Factors associated with provision of mothers' own breast milk for Very Low Birth Weight (VLBW) infants on a South African tertiary care neonatal unit

Dr Kunda Mutesu-Kapembwa

MTSKUN002

SUBMITTED TO THE UNIVERSITY OF CAPE TOWN

In fulfilment of the requirements for the degree

MPhil in Neonatology

Faculty of Health Sciences

UNIVERSITY OF CAPE TOWN

Date of Re-Submission: 14th February, 2017

Supervisors: Dr Moegammad Shukri Raban (UCT)

Dr Yaseen Joolay (UCT)

Table of Contents

Declaration

I, Kunda Mutesu-Kapembwa, hereby declare that the work on which this dissertation/thesis is based, is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree at this or any other university.

This work has not been reported or published prior to registration for the degree, Master of Philosophy in Neonatology.

I empower the university to reproduce for the purposes of research either the whole or any portion of the contents in any manner whatsoever.

Signed by candidate

08/02/2017

Dr Kunda Mutesu-Kapembwa Date

This dissertation is submitted with the approval of the following supervisors

08/02/2017

Dr Shukri Raban Date

08/02/2017.

Dr Yaseen Joolay Date

Abstract

Background

The maternal struggle to provide adequate breast milk for the infants' nutritional needs disadvantage preterm infants as the outcomes of those exclusively breast milk fed are superior to those fed infant formula.

Objectives

To determine the proportion of Mothers' Own breast Milk (MOM) consumed by very low birth weight (VLBW) infants at Groote Schuur Hospital and explore potential maternal difficulties to provide MOM.

Methods

In a prospective cross sectional study of 104 VLBW infant-mother dyads admitted between January and May 2015, an interviewer administered a structured questionnaire to the participating mothers before day 3 and on day 14. Infant folders were reviewed for gestational age, weight, and mode of delivery and the proportion of MOM received on days 1, 7 and 14 of life.

Results

Ninety-one (88%) infants received <25% of enteral feeds as MOM on day 1. MOM made up >75% of enteral feeds in 60 infants (62%) on day 14 of life and 56(57.7%) received 100% as MOM. Infants with 2 or less siblings (22.2% vs 33.7% p=0.010) received a greater proportion MOM on day 14 as compared to those with larger families. 85.7% of the interviewed mothers would have preferred to stay in the hospital with their infants post discharge. Infant's weight, mode of delivery, maternal age, HIV status, hypertension, breastfeeding counselling, income, transport mode or distance from the hospital had no impact on MOM provision.

Conclusion

Domestic responsibilities may affect mothers' breast milk provision to the newborn preterm. Breast-feeding counselling did not improve breast milk provision in this study. The effectiveness of current counselling methods may need to be examined and improved. Facilitating accommodation and rooming in of mother infant pairs

from delivery to discharge may be useful in improving MOM provision to VLBW infants.

Acknowledgements

I would like to thank God for seeing me through this opportunity; which has been my life's biggest challenge physically, emotionally and academically.

To my husband, Kenneth Chali Kapembwa, my daughters Mutale and Musawa Kapembwa and my son Kenneth Chali Kapembwa without whose encouragement I would not have completed my studies.

To the mothers who agreed to be part of this study and afforded me a chance to see their struggles as they battled to constantly express breast milk and travel to the hospital to bring the milk for their babies. Thank you for making this study possible.

Many thanks to the nursing staff at Groote Schuur Hospital, who did a good job of talking to mothers about breast milk and physically showing them how to express the breast milk.

To the staff in the neonatal unit, thank you for your readily available help.

The consultants in the department of Neonatology at Groote Schuur Hospital and my supervisors; you all contributed to the neonatologist I have become. You allowed me to express myself and soldier on. Thank you for your support, guidance and encouragement whilst embarking on this project.

A special thanks to my sponsors African Paediatrics Fellowship Program (APFP), my APFP supervisor and friend Dr Lloyd Tooke for his kindness, encouragement and support.

Abbreviations and acronyms

BFHI	Baby Friendly Hospital Initiative
DEBM	Pasteurised Donor Expressed Human Breast Milk
EBF	Exclusive Breastfeeding
EBM	Expressed Breastmilk
GSH	Groote Schuur Hospital
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
ICU	Intensive care Unit
KMC	Kangaroo Mother Care
MOM	Mothers Own Expressed Breast Milk
NEC	Necrotising Enterocolitis
NCPAP	Nasal Continuous Positive Airway Pressure
PROMISE –EBF	Promoting Infant Health and Nutrition in Sub-Sahara Africa: Safety and Efficacy of Exclusive Breastfeeding Promotion in Era of HIV
PMTCT	Prevention of mother to child transmission of HIV
QI	Quality Improvement
UK	United Kingdom

UNICEF	United Children's Emergency Fund
USA	United States of America
VLBW	Very Low Birthweight
VON	Vermont Oxford Network
WHO	World Health Organization

CHAPTER 1

1.1 Context

Breast milk is superior to infant formula for infant nutrition, especially in the first six months of life. [1,2] The importance of breast milk is especially emphasised in preterm infants as it is associated with better maturation of the immunological, nutritional, developmental, psychological, gastrointestinal and long-term cognitive function. A lower incidence of necrotising enterocolitis (NEC) has been described in preterm infants receiving breast milk compared to those receiving formula. [1-4]

A World Health Organisation (WHO) report concluded that non-breastfeeding infants were at increased risk of dying within the first year as compared to breastfed infants, emphasising the need for exclusive breast milk sustained for the first 6 months of life. [5] Large-scale breastfeeding promotion has the potential to prevent an estimated 11.6% of all infant deaths and reduce an estimated 21.9 million disability-adjusted life years. [6]

Despite the advantages of breast milk, the "Countdown to 2015" report (compiled by a global collaboration of multidisciplinary academics partnered with the Lancet to assist countries in reaching health related MDG targets), reported the prevalence of the timely initiation of breastfeeding to be only 48% in the 68 countries studied. [7] In these countries, only 34% of infants younger than 6 months old were exclusively breastfed.

In Africa, despite a 95% breastfeeding initiation rate, extended and exclusive breastfeeding is generally not sustained for 6 months. South Africa, with an 88% breastfeeding initiation rate, only has about 7% of women breastfeeding by age 3 months, way below the 42.5% seen in Asia and Latin America. [8, 9] The breastfeeding initiation rate was even lower in the low-income areas of the Western Cape at 77%. [9] The low rates of breastfeeding were attributed particularly to aggressive promotion and marketing of formula feeds, social and cultural perceptions, and the distribution of formula to prevent mother-to-child transmission (PMTCT) of human immunodeficiency virus (HIV). [10] According to the PROMISE-EBF study group, a multi-centre trial whose purpose was to develop and test an intervention to promote

exclusive breastfeeding in the African context of HIV, early cessation of breast feeding was because of antenatal intention not to breast-feed, indecision, breast health problems and mother's ability to afford infant formula. [8]

Other reported maternal barriers to breastfeeding include lack of education, negative attitude towards breastfeeding, poor socio-economic factors and peer group influence. [11]

Another important and perhaps ignored factor in early and continued breastfeeding is healthcare provider awareness and knowledge. A hospital based study showed that some providers used their own breastfeeding experiences instead of evidence-based knowledge and recommendations when informing or teaching their patients. [11] This resulted in negative influence in those that found breastfeeding difficult. Lack of knowledge leads to inconsistent messages, further frustrating mothers. A further review reported that heavy workloads in most neonatal units compounded by short postnatal stays played a critical negative role in promoting breastfeeding. [11-13]

In order to improve breastfeeding rates worldwide, WHO and UNICEF designed the Baby Friendly Hospital Initiative (BFHI), an initiative that increased breastfeeding rates and decreased mortality in some countries. The BFHI initiative however, had limited impact in some countries like the USA where only 5% of hospitals have achieved the status. This was attributed to the hospitals providing formula to more than 25% of breast-fed infants, a practice that undermines breastfeeding efforts. [14]

In 2011, the South African Department of Health along with various nongovernmental parties with aligned interests released the Tshwane declaration in support for and with a resolve to promote exclusive breastfeeding and the BHFI principles in South Africa. [10]

It is already known that mothers of preterm infants and especially primiparous mothers find it difficult to initiate and sustain breastfeeding or breast milk supply. [1] Mothers of preterm infants may not have fully developed hormonal and physiological mechanisms that promote lactation and breast development. Moreover, the preterm infant's inability to suckle at the breast requires mothers to express breast milk. [11, 12] Establishing feeds is further hampered by feeding intolerance due to immaturity of the

preterm gut as well episodes where NEC is clinically suspected in the patient, repeatedly causing enteral feeds to be withheld periodically.[1] Maternal psychological factors associated with a sick infant make milk production and expressing a daunting task. [13] Success in early milk production has been shown in mothers who begin this process within the first few hours of birth allowing for early removal of colostrum. [1]

With the aim to reduce exposure to formula feeding and promote breast milk, some neonatal units utilise pasteurized donor expressed human breast milk (DEBM) in preterm infants when the mother's own breast milk (MOM) is unavailable, especially in the first few days of life. [3] The use of DEBM as an alternative to formula feeding is however restricted by a small pool of breast milk donors, resulting in a limited availability of this resource. Additionally, the process of freezing and pasteurization of DEBM may alter the human milk, reducing its growth factors and micronutrients. [15]

Groote Schuur Hospital (GSH) is a BFHI accredited public hospital under the auspices of the Western Cape department of Health. The hospital provides tertiary level neonatal intensive care, obstetric and antenatal services to women with pregnancy complications from the West Metropole of Cape Town, South Africa. The 75-bed capacity neonatal unit admits approximately 2000 infants annually, 500 of which are preterm infants with a birth weight less than 1500g.

The standard protocol in the unit at the time was to provide DEBM with parental consent to preterm infants who weighed less than 1200g when the mother's own milk was not available and to supplement feeds with infant formula for those who weighed 1200g and higher. The weight cut-off for DEBM in the unit policy had been implemented due to the limited availability of breast milk donors and resources. A small amount of DEBM was obtained from a pool of in-house donors (i.e. lactating staff, or mothers of patients with excess supply) and was then pasteurised and stored according to strict protocols. The majority of donor milk was however, sourced from a local community based milk bank, at a significant cost to the institution, and was also of variable supply due to the fluctuating number of donors.

As already stated, breast milk fed preterm infants have a lower incidence of NEC. The Vermont Oxford Network (VON) database is a quality improvement tool that

comprises of a global network of developing and developed world neonatal units tracking the various outcomes of very low birth weight (VLBW) patients including morbidity such as NEC. With over 50000 VLBW infants anonymously included in the database annually it serves as a tool against which to benchmark individual units' performance. GSH has participated since 2012 in the VON. The prevalence of NEC at GSH was around 7% for VLBW infants in 2013, a rate at the upper end of the 75th interquartile range when compared to the entire network. [16] The presence of the mother, and the availability and utilisation of MOM for preterm infants could potentially reduce the total cost burden of treating infants with NEC [17] and address both the cost and the limited supply of DEBM. More importantly, it would avail all the benefits of breast milk to both the infants and the mothers themselves.

The purpose of the study reported in chapter two of this thesis was to determine the proportion of Mothers' Own breast Milk (MOM) consumed by VLBW infants, and to also explore potential maternal barriers to the provision of MOM to VLBW infants in our unit with a view to identifying better practices to improve maternal expressed breast milk (EBM) provision.

1.2 Ethical Considerations

Approval to conduct the study was obtained from the University of Cape Town (UCT) Health Sciences Faculty Human Research Committee (FHS HREC) with the approval number HREC/Ref:725/2014.The protocol conformed to the principles of the "Declaration of Helsinki" version 2013.[18]

Permission to conduct the study was obtained from the medical superintendent of Groote Schuur Hospital.

All records were kept confidential and data was entered in a password protected data base and the final data set for analysis had identifying data removed.

Informed consent was obtained from mothers that participated in the study in the language of their choice (Xhosa, Afrikaans or English).

Mothers' feeding choices were respected by applying a standardised questionnaire. Those whose knowledge of breastfeeding was lacking were educated after the

interview and referred to the infant feeding counsellor or a trained attending nurse to learn the technique of expressing breast milk.

Mothers who did not know their HIV status were referred to the PMTCT counsellor for counselling and testing for HIV.

1.3 Author guidelines for The South African Medical Journal

The South African Medical Journal was chosen for possible publication of the manuscript because it publishes leading research impacting clinical care in Africa and is relevant to readers with diverse backgrounds. It is also widely read in South Africa where the current study was done and may help settings like GSH improve the current low breastfeeding rates.

The author guidelines are outlined in appendix 1.

References for Chapter 1

1. Callen J, Pinelli J. A review of literature examining the benefits and challenges, incidence and duration, and barriers to breast feeding in preterm infants. Adv Neonatal Care. 2005;5(2):72-88
2. Lonnerdal B. Nutrition and physiological significance of human milk proteins. American Journal of Clinical Nutrition. 2003; 77(suppl),1537S-43S
3. Cristofalo AE, Schanler JR, Blanco CL, et al. Randomized trial of exclusive human milk versus preterm formula diets in extremely premature infants. J Pediatr. 2013; 163(6):1592-1595
4. Pinelli J, Saigal S and Atkinson SA. Effect of breast milk consumption on neurodevelopment outcomes at 6 and 12 months of age in VLBW infants. Adv Neonatal Care. 2003; 3:76-87
5. Bahl R, Frost C, Kirkwood BR, et al. Infant feeding patterns and risks of death and hospitalisation in the first half of infancy. Multi-centre cohort study. Bulletin of the World Health Organisation. 2005; 83(6)418-426
6. Bhutta ZA, Ahmed T, Black RE, et al. What Works? Interventions for maternal and child Undernutrition and survival. Lancet.2008;371:417-40
7. Bhutta ZA, Chopra M, Axelson H, et al. Countdown to 2015-decade report (2000-10): Taking stock of Maternal, Newborn, and Child survival. Lancet.2010;375:2032–44
8. Nor B, Ahlberg MB, Doherty T et al. For the PROMISE-EBF study Group. Mother's perceptions and experiences of infant feeding within a community based peer counselling intervention in South Africa. Maternal and Child Nutrition.2012,448-458
9. Goosen C, McLachlan MH and Schubl C. Infant feeding practices during the first 6 months of life in a low–income area of the Western Cape Province. S Afr CH.2014; 8(2):50-54
10. Tshwane declaration of support for breastfeeding in South Africa: S Afr J Clin. Nutr 2011;24(4)
11. Strong G. Barriers to breastfeeding during the neonatal period. Journal of Neonatal Nursing.2013;19,134-138

12. Embleton ND. Optimal nutrition for preterm infants: Putting the ESPGHAN guidelines into practice. Journal of Neonatal Nursing.2013;19,130-133

13. Wagner AE, Chantry CJ, Dewey KG et al. Breastfeeding Concerns at 3 and 7 days Postpartum and Feeding Status at2months.Pediatrics.2013;132:e865-e875

14. Perez-Escamilla R, Curry L, Minhas D et al. Scaling Up of Breastfeeding Promotion Programs in Low and Middle-income Countries: the "Breastfeeding Gear" Model. American Society for Nutrition. Adv. Nutr. 2012; 790-800

15. Smith H, Embleton ND. Improving expressed breast milk (EBM) provision in the neonatal unit: A rapid and effective quality improvement (QI) intervention. Journal of Neonatal Nursing. 2013;19,149-153

16. Vermont Oxford Network, Annual report for infants born in 2012, Centre 1052, August 14, 2013

17. Ganapathy V, Hay JW and Kim JH. Costs of necrotising enterocolitis and cost effectiveness of exclusively human milk-based products in feeding extremely premature infants. Breastfeed Med. 2012 ;7(1):29-3

18. World Medical Association Declaration of Helsinki, Ethical Principles of Medical Research involving Human Subjects. JAMA, Published online October 19, 2013

CHAPTER 2

Publication-ready manuscript

2.1 Title Page

Title: Factors associated with the provision of mothers' own breast milk for Very Low Birth Weight (VLBW) infants on a South African tertiary neonatal unit

Authors:

K. Mutesu-Kapembwa* MBChB, MMED (Paed), Cert. Neonatology (SA)

M.S.Raban† MBChB (Stell), FCPaed (SA), Cert. Neonatology (SA), DCH (SA), DipHIVMan (SA), MPhil Neonatology (UCT)

Y. Joolay† MBChB (Stell), FCPaed (SA), Cert. Neonatology (SA), MPhil Neonatology (UCT)

Affiliations: *Department of Paediatrics, Livingstone Central Hospital, Zambia

†Neonatal Medicine, Department of Paediatrics, University of Cape Town

Corresponding Author/Reprint Requests: Yaseen Joolay

Email: Yaseen.joolay@uct.ac.za Telephone: +27825627892

Address: University of Cape Town, Neonatal Medicine, H46-OMB, Groote Schuur Hospital, Observatory, Cape Town, South Africa 7925

Competing interests: None of the authors has any competing interests.

Ethics Approval: Obtained from University of Cape Town (UCT) Health Sciences Faculty Human Research Committee (FHS HREC); HREC/Ref: 725/2014

Key Words/MeSH

Very low birth weight infants, preterm infants, breast milk, barriers to breast milk provision

Word Count for Main Text: 2,836

Number of figures: 1 Number of tables: 7

Author contributions

K. Mutesu-Kapembwa: As the principal investigator, KMK contributed to the conceptualization, and design of the study; coordinated the recruitment of study participants and supervised the data collection; drafted the initial manuscript and approved the final manuscript as submitted.

Y. Joolay: YJ contributed to the conceptualisation and design of the study, assisted with the analyses, reviewed and revised the manuscript, and approved the final manuscript as submitted.

M.S. Raban: MSR suggested the study, contributed to conceptualisation, protocol development, and design of the study, assisted with the analyses, reviewed and revised the manuscript, and approved the final manuscript as submitted.

2.2 Abstract

Background

The maternal struggle to provide adequate breast milk for the infants' nutritional needs disadvantage preterm infants as the outcomes of those exclusively breast milk fed are superior to those fed infant formula.

Objectives

To determine the proportion of Mothers' Own breast Milk (MOM) consumed by very low birth weight (VLBW) infants at Groote Schuur Hospital and explore potential maternal difficulties to provide MOM.

Methods

In a prospective cross sectional study of 104 VLBW infant-mother dyads admitted between January and May 2015, an interviewer administered a structured questionnaire to the participating mothers before day 3 and on day 14. Infant folders were reviewed for gestational age, weight, mode of delivery and the proportion of MOM received on days 1, 7 and 14 of life.

Results

Ninety-one (88%) infants received <25% of enteral feeds as MOM on day 1. MOM made up >75% of enteral feeds in 60 infants (62%) on day 14 of life and 56(57.7%) received 100% as MOM. Infants with 2 or less siblings (22.2% vs 33.7% p=0.010) received a greater proportion MOM on day 14 as compared to those with larger families. 85.7% of the interviewed mothers would have preferred to stay in the hospital with their infants post discharge. Infant's weight, mode of delivery, maternal age, HIV status, hypertension, breastfeeding counselling, income, transport mode or distance from the hospital had no impact on MOM provision.

Conclusion

Domestic responsibilities may affect mothers' breast milk provision to the newborn preterm. Breast-feeding counselling did not improve breast milk provision in this study. The effectiveness of current counselling methods may need to be examined and

improved. Facilitating accommodation and rooming in of mother infant pairs from delivery to discharge may be useful in improving MOM provision to VLBW infants.

2.3 Text

2.3.1 Background

Breast milk is superior to infant formula especially in the first 6 months of life, a period when exclusive breastfeeding has been shown to decrease infant mortality. Particular benefits in breastfed preterm infants include cognitive development, immunological, psychological and nutritional status, as well as in decreasing the incidence of necrotising enterocolitis (NEC). [1] It is for this reason that some neonatal units resort to using human donor breast milk (DEBM) instead of formula if mothers' own milk (MOM) is not available.

Worldwide, the breastfeeding rates are generally low. [2] In Africa, despite a 95% breastfeeding initiation rate, extended and exclusive breastfeeding is generally not sustained for 6 months. South Africa, with an 88% breastfeeding initiation rate, only has about 7% of women breastfeeding by age 3 months [3], way below the 42.5% seen in Asia and Latin America. [3] The breastfeeding initiation rate was even lower in the low income areas of the Western Cape at 77%. [4]

Primiparous mothers and mothers of preterm infants find it difficult to initiate and sustain breastfeeding or breast milk supply as they may not have fully developed hormonal and physiological mechanisms that promote lactation and breast development. Moreover, the preterm infant's inability to suckle at the breast requires mothers to express breast milk. [5] Maternal psychological factors associated with a sick infant make milk production and expressing a daunting task. [6] Success in early milk production has been shown in mothers who begin this process within the first few hours of birth allowing for early removal of colostrum. [1]

Other reported maternal barriers to breastfeeding include lack of education, negative attitude towards breastfeeding, poor socio-economic factors, peer group influence [5] as well as ineffective breastfeeding counselling by health care providers. [6]

In order to improve breastfeeding rates worldwide, WHO and UNICEF designed the Baby Friendly Hospital Initiative (BFHI), an initiative that has had mixed success, with increased breastfeeding rates and decreased mortality in some countries. Mixed feeding of newborn infants in hospital, a practice that undermines breastfeeding efforts, has resulted in only a minority of hospitals in developed countries achieving BFHI accreditation. [7]

In 2011, the South African Department of Health along with various nongovernmental parties with aligned interests released the Tshwane Declaration in support for and with a resolve to promote exclusive breastfeeding and the BHFI principles in South Africa. [8]

The objectives of this study were;

i) To determine the proportion of mothers' own breast Milk (MOM) consumed by very low birth weight (VLBW) infants in our neonatal unit.

ii) To explore potential maternal barriers to the provision of MOM to VLBW infants in our unit.

2.3.2 Method

Setting

This descriptive cross sectional study was conducted between January and May 2015 of 99 mother infant dyads admitted to the Groote Schuur Hospital (GSH) neonatal unit.

GSH is a BFHI-accredited public tertiary hospital, which provides obstetric services and neonatal intensive care for West Metropole of Cape Town, South Africa. The 75bed capacity neonatal unit admits in excess of 500 preterm infants with a birth weight below 1500g annually.

Inclusion criteria

• All mother and preterm infant pairs ≤ 1500 g admitted to the neonatal unit were eligible for study participation.

Exclusion criteria

- Mothers who had placed their infant up for adoption.
- Mothers who were managed at other health care facilities.
- Mothers who declined consent

Sample size, data collection and analysis

The primary outcome of the study was to determine the proportion of mothers providing above 75% of the prescribed breast milk volume to their infants on day 14.

The secondary outcome was to describe maternal barriers to provision of mothers' own breast milk to VLBW infants.

The sample size calculation was powered for the primary outcome and was based on an infinite population size as the study was exploratory. The sample size of 100 mother infant pairs assumed a 50% proportion with a margin of error of 10% on either side of the 50%. Convenience sampling was used.

Eligible mother-infant pairs were approached for enrolment. Informed consent was obtained from the mothers in their language of preference; namely English, Xhosa or Afrikaans. This was followed by a 20-minute interview conducted by the principal investigator, a registered nurse or a paediatrician within the first 3 days of admission, and second interview on day 14. The interviewer administered a questionnaire in a private room or by telephonic interview if the mother was not available on the day of the second interview.

The first questionnaire collected data from hospital records and personal interview on the mothers' demographic details and antenatal history including co-existing conditions, including but not limited to, HIV, hypertension and diabetes, as well as baseline maternal knowledge on breastmilk and breastfeeding. The second questionnaire gathered data on potential factors affecting MOM provision during the hospital admission, including but not limited to health worker factors such as breast feeding counselling, continued breastfeeding support to the mothers, and mothers transport to the hospital from home.

The questionnaire was developed by the investigator with questions based on background literature search. The questionnaire utilised a combination of multiple choice and open-ended questions, making provision for answers not presented by the questions, and this was piloted prior to commencement of data collection.

Infants records were reviewed for gestational age, weight, mode of delivery, state of health (whether ventilated or on room air), feeding status (bolus or continuous) and the proportion of mother's own expressed breast milk (MOM) given on days 1, 7 and 14.

The VLBW infants received 2 hourly bolus feeds via an intra-gastric tube. Infants presenting with feeding intolerance (recurrent vomits/abdominal distension due to immature gut) received continuous intra-gastric feeds until they could tolerate 2 hourly bolus feeds. Enteral feeds were commenced within the first 24 hours after birth at between 12-24 ml/kg/day and incremented daily by 24ml/kg/day until a full enteral volume of 200 ml/kg/day were achieved. Supplemental intravenous fluids were provided until an enteral volume of 150 ml/kg/day was achieved and tolerated.

Mothers presenting to the unit for the first time were expected to be shown how to express breast milk and feed their infants by the attending nurses who had undergone breast feeding training.

At the time of the study, the standard protocol in the unit was to, after obtaining parental consent; offer DEBM to preterm infants who weigh less than 1200g when MOM was insufficient for enteral requirements. The weight cut-off for DEBM in the unit policy was being implemented due to the restricted supply of DEBM. Infants with weight above 1200g were supplemented with formula until adequate MOM.

Data were described using standard statistical methods using Stata version 12 (Stata Corporation; college station, USA). Continuous variables that were normally distributed were analysed using the mean and standard deviation (SD) as measures of central tendency. The student t-test (if the data are normally distributed) or the Wilcoxon Mann-Whitney test (if the data are skewed), were used to compare continuous variables. Categorical data were described using frequencies, percentages and proportions; and the Chi square or Fischer's exact tests were used to compare categorical variables. $p<0.05$ was assigned to determine statistical significance.

2.3.3 Results

Of the 101 mothers approached, we recruited 99 mothers and 104 infants owing to 5 sets of twins (figure 1). Only 92 mothers (and 97 infants) were available for interview and analysis on Day 14. Three babies had died and four had been transferred out to step- down facilities. The characteristics of mothers and infants at initiation are shown in tables 1 and 2 respectively.

The commonest reason for maternal admission was hypertension related illnesses, 49 (49.5%). Twenty-one (21.2%) of the total number of mothers enrolled were HIV positive and all had been initiated on highly reactive antiretroviral therapy (HAART). Only one (1%) mother out of the 99 enrolled did not know her HIV status. (Table 1)

The mean birth weight of infants was 1123g (Range 630-1490g, SD=231g) and the majority of infants, 74 (71%), were delivered by caesarean section. (Table 2)

All except one mother in the study knew at least one benefit of breast feeding and breast milk. However, 19 (19.2%) did not know when to start feeding postnatally. (Table 3)
Although only 56 (60.9%) of the mothers had received breastfeeding counselling in the first 14 days of admission, 75 (82.4%) had actually been physically shown how to express breast milk. (Table 4)

At least 45 (49.5%) of the mothers visited their infants everyday post discharge and most of them 79(86.8%) used public transport to get to the hospital. 78(85.7%) of the mothers interviewed would have opted to stay in the hospital with their baby given a choice. Of the 31 mothers who were in formal employment, 77.4% were on maternity leave. (Table 4)

Ninety-one (88%) infants received <25% of their enteral nutrition as MOM on day 1. On day 14 of life, 60 (62%) infants received >75% as MOM with 56 (57%) infants receiving exclusive MOM. (Table 5)

Birth weight >1200g (71.4% Vs 54.6%, p=0.09), gestational age greater or less than 30 weeks (p=0.237) and need for respiratory support (p=0.695) at any time during admission did not affect MOM provision by day 14. (Table 6)

Mothers younger than 30 years of age had no advantage of MOM provision compared to those above 30. (48.2% vs 32.3% p=0.079). (Table 7)

Maternal illness- hypertension (54.6% vs 31.3% p=0.161) and HIV (70.0% vs 40.3% p=0.402) and also birth by caesarean section (59.1%vs 30.8% p=0.367) had no impact on provision of MOM to the study infants.

Infants born to mothers' who had more than 3 living children were less likely to receive a high proportion of MOM on day14 (22.2% vs. 33.7%, p=0.010 , OR 0.145 CI 0.014 to 0.847). Being on maternity leave for the employed mothers did not improve MOM provision (62.5% vs. 69.6% p=0.206)

The proportion of mothers who reported antenatal breastfeeding counselling was 62%, however MOM provision at 2 weeks of age was not different to those who had not received any form of feeding counselling (61.8% vs 38.0%, p=0.973).

Using Wilcoxon rank-sum test, no difference was detected between mothers who were able to provide more that 75% EBM and those who did not, in terms of their living address distance from the hospital (p = 0.89) or monthly income (p=0.73)(results not tabulated). Owning a car did not also amount to adequate MOM provision.

2.3.4 Discussion

In this descriptive study of factors affecting provision of mothers' own milk to VLBW infants, our findings concur with other studies that VLBW infants are more likely to have delayed initiation of breastfeeding/breast milk provision from their mother. [1] Infants in our study consumed low volumes of MOM on day 1 of life, instead receiving alternative milk feeds in the absence of the availability of MOM. The majority of infants received a high proportion of MOM on day 14 of life; most of those (57% of study patients) were exclusively fed MOM. This however, fell well below the 77% breastfeeding initiation rate reported by Goosen et al in a low income community based survey in the Western Cape. [4] This 77% however, was not specific to preterm infants.

A birth weight of 1200g was used as one of the variables in this study because this weight category did not qualify for DEBM according to unit policy at the time as

noted above. We postulated that mothers of these infants felt more urgency to express breast milk which would result in more MOM if the benefits of breastmilk compared to formula were highlighted during breastfeeding counselling. There was also the possibility that mothers of the bigger infants received greater counselling from the nurses and doctors seeing they had no alternative breast milk. Contrary to the postulations, birthweight was not significant for MOM provision.

Sixty (58%) of the infants in this study cohort were below 1200g (Table 2) and were therefore eligible for DEBM. It is however important to note that while DEBM has several advantages over infant formula for preterm nutrition, preterm mothers' breast milk during the first two weeks of life is especially protein rich and may be superior to DEBM. In addition, fluctuating availability of DEBM and processes involved with breast milk pasteurisation and banking make it a less than perfect alternative to MOM. [9]

Although previous studies showed that age younger than 35 years resulted in earlier initiation of breastfeeding [10], our study showed no significant difference in MOM provision in those above or below 30 years of age.

We also found that mothers who had had more than 3 children did not produce adequate supplies of MOM. The reasons for this finding is unclear, however we postulate that younger mothers with smaller families were likely less engaged in caring for other children and so had more time to focus on their infants. The current facility space constraints for lodging mothers necessitate the discharge of preterm mothers with the plan that they will be able to express breast milk at home and bring it back to the hospital for the infant. Family responsibilities may result in less milk provision by these mothers.

Emotional and psychological stress caused by maternal illness may be an additional factor in the delayed initiation of breast milk provision especially in those with VLBW infants. Furthermore, they may have difficulty maintaining their milk supply due to protracted hospitalization or separation from their infant. [5] Mothers with Hypertension were not singled out as there was a general delay in MOM provision in the whole study cohort.

It is well known that caesarean section delays early initiation of breastfeeding even when there's no neonatal condition that interferes with early initiation of breastfeeding. [11] We however did not find a difference in milk production between mothers that delivered vaginally and those that delivered by caesarean section. In our unit, all mothers' are visited shortly after delivery by the admitting neonatal medical staff to counsel them on infant progress as well as actively encourage breast milk expression by supplying mother with educational materials and a sterile receptacle for expressed breast milk.

Despite evidence that maternal HIV status significantly affect breastfeeding, HIV status was not a significant factor in our study cohort. [12]

While breastfeeding counselling is a technique that has been shown to improve breast milk production, [9] our study showed that MOM provision from mothers who reported that they had received breastfeeding counselling at any time during pregnancy or after birth were similar to those that reported no recollection of counselling. This raises concerns about the technique and content of the counselling with regards to preterm infants and their feeding limitations. [1]

The use of public transport, owning a car and income below the median of R2000 were used as proxies to assess the effects of social economic status on MOM provision, none of which appeared to significantly affect the provision of MOM.

The travelling distance between the mothers' residential addresses and the hospital was not a statistically significant barrier to maternal breast milk provision in this study, even when mothers' whose address was over 100km from the hospital was compared to those living nearer. This could possibly be explained by the fact that many of the mothers who resided large distances away were accommodated in our limited lodging space if they were willing and a lodging bed was available. We did not record which mothers were lodging in-hospital and we could not determine if this was a factor.

The strength of our study lies in having been the first study at our hospital giving us a fair idea of what the barriers to provision of MOM in our population of patients are. It also highlights the known facts about the challenge of feeding VLBW infants and will

help us emphasise on improving counselling techniques as a way to increase supply of MOM. Rooming in [6] would help mothers with big families who would be too distracted to express and bring milk provided they have enough social support structure to allow them to remain in the hospital. It was encouraging to note that 85.7% of the mothers interviewed would have opted to stay in the hospital to nurse their babies. Being on maternity leave for employed mothers did not result in improved MOM provision in this study.

A more targeted program towards encouraging provision of MOM may be beneficial as demonstrated by published quality improvement programmes. [9, 13]

We did not find an association between level of mothers' education, gestational age, and state of the infants' health on breast milk production. We did not investigate feeding interruption and the effect this may have had of MOM and this may be a limitation in our findings. Our analysis did not also investigate association of twins and MOM provision as the study was not adequately powered for this outcome. The above factors require further studies, preferably longitudinal studies with larger sample sizes for significant findings. We did not follow up patients until discharge (post the study period) and this may be a limitation of this study. Other limitations were that this was a hospital based cross sectional study, with a limited demographic and sample size; the results may not be generalizable to most women in South Africa.

2.3.5 Conclusion

Domestic responsibilities may affect breast milk production and strengthening of the system incorporating rooming in of mother infant pairs from delivery to discharge is critical in improving MOM provision to VLBW infants. Breast-feeding counselling did not improve breast milk provision in this study. The effectiveness of current counselling methods may need to be examined and improved.

2.4 Funding

This research was funded by the University of Cape Town School of Child and Adolescent Health (SCAH).

2.5 Acknowledgements

We acknowledge the staff in the neonatal ward of Groote Schuur Hospital for their tireless efforts in taking care of preterm infants and their breast milk needs.

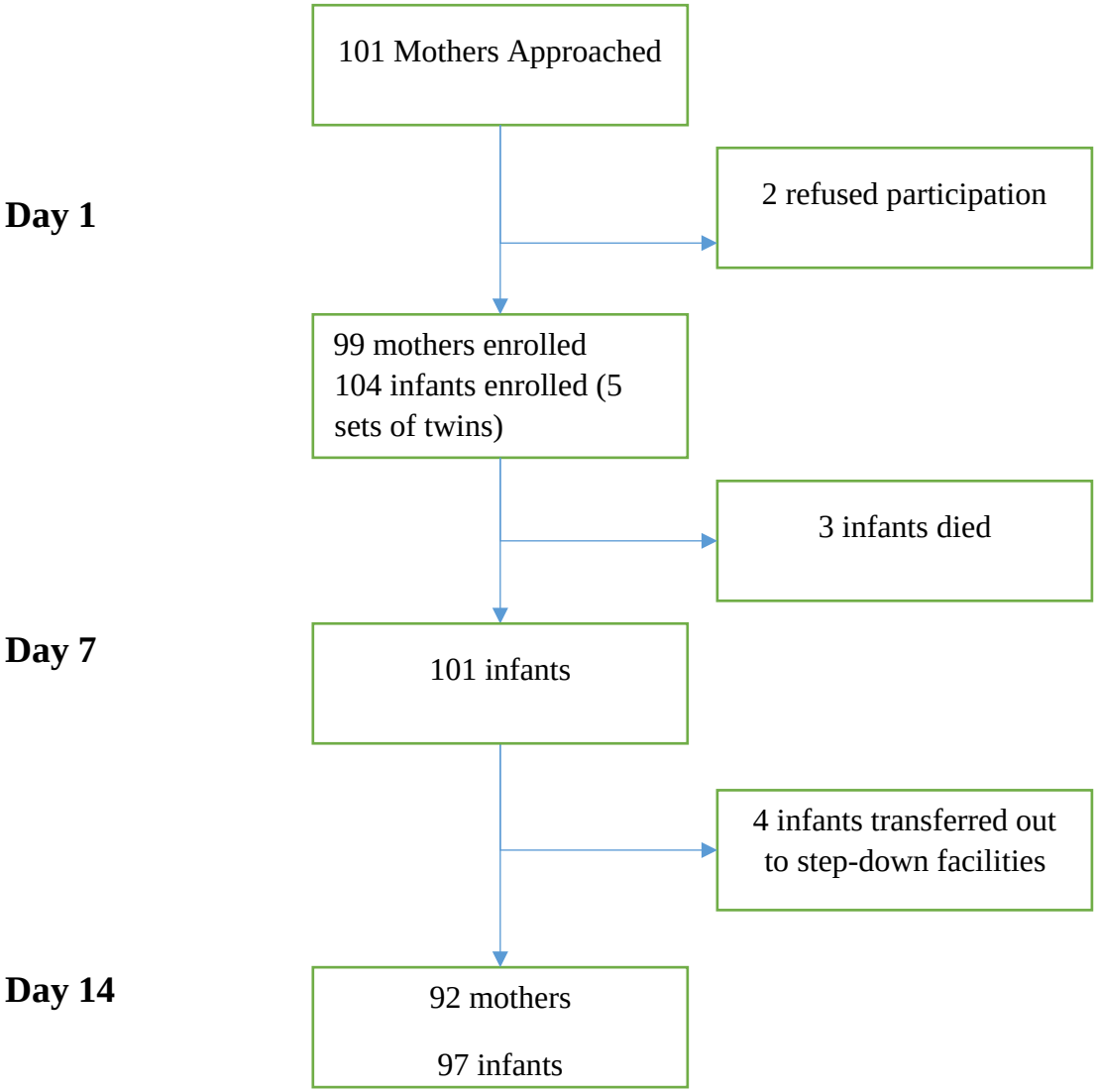
2.6. References for chapter 2

1. Callen J and Pinelli J. A review of literature examining the benefits and challenges, incidence and duration, and barriers to breast feeding in preterm infants. Adv Neonatal Care. 2005 Apr;5(2):72-88
2. Bland R, Rollins N, Coutsoudis A and Coovadia H for the Child Health Group. Breastfeeding Practices in an area of high HIV prevalence in rural South Africa. Acta Paediatrics.2002; 91,704-711
3. Nor B, Ahlberg MB, Doherty T, Zembe Y et al. For the PROMISE-EBF study Group. Mother's perceptions and experiences of infant feeding within a community-based peer counselling intervention in South Africa. Maternal and Child Nutrition.2012,448-458 [DOI ; I0.1111/j.1740-8709.2011.00332.x]
4. Goosen C, McLachlan MH and Schubl C. Infant feeding practices during the first 6 months of life in a low–income area of the Western Cape Province. S Afr CH.2014; 8(2):50-54[DOI:10.7196/SAJCH.675]
5. Embleton ND. Optimal nutrition for preterm infants: Putting the ESPGHAN guidelines into practice. Journal of Neonatal Nursing.2013;19,130-133[http://dx.doi.org/10.1016/j.jnn.2013.02.002]
6. Strong G. Barriers to breastfeeding during the neonatal period. Journal of Neonatal Nursing.2013;19,134-138[http://dx.doi.org/10.1016/j.jnn.2013.04.005]
7. Perez-Escamilla R, Curry L, Minhas D et al. Scaling Up of Breastfeeding Promotion Programs in Low and Middle-income Countries: the "Breastfeeding Gear" Model. American Society for Nutrition. Adv. Nutr. 2012; (3), 790-8008.[doi:10.3945/an.112.002873]
8. Tshwane declaration of support for breastfeeding in South Africa: S Afr J Clin Nutr 2011;24(4)
9. Smith H, Embleton ND. Improving expressed breast milk (EBM) provision in the neonatal unit: A rapid and effective quality improvement (QI) intervention. Journal of Neonatal Nursing. 2013; 19,149-153[http://dx.doi.org/10.1016/j.jnn.2013.02.001]

10. Patel A, Bucher S, Pusdekar Y et al: Rates and determinants of early initiation of breastfeeding and exclusive breastfeeding at 42 weeks postnatal in six low and middle income countries: A prospective cohort study. *Reproductive Health 2015*,**12**(suppl 2):S10 [doi:10.1186/1742-4755-12-S2-**S10]**
11. Cakmak H, Kuguoglu: Comparison of the breastfeeding patterns of mothers who delivered their babies per vagina and via caesarean section: an observational study using the LATCH breastfeeding charity system. Int J Nurs. Stud 2007,44(7): 11281137
12. Sepeng L, D E Ballot: Audit of feeding practices in the neonatal wards at the Charlotte Maxeke Johannesburg Academic Hospital. South African Journal of Child Health 2015;9(4):133-136 (DOI:10.7196/SAJCH.2015 vs 914.895)
13. Husebye ES, Kleven IA, Kroken KL et al: Targeted Program for Provision of Mother's Own Milk to Very Low Birth Weight Infants. Pediatrics 2014(2):134

2.7 Figures

Fig 1: Flow diagram of the study participants



2.8 Tables

Table 1: baseline characteristics of mothers n = 99 [a]

Age group(years)	<20	10 (10.1)
	21-29	61 (60.6)
	31-39	27 (27.3)
	≥40	1(1.0)
Mother's education	Basic (grade 1 to 7)	4 (4.0)
	Secondary(grade 8 to 12)	79 (79.8)
	Post-matric	16 (16.1)
Mother's employment	Formal Employment	34(34.3)
	Full time house wife	52(52.5)
	Self employed	4 (4.0)
	Other (unemployed/retired)	9 (9.1)
Maternal illnesses	Diabetes	3 (3.0)
	Hypertension	49 (49.5)
HIV	Infected	21(21.2)
	Unknown	1 (1.0)
	HAART	21(100)
Social habits	Alcohol	9(9.1)
	Smoking	19(19.2)
Monthly income in ZAR median(IQR)b		2000(800-3700)
Breast feeding counselling on admission		56(60.9)
Antenatal Infant feeding counselling		60(60.1)
No. of pregnancies mean(SD)c		2.5(1.3)
No. of children mean(SD)c		2.1(1.1)
No. of dependents mean(SD)c		1.3(1.4)

a: percentage unless otherwise specified b: IQR – Interquartile range c: SD- standard deviation

Table 2: Baseline Characteristics of infants n=104 [a]

Gestational Age in weeks	>29	38(36.0)
	</= 29	67(63.0)
	<1000	34 (33.0)
Birth weight in categories (grams)	1001- 1200	26 (25.0)
	1201-1500	43(42.0)
	Vaginal delivery	23(22.0)
	Breech extraction	5(5.0)
Mode of delivery	Caesarean section	74(71.0)
	Laparotomy for abdominal pregnancy	1(1.0)
	Forceps	1(1.0)
Gestation age of baby mean(SD)[b]		29.4 (2.16)
Birth weight mean(SD)[b]		1122.7 (230.8)

a:Percentage unless otherwise specified b: SD= standard deviation

Table 3: Breastfeeding Knowledge of the mothers n=99[a]

Source of knowledge on breastfeeding	Radio	0
	Antenatal	54(58.6)
	Nursing staff	24(24.2)
	Doctors	0
	Other	17(17.2)
Reported benefits of breastfeeding/breast milk	Makes baby grow	58(58.9)
	General health and Immunological benefits	68(69.0)
	Promotes mother-child bonding	8(8.1)
	Cheaper	10(10.1)
	Other (prevents colic, readily available, don't know, cleans baby's tummy)	4(4.0)
Timing of Post-delivery feeding(EBM/breast)	Immediately	77(77.8)
	First day	1(1.0)
	Don't know	19(19.2)
	Other	2(2.0)
Importance of colostrum	Cleanses the tummy	3(11.5)
	Healthy for the baby	16(61.5)
	Nutritious	7(26.9)
	Prevents infections	2(7.7)
	Don't know	1(3.8)

Table 4: Results of maternal interview of Day 14 post-delivery n=92[a]

Frequency of milk expression per day	Hourly	6 (6.6)
	2 hourly	56 (61.5)
	3 hourly	16 (17.6)
	Other	13(14.3)
Frequency of hospital visits since discharge	Every day	45(49.5)
	Every other day	39(42.9)
	Once a week	5(5.5)
	Other	2(2.2)
Reasons for inadequate breast milk	Inadequate milk	27(27.3)
	Decided to formula feed	2(6.2)
	No transport money	3(9.4)
Breast feeding counselling since admission		56/92 (60.9)
Physical demonstration of breast milk expression		75(82.4)
Mothers discharged from postnatal ward		90(98.9)
Average admission days post-delivery ; mean (SD)[b]		4(3.4)[b]
Mothers whose families own a car		7 (7.7)
Use of public transportation to hospital		79(86.8)
Public transport cost(ZAR) to hospital ;mean(SD) [b]		36 (17.9)[b]
Milk is adequate for the baby until the next visit		59(64.8)
Mothers if given a choice would stay in hospital with the baby		78(85.7)
Mothers who would use free transport to hospital if available		82(90.1)
Mothers would use milk delivery facility to hospital if available		50(55.0)
Maternity Leave (N = 31)		24(77.4)

a:Percentage unless otherwise specified b: SD= standard deviation

Table 5: MOM provision on days 1, 7 and 14 of infant life n[a]

		D1 n=104	D7 n=101	D14 n=97
Feeds as MOM on specific day (%)	<25%	91(88)	27(26)	33(34.0)
	25% to 50%	3(3)	6(6)	3(3.1)
	50% to75%	2(2)	7(7)	1(1.0)
	>75%	8(8)	62(61)	60(61.9)
	100% MOM	0		56(57.7)

a: Percentage unless otherwise specified

Table 6: Infant Factors associated with >75% MOM provision on Day 14

		n/N (%)	P value
Birth weight	**> 1200g**	30/42 (71.4%)	0.090
	≤ 1200g	30/55 (54.6%)	
Gestation age	**> 30 weeks**	31/83 (37.4)	0.237
	≤ 30 weeks	35/61 (57.4%)	
Need for Respiratory support		8/14 (57.1)	0.695
Breathing Room Air		31/83 (37.4)	

Table 7: Maternal factors associated with>75% MOM provision on Day 14

		n/N (%)	OR	P Value	95% Confidence Interval
Maternal age	≥ 30 years	13/27 (48.2%)	0.079	0.443	0.160 - 1.227
	< 30 years	21/65 (32.3%)			
Maternal hypertension		24/44 (54.6%)	0.161	0.545	0.213 - 1.389
Normotensive		15/48 (31.3%)			
Recalls breastfeeding counselling		34/57 (61.8%)	0.973	0.986	0.380 - 2.526
Denied receiving counselling		14/35 (38.0%)			
Delivery	Caesarean	39/66 (59.1%)	0.367	0.367	0.211 - 1.838
	Non- Caesarean	8/26 (30.8%)			
HIV	Positive	14/20 (70.0%)	0.402	1.574	0.493 - 5.572
	Negative	29/72 (40.3%)			
Number of children	> 3	2/9 (22.2%)	0.010	0.145	0.014 - 0.847
	≤ 3	28/83 (33.7%)			
Income	> 2000 ZAR	26/41 (63.4%)	0.796	1.118	0.441 - 2.857
	≤ 2000 ZAR	20/51 (39.2)			
Access to car		4/7 (57.1%)	1.000	0.805	0.127 - 5.864
No access to car		32/85 (37.7%)			
Employed – on maternity leave		16/23 (69.6%)	0.206	3.81	0.535 - 30.353
– returned to work		5/8 (62.5%)			

Appendices

Appendix 1: Author guidelines for The South African Medical Journal

Manuscripts

Shorter items are more likely to be accepted for publication, owing to space constraints and reader preferences.

Research articles (previously 'Original articles') not exceeding 3 000 words, with up to 6 tables or illustrations, are usually observations or research of relevance to clinical medicine and related fields. References should be limited to no more than 15. Please provide a structured abstract not exceeding 250 words, with the following recommended headings: Background, Objectives, Methods, Results, and Conclusion.

Manuscript preparation

Refer to articles in recent issues for the presentation of headings and subheadings. If in doubt, refer to 'uniform requirements' **- www.icmje.org**. Manuscripts must be provided in **UK English.**

Qualification, affiliation and contact details of ALL authors must be provided in the manuscript and in the online submission process.

Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'Intravenous (IV)' or 'Department of Health (DoH)'.

Scientific measurements must be expressed in SI units except: blood pressure (mmHg) and haemoglobin (g/dl). Litres is denoted with a lowercase 'l' e.g. 'ml' for millilitres).
Units should be preceded by a space (except for %), e.g. '40 kg' and '20 cm' but '50%'.

Greater/ smaller than signs (> and 40 years of age'. The same applies to ± and º, i.e.

'35±6' and '19ºC'.

Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160...

Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.

General formatting; The manuscript must be in Microsoft Word or RTF document format. Text must be single-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes, with the exception of Tables).

Illustrations and tables

If tables or illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.

Tables may be embedded in the manuscript file or provided as '**supplementary files**'. They must be numbered in Arabic numerals (1, 2,3...) and referred to consecutively in the text (e.g. 'Table 1'). Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged. Tables must be cell-based (i.e. not constructed with text boxes or tabs), and accompanied by a concise title and column headings. Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Fig. 1)'. Figure legends: Fig. 1. 'Title...' All illustrations/figures/graphs must be **of high resolution/quality**: 300 dpi or more is preferable, but images must not be resized to increase resolution. Unformatted and uncompressed images must be attached individually as 'supplementary files' upon submission (not solely embedded in the accompanying manuscript). TIFF and PNG formats are preferable; JPEG and PDF formats are accepted, but authors must be wary of image compression. Illustrations and graphs prepared in Microsoft Power Point or Excel must be accompanied by the original workbook.

References

References must be kept to a maximum of 15. Authors must verify references from original sources. Only complete, correctly formatted reference lists will be accepted.

Reference lists must be generated manually and not with the use of reference manager software. Citations should be inserted in the text as superscript numbers between square brackets, e.g. These regulations are endorsed by the World Health Organization,[2] and others.[3,4-6] All references should be listed at the end of the

article in numerical order of appearance in the **Vancouver style** (not alphabetical order). Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus. Names and initials of all authors should be given; if there are more than six authors, the first three names should be given followed by et al. First and last page, volume and issue numbers should be given.

Wherever possible, references must be accompanied by a digital object identifier (DOI) link and Pub Med ID (PMID)/Pub Med Central ID (PMCID). Authors are encouraged to use the DOI lookup service offered by **CrossRef.**

Journal references: Price NC, Jacobs NN, Roberts DA, et al. Importance of asking about glaucoma. Stat Med 1998;289(1):350-355. [http://dx.doi.org/10.1000/hgjr.182] [PMID: 2764753]

Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth,

1975:96-101. Chapter/section in a book: Weinstein L, Swartz MN. Pathogenic

Properties of Invading Microorganisms. In: Sodeman WA Jun, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457472.

Internet references: World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: World Health Organization, 2002. http://www.who.int/whr/2002 (accessed 16 January 2010).

Other references (e.g. reports) should follow the same format: Author(s). Title. Publisher place: publisher name, year; pages. Cited manuscripts that have been accepted but not yet published can be included as references followed by '(in press)'. Unpublished observations and personal communications in the text must not appear in the reference list. The full name of the source person must be provided for personal communications e.g. '...(Prof. Michael Jones, personal communication)'.

Appendix 2

Questionnaire 1 (first interview)

A. Demographic factors

1. How old are you?
    a. <20
    b. 20-30
    c. 30-40
    d. d. >40
2. How many times have you been pregnant?
3. How many children do you have……
4. Where do you live?
5. What type of work do you do?
    a. Formal Employment
    b. Full time house wife
    c. Self employed
    d. Other (please specify).....
6. What type of work does your husband/partner do?
    a. Formal employment
    b. Unemployed
    c. Self employed
    d. Other (please specify).....
7. What are your other sources of income?
8. Approximately how much money do you make per month?
9. Social habits;
    a. Do you take alcohol- Yes /No

b. Do you smoke- Yes/No

c. Do you use other drugs apart from those prescribed at the hospital- Yes/No

B. Antenatal

10. How many antenatal visits have you had?

.....

11. What is your HIV status?

a. Positive

b. Negative

c. I don't know

12. If 12 = yes, are you on treatment for the HIV?

a. Yes

b. No

13. Did you receive any infant feeding counselling antenatally?

a. Yes

b. No

14. Did you have other illnesses in this pregnancy?

a. Diabetes

Yes

No

b. Hypertension-

Yes

No

c. Other (please specify)……..

15. What medications did you use for these illnesses? (Please specify)…….

C. Knowledge about breast feeding

16. How have you obtained your knowledge on breast feeding;

    a. Radio

    b. Antenatal clinic

    c. Nursing staff

    d. Doctors

    e. Other (please specify).....

17. Are you aware of any benefits of breastfeeding/ breast milk? What are they?

……

……

……..

…….

18. If you have chosen to breastfeed, how soon after delivery should mothers begin expressing their milk/ breast feeding?

…….

19. (i) Do you know what colostrum is?

    a. Yes

    b. No

ii. Do you know its importance?

    a. Yes

    b. No

iii. If yes, state the importance…….

Appendix 3

Questionnaire 2 (day 14)

1. Has anyone ever explained the importance of breast milk to you since your baby's admission to hospital
   a. Yes
   b. No

2. How many times do you express milk per day?
   a. Hourly
   b. 2 hourly
   c. 3 hourly
   d. Other ;please specify

3. How many times are you reminded by nurses and doctors to express milk for your baby?
   a. Everyday
   b. Once a week
   c. Not at all

4. Have you been physically shown how to express milk from your breast?
   a. Yes
   b. No

5. Do you express enough milk for the baby to drink per day?
   a. Yes
   b. No

6. Has your breast milk supply improved in the time your baby has been here?
   a. Yes
   b. No

7. (i) Have you been discharged from hospital

   a. Yes

   b. No

   (ii) If yes, how long after delivery were you discharged from hospital?

   ……

8. Do you own a car?

   a. Yes

   b. No

9. Do you use your own car to get to the hospital?

   a. Yes

   b. No

10. Do you use public transport to get to the hospital?

   a. Yes

   b. No

11. How much does it cost you to come to the hospital by public transport?

   .....

12. If you have been discharged, how often do you come to the hospital to bring milk for the baby?

   a. Every day
   b. Every other day
   c. Once a week
   d. Other……

13. Is the amount of milk you bring adequate for the baby until the next visit?

   a. Yes

   b. No

14. What are the reasons for not bringing adequate breast milk for your baby?

……

15. If you were given a choice, would you stay in the hospital to look after your baby?

    a. Yes

    b. No

16. If a service was available to pick you up from your home to come to the hospital, would you use such a service?

    a. Yes

    b. No

17. If a service was available to pick your breast milk up from your home or nearest drop off point, would you use such a service?

    a. Yes

    b. No

18. Have you been given maternity leave from work?

    a. Yes

    b. No

    c. Not applicable

19. Are you able to express milk at your work place?

    a. Yes

    b. No

    c. Not applicable

Appendix 4: Parental Information:

Title: Factors associated with the provision of mothers' own breast milk for Very Low Birth Weight (VLBW) infants on a South African tertiary neonatal unit

Invitation

You are being invited to enrol you and your baby in a research study. Before you decide whether or not to participate, it is important for you to understand why the research is being done and what it will mean for you both. Please take time to read the following information carefully.

Why is this study being done?

Studies have shown that South Africa has very low breastfeeding rates as very few mothers start and continue breast feeding. This is very worrying because breast milk feeding is very important for babies.

We are doing a study to determine ways to assist mothers own breast milk supply for their baby at Groote Schuur Hospital. In order to do this, we have to understand reasons for the low breast feeding rates so that we can work together to increase babies getting their mothers own milk.

This will help us identify the areas where improvement is needed in both the health staff and the mothers themselves. By participating in this study you will help us with this work.

We think you could also benefit by learning how to express breast milk for your baby so that he/she will grow better. We know that if mothers can keep breastfeeding, they can save the money spent on formula.

Why have I been asked to take part?

We are interested in the smallest babies. You have been approached because your baby weighs less than or equal to 1500 g.

Do I have to take part?

It is up to you to decide whether or not to take part in this study. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. Your baby will receive the best care as all the babies.

What will happen to my baby if I do not take part in the study or I withdraw my baby from the study?

This will make no difference to the care we provide to all babies. Breast milk will still be encouraged.

Breast milk and HIV infection

If you are HIV positive, your expressed and pasteurized breast milk still offers the best immunity and nutrition to your baby.

What is required of you?

We will information about how your baby is growing and the breast milk he/she gets, so we will get information about growth from his chart.

We will interview you on the 1st day and on the 14th day after delivery.

The interviews will help us see whether we are offering the required support to you in terms of expressing and feeding your baby.

Will your information be kept confidential?

We will not write or speak your name or your baby in any place where anyone can link you to what information we find out. We will keep the information of your baby private, throughout the research period and after it is finished. Nobody other than the research clinicians who enrol your baby into the research project will know that you are a participant. When we report this research, we will ensure that neither you nor your baby can be identified.

The researchers will consider baby's records private to the extent permitted by the law.

These records may also be reviewed by the University of Cape Town Human Research Ethics Committee which protects the rights of people participating in research. They will ensure the information is kept confidential, as required by law.

Appendix 5: Consent form

I have been invited to participate in the study entitled “Factors influencing the provision of mothers' own breast milk for preterm infants in a South African tertiary neonatal unit”.

I have read and discussed this form with the researchers and understand what the research project is about. My questions have been answered.

I freely agree: (tick appropriate block/s)

☐ To take part in the above study

☐ I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

☐ I understand that my participation is voluntary and I am free to withdraw at any time, without giving a reason

Name of parent	Signature	Date
Name of researcher	Signature	Date
Name of witness	Signature	Date

Appendix 6: Infant Case record form

Title: Factors associated with the provision of mothers' own breast milk for preterm infants on a South African tertiary neonatal unit".

Infant study Number……

Gestational age ……Birth weight…….

Date of birth……Mode of delivery…….

Infants' current location in the ward.....

Infants' state of health;

a. Ventilated
b. On CPAP
c. On HFNC
d. NPO2
e. In room air

Feeding status

a. Bolus feeds
b. Continuous feeds
c. Nil by mouth

Millilitres of EBM of the required volume provided in last 24 hours expressed as a percentage;

a. <25%
b. 25% to 50%
c. 50% to75%
d. >75%

Appendix 7: Data collection sheets

Infant Record Review

Day	1	7	14
Infants' current location in the ward			
Infants' state of health			
Feeding status			
Mililitres of MOM of the required volume provided in last 24 hours expressed as a percentage;			

Appendix 8: Interview Record sheet

Patient study number	**Consent** **Yes/No**	**Reason if** **No**	**Interview dates**	
			Day 1	Day 14