

Sociodemographic factors associated with mixed feeding practices among a cohort of mothers with infants aged 4-14 weeks in Tlokwe sub-district

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PREFACE

This mini-dissertation has been completed in article format by Mr Nkululeko Milton Semenekane for the degree Magister Scientiae in Nutrition. The mini-dissertation was completed under the supervision of Mrs Chantell B. Witten, who provided supervision throughout the research process, and Mrs Eloise Swanepoel, who provided technical support in writing up and reviewing the mini-dissertation. The mini-dissertation was written according to guidelines stipulated by the “Manual for Master’s and Doctoral studies” (NWU, 2018).

I, Nkululeko Milton Semenekane, Student number: 23591536, ID number: 9401075517087, declare that:

- I have read the North-West University’s “Conduct regarding plagiarism at North-West University” (NWU, 2006).
- I am aware that plagiarism is an offence representing intellectual/academic theft.
- I have followed the required conventions in referencing to give recognition to original authors whose ideas or facts I have used.
- This mini-dissertation is my own work and I acknowledge and recognise all contributions made by my research team and supervisors.

Mr. Nkululeko Milton Semenekane

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*“I have fought the good fight, I have finished the race, I have kept the faith.”
2 Timothy 4:7*

Dear God our Father in Heaven, I am kneeling down and coming to give you thanks and appreciation for the strength you gave me through this tough time. I thank you Lord, in Jesus Christ, our Lord. Amen.

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ABSTRACT

Background

The first-ever Lancet Series on breastfeeding has unequivocally established that breastfeeding (BF) is a cost-effective investment that contributes to a smarter, healthier and a more thriving future for the world. Globally, only one in three infants younger than six months of age are exclusively breastfed, and this rate (37%) has not improved for the last two decades. The mixed feeding (MF) practices in infants less than six months of age may shorten BF duration and expose the infant to increased risk of morbidity and mortality. The timely and adequate introduction and use of complementary feeding is important for optimal infant development and growth. In South Africa, more especially in the North-West Province, little is known about infant feeding practices of infants younger than 14 weeks.

Aim

To identify the MF practices in a cohort of mothers with infants aged 4-14 weeks, in the Tlokwe sub-district of North West Province, South Africa.

Objectives

The objectives were to determine the MF practices of a cohort of mothers with infants aged 10-14 weeks in the Tlokwe sub-district; secondly, to determine the association between sociodemographic factors and MF in a cohort of mothers with infants aged 10-14 weeks; and finally, to compare changes in sociodemographic factors and infant feeding practices from 4-8 weeks to 10-14 weeks in a cohort of mothers with infants aged 4-14 weeks in the Tlokwe sub-district.

Methodology

This sub-study formed part of a larger study that was a prospective cohort study designed to follow mothers from the early BF period (day 3-14) through to the infant age of 20-24 weeks. The recruitment was done in eight health facilities of the Tlokwe sub-district. One hundred and fifty-nine mothers with infants aged 4-14 weeks consented to complete a sociodemographic tool and a repeated 7-day infant feeding and food frequency questionnaire. Data was collected at 4-8 weeks and 10-14 weeks. Data was analysed

using SPSS version 25.0 (IBM, USA). Normally distributed data was expressed as means $\pm$ standard deviation (SD) and skewed data was expressed as median (25th, 75th percentiles) values. Chi-square tests and logistic regression were used to analyse the association between sociodemographic factors and MF practices at time point two (10 - 14 weeks).

Results

Although the majority of mothers were not married, 89.3% reported being in a stable relationship, but only 28.9% lived with the father of their infant. While the majority (80.5%) of mothers had some level of high school education, 75.5% were unemployed. Most households reported an income of R3000 or less. Approximately half reported having received mobile health (mhealth) messages from MomConnect. At the age 10-14 weeks, 86.2% of the infants were breastfed with low exclusive breastfeeding (EBF) rates (38.5%), while 20% were mixed fed with formula milk. Of those who were MF (61.5%), 36.7% were mixed fed with water, while 15.6% were mixed fed with food only. Of the sociodemographic factors that were investigated, there was a significant association between parity and MF ($p=0.003$). There was a significant change with child support grants from time point 1 (4-8 weeks) to time point 2 (10-14 weeks) and infant feeding practices ($p=0.009$).

Conclusion

A high proportion of mothers practiced MF, which increased with infant age. In line with literature, MF remains a common practice in South Africa. The majority of mothers mixed fed with water, less than expected mixed fed with formula and even less with food. At 10-14 weeks, there was a positive association of MF only with parity and access to the child support grant increased the risk for MF.

Key terms: breastfeeding, exclusive breastfeeding, mixed-feeding, infant feeding and sociodemographic factors

LIST OF ABBREVIATIONS

EBF	Exclusive Breastfeeding
HIV	Human Immunodeficiency Virus
LMIC	Low- and Middle-income Countries
IYCF	Infant and Young Child Feeding
MF	Mixed Feeding
NDoH	National Department of Health
SADHS	South Africa Demographic Health Survey
SDG	Sustainable Development Goals
UNICEF	United Nations Children's Fund
WHO	World Health Organisation

DEFINITIONS

Breastfeeding: The child is receiving breast milk, either directly from the breast or expressed. This definition may include exclusive, predominant and partial breastfeeding (World Health Organisation, 2001:8).

Complementary feeding: When breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. The transition from exclusive breastfeeding to family foods – referred to as complementary feeding – typically covers the period from six–24 months of age, even though breastfeeding may continue to two years of age and beyond (World Health Organisation, 2001:8).

Exclusive breastfeeding: No other food or drink, not even water, except breast milk (including milk expressed or from a wet nurse) for six months of life, but allows the infant to receive oral rehydration solution (ORS), drops and syrups (vitamins, minerals and medicines) when medically prescribed (World Health Organisation, 2001:8).

Food: All items recognised for their nutritive or additional dietary values, which are ingested via mouth, swallowed and digested (MacClancy *et al.*, 2007).

Mixed feeding: The infant (under six months of age) is given some breast milk and some artificial feeds, either milk or cereal, or other food or water or formula milk (World Health Organisation, 2001:8).

Over the counter/self-prescribed medications, conventional medicines: A broad domain of healing resources that encompass all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historical period. This includes all such practices and ideas self-defined by their users as preventing or treating illness or promoting health and well-being (Zollman & Vickers, 1999:693).

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CHAPTER 1: BACKGROUND INFORMATION AND RATIONALE FOR THE STUDY

1.1 Introduction

The first-ever Lancet Series on breastfeeding has unequivocally established that breastfeeding (BF) is a cost-effective investment that contributes to a smarter, healthier and a more thriving future for the world (Rollins *et al.*, 2016:491). The World Health Organisation (WHO) recommends that globally, infants should be exclusively breastfed for the first six months of life, with continued BF along with appropriate, adequate and safe complementary foods from age six months up to two years or beyond (WHO/UNICEF, 2003:8). In addition, the directive of the Tshwane Declaration of 2011 and the South African Infant and Young Child Feeding (IYCF) policy has also committed to protect, support and promote exclusive breastfeeding (EBF) regardless of the mother's human immunodeficiency virus (HIV) status (National Department of Health (NDoH), 2013:14; NDoH, 2011:214; WHO, 2016a:28).

Adequate nutrition and appropriate feeding practices during infancy is crucial for child survival, optimal growth and development throughout life (Victora *et al.*, 2016:487). EBF has numerous benefits that continue throughout childhood into adulthood (Bernardo *et al.*, 2013:1); these benefits are, among others, reduced morbidity from diarrhoeal and respiratory illness (Horta & Victora, 2013:43) and social and economic benefits such as cognitive improvements (Rollins *et al.*, 2016:497-498). A study conducted by Hansen (2016:416) supports that when a child is well nourished, the country's economic growth is positively driven. BF also has benefits for mothers, which include quicker recovery from childbirth, delaying ovulation and menstruation, encourages bonding with the infant (Chowdhury *et al.*, 2015:96; Rollins *et al.*, 2016:491), and substantially reduces the risk of both breast and ovarian cancers, type 2 diabetes and heart disease (UNICEF/WHO, 2018:1).

As part of the efforts to decrease child morbidity and mortality, the United Nations (UN) Decade of Action on Nutrition set goals for 2025 at the 65th World Health Assembly (WHO, 2017:1). One of the goals is to increase EBF rate for infants aged six months and younger to 50% at country level (WHO, 2017:1). This is also essential for achieving the Sustainable Development Goals (SDGs) in relation to eradicating hunger, ending

malnutrition, and improving infant and maternal survival, health and their wellbeing by 2030 (Victora *et al.*, 2016:2089; WHO, 2016c:7).

Despite its established benefits across all settings and income levels, EBF for the first six months is no longer a norm in many communities (Rollins *et al.*, 2016:491). Globally, it is estimated that only one in three infants younger than six months of age are exclusively breastfed, and that this current rate (37%) has not improved for the last two decades (Victora *et al.*, 2016:375; WHO, 2016b:1). Similarly, Cai *et al.* (2012:2) showed trend data from low-and middle-income countries (LMIC) that EBF has disappointingly only increased from 33% in 1995 to 39% in 2010. The mix-feeding practices in infants less than six months of age may shorten BF duration and expose the infant to an increased risk of morbidity and mortality (Tang *et al.*, 2015:126). These practices are highly prevalent in LMIC (Black *et al.*, 2013:427). Infants less than six months of age who are mixed fed in LMICs are up to 2.8 times more likely to die than those who are exclusively breastfed, as shown in a systematic review and meta-analysis conducted by Sankar *et al.* (2015:8).

The timely and adequate introduction and use of complementary feeding is important for development and growth (Prado & Dewey, 2014:267; Salam *et al.*, 2015:1117; Victora *et al.*, 2016:387), and the dangers of early introduction includes diarrhoeal and respiratory illness (Horta & Victora, 2013:43). Early introduction of solids and liquids as alternatives to breast milk increases the risk of infant exposure to microbial contaminated foods and fluids, which is especially the case in under-resourced LMICs (Lamberti *et al.*, 2011:1; Tang *et al.*, 2015:126).

Nearly one-third (30.8%) of all pregnant women in South Africa are living with HIV (NDoH, 2017a:3). In the context of HIV, use of antiretroviral (ARV) drugs and appropriate infant feeding practices (such as EBF for the first six months) are a fundamental part of the prevention of mother-to-child transmission (PMTCT) of HIV (NDoH, 2019; Newell, 1999:442). In the context of HIV, it is essential that mothers should not introduce early complementary feeding because mixed feeding has been associated with higher HIV transmission and negative health outcomes (WHO, 2018:12). South African infant feeding guidelines, with relation to PMTCT, are in line with the WHO guidelines on HIV and infant feeding, and recommends that all HIV-infected mothers should breastfeed their infants

exclusively for the first six months of life and receive ARV drugs to prevent HIV transmission (NDoH, 2019).

In South Africa poverty is a reality, and therefore it is another important reason why we should advocate for BF seeing as it is cost-effective and formula is an additional expense for already financially constrained households. Poverty is a major driver of inappropriate infant feeding in South Africa (Iversen *et al.*, 2011:76). Low-income households are not able to buy sufficient infant formula to provide safe and adequate feeds for their infants (Doherty *et al.*, 2006:2425). Most South African infants are mixed fed (47.2%), with a low rate of EBF of only 32% for infants below six months of age (NDoH *et al.*, 2017:29). It is especially important in such settings that appropriate feeding practices are promoted to assist with reducing infant mortality and morbidity (Horta & Victora, 2013:43). Improved BF practices could pay enormous economic dividends, such as reduced healthcare costs, higher intelligence quotients (IQ), greater school attainment and a higher salary in later years (UNICEF & WHO, 2017:2-5).

In South Africa, the early introduction of complementary feeding is a common infant feeding practice (Ijumba *et al.*, 2014:108-109; Siziba *et al.*, 2015:171), with a national EBF prevalence of only 28% for infants aged between 2-3 months (NDoH *et al.*, 2017:29). In a study in KwaZulu-Natal Province by Horwood *et al.* (2018:5), some of the factors associated with higher mixed-feeding practices of infants at 14 weeks of age were reported to be the age of the mother, a higher education level, returning to work or school and being in a higher socioeconomic status. In their study, a higher rate of EBF (49.8%) was reported with a mixed-feeding rate of 23.1%. The study identified mothers being HIV positive, and lack of support for working or schooling mothers to continue giving breast milk when separated from their infants, as challenges to achieving optimal BF practices at 14 weeks.

In a birth cohort study conducted in the peri-urban area of Paarl, located 60 km outside of Cape Town, South Africa, in 2016, low rates of EBF (13%) were found after the age of three months. The study reported frequent early introduction of complementary foods and a concerning pattern of a high consumption of inappropriate snack foods, which increased from 8% at 10 weeks to 19% at 14 weeks (Budree *et al.*, 2017:5). Another birth cohort study conducted in the Limpopo Province, reported a low rate of EBF of 0.4%, as all

infants were introduced to other liquids and food as early as in the first month (Mbhenyane *et al.*, 2017:502).

There are several factors associated with the choice, initiation and duration of BF, such as socioeconomic characteristics of the mother, maternal education (Engebretsen *et al.*, 2014:5; Smith *et al.*, 2017:9-12), latching problems, baby rejecting the breast, mothers being tired of BF and perceived ideas of not having enough milk (Redshaw & Henderson, 2012:24-27). In South Africa, more especially in the North West Province, little is known about sociodemographic factors that are associated with infant feeding practices of infants aged 4 – 14 weeks.

This sub-study aims to identify the mixed feeding practices of a cohort of mothers with infants aged 4-14 weeks in the Tlokwe sub-district in North West Province and these findings are from the analysis of a larger cohort study which aims to investigate mothers with infants aged 0-24 weeks.

1.2 Problem statement

Promotion of optimal BF practices for the first six months of life is the most cost-effective intervention and crucial for child survival, optimal growth and development throughout (Ulak *et al.*, 2012:1). The South Africa Demographic Health Survey (SADHS), published in 2017, has shown high rates of BF initiation, low rates of EBF and high rates of MF early in the first to three months of age (24.9%) (NDoH, 2017:29). These sub-optimal infant feeding practices underpin the poor health outcomes of infants and threatens the South African economy (Sanders & Reynolds, 2017:75). In South Africa, more especially in the North West Province in Tlokwe sub-district, the sociodemographic factors that are associated with MF practices are not known.

1.3 Title

Sociodemographic factors associated with mixed-feeding practices among a cohort of mothers with infants aged 4-14 weeks in Tlokwe sub-district.

1.4 Aim

To identify the mixed-feeding practices in a cohort of mothers with infants aged 4-14 weeks.

1.5 Objectives

- To determine the mixed-feeding practices of a cohort of mothers with infants aged 10-14 weeks in the Tlokwe sub-district.
- To determine the association between sociodemographic factors and mixed feeding in a cohort of mothers with infants aged 10-14 weeks in the Tlokwe sub-district.
- To compare changes in sociodemographic factors and infant feeding practices from 4-8 weeks to 10-14 weeks in a cohort of mothers with infants aged 4 -14 weeks in the Tlokwe sub-district.

1.6 Study team

This study consisted of four members.

The principal investigator of the larger study (Lerato la Mme), Professor H. Salomé Kruger, sub-study supervisor Mrs Chantell B. Witten, co-supervisor Mrs Eloise Swanepoel and the MSc student Mr Nkululeko Milton Semenekane.

Table 1-1. Roles and responsibilities of the team members

Affiliation	Team member	Expertise	Role and responsibility
North-West University (NWU), Centre of Excellence for Nutrition (CEN)	Professor H. S. Kruger (PhD, Dietetics)	Expert in public health nutrition, and infant and young child feeding.	Principal investigator of the larger study Quantitative data analysis supervision.
North-West University (NWU), Centre of Excellence for Nutrition (CEN)	Mrs C. B. Witten (MSc, Dietetics)	Expert in infant and young child feeding with focus on breastfeeding	Student supervisor of mini-dissertation. PhD student. Execution of larger study.
North-West University (NWU), Centre of Excellence for Nutrition (CEN)	Mrs E. Swanepoel (MSc, Dietetics)	Registered Dietitian with special interest in infant and young child feeding	Co-supervisor of MSc student and expert resource on early infant feeding
North-West University (NWU), Centre of Excellence for Nutrition (CEN)	Mr N. M. Semenekane (BSc, Nutrition)	Registered Nutritionist	MSc student on this sub-study. Data collection and data entry for the larger study (3-14 days, 4-8 weeks, 10-14 weeks and 20-24 weeks). Statistical analysis for 4-14 weeks using SPSS package and writing of mini-dissertation.

1.7 Structure of the mini-dissertation

This mini-dissertation for the partial completion of the degree Master of Science in Nutrition is written in article format and presented in four chapters. The mini-dissertation was language edited and referenced according to the NWU Harvard style. It is structured as follows:

Chapter 1: Rationale of the study

Chapter 1 includes background information on BF, EBF and MF for the global and the local South African context. The study aim, objectives, team members and their experience in research are presented.

Chapter 2: Literature review

The literature review is focused on addressing the following aspects of mixed feeding:

- Exclusive breastfeeding rates globally, in LMICs and in South Africa.
- The risks and consequences of mixed feeding infants younger than six months.
- Challenges to achieving optimal feeding for infants younger than six months.

The aim of the literature review was to determine the importance and benefits of EBF for infants and mothers, MF and its impact on child health and development, sustainable development goals and interventions to improve EBF in South Africa.

Chapter 3: Research article

The research article is titled “Sociodemographic factors associated with mixed feeding practices among a cohort of mothers with infants aged 4-14 weeks” and is written according to the specifications of the South African Journal of Child Health using the Vancouver reference style.

Chapter 4: Conclusions, limitations and recommendations

Summary and conclusions of the most relevant findings is presented at the end of the mini-dissertation. Recommendations and limitations are made and discussed for future

studies. The bibliography at the end of Chapters 1 and 2 is for references cited according to the North-West University Harvard style.

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CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter represents an overview of evidence-based literature that discusses the importance of BF and EBF, globally and locally in South Africa. Furthermore, it provides the prevalence of EBF and MF practices and its impact on child health and development, and interventions to improve EBF in South Africa. It also contains the sociodemographic factors that are associated with MF in the first six months of life in infants.

2.2. Breastfeeding benefits, global recommendations and EBF rates

The World Health Organisation (WHO) recommends early initiation of BF within one hour of birth, and EBF during the first six months of life where the infant receives only breast milk and no other fluids or foodstuff. After six months, the infant should continue to be breastfed with appropriate complementary feeding until 24 months of age or beyond to maintain the benefits for both mother and child (WHO/UNICEF, 2003:8). The evidence documented in the Lancet Series on breastfeeding has proven that BF is a worthy investment that contributes to a smarter, healthier and a more thriving future for the world (Rollins *et al.*, 2016:491). Breastfeeding is one of the most effective interventions for survival in newborn, infancy and early childhood (Sankar *et al.*, 2015:3).

Breastfeeding has short and long-term benefits, which include reduced morbidity due to infectious and respiratory diseases in childhood, and reduced risk of childhood obesity and diabetes (Horta *et al.*, 2013:1; Reynolds *et al.*, 2014:887; Victora *et al.*, 2016:475). This is due to the provision of maternal antibodies (Horta *et al.*, 2015:43). Likewise, mothers who exclusively breastfeed their infants, have greater benefits of reducing stress, decreasing risk of postpartum depression and reducing the risk of getting non-communicable diseases, such as diabetes and some cancers (Chowdhury *et al.*, 2015:96; Rollins *et al.*, 2016:491; UNICEF/WHO, 2018:1). Furthermore, BF helps to space pregnancies by delaying onset of menstruation, which is protective of maternal health and nutrition status (WHO, 2018a:1).

Despite the importance of recommendation to EBF the first six months, EBF is no longer a practice in various settings (Bhattacharjee *et al.*, 2019:1205; Rollins *et al.*, 2016:491). Globally, 80% of neonates receive breastmilk, but only about 50% are breastfed within

the first hour of their life, and about 50% of infants younger than six months are exclusively breastfed (Victora *et al.*, 2016:485). Although progress has been made since the 1990s, prior reviews of global trends highlight modest improvements in the prevalence of EBF among infants aged less than six months (Labbok *et al.*, 2006). Unfortunately, early cessation of BF in favour of commercial BF substitutes, introduction of liquids such as water, juices, and tea, needless supplementation and poorly timed introduction of solid, semi-solid and soft foods, often of poor quality, is far too common globally (Labbok *et al.*, 2006).

Global BF trends shown in Figure 2-1 show that the prevalence of poor infant and young child feeding IYCF practices remains high in many parts of the world (Cai *et al.*, 2012:2). The study reported that in 74% of LMICs, the EBF trend has only increased by 4% in 15 years (Cai *et al.*, 2012:2). West and Central Africa were reported to have significantly increased their EBF rate as it doubled, and modest gains were made in Southern and Eastern Africa, where rates increased from 35% in 1995 to 47% in 2010. In this study, researchers reviewed additional data on IYCF practices and noted that improvements were predominantly due to the decreased consumption of water, non-milk liquids and infant formula (Cai *et al.*, 2012:3).

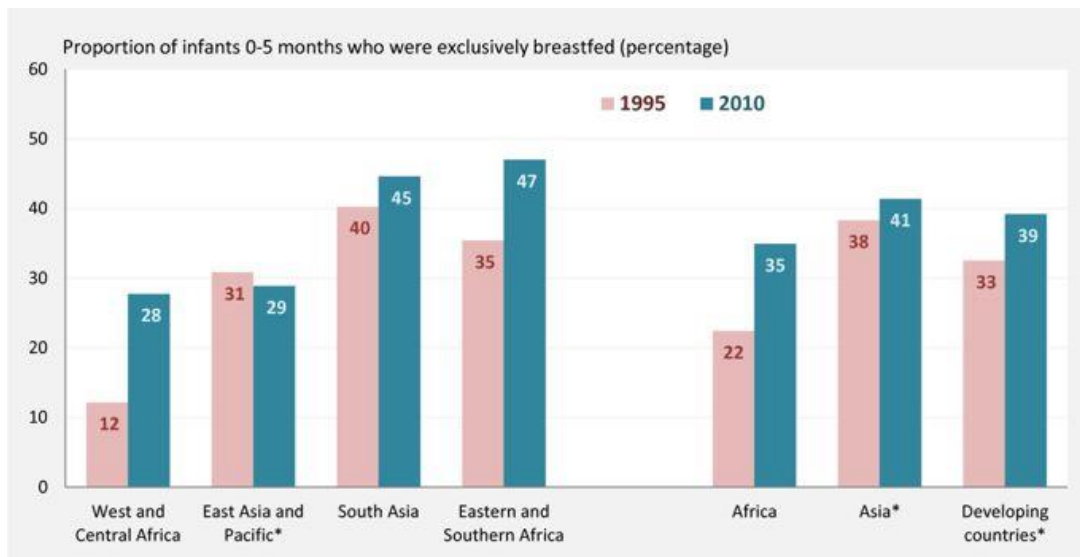


Figure 2-1: Global trends in exclusive breastfeeding among infants aged 0-5 months from 1995-2010 (Source: Cai *et al.* (2012:2))

Literature has shown that high-income countries (HICs) have a shorter EBF duration than LMIC. However, even in LMIC, low percentages (37%) of infants younger than 6 months are exclusively breastfed (Victora *et al.*, 2016:375; WHO, 2016b:1). South Africa as a LMIC has a characteristic shorter duration of BF which decreases with age from 44% for infants age 0-1 month to 24% for infants aged 4-5 months. EBF for infants 0-5 months is low at 32% (NDoH *et al.*, 2017:28).

2.3. South African breastfeeding recommendations and rates

South Africa's IYCF policy is in line with the recommendations from WHO (WHO/UNICEF, 2003:1). According to the South African early childhood review of 2016, a survey that was conducted between 2012 and 2013 in public health facilities, showed that 58% of infants aged 4-8 weeks (HIV positive infants included) were exclusively breastfed (DPME, 2016:14). The review reported 20% of HIV-exposed infants were mixed fed, which put them at risk of HIV transmission (DPME, 2016:14). The most recent South Africa Demographic Health Survey (SADHS) reported that only 36.1% of mothers exclusively breastfeed within the first three months of life and 31.6% continued to exclusively breastfeed up until six months of age (NDoH *et al.*, 2017:28).

Table 2-1 shows a summary of studies reporting EBF and MF data in South Africa over the past 16 years in different provinces. The table shows that MF has been a common practice in all settings across South Africa.

Table 2-1: Summary of studies reporting on EBF and MF in South Africa

Reference	Area	Study population	Sample size	EBF rate	MF introduction	Study design
Kruger and Gericke (2003)	Gauteng	Mothers at PHC	144	Not reported	2-3 months	Qualitative study (FGD)
Mamabolo <i>et al.</i> (2004)	Limpopo	Mothers at PHC	276	1 month: 44% 3 months: 10.1%	1 month: 38.1% 3 months: 57.7%	Prospective cohort study
MacIntyre and Baloyi (2005)	Gauteng	Mothers at postnatal clinic	150	4.6% (9 weeks)	<7 weeks: 37%	Cross-sectional study
Faber and Benadé, (2007)	KwaZulu-Natal	Mothers at PHC	505	11% (4 months)	3.3 months: 23%	Cross-sectional survey
Mushaphi <i>et al.</i> (2008)	Limpopo	Mothers at PHC	185	7.60% (6 months)	<2 months: 15% 3 months: 43.2%	Descriptive and exploratory study
Sibeko <i>et al.</i> (2009)	Western Cape	Mothers at PHC	115	Not reported	≤1 month: 32.0% >1-3 months: 24.0%	Cross-sectional study
Ladzani <i>et al.</i> (2011)	Mpumalanga	HIV-positive mothers at PHC clinics	815	3-6 months: 35.6%	3 months: 12.4%	A cross-sectional survey study
Tylleskar <i>et al.</i> (2011)	Western Cape and KZN	Community-based mother-infant pairs	2579	12 weeks: 18%	Not reported	Multicentre community-based cluster-randomised behavioural - intervention trial

Reference	Area	Study population	Sample size	EBF rate	MF introduction	Study design
Goga <i>et al.</i> (2012)	Western Cape, KZN and Gauteng	PMTCT sites at PHC clinics	883	HIV+ women < 5 weeks: 16.0%; 12 weeks: 8% HIV- women < 5 weeks: 18.0%; 12 weeks:	HIV+ women < 5 weeks: 38.0% 12 weeks: 36.0% HIV- women < 5 weeks: 84.0%; 12 weeks 88.0%	Prospective observational cohort study
Van der Merwe <i>et al.</i> (2013)	Eastern Cape	Mother and infant pairs at PHC clinics	218	6 month 35.70%	From 45 days	Cross-sectional study
Kassier and Veldman (2013)	Free State	Mothers or caregivers	189	Not reported (FF only)	2 months: 12.7% 3 months: 59.2%	Cross-sectional descriptive survey
Goosen <i>et al.</i> (2014)	Western Cape	Community-based mother-infant pairs	140	0-6 months: 6.0%	3 months	Cross-sectional community-based study
Siziba <i>et al.</i> (2015)	North West, Gauteng, Free State and Eastern Cape	Mothers and caregivers at PHC clinics	580	2 months: 60.0% 3 months: 50.0%	2 months: 40.0% 3 months 52.0%	Cross-sectional descriptive study
Van der Merwe <i>et al.</i> (2015)	Mpumalanga	Mother and infant pairs at PHC clinics	435	1-2 months: 68.0%; 2-3 months: 54.0%	1-2 months: 8.0% 2-3 months: 16.0%	Cross-sectional, descriptive and observational in design, with an analytical component

Reference	Area	Study population	Sample size	EBF rate	MF introduction	Study design
Budree <i>et al.</i> (2017)	Western Cape	Mother and infant pairs at PHC clinics	1071	0-6 months: 13.0%	6-10 weeks: 8%; 14 weeks: 19%	Birth cohort study
Jama <i>et al.</i> (2017)	KZN	Mothers at PHC	22	2 months: 10% 3 months: 75	2 months: 9% 3 months: 7%	The qualitative, longitudinal cohort design
Horwood <i>et al.</i> (2018)	Kwazulu-Natal	Mothers and caregivers of infants 14 weeks of age	4172	14 weeks: 44.6%	14 weeks: 23.2%	Multistage random sampling design
Nieuwoudt <i>et al.</i> (2018)	Gauteng	PMTCT sites at PHC clinics	298	<3 months: 46.0%	<3 months: 24.7%	Cross-sectional survey

FF = Formula feeding; FGD = Focus group discussions; KZN = KwaZulu-Natal; PHC = Primary health care; HIV = Human immunodeficiency virus; PMTCT = Prevention of mother-to-child transmission

Table 2-2: The national EBF and mixed-feeding prevalence in SA from 1998-2016

Breastfeeding Practices	SADHS 1998	SADHS 2003	SANHANES 2012	SADHS 2016
EBF				
0 – 3 months	10.4%	11.9%	-	36.1%
0 – 6 months	7.0%	8.3%	7.4%	31.6%
Mixed feeding				
0 – 3 months	72.9%	65.4%	-	39.9%
0 – 6 months	75.8%	65.1%	75.1%	43.2%

EBF = Exclusive breastfeeding; SADHS = South Africa Demographic and Health Survey; SANHANES = South African National Health and Nutrition Examination Survey

From Table 2-1, most of the research in the South African context has shown a very poor initiation of BF, which will result in low EBF rates and high MF practices. However, the difference in BF rates may be explained by the context of different studies and the

different study methods. Table 2-2 shows the National Department of Health's surveys that were conducted and reported on EBF and MF. The first two surveys were reported before the year 2011 when NDoH was still providing free formula, showing low rates of EBF. The EBF rates have been low for the past two decades, with high rates of MF practices. The 2016 National Survey reported a high initiation of BF in the first month and decrease at the third month, with increased MF through to the sixth month (NDoH *et al.*, 2017:29).

2.4. The cost of not breastfeeding

Despite the well-known benefits of BF, global BF rates remain below target (50% EBF) (Rollins *et al.*, 2016:491). Both the Lancet series on breastfeeding and the Global Breastfeeding Collective advised that investing into and scaling up BF to a universal level of 95% could save up to 823 000 lives (UNICEF & WHO, 2017:7; Victora *et al.*, 2016:487). Rollins *et al.* (2016:491) advise that further investments to promote BF, in high-income countries (HIC) and LMIC need to be weighed against the cost of not doing so.

It has been proven that improving child development through BF has resulted in positive economic gains for families as well as at the national level (WHO, 2018a:1). However, inadequate IYCF practices have been increasingly recognised as major contributors to poor infant nutrition that may affect the economy (Onyango *et al.*, 2014:1975). According to the WHO (2018a:1), more than two-thirds of deaths, often associated with inappropriate feeding practices, occur during the first year of life.

2.5. Breastfeeding support in South Africa

The international guidelines on infant feeding for HIV-positive mothers promote EBF (WHO, 2018:16). In 2001, as part of the Prevention of Mother-to-Child Transmission (PMTCT) strategy, South Africa distributed free infant formula milk for infants up to six months at public health facilities (Ijumba *et al.*, 2012:761). However, South Africa has acknowledged the United Nation's (UN) agencies BF recommendations that promote EBF. In 2011, the South African Minister of Health, signed and declared South Africa as a country that actively promotes, protects and supports EBF (also in the context of HIV) (NDoH, 2011:214). The Tshwane Declaration changed South Africa's programme by removing free infant formula from the PMTCT programme. The National Department of Health (NDoH) has made progress in developing and implementing national guidelines,

programmes and policies that intend to support optimal infant feeding agenda (NDoH, 2011:214).

The NDoH specifically committed itself to promoting safe BF interventions with the provision of free life-long antiretroviral drugs to prevent HIV transmission through BF and improve the health and survival of HIV-infected mothers (NDoH, 2011:214). The NDoH further committed to continue promoting human milk banking, fully implementing national regulations on the International Code of Marketing of Breast Milk substitutes, implementation of the Baby Friendly Hospital Initiative (BFHI) and Kangaroo Mother Care (KMC) in all public and private health facilities (NDoH, 2011:214).

In addition, the KwaZulu-Natal Initiative for Breastfeeding Support (KIBS) is one of the initiatives that supports the initiation of BF and ongoing BF in KZN health facilities using skills development, mentoring and evaluation at all levels of the system, including community, PHC facilities and hospitals (Kaldenbach, 2018:56). Furthermore, the project aim was to support and evaluate the development of Human Milk Banks in all 11 districts in KZN. The project includes a cross-sectional survey to determine feeding practices at 14 weeks at baseline and on completion of project activities, as well as a cohort study to investigate determinants of feeding practices (Kaldenbach, 2018:56). This may explain the higher rate of EBF in the province.

South Africa has made slow progress in increasing the national EBF rates over the past years (NDoH *et al.*, 2017:29). Therefore, the NDoH has taken efforts to promote, protect and support BF. The following are initiatives, policies and campaigns that have been implemented in South Africa.

2.5.1. Mother-Baby Friendly Initiative

Since 1994, the NDoH adopted the Mother-Baby Friendly Initiative (MBFI), previously known as Baby-Friendly Hospital Initiative (BFHI), as a key strategy to contribute in reducing the infant and child mortality. This intervention aimed to protect, promote and support the appropriate, safe infant feeding and mother-friendly practices at all levels of healthcare (WHO/UNICEF, 2003) .

Studies have shown that in both LMICs and HICs, the MBFI made a positive impact on increasing the rates of BF at hospital level (Abrahams & Labbok, 2009:6; Beake *et al.*,

2012:151; Pérez-Escamilla & Hall Moran, 2016:377; Van der Merwe *et al.*, 2015:124). Van der Merwe *et al.* (2015:122) compared the infant feeding practices of two sub-districts with the same baby-friendly status: Mbombela with four public health maternity facilities out of five accredited, and Emalahleni with two out of three accredited as being baby friendly. The average age of introduction of complementary food was <1 month, which ranged from birth to 4 months, and was earlier than the recommended age of 6 months in both sub-districts. In comparison, between the sub-districts the EBF rate for all participants in Emalahleni was significantly higher (60%) than that in Mbombela (48%). The mixed breastfeeding was higher with 2% in Mbombela sub-district (22%) than in Emalahleni sub-district (20%) at three months. In conclusion, the study reported that, the BFHI was successful in improving infant-feeding practices for at least the first six months of life. In the Lancet Series for Breastfeeding, Rollins *et al.* (2016:387) reported that 15 studies on MBFI showed increased EBF rates by 49%, and 13 studies on any BF by 66%.

2.5.2. National policies and guidelines that support and promote BF

The national policies, such as the 2013 IYCF policy (NDoH, 2013), the 2013-2017 Roadmap for Nutrition in South Africa (NDoH, 2018) and the 2019 National Consolidated Guidelines for the PMTCT (NDoH, 2019) and the management of HIV in children, adolescents and adults, and for supporting BF in the workplace under the 2030 National Development Plan, also recommended EBF.

2.5.3. The mHealth ‘MomConnect’ campaign

Mobile health, or mHealth, refers to the use of wireless, portable information and communication technologies (ICT) to support health and healthcare. mHealth technologies are increasingly being used to enhance healthcare utilisation, improve the quality of pre- and post-pregnancy care, and as a means of collecting pregnancy and child health data (Lee *et al.*, 2016:2;13).

Like many other LMIC, South Africa is implementing numerous programmes to improve infant health. In 2014, the NDoH launched an initiative to use mobile phone technology to implement MomConnect as a national maternal and child health programme (Seebregts *et al.*, 2016:125-126). MomConnect takes advantage of the fact that most South Africans have access to mobile phone technology. This NDoH initiative aims to support maternal health through the use of cell phone-based technologies integrated into

maternal and child health services. The services are free to the user, and messages are available in all South Africa's 11 official languages. It is voluntary and the pregnant woman can opt out at any time. The service sends messages to the users via SMS which promotes better healthcare for pregnant women and mothers with children younger than 24 months. The SMSes provides information on stage of their pregnancy, reminders for appointments at the local clinic and when to introduce solid foods (NDoH, 2017b:1). The number of MomConnect registrations increased from 150 000 in 2014 to more than 1 500 000 in 2017 (NDoH, 2017b:1).

2.5.4. The Integrated Management of Childhood Illness and Sustainable Development Goals

The impact of child-survival interventions using the Integrated Management of Childhood Illness (IMCI) approach to treat common childhood illnesses, promoting BF and PMTCT contributed to the decrease in under-five mortality in South Africa (Ketsela *et al.*, 2006:92). Although, millennium development goals (MDGs) targeted the assurance of economic freedom and improved quality of life, South Africa was unable to achieve a two-thirds reduction of under-five child mortality rates (StatsSA, 2015:8). Therefore, Sustainable Development Goals (SDGs) made a bold commitment (SDG 3), with regards to BF, of reducing mortality by 12 deaths per 1,000 live births, and under-five mortality to at least 25 deaths per 1,000 live births, within all countries (UNICEF, 2017:1; WHO, 2018b:1).

As indicated in the BF and SDGs factsheet (UNICEF, 2016:1), national governments throughout the world should develop budgets and action plans to achieve the SDGs, and BF should be a priority. BF is also a critical component of the Global Strategy for Women's, Children's and Adolescents' Health (WHO *et al.*, 2016:1-2). The global EBF rate in 2014 was recorded as 38% (UNICEF, 2014:40-41), however, South Africa was among the lowest EBF rates in Africa and the world at large.

In 2018, the NDoH launched the communication and social behaviour change Side-by-Side campaign for children under the age of 5 years. The aim was to ensure that all children in South Africa received the prescribed nurturing care and protection that children need to reach their potential (NDoH, 2018:3). Furthermore, it aimed to increase caregivers' understanding of childcare needed for children's optimal development. This

aimed to increase the knowledge of IYCF of caregivers. This is a social media campaign and shares updated information on IYCF.

There are provincial governments working towards supporting and promoting BF and EBF in South Africa. KwaZulu-Natal Province has improved EBF from 25% to almost 50% through the KZN Initiative for Breastfeeding Support (KIBS) (Kaldenbach, 2018). Furthermore, to promote BF in the Limpopo Province, initiatives have included enhanced training for community health workers, seizing opportunities to involve men and grandparents in BF promotion, and using social media and traditional media, such as local radio shows (Mgolozeli & Shilubane, 2015). In Western Cape Province, a policy framework and implementation plan for Breastfeeding Restoration has been formulated. The restoration plan was aligned with the Tshwane Declaration and included focus areas related to Policies and Practices and Healthcare Practices (SAFoodLab & WCGovernment, 2016). The province has standardised key messages through provincial documents, initiatives and policies as much as possible.

2.6. The determinants of breastfeeding practices

In order to explain differences in BF practices, such as initiation of EBF, Rollins *et al.* (2016:492) presented a conceptual framework (Figure 2-2) that helps to identify the determinants of BF at multiple levels and affects BF decisions and behaviours over time. As shown in Figure 2-2, pregnant women and women with young children are affected in more direct and personal ways in society than are men and the community at large. This is determined by various interactions, attitudes, practices, and information in the three distinct structures affected by the social, cultural, and market context. These in turn are affected by health systems, family, community and the workplace (Rollins *et al.*, 2016:492).

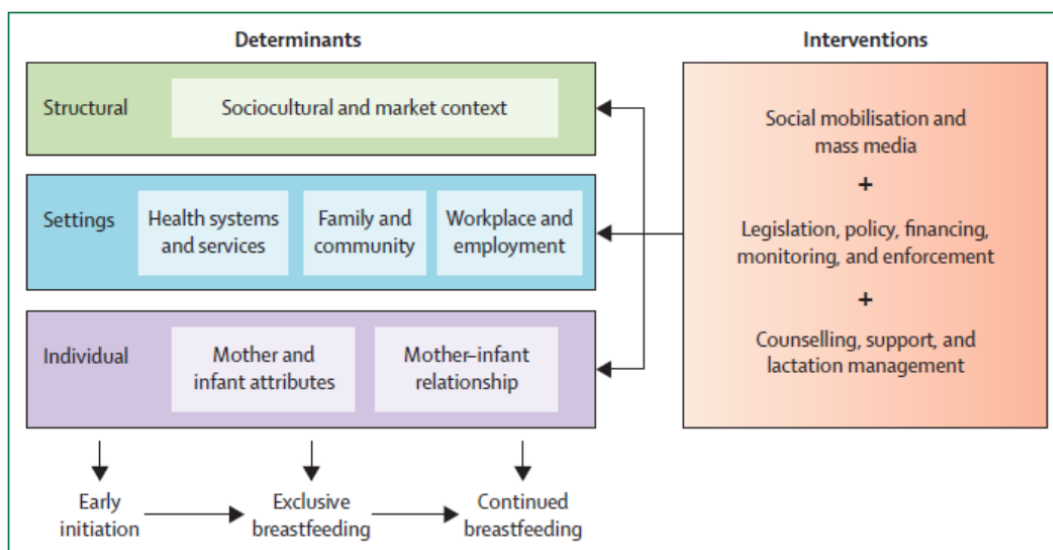


Figure 2-2: The components of an enabling environment for breastfeeding

(Source: Rollins *et al.* (2016:492))

2.7. Factors that affect EBF

Research has shown there are external multidimensional factors that may influence the practice of EBF and its determinants (Alianmoghammad *et al.*, 2018:2; Boccolini *et al.*, 2015:2). These factors, among others, may include different cultural and sociodemographic contexts, the effect of partners, healthcare professionals, obstetric characteristics of the mother and existing community belief (Alianmoghammad *et al.*, 2018:38; Boccolini *et al.*, 2015:2; Karim *et al.*, 2018:2-3).

2.8. Factors that contribute to mixed feeding practices in South Africa

Factors that contribute to MF practices in South Africa as early as the first month are nondisclosure to the family and partner about HIV status, pressure from family members, maternal employment and cultural practices (Jama *et al.*, 2017:10; Madiba, 2015:27; Nieuwoudt *et al.*, 2018:761).

In a qualitative study conducted in Limpopo Province, four themes that determined MF practices emerged. These were lack of knowledge about safe infant feeding practices, cultural and traditional beliefs, perceptions about feeding choices and related risks, and poor support system (Mgolozeli & Shilubane, 2015:93). The study recommended that infants and young children's feeding policies should be everybody's responsibility.

Reasons for early cessation of BF generally, and EBF specifically, differ significantly between individuals and settings. These can include the understanding of the term “exclusive breastfeeding,” cultural practices, and infants who cry or cannot sleep at night (Nor *et al.*, 2012:454).

As previously discussed, in South Africa it has been shown that MF is a norm for mothers with infants aged less than six months (Ijumba *et al.*, 2014; NDoH *et al.*, 2017:108-109; Siziba *et al.*, 2015:17). The possible factors that might contribute to the mothers’ infant feeding decisions in the South African context are reported to be aggressive promotion of infant formula, lack of support for BF in the workplace, teenage mothers leaving their babies to go back to school, lack of family and community support, poor involvement of men in supporting BF and confusion about the risk of HIV transmission and BF (Jama *et al.*, 2017:10).

Nieuwoudt *et al.* (2018:761) mentioned EBF practices among HIV-positive mothers have been attributed to intensive PMTCT counselling over the past decade, with the result that EBF is perceived as an involuntary HIV disclosure. However, Mphasha and Skaal (2019:71) argue that the confusion exists more in the context of HIV, with some health workers encouraging the use of formula and others BF. Thus, knowledge of healthcare professionals is lacking, and they are not giving a uniform message, which is a concern. Consequently, health workers need to communicate clear counselling messages and be able to address the challenges that the mothers are experiencing (Jama *et al.*, 2017:11). If health workers lack the skills and knowledge to provide solutions to problems experienced by BF mothers, this increases the chance of mothers mix feeding their infants (Jama *et al.*, 2017:11).

2.9. Dangers of mixed feeding

It has been reported that MF practices could reduce the economic dividends and increase healthcare costs, reduce intelligence quotients (IQ), poor school attainment and a lower salary in later years (UNICEF & WHO, 2017:2-5). In a meta-analysis of prospective cohort studies conducted by Wang *et al.* (2016:768), it was reported that there was a significant positive association between the introduction of complementary food before four months of age and risk of being overweight or obese in childhood. Therefore, the authors recommended the avoidance of the very early introduction of complementary

foods. It has been shown that being overweight or obese during childhood tends to be accompanied by metabolic syndromes, hypertension or dyslipidaemia, and predicts the risk of diabetes mellitus, stroke, coronary artery disease and several cancers later in life (Liang *et al.*, 2015:89; WHO, 2002:60).

2.10. Sociodemographic factors in relation to BF, EBF and MF

In a systematic review that was conducted by Boccolini *et al.* (2015:1), 36 factors associated with EBF were identified. Of these, the distal factors, which represents an underlying vulnerability for a particular condition or event, were place of residence, maternal age and education to more likely EBF. Those mostly with proximal factors, which represents an immediate vulnerability for a particular condition or event were maternal employment, age of the child and financing of primary health care and associated with EBF.

Studies have shown that BF is influenced by the quality of infant feeding counselling, maternal education and employment, financial implications of formula feeding, family pressure, and cultural practices (Chisenga *et al.*, 2011:151; Madiba & Langa, 2014:265). According to Inoue *et al.* (2012:11), the fact that BF is a social practice and is supported by friends and family have a great impact on the mother's feeding practices.

2.10.1. Maternal age

A review in infant feeding and BF duration found that maternal age was associated with a longer duration of BF (Inoue *et al.*, 2012:11). In this review, the mean age of mothers who chose to formula feed their infants was significantly higher than those who chose to breastfeed. Studies conducted in high-income countries revealed an inverse relationship between maternal age and BF duration (Inoue *et al.*, 2012:11).

2.10.2. Parity

In a cross sectional study conducted by Akter and Rahman (2010:595) in Bangladesh, they found the total number of children a woman has is a significant predictor of the rate and short duration of BF. They further explained that higher parity leads to shorter birth intervals, hence, shorter time available for BF (Akter & Rahman, 2010:599). Another study in Hershey, Pennsylvania, found that multiparous mothers had a longer intended BF

duration (Hackman *et al.*, 2015:159). More primiparous women reported early BF problems and BF at hospital discharge despite reporting less breastfeeding-associated pain during the first week. Multiparous women were more likely to continue EBF through 6 months.

2.10.3. Education level

Hauck *et al.* (2011:266) examined the association between a mother's education level and age of BF cessation before six months. They reported a significant association between low education level of the mother and early BF cessation before six months ($p < 0.001$).

2.10.4. Maternal employment and income

A cross sectional study in Addis Ababa, Ethiopia, reported a significant association between maternal income and EBF (Shifraw *et al.*, 2015:5). The study indicated that when the mother earned a high income, EBF rates decreased. The reason was that mothers with higher income were less likely to stay at home during the daytime and this compromised the EBF practices. In addition, they could afford the infant formula and cow's milk, hence they mixed fed.

2.10.5. Relationship status

In a cross sectional study conducted by Bennett *et al.* (2016:174), fears that BF might lead to an emotional rift and decreased intimacy with partners were reported. In a scoping review conducted by Sihota *et al.* (2019:9), it was reported that for some fathers, finding a space for themselves as important members of BF teams can be challenging. Furthermore, men may feel inadequate due to a lack of BF knowledge, or a belief that their concerns and needs are secondary to those of their partner. The review, therefore, concluded with a highlight of the need for comprehensive BF antenatal support and education designed for fathers of breastfed infants and a wider need to support involved fathering in infant nutrition, as this may act as a catalyst for long-term involvement of fathers in their children's nutrition (Sihota *et al.*, 2019:11).

2.11. Conclusion

In conclusion, literature has established that EBF from 0-6 months of the infant's life is a golden feeding standard, but it is not a universal practice. As in other LMICs, South Africa has a low EBF and the majority of mothers MF their infants. The factors that contribute to these MF practices as early as the first month are, pressure from family members, maternal employment and cultural practices. Although South African NDoH has national guidelines, programmes and policies that intend to drive optimal infant feeding, the rate of MF undermines efforts to reach the 2025 target of 50%. Therefore, intensified efforts to address the drivers of MF are needed to accelerate the EBF rate in South Africa.

CHAPTER 3: ARTICLE

Sociodemographic factors associated with mixed feeding practices among a cohort of mothers with infants aged 4-14 weeks in Tlokwe sub-district

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Background. There is sufficient scientific evidence that supports exclusive breastfeeding (EBF) as a golden global infant feeding practice, but mixed feeding (MF) is still common in different settings. In South Africa, more especially in the North West province, in the Tlokwe sub-district little is known about association between sociodemographic factors and infant MF practices.

Objective. To identify the sociodemographic factors associated with mixed feeding practices in a cohort of mothers with infants aged 4-14 weeks in the Tlokwe sub-district of North West Province, South Africa.

Methods. The study setting was in eight health facilities of the Tlokwe sub-district. Participants consisted of postpartum women with infants aged 4-14 weeks. The sociodemographic tool comprised of questions previously asked in the demographic health survey (DHS) and a 7-day infant feeding and food frequency questionnaire based on the food categories of the standardised World Health Organisation (WHO) 24-hour recall form. Data was analysed using SPSS version 25.0 (IBM, USA). Normal data was expressed as means $\pm$ standard deviation (SD) and skewed data was expressed as median (25th, 75th percentiles) values. Categorical values were expressed

as percentages and frequencies. Chi-square tests and logistic regression were used to analyse the association between sociodemographic factors and MF practices at time point two (10 -14 weeks)

Results. The majority of the mothers were in ages between 25-29 years and 37% had at least two live children. The majority (89.3%) were in a stable relationship, 69.2% were living with their families and 28.9% with the father of the infants. Most of the mothers were unemployed and had monthly household income of R3000 or less (41.5%). The majority (93.1%) were primary caregivers. At the ages between 10-14 weeks, majority of the infants were breastfed (86%) with low EBF rates of 39% and while 20% received formula milk and breastmilk. The EBF rates (39%) were less than MF rates (62%) particularly with BM+water (37%), while BM+food were low with only 16%. There was a significant association between parity and MF analysed with logistic regression. There was also a significant association when change on the infant receiving child support grants at 10-14 weeks with infant feeding practices.

Conclusion. This study reported a high percentage of BF at age 4-8 weeks, although mothers failed to maintain EBF within the six months recommended by WHO. There was an association between parity and MF, and association between changes in receipt of child support grant at 10-14 weeks with infant feeding practices. This confirms that MF is common in Tlokwe setting. Therefore, a strengthened BF education about appropriate infant feeding choices as an important factor in the promotion of infant development and survival for short and long-term should be emphasised.

3.1 Introduction

The evidence documented in the 2016 Lancet Series on breastfeeding has without a doubt proven that breastfeeding (BF) is a lucrative investment that contributes to a smarter, healthier and a more thriving future for the world⁽¹⁾. Furthermore, it is known that BF is one of the most effective interventions for the benefits and survival in newborn, infancy and early childhood⁽²⁾. The World Health Organisation (WHO) recommends that globally, infants should be exclusively breastfed for the first six months of life, with continued BF along with appropriate, adequate and safe complementary foods from age six months up to two years or beyond⁽³⁾.

Breastfeeding has short and long-term benefits which includes reduced morbidity due to infectious and respiratory diseases in childhood, and reduced risk of childhood obesity⁽⁴⁾ and diabetes^(5,6). In spite of these well-established benefits, global exclusive breastfeeding (EBF) rates remain far below global targets⁽¹⁾.

The most recent South Africa Demographic Health Survey (SADHS) showed that 36.1% of the mothers EBF within the first three months of life and 31.6% continue to exclusively breastfeed up until six months of age⁽⁷⁾. Further, it reported 39.9% and 43.2% of mothers MF at age three months and five months, respectively ⁽⁷⁾. Various interventions exist in South Africa to address the poor infant feeding practices. Through the Tshwane declaration, the National Department of Health (NDoH) of South Africa specifically committed to scaling up BF interventions by providing free antiretroviral drugs to prevent Human Immunodeficiency Virus (HIV) transmission through BF, and to improve the health and survival of HIV-infected mothers⁽⁸⁾. Furthermore, the Tshwane declaration committed to establishing human milk banks, fully implementing national regulations on the International Code on Marketing of Breast Milk Substitutes, implementation of the Baby Friendly Hospital Initiative (BFHI) and Kangaroo Mother Care (KMC) in all public and private health facilities⁽⁸⁾.

Unfortunately, early cessation of breastfeeding in favour of commercial breast milk substitutes, introduction of liquids such as water, juices, and tea, needless supplementation and prematurely timed introduction of solid, semi-solid and soft foods, often of poor quality, is far too common as a MF practice⁽⁹⁾. It has been reported that MF practices could reduce the economic dividends and increase healthcare costs, reduce intelligence quotient (IQ), poor school attainment and a lower salary in later years⁽¹⁰⁾. In South Africa, it has been shown that MF is a norm for mothers^(11, 12). This study was undertaken to identify the mixed-feeding practices in a cohort of mothers with infants aged 4-14 weeks in the Tlokwe sub-district of North West Province, South Africa and to determine the sociodemographic factors that is associated with MF practices. Understanding sociodemographic determinants is critical for informing effective evidence-based interventions to improve EBF rates and reduce MF practices and thereby ultimately to improve the nutritional status of infants and young children.

3.2 Methods

Research design

This sub-study, of a larger prospective cohort study, which was designed to follow mothers and examine the rate of discontinuation of EBF from the early BF period (day 3-14), at 4-8 weeks, 10-14 weeks through to the infant age of 20-24 weeks. The study recruited pregnant women in their third trimester or post-partum mothers with infants aged 3-14 days attending eight health facilities in the Tlokwe sub-district of the North West Province. Data was collected from the study

participants during their routine visits to the health facility or at their homes. This sub-study focused only on sociodemographic factors and MF practices at two time points – infants aged 4-8 weeks and 10-14 weeks.

3.3 Study context and technique

The sample size of this study was 159 infants at age 4-8 weeks and 109 infants at age 10-14 weeks. The study sample power was calculated at 80% which is $n=110$ at 10-14 weeks based on the prevalence of EBF of 32% amongst a cohort of infants less than six months of age. The recruitment process was conducted with the support of the Tlokwe sub-district primary health care programme manager and the sub-district primary health care facilities. Sociodemographic data was collected at 4-8 weeks, selected questions were repeated at 10-14 weeks infant feeding and food frequency data was completed at all-time points. The researcher administered the questionnaire by asking the mother to provide sociodemographic background information (living arrangements, type of house, relationship status, employment status and source of income). A 7-day infant feeding and food frequency questionnaire based on the food categories of the standardised WHO 24-hour recall form was used. The researcher administered interview with the mother to provide information on specific foods either solids, pureed and/or liquids given to her infant over the seven days prior to the interview.

3.4 Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee (NWU-HREC) of the North-West University (Ethics reference number: NWU-00030-17-A1-02).

3.5 Data analysis

Data was analysed using SPSS version 25.0 (IBM, USA). Normal data is expressed as means $\pm$ standard deviation (SD) and skewed data as median (25th, 75th percentiles) values. Categorical values are expressed as percentages and frequencies. Data was analysed for associations using Chi-square and logistic regression for adjusting potential covariates.

3.6 Results

The sociodemographic information of the mothers is presented in Table 3-1. A third of mothers were in the age category 25-29 years. More than half (57.2%) spoke SeTswana language. While the majority of the mothers reported being in stable relationships (89.3%), only 28.9% lived with

the father of their infants. The majority (80.5%) of the mothers had some degree of high school education (grade 8-12) and 75.5% were unemployed. Most households received an income of R3000 or less (41.5%) while a third did not know the household income. Only 48.4% were receiving child support grants. The majority (93.1%) of mothers self-reported as primary caregiver. Approximately half (55.3%) reported having received mHealth messages from MomConnect, the National Department of Health (NDoH) programme.

Table 3-1: Sociodemographic profile of eligible mothers of infants aged 4 – 8 weeks (n = 159)

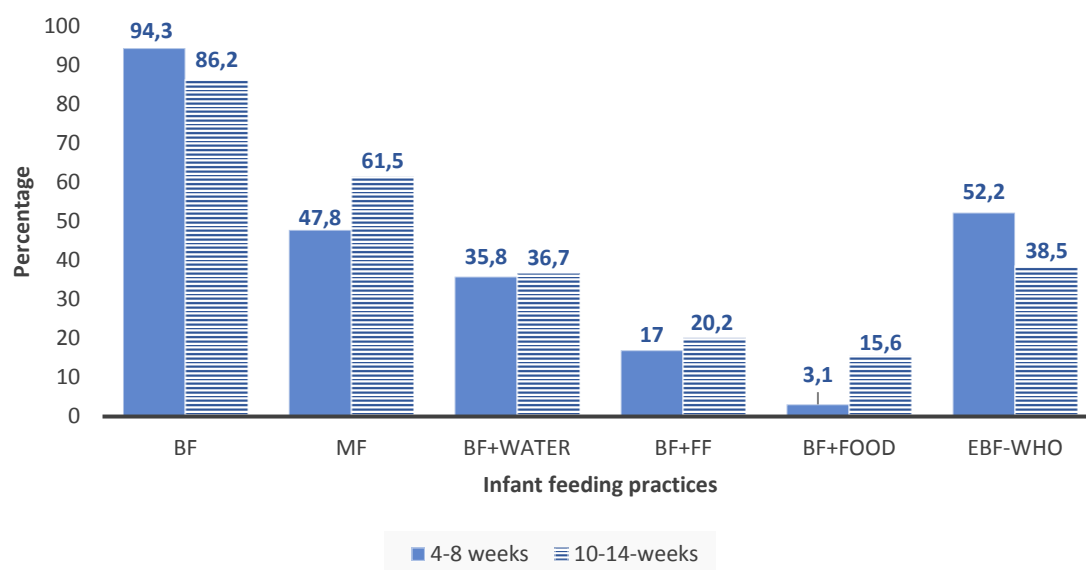
<i>Sociodemographic variables</i>	<i>Categories</i>	<i>n (%)</i>
<i>Age of mothers (years)</i>	19 – 24	45 (28.3)
	25 – 29	52 (32.7)
	30 – 34	36 (22.6)
	>35	26 (16.4)
<i>Ethnicity</i>	Tswana	91 (57.2)
	Zulu	3 (1.9)
	Xhosa	19 (11.9)
	Coloured/Afrikaans	12 (7.5)
	Sotho	20 (12.6)
	Other	14 (8.2)
<i>*Parity</i>	1 child	43 (27.0)
	2 children	59 (37.1)
	3 children	40 (25.2)
	4 or more children	17 (10.7)
<i>Living arrangements</i>	Father of the baby	46 (28.9)
	Family	110 (69.2)
	New partner	3 (1.9)
<i>Relationship status</i>	Stable relationship	142 (89.3)
	Not stable relationship	17 (10.7)
<i>Education level</i>	Grade 0-7, primary school	12 (7.5)
	Grade 8-12, high school	128 (80.5)
	Post-high school training	19 (11.9)
<i>#Employment status</i>	Employed	39 (24.5)
	Unemployed	120 (75.5)
<i>\$HH income (pm) (n = 111)</i>	<R1000 (70 US dollar)	23 (14.5)
	R1001 – R3000 (70 – 200 US dollar)	43 (27.0)
	R3001 – R6000 (200 – 400 US dollar)	26 (16.4)
	>R6000 (>400 US dollar)	19 (11.9)
<i>Child support grants</i>	Received	77 (48.4)
	Not received	82 (51.6)
<i>MomConnect</i>	Received	88 (55.3)
	Not received	71 (44.7)
<i>Mother primary caregiver</i>	Yes	148 (93.1)

*Parity = Mother's recall of the number of the children she has; #Employed = Indicates whether the mother has a job or not; HH = Household;

mHealth = Mobile health; \$HH income = Indicates the mothers who responded with "Do not know" and were excluded.

The mixed-feeding practices of mothers with infants aged 4-8 and 10-14 weeks

Figure 3-1 presents the infant feeding practices analysed by infant age at time point 1 (4-8 weeks) and at time point 2 (10-14 weeks). This includes when infants was BF either with formula milk (BFFF), water (BFwater) or foods (BFfoods). At time point 2, addressing objective 2 of this study, the proportion of infants who were breastfed was (86.2%) with low EBF rates of 38.5% while 20% received formula milk and breast milk. MF increased with infant age. MF rates (61.5%) were BF with water (BFwater 36.7%), while BF with food was 15.6% (BFfood).



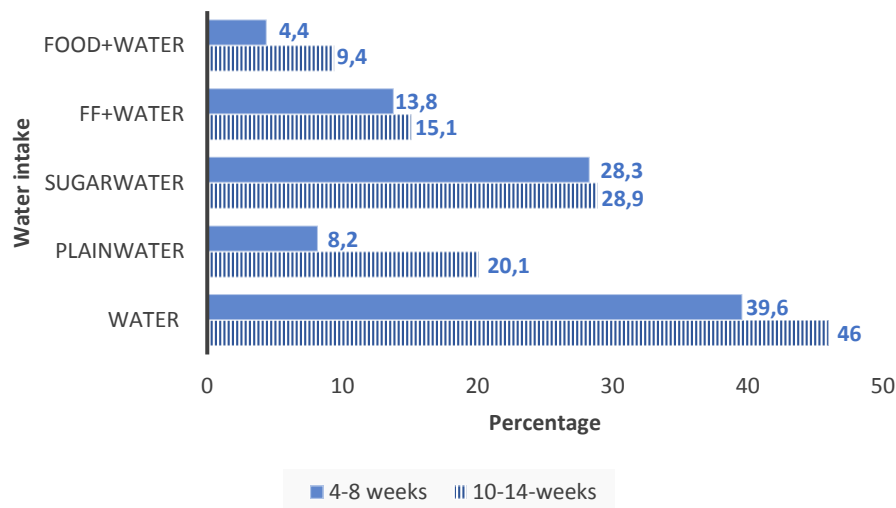
N = total population; BF = Breastfeeding; EBF = Exclusive breastfeeding; FF = Formula feeding; MF= Mixed-feeding; BFWater= Breastfeeding and water; BFFF = Breastfeeding and formula feeding; BFFood = Breastfeeding and food; EBFWHO = Exclusive breastfeeding defined by World Health Organisation

Figure 3-1: Mixed-feeding practices of a cohort (n = 109) of mothers with infants aged 4-8 weeks and 10-14 weeks in the Tlokwe sub-district

The practices of mixed-feeding with water

The mothers who were MF with either water, water and formula or with foods are presented in Figure 3-2. Of the mothers (n=159) who were feeding their infants water at 4-8 weeks, 8.2% gave them plain water. More than a quarter of mothers (29.3%) gave their infants water with added sugar, whereas 13.8% water and formula milk and 4.4% water and food. At the second time point (10-14 weeks), 46% of mothers reported to have given plain water. At this time point (10-14 weeks, n =109), 20.1% of mothers gave plain water and those who gave water with added sugar

increased to 28.9% and those who gave their infants water and formula feeding and water and food increased to 15.1% and 9.4%, respectively.

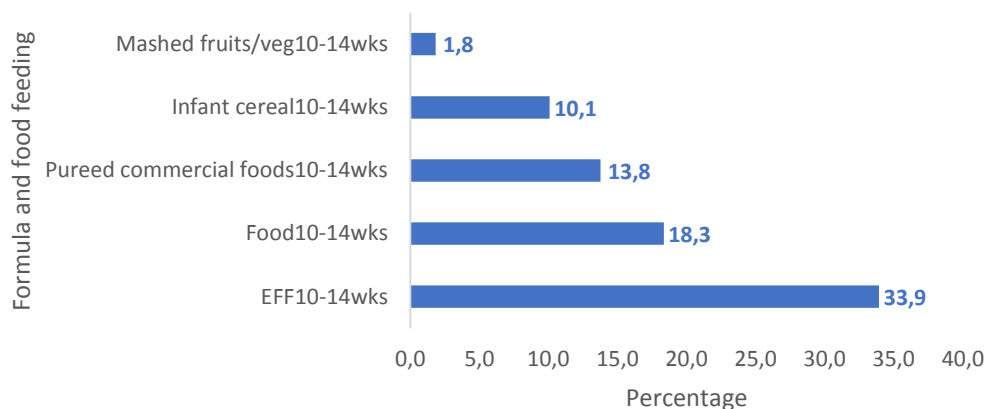


FF = Formula feeding; wks = Weeks

Figure 3-2: The water feeding practices of mothers with infants aged 4-8 weeks (n=159) and 10-14 weeks (n=109)

Formula feeding and food feeding

Figure 3-3 illustrates the formula feeding and food feeding of infants aged 10-14 weeks at time point 2. The percentage of mothers practising exclusive formula feeding at 10-14 weeks was 33.9% as shown in Figure 3-3. Food feeding at 10-14 weeks increased by six-fold from that at 4-8 weeks to 18.3%. Of the food feeding, 13.8% gave pureed commercial food, while 10.1% and 1.8% gave infant cereal and mashed fruits/vegetables, respectively.



EFF = Exclusive formula feeding; Wks = weeks

Figure 3-3: The exclusive formula feeding and food feeding of infants aged 10-14 weeks (n = 109)

Association of the sociodemographic factors and mixed-feeding practices

The association between sociodemographic factors and MF practices are shown in Table 3-2. There was no significant association between any of the sociodemographic variables and MF practices (Table 3-2). A close association with MF was seen between receiving MomConnect messages and age of the mother with p-values of $p=0.103$ and $p=0.123$, respectively. When the Goodness of fit (Hosmer and Lemeshow Test) was applied, an improvement was seen from the full model to final model (chi-square 15.3 and $p=0.009$). The result of this test was a significant association between parity and MF (OR = 0.536; CI = 0.357, 0.805; $p= 0.003$), thus the more children a mother has the more likely she is to MF. The mother as a primary caregiver showed an association with less likely to mix feed although it was not statistically significant ($p = 0.109$). No significant association in other sociodemographic variables and MF practices were found as shown in Table 3-3.

Table 3-2: Association between sociodemographic factors and mixed-feeding among mothers at time point 2 (infant aged 10-14 weeks) (n=109).

<i>Sociodemographic variable</i>	<i>Mixed-feeding</i>	<i>EBF</i>	<i>p-value</i>
<i>Mother's age <25 years</i>	18 (26.9)	6 (14.3)	0.123
<i>Mother's age ≥25 years</i>	49 (73.1)	36 (85.7)	
<i>In a relationship</i>	58 (86.6)	38 (90.5)	0.540
<i>Not in a relationship</i>	9 (13.4)	4 (9.5)	
<i>Living with partner/alone</i>	25 (37.3)	20 (47.6)	0.288
<i>Living with family</i>	42 (62.7)	22 (52.4)	
<i>Employed</i>	15 (22.4)	10 (23.8)	0.864
<i>Unemployed</i>	52 (77.6)	32 (76.2)	
<i>HH income <R3000</i>	35 (52.2)	24 (57.1)	0.808
<i>HH income ≥R3000</i>	18 (26.9)	9 (21.4)	
<i>Receiving Mconnect msg</i>	41 (61.2)	19 (45.2)	0.103
<i>Not receiving Mconnect msg</i>	26 (38.8)	23 (54.8)	
<i>Receiving CSG</i>	42 (62.7)	25 (59.5)	0.741
<i>Not receiving CSG</i>	25 (37.3)	17 (40.5)	
<i>Mother is a primary caregiver</i>	52 (77.6)	37 (88.1)	0.169
<i>Other person is a primary caregiver</i>	15 (22.4)	5 (11.9)	

BF = Breastfeeding; EBF = Exclusive breastfeeding; FF = Formula feeding; n = sample number; CSG = child support grants; Mconnect = Mom connect; HH = household; msg = message

Table 3-3: Association between sociodemographic factors and mixed-feeding among mothers at time point 2 (infant aged 10-14 weeks) analysed by logistic regression (n=109)

	Variables	Odds ratio (Exponent of B)	95% Confidence Interval for Exponent B		p-value
			Lower	Upper	
Step1	Mother's Age	1.034	0.941	1.137	0.487
Full model	Parity*	0.436	0.239	0.796	0.007
	Married (reference)				0.290
	In relationship with the father of the baby	0.379	0.094	1.533	0.174
	Not in a relationship	0.812	0.138	4.767	0.818
	Education	1.454	0.528	4.003	0.468
	CSG(1)	1.942	0.736	5.120	0.180
	HHincome	1.077	0.785	1.478	0.644
	Employment(1)	0.460	0.113	1.873	0.278
	Mcare10(1)	0.219	0.045	1.070	0.061
	mHealth	1.523	0.628	3.690	0.352
	(MomConnect)(1)				
Step 8	Parity*	0.536	0.357	0.805	0.003
Final model	Mcare(1)	0.389	0.123	1.234	0.109

*Parity = Mother's recall of the number of the children she has; HHincome = Household income; n = sample number; mHealth = Mobile health;

Mcare =Mother is a primary caregiver; p≤0.005 significant

Table 3-4 illustrates the sociodemographic factors and infant feeding practices changes in two-time points (4-8 weeks and 10-14 weeks). In all sociodemographic factors, only three changed. Although there was a significant change for child support grants (CSG) with a p = 0.009, no significant change was seen in mother being a primary caregiver and mHealth.

Table 3-4: Changes in sociodemographic factors and infant feeding practices from time point 1 (4-8 weeks) to time point 2 (10-14 weeks)

Sociodemographic Variable	Change to mixed feeding n (%)	p-value
CSG	10 (9.1%)	0.009
Mother is a primary caregiver	7 (6.4%)	0.27
MHealth (MomConnect)	9 (8.5%)	0.52

CSG = child support grants; Mcare =; mhealth = mobile health; p≤0.005 significant

3.7 Discussion

The importance of EBF in improving children's health is well established but poor EBF rates are still prevalent in South Africa⁽⁷⁾. In this study, the duration of EBF decreased as infants grew older. The findings of low EBF at 10-14 (38.5%) weeks are similar to a 2016 national survey (36.1%)⁽⁷⁾. In addition, Budree *et al.*⁽¹³⁾ reported low rates of EBF at 3 months in a cohort study conducted in a peri-urban area, Paarl, South Africa. This indicates that in the South African context, low EBF rates seem to be independent of location.

The study showed an increase in water feeding with infant age (39.6% at 4-8 weeks to 46% at 10-14 weeks). Similar to the findings of Goosen *et al.*⁽¹⁴⁾, this study also found that water was introduced within the first month of life (85%) and nutritive liquids or food within the first 3 months of life. Moreover, both BF and formula feeding mothers supplemented their milk feeds with water. In another South African study from Mpumalanga, it was recognised that mothers self-reported high EBF practices as they were not specifically questioned about providing their infants with water⁽¹⁵⁾. In general, water was given, boiled with either gripe water or added sugar as reported by Goosen *et al.*⁽¹⁴⁾. Furthermore, infants receiving water were also more likely to receive food such as infant cereal or pureed commercial foods. These results agree with the findings found by Goosen *et al.*⁽¹⁴⁾. Early introduction of water, foods or drinks is a cause of concern for good reason as it marks the end of EBF with its protective and nutritious benefits to the infant.

Studies have reported the reason to give these other items include fears about milk insufficiency and perceived reduced milk production because the infant is hungry and not receiving optimal nutrition⁽¹⁴⁻¹⁶⁾. In addition, Nor *et al.*⁽¹⁷⁾ reported that reasons for giving water and traditional medicines is that it was used for 'cleansing of the stomach'. When infants are given water, foods or drinks they may not be hygienically prepared, thus increasing the risk of infections (respiratory infections or diarrhoea) to the infant and may also increase the risk of HIV transmission from the mother to the infant⁽¹⁸⁾. Other liquids and foods given to the baby alongside the breastmilk can damage the already delicate and permeable gut wall of the small infant and allow the virus to be transmitted more easily⁽¹⁸⁾.

Of the sociodemographic factors assessed in this study, parity of the mother was significantly associated with MF practices. Mothers who had two or more children were more likely to mix feed their infants at 10-14 weeks. Ntuli and Modibedi⁽¹⁹⁾ proposed possible reasons for these results

and postulated that mothers may have previously mixed fed their older child who did not seem to have any observable negative consequences. Therefore, MF the second child would be the normative decision. In contrast, two sub-districts that has facilities with Mother-Baby Friendly Initiative (MBFI) accreditation (Mbombela and Emalahleni) in Mpumalanga, mothers with at least one older child were more likely to practise either EBF or exclusive replacement feeding⁽¹⁵⁾.

There was a significant association change in child support grant (CSGs) receipt at time point 2 (10-14 weeks) with MF. Zembe-Mkhabile *et al.*⁽²⁰⁾ reported that the CSGs were the main source of income for most of the families in South Africa , and they would have no means of meeting their children's needs without it. Furthermore, the findings showed that the CSGs was an important source of financial maintenance for all families, irrespective of geographical context, providing for basic needs such as food, schooling and health care This may also explain the significant association of parity, as a mother has more children, the more money she receives from multiple CSGs and therefore has more to spend for inappropriate infant feeding foods.

The results showed the difference in age among mothers practising MF – with older mothers MF more than younger mothers (<25y). Similarly Van der Merwe and colleagues have indicated that older mothers have independent choice than younger inexperienced mothers who are dependent on antenatal care (ANC) and support at home⁽¹⁵⁾.

The data showed no significant association between relationship status, either living with a partner or family with MF. Similarly, in a low-income setting, Goosen *et al.*⁽¹⁴⁾ found no association between marital status and MF (breastfeeding partially). However, a high proportion (84%) of MF was found among unmarried mothers with infants aged <6 months. A high proportion of mothers in this study were in a relationship, but were not living with the father of the child which is in line with the findings of Hall *et al.*⁽²¹⁾. In South African context most of the fathers would usually buy formula milk/pureed commercial foods or drinks or send maintenance money known as ‘paggeld’ to the mother of the infant as an indication of “support”⁽²²⁾. Although Sherriff *et al.*⁽²³⁾ suggests that some fathers may also benefit from attending antenatal education sessions that are held within informal or casual settings, such as pubs or sports clubs; engaging men through conventional health services is often challenging . A study conducted in a high-income country, Tasmania, Australia, showed that fathers generally viewed BF as optimal for their child's nutrition and some described it as healthy, natural, pure, and essential.⁽²⁴⁾

This study did not show an association between mothers who did not receive MomConnect and MF. In contradiction to our findings, a cluster-randomized controlled trial conducted in the Bauchi, Dass, and Ganjuwa sub-districts, Nigeria investigating cell phone messaging and women's adherence to international BF recommendations found the odds of EBF to 3 months as elevated in intervention group ($p = 0.05$) vs control group ⁽²⁵⁾. A systematic review and a meta-analysis titled “ The effectiveness of mHealth interventions, a meta-analysis of three studies on infant feeding” showed that prenatal interventions using SMS/cell phone vs general routine visit improved EBF rates for three months with 52.8% ⁽²⁶⁾.

3.8 Conclusion

In conclusion, the high proportion of mothers MF indicates that MF is still a norm as indicated in other South African context. Furthermore, MF increased with infant age. Most mothers MF with water, formula and food feeding. This study also found a significant association between parity and MF. We further found an association with change from not receiving CSG at point 1 and receiving CSG at point 2 with infant feeding practices. In Tlokwe, mothers especially older multiparous mothers receiving CSG must be encouraged to continue EBF for longer periods, with special focus on BF support throughout the first six months of an infant's age. Health education interventions should be aimed at the women with the sociodemographic factors that seem to be associated with lower BF rates and increased MF. Mothers should be given infant feeding information at antenatal care which is the appropriate period to plan and decide on feeding practices and should be continuously encouraged to BF at postnatal care.

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CHAPTER 4: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

4.1. Introduction

In this chapter, summaries and concluding remarks of the main findings in relation to the aims and objectives of the mini-dissertation are provided. The recommendations for future research on the topic at hand, based on the current findings and existing literature reviewed, are given. The study limitations are also discussed in order to provide guidance for future research.

4.2. Summary of the main findings

The aim of this study was to identify the mixed feeding (MF) practices in a cohort of mothers with infants aged 4 -14 weeks living in the low-income area of Tlokwe sub-district, North West Province, South Africa and the sociodemographic factors associated with MF practices. Changes in sociodemographic factors and infant feeding practices from 4 - 8 weeks to 10 -14 weeks were also compared for this cohort of mothers with infants aged 4 -14 weeks in the Tlokwe sub-district.

The EBF rates agreed with the 2016 national survey. We observed that MF increased with infants' age and confirmed that EBF for 6 months remains low in this area as seen in other South African contexts. Our study revealed that 33.9% of the mothers introduced formula feeding at age 10 - 14 weeks of the infant.

There was a high proportion of inappropriate introduction of water (39.6%), formula feeding (33.9%) and food (18.3%) at 10-14 weeks, which was higher than the national survey 10.3%, 13.0% and 15.8%, respectively (NDoH *et al.*, 2017:29). An increase of water feeding was seen from 4-8 weeks (39.6%) to 10-14 weeks (46%) as mothers tended to use water as part of medicine. In general, water was given boiled with either gripe water or added sugar, as reported by Goosen *et al.* (2014:53). Furthermore, infants receiving water were also more likely to receive food such as infant cereal or pureed commercial foods; this was supported by previous findings from Goosen *et al.* (2014:53).

Our study demonstrated a statistical significant association between parity and MF. Showing that if a mother had two or more children she was more likely to MF; this was further supported by the association of MF with the child support grant (CSG). EBF was

proportionally higher among mothers who were unemployed, in a stable relationship, who had low household income, lived with their family and who did not receive a (CSG). Of all sociodemographic factors analysed, parity and receipt of CSG had a significant association with MF (10-14 weeks). Neves *et al.* (2019:6) supports the finding that increased income gave mothers options to add other foods for their infant's diets.

4.3. Conclusion

In this study, the majority of the mothers did not practice EBF, which is the recommended feeding practice for infants aged zero to six months, therefore the majority of infants were exposed to MF practices, putting infants at risk of possible illnesses and death. From the sociodemographic factors analysed, increased parity significantly increased MF, hence mothers with two or more children should be identified and targeted for additional BF support.

4.4. Study limitations

The limitations of this study were:

- Excluding teenage mothers (under the age of 19 years), because their inclusion This would have allowed the study to report on the practices of teenage mothers who contribute to 15% of the pregnancies in South Africa.
- Not exploring what motivated mothers to mix feed, especially as it is a cultural norm, and interventions are needed to rectify this unhealthy and inappropriate feeding practice.

4.5. Study strengths

- The same infants were followed up over time (prospective cohort observational study) – thus infant feeding data was collected for the same infants at different times. Changes in infant feeding practices over time are thus influenced by fewer sociodemographic factors than when feeding data of different infants at different ages are compared – such as in a cross-sectional survey.
- The interviewers were from the nutrition fraternity and experienced in the field of nutrition. The researchers also shared the same language as the mothers who

were interviewed, and this was a strength as it ensured that what was reported was clearly understood.

4.6. Recommendations

The likelihood of improved rates of EBF in this low-income area of the Tlokwe sub-district will depend on a multi-sectoral approach, i.e. from health facility to families of the mothers at household level. The following are the recommendations that have emerged from this study:

- With the findings of EBF low rates and high MF practices observed, we recommend that research is undertaken to explore the policy-practice gap to gain understanding on what motivates mothers to MF.
- Investigate the quality of infant feeding counselling and support provided by healthcare workers (HCWs) and in the home setting.
- As this study found significant association between parity and mixed feeding, more support should be given to mothers with two or more children to promote EBF.
- MomConnect may need to be strengthened and be made a norm in order to improve the EBF rates by emphasising messages about water and food feeding. There is a need to investigate the impact thereof.
- The involvement of the father of the child, family members and the community is important in BF support. Therefore important messages on EBF advantages should reach them with the inclusion of community health workers (CHWs) as they educate them. Furthermore, to include the fathers, possible regular meetings provided by the local health facility's male nurse should be piloted and explored. In these meetings, the male nurse may provide information on infant feeding practices and possible strategies to solve infant feeding difficulties, especially BF.
- The cultural norms and gender perceptions could be a topic held through an open discussion with emphasis on supporting and protecting BF and the wellbeing of their partners (mothers). In this sense, fathers could also be encouraged to

accompany their partners to their antenatal care visits. This strategy could be advantageous to the fathers as there are interventions available at health facilities, such as male medical circumcision, tuberculosis screening and HIV testing.

- For future studies, this study may be limited by contextual variations (rural vs urban settings). Therefore, there is a need to conduct studies similar to this in other parts of South Africa. By doing this, we will gain the national level understanding of factors that are associated with MF practices.

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Author Guidelines

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Research ethics committee approval

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Preparing an article for anonymous review

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General:

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- Please make your article concise, even if it is below the word limit.
- Qualifications, **full** affiliation (department, school/faculty, institution, city, country) and contact details of ALL authors must be provided in the manuscript and in the online submission process.
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- Units should be preceded by a space (except for % and °C), e.g. '40 kg' and '20 cm' but '50%' and '19°C'.
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- Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'

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If you wish material to be in a box, simply indicate this in the text. You may use the table format –this is the *only* exception. Please DO NOT use fill, format lines and so on.

SAJCH is a Journal on child health, therefore for articles involving genetics, it is the responsibility of authors to apply the following:

- Please ensure that all genes are in italics, and proteins/enzymes/hormones are not.

- Ensure that all genes are presented in the correct case e.g. TP53 not Tp53.

****** NB: Copyeditors cannot be expected to pick up and correct errors wrt the above, although they will raise queries where concerned.

- Define all genes, proteins and related shorthand terms at first mention, e.g. '188del11' can be glossed as 'an 11 bp deletion at nucleotide 188.'

- Use the latest approved gene or protein symbol as appropriate:

- Human Gene Mapping Workshop (HGMW): genetic notations and symbols
- HUGO Gene Nomenclature Committee: approved gene symbols and nomenclature
- OMIM: Online Mendelian Inheritance in Man (MIM) nomenclature and instructions
- Bennet et al. Standardized human pedigree nomenclature: Update and assessment of the recommendations of the National Society of Genetic Counselors. *J Genet Counsel* 2008;17:424-433: standard human pedigree nomenclature.

Preparation notes by article type

Research

Guideline word limit: 3 000 words (excluding abstract and bibliography)

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Where appropriate, sample size calculations should be included to demonstrate that the study is not underpowered. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section,

which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

- May include up to 6 illustrations or tables.
- A max of 20 - 25 references

Structured abstract

- This should be no more than 250 words, with the following recommended headings:
 - **Background:** why the study is being done and how it relates to other published work.
 - **Objectives:** what the study intends to find out
 - **Methods:** must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.
 - **Results:** first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.
 - **Conclusion:** must be supported by the data, include recommendations for further study/actions.
- Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors. It should be able to be intelligible to the reader without referral to the main body of the article.
- Do not include any references in the abstracts.

Here is an example of a good abstract.

Scientific letters/short reports

These include case reports, side effects of drugs and brief or negative research findings.

Guideline word limit: 1500 words

- Abstract: unstructured, of about 100-150 words
- May include only one illustration or table
- A maximum of 6 references

Editorials

Guideline word limit: 1 000 words

These opinion or comment articles are usually commissioned but we are happy to consider and peer review unsolicited editorials. Editorials should be accessible and interesting to readers without specialist knowledge of the subject under discussion and should have an element of topicality (why is a comment on this issue relevant now?) There should be a clear message to the piece, supported by evidence.

Please make clear the type of evidence that supports each key statement, e.g.:

- expert opinion
- personal clinical experience
- observational studies
- trials
- systematic reviews

Review articles

Review articles should always be discussed with the Editor prior to submission.

Guideline word limit: 4 000 words

These are welcome, but should be either commissioned or discussed with the Editor before submission. A review article should provide a clear, up-to-date account of the topic and be aimed at non-specialist hospital doctors and general practitioners. They should be aligned to practice in South and/or sub-Saharan Africa and not a precis of reviews published in the international literature

Please ensure that your article includes:

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Guideline word limit: 400 words

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- Must include a correspondence address.

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Should be offered within the first year of the practitioner's death, and may be accompanied by a photograph.

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Tables

- Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged.
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- *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, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.
- *Internet references:* World Health Organisation. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002. <http://www.who.int/whr/2002> (accessed 16 January 2010).
- Legal references
- Government Gazettes:

National Department of Health, South Africa. National Policy for Health Act, 1990 (Act No. 116 of 1990). Free primary health care services. Government Gazette No. 17507:1514. 1996.

In this example, 17507 is the Gazette Number. This is followed by :1514 - this is the notice number in this Gazette.

- Provincial Gazettes:

Gauteng Province, South Africa; Department of Agriculture, Conservation, Environment and Land Affairs. Publication of the Gauteng health care waste management draft regulations. Gauteng Provincial Gazette No. 373:3003, 2003.

- Acts:

South Africa. National Health Act No. 61 of 2003.

- Regulations to an Act:

South Africa. National Health Act of 2003. Regulations: Rendering of clinical forensic medicine services. Government Gazette No. 35099, 2012. (Published under Government Notice R176).

- Bills:

South Africa. Traditional Health Practitioners Bill, No. B66B-2003, 2006.

- Green/white papers:

South Africa. Department of Health Green Paper: National Health Insurance in South Africa. 2011.

- Case law:

Rex v Jopp and Another 1949 (4) SA 11 (N)

Rex v Jopp and Another: Name of the parties concerned

1949: Date of decision (or when the case was heard)

(4): Volume number

SA: SA Law Reports

11: Page or section number

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From submission to acceptance

Submission and peer-review

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Clinic Target: 40 mothers by end of July 2018

- Pregnant women 34 weeks or more (first time and follow up visits)

- PNC up to 10 days (Mother's details needed)

Who can take part in this study?

Only mothers who are:

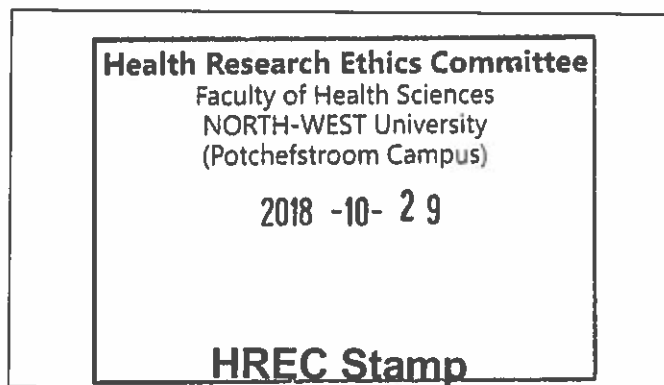
- Delivering their babies **before end of May 2018;**
- Older than 19 years of age and
- Have decided to breastfeed their baby and:
- Live in Potchefstroom area

What will be required from these mothers?

- They will be asked to complete a questionnaire which has 14 questions. This will take 20-30 minutes to complete.
- They will be asked these questions once during their pregnancy and twice after the baby arrives. Before the baby is 14 days old and again when baby is 6 weeks old.
- They may be visited for an interview to talk about how they feel about breastfeeding and about all the things that help them to breastfeed and all the things that make it difficult for them to breastfeed. These visits may take place when baby is 14 days old and again when baby is 6 weeks old.

The Lerato La Mme team will be at the clinic to give an information session so that they can ask the

researcher any questions about any part of this study. It is very important that they are fully satisfied that they clearly understand what this study involves. Also, their participation is **entirely voluntary** and they are free to decline or withdraw from the study at any point in time. If they say no, this will not affect them negatively in any way whatsoever.



Informed consent form for focus group discussion participants

TITLE OF THE RESEARCH STUDY: Mothers' breastfeeding experiences and practices:
An explorative mixed methods study in the sub-district of Tlokwe, North West Province,
South Africa

REFERENCE NUMBERS: NWU-00030-17-S1

PRINCIPAL INVESTIGATOR: Prof Salome Kruger

PROJECT LEADER: Chantell Witten

ADDRESS: North-West University, Potchefstroom, Centre of Excellence for Nutrition

CONTACT NUMBER: 072 737 2235

(If not available Chantell Witten, 071 485 5893)

You are invited to take part in a research study that will study the experiences mothers have of breastfeeding their babies. This research study is being done by a group of researchers who work in the field of nutrition and social behaviour. Please take some time to read the information given herein, which explains the details of this study. Please ask the researcher any questions about any part of this study that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research study is about. Your participation is **entirely voluntary** and you are free to withdraw from the study at any point in time. If you say no, this will not affect you negatively in any way and you will continue to use all services provided at the clinic.

This study has been approved by the **Health Research Ethics Committee of the Faculty of Health Sciences of the North-West University (NWU-00030-17-S1)** and will be done according to the ethical guidelines and principles of the international Declaration of Helsinki and the ethical guidelines of the National Department of Health. It might be

necessary for the research ethics committee members or other authorities to inspect the study records at any point in time.

What is this research study all about?

Many South African mothers do not give their babies breastmilk only up to the age of six months (exclusive breastfeeding). For this reason, the health and wellbeing of most of these babies is not good. We do not fully understand why mothers struggle to exclusively breastfeed their babies from birth until the baby is six months old. In this study we will try to understand how mothers feel about breastfeeding and what mothers say helps and what makes it difficult for them to breastfeed their babies.

This study will:

- Use focus group discussions to help understand mothers' experiences of breastfeeding their babies, especially what helps and what makes it difficult to breastfeed.
- Use focus group discussions to understand what mothers think the health services can do to support them to breastfeed their babies better.

Based on all the information gathered from this study, we will report to Department of Health on how to support more mothers to breastfeed their babies more and for a longer period.

Why have you been invited to participate?

- You are a mother with a baby aged between 6 – 24 weeks
- You are breastfeeding your baby
- You live in the area where the study is taking place
- You attend a clinic that is in the study area

What will your responsibilities be?

- You will be asked to sign a confidentiality agreement before you participate in the focus group discussion.
- You will be asked information about your experience breastfeeding your baby
- Especially, about the things that help you to breastfeed and the things that make it difficult for you to only give your baby breastmilk
- You will be asked your opinions and suggestions for how the health services can better support mothers to breast more and for a longer period.

Will you benefit from taking part in this research?

There are no direct benefits for you participating in this study. However, there are indirect benefits for you as a participant. This study will provide you the opportunity to talk openly about your feelings about breastfeeding your baby. You will be able to share your difficulties and joys about feeding your baby.

You may be happy to know that researchers and Department of Health can learn from your difficulties so that that they can help more mothers to breastfeed their babies for a longer period.

Table 7.1b: Direct benefits for the participants whom participate in the proposed study as well as indirect benefits for researchers and the breastfeeding programme in South Africa

Direct benefits for participants	Indirect benefits for researchers or the community
No direct benefits	You will help researchers to learn about the experience of breastfeeding in communities like where you are living.
	You will help the Department of Health on how better to help future mothers to breastfeed their babies more and for a longer period.

Therefore you will help to improve breastfeeding in South Africa.

Are there risks involved in your taking part in this research?

There are medium risks, but the benefits are more than the risks. There will be a safe and protected space for you to talk openly about your feelings and experiences of breastfeeding your baby. The Table below lists some anticipated risks and what we will do to lessen these risks to you during your participation in the study.

Table Possible risks involved in the proposed study as well as proposed precautions to minimize these anticipated risk

Risk	Proposed precautions
You may become stressed or feel discomfort by the questions and discussion on how you feel and how you feed your baby.	The focus group discussion will be lead by an adult woman who also breastfed her babies and understand the feelings of mothers with little babies. She will be trained to ask questions and allow you to explain and answer in your own words. She will listen to your discussion, so that you may talk freely about any fears that may arise during the discussion. Any discomfort you may have will be referred to the appropriate health service.
You may have a negative feelings about the discussion with the researchers	The researchers will act in a calm way if any conflict or tension arises, to support participants.

The focus group discussion may take a long time	FGD will be held within the agreed time of 45mins. Participants will not be separated from their babies and will be encouraged to care for their babies during the sessions
As a focus group discussion participant the other women in the group will also hear your answers to the questions	As a participant in the focus group discussion, you will be participating with other mothers from your clinic and/or your area. Please do not discuss the information of other mothers and do not share information about yourself that you would not normally share in public. All members of the focus group will sign confidentiality agreements and promise not to talk about what the other mothers said, but the researchers have no control over how focus group members may talk about the information shared in the focus group discussions.

What will happen in the unlikely event of some form of discomfort occurring as a direct result of your taking part in this research study?

- Should you have the need for further discussions after the unlikely event of distress or agitation with the focus group discussion, an opportunity will be arranged for you to visit a professional at your nearest clinic or hospital.

Who will have access to the data?

- Only the researchers will have access to the data
- Your name and personal contact details will not be shared with anyone
- The data will not be specific to you nor can it be traced back to you.
- The focus group discussion will be conducted at a venue close to your house in the study area.
- Confidentiality will be ensured by coding the information from the focus group discussions.
- Reporting of findings will be anonymous –no name or personal details of you.
- No data or quotes will be directly linked to you as an individual
- All data will be password protected and kept safe and secure by storing paper copies in locked cupboards in the project leader's office, at the Centre of Excellence for Nutrition (NWU) and the computer data will be kept safe in an office at the university.
- As soon as information has been typed on the computer, it will be deleted from the recorders. Data will be stored for 7 years.

What will happen with the data?

- This is a once off collection and data will be used by the researchers of the North-West University.

Will you be paid to take part in this study and are there any costs involved?

No, you will not be paid to take part in the study. There will be no costs involved for you, if you do take part.

- You will receive light refreshments when you are participating in the discussions
- At the end of the discussion, you will receive a Thank you gift.

Is there anything else that you should know or do?

- You can contact the principle researcher on 018 2992482 or the co-researcher on 018 2992473 if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee via Mrs Carolien van Zyl at 018 299 2089; carolien.vanzyl@nwu.ac.za if you have any concerns or complaints that have not been adequately addressed by the researcher.
- You will receive a copy of this information and consent form for your own records.

How will you know about the findings?

- An information flyer will be made available at all the participating clinics and information sessions will be held at the clinics.
- Findings will also be shared in a report to the Department of Health
- Findings will be shared at scientific meetings and published in journals
- Findings will also be shared with civil societies working in the interest of women, and maternal and child health.

Declaration by participant

By signing below, I agree to take part in a research study titled: **Mothers' breastfeeding experiences and practices: An explorative mixed methods study in the sub-district of Tlokwe, North West Province, South Africa**

I declare that:

- I have read this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions to both the person obtaining consent, as well as the researcher and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) on (*date*)/....../2018

.....
Signature of participant

.....
Signature of witness

Declaration by person obtaining consent

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter.

Signed at (*place*) on (*date*)/....../2018

.....
Signature of person obtaining consent

.....
Signature of witness

Declaration by researcher

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter.

Signed at (*place*) on (*date*)/...../2018

.....
Signature of researcher

.....
Signature of witness

SOCIO-DEMOGRAPHIC AND HEALTH QUESTIONNAIRE

(All information in this questionnaire is confidential).

Interviewer:

1. CW	2. BO	3. NM	4. NS	5. SK	6. Other
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Date of interview

Y	Y	M	M	D	D

Participant number

Clinic Number 1-8	Participant Date of Birth						Participant# 1-30	
	Y	Y	M	M	D	D		

Section 1: Socio-demographic questions

1. Date of birth of the study participant (the mother)

Y	Y	Y	Y	M	M	D	D

2. What is your ethnicity (cultural group) and what language is spoken in your home?

Circle the appropriate response as given by the mother				
Ethnicity			Language spoken at home	
1	Tswana		1	Setswana
2	Zulu		2	IsiZulu
3	Xhosa		3	IsiXhosa
4	Coloured		4	Afrikaans
5	Sotho		5	SeSotho
6	Other (specify)		6	English
7	No response		7	Other

3. How many children do you have including this baby?

1	2	3	4 or more
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4. Was your baby delivered via normal birth or by C-section?

1	2
C-section	Normal delivery

5. What is your baby's date of birth

Y	Y	Y	Y	M	M	D	D

6. What was your baby's birth weight (Road to Health Booklet)

7. What is your current relationship status?

1	2	3	4	Other
Married	Not married but in a relationship with the father of the child	Single and not currently in a relationship	Single but in a new relationship (Not the father of the child)	

8. What was the last standard/grade you passed?

Codes	Education	Mark (X) only one response
1	No school education	
2	Primary School Last standard or grade:	
3	High school Last standard or grade:	
4	Tertiary Education Further Educational Training	
5	University education Last year completed	
6	Other	

9. I will ask you a few questions about the house you are living in now.

	<i>Code</i>	1	2	3	4	5
9.1	What material is your house built from?	Brick	Zinc / shack	Prefabricated wooden housing	Container	Other (Specify)
9.2	Most of the time, where do you get drinking water from? (Tick one)	Own tap in or outside the house	Communal tap	Borehole, Well	Jojo tank	Other (Specify)
9.3	What type of toilet does your house have? (Tick one)	Flush	Pit	Bucket, Pot	VIP	Other (Specify)
9.4	What fuel do you use most of the time for cooking (You can tick more than one)	Electric	Gas	Paraffin	Wood/ Coal	Open fire
9.5	Besides you and the baby, how many other people sleep in the same room with you (Tick one)	0	1	2	3	4 or more

10. Who are you living with currently?

1	2	3	4	5
Living with the father of the baby	Living with a new partner (not the baby's father)	Living with family	Living on your own	Other

11. Who looks after your baby most of the time?

1	2	3	4	5	6
Me myself (the mother)	Family member	Day care mother	Crèche or ECD center	Domestic worker	other

12. Have you registered your baby for the Child Support Grant?

1	2
Yes	No

13. What is your current source of income?

Codes	Source of income	
1	No income (unemployed)	
2	Self-employed: small business, sales	
3	Wage earner e.g. cleaner/domestic worker	
4	Salaried monthly paid	
5	Social grant	
6	Other (specify).....	

Section 2: Health questionnaire/ medical history

Has a doctor or nurse told you (diagnosed) that you have any of the following:

2.1 High blood pressure

1	2
Yes	No

2.2 Diabetes or high sugar levels in the blood

1	2
Yes	No

2.3 Asthma

1	2
Yes	No

2.4 Epilepsy

1	2
Yes	No

3. Postnatal care

3.1 Do you smoke?

1	2
Yes	No

3.2 In the past 7 days have you drunk any alcohol?

1	2
Yes	No

3.3 In the past 7 days, did you face any breastfeeding difficulties?

1	2
Yes	No

3.3.1 If yes, what type of breastfeeding difficulty did you have?

3.4 Did you seek any help for your breastfeeding difficulties?

1	2
Yes	No

3.5 From whom did you seek help for your breastfeeding difficulty?

1	2	3	4	5
Family member	Friend or peer	Clinic	Pharmacy	other

3.6 Are you receiving messages from MomConnect?

1	2
Yes	No

Thank you for your time. This interview will be repeated when your baby is 6-weeks old.

Infant Feeding and Food Frequency Questionnaire

Interviewer:

1. CW	2. BO	3. NM	4. NS	5. SK	6. Other
----------	----------	----------	----------	----------	----------

Date of interview

Y	Y	M	M	D	D

Participant number

Clinic Number 1-8	Participant Date of Birth						Participant# 1-30	
	Y	Y	M	M	D	D		

1. Are you breastfeeding your baby?

Yes Go to question 1.1	No Go to question 2
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1.1 **Besides breastmilk** are you giving your baby any other milk to drink?

Yes Go to question 2	No Go to question 3
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2. What milk feeds, (other than breastmilk), are you giving your baby? **[Do not read the options]**

		Coding		How often (select one option only)		
		Yes 1	No 2	1 Every day	2 2-6x/week	3 Once a week
2.	Questions and frequency only if response is YES					
A	Infant / baby formula (tinned formula milk). Brand:					
B	Powdered milk (Klim/Nespray/Numel) Brand:					
C	Fresh / Long-life cow's milk Brand:					
D	Drinking Yoghurt					

	Brand:					
E	Flavoured milk (Steri-stumpie / milo) Brand:					
F	Sweetened tinned milk (condensed milk) Brand:					
G	Other milk drinks (specify)					

3. In the last seven days, have you given your baby water to drink?

Yes Go to question 4	No Go to question 5
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4. Was it plain water or did you add anything to the water? How often did you give your baby water to drink? **[do not read the options]**

	Questions and frequency only if response is YES	Coding		How often (select one option only)		
		Yes 1	No 2	1 Every day	2 2-6 x/week	3 Once a week
4.1	Did your baby get any					
A	Boiled plain water					
B	Sugar or honey water					
C	Other water mixtures (specify)					

5. In the last seven days, besides milk feeds and water, have you given your baby anything else to drink?

Yes Go to question 6	No Go to question 7
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6. What drinks (other than milk feeds and water, did you give your baby, in the past seven (7 days) **[do not read the options]**

	Questions and frequency only if response is YES to question 5	Coding		How often (select one option only)		
		Yes 1	No 2	1 Every day	2 2-6x/week	3 Once a week
6	Did your baby get any					
A	Tea (e.g. Rooibos)					
B	Fruit juice					
C	Juice drinks or cordial (e.g. Oros)					
D	Water based clear soup/ both (No blended veg or starch)					
E	Thin porridge in a bottle (specify)					
F	Fizzy drinks (e.g. flat Coke)					
G	Any other liquids Specify:					

7. In the past seven days, have you given your baby any food to eat?

Yes Go to question 8	No Go to Question 9
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8. What foods have you given your baby in the last seven (7) days? **[do not read the options]**

	Questions and frequency only if response is YES	Coding		How often (select one option only)		
		Yes 1	No 2	1 Every day	2 2-6x/week	3 Once a week
8	Did your baby get any					
A	Pureed commercial Baby foods (specify)					
B	Infant cereals e.g. Nestum					
C	Other packaged baby foods (e.g. biscuits)					
D	Porridge (any type)					
E	Bread (white or brown)					
F	Specify spread on bread					
G	Rice					

H	Mashed potatoes e.g. smash					
I	Mashed vegetables (specify)					
J	Mashed fruits					
K	Liver, heart (organ meats)					
K	Red meat (specify)					
L	Poultry (chicken, duck) specify					
M	Fish (tin and fresh) specify					
N	Eggs					
O	Sweets/Chocolates					
P	Chips (e.g. Flings)					
Q	Biscuits (e.g. Marie) specify					
R	Grubs, snails or worms specify					
S	Other foods specify					

9. In the past 7 days, have you given your baby any vitamins?

Yes	No
Go to question 9.1	Go to question 10

9.1 What vitamins are you giving your baby? **[do not read the options]**

	Questions and frequency only if response is YES	Coding		How often (select one option only)		
		Yes	No	1	2	3
9.1	Did your baby get any	1	2	Every day	2-6x/week	Once a week
A	Scotts emulsion (specify)					
B	Other (specify)					

10. In the past 7 days, have you given your baby any medicines?

Yes Go to question 10.1	No Go to question 11
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10.1 What did you give your baby? **[do not read the options]**

	Questions and frequency only if response is YES	Coding		How often (select one option only)		
		Yes	No	1	2	3
10.1	Did your baby get any	1	2	Every day	2-6x/week	Once a week
A	Dutch medicines (specify)					
B	Colic medicines (Gripe water)					
C	Traditional medicines					
d	Other (specify)					

11. In the past 7 days, have you given your baby any ORS (oral rehydration solution) or ORT (Oral Rehydration Therapy)

Yes Go to question 11.1	No End of questionnaire
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11.1 What did you give your baby? **[Do not read the options]**

11.1	Questions and frequency only if response is YES	Coding		How often (select one option only)		
		Yes 1	No 2	1 Every day	2 2-6x/week	3 Once a week
A	ORS mixture					
B	Raw custard (maizena water)					
C	Flat Coke					
d	Other					

Thank you for your time. This interview will be repeated when your baby is 6-weeks old.