack of attention paid to the immunological and other differences for the infant (and the mother) between breastfeeding and breast milk feeding (Labbok, 2000). If defining breastfeeding relies on the infant solely receiving breast milk this then negates the advantages of the act of breastfeeding. Breastfeeding is an intimate, reciprocal relationship between the mother and infant and is often not given consideration by researchers (Dignam, 1998; Labbok & Coffin, 1997; Nicoll & Williams, 2002). Many papers using definitions of breast milk feeding often do not state how the infant received the breast milk. Current breastfeeding definitions also fail to recognise the unique situation of the premature infant transitioning to oral feeding as these infants are often exposed to a variety of feeding methods.

The New Zealand Ministry of Health (MOH) definitions differ from those that are recommended internationally (Cattaneo, Davanzo, & Ronfani, 2000; Labbok, 2000; WHO Nutrition Unit, 1996). The MOH includes four descriptions of breastfeeding (with the fourth being fed artificial baby milk). There is no provision for the collection of premature infant feeding data, and the MOHs and the WHO data collection points provide no guidance for those infants born early (see appendix 4). There is difficulty establishing when data collection points for these infants should be attained: should they be collected when oral feeds have begun, when oral feeds are established, when the infant is at the chronological age stated (for term healthy infants) or at corrected gestational age of 40 weeks? The lack of consistency of data collection points for both term and premature infants makes comparisons between studies difficult (McVeagh, 2002).

Data collection from a public health stance is required to assess the progress of national targets because *success* is measured in these terms by the number of breastfeeding versus bottle-feeding infants. Breastfeeding data is also used to benchmark against other outcomes both nationally and internationally.

Benchmarking occurs between term healthy infants and premature infants and aims to assist in addressing inequalities in breastfeeding outcomes for the premature infant. The way data is collected potentially biases the results (Cattaneo et al., 2000).

While New Zealand has not shown an improvement in breastfeeding outcomes in the last 20 years, the definitions of breastfeeding and the data collection points changed in 1999 (see appendix 4). The New Zealand Ministry of Health (MOH) also made standardised reporting a requirement from 2003. The Report on Maternity 2000 and

2001 (MOH, 2003), showed that 36% of breastfeeding data was not collected at the time of hospital discharge. Another issue with the data collection in New Zealand is the significant change in maternity services and well child health provision.

Historically the Plunket Society collected breastfeeding data and they had coverage of 87% of infants born in New Zealand (D'Souza & Wood, 2003). The situation in New Zealand now is that there are numerous lead maternity carers (LMCs) and well child providers (WCPs), (D'Souza & Wood, 2003). Another factor is that the large number of missing data may well represent a group in society that tends not to breastfeed or seek well childcare. Cattaneo, Davanzo, and Ronfani (2000) suggest that lack of standardization in breastfeeding definitions, data collection points, and non-representative sampling bias breastfeeding outcome data. The data may in fact be lower than that published (Cattaneo et al., 2000).

DEFINING BREASTFEEDING SUCCESS

While there has been much discourse in the literature regarding breastfeeding definitions and outcomes there has been little regarding the definition of success. There are many possible definitions of successful breastfeeding. Leff, Gagne, and Jefferis (1994) suggest that health professionals tend to emphasize breastfeeding duration and nutritional aspects. The World Health Organisation (WHO) definitions are an example: exclusive breastfeeding for six months and continued breastfeeding into the second year of life with the safe use of complementary foods (WHO/UNICEF, 2003), this is considered the gold standard. If you live in New Zealand, the government's recommendation would be to breastfeed exclusively for four to six months with continued breastfeeding for at least 12 months (MOH, 2000).

The MOH's (2002, p.10) targets for breastfeeding are:

- to increase the breastfeeding (exclusive and fully) rate at 6 weeks to 74% by 2005 and to 90% by 2010
- to increase the breastfeeding rate (exclusive and fully) at 3 months to 57% by 2005 and 70% by 2010
- to increase the breastfeeding rate (exclusive and fully) at 6 months to 21% by 2005, and 27% by 2010.

This is interesting in that the aim is for exclusive breastfeeding for the first six months, however success will be achieved if only a quarter of the breastfeeding mothers achieve this.

Sellen (2001) argues that child-feeding practices rarely conform to global recommendations and is of universal concern from a public health policy perspective. It has been questioned whether near universal compliance is even feasible in today's world. Sellen (2001) suggests in her ethnographic and demographic study from sample populations published between 1873 and 1998 that current estimates for breastfeeding duration are close to the optimum and recommendations currently advised are attainable within most societies (Sellen, 2001). The biomedical stance of breastfeeding success may be somewhat narrow however (Beasley, 1991). While breastfeeding outcomes may be based in a public health perspective, this may not be the case for the individual mother who is living through the experience of breastfeeding (Carter, 1995).

Morse and Bottorff (1990) and Leff, Cagne and Jeffris (1994) suggest that the mother who is experiencing breastfeeding should define success. Leff, Cagne and

Jeffris (1994) interviewed 26 breastfeeding mothers concerning successful and unsuccessful breastfeeding. Mothers described successful breastfeeding as a complex interactive process that involve mutual satisfaction of both mother and infant needs. There were five major categories identified: infant health, infant satisfaction, maternal enjoyment, desired maternal role attainment and lifestyle compatibility (Leff, Gagne, & Jefferis, 1994). Newton (1971), an early pioneer of breastfeeding research argues that maternal enjoyment is an important issue.

The premise for this is that if a mother is breastfeeding because she feels she has to, and feels negative about it, these feelings will be transferred to the infant and may well interfere with the mother-infant relationship (Newton, 1971). The study by Newton however was at a time when breastfeeding rates internationally were at their lowest. The cultural and social situation a mother finds herself in will impact on the way she perceives the breastfeeding experience (Palmer, 2004).

Another issue to consider when discussing issues of success is the alternative, that of failure. For the individual breastfeeding mother who breastfed for six months and then stopped because she wanted to, is she regarded as a success or failure? What of the mother who wanted to breastfeed for six months and beyond but was unable to do so, how does she regard herself in terms of success or failure? Mothers who do not enjoy the experience of breastfeeding because of pain or the sense of a lack of freedom with breastfeeding, may continue to persevere with it but they may not consider themselves as successful (Leff et al., 1994). A perceived lack of milk supply, seen as slow growth or a hungry infant by the mother, has been identified as a reason for feelings of failure in some mothers (McNatt & Freston, 1992).

Adequacy of breastfeeding to support infant growth is commonly perceived to be associated with improved infant health (Diaz, Herreros, Aravena, Casado, & Schiappacasse, 1995).

Within the issue of infant health sits the issue of infant growth, the two appear to be inextricably linked (Sherry, Mei, Grummer-Strawn, & Dietz, 2003). Growth becomes an important issue for mothers who have premature infants (Meier et al., 1994). Not only is the infant born very small but also in the medical environment of the neonatal intensive care unit (NICU), infants are constantly weighed, and growth is considered vitally important. It has been argued that growth monitoring generally has not been scientifically validated (Panpanich & Garner, 2004) yet is widely accepted. Infants born very premature tend to have slower growth on mothers milk alone, especially while hospitalised (Morley & Lucas, 2000; Steward & Pridham, 2002). It has been suggested that their catch-up growth will occur after discharge (Steward & Pridham, 2002). The question is raised however, if breastfeeding success should be regarded in terms of appropriate weight gain and if so is weight gain based on appropriate growth reference charts.

One needs to consider the growth references that are used. Currently growth reference charts are not based on a homogenous group of breastfeeding infants but on predominantly artificial baby milk (ABM) fed infants (de Onis & Onyango, 2003; Dewey, 2001; WHO Working Group on the Growth Reference Protocol and WHO Task Force on Methods for the Natural Regulation of Fertility, 2000). Breastfed and ABM fed infants grow differently (de Onis & Onyango, 2003). The consequence of using inappropriate growth reference charts is that it appears that breastfed infants

grow poorly (compared to ABM fed infants) and has led to a situation where some breastfed infants have been considered “failure to thrive” and have been advised (or forced) not to continue breastfeeding (Dewey, 2001). Growth references for premature infants are also poorly devised and also raise concern (Sherry et al., 2003). The impact of growth on breastfeeding success (or failure) has not been given due regard in the breastfeeding literature on premature infants.

Growth is considered important for both term and premature infants and is often used as an indicator for health in infants. But what of the poorly growing breastfed premature infants. Premature infants often grow slowly initially (Sherry et al., 2003) and anecdotely it appears that they receive extra supplements of ABM or are weaned off breastmilk totally because of this. However, perhaps health should be considered at the expense of accelerated growth in this vulnerable population of infants who will have improved outcomes from breastfeeding and less hospital admissions. Perhaps success is better viewed from a more holistic viewpoint rather than the narrow weight based ones that are currently recommended. Most of the studies are inconclusive regarding this issue. It appears that not only do we require breastfeeding growth reference charts but also breastfeeding premature infant growth reference charts that truly reflect the unique situation of the very premature infant.

NEONATAL INTENSIVE CARE UNITS

The World Health Organisation (WHO) and the United Nations Children’s Fund (UNICEF), state that the proportion of low birth weight (LBW) infants (birth weight <2500grams) born yearly varies from 6% - 28%, depending on the country. In real terms the figure is 20 million LBW babies born every year. Four million neonatal deaths occur each year and of these 20% will be the result of prematurity or LBW

(WHO/UNICEF, 2003). In New Zealand in the year 1998 to 1999, 1084 infants born alive were very low birth weight (VLBW, infants born <1500 grams). Of the 112,402 live births in New Zealand this accounted for 0.96% of the live births that year. Of these, 90.3% survived to discharge home (Darlow et al., 2003). The neonatal intensive care unit (NICU) of the study centre has 1300 infants admitted yearly and of these, 160 (12.3%) are VLBW (Kuschel, 2005). Over the last 15 years, there has been an increase in births of VLBW infants associated with increased survival (Darlow et al., 2003). Mortality and morbidity outcomes are important considerations for the premature infant and research on the impact of breastfeeding has shown it to be important protective element (Hylander, Strobino, Pezzullo, & Dhanireddy, 2001; Lucas & Cole, 1990; Lucas, Morley, & Cole, 2000).

Until recently most of the literature on breastfeeding premature infants came from countries where breastfeeding rates in term, healthy infants is low such as the United Kingdom (UK) and the United States of America (USA), (Furman et al., 2003; Lang, 1998; Meier & Brown, 1996). In the USA only 55.5% of women initiate breastfeeding after the birth of term, healthy infants (Hill et al., 1997). In New Zealand initiation rates for breastfeeding, in general, are relatively high, being in the vicinity of 90% however this figure drops to around 60% by the time the infant is five to six weeks of age (MOH, 2002). Breastfeeding attitudes vary between breastfeeding populations and over time. It is advised that premature infant breastfeeding outcomes, be assessed alongside term infants from the same region and the same time (Killersreiter, Grimmer, Buhrer, Dudenhausen, & Obladen, 2001).

The possible consequences of low breastfeeding rates in countries where the culture of breastfeeding is not supported may be that interventions to support premature infant breastfeeding may not have the same impact as in a culture where breastfeeding is expected. Successful breastfeeding outcomes probably require a multi-factorial approach to improve them and factors that influence breastfeeding term healthy infants may not necessarily have the same impact on premature infants (Bell, Geyer, & Jones, 1995; Meier, 2001).

BREASTFEEDING OUTCOMES

The incidence of breastfeeding premature infants varies widely. Bell et al (1995) reported a retrospective chart review of 15 infants, in which it was found that, of mothers who wanted to breastfeed, only 40% of the infants received breast milk at discharge. After a structured intervention was introduced to this United States of America (USA) neonatal intensive care unit (NICU), breastfeeding improved to 80% (of 102 mothers who intended to breastfeed). The structured intervention included education of mothers and staff and revision of the protocol for breastfeeding the premature or ill infant. Despite this rise only 3% of these infants received breast milk from the breast and only 58% of mothers in the NICU, where the study was undertaken, intended to breastfeed. Mothers reported several key issues that were considered barriers to breastfeeding: lack of privacy, high stress environment, bottle-feeding prior to breastfeeding, small and fragile infant, dislike of breastfeeding, personal stress and return to work (Bell et al., 1995). This study was small and did not define breastfeeding nor did the authors state the gestational age of the infants in the cohort.

A group of authors from the USA performed a retrospective, descriptive study of breastfeeding very low birth weight (VLBW, <1500 grams) infants in a large NICU (Furman, Minich, & Hack, 1998). Of the 82 mother-infant dyads studied, 47 % (n=39) chose to express breast milk. But only 20% (n=8) of these, transitioned to feeding at the breast. This translates to only 9.7% of those who initiated expressing breast milk breastfed (at the breast) at the time of discharge. The definition of breastfeeding in this study was that over half of the infant's feedings were at the breast for more than a month (Furman et al., 1998). The narrow definition of breastfeeding in this study would be considered partial breastfeeding by other definitions (Labbok, 2000; MOH, 2002; WHO Nutrition Unit, 1996). Furman et al. conclude that there are multiple practical challenges that impact on the mother's experience of breastfeeding, especially those with infants of VLBW. These mothers should be able to make an informed choice, receive emotional support, and necessary resources from knowledgeable staff. These should be available to the mother immediately post partum and continue after hospital discharge (Furman et al., 1998).

A later study by the same authors set out to determine the correlates of lactation success in a prospective observational study of 119 mother-infant pairs of VLBW (mean birth weight of 1056 grams and mean gestational age of 28 weeks) in another NICU in the USA (Furman et al., 2003). The definition of successful breastfeeding in this study was if the mother was still lactating at the different time periods of 3 weeks postpartum, 35 weeks corrected age (CA), 40 weeks CA, and 4 months CA. The implication of this definition is that any amount of milk that the mother produced, regardless of how the infant received it, was considered successful. In this study 73% of mothers intended to breastfeed, however of these, 44% had

discontinued lactation by 35 weeks CA and only 34% of mothers were still lactating at 40 weeks (term) CA. The figure dropped even further, to 14% breastfeeding at the breast at 4 months CA. Mothers who were still lactating at 40 weeks tended to have breastfed a previous child ($p=0.06$), significantly more had used kangaroo care, began expressing within 6 hours of birth, expressed a minimum of five times per 24 hours, and produced more milk at each expression compared to those who had discontinued (Furman et al., 2003). It is disappointing to note that in all the age groups, none of the infants were exclusively breastfed.

A further study from the United States of America (USA) is another retrospective chart review of infants born before 34 weeks gestation (Espy & Senn, 2003). During hospitalisation 50% of the infants received breast milk. Statistical analysis showed no difference in gestational age, sex, age at first oral feed and corrected age at discharge, between those infants breastfeeding and artificial baby milk (ABM) feeding. Mothers of the breastfeeding infants were more likely to be older ($p=0.03$), have medical insurance and be non-smokers although there was no difference in ethnicity, marital status or previous children. Espy and Senn (2003) suggest that the large variability of breast milk feeding in different NICU settings implies that the factors that relate to lower breastfeeding outcomes are modifiable. The implication for practice is that intervention programmes should be targeted at specific populations to improve outcomes.

A study in the United States of America (USA) assessed the impact of the introduction of the baby friendly hospital initiative (BFHI) in a maternity facility on breastfeeding outcomes in a neonatal intensive care unit (NICU). In 1995, 110

infants were included and compared to outcomes of 117 infants in 1999 (Merewood et al., 2003). Initiation of breastfeeding was defined as the infant having received any breast milk during the first week of hospitalisation. At the two and six week assessment breastfeeding was defined under four categories of type of milk received: exclusive breast milk, mostly breast milk, mostly formula, and exclusive formula feeding. Breastfeeding initiation and duration (measured at two weeks) doubled between the study years. Merewood et al. attributed the BFHI as easing the complications of the NICU setting especially for those mothers of low income. Kangaroo care (KC) in the NICU, extra support for mothers in the NICU and increased access to breast pumps also contributed to the difference seen.

The last study from the United States of America (USA) was a survey of 361 mother-infant dyads born weighing less than 1500 grams. Questionnaires were sent to mothers of their now six to eight year old children. In this study 60% of mothers initiated lactation although lactation lasted for 1 to 3 months in 52% of the mothers. The study outcomes showed that while infant and maternal demographics influenced the decision and duration of breast milk feeding, infant health influenced the transition to direct breastfeeding (Smith, Durkin, Hinton, Bellinger, & Kuhn, 2003).

The above results are in contrast to that of Gunn (1991), in a neonatal intensive care unit (NICU) in Auckland, New Zealand. In a retrospective review of 43 very low birth weight (VLBW) infants, Gunn reported that 77% were fully breastfeeding at discharge, and 85% of these were still breastfeeding 3 months later. Maternal intention to breastfeed was reported as 84%. While definitions of breastfeeding were not included in the study report, Gunn did state that of the 88% of mothers

discharged home breastfeeding only two were giving supplements at three months post discharge.

The infants discharged home bottle-feeding were more likely to be smaller (1890 grams, $p<0.01$), younger (33.7 weeks gestation, $p<0.01$), and had longer hospital stays (mean of 35 days), (Gunn, 1991). The gestational age of the study cohort was 30 – 35 weeks and the infants had an average hospital stay of only 16 days. It can be assumed by these demographics that the infants were therefore relatively well and relatively mature. The positive results seen in this study may have been influenced by these demographics. Mothers in this NICU were encouraged to express early and frequently and encouraged to spend the day caring for their infant themselves (with nurse support). As breastfeeding was becoming established infants were 'test-weighted' pre and post breastfeed and the deficit of their calculated milk volume was complemented by naso-gastric tube or bottle.

A further study by Gunn et al. (2000), a randomised controlled trial to evaluate an early discharge programme, also showed high breastfeeding rates. Approximately 93% of mothers in this study intended to breastfeed. At discharge around 80% of infants were breastfeeding (approximately 55% exclusively). This had fallen to 57% at six weeks (approximately 33% exclusively) and to 36% by six months post discharge (Gunn et al., 2000). While in hospital the vast majority of infants received a combination of breast, bottle and gavage feeding and the definition of breastfeeding was based on five categories of the percentage of breast milk the infant received. As with the previous study, these infants were also relatively mature, born at a mean age of 33 weeks gestation (± 1.5 weeks).

An earlier study in New Plymouth, New Zealand, reported a retrospective chart review of 12 very low birth weight infants (VLBW) who initiated breastfeeding (Pearse & Buchanan, 1979). At the time of discharge 10 (83%) infants were fully breastfed. Pearse and Buchanan suggest that the success of breastfeeding in their neonatal intensive care unit (NICU) was due to many factors that included: close mother-infant contact, optimistic and knowledgeable staff, early expression of breast milk and early infant suckling with the breastfed infant virtually never being offered bottles. It is of interest to note that electric breast pumps were not used to establish and maintain lactation. All infants born VLBW were given expressed breast milk (EBM) either mother's own milk or donor milk from mothers in the NICU. Breastfed infants weight gain was compared to bottle fed infants, fed with EBM which showed no difference between the two groups. The innovations to support breastfeeding in this NICU ought to be applauded as they occurred more than 25 years ago, and in an era when breastfeeding rates in New Zealand were at their lowest (MOH, 2002). It is these very practices that the literature is suggesting today that are required to support successful breastfeeding in the premature infant population.

More recently an audit of breastfeeding outcomes from an Australian neonatal intensive care unit (NICU) showed variable breastfeeding outcomes (Dawson & Benson, 2001). The cohort of infants included all infants admitted to the NICU during 1997. Of the infants in the 29 – 31 week gestational age group, 20% were discharged home artificial baby milk fed (ABM) compared to the less than 28 weeks gestational age group where 66.7% of them were discharged home fully ABM fed. They concluded that gestational age was a predictor of breastfeeding outcomes. Dawson and Benson suggest that this may be due to mothers not being able to

maintain lactation for long periods of time. The expressing protocol for the NICU (or the individual mothers) was not discussed, it may well have been poor expressing schedules that impacted on success. It is interesting to note that the infants that were breastfeeding had an average length of stay of only five days compared with nine days in the non-breastfeeding group. The length of stays reported are relatively short and it is presumed that the majority of infants were fairly well and of advanced gestational age, however this is not stated in the study.

A convenience sample of 100 infants from another Australian neonatal intensive care unit (NICU) used questionnaires, during hospitalisation and after discharge, to assess breastfeeding outcomes and determinants for NICU infants (Wheeler, Chapman, Johnson, & Langdon, 2000). In this study, neonatal admission appeared to enhance maternal belief that breastfeeding was better for the infant. Improved breastfeeding outcomes were seen in the mothers who intended to breastfeed, established early infant contact, and expressed breast milk. They also had positive breastfeeding experiences, supported by the neonatal nurses.

Another retrospective chart review from an Australian neonatal intensive care unit (NICU) showed that 83% of the infants in the NICU received breast milk at some stage during hospitalisation (Yipp, Lee, & Sheehy, 1996). At discharge 64% of the infants were having some breast milk and of these, 45% were having breast milk exclusively and 19% both breast milk and formula. Of the 64% of infants receiving breast milk, 38% of the infants were having some breastfeeding at the breast, these included 17% exclusively at the breast, and 21% combining breast-feeding with either bottle-feeding or an intragastric tube. Increasing gestational age (33-34 weeks

gestation compared with less than 29 weeks gestation) was also associated with increased rates of breastfeeding in their audit (Yipp, Lee, & Sheehy, 1996).

A study by Jones (1994) from England during 1990, showed 27% (of 18 mothers), who had premature infants in the neonatal intensive care unit (NICU), established lactation and only 5 % were discharged home fully breastfeeding. Lactation success was improved to 83% (of 31 mothers) and exclusive breastfeeding at discharge improved to 58%, when a premature infant feeding protocol was introduced (Jones, 1994). The protocol included three target groups: parents, nursing staff and medical staff. Education, kangaroo care (KC), non-nutritive sucking at the breast and transitioning to full sucking at the breast formed the basis of the protocol. Bottles were not introduced until breastfeeding was well established. To ensure adequate milk intake, a strict *time at the breast* protocol was used. Timing infants at the breast as a means of evaluating breast milk intake is contraindicated in the breastfeeding literature and has not been validated for use in term or premature infants (Riordan, 2005). Changes in protocols however, require that staff providing the care of the mother and infant be supportive of the change, if not results may not be what would be expected.

In 1994 a large multi-centre study, part of a larger study investigating neonatal intensive care units (NICUs), investigated feeding outcomes and practices of 24 hospitals in the United Kingdom (UK). Mothers were sent questionnaires that resulted in 444 infants being included in the study (Ingram, Redshaw, & Harris, 1994). The results showed that increased breastfeeding was associated with hospital stay of less than two-weeks, the infant weighing more than 1500 grams and was

more than 32 weeks gestation. Reduced breastfeeding outcomes were seen if the infant was ventilated and if the mother was an antenatal patient. Mothers complained that they did not receive enough advice and support, although this was the same for those breastfeeding and bottle-feeding. The infant's sex, delivery type, early infant-maternal contact, and the mother's physical health, did not appear to influence breastfeeding outcomes in this study. A number of mothers claimed that separation from their infant was overwhelming and that more help, support, encouragement and privacy were required. Ingram et al. (1994) conclude that the degree of parental involvement in the NICU may impact on breastfeeding outcomes.

Stine (1991) introduced a protocol without bottles to transition infants to breastfeeding in a United States of America (USA) neonatal intensive care unit (NICU). At the time of delivery, 38% of mothers indicated a desire to breastfeed. At the time of discharge, 50% (19% of the cohort) of those mothers who wanted to breastfeed were doing so exclusively and 73% were breastfeeding some of the time. Breastfeeding was defined as exclusive, any breastfeeding, and bottle-feeding. The mean gestational age of the cohort was 36 weeks gestation (Stine, 1991).

The protocol in this NICU included an aggressive expressing protocol: starting as soon as possible after the birth, expressing 8-12 times in 24 hours and the use of the drug Metoclopramide (it can be used as a galactagogue because it has a side effect of raising prolactin levels) after one to two weeks, if milk supply was low. The mother was encouraged to cuddle the infant as much as possible with the infant being put to the breast as soon as it was stable (as young as 30 weeks gestation). Breastfeeding efficacy was also based on time in this NICU. They initially used test-weighs to

determine milk transfer but this proved to be too unreliable and distressing for the mothers and they changed to daily weighing of the infant. There was a lactation consultant (LC) involved in providing extra support and encouragement for the mothers (Stine, 1991). Unfortunately there was no data provided on breastfeeding outcomes prior to the introduction of the protocol. The protocol that was used appeared to be anecdotally based rather than evidence based especially as the *time at the breast* tool had not been scientifically validated.

The report by Stine (1991) led a group to undertake a randomised controlled trial to assess the effect of the type of supplementation used when premature infants were transitioning to breastfeeding (Kliethermes, Cross, Lanese, Johnson, & Simon, 1999). The results were statistically significant in the group who received naso-gastric supplementation compared with bottle supplementation. The group who received naso-gastric supplementation had higher breastfeeding outcomes.

Approximately 80% (of 38 infants) were fully breastfeeding at discharge. This is compared with the bottle-supplemented group where only 38% (of 46 infants) were fully breastfeeding at discharge. The effect continued to be significant at three and six months post discharge. The NICU setting of this study provided a supportive breastfeeding environment that included: ongoing support, encouragement and advice throughout the in-hospital breastfeeding experience to the mothers. The specific expressing protocol was not mentioned although all the mothers had access to two qualified lactation specialists. There was a private breastfeeding room and mothers were encouraged to be present in the NICU as often as possible.

Kliethermes et al. (1999) conclude that the type of supplementation during hospitalisation for premature infants strongly influences breastfeeding outcomes.

A study from Norway assessed the duration of lactation in 108 mothers of premature infants (Gloppestad, 2000). Definition of lactation was: feeding at breast (partial or total) and or feeding with the mother's expressed milk. Data was obtained from a structured interview at discharge from the neonatal intensive care unit (NICU), and follow-up phone calls to the mothers. The infants' median gestational age at birth was 30.5 weeks (23-36 weeks), their birth weight was a median of 1447.5 g (600-2480g), and median length of stay was 46.5 days. The mothers lactated for a mean of 168.3 days (range 2 - 713 days). Those mothers who had previously breastfed, continued lactation significantly longer than those who had not ($p= 0.029$). Mothers who smoked after the birth had a significantly shorter lactation period compared to non-smoking mothers respectively, median 53 and 153 days ($p= 0.0006$). A longer lactation period was also associated with early skin to skin holding of infants ($p= 0.0055$), and with increasing length of maternal education ($p= 0.0001$). A shorter period of lactation showed a significant relationship with low gestational age ($p= 0.0001$) and with low birth weight ($p= 0.0001$), (Gloppestad, 2000). The group of infants in this study had a wide range of variability of characteristics.

Until a study by Killersreiter et al. (2001) the incidence and duration of breastfeeding very low birth weight (VLBW) infants had never been assessed with a reference group of term healthy newborns. In this study the VLBW infants were matched with a control group of healthy, term infants from the same region, in a prospective, descriptive, correlational study. During hospitalisation the breast milk intake in the VLBW group was determined by calculating the first and last day the infant received breast milk. This meant that any amount of breast milk classified as breast milk feeding. After discharge, and in the term healthy cohort, breastfeeding outcomes

were assessed from a maternal questionnaire administered at 6 months and 12 months corrected age. Mean gestational age of the VLBW infants was 29 weeks (range 23.5-34.3), mean birth weight was 1150 grams (range 525 – 1410 grams) and mean duration of hospitalisation was 70 days (range 21-315).

In the VLBW group, 22% never received any breast milk compared to the control group of 6.5% ($p<0.0001$). At discharge from hospital almost 60% of VLBW infants were exclusively artificial baby milk (ABM) fed compared to the control group where more than 90% were breastfed. Median duration of breast milk feeding was 36 days in the VLBW group compared to 112 days in the control group ($p<0.0001$). Multivariate analysis showed that smoking and low parental school education were independent negative predictors of breastfeeding. In the VLBW group prolonged breastfeeding was associated with a gestational age of less than 29 weeks gestation, multiple pregnancy, maternal age greater than 35 years and spontaneous pregnancy (Killersreiter et al., 2001).

Another comparative study, this time from Sweden, produced a long-term descriptive study of low birth weight (LBW) infants (Flacking, Nyqvist, Ewald, & Wallin, 2003). These infants were followed up for eight months and their breastfeeding statistics were compared to those of term healthy infants.

Unfortunately the Swedish breastfeeding definitions are also rather restrictive. Full breastfeeding was defined as breast milk and some semi-solid food; partial breastfeeding was defined as breast milk in addition to formula or other food; and no breastfeeding. The data collection for both groups was obtained at discharge and postnatal ages of two, four, six and eight months. The mean gestational age of the

LBW infants was 33.6 weeks (range 27 - 40 weeks). At discharge 93% of the LBW infants were breastfeeding (full or partial) and 95% of them at the breast. This compares to the control group where 97% were breastfeeding at discharge. At two months 82% of LBW infants were breast milk feeding (full and partial) compared to 92% of the control group. At four months 63% were breastfeeding compared to 83% of the control group. At six months postnatal age 36% of LBW infants were still breastfeeding compared to 75% of the control infants.

Flacking et al. (2003) stated that there was a modified Baby Friendly Hospital Initiative (BFHI) in the NICU, that encouraged mothers to express milk within the first day of delivery and to put the infant to the breast as soon as clinically stable. While mothers were randomly encouraged to have skin-to-skin contact with their infants, kangaroo mother care (KMC) was not routinely initiated. It was felt that given the evidence found in the literature, KMC may make a difference to long-term breastfeeding outcomes in LBW infants (Flacking, et al., 2003). Maternal-infant separation along with strict feeding schedules and volumes creates an unnatural breastfeeding environment (Flacking et al., 2003). They also suggest that for mothers of LBW infants “breastfeeding becomes mainly providing adequate nutrition, not an expression of comfort, closeness and joy” (p 162).

Bartle (2004) argues that it is not only breastfeeding that needs to be protected in the neonatal intensive care (NICU) environment. The avoidance or reduction of psychological and or emotional trauma should be a major consideration for both the mother and the infant (Bartle, 2003a; Bergman, 2003; Levin, 1999). Humane neonatal care is becoming a topic of importance for some health care workers. The

work by Levin (1999) highlights an eleven-step plan for improvement in the care of the sick neonate (appendix 7). The plan suggests 24 hour care of the mother and infant together and support for both their psychosocial environment is paramount in his plan. The International Network for Kangaroo Mother Care also has its ethos based on this holistic philosophy (Cattaneo, Davanzo, Uxa, & Tamburlini, 1998). The premise here is that the mother and infant are considered one. In fact the naked premature infant is 'cocooned' between the mother's breasts, 24 hours a day, seven days a week. Exclusive breastfeeding and early discharge occurs for these mother-infant dyads (Cattaneo et al., 1998).

The kangaroo mother care (KMC) strategy meets the infant's needs for warmth, breastfeeding, protection from infection, stimulation, safety, and love (Bergman, 2003; Cattaneo et al., 1998; WHO, 2003). These are not easy concepts for some health professionals to grasp. It appears that those professionals whose identity is tied to scientific and technological competence have the most difficulty changing their philosophy of care to a more holistic and humane one (Westrub, Kleberg, & Stjernqvist, 1999). There appears to be a dichotomy in NICUs where mothers and infants are separated with little regard for the problems that may be caused, or the use of strategies to prevent them (Bartle, 2004; Bergman, 2003; Nystrom & Axelsson, 2002; WHO, 2003). The rising number of low birth weight (LBW) and/or premature births and the disadvantages of artificial baby milk (ABM) feeding in this group of infants, deserves more attention and research into strategies that may improve their breastfeeding outcomes.

The common themes that emerged from this literature review are that mothers

require (and ask for) more professional support and appear to require privacy with their infant (Bell et al., 1995; Jones, 1994; Stine, 1991). Establishing and maintaining a milk supply is a key task for mothers of premature infants. While mothers of premature infants appear keen to initiate breastfeeding, duration appears to be problematic. Failing to maintain a milk supply may be a key variable in failing to progress to long-term breastfeeding (Flacking, et al., 2003; Furman et al., 2002; Hartmann & Cregan, 2001; Mitoulas, 2004; Piper & Parks, 1996; Wooldridge & Hall, 2003). Kangaroo care (KC) and or close maternal/infant contact have been shown to be beneficial to the mother infant dyad in more ways than breastfeeding alone (Feldman, Eidelman, Sirota, & Weller, 2002; Furman & Kennell, 2000). Several studies have identified KC as improving milk supply and breastfeeding outcomes (Furman et al., 2002; Pearse & Buchanan, 1979). The use of bottles in the premature population has been linked to breastfeeding failure (Kliethermes et al., 1999; Pearse & Buchanan, 1979; Stine, 1991).

CONCLUSION

A possible reason for the relatively good breastfeeding outcomes, in some of the centres, may be the heterogeneous group of infants in studies. Most of the results are based on outcomes of infants that are more mature and have relatively short length of stays. Also weight rather than gestational age has been chosen as a variable in some of the studies, which is problematic. An infant's functional ability to orally feed is based on maturity (Mizuno & Ueda, 2003) and not weight. Therefore birth weight does not necessarily reflect the maturational ability of these infants.

The outcome measure of the infant receiving breast milk versus the mother still lactating will influence the outcome statistics. Most studies investigating outcomes

use the infant's date of birth as the starting point for lactation of the mother. When mothers of very low birth weight (VLBW) infants establish a milk supply the volumes of milk produced will generally exceed the volumes of milk the infant initially ingests. It is not uncommon for delays in establishing full enteral feeds to occur in these infants. The mother's milk is then frozen and stored for later use. Also mothers who deliver VLBW infants may receive different counselling than mothers who don't. These infants tend to be sicker and require more intensive care and therefore their mothers may be exposed to more health professional advice than the low birth weight (LBW, <2500 grams) infants who tend to have shorter lengths of stays.

Analysing data for outcomes of breastfeeding for premature infants is difficult. Firstly the outcome measures are often different. Some studies may use post-discharge age; others corrected age and yet others post-conceptual age, therefore conclusions from comparison groups are difficult. The cohort of infants may also be different. There are studies that analyse data for all babies <37 weeks gestation and others that include all babies admitted to the NICU during specific time periods. Yet other studies are more specific, aiming at the <30week population or infants that have undergone surgical procedures. Breastfeeding definitions are not consistent and protocols within units are very different but not always elaborated on. The accuracy of data depends on standardised definitions and methods of studies (Cattaneo et al., 2000). While socio-economic and other factors influence the duration of breastfeeding it must be remembered that breastfeeding is a biological behaviour that is deeply set in human societies and there are variations within families (Krouse, 2002) and across cultures (Koçturk & Zetterstrom, 1999).

The majority of research that has been published on breastfeeding outcomes and correlates of lactation in premature infants has occurred in the last five years. There is a predominance of retrospective chart reviews with some ex-post-facto research designs. Although the intentions of authors appear to be well placed, the protocols used in ex post-facto designs appear to be anecdotally based rather than evidence based (Bell et al., 1995; Stine, 1991).

While non-experimental research is unable to be generalised to the wider population of premature infants, they do provide evidence that there is a variability of breastfeeding outcomes across settings. Countries that have high initiation rates and longer duration of breastfeeding tend to have better outcomes in the premature infant population (Flacking, et al., 2003; Gunn et al., 2000). More research is required to highlight the issues that are modifiable in premature infants and their mothers.

The background and literature review chapter has given an overview of the breastfeeding situation from a public health perspective. Included in this some of the international breastfeeding promotion strategies have been discussed. Breastfeeding outcomes for premature or sick infants were discussed in depth and some of the key determinants that contributed to success were identified. Some of the research difficulties with this distinct population of infants, and breastfeeding in general, have been discussed. The following chapter is the methods chapter.

CHAPTER THREE

METHOD

The previous chapter has provided an overview of the literature relating to breastfeeding outcomes of premature infants. It provides the basis for identifying the key determinants to breastfeeding success in this population of infants. The methods chapter describes the methods used to conduct this study. Included in this topic are the study design and why this particular design was chosen. Secondly, the setting for the research is described and the issue of ethics is addressed. Thirdly, the procedure of the research process is discussed. Also included are the sampling procedure, how and why the participants were selected and a description of the study sample. Data collection is then described including how data errors were minimised, how the data was cleaned and then analysed. A full description of the variables used for data collection can be seen in appendix eight. In the analysis section types of statistics that were used to analyse the data will be discussed.

DESIGN

The study is a retrospective chart review of inpatient files that the researcher has legitimate access to for general work and audit purposes. This is in keeping with the researchers professional role and job description in the institution where the research is being undertaken. As can be observed in the previous chapter the methodologies chosen by various authors to explore the specialty of breastfeeding premature infants are predominantly retrospective chart reviews, surveys (questionnaires) and ex post-facto design.

The scientific/modernist paradigm appears to be the favoured philosophic approach. One of the criticisms of such approaches on breastfeeding is that it is impossible to control for the *maternal* variable, that it is too imprecise and non-specific (Lawrence, 1999; Newton, 1971). The quantitative approach does provide a sound knowledge base that is appropriate to guide nursing practice.

Quantitative research is a formal, objective, systematic process in which numerical data are used to obtain information (Burns & Grove, 2001). This study uses a non-experimental, cross-sectional, descriptive, correlational design, and involves a retrospective chart review of infants born less than 30 weeks gestation at the study centre, during the years 2000 and 2001. In non-experimental descriptive studies such as this one phenomenon is observed and data is collected as it naturally occurs.

Although the gold standard in empirical research is the experimental, double blind, clinical trial, a non-experimental design such as in this study may be chosen as a research method because some questions cannot be answered by experimental or quasi-experimental designs (Marttinen Doordan, 1998; Polit & Tatano Beck, 2004).

There are ethical reasons why an experimental approach has not been selected for this study. It is not ethical to randomly assign participants to breastfeed or not to breastfeed (McVeagh, 2002), for mothers to provide breast milk for their infants or not, or for mothers to have close contact with the infant or not. Because one of the aims of this research is to describe the feeding characteristics of the cohort, experimental research was not considered appropriate. Descriptive studies aim to document characteristics, prevalence, intensity and/or the nature of a phenomena (Polit & Tatano Beck, 2004). Nonexperimental research often precedes experimental

research by documenting the problem and describing relationships between the relevant variables (Polit & Tatano Beck, 2004) as is the case in this study.

Descriptive studies set out to observe, describe and document an area of interest and when teamed with correlational design, describe relationships among variables (Burns & Grove, 2001; Polit & Tatano Beck, 2004). The underlying theory is that there is a tendency for variation in one variable to be related to variation in another. An example would be that gestational age and oral feeding ability are correlated because mature infants feed well. Unlike experimental design research, in which variance in variable scores is controlled, correlational designs require a large variance in the variable scores, which is necessary to determine the existence of a relationship (Burns & Grove, 2001). It has been suggested that this lack of control may weaken the validity of the research however, given the aim of this study, the descriptive correlational design method allows the existence of relationships to emerge (Polit & Tatano Beck, 2004). This will allow the researcher to infer relationships among the variables because conclusions about cause and effect are unable to be drawn (Dempsey & Dempsey, 2000). Just because a relationship has been shown to exist, even if it is a strong one, does not mean that one variable caused the other (Polit & Tatano Beck, 2004). Despite this limitation descriptive studies are a valuable way of documenting the extent, nature and magnitude of health related behaviours (Polit & Tatano Beck, 2004).

Descriptive correlational studies are usually cross-sectional in design (Polit & Tatano Beck, 2004). Marttinen Doordan (1998) describes cross-sectional research as a group of the population being sampled at one time. Polit and Tatano Beck (2004) add that

cross-sectional designs are useful in time-related purposes. To elaborate further, some research projects involve phenomenon that evolve over time. Such is the nature of this current study. The data was collected retrospectively (after the infants were discharged from hospital) but involved data collection points throughout the infant's hospital stay and some time post discharge. The data was taken from the infant's medical and nursing records at points that were identified by the researcher but also were reflective of points identified in the literature.

Retrospective designs involve research studies where the outcome variable is identified in the present and the variables associated with the outcome are investigated in the past (Polit & Tatano Beck, 2004). The retrospective approach was chosen for this study for several reasons. The first was the desire of the researcher to clearly evaluate, from nursing documentation, the infant feeding practices of the NICU during the study years. Infant feeding practices in NICUs have not been clearly documented in the literature in the New Zealand context. It was also felt that the researcher could strongly bias the breastfeeding outcomes, either intentionally or unintentionally, in a prospective study. Given that researcher involvement in a study is thought to bias or sway the perceptions and values of the participant (Burns & Grove, 2001) then it is possible that a prospective study of this cohort would have encountered these difficulties due to the intimate involvement of the researcher with most of the mothers and infants in the population group studied. Some mother-infant dyads may obtain more intense involvement and education than others. A retrospective study such as has been undertaken here counters this effect. There is also the concern of the Hawthorne affect in experimental research, a phenomenon

that occurs as a result of behaviors and or practices changing just because of involvement in the study (Polit & Tatano Beck, 2004).

Retrospective studies do have some disadvantages. Firstly, the documents used to retrieve data from may not be complete or reliable (Sarantakos, 1998). There is also some bias related to the documents because they represent individual interpretation of events. This makes retrospective designs not necessarily representative of the group being studied (Sarantakos, 1998). They do however tend to be quick, easily accessible and non-reactive. That is the method and measurements do not effect the results because the outcomes have already been determined (Sarantakos, 1998).

Reinhardt and Ray (2003), suggest that it is important to distinguish between quality improvements and research because of procedural differences between the two. The main reason for this is to ensure that the participants are protected from risk and that informed consent is obtained if the project falls into the research category. Reinhardt and Ray (2003) have identified four criteria for distinguishing quality improvement from research, intervention, risk, audience and data source. Intervention in quality improvement is when a practice or treatment is considered accepted practice. This is in contrast to research where the intervention is either a new or an untried practice. The second criteria is risk, in quality improvement there is no risk to participants. This is in contrast to research where there is the presence of risk, even if it is considered small. The third criteria, the audience are viewed in quality improvement as the organization carrying out the study. In research the audience is considered to be the scientific community and consumers. The information is therefore considered generalisable. The last criterion is the data source and in quality improvement this

comes from a single organization. In research the data source may come from multiple organizations.

When evaluating this current study for ethics committee review, using the four criteria mentioned above (intervention, risk, audience and data source), this study comes under the approach of quality improvement and does not therefore require formal ethics review (see page 53 heading 'Research Ethics'). This is also in keeping with both the requirements of the Area District Health Board where the research is to be undertaken (Auckland District Health Board, 2005a) and also the New Zealand Health and Disability Ethics Committees advice on audits versus research (New Zealand Health and Disability Ethics Committees, 2005).

SETTING

The study was undertaken in a large urban tertiary neonatal intensive care unit (NICU) in New Zealand. The NICU has a philosophy of care to support breastfeeding and an extensive recommended best practice policy on breastfeeding based on the Baby Friendly Hospital Initiative (BFHI). The hospital where the NICU is located is not an accredited Baby Friendly Hospital. A lactation consultant is employed in the NICU four days a week and provides staff education, policy and procedure formation and is available for consultations with mothers. It is therefore an expectation of all staff to support mothers in establishing and maintaining a breast milk supply and to breastfeed, if that is the mother's intention. Mothers are given hand-expressing pumps to take home to use, free of charge, and pamphlets regarding expressing and breastfeeding premature infants are also provided. Mothers are encouraged to express breast milk beside their infants' cot. The NICU had removed designated expressing rooms several years before the study was commenced. In the

NICU there are many hospital grade electric breast pumps for the mothers to use. There is also a parent-to-parent support group on site who are very supportive of breastfeeding. A sibling playroom, staffed by trained early childhood educators, is also available for all mothers with other children (under five years) to use. Mothers with other children are able to spend extended periods of time with the infant in the NICU.

At the time of the study there were several recommended best practices in place and several relevant ones require mention. In regard to the transition to oral feeds, it was expected that if a mother wanted to breastfeed her infant, and was available for three to four feeds a day, the infant would not be given a bottle. This was regardless of gestational age but contingent on the infant showing 'readiness to feed' cues. These infants would transition to breastfeeding using naso-gastric tube feeding. All infants born less than 1500 grams would routinely have their own mother's breast milk fortified with a cow's milk based fortifier. If breast milk was not available then a premature infant formula was given. There was no human breast milk bank in New Zealand at the time of the study.

RESEARCH ETHICS

A formal ethics application was submitted to the Massey University Human Ethics Committee (MUHEC). As per Massey University protocol at the time, the MUHEC advised that ethical review should be made through the Auckland Ethics Committee (AEC). The AEC administrator was formerly approached and after discussion with the chairperson and deputy chairperson, I was advised that formal ethics review was not required because of the nature of the study. Appendix 9 shows the

correspondence from the AEC. The AEC response is in keeping with both the requirements of the Area District Health Board where the research was undertaken (Auckland District Health Board, 2005a) and also the New Zealand Health and Disability Ethics Committee's advice on audits versus research (NZ Health and Disability Ethics Committees, 2005). Appendix 10 shows the letter from the clinical director of the study centre giving permission for the study to be undertaken.

PROCEDURE

Participant Selection

This study uses a nonprobability sample of infants born before 30 weeks gestation. These infants were not selected at random but rather for convenience. Convenience sampling is said to be the most common type of sampling used in non-experimental research. Nonprobability sampling is the weaker of the two types of sampling (the other being probability sampling) because less confidence can be placed in the representative nature of the sample (Polit & Tatano Beck, 2004). This can therefore lead to sampling bias, that is an over representation or an under representation of a variable or characteristic that is relevant to the research question (Sousa, Zauszniewski, & Musil, 2004). An example is that there tends to be an over representation of infants born prematurely to mothers in the lower socio-economic group (Chomitz, Cheung, & Lieberman, 1995; Tipene-Leach et al., 2000) and this population also tend to have poorer breastfeeding outcomes (Espy & Senn, 2003; Li & Grummer-Strawn, 2002; MOH, 2002). Further, the infants in this study may not be representative of the ethnic or cultural background of the New Zealand population because of the higher ratio of Maori, Pacific Island and Asian populations in the north (Statistics New Zealand, 2005). The sampling method has relevance because it

is convenient and describes the population of interest over time, as is the intention of this study.

Sousa, Zauszniewski, and Musil (2004) suggest that methods should be used to assess possible bias in convenience sampling however it is often not documented in nursing research. This can be done if the researcher has access to population data (Sousa et al., 2004). A comparison with population data during the study years (2000 – 2001) could be achieved in this study and is presented in the results chapter.

The following categories of infants were included in the study and a justification for each follows.

Inclusions

All babies born at 30 weeks post-conceptual age or less in 2000 and 2001 were included in the study. These years coincided with the statistics obtained from the Report on Maternity 2000 and 2001, regarding breastfeeding outcomes of term healthy infants (MOH, 2003). These years were chosen to enable an adequate cohort size to be examined, sample size is discussed further on page 60.

A gestational age of 30 weeks was chosen because information regarding breastfeeding in this cohort of infants is not prevalent in the literature. These infants tend to be more medically fragile, require more intervention, and have longer lengths of hospital stay than more mature infants and therefore have different issues than those born more than 30 weeks gestation. Gestational age as a variable was chosen over birth weight because of inherent differences within these two groups of infants.

The functional ability of infant sucking occurs due to maturation and not weight (McGrath & Bodea Braescu, 2004; Nyqvist, Sjoden, & Ewald, 1999).

As will have been seen from the literature review, studies vary with some using gestational age and some using birth weight as the main variable. This makes it difficult to assess outcomes between studies because in studies where birth weight is used as a variable there will be a wider range of gestational age. Infants who are born small for gestational age (SGA) but may be more mature than 30 weeks gestation will be included in such studies and infants born large for gestational age (LGA) but may be less than 30 weeks gestation, will be excluded from the studies.

Gestational age was one of the variables obtained from the neonatal database of the study centre. Gestational age was ascertained by one of three ways. The first is by confirmation of an early ultrasound scan, before 15 weeks gestation. The next measurement used, if an early scan result is not available is maternal 'sure of dates'. This is ascertained from the date of the mother's last menstrual period and calculated from a gestation calculator. Lastly, a late scan (up to 20 weeks gestation), would be used if the other two options were not available. The neonatal database entries for gestational age are entered in whole weeks. Infants born < 30 weeks gestation would have been entered into the data base as 29 weeks but could have been 29 weeks plus six days. Therefore gestational age is gestational age in weeks with a possible error of up to + six days.

All babies were included in the study regardless of whether the infant's mother chose to breastfeed or formula feed. This allowed comparisons to be made of the two groups in regards to growth, time to full oral feeding and time of discharge.

Exclusions

Infants born at other hospitals, and transferred to the study centre were excluded. Hospitals have different policies and feeding practices that may not fit with that of the study centre. This also includes the guidelines given to mothers regarding expressing breast milk. Hospitals also have different strategies (both nursing and medical), of caring for infants. An example is continuous positive airway pressure (CPAP) versus ventilators for respiratory support of sick or premature infants. These differences may impact significantly either positively or negatively, on feeding outcomes for babies (Dawson & Benson, 2001). Including infants only from the study centre allows a more homogenous group, regarding intervention and hospital policies, to be observed.

Infants transferred to other hospitals for care were excluded. As referred to above, differing hospital practices may impact on feeding outcomes. This audit of feeding practices was internal and did not allow the researcher access to clinical information once the infant was discharged from the study centre. This meant that follow-up of infants' progress in a different setting was not a viable option for the researcher.

Infants born with congenital or chromosomal abnormalities were excluded from the study. Functional ability to oral feed may be affected in this group of infants. For example infants with down's syndrome have an increased risk of feeding problems (Hawden, Beaugard, & Kennedy, 2000). Infants with cardiac abnormalities often have

higher energy requirements and difficulties transitioning to oral feeding (Hawden et al., 2000). Infants with a patent ductus arteriosus (PDA) were not excluded as this is considered a common consequence of being born premature. A homogenous cohort, of infants unencumbered with physical disability, will assist in the reliability of the study. There were infants who developed certain conditions who were not excluded from the study (unless they died) as it was felt these were common consequences of being born premature. Such conditions included necrotising enterocolitis (NEC), intraventricular haemorrhage (IVH), respiratory distress syndrome (RDS), chronic lung disease (CLD), retinopathy of prematurity (ROP) and sepsis.

Infants who died during their hospital stay or within the follow-up period at home were also excluded from the study. Infants who have died are unable to have complete data collection obtained.

Description of Study Sample

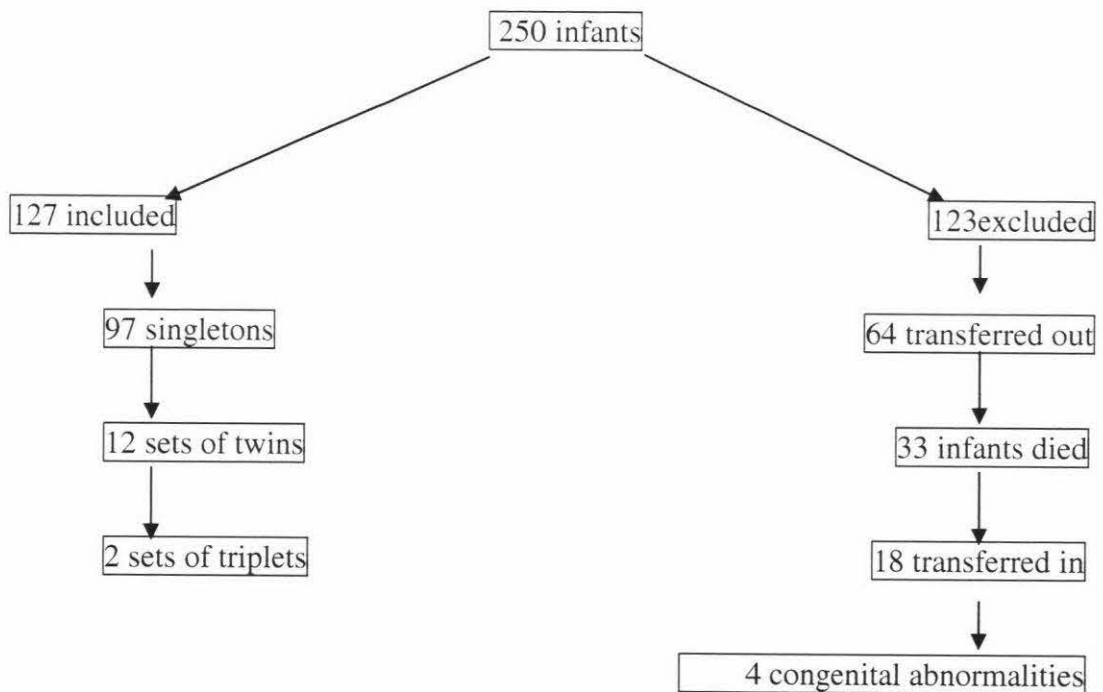
During the study period 250 infants born less than 30 weeks gestation, were identified from the neonatal database, of the neonatal intensive care unit (NICU) of the study centre (see Figure 1). Of these 127 (51%) infants met the study entry criteria. The study criteria were: all infants born at the study centre at less than 30 weeks gestation during the years 2000 and 2001. Infants were excluded if they were transferred in or out of the study centre, born with congenital abnormalities, or died during hospitalisation.

The inclusions comprised 97 (76%) singletons, 12 (19%) sets of twins and 2 (5%) sets of triplets. Excluded from the study were 123 (49%) infants. The exclusions comprised 64 (52%) who were transferred out to other centres and 18 (15%) who

were transferred in from other centres. Also meeting the exclusion criteria were 4 (3%) infants' born with congenital abnormalities. Of these 2 infants had congenital heart disease that required surgery, 1 infant had a liver abnormality, and 1 infant had a cleft lip and palate.

Thirty-three (27%) infants were excluded because of death during hospitalisation these deaths were originally recorded as live births. Eighty five percent of these deaths were due to complications of prematurity. No live infants were excluded because of complications of prematurity, this is therefore a representative sample of infants born before 30 weeks.

Figure 1: Inclusions and Exclusions



Sample Size

Polit and Tatano Beck (2004) suggest that representiveness is the main criterion determining sample size for research purposes. In other words, how similar is the sample to the rest of the population and avoids bias (Polit & Tatano Beck, 2004). The answer to this requires statistical reasoning and informed guesswork (du V Florey, 1993). Du V Florey elaborates by suggesting that calculations of sample size are based on four factors: the variance of the variable being studied, the size of the effect of interest, the level of significance, and the power of the test (du V Florey, 1993). The main problem with using samples to represent a population is that the results are influenced by chance, that is sampling variation. The aim of providing an adequate sample size is to reduce the risk of the variation occurring by chance.

Sample size in this study was determined by the number of infants born during the study years, minus the infants that were excluded as highlighted above. In nine recent studies investigating breastfeeding outcomes in NICUs, six had sample sizes between 70 and 145 (mean 100) infants (Flacking, Hedburg Nyqvist, Ewald, & Wallin, 2003; Furman et al., 2002; Furman et al., 1998; Griggs et al., 2001; Killersreiter et al., 2001; J. Wheeler, Johnson, Collie, Sutherland, & Chapman, 1999). The three other studies had sample sizes of 361, 405 and 734 infants. The larger the sample size, the more representative it is of the population, therefore a reduced risk of sampling errors (Polit & Tatano Beck, 2004). In contrast, small sample size can lead to unreliable results. With nonprobability sampling however, even a large sample size can result in extensive bias (Polit & Tatano Beck, 2004).

A small sample size may be considered appropriate if the population in the study is relatively homogeneous (Polit & Tatano Beck, 2004). Another reason why small

sample size may be considered is if attrition of the sample and sub-group analysis are unlikely (du V Florey, 1993). In this current study, a moderate sample size was chosen for several reasons. Firstly the cohort of infants is relatively homogeneous; they all require neonatal intensive care, all born and treated at the same hospital therefore were all exposed to similar treatment regimes and had a narrow gestational age range. Another justification for the relatively small sample size is that attrition is not likely to occur although sub-group analysis was probable. This current study is in keeping with the current literature regarding sample size.

Data Collection

Maternal and infant demographic data was downloaded from the neonatal database at the study centre. The participants were selected from the Neonatal Database based on gestational age less than 30 weeks gestation. The infants' hospital numbers were used to access the medical records. When transcribing information onto the data collection sheet name and hospital numbers were removed and replaced with a number 1-127 to maintain anonymity. The researcher of this study did not enter data into the neonatal database. While errors are likely to occur in data collection and entry into the neonatal database (Kraenzle Schneider & Deenan, 2004), this was minimised by the use of only two neonatal nurses, especially trained in data entry skills. The data collected from the neonatal database included demographic data of the mother and the infant. These included for the mother, age, ethnicity, parity, lead maternity carer (LMC), breastfeeding intention, antenatal steroids, mode of delivery and plurality. Demographic data collected for the infant included admission date, discharge date, gestational age, birth weight, sex, apgar scores at one and five minutes, days on mechanical ventilation, days on continuous positive pressure

(CPAP), days on oxygen, diagnosis of necrotising enterocolitis (NEC) and diagnosis of intraventricular haemorrhage (IVH).

Specific data regarding in hospital practices and home care practices were collected from individual case notes of the infants. This data was extensive and included kangaroo care (KC) initiated, regular KC, age of full enteral feeding, day of first oral feed, type of first oral feed, percentage of NG feeds, percentage of bottle feeds, percentage of breastfeeds, type of teat used, age bottle introduced, percentage of breast milk throughout hospitalisation, age of four oral feeds a day achieved, age of full oral feeding, number of breastfeeds per day, lactation consultant involvement, nipple shield use, oral feeding difficulties, code at discharge for last 24 hours and last 48 hours, and rooming in. Oral feeding difficulties were deduced from the infant's medical records by the researcher. These infants did not necessarily have a formal feeding assessment. Further data was collected after discharge from the homecare nursing notes. This data included, visited by homecare, number of visits, number of days in homecare service, oral supplements given, number of days received supplements, days to weight gain, weight at discharge, weekly weight for 6 weeks, feeding code at discharge from homecare, well child provider (WCP), and breastfeeding at follow-up. See appendix 8 (page 172) for specific outcome measures and how they were defined.

Only the researcher collected the data using a pre-designed format. There were no missing infant records. Permission to access the notes was given by the Director of Neonatal Intensive Care (see appendix 10, page 180). The raw data was entered directly into an excel spreadsheet. This was then imported into the Statistical

Analysis System (SAS) programme. The data was then coded as required by the analysis using the SAS programme. SAS is a trademark of SAS Institute Inc., Cary, NC, USA. SAS programmes read *raw* data, create SAS datasets, perform transformations, and perform analyses (DiIorio & Hardy, 1996).

Data Errors

Missing or inaccurate data can weaken research findings (Kraenzle Schneider & Deenan, 2004). Human error is common however (DiIorio & Hardy, 1996), which led Kraenzle Schneider and Deenan (2004) to identify several strategies to minimize them. These include adequate preparation of the data collection tool and training of the data collectors. Secondly, appropriate review of the forms while the data is being collected which is usually done by the data collector. A second reviewer may then check to ensure accuracy, especially when data calculations are done during data collection. Thirdly, minimising data entry errors by following protocols followed by verification of data entry accuracy (Kraenzle Schneider & Deenan, 2004).

The study and the data collection tool were devised by myself. I and was the only person to collect and enter the data thereby minimising errors by having two or more data collectors. Twelve of the infants' datasets were randomly selected and checked for accuracy by an independent observer, trained by the researcher. With these strategies, errors were minimised and more reliability placed on the statistical results and conclusions. This is in keeping with strategies reported in the literature (Kraenzle Schneider & Deenan, 2004).

Data Cleaning

Data cleaning is required to prepare the data for analysis. To ensure data is consistent and accurate, checks are performed (Kraenzle Schneider & Deenan, 2004). Polit and Tatano Beck (2004) suggest two types of checks when data cleaning. The first is to check for outliers and wild codes. Outliers are described as numerical values of codes that fall outside the coding scheme and are removed from one another on the graphic display of the distribution (Martinen Doordan, 1998). By checking frequency distributions, paying attention to the lowest and highest values, outliers can be found. Frequency distributions is a descriptive statistical method of summarizing all the scores and frequency of occurrence for each score in a data set (Martinen Doordan, 1998). A problem can occur because some outliers may be legitimate, therefore all outliers cannot be presumed to be false (Polit & Tatano Beck, 2004). Coding errors can also occur when a code is entered wrongly, for example male entered instead of female. It is imperative therefore to be meticulous when performing coding, entering, verifying and cleaning of the data (Polit & Tatano Beck, 2004).

The second data cleaning process that can be done is consistency checks. This requires the researcher to focus on the internal data for consistency (Polit & Tatano Beck, 2004). There is conflict in the literature regarding verification of data entry (Kraenzle Schneider & Deenan, 2004). Traditionally data entry verification is done by 100% verification with dual entry, that is data is entered twice into two different datasets, the two are then compared electronically (Kraenzle Schneider & Deenan, 2004; Mullooly, 1990). Mullooly (1990) however suggests that modern data entry technology has made the necessity for 100% verification redundant and that verification of randomly selected fields along with 100% verification of important

fields is cost efficient and provides quality results. As mentioned in the data errors section, verification was done on approximately 10% of the cohort by an independent observer.

Data Analysis

Once the data was collected and cleaned it was analysed by a statistician using SAS (SAS Institute Inc, 1990). Statistics can be categorised as either descriptive or inferential. In this study, descriptive statistics were used to describe and summarise the data. This type of analysis generates results such as percentages and averages (Polit & Tatano Beck, 2004). To be able to generate these, the data needs to be organised. Frequency distribution is a means of achieving this. There are three characteristics of frequency distribution that can completely describe a set of data. These characteristics are the shape of the distribution of values, central tendency and variability (Polit & Tatano Beck, 2004).

The shape of distribution is used to describe the magnitude and spread of the data scores or values (Martinen Doordan, 1998). This is often displayed in graph form on a histogram or frequency polygon. Normal distribution is commonly seen in many human attributes such as height and intelligence. This particular distribution is symmetrical as presented in the typical bell curve. Asymmetrical data is referred to as skewed data, with a peak that is off centre with a longer tail. If the tail is to the right of the graph it is deemed to be a positively skewed distribution. Conversely if the tail points to the left it is regarded as negatively skewed (Polit & Tatano Beck, 2004).

The term *average* is used to imply central tendency, however there are three types of central tendency. The mode is the most frequently occurring value or category, the median is the middle number in the set of observations and the mean is the mathematical calculation of the average. The mean is calculated, as equal to the sum of all scores divided by the total number of scores. The mean is the most common measure of central tendency because it is the most stable indicator of central tendency. The mean is also often used in tests of statistical significance however this will depend on the question being asked (Polit & Tatano Beck, 2004) When the distribution of scores is symmetrical, then the median, mode and mean coincide (Polit & Tatano Beck, 2004). In asymmetrical distributions the mean will always be pulled towards the tail.

The measures of central tendency do not reveal the whole picture of distribution. The shape or how spread out the data is will play a role (Polit & Tatano Beck, 2004). This is referred to as the variability, that is the degree of difference and distribution of the values (Marttinen Doordan, 1998). The range, semiquartile range, and standard deviation are the most common indices of variability. The range is the highest score minus the lowest score in a distribution. With only two scores to base the range, it is therefore unstable and not reliable and tends to be used in conjunction with other indices. The semiquartile range is calculated based on quartiles of distribution. The upper quartile is the point below which 75% of the cases fall and the lower quartile is the point where 25% of the cases fall. This index is based on middle cases rather than extreme scores and therefore tends to be more stable.

Standard deviation is the square root of the variation, that is the average variation from the mean value for all values in the data set (Marttinen Doordan, 1998).

Simplified, standard deviation indicates the researcher's degree of error when using the mean to describe a whole sample. The standard deviation is a stable estimate of a parameter and is the preferred index of a distribution variability for variables measured on the interval or ratio scale (Polit & Tatano Beck, 2004). The mean, mode, standard deviation etc are univariate descriptive statistics, that is they describe one variable at a time. Other methods are used when analysing bivariate statistics.

Bivariate descriptive statistics describe the relationship between variables and include contingency tables and correlation. A contingency table is a two-dimensional frequency distribution where two variables are cross-tabulated (Marttinen Doordan, 1998; Polit & Tatano Beck, 2004). Contingency tables allow relationships between two variables to be viewed easily and simply and are usually used with nominal or ordinal data. The relationship between two variables is usually described through correlation procedures.

Correlation between variables is usually shown in graphs known as scatter plots. An upward slope from the left to the right indicates a positive correlation. Negative correlation slopes on the other hand start high on the left and slop down to the right. The more closely the points are to a straight line, the stronger the correlation. A perfect correlation is represented by a perfect straight line (Polit & Tatano Beck, 2004).

Expressing the relationship between variables can also be computed and expressed as the correlation coefficient. Zero represents no relationship, up to +1.00 being positively correlated and down to -1.00 being negatively correlated (Polit & Tatano Beck, 2004). The Pearson's r is the most common type of correlation index used and is used with measures of interval or ratio scale (Marttinen Doordan, 1998). Variables on the ordinal scale are measured using the Spearman rank-order correlation coefficient (Spearman rho). Much then can be gleaned from data using descriptive statistics but these only tell part of the story. As mentioned earlier descriptive statistics are used to describe, explain and summarize numerical data. Inferential statistics on the other hand are used to make conclusions and presumptions about the probability of the findings from the sample group occurring in the population in general (Marttinen Doordan, 1998).

Inferential statistics give a framework for helping decide if sampling error is too high to provide results that can be generalised to the general population or conversely allows researchers to estimate population parameters from sample statistics (Polit & Tatano Beck, 2004). Judgements can be made about the statistics reliability in a systematic and objective way (Polit & Tatano Beck, 2004).

In this study the following statistical tests were used in two phases. Phase one involved using univariate descriptive statistics to obtain percentages (%), means (M), 95% confidence intervals (CI), semiquartile range (SQR) and standard deviations (SD). These parameters helped describe the maternal and infant characteristics, infant feeding characteristics and homecare variables. Breastfeeding outcomes (dependent variables) were established during hospitalisation, discharge from

hospital, discharge from homecare and at follow-up. The chi-square (X^2) test was used to provide univariate descriptive statistics to test the relationships between independent and dependent variables. Inferential statistics were obtained using analysis of variance (ANOVA) for normally distributed statistics and the Wilcoxin, Kruskall-Wallis test was used for non-parametric data analysis. Phase two used multiple regression analysis, in a stepwise fashion, to assess the contribution of independent variables on outcome variables. Two-tailed tests were used for all statistical analysis. For all inferential statistical analysis alpha (p -value) was set at 0.05 to establish significance.

CONCLUSION

The methods chapter has described the study design, the setting of the research and research ethics. Participant selection has been given with a description of the study sample. Data collection, with consideration to data errors and data cleaning, has been discussed. Finally data analysis has been addressed with a summary of specific tests that were used in this study. The following results chapter will describe the results of the research.

CHAPTER FOUR

RESULTS

The previous chapter discussed the methods used in this research project. The aims of the study are: to identify the breastfeeding outcomes of premature infants born before 30 weeks gestation; to identify key determinants that may contribute to the success of breastfeeding in this population of infants; and to describe the feeding practices of this population during hospitalisation and post-discharge. Specific categories identified are the breastfeeding outcomes, maternal characteristics, infant characteristics, the key determinants of breastfeeding success (support, maternal milk supply, kangaroo care (KC), and bottle use), feeding problems and growth. In total 127 infants were included in the study. The results of the research are presented in this chapter.

BREASTFEEDING OUTCOMES

Intention

There was no documentation in 52 (41%) infants' medical records of mothers' intention to breastfeed as table 1 indicates. Of the remaining 75 (59%) infants, 67 (89%) mothers intended to breastfeed and 3 (4%) mothers intended to bottle-feed expressed breast milk (EBM). When analysing results for intention to breastfeed both these groups were combined. Therefore, of the mothers' who had intention to breastfeed documented in the infants' medical records, 93% wanted to breastfeed.

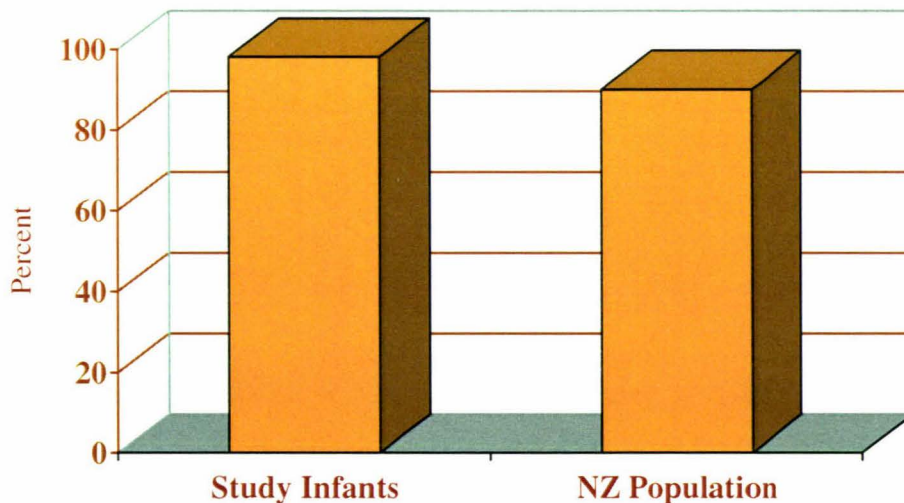
Table 1: Breastfeeding Intention

	n	%
Yes	67	53
No	5	4
Unknown	52	41
Bottle-feed EBM	3	2

Initiation

The results show a high initiation rate of lactation in this cohort of mothers (98%) in comparison to the New Zealand population of breastfeeding (see figure 2). There were more mothers who initiated lactation (98%) than intended to breastfeed (93%) in the study group.

Figure 2: Comparison of Breastfeeding Initiation Between Study Group and the New Zealand Population

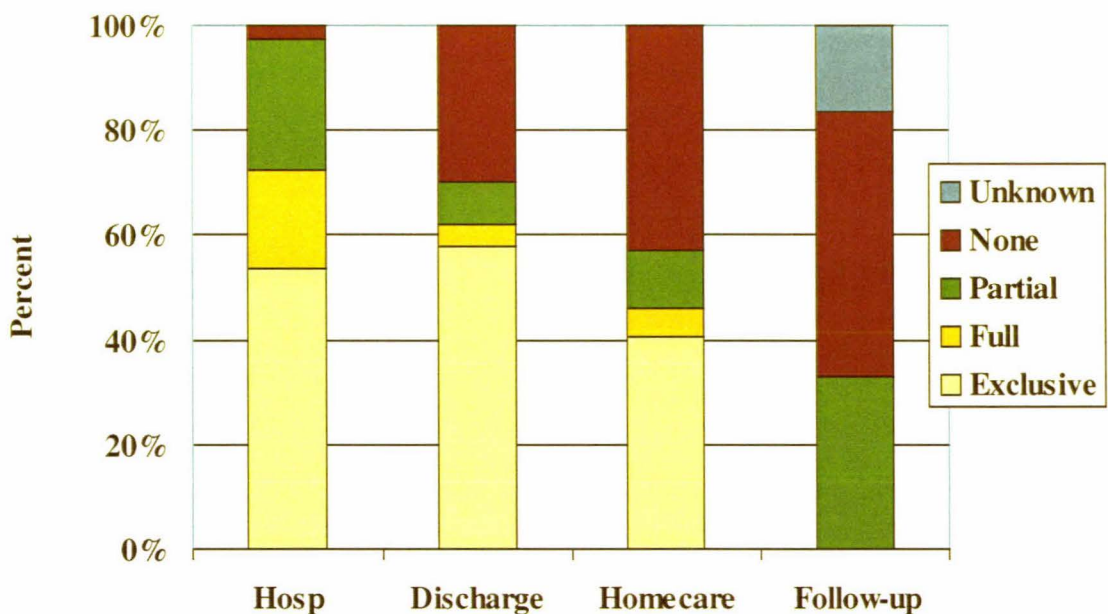


Source of NZ population data: MOH. (2003). Report on Maternity 2000 & 2001. Wellington:MOH

Duration

Figure 3 shows the breast milk feeding status at the main data collection points of the study. During the hospital stay, 98% of infants received some breast milk. The amount of breast milk the infant received during hospitalisation is expanded on in the milk supply section (see figure 13). At the time of discharge from hospital (recorded during the last 24 hours), 73% were receiving some breast milk and 52% were receiving exclusive breast milk. At the time the infant was discharged from homecare, 61% were receiving breast milk, 37% were breast milk feeding exclusively. At the time of follow-up with the neonatologist, 32% were recorded as breastfeeding, 49% were recorded as artificial baby milk feeding (ABM) and 16% did not have feeding type recorded. No infants were recorded as exclusively breastfeeding at follow-up because this was not documented in the infants' medical records.

Figure 3: Percentage of Breast Milk Feeding During Study Period

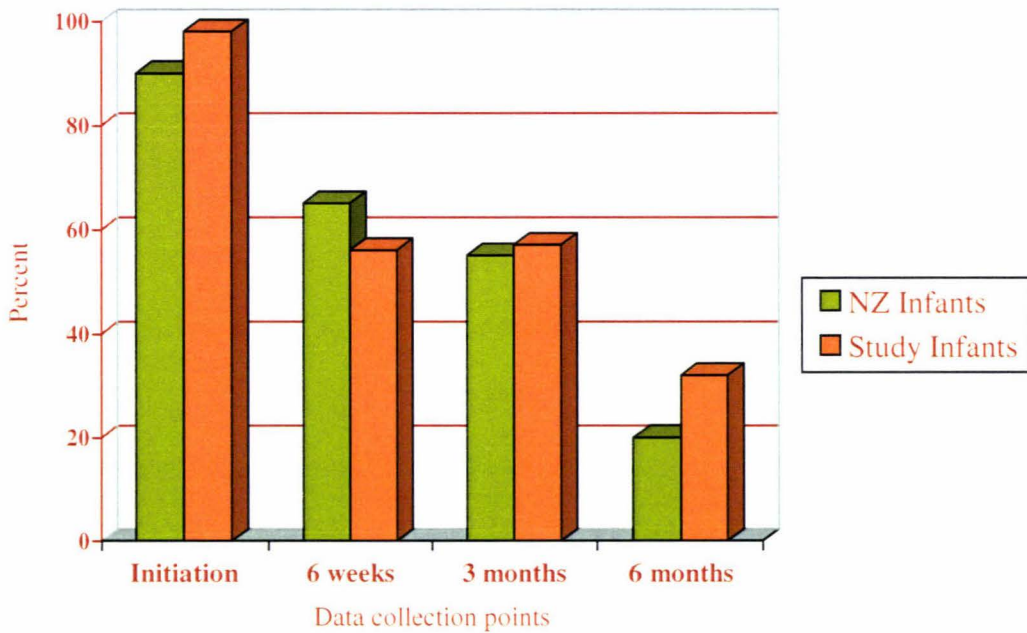


Duration: National Comparison

Breastfeeding duration is shown in figure 4 (page 74) as a comparison of the study infants with the New Zealand population of term healthy infants during the same study years. Initiation included infants who had received any breast milk. The six-week data collection point only included infants that were fully breast milk fed (breastfeeding code 1 and 2 - >80% breast milk fed). The data collection points of three and six months included infants who were receiving any breast milk. The data collection points for the New Zealand population of infants was chronological age (MOH, 2003). For the study infants the data collection points were initiation, discharge from hospital, discharge from home care and at follow-up. These time frames provide a conservative approximation to those of the New Zealand infant population. There are some issues with the data collection for the general population. Firstly breastfeeding data was not recorded in 36% of the infants (MOH, 2003). Also, the definitions of the statistics were not standardized throughout NZ until 2002, so errors may have occurred in these areas (MOH, 2003).

Figure 5 (page 74) shows the comparison of the study group compared with New Zealand breastfeeding data for initiation of breastfeeding and amount of breast milk received. The statistics for amount of breast milk received (exclusive, partial or none) were collected when the mother and infant were transferred to the care of the well child provider (WCP) for both groups. The transfer of care occurred at around 4 – 6 weeks postnatal age for the term healthy NZ infants. The transfer of care to the WCP for the study infants occurred at around three months of age, so in fact they were chronologically older than the New Zealand group but corrected age was similar.

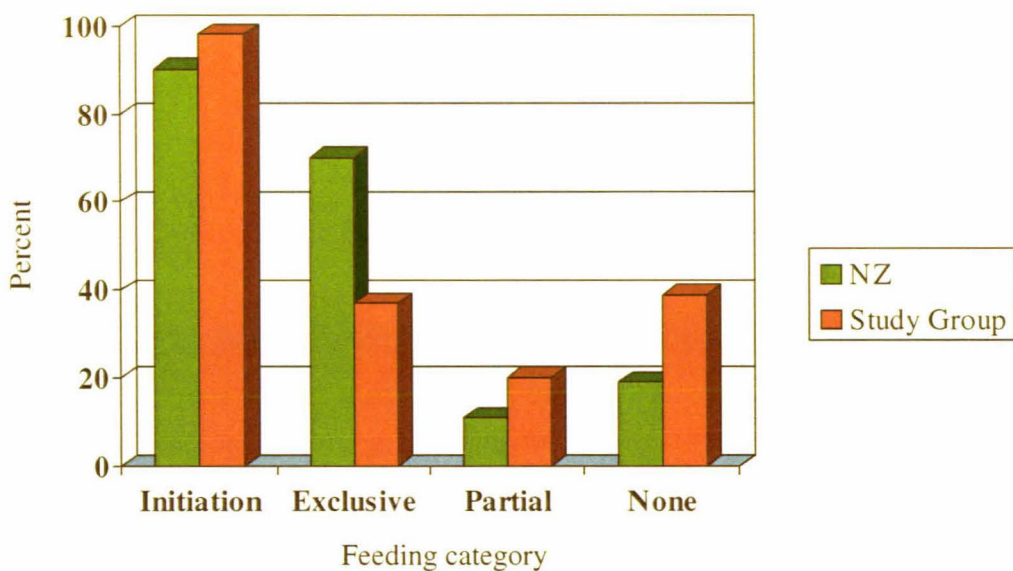
Figure 4: Comparison of Breastfeeding Study Infants and New Zealand Infants at Similar Data Collection Points



NB: Data collection points not exact for both groups

Source of New Zealand data: MOH. (2003). Report on Maternity 2000 & 2001. Wellington: MOH.

Figure 5: Comparison of Study Group With Term Healthy New Zealand Infants at Transfer of Care to Well Child Provider (WCP)



New Zealand data source: MOH. (2003). Report on Maternity 2000 & 2001. Wellington:MOH.

Figure 6 shows how the exclusively breast milk fed infants at discharge from hospital received their breast milk in comparison to discharge from homecare (see appendix 1, page 161). Seventeen infants were exclusively breast milk fed at the breast (breastfeeding code A1) at discharge from hospital and this number remained the same at discharge from home care. Three quarters of the partial breastfeeding at the breast group (breastfeeding code C1) had stopped this combination at discharge from homecare. Two thirds of the token breastfeeding group (breastfeeding code D1) had stopped this type of feeding at discharge from homecare. See appendix 1, page 161 for clarification of breastfeeding codes.

Figure 6: Breastfeeding Code at Discharge From Hospital and Homecare for Exclusive Breastmilk Fed Infants

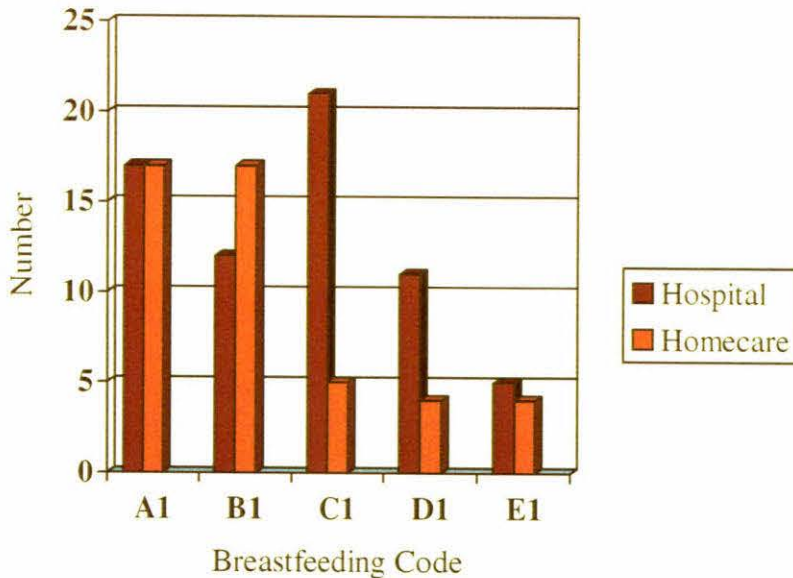
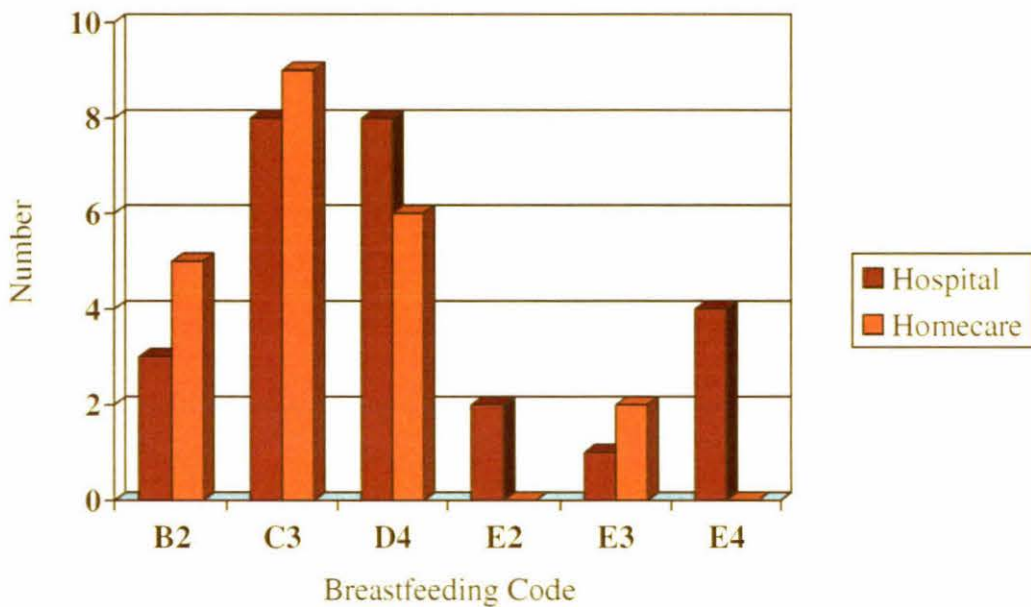


Figure 7 (page 76) shows the pattern of feeding for infants who were feeding a combination of breastmilk and ABM. The infants in the groups E2 and E4 show a drop from discharge from hospital to discharge from homecare and this is likely to be due to weaning off breast milk to exclusive ABM feeding (E5). The C3 group

(partially breast milk feeding partially at the breast) showed a slight increase from discharge from hospital to discharge from homecare. The B2 group (>80% breast milk fed >80% of the time at the breast) showed a slight increase.

Figure 7: Breastfeeding Code at Discharge From Hospital and Homecare For Mixed Feeding Infants



KEY DETERMINANTS

Maternal Characteristics

Table 2 shows the maternal characteristics. Maternal age range (n=122) is 17-41 years with a mean of 31.9 years (missing data on five mothers). The mothers in the study group had between one to six children (including the infant/s in the study) with a mean of 2.1 children. Delivery type was divided into three categories, seventy-two mothers (56.7%) had caesarean section (C/S - includes emergency and elective), 49 (38.6%) had normal vaginal deliveries (NVD) and 5 (3.9%) had instrumental

deliveries (forceps). Lead maternity carer (LMC) was poorly documented with 45 (35.4%) mothers with no documentation of LMC. Of the remaining 82 mothers, two (2.4%) were under the care of a general practitioner (GP), seven had midwifery care, 16 (19.5) had obstetrician care and 57 (69.6) were under the care of the hospital clinic midwives. Virtually all the mothers received antenatal steroids and data was documented on this in 124 (97.6) mothers. Of those who received antenatal steroids, 75 (59%) received a complete course, 14 (11%) had received them more than 7 days before delivery, 25 (19.7%) received them less than 24 hours prior to delivery and 10 (7.9%) received no steroids at all.

Two-way analysis of variance (ANOVA) was used to test the significance of differences between group means with the dependant variables (breastfeeding at discharge from hospital) and found no significance.

Maternal demographics of smoking and socio-economic status were not available from the infant's medical and nursing notes. Information obtained from the Auckland District Health Board (ADHB) website showed that the population in this area had a 20% smoking rate and 31% received income support from the government (Auckland District Health Board, 2005b).

Table 2: Maternal Characteristics

	<i>n</i>	range	<i>M</i>	%	$X^2(2)$	<i>α.</i>
Age (years)	122	17-41	31.9		1.289	ns
Parity¹	127	1-6	2.1		0.7	ns
Ethnicity	126				5.196	*
Delivery (type)	126				2.61	ns
C/S	72			56.7		
Instrumental	5			3.9		
Vaginal	49			37.8		
LMC	82			35.4		
GP	2			2.4		
Midwife	7			8.5		
Obstetrician	16			19.5		
Hospital	57			69.6		
Antenatal steroids	124			2.4	0.817	ns
Complete	75			59.0		
>7 days	14			11.0		
<24 hours	25			19.7		
None	10			7.9		

¹ Inclusive of infant/s in this study.

NB: Total percentages may not always equal 100% due to effects of rounding.

* $p < 0.05$

Kruskal-Wallis test for chi-squared analysis.

Ethnicity

Table 3 shows the ethnic diversity between the study infants, infants within the district health board of the study centre and the New Zealand population. This becomes relevant when comparing the population based breastfeeding outcomes with the study centre. The ethnicity of the majority of mothers was cited as Caucasian, there were 70 (55.2%) in this group. The next common group was Polynesian, with 22 (17.3%) mothers, followed by 20 (15.5%) Asian mothers and 13 (10.2%) Maori. Ethnicity was not documented for one of the mothers.

Table 3: Comparisons of Ethnicity With Study Cohort, ADHB and New Zealand Population

	Study Cohort (%)	ADHB⁺ (%)	New Zealand^{++ 1} (%)
Caucasian	55	59	80
Polynesian	17	12	7
Asian	16	13	7
Maori	10	9	15
Other	1	7	1

¹ Percentage totals more than 100 because of people identifying themselves as having more than one ethnic group.

NB: Percentages may not total 100 due to rounding.

***Source:** Auckland District Health Board. (2005a). Population statistics. Auckland District Health Board. Retrieved 28 February, 2005, from the World Wide Web: www.adhb.govt.nz/population_stats.htm

****Source:** Statistics New Zealand.(2001). Census of population and dwellings: Ethnic groups. Statistics Wellington: New Zealand

Figure 8 shows the breast milk feeding outcomes divided into the four categories of ethnicity. The separate ethnic groups will be shown individually in figures 9 to 12 (pages 79-81). Figure 8 shows that the Caucasian infants received more breast milk than the other ethnic groups. No Caucasian infants received only ABM. In the Polynesian group there were no exclusively breast milk fed infants. Both the Maori and Polynesian groups had a large proportion of token breast milk feeding. Multivariate analysis showed that race was a negative predictor for breastfeeding success ($p < 0.0044$, CI 0.38-2.09). The dependant variable was more than 80% of feeds were breast milk feeds.

Figure 8: Percentage of Infants Breast Milk Fed During Hospitalisation By Ethnicity

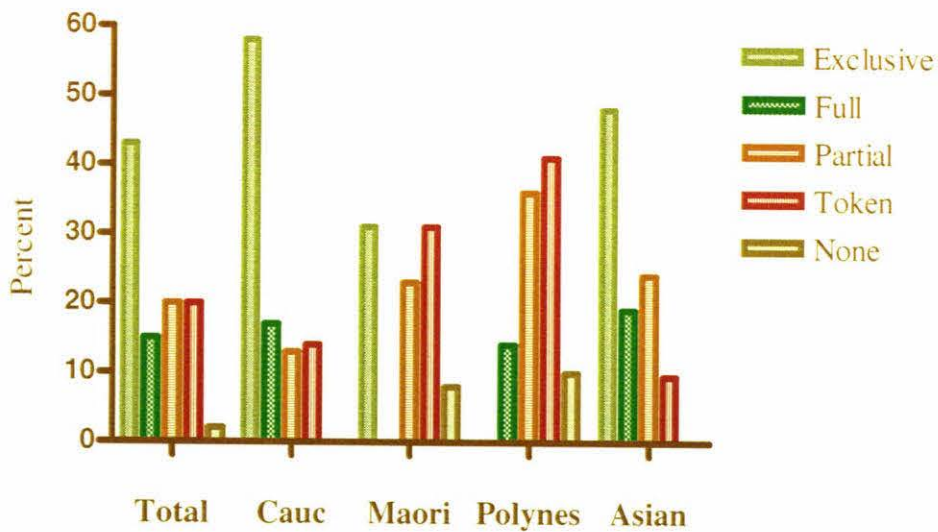


Figure 9 (page 81) shows the breastfeeding outcomes of the Caucasian infants of which 41 (59%) received breast milk exclusively during their hospital stay. In the full category there were 12 (17%) infants, in the partial category there were 9 (13%) and in the token category there were 10 (14%). There were no Caucasian infants that

received only ABM. There are a large percentage (76%) of infants who received over 80% of their oral feeds as breast milk.

Figure 9: Percentage of Caucasian Infants Breast Milk Fed During Hospitalisation

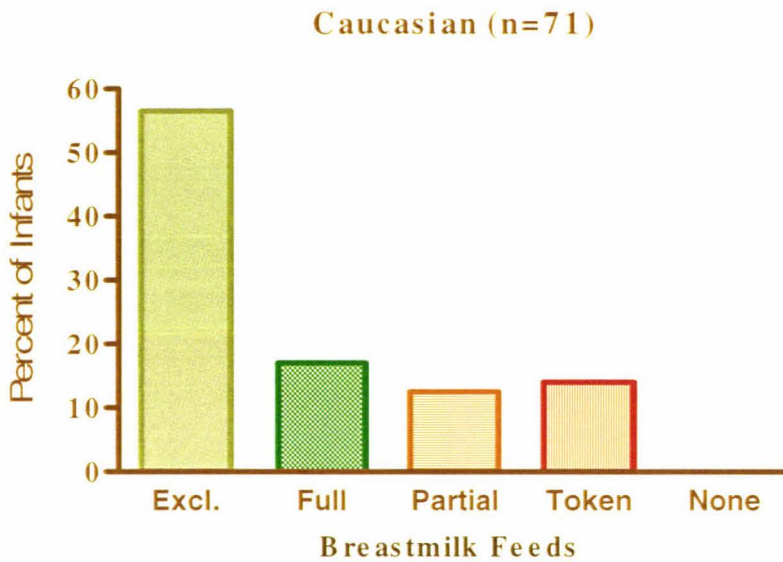


Figure 10 (page 82) shows the breastfeeding outcomes for the Asian infants. All of the Asian infants received some breast milk during hospitalisation. Forty eight percent (n=20) were exclusively breast milk fed, 19% (n=4) were fully breast milk fed, 24% (n=5) were partially breast milk fed and 10% (n=2) received token breast milk. There were no infants in the 'none' category. Sixty seven percent of these infants received more than 80% of their milk feeds as breast milk.

Figure 10: Percentage of Asian Infants Breast Milk Fed During Hospitalisation

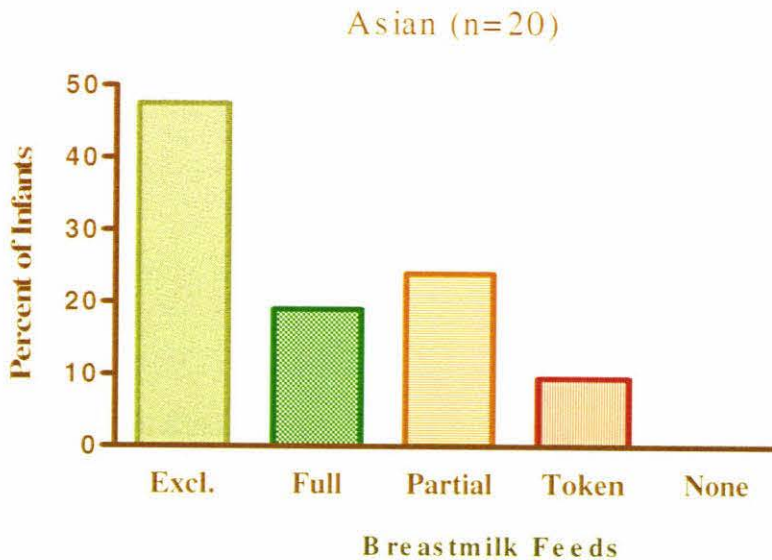


Figure 11 (page 83) shows the breastfeeding outcomes for the Maori infants. Of the 13 Maori infants, 31% (n=4) were exclusively breast milk fed, 23% (n=3) were partially breast milk fed, 31% (n=4) had only token breast milk and 8% (n=1) received no breast milk. There were no infants in the full breast milk category. These results show that 31% of the Maori infants received more than 80% of their milk feeds as breast milk and 92% received all or some breast milk during hospitalisation.

Figure 12 (page 83) shows the Polynesian infants' breast milk feeding outcomes during hospitalisation. There were 14% (n=3) in the full category, 36% (n=8) in the partial category, 41% (n=9) in the token category and 9% (n=2) received no breast milk. This shows that only 14% of the Polynesian infants received more than 80% of their feeds as breast milk. In contrast 50% (n=11) of infants received less than 20% of breastmilk during hospitalisation.

Figure 11: Percentage of Maori Infants Breast Milk Fed During Hospitalisation

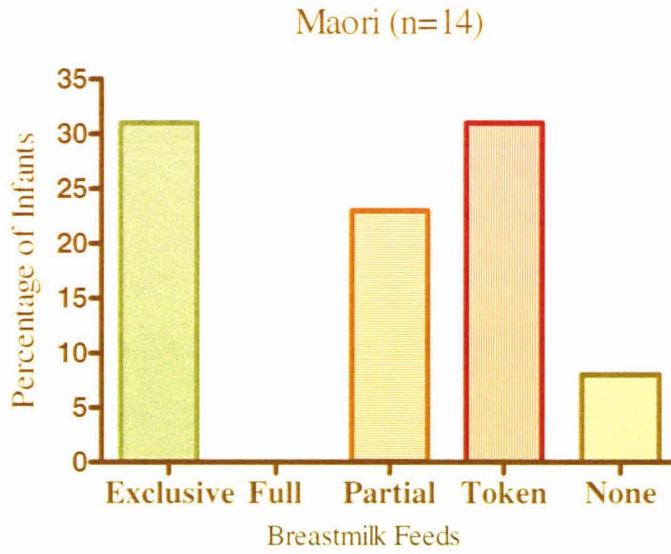
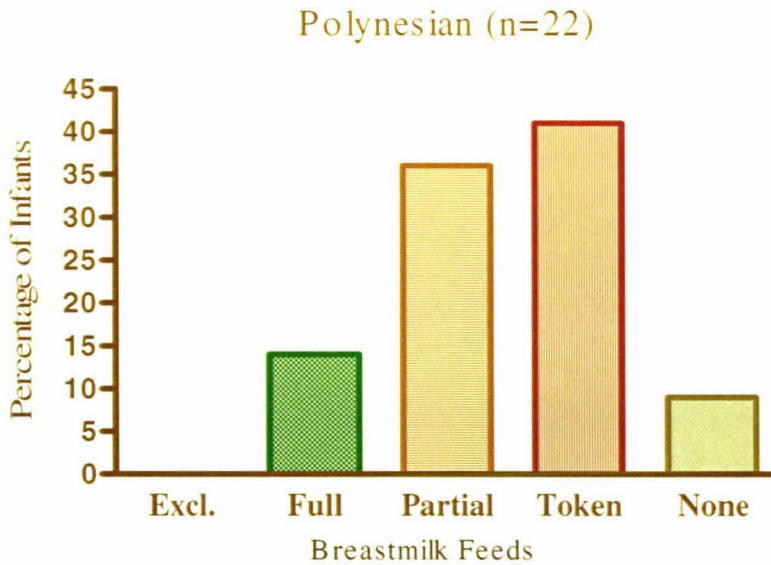


Figure 12: Percentage of Polynesian Infants Breast Milk Fed During Hospitalisation



Infant Characteristics

Table 4 shows the characteristics of the infant. No data were missing in this dataset of characteristics. The gestational age range of 24 to 25 weeks is considered on the borderline of viability. This group of infants are generally the sickest and smallest. The number of ventilator days is low considering the low gestational age of the cohort (mean 27.3 weeks gestation). This reflects the neonatal intensive care unit (NICU) policy of early weaning from the ventilator in favour of the less invasive respiratory therapy of nasal continuous positive airways pressure (CPAP). The number of days on oxygen exceeds the number of hospital days because some infants were discharged home on oxygen. The infant who received oxygen for 858 days had chronic lung disease that required long-term therapy. Some of this time was receiving oxygen at night-time only. The mean length of hospital stay was 73 days which equates to 10.4 weeks with a range of 4 to 18 weeks.

Table 4: Infant Characteristics

Characteristics	<i>M</i>	Range	95% CL	$X^2(2)$	α
Gender	M=69 F=58			0.699	ns
Gestational age (weeks)	27.3	24 - 29	27 - 27.6	0.535	ns
Birth weight (grams)	1063	560 - 1800	1014 - 1112	3.267	ns
Ventilator days	3.6	0 - 40	2.4 - 4.9	7.817	ns
CPAP days	28	1 - 77	24 - 31	2.9	ns
Oxygen days	63	0 - 858	38 - 88	4.433	ns
Hospital days	73	31 - 127	69 - 77	6.613	ns

Kruskal-Wallis test for chi-squared analysis

Infant Feeding Characteristics

The infant feeding characteristics are shown as the infant’s age in days and corrected gestational age (GA) in weeks, in table five. Most infants were fully enterally feeding by 2 weeks of age (95% CL, 13 – 16 days). The infants received their first oral feed at a mean of 38 days (corrected gestational age mean of 33 weeks). Infants were fully orally feeding at a mean of 66 days (95% CL, 63 – 69 days) of age and this coincided with discharge home. This is in keeping with the study centre protocol that infants are deemed ready for discharge once 24 hours of oral feeds has been attained.

Table 5: Infant Feeding Characteristics

Characteristics	<i>M</i>	Range	95% CL	$X^2(2)$	<i>α</i>
Full enteral feeding (days)	15	4 - 69	13 - 16	1.787	ns
(GA in weeks)	29	26 - 37	29 – 30		
First oral feed (days)	38	9 – 80	35 - 41	3.717	ns
(GA in weeks)	33	29 – 37	32 – 33		
4 feeds per day (days)	59	22 - 80	53 - 67	1.676	ns
(GA in weeks)	36	32 – 38	35 – 38		
Full oral feeds(days)	66	34 – 116	63 - 69	3.344	ns
(GA in weeks)	37	34 – 43	36 – 37		

Kruskel-Wallis test for chi-squared analysis

Support

Lead Maternity Carer

As shown in table two (page 78) the majority of women were cared for by the hospital obstetric clinic (n=57, 69.6%). Private obstetricians cared for 16 (19.5%) of the mothers, independent midwives 7 (8.5%) and general practitioners 2 (2.4%). This probably reflects that the women were identified as high risk and therefore were considered to require advanced care that the independent midwife and general practitioner alone were not able to care for.

Lactation Consultant

The lactation consultant (LC) of the neonatal intensive care unit (NICU) consulted with 80 (63%) of the mother-infant dyads. At the time of hospitalisation the LC would have been asked to assess both infants who were breastfeeding and bottle-feeding. Although information was not obtained regarding the reason for the consultation it would have included both maternal conditions and infant feeding difficulties.

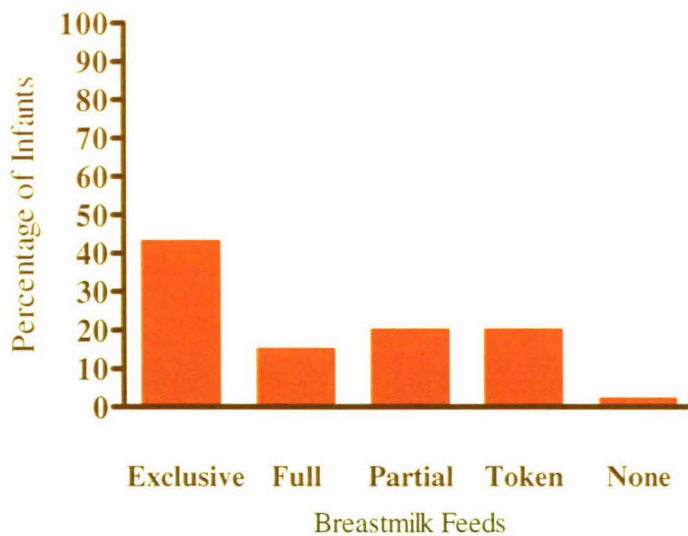
Homecare

The majority of the infants were followed up by the homecare service after discharge from hospital (91%). The remaining 9% of infants were transferred to other homecare services outside the jurisdiction of the health board of the study centre. Homecare data of three infants were unable to be found and were excluded from homecare data analysis.

Milk Supply

Figure 13 shows the percentage of infants who were breast milk fed during hospitalisation. Not only is the amount of breast milk the infant received shown but it also is a proxy measure for the amount of breast milk that the mother produced. Forty three percent (n=55) of infants received exclusive breast milk for their entire length of stay. There were 15% (n=19) in the full category, 20% (n=25) in the partial and token categories and 2% (n=3) received no breast milk at all. This shows that for this cohort of infants 98% received some breast milk during hospitalisation and 58% received more than 80% of their feeds as breast milk and 78% received more than 20% of their oral feeds as breast milk. Of the three infants who did not receive any breast milk, one mother was advised not to provide breast milk for medical reasons.

Figure 13: Percentage of Infants Receiving Breast milk During Hospitalisation



Kangaroo Care

Kangaroo care (KC) documentation in the nursing notes showed 13 (10%) infants had daily KC. There was no documentation in 23 (18%) cases and the remaining 92 (72%) infants appeared to have erratic KC. The initiation of KC was shown to occur on a mean of 21 days (95% CI, 10 – 31 days). The study centre protocol on KC prevents infants receiving KC before five days of age if born before 32 weeks gestation.

Table 6: Description of Kangaroo Care (KC) By Ethnicity

<u>Ethnicity</u>	<u>KC - daily</u> %	<u>KC - no</u> %	<u>KC - erratic</u> %
Caucasian n=72	15	11	73
Maori n=14	14	21	64
Asian n=20	5	15	80
Polynesian n=22	0	41	59

NB: Total percentages may not always equal 100% due to effects of rounding.

Table six describes kangaroo care (KC) received according to ethnicity (as a percentage of 100% for each ethnic group). A higher percentage of Maori and Caucasian infants received daily KC compared to the Asian and Polynesian infants. This is in contrast to the Maori and Polynesian infants who had higher rates of no KC documented. The majority of infants received erratic KC across all the ethnic groups.

Bottle Use

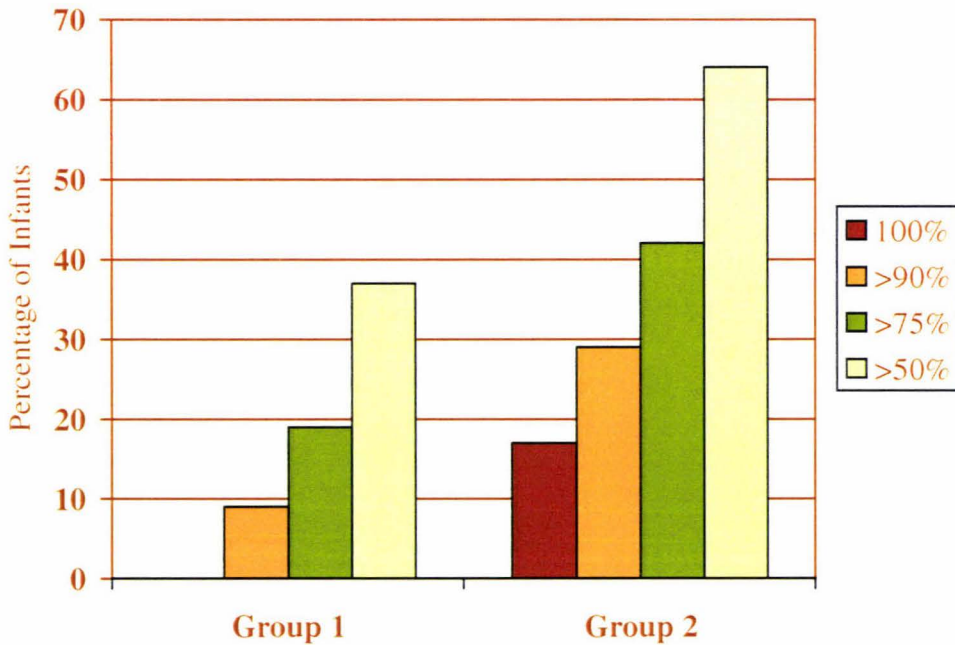
First Oral Feed

Bottles were given to 46/127 (36%) infants as a first oral feed and 81/127 (64%) of infants were offered the breast as their first oral feed. All of the infants received a bottle at some stage during hospitalisation. The first day a bottle was introduced was a mean of 45 days of age (34 weeks gestation), (95% CI, 43 – 49 days or 33 – 34 weeks gestation).

Bottle Feeds During Hospitalisation

Figure 14 (page 90) shows the description of feeding during hospitalisation for the infants, divided into two groups. The first group represents the 46/126 (37%) infants who received more than 50% of their oral feeds in hospital as breastfeeds. The second group represents 81/126 (64%) infants who received more than 50% of their oral feeds in hospital as bottle feeds. No infants in group one received all of their oral feeds as breastfeeds, 11/126 (9%) of the cohort received more than 90% of their oral feeds as breastfeeds and 24/126 (19%) received more than 75% of their oral feeds as breastfeeds. In group two 21/126 (17%) of the cohort of infants received 100% of their oral feeds as bottle feeds, 53/126 (42%) of infants received more than 75% of their oral feeds as bottle feeds and 36/126 (29%) received more than 90% of their oral feeds as bottle feeds.

Figure 14: Description of Type and Percentage of Oral Feeds During Hospitalisation



Group 1 = infants who received more than 50% of oral feeds as breastfeeds
Group 2 = infants who received more than 50% of oral feeds as bottle-feeds

Supplements During Homecare

Table seven (page 91) depicts the number of supplements that the infants received during their time under the homecare service. Due to the documentation of the homecare notes, the researcher was unable to identify if the infants received breast milk or ABM as supplements. Only two infants did not receive supplements after discharge from hospital. Documentation showed that many of the infants in group one received supplements as a means of giving medication to the infant. The infants in group three received supplements with almost every breastfeed or were fed a bottle instead of a breastfeed.

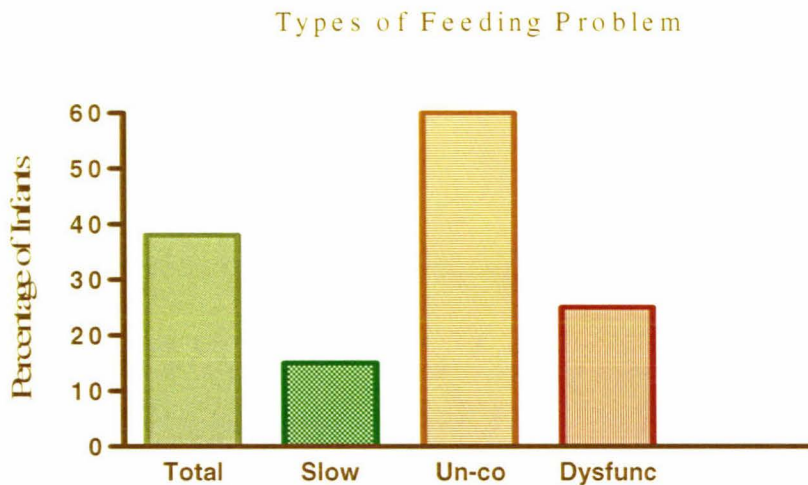
Table 7: Number of Supplements Given Per Day During Homecare

Group	Infants (n)	Supplements (n)
Group 0	2	0
Group 1	27	1-3 per day
Group 2	9	4-6 per day
Group 3	28	>6 per day

Feeding Problems

Figure 15 shows the total percent of feeding problems of the cohort and the type of feeding problems these were. Thirty eight percent of the cohort was identified as having feeding problems. Of these, 15% were slow to establish feeds, 60% exhibited uncoordinated feeding patterns and 25% exhibited dysfunctional feeding.

Figure 15: Types of Feeding Problems



Feeding problems and ethnicity

Figure 16 depicts the feeding problems of the cohort subdivided into ethnic groups. The percentage out of 100 is shown for that ethnic group, not for the total cohort of infants. Over half of the Maori infants and two thirds of the Polynesian infants had feeding difficulties. This is in contrast to the Caucasian and Asian infants where a quarter and a third, respectively had feeding problems.

Figure 16: Percentage of Infants Having Feeding Problems By Ethnicity

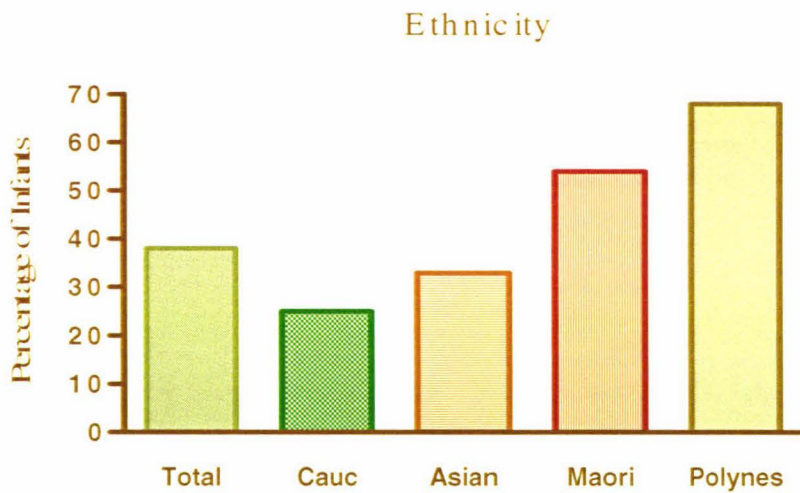


Figure 17 (page 93) shows the types of feeding problems by ethnicity. None of the Maori or Asian infants were identified as slow feeders. As with figure 16, the Polynesian infants had the highest rate of feeding problems, followed by Maori, Asian and then Caucasian. This effect was seen in both the uncoordinated and dysfunctional feeding problem groups.

Figure 17:Types of Feeding Problems By Ethnicity

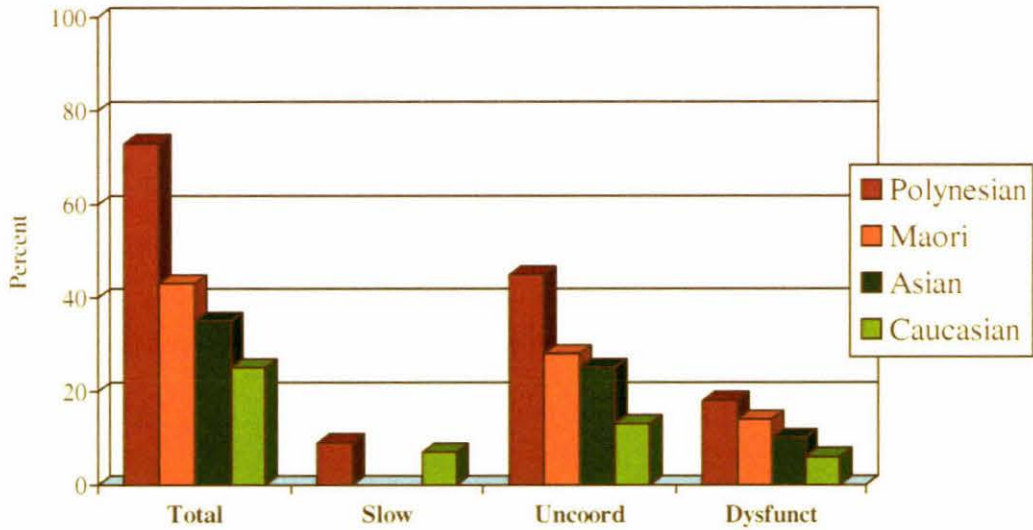
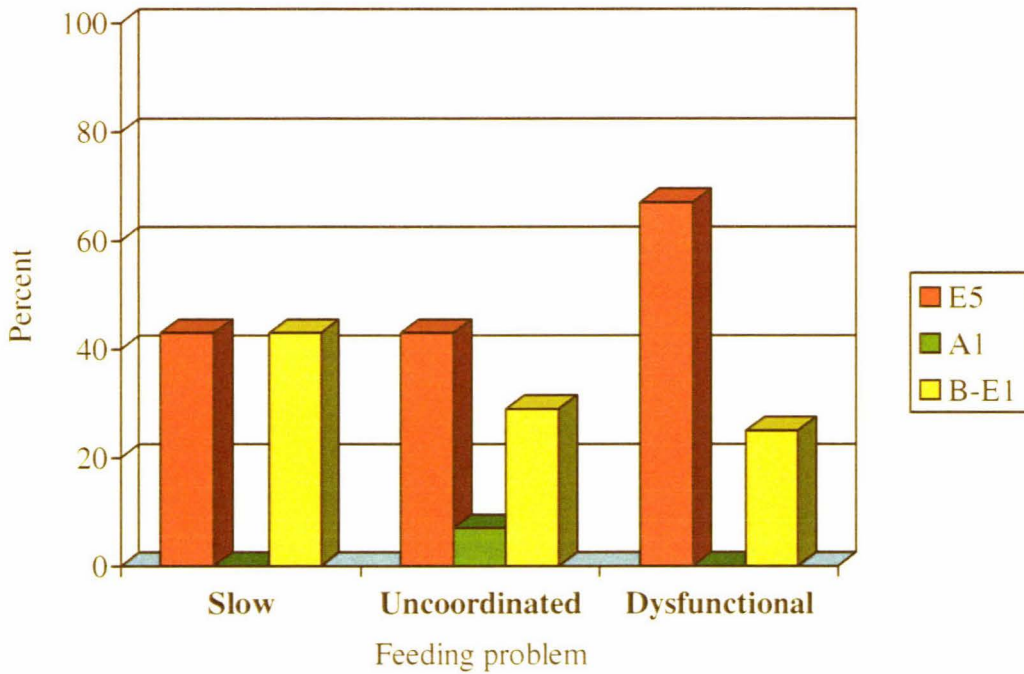


Figure 18 (page 94) depicts the feeding outcomes of the infants who were identified as having feeding problems. Of the slow feeders, 42% were fully artificial baby milk (ABM) fed from the bottle. This group had the same number that were exclusively breast milk fed but with a mixture of bottles and breastfeeds. No infants in this group were exclusively breastfed (code A1). In the uncoordinated feeding group, 42% were fully ABM fed compared with 39% who were exclusively breast milk fed but with a mixture of breastfeeding and bottle-feeding. A majority of the dysfunctional feeding group (66%) were exclusively fed ABM. No infants in this group were exclusively breastfeeding however 25% of them were exclusively breast milk fed by either breast or bottle.

Figure 18: Types of Feeding Problems and Feeding Outcomes at Discharge From Hospital



Growth

Table eight (page 95) shows the number of days it took the infants to gain 15 grams per day after discharge from hospital. The breast group included all those infants who were more than 80% breast milk fed at discharge from hospital (fully and exclusive, breastfeeding codes 1 and 2). The bottle group included all those infants who were more than 80% artificial baby milk (ABM) fed at discharge from hospital. This result was not statistically significant ($p < 0.82$).

Table 8: Days to Weight Gain (15gms/day)

	Minimum	Maximum	<i>M</i>
<u>Breast</u>	1	11	3.8
<u>Bottle</u>	1	12	3.3

Figure 19 (page 96) shows the growth of the infants over the six-week period from discharge from hospital. For this analysis the breastfeeding group was defined as infants receiving more than 80% of their feeds as breast milk. The bottle-fed infants were those that received more than 80% of their feeds as ABM. In the group labelled both, were those infants who received more than 20%, but less than 80% of their feeds as breast milk. The rate of growth was different for all three groups.

In the ABM group the rate of growth in the beginning was accelerated however by six weeks the growth had slowed in this group of infants. The breast milk fed group initially grew slower to around the second to third week and then growth accelerated. Of interest is the 'both' group where their growth was static for a longer period (up to two to three weeks) was slow for another two to three weeks and then showed signs of acceleration.

Figure 19: Growth of Infants During Homecare

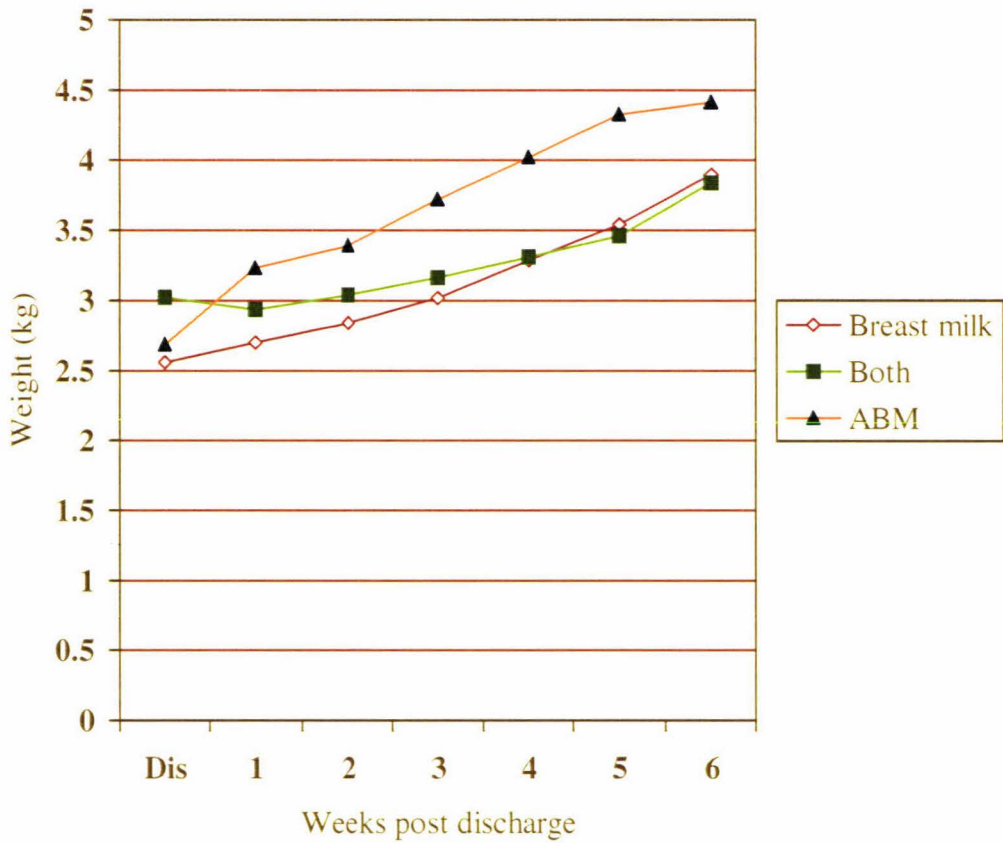


Table 9 (page 97) shows the alpha value of the growth differences of the infants over the six-week period based on the type of milk the infant was receiving at discharge from hospital. At discharge the bottle fed group weighed more than the breastfed group and both groups ($p < .0001$). As the weeks went by the difference in growth acceleration was reducing so that by week three, after discharge from hospital, there was no statistical difference in growth. Figure 19 shows the actual growth of the infants over the six-week period.

Table 9. Growth of Infants During Homecare

Weeks	α	Breast n	Bottle n	Both n
Discharge	$p < .0001$	37	44	38
Week 1	$p < .03$	36	42	31
Week 2	$p < .04$	33	38	23
Week 3	$p < .18$	17	20	12
Week 4	$p < .37$	12	14	6
Week 5	$p < .41$	8	14	6
Week 6	$p < .81$	8	13	6

Statistical test: Krushall-Wallis test for non-parametric data

CONCLUSION

The results of the research have been presented in this chapter under the relevant subject headings. Breastfeeding outcomes have been given along side a reference group of term healthy infants born during the same study period. Maori and Polynesian infants had poorer breastfeeding outcomes but also had the highest incidence of oral feeding problems. Results related to the key determinants have been shown with support, establishing a milk supply, kangaroo care, and bottle use not having a significant impact on breastfeeding outcomes. Feeding problems appear to impact on breastfeeding outcomes and are more pronounced in the ethnic minorities. Growth during homecare has been described between three groups and differences noted. The following chapter, the discussion, will analyse what the results mean and the relevance they have to the clinic setting and to the literature. Limitations of this research project will be discussed and conclusions drawn.

CHAPTER FIVE

DISCUSSION

The aims of this study were to identify the breastfeeding outcomes of premature infants born before 30 weeks gestation, to identify the key determinants that contribute to the success of breastfeeding in this population of infants, and to describe the feeding practices during their extended hospitalisation and subsequent discharge. The previous chapter (chapter 4) has detailed the results of this research project. The following discussion chapter will summarise the research findings, and discuss them in relation to the literature and the aims of the study.

Breastfeeding outcomes will be discussed with specific attention to duration. Data collection points are at initiation, discharge from hospital, discharge from homecare and at follow-up with the neonatologist. The impact of maternal and infant characteristics will be covered in this chapter with particular attention to those characteristics that were found to be of importance. The four specific variables to be addressed are: maternal support, maternal milk supply, kangaroo care (KC) and bottle use. Finally the issues of feeding problems and growth will also be discussed.

BREASTFEEDING OUTCOMES

The breastfeeding outcomes explored in this study include intention, initiation and duration of breastfeeding, breastfeeding during hospitalisation, on discharge from hospital and on discharge from homecare. Each of these outcomes will be presented in detail.

Intention

A large number of mothers in this study intended to breastfeed: 55/59 (93%), as shown in table 1 (page 71). It is unfortunate to see that 54 (42%) mothers did not have their feeding intentions acknowledged in the infants' medical and nursing records. This may be because the mothers were not asked or because it was not transcribed from the mother's midwifery records to the infant's medical and nursing records. Not having intention to breastfeed documented has several implications, notwithstanding the institutional philosophy of family centred care, where the parents are encouraged to have active participation regarding their infants' care. The mothers who have not decided on their feeding option could be targeted with further information regarding infant feeding to enable them to make an informed choice. Mothers appear to choose the bottle-feeding option based on inappropriate knowledge (Miracle, Meier, & Bennett, 2004). Factors that have contributed to them being indecisive about feeding choice could be investigated and support and care planned around these.

The high intention rate seen in this study could be a reflection of continued national support for breastfeeding during the study period due to the launch of the Baby Friendly Hospital Initiative Aotearoa, in 2000 (NZBA, 2005). As part of the BFHI initiative, women are encouraged to breastfeed during antenatal education and there have been national advertising campaigns to support breastfeeding. These factors may have contributed to the intention to breastfeed figures in this study.

Mothers may also choose to preferentially breastfeed their vulnerable infant. Women admitted to hospital before delivery with a high-risk pregnancy would have had several visits from medical and nursing staff regarding the impending delivery. It is

usual in the study centre to address the issue of providing breast milk, especially for the very low birth weight infant (VLBW, <1000grams). Mothers may have been encouraged to start expressing as soon as possible after the delivery of the infant.

The figure of 93% intending to breastfeed in this study is comparable with that of Gunn et al. (2000) who also found that overall 93% of mothers planned to breastfeed. The New Zealand population initiation rate is also similar at 90% (MOH, 2002) as is shown in figure 4. Although missing data (in both this current study and from the New Zealand population) creates difficulties in the accuracy of this figure, 93% is still high compared to international figures (WHO Nutrition Unit, 1996).

Initiation

The high initiation of breast feeding (98%) is higher than that for the general population in New Zealand (see figure 2, p. 71 and 5, p. 74) and higher than any published in the literature for infants born less than 30 weeks gestation (Ingram et al., 1994; Killersreiter et al., 2001; Smith et al., 2003; Warren, Tan, Dixon, & Ghaus, 2000). This may be reflective of New Zealand mothers preferentially deciding to breastfeed their small vulnerable infant as mentioned earlier. The emphasis on expressing and providing mothers' own breast milk for infants in the neonatal intensive care unit (NICU), especially those born of very low birth weight (VLBW) may also be a factor.

The breastfeeding initiation outcomes of infants born before 30 weeks gestation in the study centre can be compared with a published study from the same study centre. The Gunn et al. (2000) study cohort had an initiation rate of 93%. Although there are difficulties in comparing the Gunn et al. (2000) outcomes because the infants were of

older gestation (mean 33.1 weeks versus 27.3 weeks), were of heavier birth weight (mean 1900g versus 1063gms) and of different ethnic breakdown (Caucasian, 66% versus 55% in this study, Polynesian 6% versus 22%, Asian 10% versus 15% and Maori 17% versus 10%). The policies and protocols for the setting were similar and this may explain the similarity in the two initiation rates.

The good results may also be due to the high initiation rates for the New Zealand population in general. Of interest is the fact that 93% intended to breastfeed but a higher number (98%) actually initiated lactation. This may be due to effective interventions and the supportive neonatal intensive care unit (NICU) environment to breastfeeding.

Duration

Breast milk feeding throughout the study period is shown in figure 3 (page 72). As can be seen there is a downward trend away from breast milk feeding and an upward trend to artificial baby milk (ABM) feeding. These results clearly show that while most mothers initiated breastfeeding less than half were able to meet their infant's full nutritional needs. There is an apparent rise in exclusive breast milk feeding during hospitalisation to discharge from hospital. This can be explained by the fact that the hospitalisation data is for the infants' whole stay, whereas the discharge from hospital data was collected for the last 24 hours of hospitalisation. Another explanation is that prior to discharge more breastfeeding would have occurred that may have boosted some mothers' milk supply, especially those that were in the fully breast milk fed (breastfeeding code 2) category initially.

Figure 4 (page 74) shows a comparison of breastfeeding duration of the study cohort compared with the population of term healthy infants in New Zealand. This has only been reported once before (Flacking, et al., 2003) and never in New Zealand with this select cohort. As can be seen from this figure, premature infants born before 30 weeks gestation, in the study centre, have breastfeeding outcomes that are at least as good as the general population of healthy term infants. Modifiable factors that improve breastfeeding outcomes in the term healthy population may impact on the outcomes of the premature infant population. Because these factors include maternal education, socio-economic status and smoking, the strategies to improve rates sit in the multi-sectorial, public health arena. Sweden has high initiation rates of breastfeeding for their term healthy infants (93% at one week) and 75% are still breastfeeding at 6 months (Flacking, et al., 2003). Flacking et al. suggest a key reason for this is their comprehensive paid parental leave policy.

Figure 5 (page 74) shows a comparison of breastfeeding data for the study infants and the New Zealand population at one data collection point. The difference in this figure is that it shows the comparison of intensity of breast milk obtained by the infants in the two groups. As can be seen initiation of breast milk feeding is slightly higher in the study infant group compared to the New Zealand population of infants. Of interest is that the study infants were least likely to be exclusively breastfeeding (almost half of the comparison group) and more likely to be exclusively artificially baby milk (ABM) feeding. Figures 4 and 5 (page 74) highlight that while breastfeeding rates of the infants in this cohort are similar to the New Zealand population there are key differences in the intensity of breast milk feeding, with the premature infants being disadvantaged. While comparing outcomes shows that the

premature infants do well, looking closer at breast milk intensity shows a different picture. The lower intensity of breast milk feeding may be reflective of the difficulties these mothers have in establishing a milk supply and is consistent with the work by several authors suggesting that 50% of mothers of premature infants who start expressing, fail to make the progression to establishing an adequate milk supply (Cregan, De Mello, Kershaw, McDougall, & Hartmann, 2002; Hartmann & Cregan, 2001; Hill, Aldag, Chatterton, & Zinaman, 2005)

Flacking et al. (2003) conducted the first study to look at the comparison of breastfeeding outcomes between low birth weight (LBW, <2500 grams) infants between 27 – 40 weeks gestation, and a population control group of term healthy infants. At two months of age there was a 10% difference in breast milk feeding (full and partial) between the two groups. By four months of age this had increased to a difference of 20% and by six months the difference was 50%. Flacking et al. suggest that the reason why breastfeeding outcomes are worse in LBW infants is because of the strict feeding regimes in the neonatal intensive care unit (NICU). The NICU environment and the strict feeding schedules create an unnatural environment that is not conducive to breastfeeding. Flacking et al. (2003) state “breastfeeding becomes mainly about providing adequate nutrition, not an expression of comfort, closeness and joy” (p 162). In this current study this may also explain some of the differences seen in intensity of breast milk supply although this was not studied and other factors may have contributed (Riordan, 2005).

Discharge From Hospital

The hospital discharge breastfeeding rate in this current study was 73% (see figure 3, p. 72). While this figure appears high it shows that almost a quarter of the mothers

had stopped expressing by the time their infants were discharged home. Gunn et al. (2000) reported a higher breastfeeding rate of 85%. A possible explanation for this is the different infant characteristics as mentioned above, that is more mature infants in the Gunn et al. (2000) study. The Hawthorne effect may also have been a factor in the Gunn study. It was a prospective study and the mother infant dyads were enrolled while the infants were still being gavage fed. It is possible that the mothers may have accessed more support during hospitalisation simply because of increased awareness based on participation in the study.

Discharge From Homecare

At discharge from homecare 59% of the infants were still receiving some breast milk however there is a further decrease of 12% of mothers ceasing lactation in a relatively short time frame (see figure 3, p. 72). There is also a drop of 15% of those mothers providing exclusive breast milk (breastfeeding code 1). Figure 6 shows that while there was a small increase (5%) in the breastfeeding code B1 category, there is a move away from feeding at the breast to more feeding from the bottle. In the C1 – E1 groups there was a drop of 24 infants and a rise of only 5 infants in the B1 group. For the majority of infants intensity of feeding at the breast appeared to be decreasing. There appears to be a link between figure 3 (p. 72) and figure 4 (p. 74) that shows a downward trend away from breastfeeding, for both the study infants and the New Zealand comparison group. Another explanation is the relatively short period of time of breastfeeding before discharge home. Most infants spend only 24 to 48 hours of full breastfeeding whilst rooming-in with mother. Breastfeeding problems may not emerge in this narrow time-frame.

Most often by the time breastfeeding has begun, infants are often so close to being discharged that little time is left for mothers (and infants) to technically learn breastfeeding techniques (Muberg, Willgaffe, & Sande, 1982). In the study centre discharge is based on the infant's ability to take full oral feeding for 24 hours as is the case in the study by Gunn et al. (2000). This may explain why so many stop breastfeeding in the first weeks post discharge.

Figure 7 (page 76) shows the breastfeeding code at discharge from hospital and homecare for mixed feeding infants. Seven infants were receiving 20 – 80% breast milk (breastfeeding code 2 – 4) exclusively by bottle. Infants who were fully breastfeeding at the breast (B2) and partially breastfeeding at the breast (C3) showed a slight upward trend to more breast milk and breastfeeding (3 infants in total). The token (D4) breastfeed infants showed a downward trend away from breastfeeding along with the E2 and E4 group. The E4 group showed the biggest drop and may be reflective of a move to exclusively artificial baby milk (ABM) feeding. The rewards for the mother may not have been worth the effort of mixed feeding to continue with low amounts of breast milk.

The move away from breastfeeding may be explained by the transition to home being a time of distress and anxiety for some mothers (Ortenstrand, Winbladh, Nordstrom, & Waldenstrom, 2001). Mothers often feel they lack the skills to cope with their premature infant at discharge (Wooldridge & Hall, 2003). A 'triple nipple' syndrome situation eventuates where mothers are often expressing, breastfeeding and bottle-feeding, thus creating the task of feeding as very time consuming (Wight, 2004). Compounding this tiring task there is often an underlying fear that the infant or not

getting enough milk, might get sick or die (Pridham, Limbo, Schroeder, Thoyre, & Van Riper, 1998). Anxiety and depression contribute to the mounting maternal distress that mothers often feel (Holditch-Davis & Miles, 2003) that may contribute to less breast milk feeding.

Breastfeeding at Follow-up

There is a consistent downward trend away from breastfeeding over time, however this is also the case for the New Zealand population as well. Despite this a relatively large number of infants were still being breastfed at follow-up (see figure 3, p. 72) with the neonatologist. Follow-up generally occurred at around three months for the first visit. There is a further increase of 10% of artificial baby milk (ABM) feeding at this data collection point (see figures 4 and 5, page 74). It appears the rate of drop had slowed and is probably reflective of the commitment of the mother to continue breastfeeding her vulnerable infant. The continued breastfeeding rate is higher than that for the general population at the data collection point of 6 months chronological age, which most of the study infants would have been at the time of follow-up. This may be because of the higher initiation rate to begin with.

Figure 4 (page 74) shows a comparison of breastfeeding duration of the study cohort compared with the population of term healthy infants in New Zealand. Comparative studies have only been reported once before (Flacking, et al., 2003) and never in New Zealand with this select cohort. As can be seen from this figure, premature infants born before 30 weeks gestation, in the study centre, have breastfeeding outcomes that are as least as good as the general population of healthy term infants. Therefore modifiable factors that improve breastfeeding outcomes in the term healthy infant population may also impact on the outcomes of the premature infant population.

Because these factors include maternal education, socio-economic status and smoking, the strategies to improve breastfeeding outcomes involves a multi-sectorial, public health approach. Sweden has high initiation rates of breastfeeding for their term, healthy infants and 75% are still breastfeeding at 6 months (Flacking, et al., 2003). Flacking et al. suggest a key reason for this is their comprehensive paid parental leave policy.

KEY DETERMINANTS

The key determinants examined in this study were maternal characteristics, infant characteristics, maternal support, maternal milk supply, kangaroo care (KC), and use of bottles. Feeding problems and growth were also examined to ascertain if they had an impact on breastfeeding outcomes. The results will be discussed in this section in relation to the literature and how they correlate with each other.

Maternal Characteristics

Table 2 (page 78) shows the maternal characteristics. Although there was a range of maternal characteristics explored in this study, only one was determined to predict breastfeeding success: ethnicity. Those that were determined not to predict breastfeeding success included age, parity and delivery type. Ethnicity will be examined in depth in this section.

Ethnicity

Ethnicity proved to be the strongest predictor of breastfeeding success in this study. Maori and Polynesian infants had the lowest breastfeeding rates compared with Caucasians and Asians (see figure 8, page 80). That is, a Maori or Polynesian infant was less likely to be successfully breastfed than any other infants in the study when

success was measured as >80% breast milk fed during hospitalisation ($p < 0.0044$, CI 0.38-2.09). A large number of the Maori and Polynesian infants in this study (see figures 8, 11, and 12) were <20% breast milk fed (code 4 - token). It appears there was a commitment to start expressing breast milk but a failure to maintain that supply. Reasons for this could be poor quality or quantity of expressing that mimicked a regime of weaning rather than initiating and maintaining a milk supply although this could not be demonstrated in this study. Token breastfeeding has been associated with early weaning and is reflective and causative of a poor milk supply (Hausman, 2003; Riordan, 2005) but may also be due to cultural influences (Quandt, 1995; Tipene-Leach et al., 2000).

It is common practice for Maori women to supplement breastfeeding with artificial baby milk (ABM) because of a perceived insufficient milk supply (Tipene-Leach et al., 2000). Lack of knowledge about normal breast changes, variations in normal breastfeeding patterns, along with episodes of an unsettled infant, contributed to the perceived lack of milk supply in a study of 100 Manawatu women (Beasley et al., 1998). This is also a common occurrence that mothers cite when they initially take their premature infant home (Elliott & Reimer, 1998). Breastfeeding for Maori and Polynesian populations in New Zealand is lower than for Caucasian women (Essex, Smale, & Geddis, 1995; Ford et al., 1994; MOH, 2002) and these populations groups have been targeted by the New Zealand Ministry of Health (MOH) to improve their breastfeeding outcomes (MOH, 2002). Even though the mother-infant dyad may be physically separated in the neonatal intensive care unit (NICU), they still exist in a milieu of family and friends that is socially and culturally constructed (Koçturk & Zetterstrom, 1999; Krouse, 2002). It is important that cultural issues are considered

by the health care professional to enable them to widen their scope in supporting and protecting breastfeeding (Dignam, 1998).

Feeding problems appear to be a major factor in Maori and Polynesian infants and this is discussed later under the feeding problem section of this chapter. Other factors that have been shown to inhibit successful breastfeeding in Maori (e.g. poor support, poor understanding of the breastfeeding process, stress of difficult social conditions and smoking) may be used to develop strategies that support positive change in the lives of those caring for the Maori mother- infant dyad (Tipene-Leach et al., 2000). Vogel (2004) showed that with appropriate breastfeeding support by culturally appropriate health workers, who were in turn supported by a lactation specialist, breastfeeding initiation and duration improved (Vogel, 2004). Further study is required to investigate the unique nature of the breastfeeding process for ethnic minorities born prematurely in New Zealand and the possible causes of lactation failure in this vulnerable population. There were no reports for these specific infants found in the literature.

Infant Characteristics

Once again, although a range of infant characteristics were examined, only ethnicity and feeding problems were determined to predict breastfeeding success. Those that were determined not to predict breastfeeding success included gender, birth weight, days on ventilation, days on continuous positive airways pressure (CPAP), days on oxygen, days in hospital and rooming in (see table 4). The low number of ventilation days (mean 3.6 days) and relatively high number of CPAP days (mean 28 days) reflects the study centres' philosophy of respiratory management. Other institutions may favour the use of ventilation as the key strategy for managing respiratory distress

in premature infants. However some studies use ventilator days as a proxy for severity of infant illness and this is used as an independent variable to assess impact on breastfeeding outcomes. Length of time on CPAP or oxygen therapy may be a more reliable variable to use.

Infant feeding characteristics were also considered and included days to full enteral feeding, first oral feed, days to achieve four oral feeds, and days to full oral feeding (see table 5, p. 85). Kangaroo care (KC) and bottle introduction will be examined later in this chapter. This section will examine the impact of gestational age, infant feeding characteristics and the impact of rooming-in.

Gestational Age

Gestational age did not appear to affect breastfeeding outcomes in this current study (see table 4, p. 84). Audits by Yipp et al (1996) and Dawson and Benson (2001) do not support this outcome. Their study infants showed that lower gestational age groups were less likely to successfully breastfeed. There are several reasons these differences may have occurred. Firstly, most of the infants in Dawson and Benson's (2001) audit, born <32 weeks gestation received bottles as their first feeds. The authors did not elaborate on the percentage of breastfeeds versus bottle-feeds that the infants were exposed to; high bottle-feeding ratios may impact on feeding outcome. The infants born <29 weeks had a discharge artificial baby milk (ABM) feeding rate of 66.7%. In comparison to this current study this is high given that 27 % were discharged home receiving solely ABM. Secondly it is not known how supportive the study settings were in supporting, protecting and promoting breastfeeding. An unsupportive environment may have contributed to poorer outcomes. Thirdly a large number of infants in the Yipp et al (1996) and Dawson and Benson (2001) studies

had required surgery. Surgery may have created other unknown variables that may have impacted on their breastfeeding outcomes.

Infant Feeding Characteristics

Table 5 (page 85) shows the infants' feeding characteristics. Most of the infants achieved full enteral feeds by two weeks of age (CI, 13-16). The number of days to the first oral feed was a mean of 38 days (CI, 35-41). A relatively long time to first oral feed reflects the immaturity of this cohort of infants. Oral feeds cannot be offered until infants come off ventilation and continuous positive airways pressure (CPAP) therefore there is a relationship between first oral feed and days on CPAP. There was quite a variation in the time to the infant achieving four oral feeds a day (95% CI, 53-67). The number of days to achieving full oral feeds was a mean of 66 (CI, 63-69). The number of days to full oral feeding once four feeds a day was achieved was relatively short. A reason why this information was obtained was that it appeared anecdotally that this was the case. In the clinical setting this has relevance as it may assist in discharge planning and estimating when discharge is likely to occur because discharge is based on the infant obtaining full oral feeds in 24 hours (Gunn et al., 2000) in the study centre

Rooming In

A majority of the mothers (73%) roomed in with their infants for at least 24 hours prior to discharge and these were predominately breastfeeding mothers. The 27% who did not room in reflects the infants who were discharged home artificial baby milk (ABM) feeding. There was no association shown between breastfeeding outcome and rooming in. Rooming in has been shown to positively correlate with breastfeeding outcome in other studies (Killersreiter et al., 2001). However there are

several problems with using rooming-in as a variable for breastfeeding outcomes. Rooming-in usually occurs in the last days prior to discharge, at this time some mothers may have already discontinued expressing, and be feeding artificial baby milk (ABM) exclusively. In the study centre rooming in is generally preferentially offered to mothers who are breastfeeding so this may show an artificial correlation with breastfeeding success. Although this issue was not discussed in the Killersreiter et al. (2001) study it may well have been the situation.

Support

Lead Maternity Carer

It was disappointing to see that 45 (35.4%) of the infant charts did not have a lead maternity carer (LMC) recorded (table 2, page 78). Continuity of care is an aim of the New Zealand Ministry of Health and they recommend that the LMC still have responsibilities to the mother and infant should the infant require treatment in a neonatal intensive care unit (NICU) (MOH, 2003). Regarding the mother as equally important as the infant in the NICU, as recommended by Levin (1999), still has some way to go in the New Zealand situation. Not documenting the LMC implies a lack of communication between the LMC and the NICU. Lack of communication may contribute to the provision of inconsistent information and advice. Thus inconsistent advice and information may contribute to poor milk supply, conflicting advice regarding use of bottles and artificial baby milk (ABM) and poor breastfeeding outcomes. If aiming for a more holistic approach to care of the mother-infant dyad then consideration of this point needs to be made.

Lactation Consultant

The lactation consultant (LC) in the neonatal intensive care unit (NICU) had clinical contact with 75% of the cohort. Bivariate analysis demonstrated that LC input did not contribute to breastfeeding success. There are several explanations for this. Firstly, because the LC in the neonatal intensive care unit (NICU) was positioned there, she was often called to assess infants regardless of whether they were breastfeeding or bottle-feeding. The LC in the NICU at the time of the study was involved in quality improvement issues of bottle-feeding premature infants. This meant that the LC would have been involved with both breastfeeding and bottle-feeding issues. An ex post facto study in England showed that having an LC and a developmental therapist in the NICU significantly improved breastfeeding outcomes (Warren et al., 2000). Having an LC in the NICU may contribute to overall outcomes because of increasing the profile of breastfeeding in the NICU. Lactation protocols and staff education generally are included in LC's job descriptions (Riordan, 2005) as in the case of the study centre.

Maternal Milk Supply

Given that 98% of mothers initiated breast milk production for their infants and that at the time of discharge, only 73% were still lactating, it can be deduced that 25% of the mothers stopped breast milk production for some reason. The scope of this study did not allow for an explanation from the mothers as to why they stopped expressing. The initiation of a milk expression schedule can however be difficult to achieve because it may necessitate a strong commitment to the future that is impossible for the mother to make (Lang, 1998). Stress may also play a large role and has been implicated in reduced milk supply (Lau, 2001). Antenatal factors, such as poor

glandular development or antenatal steroids may also impact but little research has been done in this area.

Antenatal steroids may be an explanation for lactation failure in so many mothers. Although the literature supports this it was not shown in this study to be a factor. An explanation for this is that a majority of infants received antenatal steroids (92%). Recently there has been some evidence in the literature regarding a link between antenatal steroids and poor milk supply in the mother. Original work was done on sheep that showed a high correlation between antenatal steroids and reduced lactogenesis II (Hartmann, 2004; Hartmann & Cregan, 2001). Although the breast milk volumes for the mothers were not collected during this study, it became obvious to me during the data collection that most of the mothers who stopped providing breast milk for their infant, did so within the first two to four weeks of the infants' birth. Stopping expressing early was also found in a study of very low birth weight (VLBW) infants by (Killersreiter et al., 2001).

The infant's health status may impact on a mother's decision to continue expressing or it could be due to not being able to produce *enough* milk. It may also be due to a failure to establish an adequate milk supply. As mentioned in the literature review, there are many causes for this but inappropriate advice from health professionals or a lack of commitment from the mother are key factors (Furman et al., 2002). The lack of commitment may be driven by stress regarding her infant and perhaps illness of the mother herself (Aguayo, 2001). Another consideration is that it could be a reflection of cultural practices. Looking at information from the general population of

breastfeeding infants in New Zealand there is a large drop in breastfeeding within the first six weeks (MOH, 2002).

Furman et al. (2002) showed in their study that those mothers who continued lactation beyond 40 weeks corrected gestational age of their infant, expressed more milk, started expressing within 6 hours of birth, and expressed more than 5 times in 24 hours (including a night time expression) when compared to those mothers who had discontinued lactation. The study by Wheeler et al. (2000) also support; they showed that breast milk expressing less than six times a day (compared with more than six times a day) ($p=0.04$), and delayed expressing ($p=0.03$) were associated with a decrease in milk supply. Flacking et al. (2003) showed that the mothers of LBW infants who did not achieve a sufficient milk supply by the end of the first week (determined by not enough milk to meet the infant's needs) were more likely not to be breastfeeding at 2 months ($p=.039$) and 4 months ($p=0.001$).

There is controversy in the literature regarding the ability to lactate after premature birth. The ability to lactate is not impaired by premature birth according to Killersreiter et al. (2001) but this conflicts with recent research that suggests that prematurity is a risk factor for lactation failure (Cregan et al., 2002; Hill et al., 2005). It may be that the cause of premature labour itself may impact on lactation. This is an area that warrants further study. It appeared from the observations in this study that most of the mothers who stopped expressing did so early and the milk that was given to the infant was probably that, which had been produced at the initiation of lactation and subsequently stored.

There is a perception that has been observed anecdotally that some mothers believe that lactation will just happen when they 'get their babies home'. Anecdotally continued lactation rarely occurs in mothers who have not initiated it. Another issue within the context of the neonatal intensive care unit (NICU) of the study centre is that there are no private rooms for mothers to express in. Screens are available for mothers to use, however that requires the mother to ask for them and some mothers may not have the confidence to do that. An unpublished audit (n=40 mothers) sought to ascertain how mothers felt about not having rooms to express in (Thomas, 2003). The vast majority of mothers felt confident expressing by their infant's bedside, however lack of ethnic demographics calls this audit into question. Maori and Polynesian mothers may well feel uncomfortable expressing in open areas. The NICU environment can also be intimidating to many mothers due to the technology and sick infants being admitted and treated on a regular basis (Aguayo, 2001). Hospital based interventions early in the postnatal period need to be assessed for their efficacy in supporting mothers to maintain lactation under difficult circumstances.

When assessing breast milk intensity it was found that one infant had one millilitre of artificial baby milk (ABM) at the beginning of its hospital stay but received exclusive mother's milk for the remainder of hospitalisation. Another infant was exclusively breast milk fed until the last feed before discharge when a bottle of artificial baby milk (ABM) was given. Both these infants therefore were not placed in the exclusive breast milk fed category. Although the reasons are not known why these infants received such small amounts of ABM when their mothers obviously had an adequate milk supply (having provided enough breast milk for the rest of the hospital stay) it is a disappointing situation and perhaps suggests that ABM was given in error.

The limitations of this study did not allow for mother's long-term breastfeeding goals to be assessed or what her expressing regimes were therefore it is impossible to make assumptions regarding the reasons for the reducing breastfeeding outcomes in this study. It is interesting to note however that 40% of the cohort were identified as having feeding problems and it cannot be ruled out that this was a contributing factor. The mothers may have been struggling with the poor breastfeeding behaviour of their infants.

Kangaroo Care

It was disappointing to see the lack of consistency with kangaroo care (KC) shown in table 6 (page 88). Given the many benefits that KC is purported to have it seems it should be considered an essential aspect of care. There appears to be some nervousness around offering KC to the very sick and medically fragile infant (Hedberg Nyqvist, 2004), and KC requires further study in this group. However there seems to be a lack of conviction from staff to offer this 'therapy' to mothers. This could be due to the high tech environment of the NICU and the perceived lack of value that low technology therapies can offer.

There is also the question of 'ownership' of the infant where the nurse has control over aspects of the infant's care and the mother takes on a subservient role (Hausman, 2003). The mother is often in a situation of having to ask for KC or cuddles with her infant and not wanting to harm her infant may take the advice of the attending nurse that may not be appropriate. Lack of understanding of this issue compounds the problem where the medical discourse favours science over a mother's natural instinct and longing to hold her infant. There may also be a situation arising where mothers are offered KC as a therapy for a poor milk supply and it may not be offered to

bottle-feeding mothers because it is assumed that KC is only beneficial to the breastfeeding relationship.

Research into this area would evaluate if a dose response of KC impacted on breastfeeding outcomes. Also, how soon should KC be initiated and what are the valid medical reasons why it should not be initiated early in the medically fragile infant. It appears when it comes to decisions regarding KC and humane NICU initiatives that theoretical problems can over ride science and nature. If breastfeeding is a normal physiological process, so too must be close physical contact between the mother and the infant. The stress response of the infant caused by maternal separation may have far reaching effects that are yet to be fully understood (Bergman, 2000).

Bottle Use

First Oral Feed

Over a third of the infants in this study received a bottle as their first oral feed. Given that 98% of mothers initiated lactation, this is a surprising finding as it could be assumed that these mothers wanted to breastfeed. It could be that some health care professionals believe that bottle-feeding is easier than breastfeeding for the infant (Dawson & Benson, 2001). Historically, as mentioned in chapter 2, infants were often expected to show bottle-feeding competence before breastfeeding is *allowed* to be commenced. The nurse may perceive that *she* has greater control over bottle-feeding an infant (compared with the mother breastfeeding her infant) especially for the first feed. There may be some anxiety over how the infant will cope with the complex process of feeding. The literature does not support this theory however and suggests that breastfeeding infants demonstrate more physiological stability than their bottle-feeding counterparts (Lemons & Lemons, 1996; Meier, & Anderson, 1987;

Meier, 1988). If the theories of several authors are to be believed, it may well be devastating to successful breastfeeding for a bottle (especially in the beginning) to be given to an infant whose mother wishes to breastfeed (Kliethermes et al., 1999; Mobbs, 1989; Smotherman & Robinson, 1994).

The age at which a bottle was first introduced showed no correlation to feeding outcomes in this study. Furman et al. (2002) also showed no difference in the age of bottle introduction and continued lactation beyond 40 weeks. Furman et al. did not state how many bottles the infants had compared to breastfeeds as has been attempted in this study. There may be a dose response that is, the more bottles the infants receive, the more likely the infant is not to proceed to breastfeeding at the breast. Pearce and Buchanan (1979) suggest the success of breastfeeding in their NICU was due to many factors that included the mothers and families being allowed unrestricted visiting of the infant, optimistic and knowledgeable staff, and the infant *rarely being offered bottles*.

Bottle-feeds During Hospitalisation

Figure 14 (page 90) shows the description of breastfeeding and bottle-feeding during hospitalisation. The study NICU recommended best practice at the time was minimal use of bottles for breastfed infants. Transitioning to breastfeeding using naso-gastric tubes was recommended rather than alternatives such as cups and bottles.

It is therefore disappointing to see the large majority of infants had most of their oral feeds as bottle-feeds. While statistical analysis did not show a correlation between the number of bottle-feeds and breastfeeding outcomes this may be due to poor study design rather than a true effect. All that can be stated from this result is that it describes the history of oral feeding of these infants. It appears that a bottle-feeding

culture is still the dominant mode of infant feeding despite the mother's initial intention to breastfeed. It is unknown if the large number of bottles the infants received was due to maternal request or a recommendation by NICU staff.

Supplements During Homecare

It was disappointing to find that only 5/66 (7.6%) infants received no supplements during their time in homecare. However of these five infants, all were receiving exclusive breast milk at the breast when discharged from homecare. Of these five infants, one breastfed for 4 months, one for 7 months, one for 8 months and one for 12 months. A large majority of infants 51 (77%) continued to receive supplements after discharge from homecare.

Table 7 (page 91) shows four groups of infants depending on how many supplements were given on a daily basis. It was noted on the feeding records that the group 1 (supplements given 1-3 times per day) infants were usually only given supplements when medications were given. In the clinical setting it is often believed that medications need to be given with milk. It was disappointing to see, in the feeding charts of these infants, that these feeds often replaced a breastfeed. It is not known whether mothers were given other options for giving medications other than by bottle. The infants in group 3 were given supplements after every feed. It is not known if these mothers had a poor milk supply and if so if they were being managed or treated for this.

Feeding Problems

Feeding problems were identified in 38% of the cohort (see figure 15, page 91). The slow and uncoordinated groups accounted for 75% of the cohort of infants with feeding problems. The infants with dysfunctional feeding accounted for 25% of the infants with feeding problems. Feeding problems are considered normal aspects of prematurity and usually improve with maturation of the infant (Meyer Palmer, 2002). Premature infants have immature neurological and gastrointestinal function and the more premature the infant is the more marked these are (Lawrence, 1999). Nowhere in the breastfeeding literature on breastfeeding outcomes in neonatal intensive care units (NICUs), have feeding problems been mentioned as a possible cause of breastfeeding failure. Reported feeding problems in the NICU is in the vicinity of 40 – 70 % (Rudolph & Link, 2002). Given the relatively high rate of feeding problems occurring in the NICU it is surprising that it is not given more consideration in the breastfeeding literature regarding premature infants.

Hawdon et al. (2002) showed that 50% of the infants with disorganised or dysfunctional feeding in their prospective study were born before 30 weeks gestation. The lack of attention to this problem in breastfeeding literature may be because feeding problems in the breastfed infant have been reported as low as 1-5% (Bovey, Noble, & Noble, 1999) and therefore not regarded as a serious issue. This may be because of low breastfeeding rates in premature infants and because of lack of research. The researcher decided to include it as independent variable because of the assumption that feeding problems would impact on breastfeeding outcomes, however there is little evidence to guide practice with these infants.

The assessment of premature infant feeding is an important area of practice and has traditionally fallen within the scope of practice of occupational therapists or speech and language therapists (Kennedy, 1995). In the absence of such therapists in the neonatal intensive care unit (NICU), which is the majority of NICUs in New Zealand, nurses or physiotherapists often undertake this task. Nurses may be poorly qualified to take on this role with little or no specific training in this area. Rarely is infant feeding assessment comprehensive and often problems are not identified until they are severe (Kuhn & Matson, 2002). It is commonly thought that perhaps time is what the infant requires, that with increased maturity (and perhaps practice), improved competence in feeding will eventuate. Lemons and Lemons (1996) have raised this issue and they suggest that rather than trying to accelerate the feeding process that is inherently maturational, efforts should be made to provide adequate nutritional support during this process while trying to avoid unnecessary stress and fatigue.

Stress in the low birth weight infant appears to contribute to a lack of rate change between non-nutritive and nutritive sucking (Palmer, 1993). There are several interesting concepts to consider regarding this issue. Infants can be forced to bottle feed, even if they do not want to and this forcing can induce stress in infants. Bottle-feeding can also be a passive process in the infant while breastfeeding is an active process by the infant. It is difficult to force an infant to breastfeed due to the physiological requirements of breastfeeding by the infant. The type of fluid the infant receives may also affect feeding patterns. There is some evidence to suggest that the type of liquid that the infant receives orally may induce poor feeding behaviours in infants (Mizuno, Ueda, & Takeuchi, 2002). Infants bottle fed expressed breast milk showed less uncoordinated feeding episodes than those infants fed ABM or distilled

water. Most studies evaluating bottle feeding problems often fail to state the type of fluid that the study infants received as well as the type of teat that was used.

There remains controversy as to whether bottles given to breastfeeding infants, regardless of prematurity, contributes to breastfeeding problems. Meyer Palmer (2002) suggest that the premature infants demonstrate poor adaptability and do not easily change between breastfeeding and bottle-feeding. Another question that has not been adequately addressed is if there is a critical window when oral feeding, particularly for premature infants, should be introduced. If there is, there may actually be more problems created by not allowing the infant to have any sucking opportunities at all when the infant is not able to latch on and suck at the breast. This is often the case for very premature infants who may have prolonged ventilation or continuous positive airways pressure (CPAP) management.

In the study centre CPAP is used as a management strategy for airways disease. It is considered a less invasive form of respiratory management than intubation and mechanical ventilation (Fanaroff & Martin, 2002). It is a relatively new approach to neonatal care and little is known about the benefits or detriments of its impact on infant feeding.

In this study infants with feeding difficulties were more likely to be discharged home feeding artificial baby milk (ABM), especially the ones identified in the dysfunctional feeding group (figure 18, p. 94), where 65% were discharged home feeding ABM. No infants in this group were exclusively breastfeeding however 25% were receiving exclusive breast milk with a combination of breast and bottle-feeds.

Another unexpected finding of this study was the large number of Maori and Polynesian infants who had feeding problems. Approximately half of the Maori infants and two thirds of the Polynesian infants were identified as having feeding problems. This has not been previously presented as a cultural phenomenon, either in the New Zealand context or internationally. Many questions have been raised and there are few explanations for this finding. One might expect that there were larger numbers of extremely premature infants or that the infants in the Pacific and Maori ethnic groups were sicker and had a more complicated neonatal course. A closer examination of the data showed that this was not the case.

Ethnicity and Infant feeding Problems

The only correlation between infant feeding characteristics and breastfeeding success in this study was ethnicity and feeding problems. That is, Maori and Polynesian infants were less likely to breastfeed but they also had the highest incidence of feeding problems. This has not been described elsewhere, however it was hinted at in a study investigating the initiation of breastfeeding in low birth weight infants (Smith et al., 2003). They suggest that socio-demographic factors influenced the *decision* to breastfeed, however factors relating to infant health only influenced the transition to *direct* breastfeeding. Infant health may affect breastfeeding ability and perhaps feeding problems are a proxy for infant health (Burklow, Phelps, Shcultzl, McConnell, & Rudolph, 1998) in this population of infants. It appears the more intervention and health problems the infant has the more likely the infant is to develop feeding problems.

Growth

Growth post discharge showed a discrepancy between those that were fully artificial baby milk (ABM) (>80% ABM) fed and those that were fully breastfed (>80% breast milk fed), and those who had a combination of both (20 – 80%). It is acknowledged that not all infants were followed for six weeks. Only the infants that required ongoing support at home, perhaps because of continuing oxygen therapy, feeding problems or poor growth would have still been followed at six weeks post discharge.

The artificial baby milk (ABM) group showed the most growth immediately post discharge and continued on a steady slope upwards until about week five when growth appeared to slow (see figure 19, p. 94). This may be reflective of the higher calories that infants tend to ingest when they are fed ABM (Kramer et al., 2002), the more control mothers have in terms of offering the bottle and how much the infant consumes from the bottle. Breastfeeding requires active participation by the infant compared to bottle-feeding that can occur passively (Lemons & Lemons, 1996).

The breast milk fed infants tended to grow at a much more consistent rate over the six weeks. The first two to three weeks showed slower growth than the last three weeks that showed an acceleration of growth. This may be explained by the fact that the mothers potentially had more breast milk available for the infant that increased as the infant grew. Also over time the infant becomes more mature and becomes more proficient at feeding. It may also be possible that for premature infants, this may be a more physiological way of growing.

Surprisingly, those infants that received a combination of breast milk and artificial baby milk (ABM) showed the most interesting growth picture. Their growth was

static for the first two to three weeks then showed a slow increase to about week five. The last week showed an acceleration of growth. There may be several explanations for this. It could possibly reflect a milk supply in the mother that was not improving with increased feedings at the breast. It may be that mothers in this category had stopped expressing at discharge, the infant was not getting enough milk and more supplements were given thus also contributing to a failing milk supply. The rise at the end could be attributable to more of these mothers weaning completely and using ABM exclusively.

In the study by Pearce and Buchanan (1979), there was no difference in the growth between those infants that were fully breastfed and those who were bottle-fed expressed breast milk (EBM). This was also shown to be true for a study looking at cup feeding, bottle-feeding and breastfeeding (Brown, Alexander, & Thomas, 1999). Steward et al. (2002) showed that extremely low birth weight infants (ELBW <1000g) develop a growth deficit during the first few weeks of life that persists and worsens during hospitalisation. These infants are discharged with a growth deficit and therefore will have to have catch-up growth at home.

There appeared to be a 'turning point' where growth improved for the breastfeeding population in this study (see table 9, p. 95). This occurred at around 2-3 weeks after hospital discharge. A possible explanation could be that the infants were more mature and had more practice at the behaviour and were therefore more efficient. It may also be a reflection of the change from breastfeeding to more infants' bottle-feeding in the cohort.

Kavanaugh (1995) & Piper (2002) Several studies identified a “turning point in breastfeeding behaviour at around two weeks discharge where feeding improved and less supplementation was required (Piper, 2002) (Kavanaugh et al., 1995). Woolridge and Hall (2003) in Australia suggest that many women were still making the transition to exclusive breastfeeding by week four. Premature infants should be followed-up by the neonatal homecare service for at least this length of time (Woolridge & Hall, 2003). The length of time infants were followed by the homecare team in this study may well have been before the turning point had been reached and more commonly before the four weeks that Woolridge and Hall have suggested.

LIMITATIONS

A limitation of this study is the study design. Non-experimental research prevents generalisation outside the study centre. While sample size was moderate, sub-categories were small and became difficult to analyse, for example ethnicity and lower gestational age groups. A large number of variables were used in the data collection tool that became difficult to manipulate. Refinement of the tool is recommended. Several variables were difficult to collect from the medical records. Kangaroo care was especially erratic and it was unclear in some cases if the infant had had KC that was not documented or if the infant had had a standard cuddle. The large amount of bottle use also became problematic especially in the homecare setting as the documentation was not always exact. A prospective study may give more rigour to the variables that were found to be questionable.

A limitation of this is that it dealt with the biophysical aspects of breastfeeding premature infants, negating the experience of the mother in the process. It fails to

answer any questions relating to the dynamic relationship between the mother and the infant, the enormous task the mother undertakes when she delivers a vulnerable infant or the many cultural and social issues that impact on breastfeeding. The study also did not question the nurses and their rationale for providing certain feeding options. A triangulation study may be better in terms of assessing the quantitative and qualitative aspects of breastfeeding research.

Key factors that impact on breastfeeding outcomes in the general population that were not included in this study include economic status, level of education and married or not, and smoking. Smoking has been found to be a significant indicator of poor lactation, poor infant growth and early cessation in breastfeeding in term healthy infants (Horta, Kramer, & Platt, 2001; Riordan, 2005). Smoking has also been associated with lower birth weights and premature births (Kharrazi et al., 2004; Salihu et al., 2004). These factors were unable to be controlled for because the information was not available to me as data was obtained from the infant medical history or the neonatal data-base.

An assumption of this study was that factors that influence breastfeeding in the general population would have the same impact on the breastfeeding outcomes of premature infants and therefore it was expected that the factors that specifically impact on premature infants would emerge. In fact this was not shown in this study. A strong negative predictor of breastfeeding outcomes was in fact ethnicity, as it is in other countries and in New Zealand in particular (MOH, 2003; Tipene-Leach et al., 2000). The large number of infants in the ethnic minorities with feeding

problems may have had an impact on the cultural differences in breastfeeding outcomes seen.

It was considered that the study infants represented an homogeneous sample of infants born <30 weeks gestation, however there is a big difference between an infant born at 24 weeks gestation and one born at 30 weeks gestation. Differences are seen in terms of degree of illness, mortality and morbidity and outcomes. The population of gestational age was positively skewed with more infants being born towards the 30-week gestational age group compared with the 24-week gestational age group. Although gestational age did not affect breastfeeding outcomes this may have been due to the small sample size in the lower gestational age groups.

There is no formal routine assessment of infant feeding in the study centre. If a health professional perceives that there is a problem or if the infant is taking longer than expected to establish full oral feeding, then a referral may be made to the NICU speech and language therapist or the lactation consultant. Not all of the infants identified with feeding problems by me (during data collection) would necessarily have been referred to a feeding specialist. Hawdon et al. (2002) suggests it is difficult for medical and nursing staff to identify infants with disorganised or dysfunctional feeding problems. It is possible that errors have been made in categorising the infant into specific feeding problems.

The feeding problem categories were based on the neonatal oral-motor assessment scale (NOMAS) developed primarily for the bottle fed infant (Meyer-Palmer, Crawley, & Bianco, 1993). To my knowledge there is no such scale for breastfed

infants other than scales identifying breastfeeding behaviour that falls within normal limits. Such scales include the Latch Score (Jenson, Wallace, & Kelsay, 1994) and the Premature Infant Breastfeeding Assessment Scale (Hedberg Nyqvist & Ewald, 1999). Meyer-Palmer (2002) argues that the evaluation of oral-motor patterns during reflexive sucking is not dependent on whether the infant is breastfed or bottle-fed. It is however acknowledged that the process of feeding is distinctly different between breastfed and bottle-fed infants. The researcher felt however, in the absence of a tool that has been validated for both breastfeeding and bottle-feeding, that the NOMAS still provided an appropriate assessment for both types of feeding. The main reason for the choice of the NOMAS score is because it is based on functional feeding ability of the infant. This enabled the researcher to adequately categorize feeding problems. Research in the future should aim to validate a breastfeeding assessment tool for infants with feeding problems.

CONCLUSIONS

Only recently have researchers investigated and published breastfeeding outcome data and determinants of success (or failure) for premature infants. The international movement toward promoting, protecting and supporting breastfeeding generally may have contributed to recent interest in premature infant breastfeeding outcomes. Another reason is the accumulating body of knowledge pertaining to the unequivocal value of breast milk and breastfeeding for the premature infant. In the New Zealand context, in a large urban NICU, breastfeeding rates are high compared to other published reports. There is a drop off in breastfeeding in this population of infants that is consistent with other country reports for the premature infant population and also for the New Zealand breastfeeding situation. There does appear however to be a discrepancy in the intensity of breast milk feeding in this population compared to

term healthy infants. While some factors may be modifiable based on outcomes in the general population, other factors may be inherently related to being born early. Both the mother, in terms of her ability to produce enough milk, and the infant, in terms of its ability to orally feed need further study.

There is a major problem comparing outcomes of premature infants with those born at term because of the different data collection points. Premature infants clearly behave different to term healthy infants in regard to breastfeeding. There is nothing in the literature that guides practice in terms of data collection points for the premature infant and also breastfeeding definitions. There is needed from the international community discussion and consensus regarding these issues to enable researchers to adequately assess and improve breastfeeding outcomes.

The rates of premature births are increasing along with improved mortality and morbidity. Research for the future should aim to add to the body of knowledge regarding the specific difficulties of mothers and their premature infants. These issues should address the impact of a 'humanised' neonatal care approach taking into account the rights of both the mother and the infant. Further work needs to be done not only on the assessment of feeding problems in the premature infant but also regarding the prevention of these problems. Issues around expressing, the initiation and maintenance of a milk supply for the mother need further clarification. An individualised approach appears to be required as there are many variables that impact on the mother-infant relationship in terms of breastfeeding.

If all this is to be achieved from a clinical perspective, more resources need to be put in place to provide appropriate care. This will include specialist lactation support in the area of breastfeeding premature infants, which may well fall outside of the scope of practice for midwives given the long time frame that infants spend in hospital and also the complex nature and feeding complications that can occur. That is not to say that the lead maternity carer (LMC) should not have a role to play, but rather an acknowledgement that the premature infant has special needs that may require a multi-disciplinary approach to management. This should include dietitians, speech, language and feeding therapists, developmental therapists, nurses, doctors, LMC and lactation specialists. All these health professionals require lactation education to enable them to provide holistic and appropriate care of the breastfeeding mother-infant dyad.

There needs to be established standards of care that include establishing and maintaining a milk supply, transition to oral feeds and kangaroo care. While stress was unable to be quantified in this current study, it remains an area that requires further investigation. However, the benefits of KC may well be the missing link to improving the mother-infant relationship by contributing to reducing stress, improving breastfeeding outcomes, and improving neuro-developmental outcomes. Human research in the future should focus not only on the effect of stress on the mother-infant relationship and breastfeeding but ways of minimising it.

Ethnicity is a predictor of poor breastfeeding outcomes for premature infants in New Zealand. Maori and Polynesian mothers should be targeted for extra support, early in the post-partum period. Family may also need to be targeted for this support.

A common problem associated with premature infants is feeding difficulties. These appear to occur more commonly in non-European populations in New Zealand. Feeding problems in other country ethnic minorities was not found in the breastfeeding literature. Feeding problems lead to longer hospitalisation (further disrupting the mother-infant relationship), is a sign of poor neuro-developmental outcome, and is therefore a costly morbidity (Rudolph & Link, 2002). Urgent research is required to identify the causes of feeding problems in premature infants and prevention or treatment options designed.

Weight gain appears to be different for bottle-fed infants, breastfed infants, and infants combined breast and bottle-feeding. For breastfed infants weight gain may occur slowly immediately post discharge, however over a period of time growth rates appear to improve. Further research is required to assess if there is an impact on slow initial growth immediately after discharge from hospital on the premature infant. While growth reference charts for premature infants are based on foetal growth rates up to 42 weeks gestation, after this period of time growth reference charts are the same as for term healthy infants. There is a need for new growth reference charts for breastfed premature infants that may need to carry on into the second year of life because of their known growth delay.

Prior to discharge from hospital the infants roomed in for 24-48 hours and statistics collected on feeding at discharge from hospital were collected during the last 24 hours in hospital. There may not have been enough time for breastfeeding issues to clinically be evident. The time of discharge is also a time of *crisis* for some mothers who are anxious and unsure of feeding. Bottles may be given due to perceived or

actual poor infant feeding skills and perceived or actual insufficient milk supply. The mother and infant would have also returned to their usual socio-cultural setting with *lay* support people (family, friends, and community) dominating rather than professional support people.

Growth is also an important issue for these mothers and they may not have the confidence or the skills to be patient with their infant's emerging feeding behaviour that can be erratic at the time of discharge. Not only is the mother going through new experiences but so too is the infant. There appeared to be a period at about 2–3 weeks where growth improved for the breastfed infant. Extra support as offered in the study by Gunn et al. (2000), and a better understanding of infant feeding behaviour is required to help these mothers through a difficult time. Support and education should also be provided to the mother's significant support people to help guide and support the mother and infant during this time of crisis.

While the aims of this study have been met and many variables have been considered, this research project has highlighted the urgent need to obtain evidence based interventions to promote, protect and support breastfeeding in this vulnerable group of infants and their mothers. The key areas that need addressing are: standardised data collection for measuring breastfeeding outcomes and breastfeeding definitions that take into account the unique situation of the premature infants, issues addressing feeding problems with particular attention to ethnicity, and growth post discharge from hospital.

It is apparent from this research that the mothers are being successful under enormous difficulties with complicating factors such as artificially sustaining a milk supply, slower growth immediately post discharge, feeding problems, and stress. Maternal demographic factors and issues regarding premature birth appear to influence the intensity of breast milk the infant receives but it may be infant characteristics that determine the transition to direct breastfeeding.

REFERENCES

- Aguayo, J. (2001). Maternal lactation for preterm newborn infants. Early Human Development, 65(29).
- American Academy of Pediatrics. (2005). Policy Statement. Section on Breastfeeding. Breastfeeding and the use of human milk. Pediatrics, 115(2), 496-506.
- Anderson, J. W., Johnstone, B., & Remtey, D. (1999). Breastfeeding and cognitive development: A meta-analysis. American Journal of Clinical Nutrition, 70, 525-535.
- Anthony, M. (2003). Donor human milk versus formula for preventing necroenterocolitis in preterm infants: Systematic review. Archives of Disease in Childhood Fetal & Neonatal Edition, 88, F11-F14.
- Arifeen, S., Black, R. E., Antelman, G., Baqui, A., Caulfield, L., & Becker, S. (2001). Exclusive breastfeeding reduces acute respiratory infection and diarrhoea deaths among infants in Dhaka slums. Pediatrics, 108(4), 1-8.
- Auckland District Health Board. (2005a, 29/10/03). Ethics approval.
Auckland District Health Board. Retrieved 18 January, 2005, from the World Wide Web: <http://www.adhb.govt.nz/rdo/guidelines.htm>
- Auckland District Health Board. (2005b). Population statistics. Auckland District Health Board. Retrieved 28 February, 2005, from the World Wide Web: www.adhb.govt.nz/population_stats.htm

Backwell-Sachs, S., & Blackburn, S. (2003). State of the science: Achievements and challenges across the spectrum of care for preterm infants. Journal of Obstetric, Gynecologic and Neonatal Nursing, 32, 683-695.

Bartle, C. (2003a). Breastfeeding in the NICU: The impact of NICU culture on breastfeeding. Paper presented at the Milk, mammals and marsupials: An international perspective. 2003 conference and annual meeting of the International Lactation Consultant Association, Sydney, Australia.

Bartle, C. (2003b). How 'safe' are artificial baby milks. Breastfeeding Communique, 14, 12-17.

Bartle, C. (2004). The Humane Neonatal Care Initiative. Aroha, La Leche League New Zealand, 6(3), 3-6.

Beasley, A. (1991). Breastfeeding studies: culture, biomedicine, and methodology. Journal of Human Lactation, 7(1), 7-14.

Beasley, A., Chick, N., Pybus, M., Weber, J., Mackenzie, D., & Dignam, D. (1998). 'I was scared I had run out of milk!': Breastfeeding and perceptions of insufficient milk among Manawatu mothers. In A. Beasley, & Trlin, A. (Ed.), Breastfeeding in New Zealand: Practice, problems and policy. Palmerston North: The Dunmore Press.

Bell, E., Geyer, J., & Jones, L. (1995). A structured intervention improves breastfeeding success for ill or preterm infants. MCN, American Journal of Maternal Child Nursing, 20(6), 309-314.

Bergman, N. (2003). Humans and kangaroos - a biological perspective. Paper presented at the Milk, mammals and marsupials: An international perspective. 2003 conference and annual meeting of the International Lactation Consultant Association, Sydney, Australia.

Bouwstra, H., Boersma, E., Boehm, G., Dijck-Brouwer, D., Muskiet, F., & Hadders-Algra, M. (2003). Exclusive breastfeeding of healthy term infants for at least 6 weeks improves neurological condition. Journal of Nutrition, 133, 4243-4245.

Bovey, A., Noble, R., & Noble, M. (1999). Orofacial exercises for breastfed babies? Breastfeeding Review, 7(1), 23-28.

Brown, J., Alexander, J., & Thomas, P. (1999). Feeding outcome in breastfed term babies supplemented by cup or bottle. Midwifery, 15, 92-96.

Brown, L. P., Meier, P., Spatz, D. L., Zukowsky, K., & Spitzer, A. (1996). Use of human milk for low birth weight infants. Online Journal of Knowledge Synthesis for Nursing, 3(Online #27), 1-9.

Burklow, K., Phelps, A., Shcultzl, J., McConnell, K., & Rudolph, C. (1998). Classifying complex pediatric feeding disorders. Journal of Pediatric Gastroenterol Nutrition, 27, 143-147.

Burns, B., & Grove, S. (2001). The practice of nursing research: Conduct, critique, & utilization (4th ed.). Philadelphia: W.B. Saunders Company.

California Perinatal Quality Care Collaborative. (2004). Nutritional support of the very low birth weight infant: Part 1. California Perinatal Quality Care Collaborative. Retrieved 15 December, 2004, from the World Wide Web: <http://www.cpqcc.org/NutritionToolkit.html>

Carter, P. (1995). Feminism, breast, and breast-feeding. London: Macmillian Press Ltd.

Cattaneo, A., Davanzo, R., & Ronfani, L. (2000). Are data on the prevalence and duration of breastfeeding reliable? The case of Italy. Acta Paediatrica, *89*(1), 88-93.

Cattaneo, A., Davanzo, R., Uxa, F., & Tamburlini, G. (1998). Recommendations for the implementation of Kangaroo Mother Care for low birthweight infants. International Network on Kangaroo Mother Care. Acta Paediatrica, *87*(4), 440-445.

Cattaneo, A., & Buzzetti, R. (2001). Effect on rates of breast feeding of training for the Baby Friendly Hospital Initiative. British Medical Journal, *323*, 1358-1362.

Chen, A., & Rogan, W. (2004). Breastfeeding and the risk of postneonatal death in the United States. Pediatrics, *113*(5), e435-e439.

Chomitz, V., Cheung, L., & Lieberman, E. (1995). The role of lifestyle in preventing low birth weight. Future of Children, *5*(1), 121-138.

Clifford, T. (2003). Breastfeeding and obesity. British Medical Journal, *327*, 879-880.

Collaborative Group on Hormonal Factors in Breast Cancer. (2002). Breast cancer and breastfeeding: Collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries. Lancet, 360, 187-195.

Cregan, M., De Mello, T., Kershaw, D., McDougall, K., & Hartmann, P. (2002). Initiation of lactation in women after preterm delivery. Acta Obstetricia et Gynecologica Scandinavica, 81(9), 870-877.

Cumming, R., & Klineberg, R. (1993). Breastfeeding and other reproductive factors and the risk of hip fractures in elderly women. International Journal of Epidemiology, 22(4), 684-691.

Darlow, B. A., Cust, A. E., Donoghue, D. A., & on behalf of the Australian and New Zealand Neonatal Network (ANZNN). (2003). Improved outcomes for very low birthweight infants: Evidence from New Zealand national population based data. Archives of Disease in Childhood Fetal & Neonatal Edition, 88, F23-F28.

Dawson, J., & Benson, S. (2001). Do we send our neonatal intensive care unit (NICU) babies home breastfeeding? Breastfeeding outcomes from an Australian NICU. Neonatal, Paediatric and Child Health Nursing, 4(2), 14-19.

de Onis, M., & Onyango, A. (2003). The Centres for Disease Control and Prevention 2000 growth charts and the growth of breast fed infants. Acta Paediatrica, 92(4), 413-417.

Dempsey, P., & Dempsey, A. (2000). Using nursing research: Process, critical evaluation, and utilization. (5th ed.). New York: Lippincott.

Dewey, K. (2001). The challenges of promoting optimal growth. Journal of Nutrition, 131, 1879-1880.

Dewey, K., Cohen, C., Brown, K., & Rivera, L. (2001). Effects of exclusive breastfeeding for four versus six months on maternal nutritional status and infant motor development: Results of two randomised trials in Honduras. Journal of Nutrition, 131(2), 262-267.

Diaz, S., Herreros, R., Aravena, R., Casado, M., & Schiappacasse, V. (1995). Breast-feeding duration and growth of fully breast-fed infants in a poor urban Chilean population, American Journal of Clinical Nutrition, 62, 371-376.

Dignam, D. M. (1998). Breastfeeding, intimacy and reconceptualising the breast. In A. Beasley & A. Trlin (Eds.), Breastfeeding in New Zealand: Practice, problems and policy. (pp. 75-93). Palmerston North: Dunmore Press.

Dignam, D. M. (2001). 'Linking as One': An intimate breastfeeding moment. Unpublished Doctor of Philosophy, Massey, Palmerston North.

DiIorio, F., & Hardy, K. (1996). Quick start to data analysis with SAS. Belmont, CA: Duxbury Press.

D'Souza, A., & Wood, E. (2003). Making New Zealand fit for children. Promoting a national plan of action for New Zealand Children (Healthy Lives Section). Wellington: UNICEF New Zealand.

du V Florey, C. (1993). Sample size for beginners. British Medical Journal, 306, 1181-1184.

Duncan, B., Ey, J., Holberg, C., Wright, A., Martinez, F., & Taussig, L. M. (1993). Exclusive breastfeeding for at least 4 months protects against otitis media. Pediatrics, *91*(5), 867-872.

Elliott, S., & Reimer, C. (1998). Postdischarge telephone follow-up program for breastfeeding preterm infants discharged from a special care nursery. Neonatal Network Journal of Neonatal Nursing, *17*(6), 41-45.

Espy, K. A., & Senn, T. E. (2003). Incidence and correlates of breast milk feeding in hospitalized preterm infants. Social Science & Medicine, *57*(8), 1421-1428.

Essex, C., Smale, P., & Geddis, D. (1995). Breastfeeding rates in New Zealand in the first six months and the reasons for stopping. New Zealand Medical Journal, *108*, 355-357.

Fanaroff, A. A., & Martin, R. J. (2002). Neonatal-perinatal medicine: Diseases of the fetus and infant (7th ed.). St Louis: Mosby.

Feldman, R., Eidelman, A., Sirota, L., & Weller, A. (2002). Comparison of skin-to-skin contact and traditional care: Parenting outcomes and preterm infant development. Pediatrics, *110*(1), 16-26.

Flacking, R., Hedburg Nyqvist, K., Ewald, U., & Wallin, L. (2003). Long-term duration of breastfeeding in Swedish low birth weight infants. Journal of Human Lactation, *19*(2), 157-165.

Ford, R. P., Mitchell, E., Scragg, R., Stewart, A., Taylor, B. J., & Allen, E. M. (1994). Factors adversely associated with breast feeding in New Zealand. Journal of Paediatric Child Health, 30(483-489).

Furman, L., & Kennell, J. (2000). Breastmilk and skin-to-skin kangaroo care for premature infants. Avoiding bonding failure. Acta Paediatrica, 89(11), 1280-1283.

Furman, L., Minich, N., & Hack, M. (2002). Correlates of lactation in mothers of very low birth weight infants. Pediatrics, 109(4).

Furman, L., Minich, N. M., & Hack, M. (1998). Breastfeeding of very low birth weight infants. Journal of Human Lactation, 14(1), 29-34.

Furman, L., Taylor, G., Minich, N., & Hack, M. (2003). The effect of maternal milk on neonatal morbidity of very low-birth-weight infants. Archives of Pediatrics & Adolescent Medicine, 157(1), 66-71.

Gloppestad, K. (2000). Total duration of lactation in mothers of pre-term infants. Vard i Norden. Nursing Science & Research in the Nordic Countries, 20(1), 15-21.

Griggs, J., Spence, K., & Ellercamp, C. (2001). Breastfeeding outcomes of a neonatal intensive care unit in a children's hospital. Neonatal, Paediatric and Child Health Nursing, 4(3), 15-22.

Gunn, T. R. (1991). Breastfeeding preterm infants. NZ Medical Journal, 104, 187-188.

Gunn, T. R., Thompson, J. M., Jackson, H., McKnight, S., Buckthought, G., & Gunn, A. J. (2000). Does early hospital discharge with home support of families with preterm infants affect breastfeeding success? A randomized trial. Acta Paediatrica, 89(11), 1358-1363.

Hanson, L. (1999). Human milk and host defence: Immediate and long term effects. Acta Paediatrica, 88, 42-46.

Hartmann, P. (2004). Initiation and establishment of lactation with special reference to mothers who deliver pre-term. Paper presented at the Human Lactation: Current Research and Clinical Implications. Breastmilk for pre-term babies conference, Amarillo, Texas.

Hartmann, P., & Cregan, M. (2001). Lactogenesis and the effects of insulin-dependent diabetes mellitus and prematurity. Journal of Nutrition, 131(11).

Hausman, B. L. (2003). Mother's milk: Breastfeeding controversies in American culture. New York and London: Routledge.

Hawden, J., Beauregard, N., & Kennedy, G. (2000). Identification of neonates at risk of developing feeding problems in infancy. Developmental Medicine & Child Neurology, 42, 235-239.

Hedberg Nyqvist, K. (2004). Consultants' corner. How can kangaroo mother care and high technology care be compatible? Journal of Human Lactation, 20(1), 72-74.

Hedberg Nyqvist, K., & Ewald, U. (1999). Infant and maternal factors in the development of breastfeeding behaviour and breastfeeding outcome in preterm infants. Acta Paediatrica, 88(11), 1194-1203.

Heining, D. (1997). Health effects of breastfeeding for mothers: A critical review. Nutrition Research Reviews, 10, 35-36.

Hill, P., Aldag, J., Chatterton, R., & Zinaman, M. (2005). Comparison of milk output between mothers of preterm and term infants: The first six weeks after birth. Journal of Human Lactation, 21(1), 22-30.

Hill, P., Ledbetter, R., & Kavanaugh, K. (1997). Breastfeeding patterns of low-birth-weight infants after hospital discharge. JOGNN Journal of Obstetric, Gynecologic, & Neonatal Nursing, 26(2), 189-197.

Holditch-Davis, D., & Miles, M. S. (2000). Mothers' stories about their experiences in the neonatal intensive care unit. Neonatal Network, 19(3), 13-21.

Horta, B., Kramer, M., & Platt, R. (2001). Maternal smoking and the risk of early weaning: a metanalysis. American Journal of Public Health, 91, 304-307.

Horwood, L., Darlow, B., & Mogridge, N. (2001). Breast milk feeding and cognitive ability at 7-8 years. Archives of Diseases in Childhood, Fetal & Neonatal Ed., 84, F23-F27.

Howie, P. W., Forsyth, J. S., Ogstan, S. A., & du V Florey, C. (1990). Protective effect of breastfeeding against infection. British Medical Journal, 300, 11-16.

Hylander, M., Strobino, D., Pezzullo, J., & Dhanireddy, R. (2001). Association of human milk feedings with a reduction in retinopathy of prematurity among very low birthweight infants. Journal of Perinatology, *21*(356-362).

Ingram, J., Redshaw, M., & Harris, A. (1994). Breastfeeding in neonatal care. British Journal of Midwifery, *2*(9), 412-417.

Jenson, D., Wallace, S., & Kelsay, P. (1994). LATCH: A breastfeeding charting system and documentation tool. JOGNN Journal of Obstetric, Gynecologic, & Neonatal Nursing, *23*, 27-32.

Jones, E. (1994). Breastfeeding in the preterm infant. Modern Midwife, *4*, 23-26.

Jones, G., Steketee, R. W., Black, R. B., Bhutta, Z. A., Morris, S. S., & The Bellagio Child Survival Study Group. (2003). How many child deaths can we prevent this year? Lancet, *362*(9377), 65.

Kavanaugh, K., Mead, L., Meier, P., & Mangurten, H. H. (1995). Getting enough: mothers' concerns about breastfeeding a preterm infant after discharge. JOGNN: Journal of Obstetric, Gynecologic, and Neonatal Nursing, *24*(1), 23-32.

Kennedy, G. (1995). The role of speech and language therapist in management of premature babies and neonates presenting with feeding problems. Neonatal Nurses Yearbook, *2*, 66-69.

Kharrazi, M., DeLorenze, G., Kaufman, F., Eskenazi, B., Bernert, J., Graham, S., & Pearl, M. (2004). Environmental tobacco smoke and pregnancy outcome. Epidemiology, *15*(6), 660-670.

Killersreiter, B., Grimmer, I., Buhrer, C., Dudenhausen, J., & Obladen, M. (2001). Early cessation of breastmilk feeding in very low birthweight infants. Early Human Development, 60,193-205.

Kliethermes, P. A., Cross, M. L., Lanese, M. G., Johnson, K. M., & Simon, S. D. (1999). Transitioning preterm infants with nasogastric tube supplementation: increased likelihood of breastfeeding. JOGNN Journal of Obstetric, Gynecologic, & Neonatal Nursing, 28(3), 264-273.

Koçturk, T., & Zetterstrom, R. (1999). Thoughts about rates of breastfeeding. Acta Paediatrica, 88(4), 356-358.

Kraenzle Schneider, J., & Deenan, A. (2004). Reducing quantitative data errors: Tips for clinical researchers. Applied Nursing Research, 17(2), 125-129.

Kramer, M. S., Chalmers, B., Hodnett, E. D., Sevkovskaya, Z., Dzikovich, I., Shapiro, C., Collet, J. P., Vanilovich, I., Mezen, I., Ducruet, T., Shishko, G., Zubovich, V., Mknuk, D., Gluchanina, E., Dombrovskiy, V., Ustinovitch, A., Kot, T., Bogdanovich, N., Ovchinikiva, L., Helsing, E., & for the PROBIT Study Group. (2001). Promotion of breastfeeding intervention trial (PROBIT): A randomised trial in the Republic of Belarus. The Journal of the American Medical Association, 285(4), 413-420.

Kramer, M. S., Guo, T., Platt, R. W., Shapiro, S., Collet, J. P., Chalmers, B., Hodnett, E., Sevkovskaya, Z., Dzikovich, I., Vanilovich, I., & Group, P. S. (2002). Breastfeeding and infant growth: biology or bias? Pediatrics, 110(2 Pt 1), 343-347.

Krouse, A. M. (2002). The family management of breastfeeding low birth weight infants. Journal of Human Lactation, 18(2), 155-165.

Kuhn, D., & Matson, J. (2002). A validity study of the screening tool of feeding problems (STEP). Journal of Intellectual & Developmental Disability, 27(3), 161-167.

Kull, I., Wickman, M., Lilja, G., Nordvall, S., & Pershagen, G. (2002). Breastfeeding and allergic diseases in infants. Archives of Diseases in Childhood, 87, 478-481.

Kuschel, C. (2005). Newborn Services homepage. Newborn Services Auckland District Health Board. Retrieved 31/01/05, 2005, from the World Wide Web: <http://www.adhb.govt.nz/newborn/>

Labbok, M. (1994). The lactational amenorrhoea method (LAM): A postpartum introductory family planning method with policy and programme implications. Advances in Contraception, 10(2), 93-109.

Labbok, M. (2000). What is the definition of breastfeeding? Breastfeeding Abstracts, 19(3), 19-20.

Labbok, M., Belsey, M., & Coffin, C. (1997). A call for consistency in defining breast-feeding. American Journal of Public Health June, 87(6), 1060-1061.

Labbok, M., & Coffin, C. (1997). A call for consistency in definition of breastfeeding behaviors. Social Science & Medicine, 44(12), 1931-1932.

Labbok, M., & Krasovic, K. (1990). Consistency in breastfeeding definitions. Studies in Family Planning, 20(4), 226-230.

Lang, S. (1998). Breastfeeding special care babies. London: Bailliere Tindall.

Lau, C. (2001). Effects of stress on lactation. Paediatric Clinics of North America, 48(1), 225-235.

Lawrence, R. (1999). Breastfeeding: A guide for the medical profession. St Louis: Mosby.

Leff, E. W., Gagne, M. P., & Jefferis, S. C. (1994). Maternal perceptions of successful breastfeeding. Journal of Human Lactation, 10(2), 99-104.

Lemons, P. K., & Lemons, J. A. (1996). Transition to breast/bottle feedings: the premature infant. Journal of the American College of Nutrition, 15(2), 126-135.

Levin, A. (1999). Humane Neonatal Care Initiative. Acta Paediatrica, 88(4), 353-355.

Li, R., & Grummer-Strawn, L. (2002). Racial and ethnic disparities in breastfeeding among United States infants: Third national health and nutrition examination survey, 1988–1994. Birth, 29(2), 251-257.

Lucas, A., & Cole, T. J. (1990). Breast milk and neonatal necrotising enterocolitis. Lancet, 336(8730), 1519-1523.

Lucas, A., Morley, R., & Cole, T. J. (2000). Randomised trial of early diet in preterm babies and later intelligence quotient. British Medical Journal, 317(7171), 1481-1487.

Lucas, A., Morley, R., Cole, T. J., Gore, S. M., Lucas, P. J., Crowle, P., Pearse, R., Boon, A. J., & Powell, R. (1990). Early diet in preterm babies and developmental status at 18 months. Lancet, 335(8704), 1477-1481.

Lucas, A., Morley, R., Cole, T. J., Lister, G., & Leeson-Payne, C. (1992). Breast milk and subsequent intelligence quotient in children born preterm. Lancet, 339(8788), 261-264.

Marttinen Doordan, A. (1998). Research survival guide. Philadelphia: Lippincott.

McGrath, J., & Bodea Braescu, A. (2004). Feeding readiness in the preterm infant. Journal of Perinatal and Neonatal Nursing, 18(4), 353-368.

McNatt, M. H., & Freston, M. S. (1992). Social support and lactation outcomes in postpartum women. Journal of Human Lactation, 8(2), 73-77.

McVeagh, P. (2002). Is breastfeeding best practice? Medical Journal of Australia, 177(3), 128-129.

Meier, P. (1987). Responses of small preterm infants to bottle and breast-feeding. MCN-American Journal of Maternal and Child Nursing, 12(2), 97-105.

Meier, P. (2001). Breastfeeding in the special care nursery: Prematures and infants with medical problems. Paediatric Clinics of North America, 48(2), 425-442.

Meier, P. (1988). Bottle- and breast-feeding: Effects on transcutaneous oxygen pressure and temperature in preterm infants. Nursing Research, 37(1), 36-41.

Meier, P., & Brown, L. (1996). State of the science. Breastfeeding for mothers and low birth weight infants. Nursing Clinics of North America, 31(2), 351-365.

Meier, P., Engstrom, J., Crichton, C., Clark, D., Williams, M., & Mangurten, H. (1994). A new scale for in-home test-weighing for mothers of preterm and high risk infants. Journal of Human Lactation, 10(3), 163-168.

Merewood, A., Philipp, B. L., Chawla, N., & Cimo, S. (2003). The Baby-Friendly Hospital Initiative increases breastfeeding rates in a US neonatal intensive care unit. Journal of Human Lactation, 19(2), 166-171.

Meyer Palmer, M. (2002). Recognizing and resolving infant suck difficulties. Journal of Human Lactation, 18(2), 166-167.

Meyer-Palmer, M., Crawley, K., & Bianco, I. (1993). Neonatal oral-motor assessment scale: A reliability study. Journal of Perinatology, 13(1), 28-35.

Minchin, M. (1998). Breastfeeding matters. (4th ed.). Melbourne: Alma Publications.

Miracle, D. J., Meier, P. P., & Bennett, P. A. (2004). Mothers' decisions to change from formula to mothers' milk for very-low-birth-weight infants. JOGNN Journal of Obstetric, Gynecologic, & Neonatal Nursing, 33(6), 692-703.

Mitoulas, L. R. (2004). Pumping frequency and duration and milk yields in pre-term mothers. Paper presented at the Human lactation Conference: Current research and clinical implications. Breastmilk for pre-term infants . Amarillo, Texas.

Mizuno, K., & Ueda, A. (2003). The maturation and coordination of sucking, swallowing, and respiration in preterm infants. Journal of Pediatrics, 142(1), 36-40.

Mizuno, K., Ueda, A., & Takeuchi, T. (2002). Effects of different fluids on the relationship between swallowing and breathing during nutritive sucking in neonates. Biology of the Neonate, 81(1), 45-50.

Mobbs, G. (1989). Human imprinting and breastfeeding -- are the textbooks deficient? Lamp, 46(11), 33-36.

MOH. (2000). Food and nutrition for infants and toddlers (aged 0-2 years): A background paper. Wellington: MOH.

MOH. (2002). Breastfeeding: A Guide to Action. Wellington: MOH.

MOH. (2003). Report on Maternity 2000 & 2001. Wellington: MOH.

MOH. (2004). Review of the New Zealand Interpretation of the World Health Organisation's International Code of Marketing of Breast-milk Substitutes. Wellington: MOH.

Morley, R., & Lucas, A. (2000). Randomized diet in the neonatal period and growth performance until 7.5-8 y of age in preterm children. American Journal of Clinical Nutrition, 71(3), 822-828.

Morse, J. M., & Bottorff, J. L. (1990). The emotional experience of breast expression. Breastfeeding Review, 2(1), 27-32.

Morton, J. A. (2003). The role of the pediatrician in extended breastfeeding of the preterm infant. Pediatric Annals, 32(5), 308-316.

Muberg, A., Willgaffe, S., & Sande, H. (1982). High potential for breastfeeding among mothers giving birth to pre-term infants. Acta Paediatrica Scandinavia, 71, 661-662.

Mullooly, J. P. (1990). The effects of data entry error: an analysis of partial verification. Computers & Biomedical Research, 23(3), 259-267.

Newton, N. (1971). Psychologic differences between breast and bottle feeding. The American Journal of Clinical Nutrition, 24, 993-1004.

Nicoll, A., & Williams, A. (2002). Breastfeeding. Archives of Diseases in Childhood, 87, 91-92.

Nyqvist Hedburg, K., Sjoden, P., & Ewald, U. (1999). The development of preterm infants' breastfeeding behavior. Early Human Development, 55(3), 247-264.

Nystrom, K., & Axelsson, K. (2002). Mothers' experience of being separated from their newborns. Journal of Obstetric, Gynecologic, & Neonatal Nursing, 31, 275-282.

NZ Health and Disability Ethics Committees. (2005). Information for researchers: Does observational research or audit require a review by an ethics committee? NZ Health and Disability Ethics Committees. Retrieved 18 January, 2005, from the World Wide Web:
<http://www.newhealth.govt.nz/ethicscommittees/researchers.html#general>

NZBA. (2005). Baby friendly hospital initiative. NZBA. Retrieved 29/01/05, 2005, from the World Wide Web: www.babyfriendly.org.nz/

NZIFMA. (1997). Code of practice for the marketing of infant formula. Wellington: NZIFMA.

Oddy, W. (2001). Breastfeeding protects against illness and infection in infants and children: A review of the literature. Breastfeeding Review, 9(2), 11-18.

Ortenstrand, A., Winbladh, B., Nordstrom, G., & Waldenstrom, U. (2001). Early discharge of preterm infants followed by domiciliary nursing care: parents' anxiety, assessment of infant health and breastfeeding. Acta Paediatrica, 90(10), 1190-1195.

Palmer, G. (1993). The politics of breastfeeding. London: Pandora Press.

Palmer, G. (2004). Feminism and Breastfeeding. In M. Stewart (Ed.), Pregnancy, Birth and Maternity Care: Feminist Perspectives. Edinburgh: Books for Midwives.

Panpanich, R., & Garner, P. (2004). Growth monitoring in children. Cochrane Database of Systematic Reviews, 4, 4.

Pearse, J., & Buchanan, L. (1979). Breast milk and breastfeeding in very low birth weight infants. Archives of Disease in Childhood, 54, 897-899.

Piper, S. (2002). Feeding patterns of preterm infants post NICU discharge. In K. Auerbach (Ed.), Current Issues in Clinical Lactation. Boston: Jones and Bartlett Publishers.

Piper, S., & Parks, P. (1996). Predicting the duration of lactation: evidence from a national survey. Birth, 23(1), 7-12.

Polit, D., & Tatano Beck, C. (2004). Nursing Research: Principles and methods. (7th ed.). Philadelphia: Lippincott Williams & Wilkins.

Pridham, K., Limbo, R., Schroeder, M., Thoyre, S., & Van Riper, M. (1998). Guided participation and development of care-giving competencies for families of low birth-weight infants. Journal of Advanced Nursing, November, 28(5), 948-958.

Quandt, S. A. (1995). Sociocultural aspects of the lactation process. In P. Stuart-Macadam & K. A. Dettwyler (Eds.), Breastfeeding: Biocultural perspectives. New York: Aldine de Gruyter.

Reinhardt, A., & Ray, L. 2003. Differentiating quality improvement from research. Applied Nursing Research 16(1), 2-8

Riordan, J. (2005). Breastfeeding and human lactation (3rd ed.). Boston: Jones and Bartlett Publishers.

Rudolph, C., & Link, D. (2002). Feeding disorders in infants and children. Paediatric Clinics of North America, 49(1), 97-111.

Salihu, H., Shumpert, M., Aliyu, M., Alexander, M., Kirby, R., & Alexander, G. (2004). Stillbirths and infant deaths associated with maternal smoking among mothers aged ≥ 40 years: A population study. American Journal of Perinatology, 21(3), 121-129.

Sarantakos, S. (1998). Social Research (2nd ed.). Melbourne: MacMillan Education Australia Pty Ltd.

SAS Institute Inc. (1990). SAS/Stat guide for personal computers. (Version 6). Cary(NC): SAS Institute Inc.

Sellen, D. (2001). Comparison of infant feeding patterns reported for non-industrial populations with current recommendations. Journal of Nutrition, 131(10), 2707-2715.

Sherry, B., Mei, Z., Grummer-Strawn, L., & Dietz, W. (2003). Evaluation of and recommendation for growth references for very low birth weight (<1500 grams) infants in the United States. Pediatrics, 111(4), 750-758.

Singhal, A., Cole, T. J., Fewtrell, M., & Lucas, A. (2004). Breastmilk feeding and lipoprotein profile in adolescents born preterm: follow-up of a prospective randomised study. Lancet, 363(9421), 1571-1578.

Smith, M. M., Durkin, M., Hinton, V., Bellinger, D., & Kuhn, L. (2003). Initiation of breastfeeding among mothers of very low birth weight infants. Pediatrics, 111(6), 1337-1342.

Smotherman, W., & Robinson, S. (1994). Milk as the proximal mechanism for behavioral change in the newborn. Acta Paediatrica, 397(64-70).

Sousa, V., Zauszniewski, J., & Musil, C. (2004). How to determine whether a convenience sample represents the population. Applied Nursing Research, 17(2), 130-133.

Spatz, D. (2004). Ten steps for promoting and protecting breastfeeding for vulnerable infants. Journal of Perinatal & Neonatal Nursing, 18(4), 385-396.

Statistics New Zealand. (2005). Where Maori live. Statistics New Zealand. Retrieved 20 February, 2005, from the World Wide Web: www.stats.govt.nz

Steward, D., & Pridham, K. (2002). Growth patterns of extremely low-birth-weight hospitalized preterm infants. JOGNN Journal of Obstetric, Gynecologic, & Neonatal Nursing, 31, 57-65.

Stine, M. (1991). Breastfeeding the premature newborn: A protocol without bottles. Journal of Human Lactation, 6(4), 167-170.

The Bellagio Child Survival Study Group. (2003). Child survival V: Knowledge into action for child survival. Lancet, 362, 323-327.

Thomas, C. (2003). Expressing in the neonatal intensive care unit. Auckland: Newborn Services, National Women's Hospital.

Tipene-Leach, D., Abel, S., Finau, S., Park, J., & Lennan, M. (2000). Maori infant care practices: Implications for health messages, infant care services and SIDS prevention in Maori communities. Pacific Health Dialog, 7(1), 29-37.

UNICEF UK Baby Friendly Initiative. (2002). Breastfeeding information: Statistics. UNICEF UK Baby Friendly Initiative. Retrieved 26/01/05, from the World Wide Web: www.babyfriendly.org.uk/

Unit for Health Services Research and International Health. (2003). Promoting, protecting and supporting breastfeeding: An action plan for Europe. Italy.

USA Department of Health and Human Services Office on Women's Health. (2000). HHS Blueprint for action on breastfeeding. Washington DC: USA Dept of Health and Human Services.

Vogel, A. (2004). The evaluation of the B4 Baby breastfeeding support project. Issues: New Zealand Lactation Consultants Association, 14(1), 44-49.

Vogel, A., & Mitchell, E. (1998). The establishment and duration of breastfeeding. Part 1: Hospital influences. Breastfeeding Review, 6(1), 5-9.

Warren, I., Tan, G., Dixon, P., & Ghaus, K. (2000). Breast feeding success and early discharge for preterm infants. Journal of Neonatal Nursing, 6(2).

Weimer, J. P. (2001). Economic benefits of breastfeeding. Washington: Economic Research Service USDA.

Westrub, B., Kleberg, A., & Stjernqvist, K. (1999). The humane neonatal care initiative and family-centred supportive care. Acta Paediatrica, 88(4), 1051-1052.

Wheeler, J., Chapman, C., Johnson, M., & Langdon, R. (2000). Feeding outcomes and influences within the Neonatal Unit. International Journal of Nursing Practice, 6, 196-206.

Wheeler, J., Johnson, M., Collie, L., Sutherland, D., & Chapman, C. (1999). Promoting breastfeeding in the neonatal intensive care unit. Breastfeeding Review, 7(2), 15-18.

WHO. (1981). International code of marketing of breast-milk substitutes. Geneva: WHO.

WHO. (1998a). Complementary feeding of young children in developing countries. A review of current scientific knowledge. Geneva: WHO.

WHO. (1998b). Evidence for the ten steps to successful breastfeeding.

Geneva: WHO.

WHO. (2003). Kangaroo mother care: A practical guide. Geneva: WHO.

WHO Nutrition Unit. (1996). Global database on breastfeeding. Geneva: WHO.

WHO Working Group on the Growth Reference Protocol and WHO Task Force on Methods for the Natural Regulation of Fertility. (2000). Growth patterns of breastfed infants in seven countries. Acta Paediatrica, 89, 215-222.

WHO/UNICEF. (1989). Protecting, promoting and supporting breastfeeding: The special role of maternity services. Geneva: WHO/UNICEF.

WHO/UNICEF. (1990). Innocenti Declaration on the protection, promotion and support of breastfeeding. Geneva: WHO.

WHO/UNICEF. (2003). Global strategy for infant and young child feeding. Geneva: WHO.

Widstrom, A. M. (2001). Lessons from Sweden: Aren't babies clever? ACE Graphics. Retrieved 31/01/05, from the World Wide Web:
<http://www.acegraphics.com.au/resource/papers/widstrom01.html>

Widstrom, A. M., Wahlberg, V., Matthiesen, A. S., Eneroth, P., Uvnas-Moberg, K., Werner, S., & Winburg, J. (1990). Short-term effects of early suckling and touch of the nipple on maternal behaviour and breast-feeding performance. Early Human Development, 21, 153-163.

Wight, N. (2004). Breastfeeding the former NICU infant. Breastfeeding Abstracts, 23(3), 19-20.

Williams, A. F. (1993). Human milk and the preterm baby. British Medical Journal, 306, 1628-1629.

Wooldridge, J., & Hall, W. (2003). Posthospitalization breastfeeding patterns of moderately preterm infants. Journal of Perinatal & Neonatal Nursing, 17(1), 50-64.

Yipp, E., Lee, J., & Sheehy, Y. (1996). Breast-feeding in neonatal intensive care. Journal of Paediatrics & Child Health, 32(4), 296-298.

GLOSSARY OF TERMS

ABM Artificial baby milk has several names that include formula and breast milk substitute

Antenatal Steroids

A course of cortico-steroids given to a mother prior to delivery of a premature infant. Steroids have been shown primarily to enhance lung development and reduce the risk of respiratory distress syndrome (RDS) and chronic lung disease (CLD).

BFHI Baby Friendly Hospital Initiative. World Health Organisation strategy to improve the practices of maternity facilities that negatively impact on breastfeeding (see appendix). Maternity facilities are awarded the accreditation of Baby Friendly Hospital once a minimum standard of all ten steps (by formal assessment) has been achieved.

BPD Bronchopulmonary dysplasia - chronic lung disease. A possible consequence of prematurity.

CA Corrected age. The premature infants gestational age plus chronological age.

CI Confidence interval

CPAP Continuous positive airways pressure – a method of treatment for RDS

C/S Caesarean section

EBM Expressed breast milk

ELBW Extremely low birth weight. Infant weighs <1000g at birth.

Feeding Problems

For this study, three groups of feeding problems were identified: slow to feed or slow to establish feeds, uncoordinated feeding or dysfunctional feeding. Breastfeeding problems (a term often used in the literature) is not this situation although feeding problems may cause breastfeeding problems.

HMF Human milk fortifier. A cows milk based powder added to breast milk to increase protein, calcium and phosphorous predominantly to assist growth of VLBW infants.

ICMBMS International Code of Marketing Breast Milk Substitutes. World Health Organisation strategy to regulate the unethical marketing strategies of breast milk substitutes (also known as artificial baby milk (ABM)).

- IUGR** Intra-uterine growth retardation. Infant's weight when born is 2 SD below what is expected. Also known as growth restricted or small-for-dates.
- IVH** Intraventricular haemorrhage – bleeding into the ventricles of the brain. A common consequence of prematurity
- KC** Kangaroo Care. A method of holding the infant, snuggled skin-to-skin with the caregiver (usually the mother).
- KMC** Kangaroo mother care. Naked infant is strapped to mother's naked chest 24 hours a day, seven days a week. Exclusive breastfeeding and early discharge from hospital occur. This strategy is employed mostly in developing countries where NICUs have limited resources.
- LC** Lactation consultant.
- LBW** Low birth weight. Infant weighs <2500g at birth.
- NEC** Necrotising enterocolitis – a disease of the bowel sometimes seen in premature infants.
- OECD** Organisation for Economic Co-operation and Development. The OECD countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan,

South Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States of America.

- PTSD** Post traumatic stress disorder. Psychological trauma following a traumatic experience.
- RCT** Randomised controlled trial.
- RDS** Respiratory distress syndrome. A disease process in premature infants related to immature lungs.
- Supplements** Extra milk given to infant by bottle. May be complementary to a breastfeed or replacing it. May have used ABM or EBM.
- UNICEF** United Nations Children's Fund.
- VLBW** Very low birth weight. Infant weights <1500g at birth.
- WHO** World Health Organisation.

APPENDIX 1

Study Definition of Breastfeeding.¹

Defining breastfeeding is difficult especially for the premature infant who may have experienced several different types of milk and several different methods obtaining it. The term 'breastfeeding' is often used interchangeably with 'breastmilk feeding'. The main issue is that the NZ Ministry of Health and the World Health Organisation define breastfeeding in varying degrees of the type of milk the infant consumes (breastmilk or artificial baby milk) and not whether the infant receives the milk from the breast (MOH, 2002; WHO Nutrition Unit, 1996). Chapter two, page 20-24 has an explanation of the difficulties with defining breastfeeding

The study definition of breastfeeding uses a code that incorporates two parts. Part one concerns **breastfeeding** and is scored from A to E. This part of the code relates to the degree of breastfeeding that occurs (that is obtaining breastmilk from the breast). If the infant is not 100% breastfeeding then the supplements could have been breastmilk or ABM. Calculations to obtain the code A – E were initiated when the infant commenced oral feeding either by latching onto the breast and sucking or being offered the bottle and sucking.

Part two of the code concerns the **milk type** the infant received being either breastmilk or artificial baby milk (ABM). The score is given 1 to 5. This was calculated from the first day the infant commenced enteral feeding.

For example an exclusively breastfed baby would score A1. An infant receiving formula by bottle would score E5. An exclusively breast milk fed infant from a bottle would score E1.

BREASTFEEDING CODE

A (exclusive) = breastfed at the breast only with occasional medicines *

B (full) = > 80% breastfed with occasional supplements

C (partial) = 20 – 80% breastfed feeding with frequent supplements

D (token) = <20% breastfed with mostly supplements

E (bottle fed) = 100% bottle fed

MILK TYPE

1 (exclusive) = breast milk fed only

2 (full) = > 80% breast milk

3 (partial) = 20-80% breast milk

4 (token) = < 20% breast milk

5 (formula) = formula only

*All premature infants receiving breast milk born before 30 weeks gestation are routinely supplemented with human milk fortifier (HMF) in the study centre.

¹ Study definitions based on: Labbok, M., & Kresovic, K. (1990). Consistency in breastfeeding definitions. *Studies in Family Planning*, 20(4), 226-230.

APPENDIX 2

The Baby Friendly Hospital Initiative (BFHI) – Ten Steps to Successful Breastfeeding.

Every facility providing maternity services and care for newborn infants should:

1. Have a written breastfeeding policy that is routinely communicated to all healthcare staff.
2. Train all healthcare staff in skills necessary to implement this policy
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within a half-hour of birth.
5. Show mothers how to breastfeed, and how to maintain lactation even if they should be separated from their infants.
6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
7. Practise rooming-in – allow mothers and infants to remain together - 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

Source: WHO. (1998). Evidence for the ten steps to successful breastfeeding. Geneva:WHO.

APPENDIX 3

Summary of the International Code of Marketing Breast Milk Substitutes and Subsequent World Health Assembly Resolutions.

SCOPE OF THE CODE

The code covers all breast milk substitutes and includes

- Infant formula, including hypo-allergenic, pre-term and other 'special baby milks'
- Follow-on milks
- Complementary foods such as cereals, teas, juices, water and other baby foods that are marketed for use before an infant is six months old
- All feeding bottles and teats

SUMMARY OF THE 10 PROVISIONS OF THE CODE

- No advertising of any of these products to the public.
- No free samples to mothers.
- No promotion of products in health care facilities, including the distribution of free or low-cost supplies.
- No company sales representatives to advise mothers.
- No gifts or personal samples to health workers.
- No words or pictures idealising artificial feeding, or pictures of infants on labels on infant milk containers.
- Information to health workers should be scientific and factual.

Appendix 3: (continued)

- All information on artificial infant feeding, including that on labels, should explain the benefits of breastfeeding, and the costs and hazards associated with artificial feeding.
- Unsuitable products, such as sweetened condensed milk, should not be promoted for babies.
- Manufacturers and distributors should comply with the Code's provisions even if countries have not adopted laws or other measures.

Source: MOH. (2002). Breastfeeding: A Guide to Action. Wellington: MOH.

APPENDIX 4

New Zealand Ministry of Health Breastfeeding Definitions¹

- Exclusive** The infant has never, to the mother's knowledge, had any water, formula, or other liquid or solid food. Only breast milk, from the breast or expressed, and prescribed² medicines have been given from birth.
- Fully** The infant has taken breast milk only, and no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours (this matches the WHO exclusive rate indicator).
- Partial** The infant has taken some breast milk and some infant formula or other solid food in the past 48 hours.
- Artificial** The infant has had no breast milk but has had alternative liquid such as infant formula, with or without solid food, in the past 48 hours.

Appendix 4: (continued)**RECOMMENDED DATA COLLECTION POINTS**

Initiation	48 hours following birth*
	2 weeks
Established Breastfeeding	6 weeks
	3 months*
	6 months*
Continued Breastfeeding	12 months*
	2 years

¹ Source: MOH. (2002). Breastfeeding: A Guide to Action. Wellington: MOH.

² Prescribed as per the Medicines Act 1981

* The priority collection points.

APPENDIX 5

Labbock and Krasovic Definition of Breastfeeding¹

SCHEMA OF BREASTFEEDING DEFINITION

Category of infant feeding	Requires that the infant receive:	Allows the infant to receive:	Does not allow the infant to receive:
Exclusive breastfeeding	Breast milk (including expressed milk or milk from wet nurse)	Drops, syrups (vitamins, minerals, medicines)	Anything else
Predominant	Breast milk (including expressed milk or milk as the predominant source of nourishment from wet nurse)	Liquids (water, and water-based drinks, fruit juice, ORS), ritual fluids, and drops or syrups (vitamins, minerals, medicines)	Anything else (in particular, non-human milk and food-based fluids)
Complementary feeding	Breast milk and solid or semi-solid foods	Any food or liquid including non-human milk	
Breastfeeding	Breast milk Any food or liquid including non-human milk	Any food or liquid including non-human milk or breast milk by bottle	
Bottle-feeding	Any liquid or semi-solid food from the bottle with nipple/teat		

Appendix 5: (continued)

SCHEMA AND FRAMEWORK FOR BREASTFEEDING DEFINITION

BREASTFEEDING						
	Full		Partial			Token
	Exclusive	Almost Exclusive	High	Medium	Low	
Time Postpartum/ Age of Infant						
Frequency						
Duration						
Intervals						
Artificial Nipples & Other Devices						
Expression of Breastmilk						
Type, Timing, and Amount of Other Feedings						
Others						

¹ Source: Labbok, M., & Krasovic, K. (1990). Consistency in breastfeeding definitions. *Studies in Family Planning*, 20(4), 226-230.

APPENDIX 6

World Health Organisation Breastfeeding Definition.

Category of infant feeding	Requires that the infant receive	Allows the infant to receive	Does not allow the infant to receive
Exclusive breastfeeding (EBF) ^a	Breast milk (BM), including milk expressed (EBM) or from wet nurse	Drops, syrups (vitamins, minerals, medicines)	Anything else
Predominant breastfeeding (PBF) ^a	BM, including EBM or from wet nurse, as the predominant source of nourishment	Liquids (water and water-based drinks, fruit juice, ORS), ritual fluids and drops or syrups (vitamins, minerals, medicines)	Anything else (in particular, non-human milk, food-based fluids)
Complementary breastfeeding (CBF)	BM and solid or semisolid foods or non-human milk	Any food or liquid including non-human milk	
Non-breastfeeding (NBF)	No BM	Any food or liquid including non-human milk	BM, including EBM or from wet nurse
Breastfeeding (BF)	BM	Any food or liquid including non-human milk	

Source: WHO Nutrition Unit. (1996). Global database on breastfeeding. Geneva: WHO.

APPENDIX 7

Eleven Steps for the Improvement of Psychosocial and Medical Care in Units for Sick Newborns

1. The mother should be able to stay with her sick baby for 24 hours a day.
2. Every staff member should care for the mother and the infant and should be able to cope with psychological aspects.
3. The staff should promote breastfeeding to every mother and learn the techniques of expressing breast milk.
4. The psychological stress of the mothers should be decreased during the whole treatment period.
5. Unless medically indicated, newborns should not be given anything other than breast milk.
6. If the infant cannot suckle, breast milk should be given by tube.
7. The number of tests and examinations should be reduced to a minimum.
8. Mother-and-child skin-to-skin and air-to-air contact should be used as much as possible, and the use of technical equipment in childcare should be reduced.
9. Aggressive therapy should be reduced to a minimum.
10. The mother and infant should be considered as a closed psychosomatic system. Everyday ward rounds should focus not only on the infant[s] but also on the needs of the mothers (include a gynaecologist and other specialists).
11. Healthy family members (father, grandparents or helpers) should be allowed to visit the mother and baby during a prolonged stay at the hospital

Source: Levin, A. (1999). Humane Neonatal Care Initiative. *Acta Paediatrica*, 88(4), 353-355.

APPENDIX 8

Study Variables.

OUTCOME MEASURES

Breastfeeding code at discharge from hospital

Measured during the last 24 hours before discharge. Includes type of milk received and how the infant received it. See appendix one for study breastfeeding definition.

Breastfeeding code at discharge from homecare

Includes percentage of breast milk and feeds at breast. See appendix one for study breastfeeding definition.

Breastfeeding at follow-up

Yes/no

The paediatrician who cared for the infant as an inpatient provides the follow-up.

MATERNAL CHARACTERISTICS

Maternal age In years

Ethnicity Maori/Polynesian/Caucasian/Asian/other

Classification of ethnic groups was taken from the Neonatal Database.

Parity Number of previous children, including study infant.

Breastfeeding intention

Yes/no

Antenatal steroids None/<24 hours/complete/>7 days

Mode of delivery Normal vaginal/instrumental/caesarian section

Plurality Singleton/twins/triplets.

If one twin died it would be regarded as a singleton. If one triplet died the set would be regarded as twins or a singleton if two triplets died.

INFANT CHARACTERISTICS

Admission date Used in conjunction with discharge date to give length of stay

Discharge date As above

Sex Male/female

Gestational age Measured in whole weeks (obtained from neonatal database).

Birth weight Naked weight at time of birth

Intrauterine growth retardation (IUGR)

Yes/no

Apgar score 1 Measured at one minute post birth.

Apgar score 2 Measured at five minutes post birth.

Days ventilated Number of days mechanical ventilation required.

Days on CPAP Number of days on CPAP, does not include ventilation days.

Days on oxygen Number of days oxygen required, includes if oxygen used while ventilated or on CPAP.

Necrotising Enterocolitis (NEC)

Absent/suspected/proven

Confirmed by abdominal x-ray, clinical findings and/or surgical findings.

Intraventricular Haemorrhage (IVH)

None/grade I/grade II/grade III/ grade IV

Confirmed by routine head ultrasound

INFANT FEEDING CHARACTERISTICS**Age at full enteral feeds**

Age when first full enteral feeds obtained. That is, full milk volumes per kilo were attained and intravenous nutrition ceased.

Measured as chronological age in days and corrected gestational age.

Day first oral feed First day either breast or bottle introduced. If it was a breastfeed then when first latch and sucking movements noted. If bottle-fed then first time bottle introduced and some milk taken.

Type of first oral feed

Breast/bottle

Percentage of nasogastric (NG) feeds

Percentage of NG feeds from total feeds (NG and oral) measured from when the first oral feed was given.

Age when four oral feeds per day achieved

Age that four oral feeds a day were obtained either breast or bottle independent of whether the feed was a full feed or not. Measured as chronological age in days and corrected gestational age.

Age full oral feeds obtained

Age that full oral feeds were obtained either by breast or bottle. Measured as chronological age in days and corrected gestational age in weeks.

Number of breastfeeds per day

Number of breastfeeds offered to infant on a daily basis regardless of how well the infant performed at the breast.

KEY DETERMINANTS**MATERNAL SUPPORT****Lead maternity carer (LMC)**

Independent midwife/private obstetrician/hospital clinic/
general practitioner

Lactation consultant (LC) involvement

Yes/no

Well Child Provider (WCP)

Plunket/Waitemata Homecare for Kids(WHCK)/Public Health
Nurse(PHN)/Kidzfirst Homecare/(KFHC)/Midwife/Other

Rooming in

Mother rooming in with infant for last 24 or 48 hours

Yes/no

Homecare visiting

Yes/no

Number of visits

Visitation only and does not include phone calls.

MATERNAL MILK SUPPLY

Percentage of milk infant received

Total number of feeds divided by the total number of breast milk feeds. The percentage was obtained for the whole hospital stay regardless of the method the infant received it. See appendix one for full definitions of breastfeeding for this study.

The addition of human milk fortifier (HMF) to mother's own milk creates an issue regarding *exclusivity* of breastfeeding. Because HMF is a cow's milk based substance that all infants in this study would have received routinely, it could be argued that no infant would qualify as exclusive breast milk feeders. It may on the other hand be described as a medicine because it is prescribed. In this study the addition of HMF to breast milk is regarded as exclusive breast milk feeding because of the extraordinary effort mothers go through to achieve this success. Another reason is that in this study exclusive breastfeeding was used as a measure of breastfeeding success, it was therefore considered relevant.

KANGAROO CARE (KC)

- Day KC initiated** Age first KC by either mother or father. Measured as chronological age in days and corrected gestational age.
- Regular KC** Yes (most days or alternate days)/no/erratic(not consistent)

BOTTLE USE

Percentage of bottle-feeds

Percentage of bottle-feeds from total number of oral feeds, measured from when the first oral feed was given.

Percentage of breastfeeds

Percentage of breastfeeds from total number of oral feeds, recorded from when the first oral feed was given.

Age bottle introduced

Gestational age bottle first introduced.

FEEDING PROBLEMS

Teat type Type of teat used when bottle feeds were given.

Nipple shield used Yes/no

Oral feeding problems

Slow/uncoordinated/dysfunctional.

Identified in the nursing notes. Did not necessarily have a formal feeding assessment to obtain this diagnosis.

Supplements used No/number (average per day)/not applicable (bottle fed)

Number of days supplements used

Only the days supplements were given post-discharge and not while in hospital.

GROWTH

Days to weight gain

Number of days it took for a weight gain of 15 grams a day to be achieved after discharge from hospital.

While a weight gain of 25 grams a day is defined in the literature as the expected achievement in this group of infants, the study criteria was when growth started to occur as there is usually a period of static growth immediately following discharge.

Weight at discharge All infants are weighed on the day of discharge.

Weekly weight Taken every 7 days post discharge plus or minus 1-2 days depending on homecare visit.

Data collected for the variable weight was taken every week for six weeks unless discharged prior to this.

APPENDIX 9

Ethics Committee Correspondence.

>From pat_chainey@moh.govt.nz Mon May 6 11:39:53 2002
 From: pat_chainey@moh.govt.nz
 Subject: Re: ? ethics application for clinical audit
 To: Jill Clendon <j.m.clendon@massey.ac.nz>
 X-Mailer: Lotus Notes Release 5.0.4 June 8, 2000
 Date: Mon, 6 May 2002 11:34:01 +1200
 X-MIMETrack: Serialize by Router on wmn4/MOH(Release 5.0.10 |March 22, 2002) at 06/05/2002
 11:39:35

Hi Jill
 Checked this thru the chairperson and deputy chair. Their comments are :

"On the basis of the information supplied this definitely looks like audit. The researcher is an employee of NWH and she is looking at case notes only."

Please keep this on your file - in case you're ever queried. This is a legal answer.

Rgds
 Pat

Pat Chainey
 Administrator, Auckland Ethics Committee

DDI: 09 580 9105

<http://www.moh.govt.nz>
mailto:pat_chainey@moh.govt.nz

Jill Clendon
 <j.m.clendon@massey.ac.nz> To: pat_chainey@moh.govt.nz
 cc: Subject: ? ethics application for clinical audit
 03/05/02 10:00

Hi Pat

Further to our phone conversation re: clinical audit. I have a masters student undertaking a clinical audit (retrospective audit of infant's medical notes). The study is called: Key determinants of breastfeeding outcomes of babies born before 30 weeks gestation at National Women's Hospital.

The student is an employee of National Women's Hospital in a senior midwifery position. As an employee, access to patient's clinical records for the purpose of an audit is within the realms of the student's job description. The student has approval in writing from the Clinical Leader of Newborn Services to undertake the study.

The aim is to review all medical notes of infants born before 30 weeks gestation at National Women's Hospital in 2000 and 2001. The clinical audit aims to inform midwifery practice regarding breastfeeding intervention for mothers of premature babies.

Does she need to formally apply for ethics approval?

If you require further information, please do not hesitate to contact me.

Thank you for your assistance.

Yours sincerely
 Jill Clendon BA RCpN MPhil (Hons)
 Lecturer

APPENDIX 10

Letter of Support.



NATIONAL WOMEN'S HOSPITAL

Private Bag 92 88
Auckland
New Zealand
Service:
Phone: Newborn Services
Fax: 03 89 809
3253
03 89 753
Carl.K@aadhb.govt.nz

The Ethics Committee
Massey University Albany Campus

15 May 2002

To Whom It May Concern:

Regarding **Research Proposal – Carol Thomas**

I would like to confirm my support for the research proposal from Carol Thomas evaluating determinants of breastfeeding success in babies born before 30 weeks gestation at National Women's Hospital, Auckland. I understand that this is part of her Master's Degree by thesis.

The questions being evaluated will have a significant impact on assessing criteria for discharge and for assessing the quality of care provided by our service.

Please contact me if you have any questions.

Yours truly

A handwritten signature in black ink, appearing to read 'Carl Kuschel'.

Dr Carl Kuschel, FRACP
Clinical Director, Newborn Services