UNIVERSITY OF THE WITWATERSRAND

AUDIT OF FEEDING PRACTICES IN THE NEONATAL WARDS AT THE CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

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This research report is submitted in partial fulfillment of the requirements for the degree of Master of Medicine in the Department of Pediatrics and Child Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg.

June 2015 (amended September 2015)

To Sazile

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Declaration

I declare that this research report is my own unaided work. It is being submitted for the degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Letlhogonolo Sepeng

Signed at Johannesburg on 25 September 2015

Publication and Presentations

This research has been accepted for publication in the South African Journal of Child Health, 2015.

It was also presented at the WITS Paediatric Research Day on 5 June 2014, in Johannesburg.

Acknowledgements:

The greatest gratitude goes to my supervisor Professor Daynia Ballot, who mentored me, remained patient with me as I had to learn and adapt to the world of research. When the road seemed dark she remained the ray of light on my path. It is through her selflessness that this research report has reached this stage.

A special thanks to the team who are behind entering and capturing the data onto the REDCAP system (Lebo, Milton and Thandeka), as well as the doctors who sit in the lecture room every Thursday afternoon to rectify and complete the bed letters before the data can be entered.

To my husband for the patience and understanding, to my children, parents and siblings for cheering me on when the going gets tough.

Lastly to thank the mothers and babies who entrust us with their lives and wellbeing, we will continually strive to be diligent in our work.

Abstract:

Background

Breastfeeding is the preferred choice of feeding babies. The Baby-Friendly-Hospital-Initiative (BFHI) is a ten step plan to establishing successful breastfeeding and is adopted by public sector hospitals in Gauteng. Despite this, rates of breastfeeding in sick and preterm babies remain low.

Aim

To determine feeding practices for babies discharged from the neonatal wards of the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

Methodology

A retrospective review of the CMJAH neonatal database on the type of milk feed for babies discharged between 01/01/2013- 30/04/2013.

Results

There were 404 babies in the study, 98(24%) were very-low-birth weight, 120(29.7%) were low birth weight and 186(46%) were bigger babies. Only 94(23.2%) babies were discharged on exclusive breast milk feeds, 232(57.4%) babies were discharged on exclusive formula milk feeds and 78(19.3%) discharged on mixed feeds. Significant variables associated with feeding choices were HIV exposure, perinatal asphyxia and the need for resuscitation at birth.

Conclusion

Despite the fact that the CMJAH is involved in the BFHI, rates of exclusive breastfeeding remain low. This needs to be urgently addressed with employment of lactation consultants and improved counselling of mothers exposed to HIV, on the importance and benefits of breastfeeding.

Abbreviations

AGA	Appropriate for gestational age
BFHI	Baby- Friendly –Hospital –Initiative
CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
HIV	Human immunodeficiency virus
GA	Gestational age
KMC	Kangaroo-mother care
LBW	Low birth weight
NEC	Necrotizing enterocolitis
NICU	Neonatal intensive care unit
PDA	Patent ductus arteriosus
PMTCT	Prevention of mother-to-child transmission
RDS	Respiratory distress syndrome
SGA	Small for gestational age
TTN	Transient tachypnoea of the new born
VLBW	Very low birth weight

Chapter 1: Introduction

Human milk is uniquely composed to meet the needs of the human infant and has been established as the 'optimal' form of nutrition for babies [1]. Breast milk contains 0.8%- 0.9% protein, 4.5% fat, 7.15% carbohydrates (lactose) and 0.2% ash (minerals). The fat fraction of breast milk contains specific triglycerides of palmitic and oleic acid (O-P-O triglycerides) and a large quantity of lipids bonds that are considered to have health benefits. The principal proteins in breast milk are casein, alpha-lactalbumin, lactoferrin, IgA, lysozyme and serum albumin [2].

Breastfeeding delivers immunologic advantages to the baby: the bifido bacterium and lactobacillus bacteria in the breastfed baby's gastrointestinal system produce lactate and acetate which lower pH. The low pH and other substances excreted by these bacteria inhibit the growth of some gram positive and gram negative bacteria. Bacteria present in the gut of breastfed babies detoxify ammonia and other amines and activate the immune system, thus helping to fight bacteria that cause disease. Breastfeeding is a significant protector against diarrhoeal disease, respiratory disease and other infections. Breastfed babies tend to have better nutritional outcomes, including less obesity in overfed populations and less wasting in underfed populations. Breastfeeding has beneficial effects on cognitive functioning and psychosocial development [2]. Breastfeeding has also been shown to reduce the incidence of necrotizing enterocolitis (NEC) in preterm babies.

The Baby-Friendly-Hospital-Initiative [3] (BFHI) is a ten step plan aimed at establishing successful breastfeeding and has been adopted by public sector hospitals in Gauteng. Despite this the rate of breastfeeding in the neonatal unit at the CMJAH is unacceptably low. Possible reasons for this may include reluctance among staff to promote breastfeeding for HIV+ mothers, lack of dedicated lactation counsellors and a lack of facilities for breastfeeding mothers to live in the hospital.

A number of studies have been on infant feeding, the majority of the studies being conducted in the Kwazulu Natal [4, 5, 6, 7, 8, 9] and Western Cape [11, 12, 13] provinces. In the Gauteng province [14] a study on feeding was done with relation to Prevention-of-mother-to-child-transmission (PMTCT) in the preterm baby. In Durban a UNICEF correspondent [16] reported on a majority policy shift that promoted breastfeeding in South Africa, as it was previously thought that the best way to reduce transmission of the HI virus from mother to child was exclusive formula feeds. However, as the policy rolled out there was an increase in the incidence of pneumonia and diarrhoeal diseases even though the rates of HIV decreased.

In Brazil, Coutinho [17] and colleagues compared the effects of two systems for the promotion of exclusive breastfeeding, a hospital-based system and the same system combined with a programme of home visits.

The staff was trained according to the BFHI; although the hospital training intervention achieved a higher rate of 70% of exclusive breastfeeding in the hospitals, the rate was not sustained at home and at ten days of age only 30% were exclusively breastfed.

Coutscoudis [4, 5, 6, 7, 8, 9] and colleagues in Natal investigated the beneficial effects of human milk on decreasing rates of infections such as NEC and sepsis. The objective was to look at the feasibility of providing donor breast milk to neonates in a resource limited neonatal premature unit. It was found that the staff attitudes influenced the uptake of donor breast milk [4, 6, 7].

Studies in HIV+ mothers showed that those babies who were exclusively breastfed had significant lower rates of diarrhoeal diseases and hospitalisation. In addition to the benefits of breastfeeding there was an association with better developmental scores and growth parameters during the long term follow up. The mothers who exclusively breastfed also had lower rates of postnatal depression [9].

In the Western Cape, Doherty and colleagues [11, 12, 13] conducted a prospective observational study of HIV exposed and unexposed babies between the ages 6-9 months. They concluded that HIV+ mothers were more diligent with good feeding practices and this was mainly due to good PMTCT counselling sites. This emphasized the importance of the presence of an encouraging health worker.

The same group [12, 13] also looked at three districts which were part of a trial reflecting different socio-economic conditions: the rural-urban prevalence and the HIV prevalence rates were considered. In this trial they found that there were still barriers to exclusive breastfeeding and that measures should be put into place to reduce or even break these barriers.

Other researchers have shown that HIV infection in the mother is a barrier to breastfeeding. In a study from Kwazulu Natal to investigate factors influencing mothers' feeding choices, Swarts and co-workers [10], found that almost three quarters of mothers chose breastfeeding. However, significantly more HIV infected mothers chose formula feeding over breastfeeding for fear of transmission of HIV via breast milk to their infants. This study also showed that most mothers made their own feeding choices and that less than half the mothers were influenced by health workers.

Other African countries also experience challenges to establishing and maintaining breastfeeding. In a study from Lagos in Nigeria [18], it was found that only one third of mothers exclusively breastfed at 6 months and that the majority of babies had been given formula by this time. They found that although there were breastfeeding policies in place in the hospital and that most health workers were trained in lactation, the breastfeeding protocols were not clearly displayed and that there was no breastfeeding support group in the hospital.

An earlier study by the same group showed that only 19% of mothers practiced exclusive breast feeding, although most mothers acknowledged the benefits of breast feeding.

Reasons for failure to exclusively breastfeed included poor maternal health, family pressure (from both husband and mother-in-law); fear that the baby would become addicted to breast milk and the need for mothers to return to work. The authors reported that nurses felt they

were too busy to support and promote lactation, highlighting the need for dedicated lactation support staff and counsellors [19].

Social and cultural factors also influence the uptake and continuation of breast feeding. In a study from Cameroon [20], it was found that many mothers offered babies formula and solids from an early age. Reasons for reluctance of mother to breastfeed included prohibition of sexual contact with their partners, pressure from the family to supplement with formula as this was a traditional norm, the belief that breast milk was not a sufficient source of nutrition for babies and the idea that all family members should benefit from home grown food. Education programs to address these misconceptions would be an important part of a program to promote breastfeeding.

The CMJAH neonatal unit admits approximately 2000 newborn babies annually. Many of these babies are ill and approximately one quarter is very low birth weight babies. Despite health workers being well aware of the benefits of breastfeeding and receiving on-going lactation training, as well as participation in the BFHI, the rate of breastfeeding in the CMJAH neonatal unit is low. In order to address this problem, research needs to be undertaken to establish the actual rate of breastfeeding in the CMJAH neonatal unit and subsequently to determine reasons for the failure of mothers to breastfeed.

The aim of the study is to audit feeding practices of neonates discharged from the neonatal unit at the Charlotte Maxeke Johannesburg Academic hospital (CMJAH).

Chapter 2: Methods

2.1 Study subjects and methods

The CMJAH unit prospectively collects information upon discharge of neonates for the purpose of clinical auditing. The data is entered into a database managed by Research Electronic Data Capture (REDCAP) hosted by the University of the Witwatersrand [(15)].

The current study is a review of the neonatal database.

Information collected is based on the VON (Vermont Oxford Network: www.vtoxford.org). Information includes demographics, obstetric, labour room and delivery data, disease profile (including HIV and syphilis status), interventions and outcomes. Data is subjected to a system of checking to ensure accuracy and completeness.

Babies who had been admitted to the CMJAH neonatal unit within 72 hours of birth and were discharged from hospital between 01/01/2013 to 30/04/2013 were enrolled. Those who died or were transferred back to the hospital of origin were excluded.

Babies, who were admitted to the neonatal intensive care unit (NICU), were excluded as many babies had surgical problems, were very ill, died or were transferred back to the hospital of origin: rendering data incomplete and increasing inaccuracy. At the time of the study, there was a sleep-in facility available for breastfeeding mothers with sick newborn or preterm babies.

The only sleep-in facility was the Kangaroo Mother Care (KMC) which had 15 beds, where mothers of preterm babies approaching discharge could do continuous KMC. Mothers were counselled as to the benefits of breastfeeding by attending staff, but formula milk was provided to those babies whose mothers chose not to breastfeed. There was no donor breast milk and no dedicated lactation counsellors in the neonatal ward during the study period.

Variables which were considered to possibly influence the type of milk feed were defined as follows:

- Resuscitation at birth included all babies who received bag mask ventilation;
- Necrotizing enterocolitis included Bell stage 2 and 3;
- Antenatal care, defined as at least one visit to the antenatal clinic by the expectant mother;
- Birth defects, which were major physical abnormalities noted at birth as defined by the VON;
- Standard definitions of weight category, gestational age and size for gestational age were used as follows:
- Very low birth weight (VLBW) birth weight less than 1500g, low birth weight (LBW): birth weight less than 2500g.
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- Bigger babies refers to a birthweight of >/=2500g
- Preterm: any baby born before 37 completed weeks of gestation; term was any baby born between 37 and 42 weeks gestation.
- Small for gestational age (SGA) was defined as the birth weight falling below the 10^{th} centile for gestational age (GA), while appropriate for gestational age (AGA) referred to the birth weight falling between 10^{th} and 90^{th} centiles for gestational age;
- Early onset sepsis was defined as positive blood culture within 72 hours of life; late onset sepsis occurred after 72 hours of life;
- Patent ductus arteriosus (PDA) was diagnosed on echocardiogram;
- Birth asphyxia was defined as an Apgar score of below 6 at 5 minutes
- Mixed feeding referred to babies receiving both formula and breast milk feeds.

2.2 Statistical Analysis

SPSS IBM version 21 and 22 were used for statistical analysis. Continuous variables were normally distributed, so mean and standard deviation were used as measures of central tendency.

Categorical data was described using frequencies and percentages. Babies were divided into groups according to feeding choice- breast milk only, formula milk only and mixed feeds. All feeds were initially described and then grouped by birth weight into VLBW, LBW and bigger babies.

These groups (feeding choice and birth weight) were compared using chi-square analysis for categorical variables and unpaired t-tests for continuous variables.

Variables which were similar in nature were grouped together to facilitate analysis (e.g.: hyaline membrane disease and transient tachypnoea of the newborn were classified as respiratory illness).

Chapter 3: Results

3.1 Overall:

A total of 404 babies were enrolled. There were 605 babies admitted to the neonatal unit during the same period and 201 babies were excluded. Female babies were 197 (48.76%). The mean birth weight was 2384g (SD 202). Of the 404 babies studied 98(24%) were VLBW, 120(30%) were LBW and 186 (46%) were bigger babies. There were 218(54%) preterm babies and 186(46%) term babies. A total of 45 babies (11%) were SGA.

Most babies 232 (57.4%) were discharged on formula milk, 94 babies (23.3%) were discharged on exclusive breast milk feeds and 78 babies (19.3%) received mixed feeds. Characteristics of babies in each feeding group are presented in Table 3.1. Factors significantly associated with the type of feed included maternal HIV status, birth asphyxia, birth defects and the need for resuscitation at birth.

The feeding type in babies per birth weight category is described in Table 3.2. There was no significant difference in the type of feeding in the different birth weight categories ($p = 0.108$).

Gestational age and size did not affect the type of feed. In preterm babies, 36(16.5%) were discharged on mixed feeds, 43(19.7%) on exclusive breast milk and 139(63.8%) on formula feeds.

There were 38 term babies (20.4%) discharged on mixed feeds, 49(26.3%) were discharged on exclusive breast milk and 99(53.2%) were exclusively formula fed ($p=0.097$).

Of the SGA babies 12(26.7%) received mixed feeds, 12(26.7%) received breast milk and 21 (46.6%) received formula feeds on discharge. In AGA babies, 60(19.1%) babies received mixed feeds, 78(24.8%) babies received breast milk only and 176(56%) babies received formula feeds on discharge. There was no statistical significance between the type of feed in SGA and AGA babies ($p=0.4$).

Table 3.1

Characteristics of feeds for the combined group

Variables	Breast milk only (N=94)	Mixed feeds (N=78)	Formula milk only (N=232)	p-value
Inborn	78 (82.9%)	72 (92.3%)	197 (84.9%)	0.17
Para 1	32 (34.0%)	32 (41.0%)	69 (29.7%)	0.17
Gravida 1	23 (24.4%)	27 (34.6%)	68 (29.3%)	0.32
Antenatal clinic attendance	81 (86.2%)	65 (83.3%)	188 (81.0%)	0.17
Teenage mothers	0	3 (3.8%)	6 (2.5%)	0.2
Caesarean section	52 (55.3%)	50 (64.1%)	142 (61.2%)	0.47
HIV positive	12 (12.7%)	6 (7.6%)	95 (40.9%)	<0.0001
Anti-tuberculosis treatment	0	1 (1.2%)	4 (1.7%)	0.44
Early sepsis	2 (2.1%)	3 (3.8%)	3 (1.3%)	0.37
Late sepsis	2 (2.1%)	1(1.2%)	12(5.2%)	0.19
Resuscitation	19(20.2%)	15(19.2%)	74(31.8%)	0.02
Birth asphyxia	7(31.8%)	2(9.1%)	13(59.1%)	0.04
Respiratory pathology	34(36.1%)	25(32.1%)	83(35.7%)	0.81
Patent ductus arteriosus	1(1%)	1(1.2%)	8(3.4%)	0.34
Necrotizing enterocolitis	2(2.1%)	0	1(0.8%)	0.19
NCPAP	26(27.6%)	17(21.8%)	70(30.2%)	0.28
Birth defects	4(4.2%)	2(2.5%)	1(0.4%)	0.046

Table 3.2

Comparison of the three groups by birth weight:

Data code :	**Breast milk only:**	**Breast milk and formula milk**	**Formula milk :**
VLBW(BW <1500g)	21(21.4%)	18(18.4%)	59(60.2%)
LBW (BW≥1500g<2500g)	21(17.5%)	21(17.5%)	78(65%)
BW:≥2500g	52(28.0%)	39(21.0%)	95(51.0%)

Chapter 4: Discussion

4.1 General

Breastfeeding in the CMJAH neonatal unit remains unacceptably low: only 23.2% of the babies were discharged on exclusive breastmilk feeds. Irrespective of birth weight, the preferred method of feed was formula feeds only (57.4%) while a further 19.3% of babies were discharged on mixed formula and breast milk feeds.

The most significant factors associated with feeding choice in the whole group were: birth asphyxia (p-value= 0.04), maternal HIV status (p-value<0.001) and resuscitation (p-value =0.024).

It is surprising that the lack of breastfeeding was not different between VLBW and bigger babies, as establishing breastfeeding in sick preterm babies is more challenging than in bigger, healthier babies.

The reasons for the very low rate of breastfeeding were not evaluated in the present study, but may relate to the fact that there were no lactation counsellors assigned to the neonatal wards and no donor breast milk was available during the study period.

Establishing breastfeeding in sick and preterm infants in a busy, understaffed neonatal unit is more labour intensive than formula feeding.

Adequate support in terms of education, dedicated staff and donor breast milk is essential. There was no sleep-in facility for breastfeeding mothers with sick neonates. Many of the mothers lived far away and transport was expensive.

CMJAH is a tertiary obstetric referral centre and many of the mothers are ill at the time of delivery.

The majority of babies requiring admission are delivered by emergency caesarean section, most often due to pregnancy induced hypertension. Establishing breastfeeding is more difficult in this circumstance as no donor breast milk programme was in place the time of the study.

Breast milk bank and donor breast milk are part of a whole program to help mothers establish breastfeeding. The donor milk is provided for two weeks while the baby is ill and the mother has not yet established lactation.

The mothers of infants who receive donor breast milk are encouraged to become breast milk donors, once lactation is established. Formula feeding is discouraged as this practice interferes with establishing lactation.

It is also a challenge to latch the newborn within an hour of birth and discuss feeding choices with an ill mother.

The HIV prevalence rate in the CMJAH neonatal unit is about 29%. The strong association between maternal HIV exposure and the lack of breastfeeding probably reflects reluctance on the part of the health workers to promote breastfeeding in HIV infected mothers.

It may also reflect a lag in implementing a change in the feeding policy (HIV infected mothers were provided with formula in Gauteng until early 2012). On-going education and training of health workers in the BFHI and provincial feeding policies is crucial

4.2 Limitations

This was a retrospective study confined to evaluating the type of feeding on discharge from the CMJAH neonatal unit.

Feeding choice is a complex, multifactorial issue and many of the possible factors involved could be investigated.

A prospective study including various staff and maternal factors which influence feeding choice should be conducted in the unit; therefore further prospective research is needed

4.3 Conclusion

Despite the fact that CMAJH is involved in the BFHI, the rates of exclusive breastfeeding were still low. Reasons for this were not studied but could include inadequate education of health care workers, lack of lactation counsellors, maternal illness, lack of sleep-in facilities and no donor breast milk.

Maternal factors, including previous breastfeeding experiences, socio-economic status, attendance at antenatal clinics and level of education, would also influence feeding choices, but these were beyond the scope of this study. Establishing breastfeeding in sick babies requires a team approach with dedicated counsellors and on-going training of health care workers.

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Appendix A: Paper for publication

AUDIT OF FEEDING PRACTICES IN THE NEONATAL WARDS AT THE CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL.

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The authors declare no conflict of interest.

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Abstract

Background

Breastfeeding is the preferred choice of feeding babies. The Baby-Friendly-Hospital-Initiative (BFHI) is a ten step plan to establishing successful breastfeeding and is adopted by public sector hospitals in Gauteng. Despite this, rates of breastfeeding in sick and preterm babies remain low.

Aim

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Conclusion

Despite the fact that the CMJAH is involved in the BFHI, rates of exclusive breastfeeding remain low. This needs to be urgently addressed with employment of lactation consultants and improved counselling of mothers exposed to HIV, on the importance and benefits of breastfeeding.

Abbreviations: Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), Very low birth weight (VLBW), Baby-Friendly-Hospital-Initiative (BFHI), Human Immunodeficiency Virus (HIV), Low birth weight (LBW), Necrotizing enterocolitis (NEC), Patent ductus arteriosus (PDA), Small for gestational age (SGA), Very low birth weight (VLBW).

Introduction

Human milk is uniquely composed to meet the needs of the human infant and has been established as the 'optimal form' of nutrition for babies [(1)]. Breast milk contains 0.8%- 0.9% protein, 4.5% fat, 7.15% carbohydrates (lactose) and 0.2% ash (minerals). The fat fraction of breast milk contains specific triglycerides of palmitic and oleic acid (O-P-O triglycerides) and a large quantity of lipids bonds that are considered to have health benefits. The principal proteins in breast milk are casein, alpha-lactalbumin, lactoferrin, IgA, lysozyme and serum albumin [(2)]. Breast feeding delivers immunologic advantages to the baby: the bifido bacterium and lactobacillus bacteria in the breastfed baby's gastrointestinal system produce lactate and acetate which lower ph. The low pH and other substances excreted by these bacteria inhibit the growth of some gram positive and gram negative bacteria. Bacteria present in the gut of breastfed babies detoxify ammonia and other amines and activate the immune system, thus helping to fight bacteria that cause disease. Breastfeeding is a significant protector against diarrhoeal disease, respiratory disease and other infections. Breastfed babies tend to result in better nutritional outcomes, including less obesity in overfed populations and wasting in underfed populations. Breast feeding has beneficial effects on cognitive functioning and psychosocial development [(2)]. Breastfeeding has also been shown to reduce the incidence of necrotizing enterocolitis (NEC) in preterm infants.

The Baby-Friendly-Hospital-Initiative [(3)] (BFHI) is a ten step plan aimed at establishing successful breastfeeding and has been adopted by public sector hospitals in Gauteng.

Despite this the rate of breastfeeding in the neonatal unit at the CMJAH are unacceptably low. Possible reasons for this may include reluctance among the staff to promote breastfeeding for HIV+ mothers, lack of dedicated lactation counsellors and a lack of facilities for breastfeeding mothers to live in the hospital.

A number of studies have been done on infant feeding, the majority of studies being conducted in the Kwazulu Natal [4, 5, 6, 7, 8, and 9] and Western Cape [11, 12, and 13] provinces. In the Gauteng province [14] the study on feeding was done with relation to Prevention-of-mother-to-child-transmission (PMTCT) in the preterm baby. In Durban a UNICEF correspondent [16] reported on a major policy shift that promoted breastfeeding in South Africa, as it was previously thought that the best way to reduce transmission of the HI virus from mother to child was exclusive formula feeds. However, as the policy rolled out there was an increase in the incidence of pneumonia and diarrhoeal diseases even though the rates of HIV decreased. The greatest challenge was to promote exclusive breastfeeding not only among HIV-positive mothers but also the negative mothers as the rates were at an extreme low of 8%, so the first step was to reach out to health workers, especially midwives and nurses. In Brazil: Coutinho, S [17] and colleagues compared the effects of two systems for the promotion of exclusive breastfeeding, a hospital-based system and the same system combined with a programme of home visits. The staffs was trained according to the BFHI; although the hospital training intervention achieved a higher rate of 70% of exclusive breastfeeding in the hospitals, the rate was not sustained at home and at ten days of age only 30% were exclusively breastfed.

Coutscoudis, A [4, 5, 6, 7, 8, 9] and colleagues in Natal investigated the beneficial effects of human milk on decreasing rates of paediatric infections such as NEC and sepsis. The objective was to look at the feasibility of providing donor breast milk to neonates in a resource limited neonatal premature unit. It was found that the staff attitudes influenced the uptake of donor breast milk [4, 6, and 7].

Studies in HIV+ mothers showed that those babies who were exclusively breastfed had significant lower rates of diarrhoeal diseases and hospitalisation. In addition to the benefits of breastfeeding there was an association with better developmental scores and growth parameters during the long term follow up. The mothers who exclusively breastfed also had lower rates of postnatal depression [9].

In the Western Cape, Doherty, and colleagues [11, 12, 13] conducted a prospective observational study between HIV exposed and unexposed babies between the ages 6-9 months. They concluded that HIV+ mothers were more diligent with good feeding practices and this was mainly due to good PMTCT counselling sites. This emphasized the importance of the presence of an encouraging health worker.

The same group [12, 13] also looked at three districts which were part of a trial reflecting different socio-economic conditions: the rural-urban prevalence and the HIV prevalence rates were considered.

In this trial they found that there were still barriers to exclusive breastfeeding and that measures should be put into place to reduce or even break these barriers.

The CMJAH neonatal unit admits approximately 2000 newborn babies annually; one quarter of these are very low birth weight (VLBW).

This study aimed to audit feeding practices of babies discharged from the neonatal unit at CMJAH.

Subjects and methods

The CMJAH neonatal unit prospectively collects information upon discharge of neonates for the purpose of clinical auditing, discharge summaries and quality improvement. The data is entered into a database managed by Research Electronic Data Capture (REDCAP) hosted by the University of the Witwatersrand [(15)]. The current study is a review of the neonatal database. Permission to conduct the study was obtained from the Human Research Ethics Committee of the University of the Witwatersrand.

Information collected is based on the VON (Vermont Oxford NETWORK: www.vtoxford.org). Information includes demographics, obstetric, labour room and delivery data, disease profile (including HIV and syphilis status), interventions and outcomes. Data is subjected to a system of checking to ensure accuracy and completeness.

Babies who had been admitted to the CMJAH neonatal unit within 72 hours of birth and were discharged from hospital between 01/01/2013-30/04/2013 were enrolled –those who died or were transferred out to other hospitals were excluded.

Babies, who were admitted to the neonatal intensive care unit (NICU), were excluded as many NICU babies had surgical problems, were very ill, died or were transferred back to the hospital of origin-rendering data incomplete and increasing inaccuracy.

At the time of the study, there was also no sleep-in facility available for breastfeeding mothers with sick newborn or preterm babies.

The only such facility was the Kangaroo Mother Care Unit (KMC) which had 15 beds, where mothers of preterm neonates approaching discharge could do continuous KMC. Mothers were counselled as to the benefits of breastfeeding by attending staff, but formula milk was provided to those babies whose mothers chose not to breast feed. There was no donor breast milk available and no dedicated lactation counsellors in the neonatal ward during the study period.

Variables which were considered to possibly influence the type of milk feed were defined as follows:

Resuscitation at birth included all babies who received bag-mask ventilation.
necrotizing enterocolitis included Bell stage 2 and 3.
antenatal care was defined as at least one visit to the antenatal clinic by the mother.

birth defects were major physical abnormalities noted at birth as defined by the VON.

Standard definitions of weight category, gestational age and size for gestational age were used as follows:

VLBW <1500grams at birth; low birth weight (LBW) <2500grams at birth.

preterm was any baby born before 37 completed weeks; term was any baby born between 37 and 42 weeks gestation.

small for gestational age (SGA) was defined as the birth weight falling below the 10^{th} centile for gestational age (GA), while appropriate for gestational age (AGA) referred to the birth weight falling between 10^{th} and 90^{th} centiles for gestational age.

early onset sepsis was defined as positive blood culture within the first 72 hours of life; late onset sepsis occurred after 72 hours of life.

patent ductus arteriosus (PDA) was diagnosed on echocardiogram.

birth asphyxia was defined as an Apgar score of below 6 at 5 minutes.

mixed feeding referred to babies receiving both formula and breast milk feeds.

Statistical methods

SPSS IBM version 21 and 22 were used for statistical analysis. Continuous variables were normally distributed, so mean and standard deviation were used as measures of central tendency. Categorical data was described using frequencies and percentages. Babies were divided into groups according to feeding choice- breast milk only, formula milk only and mixed feeds. All babies were initially described and then grouped by birth weight into VLBW, LBW and bigger babies.

These groups (feeding choice and birth weight) were compared using the chi-square analysis for categorical variables and unpaired t-tests for continuous variables. Variables which were similar in nature were grouped together to facilitate analysis (e.g.: hyaline membrane disease and transient tachypnoea of the newborn were classified as respiratory illness).

Results

A total of 404 babies were enrolled. There were 605 babies admitted to the neonatal unit during the same period. Female babies were 197 (48.76%). The mean birth weight: 2384g (SD 202). Of the 404 babies studied 94 (24%) were very low birth weight, 120 (29.7%) were the low birth weight babies and 186 (46%) were the bigger babies. There were 218 (54%) preterm babies and 186 (46%) term babies. A total of 45 babies (11%) were SGA.

Most babies 232 (57.4%) were discharged on formula feeds, 94 (23.3%) were discharged on exclusive breast milk feeds and 78 (19.3%) received mixed feeds.

Characteristics of babies in each feeding group are presented in Table 1. Factors significantly associated with the type of feed included maternal HIV status, birth defects and the need for resuscitation at birth. The feeding type in babies per birth weight category is described in Table 2. There was no significant difference in the type of feeding in the different birth weight categories (p=0.108).

Gestational age and size did not have any effect on the type of feed. In Preterm babies, 36 (16.5%) were discharged on mixed feeds, 43 (19.7%) on exclusive breast milk and 139 (63.9%) on formula feeds. 38 term babies (20.4%) were discharged on mixed feeds, 49 (26.3%) discharged on exclusive breast milk and 99 (53.3%) were exclusively formula fed (p=0.097). In SGA babies 12 (26.7%) received mixed feeds, 12(26.7%) received breast milk and 21(46.6%) received formula feeds on discharge. In AGA babies, 60(19.0%) received mixed feeds, 78(25.0%) breast milk and 176(56.0%) formula feeds on discharge. There was no statistical significance between the type of feed in SGA and AGA babies (p=0.04).

Table 1

Characteristics of feeds for the combined group

Variables	Breast milk only (N=94)	Mixed feeds (N=78)	Formula milk only (N=232)	p-value
Inborn	78 (82.9%)	72 (92.3%)	197 (84.9%)	0.17
Para 1	32 (34.0%)	32 (41.0%)	69 (29.7%)	0.17
Gravida 1	23 (24.4%)	27 (34.6%)	68 (29.3%)	0.32
Antenatal clinic attendance	81 (86.2%)	65 (83.3%)	188 (81.0%)	0.17
Teenage mothers	0	3 (3.8%)	6 (2.5%)	0.2
Caesarean section	52 (55.3%)	50 (64.1%)	142 (61.2%)	0.47
HIV positive	12 (12.7%)	6 (7.6%)	95 (40.9%)	<0.0001
Anti-tuberculosis treatment	0	1 (1.2%)	4 (1.7%)	0.44
Early sepsis	2 (2.1%)	3 (3.8%)	3 (1.3%)	0.37
Late sepsis	2 (2.1%)	1(1.2%)	12(5.2%)	0.19
Resuscitation	19(20.2%)	15(19.2%)	74(31.8%)	0.02
Respiratory pathology	34(36.1%)	25(32.1%)	83(35.7%)	0.81
Patent ductus arteriosus	1(1%)	1(1.2%)	8(3.4%)	0.34
Necrotizing enterocolitis	2(2.1%)	0	1(0.8%)	0.19
NCPAP	26(27.6%)	17(21.8%)	70(30.2%)	0.28
Birth defects	4(4.2%)	2(2.5%)	1(0.4%)	0.046

Table 2

Comparison of the three groups:

Data code :	**Breast milk only:**	**Breast milk and formula milk**	**Formula milk :**
VLBW(BW <1500g)	21(21.4%)	18(18.4%)	59(60.2%)
LBW (BW≥1500g<2500g)	21(17.5%)	21(17.5%)	78(65.0%)
BW:≥2500g	52(28.0%)	39(21.0%)	95(51.0%)

Discussion

Breastfeeding in the CMJAH neonatal unit remains unacceptably low: only 23% of the babies were discharged on exclusive breastmilk feeds. Irrespective of birth weight, the preferred method of feed was formula feeds only (57.4%) while a further 19.3% of babies were discharged on mixed formula feeds and breast milk feeds.

The most significant factors associated with feeding choice in the whole group were: maternal HIV status (p-value=<0.0001) and resuscitation (p-value=0.024). it is surprising that the lack of breastfeeding was not different between VLBW and bigger babies, as establishing breastfeeding in sick preterm babies is more challenging than in bigger, healthier babies.

The reasons for the very low rate of breastfeeding were not evaluated in the present study, but may relate to the fact there were no dedicated lactation counsellors assigned to the neonatal wards and no donor breast milk was available during the study period.

Establishing breastfeeding in sick and preterm babies in a busy, understaffed neonatal unit is more labour intensive than formula feeding. Adequate support in terms of education, dedicated staff and donor breast milk is essential. There was also no sleep-in facility for breastfeeding mothers with sick neonates. Many of the mothers lived far away and transport was expensive.

CMJAH is a tertiary obstetric referral centre and many of the mothers are ill at the time of delivery. The majority of babies requiring admission are delivered by emergency caesarean section, most often due to pregnancy induced hypertension. Establishing breastfeeding is more difficult in this circumstance as no donor breast milk was in place the time of the study.

Breast milk bank and donor breast milk are part of a whole program to help mothers establish breastfeeding. The donor milk is provided for the first two weeks while the baby is ill and the mother and the mother has not yet established lactation. The mothers of infants who receive donor milk are encouraged to become breast milk donors, once lactation is established. Formula feeding is discouraged as this practice interferes with establishing lactation.

It is also a challenge to latch the newborn within an hour of birth and discuss feeding choices with an ill mother. The HIV prevalence rate in the CMJAH neonatal unit is about 29%. The strong association between maternal HIV exposure and the lack of breastfeeding probably reflects reluctance on the part of health workers to promote breastfeeding in HIV infected mothers. It may also reflect a lag in implementing a change in the feeding policy (HIV infected mothers were provided with formula in Gauteng until early 2012). On-going education and training of health workers in BFHI and provincial feeding policies is crucial.

Conclusion

Despite the fact that CMJAH is involved in the BFHI, the rates of exclusive breastfeeding were still low. Reasons for this were not studied but could include inadequate education of health care workers, lack of lactation counsellors, maternal illness, lack of sleep-in facilities and no donor breast milk.

Maternal factors, including previous breastfeeding experiences, socio-economic status, attendance at antenatal clinics and level of education, would also influence feeding choices, but these were beyond the scope of this study. Establishing breastfeeding in sick babies requires a team approach with dedicated counsellors and on-going training of health care workers.

Limitations:

This was a retrospective study confined to evaluating the type of feeding on discharge from the CMJAH neonatal unit. Feeding choice is a complex, multifactorial issue and many of the possible factors involved could be investigated (as outlined above). A prospective study including various staff and maternal factors which influence feeding choice should be conducted in the unit; therefore further prospective research study is needed.

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Appendix B: Ethics letter

R14/49 Dr Letlhogonolo Sepeng

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130224

NAME: (Principal Investigator)	Dr Letlhogonolo Sepeng
DEPARTMENT:	Department of Paediatrics & Child Health CM Johannesburg Academic Hospital
PROJECT TITLE:	An Audit of Feeding Practices in the Neonatal Wards of Charlotte Maxeke Johannesburg Academic Hospital
DATE CONSIDERED:	22/02/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Daynia Ballot
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 19/04/2013

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix C: Protocol Report

PROTOCOL REPORT: MASTERS OF MEDICINE (PAEDIATRICS AND CHILD HEALTH)

CANDIDATE: LETLHOGONOLO SEPENG: MBChB (MEDUNSA)

SUPERVISOR: PROF DAYNIA BALLOT: MBBCH, FCPaed (SA), PhD

NEONATAL UNIT CMJAH

TABLE OF CONTENTS:

ABBREVIATIONS:

- **AFASS : Acceptable, Feasible, Affordable, Sustainable and Safe**
- **APGAR: Appearance, Pulse, Grimace, Activity, and Respiration**
- **BFHI : Baby Friendly Hospital Initiative**
- **CMJAH: Charlotte Maxeke Johannesburg Academic Hospital**
- **ETT : Endotracheal intubation**
- **HIV : Human Immunodeficiency Virus**
- **MOU : Midwives Obstetric Unit**
- **NEC : Necrotizing enterocolitis**
- **PMTCT : Prevention-of-mother-to-child-transmission**
- **Prem : Premature baby (born before 37 completed weeks of gestation)**

INTRODUCTION

In traditional African culture, a new mother would be assisted with her daily chores by her mother and other relatives and provided with an extra nutrition in order to establish and maintain lactation. Many mothers of today do not have this extended family support group and this may contribute to the failure of many to breastfeed successfully. Also, a significant number of single young mothers have to face the added stress of dealing with a sick preterm baby. This significantly reduces the rates of breastfeeding in these small infants, who would benefit from this practice.

Human milk is uniquely composed to meet the needs of human infant; it has a high concentration of lactose which is an excellent source of carbohydrates. There are three different categories of proteins in human milk: whey protein (which is the predominant protein), casein protein and non-protein nitrogen.

Breastfeeding also delivers immunologic advantage to the baby: the bifid bacterium and lactobacillus bacteria in the breast fed infants' gastrointestinal system produces lactate and acetate which lowers pH, and the low pH and other substances excreted by the bacteria inhibit some Gram positive as well as gram negative bacteria. These bacteria also detoxify ammonia and other amines and activate the immune system and this helps fight bacteria that cause disease. [(1)]

Breastfeeding therefore is a significant protector against diarrhoeal disease, respiratory disease and other infections. It tends to result in better nutritional outcomes, including protecting against obesity in overfed populations and against wasting in underfed populations. It has beneficial effects on cognitive functioning and psychosocial development. [(1)]

The Baby Friendly Hospital initiative (BFHI) is a ten step plan to establishing successful breastfeeding [(2)]. Breastfeeding has been adapted by public sector hospitals in Gauteng. Despite this, the fact that breastfeeding is the newborn feeding policy in Gauteng and the wealth of scientific evidence supporting the benefits of breastfeeding in newborn infants in general and preterm infants especially, the rates of breastfeeding in the neonatal unit at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) are unacceptably low. Possible reasons for this may include reluctance among staff to promote breastfeeding in HIV+ mothers, no dedicated lactation counsellors and lack of facilities so that mothers are discharged after 6 hours and cannot be accommodated if the baby is admitted.

A number of studies have been done on infant feeding, but the majority were conducted in Kwazulu Natal[(3,4,5,6,7,8, and 9)], and the Western Cape [(10,11,12,13,and 14)] provinces. A study from the Gauteng province [(15)] investigated breastfeeding with relation to prevention-of-mother-to-child-transmission (PMTCT) in the preterm baby. Coutscoudis,A [(3,4,5,6,7,8,and 9)] and colleagues in Natal looked at the beneficial effects of human milk on decreasing rates of paediatric infections such as, necrotizing enterocolitis (NEC) and sepsis. Their objective was to look at the feasibility of providing donor breast milk to infants in a resource limited Neonatal Prem

Unit. In their study only 50% of the infants received their mothers own breast milk, overall the infants showed benefits to receiving the breast milk. The challenges met in this study were the attitudes of the staff that needed to sensitize to the importance of donor breast milk, in order to improve uptake results.

Coutscoudis,A[3,4,5,6,7,8, and 9] and colleagues also did a prospective study, in which they looked at HIV positive (Human Immunodeficiency Virus) mothers who were exclusively breastfeeding their infants who were exposed to the human immunodeficiency virus. The outcome of the study showed that despite counselling there were mothers who still chose exclusive formula feeding, but infants of mothers who had chosen to continue with exclusive breastfeeding, had significantly lower rates of diarrhoea, and hospitalisation. In addition breastfeeding was significantly associated with better development scores and growth parameters at long term follow up. Another important observation was that mothers who did breastfeed exclusively had a lower risk of postnatal depression.

In order to successfully formula feed an infant, clean water, milk or formula, containers for the milk and effective cleaning methods for the containers are required. These requirements are readily met in a developed country, but are not necessarily available in a developing world. Coutscoudis, A [3, 4, 5,6,7,8, and 9] established the AFASS criteria (Acceptable, Feasible, Affordable, Sustainable, and Safe). This criteria was developed in a disadvantaged setting where, there would usually none or only one breadwinner for an entire household, and therefore money for buying formula milk on a regular basis would be a scarcity, and as a result complications such malnutrition, giving rise to failure to thrive among other things.

A prospective observational study was done in the Western Cape by Doherty and colleagues [10, 11, 12, 13, and 14] among infants who were exposed to the Human Immunodeficiency Virus, and those who were unexposed, between the ages of six to nine months. The study was looking particularly at the mothers of the two groups of infants. They concluded that the mothers who were HIV+ were more diligent with good feeding practices, and this was mainly due to the fact that these mothers had PMTCT counselling sites. This emphasized the importance of the presence of an encouraging health worker.

They (Doherty and colleagues [10, 11, 12, 13, and 14]) then went on to look at three districts which were part of the trial reflecting different socio-economic conditions: the rural-urban prevalence and HIV prevalence rates were considered. It was found that there were still mothers who practiced mixed feeding, reasons included that the infants crying even after a feed, or the failure of the infant's to sleep at night. It was concluded that there were still barriers to exclusive breastfeeding and that measures had to be put into place to reduce, even break them down.

The present study seeks to address this issue by auditing the feeding practices of newborn infants in the neonatal unit at CMJAH. Demographic and clinical factors associated with breastfeeding as opposed to formula feeding will be identified. This study serves as a starting point to describe the problem. Further research on the subject will follow.

2. AIM OF THE STUDY

The aim of the study is to audit the feeding of newborn infants in the neonatal wards of CMJAH

3. OBJECTIVES OF THE STUDY

- To determine how many sick babies in the neonatal wards of CMJAH are exclusively breastfed, exclusively formula fed or mixed fed.
- To determine basic demographic and clinical factors which influence the method of feeding
- To compare the characteristics of mothers who breastfeed with those who do not.

4. STUDY POPULATION

- **Inclusion criteria:** will be all newborn infants admitted to CMJAH within 72 hours of birth and who survive to discharge.
- **Exclusion criteria** : infants who are too ill to tolerate oral feeds
- :infants who are admitted to the neonatal intensive care unit (ward 276) for mechanical ventilation.
- : infants with incomplete data

5. STUDY METHODS

5.1 STUDY DESIGN

This is a retrospective record review observing methods of feeding newborn infants. Neonatal information is collected prospectively for the purpose of clinical audit. Information is checked for completeness and is verified. The data is entered onto a database (REDCAP-WITS University).

The method of infant feeding on discharge (whether exclusive breastfeeding, exclusive formula milk or mixed feeding) will be reviewed. Maternal, obstetric and neonatal factors which may influence feeding methods will be collected. (See appendix A)

5.2 DATA COLLECTION

The data from January and February 2013 will be reviewed. Approximately 150 babies are admitted per month, so it is anticipated that there will be +/-300 in the sample. It is estimated that 30% of the babies are in each category of feeding, so there will be +/-100 babies in each group. Data will captured on to a customised questionnaire using REDCAP (WITS

University), data will be described using standard statistical methods- continuous data using measures of central tendency(mean and standard deviation or median and interquartile range as appropriate) , categorical data using frequencies and percentages. Comparison between mothers who breastfeed v/s those who do not will be done using t tests for continuous data or chi square for categorical data. Logistic regression will be done using formula v/s breastfeeding as the binary variable and considering the various demographic and clinical characteristics as input variables. Statistics will be done using SPSS IBM version21

6. ETHICS:

Permission to conduct the study will be obtained from the CEO of the hospital as well as the matrons of the ward 177 and 184.

The study will be approved by the Human Ethics Committee of the University of the Witwatersrand prior to commencement.

7. Timing

	Oct	***Nov***	***Dec***	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sept***
Literature review												
Preparing protocol												
Protocol assessment												
Ethics application												
Collecting data												
Data analysis												
Writing up thesis												
Writing up paper												

8. FUNDING

Minimal costs anticipated will be self-funded

9. LIMITATIONS

A possible limitation would be data that is incomplete from the database.

This is a retrospective study so not all maternal information is readily available. Questions such as maternal socio-economic status, level of education, previous experience of breastfeeding and understanding of antenatal education cannot be evaluated in this study.

APPENDIX A:

○ **Birth weight (grams)**	
○ **Gestational age (weeks)**	
○ **Place of birth**	○ **Inborn** ○ **Born at another hospital** ○ **Born at MOU** ○ **Born before arrival**
○ **Maternal race**	○ **Black** ○ **White** ○ **Coloured** ○ **Indian** ○ **Asian** **Other**
○ **Maternal age**	
○ **Parity** ○ **Gravidity**	
○ **Antenatal care**	○ **Yes** ○ **No**
○ **Maternal HIV status**	○ **Yes** ○ **No**
○ **Maternal Tuberculosis**	○ **Yes** ○ **No**
○ **Teenage mother<18 years old**	○ **Yes** ○ **No**
○ **Attempted termination of pregnancy**	○ **Yes** ○ **No**
○ **Mode of delivery**	○ **Normal vaginal delivery** ○ **Vaginal breech** ○ **Assisted vaginal delivery** ○ **Caesarean section(elective)** ○ **Caesarean section (emergency)**
○ **Gender**	○ **Male** ○ **Female** ○ **Intersex**
○ **Multiple gestation**	○ **Yes** ○ **No**

○ **APGAR scores**	○ **At 1 minute** ○ **At 5 minutes** ○ **At 10 minutes**
○ **Bacterial sepsis on or before day 3**	○ **Yes** ○ **No**
○ **NCPAP without ET ventilation**	○ **Yes** ○ **No**
○ **Patent ductus arteriosus**	○ **Yes** ○ **No**
○ **Necrotizing enterocolitis**	○ **Yes** ○ **No**
○ **Gastrointestinal perforation**	○ **Yes** ○ **No**
○ **Central nervous system**	○ **Apnoea** ○ **Seizures** ○ **HIE grade 1** ○ **HIE grade 2** ○ **HIE grade 3**
○ **Major birth defect**	○ **Yes** ○ **No**
○ **Kangaroo care**	○ **Yes** ○ **No**
○ **Type of kangaroo care**	○ **Intermittent KMC in ward 177/ 185** ○ **Continuous KMC in ward 184**
○ **Feeds on discharge**	○ **Breast milk** ○ **Formula only** ○ **Mixed feeding (breast and formula)**
○ **Duration of stay**	

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