FEEDING PRACTICES AND STUNTING IN CHILDREN AGED 0-23 MONTHS IN ZAMBIA: ANALYSIS OF THE ZAMBIA DEMOGRAPHIC AND HEALTH SURVEY 2013-14 DATA

By

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DECLARATION

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DEDICATION

To all Zambian children who have died due to malnutrition - children who have directly or indirectly suffered consequences of malnutrition; to an expecting and breastfeeding mother whose nutritional status and feeding practices impact on child stunting.

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ABSTRACT

Stunting is currently one of the prominent health and welfare problems among infants and young children in Zambia. Feeding practices have a bearing on the nutritional status of children. This study aimed to establish the association between feeding practices and stunting among children between 0 and 23 months old in Zambia. Bivariate analysis and logistic regression were applied to the 2013/14 Zambia Demographic and Health Survey data using the Statistical Package for the Social Science (SPSS). Stunting was found to be increasing with age; reaching the peak (12.8%) among children in the age group 18 -23 months; and lowest (0.4%) among children below one month. Stunting was higher among male children (20.1%) than their female counterparts (15.5%, $p < 0.001$). Children who were very small at birth had higher odds of being stunted compared to those who were very large, (AOR = 5.61, 95% CI: 2.50, 12.58). Children whose mothers were had 46% higher chances of being stunted than their counterparts whose mothers had normal body size (AOR = 1.46, 95% CI: 1.07, 2.00). Stunting levels significantly declined with improved wealth status from the poorest to the richest (18.7% among the poor and 9.6% among the rich). Among the morbidity variables, the cough was significantly associated with stunting (AOR = 0.77, 95% CI: 0.62, 0.96). The study recommended that there is a need to initiate and support existing programs that promote breastfeeding education to mothers; and the need to improve the living conditions and livelihood of the poorest who are worst affected by stunting. The study also recommended a multisectoral approach to interventions against stunting by taking stock of all relevant actors in the area of nutrition and narrow the interventions to specific drivers of stunting across sectors.

KEYWORDS: children (0-23 months), stunting, feeding practices, ZDHS, Zambia

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ABBREVIATIONS

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CSO	Central Statistical Office
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization of the United Nations
HAZ	Height-for-Age Z-scores
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IYCF	Infant and Young Children Feeding practices
MOH	Ministry of Health
PAHO	Pan American Health Organization
SDG	Sustainable Development Goal
TDRC	Tropical Diseases Research Centre
UNICEF	United Nations Children's Emergency Fund
UNSCN	United Nations System Standing Committee on Nutrition
UNZA	University of Zambia
UTH	University Teaching Hospital
WFP	World Food Programme
WHO	World Health Organization
ZDHS	Zambia Demographic and Health Survey

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Malnutrition in all its forms continues to hamper the lives and opportunities of millions of people worldwide. An estimated number of 805 million people worldwide are chronically undernourished (FAO, IFAD, WFP, 2014); 161 million under 5 children are stunted (UNICEF, WHO, World Bank, 2014), while 42 million children under the age of 5 are overweight and obese (WHO, 2014). Improvements in nutrition will contribute significantly to reducing poverty, and achieving health, education, and employment goals. Many countries have made significant progress towards reducing hunger and malnutrition, but much remains to be done to achieve global and national nutrition targets. Achieving the goal of optimal nutrition encompasses the prevention, control and treatment of undernutrition, micronutrient malnutrition and overweight and obesity, promoting optimal care and feeding practices (for example, exclusive breastfeeding) and dietary diversity, and addressing food safety and quality, and ensuring access to and use of health services and a safe, hygienic environment. The co-occurrence of undernutrition, micronutrient malnutrition and obesity and overweight poses challenges and underscores the reality that malnutrition is a global phenomenon, affecting virtually all countries (IFPRI, 2014).

Malnutrition is one of the most prominent health and welfare problems among infants and young children in Zambia. Malnutrition has significant health and economic consequences, the most serious of which is an increased risk of death. Other outcomes include an increased risk of illness and a lower level of cognitive development (MEASURE DHS+ Program, 2003). More than one-third of child deaths worldwide are associated with undernutrition (Lancet, 2008).

For this study, malnutrition was considered in terms of stunting (height-for-age index- an indicator of linear growth retardation and cumulative growth deficits) according to the World Health Organization standard (WHO, 2006). Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) are considered short for their age (stunted) and are chronically malnourished. Children who are below minus three standard deviations (-3 SD) are considered severely stunted. Stunting reflects a failure to receive adequate nutrition over a long period and is also affected by recurrent and chronic illness (CSO, 2014).

Stunting generally occurs before the age of two. It is due to a chronic lack of nutrients during a child's first 1,000 days, from conception to their second birthday. Stunting often starts before birth if the mother is herself malnourished and cannot pass on enough nutrients to her unborn child. Poor feeding practices, poor food quality, and frequent infections are often associated with stunting. Whatever the cause, the damage caused by stunting is irreversible. It significantly increases the risk of childhood death.

1.2 Problem Statement

Malnutrition is the primary cause of under-five deaths in Zambia, attributable to up to 52% (MOH, 2011). More specifically, child stunting is a major nutritional problem in Zambia. Stunting in Zambia is among the highest in Africa and the world. Despite having shown a slight decline from 45% in 2007 to 40% in 2014 to 35% in 2019 (CSO, 2014; 2019), the levels of stunting remain high. Zambia was ranked among the 21 countries in the world with the highest stunting prevalence - where moderate or severe stunting is at least 40% (UNICEF, 2013). According to the Zambia Demographic and Health Survey 2013-14, the children under age 6 months in Zambia are introduced early to complementary foods; with 17% under age 6 months and 39% of children age 4-5 months consuming solid or semisolid foods in addition to breast milk (CSO, 2014). This practice is in contrast with the WHO recommendation that exclusive breastfeeding should be practiced from birth to 6 months of age and introduce complementary foods at 6 months of age while continuing to breastfeed. It is also added that in settings where environmental sanitation is very poor, waiting until even later than 6 months to introduce complementary food might reduce exposure to food-borne diseases (WHO, 2009). Even though breastfeeding in Zambia is nearly universal at 98% of children at age 2 years; only 11% of children aged 6-23 months are fed appropriately based on recommended infant and young child feeding (IYCF) practices. Besides, 8% of non-breastfed children age 6-23 months were given milk or milk products, 34% were given foods from four or more food groups, and 25 percent were fed the minimum number of times in the 24 hours preceding the survey. Only 4% of non-breastfed children were fed following the three recommended IYCF practices (CSO, 2014).

Based on the above, this study aimed to investigate how stunting in children is influenced by various feeding practices while taking into consideration the socio-economic dynamics.

1.3 Rationale of the Study

The rationale of the study is to investigate the association between feeding practices and stunting among children in Zambia. The literature highlights that Zambia is among the countries with the highest child stunting in Africa. Stunting has shown so minimal decline while the levels remain high even among the rich people.

Since it has been noted that stunting starts even before birth (the critical 1, 000 days); it can be understood that two issues affect child stunting: the factors affecting child stunting pre-birth; and factors affecting child stunting post-birth (see the conceptual framework in Figure 1).

Once the feeding practices that are significantly associated with stunting are identified, the generated information will be useful for the Ministry of Health and agencies that are involved in child health, nutrition and child survival. The information from this study will be relevant in terms of informing policy change, redirecting or amplifying efforts towards interventional programs and resource allocation to programs that are aimed to improve child feeding practices thus mitigating stunting. The study also will contribute to the body of knowledge on feeding practices and child stunting.

1.5 Research Questions

1. Are socio-demographic factors likely to influence stunting?
2. Are children who are introduced to breast milk immediately after birth less likely to be stunted than those who are introduced after some days?
3. Are children who are exclusively breastfed less likely to be stunted?
4. Are children who received pre-lacteal feed (given liquids other than breast milk in the first three days) more likely to be stunted than their counterparts who haven't?
5. Are children with shorter duration of breastfeeding more likely to be stunted than those with longer breastfeeding periods?
6. Are children whose mothers are underweight (body mass index below $16Kg/m^2$) likely to be stunted?
7. Are children who have had an infection (diarrhoea/fever/cough) likely to be stunted?

1.6 Research Objectives

1.6.1 General Objective

To establish the association between feeding practices and stunting among children aged 0 to 23 months old in Zambia.

1.6.2 Specific Objectives

1. To examine the influence of socio-demographic factors on stunting.
2. To establish the association between stunting and early initiation of breastfeeding.
3. To examine the relationship between stunting and exclusive breastfeeding.
4. To establish the relationship between stunting and pre-lacteal feeding.
5. To establish the association between stunting and the duration of breastfeeding.
6. To examine the association between stunting and mother's body mass index (BMI).
7. To determine the relationship between stunting and the infections (diarrhoea/fever/cough).

CHAPTER TWO: LITERATURE REVIEW

This chapter discusses the literature on various studies addressing feeding practices and their influence on the nutritional status of children. The literature was disaggregated based on the conceptual framework presented at the end of this chapter (in Figure 1). Broadly, literature was reviewed on feeding practices in the context of maternal socio-demographic characteristics and the presence of infections in influencing child stunting.

2.1 Maternal socio-demographic characteristics

The socio-demographic characteristics surrounding the mother may have a bearing on the nutritional status of a child.

Marital status

The marital status of the women is associated with household headship and another social and economic status of the women that affect their nutritional status (Woldemariam & Genebo, 2002). Being female and unmarried status determine the poor nutritional status (Maseda, et al., 2018). A study in Zambia showed underweight was significantly associated with the mother's marital status (Katepa, et al., 2015).

Maternal education

There is profound evidence on the association between maternal education level and child nutritional status. In Nigeria, children of non-formally educated mothers were found to be associated with malnourishment. On the other hand, women with formal education had children with lower stunting and underweight probabilities. The impact of literacy may be more important for processing the information needed to perform healthy child feeding and to protect children against undernutrition (Onubogu, et al., 2016; lckes, et al., 2015).

Household wealth index

On the community level, the economic status may influence the extent of the dual burden, with obesity increasingly affecting the already undernourished poor. The dual burden of malnutrition poses a threat to children's health in low- and middle-income countries (Tzioumis & Adair, 2014).

Maternal employment status

Maternal employment status is believed to have a certain influence on the nutritional status of children. There are varying pieces of evidence proving whether the mother's employment status has a negative or positive influence on the nutritional status of children.

A study in Malaysia found that both children of employed and unemployed mothers did not achieve the recommended nutrient intake. However, a child's weight, body mass index (BMI), energy, protein, and fat intake were significantly correlated with maternal working hours. The length of maternal working hours was found to be associated with the child's nutritional status (Shuhaimi & Muniandy, 2012). In contrast, in Ethiopia, it was found that children born from mothers who were educated and had a salary from employment had a better nutritional status. Normal maternal BMI was associated with wasting of children, while maternal height was associated with children's stunting (Negash, et al., 2015).

Other evidence proved no association between maternal employment status and the presence of stunting in children 6 to 36 months of age. However, children of mothers doing unpaid work were at higher risk of stunting (Cha´vez-Za´rate, et al., 2019).

Mother's body mass index (BMI)

A woman who has poor nutritional status as indicated by a low Body Mass Index (BMI), short stature, anemia, or other micronutrient deficiency has a greater risk of obstructed labor, of having a baby with low birth weight, of producing lower quality breast milk, of mortality due to postpartum hemorrhage, and of morbidity of both herself and her baby (Croft, et al., 2018).

A study in Bangladesh revealed that the mother's body mass index (BMI) was found to be one of the most important determinants related to the nutritional status of children. In this study, it was shown that the risk of being severely stunted and moderately stunted consistently decreases with the increase in mother's BMI. Children whose mothers were thinner (BMI < 17.0) were at 2.5 times likely to be stunted than normal children whose mothers were overweight (BMI $\geq$ 25.0) (Kamal, 2011). This consistently agreed with a study done in Haramaya district, eastern Ethiopia which showed that mothers with BMI < 18.5 were more likely to have stunted and underweight children than their counterparts (Yisak, et al., 2015).

In Zambia, a mother's BMI was found among the risk factors most associated with stunting in children aged 6–23 months aside from other factors such as child's age, access to treated water, and child's morbidity (Marinda, et al., 2018).

Maternal age

For social and biological reasons, women of the reproductive age are amongst the most vulnerable to malnutrition. Women's age and parity are important factors that affect maternal depletion, especially in high fertility (Woldemariam & Genebo, 2002). This agrees with what was found in Ghana where children whose mothers were aged 25–34 years were less likely to be stunted compared to those whose mothers were aged 15–24 years (Darteh, et al., 2014).

Birth order

Birth order is a strong underlying determinant of HAZ: children born fourth in the family or later had HAZ-scores 0.379 units lower than first-born children (Saxton, et al., 2016). It is expected that parents give less attention to older children when they give birth to a new child who needs much attention and care (Woldemariam & Genebo, 2002).

Birth Size (or Weight)

Improving birth weight contributes to reducing child growth faltering in the first two years of life, resulting in less stunting at two years of age, which is eventually reflected in increased adult height. Improved cognitive function and intellectual development across the life-course are associated with increased birth weight and reduction in stunting. The negative effects of lower birth weight on intellectual development are accentuated in lower socioeconomic groups and can be mitigated by improved home environments (UNSCN, 2010).

A Nigerian study documented that the mother's perception of the baby's size at the time of birth, which serves as a proxy for birth weight, played a crucial role in determining the growth potential of the baby. Babies that were perceived by their mothers to be small or average in size at birth tended to be more predisposed to having stunted and severely stunted growth when compared with larger babies. This reduced birth size could be due to poor maternal nutrition during the pregnancy period (Akombi, et al., 2017).

This finding was consistent with what was established in Southern Ethiopia where children who had born with small size were 2.10 times more likely to be stunted than children born larger. Conversely, children who had normal birth size were 70% less likely to develop stunting as compared to children with large birth size (Moges, et al., 2015). The prenatal causes of child suboptimal growth are closely related to maternal undernutrition, and are evident through low maternal BMI which predisposes the fetus to poor growth leading to intrauterine growth retardation; this, in turn, is strongly associated with a small birth size and low birth weight (Akombi, et al., 2017).

Place of residence

Place of residence is also an important risk factor for stunting, with rates consistently higher in rural than in urban areas (de Onis & Branca, 2016). This is consistent with the results in the Zambia Demographic and Health Survey where children residing in the urban areas were slightly less likely to be stunted than children living in rural areas, 36% and 42%, respectively in 2014. In 2019, a similar pattern continued where stunting levels were relatively less in urban than rural areas, 32% and 36% respectively (CSO, 2014; CSO, 2019).

Ethnicity

An ethnic aspect is an important factor in shaping practices including feeding practice, which subsequently may influence the nutritional status of children and health overall. Zambia is ethnically diverse comprising of about 72 ethnic groupings.

There is evidence that cultural and ethnic heritage has a tremendous impact on nearly all health-related decisions and practices, including infant feeding (Meredith, 2013). Despite this evidence, there are limited research studies done in Zambia on the influence of ethnicity and culture on feeding practices and nutritional outcomes while controlling for socioeconomic factors. Elsewhere, studies have been done in this thematic area.

A study in the United States documented that ethnicity, race, and culture can play an important role in our identities and our health behaviors, including dietary and physical activity behaviors that may potentiate obesity. Type and exclusivity of feeding differed by race/ethnicity. Hispanic mothers were more likely to report any breastfeeding compared with black mothers and white mothers. The practice of feeding their infants with solid food (primarily in the form of cereal in the bottle) was far more common among non-Hispanic black and non-Hispanic white families when compared with Hispanic families (Perrin, et al., 2014).

In Tanzania, a study was done to quantify disparities in child health based on self-four reported ethnicity (Maasai, Sukuma, Rangi, and Meru). Evidence revealed striking ethnic differences in child nutritional status as indicated by anthropometric measurements. Maasai children were at a considerable disadvantage, while Meru children were at a relative advantage. Nearly three times as many Maasai children were stunted compared to Meru children, and almost double as many when compared to Sukuma children (Lawson, et al., 2014).

Religion

Diet plays an integral role in the religious customs of a variety of faiths. For many religions, this role is manifested in the form of specialized fasting periods. During the Greek Orthodox Christian fasting periods, the daily intakes of protein, fat, saturated fat, trans-fatty acids, riboflavin, and calcium are reduced (Bloomer & Trepanowski, 2010). Among the Orthodox and Muslims, all adults are expected to fast during fasting times. Pregnant and breastfeeding women are also expected to fast, except for potentially a short period immediately after postpartum. Among the Muslims, infants and children are exempt from fasting while pregnant and lactating should fast at least until mid-day. For women who are from giving birth, they are exempted from fasting for ten to forty days after birth (Bazzano, et al., 2018).

Various studies confirm the influence of religion on the nutritional status of children. It is acknowledged that certain social, ethnic and religious groups are disproportionately affected by child malnutrition. The social belonging of persons also acts as an additional aggravating factor for nutritional inequity. The religious affiliation of a child´s family provides information on the likely dietary restrictions encountered by a child in his or her early growing years or on the child´s exposure to fasting in the womb (Miah, et al., 2016; Sabharwal, 2011; Brainerd & Menon, 2015).

2.2 Prevalence of Stunting

The World Health Organization classifies, the severity of stunting is classified as (a) low prevalence: when stunting is below 20 percent; (b) medium prevalence: when stunting is 20 to 29 percent; (c) high prevalence: when stunting is 30 to 39 percent; and (d) very high prevalence: when stunting is above 40 percent (WHO, 2010).

Nutrition status, stunting, is a robust indicator of vulnerability to chronic food insecurity. According to ZDHS 2013-14, the overall stunting rate of children under age 5 in Zambia is at 40%, showing a slight decline from 45% in the 2007 ZDHS. At the provincial level, Northern has the highest proportion of stunted children (49 percent), while Copperbelt, Lusaka, and Western have the lowest proportions (36 percent each) (CSO, 2014). According to the results from the 2018 ZDHS, stunting in Zambia currently stands at 35% indicating a decline of 5%

since 2014 (Zambia Statistics Agency, MOH and ICF, 2019).

Zambia is one of the countries in the world with high child stunting. Most vulnerable are rural households, which highly depend on seasonal food production and survive on diets that deficient in a variety of micronutrients. Despite the slight decline in stunting, the levels are still high and it remains a major source of concern for Zambia (Mukuka & Kuhlgatz, 2015).

According to the 2013-14 ZDHS, stunting rates are very high among children whose size at birth is very small (62.1%); children aged 24-35 months (54%); children whose mother's body mass index (BMI) is less than 18.5 (50.4%); children in households with lowest wealth quintile (47.3%); children whose birth interval is less than 24 months (46.1%); and children whose mothers have no education 44.7% (CSO, 2014).

2.3 Trends in Stunting in Zambia

The percentage of children who are stunted increased from 46% in 1992 to 53% in 2002 and thereafter declined to 45% in 2007 and further declined to 40% in 2014 (CSO, 2014).

In 2010, stunting was very high at 47%. Statistics show that children residing in urban areas had better nutritional status than their counterparts in rural areas. For instance, stunting was 48.3% and 42.3% for rural and urban children respectively. In terms of stunting by Province, the rates were high in Northern (53%), Eastern (52%) and Copperbelt (51%); while Southern and Lusaka Provinces recorded the low stunting rates, both at 40 % each. The incidence of stunting was 40% for children from non-poor households – meaning that poor feeding practices equally exist, even in non-poor households; but 47% in poor households and 52% in extremely poor households, (CSO, 2012).

2.4 Feeding Practices

Inappropriate feeding practices are a major cause of the onset of malnutrition in young children. Children who are not breastfed appropriately have repeated infections, grow less well, and are almost six times more likely to die by the age of one month than children who receive at least some breast milk. The incidence of malnutrition rises sharply during the period from 6 to 18 months of age in most countries, and the deficits acquired at this age are difficult to compensate for later in childhood (WHO, 2002). The inappropriate feeding practices can be simply understood as those feeding practices which do not conform to the WHO recommendations.

According to WHO recommendations (WHO, 2017), mothers are discouraged from giving any food or fluids other than breast milk, unless medically indicated. It also recommended that mothers need to be supported to recognize their infants' cues for feeding, closeness, and comfort. It is further guided that for preterm infants who are unable to breastfeed directly, non-nutritive sucking and oral stimulation may be beneficial until breastfeeding is established.

Stuebe and Schwarz (2010) concluded that breast-feeding should be acknowledged as the biological norm for infant feeding. This is because formula-feeding places mothers and infants at increased risk of a broad spectrum of adverse health outcomes, ranging from infectious morbidity to chronic disease.

2.4.1 Breastfeeding

Breast milk is not only a completely adapted nutrition source for the newborn but also an impressive array of immune-active molecules that afford protection against infections and shape mucosal immune responses (Borba, et al., 2018). Literature reveals that breastfeeding is shown to be the best natural resource to improve childhood nutrition as it has an important role in the prevention of different forms of childhood malnutrition, including wasting, stunting, over- and underweight and micronutrient deficiencies. For this reason, it is encouraged that promotion and support of breastfeeding are important to prevent childhood morbidity and mortality (Biesalski & Black, 2016). A study in Zambia by Zykaka (2017) investigated parental knowledge and compliance with recommended breastfeeding guidelines and how it influenced breastfeeding practices and the nutritional status of infants aged 1 to 23 months. It was revealed that the main cause of malnutrition was the use of wrong breastfeeding practices such as giving infants other foods before age of six months as well as relying on family members for information on infant breastfeeding practices and not health personnel.

2.4.2 Initiation of Breastfeeding

Provision of mother's breast milk to infants within one hour of birth is referred to as "early initiation of breastfeeding" and ensures that the infant receives the colostrum, or first milk, which is rich in protective factors. The skin-to-skin contact between mother and infant shortly after birth helps to initiate early breastfeeding and increases the likelihood of exclusive breastfeeding for one to four months of life as well as the overall duration of breastfeeding (WHO, 2019). Early initiation of breastfeeding sometimes may depend on whether the mother delivered at home or in the health facility. A study in Nigeria revealed that mothers who delivered in a health facility were significantly more likely to initiate breastfeeding within one hour of birth as compared to mothers who delivered at home (Berde & Yalcin, 2016). Evidence from Zambia showed that some mothers in the rural areas reported to have squeezed out and discard first milk (colostrum) as it was thought to be dirty (Katepa, et al., 2015).

Muchina and Waithaka (2010) established a significant association between the time of initiation of breastfeeding after childbirth and stunting. It was observed that children who were breastfed after one hour of birth were twice as likely to be stunted as compared to those who breastfed within one hour of birth. Reasons for late initiation of breastfeeding after childbirth such as inability of the child to suck, insufficient or no breast milk production among others revealed a lack of awareness of the rationale behind early initiation of breastfeeding.

2.4.3 Prelactoreal feeding

Prelactoreal feeding is defined as giving newborns liquids or foods other than breast milk before breastfeeding is established. This practice is identified as a barrier to optimal breastfeeding and increases the risk of diarrhoea and acute respiratory tract infections in infants (Tongun, et al., 2018). A cross-sectional survey in Ethiopia showed that pre-lacteal feeding is one of the factors or feeding practices that explain the risk of stunting in children. Children who received pre-lacteal feed were found to be at a significantly higher risk of stunting than children who did not. The higher risk of stunting among children who were fed prelactoreal feed could be due to its negative impact on breastfeeding and when children are not breastfed appropriately, they at high risk of undernutrition (Teshome, et al., 2009).

In Zambia evidence showed divided views on prelactoreal feeding. Whereas some mothers were of the view that there is no need to give anything before starting to breastfeed, others felt there was a need to give a little water to make the throat wet because the milk at that time has not yet started coming out. Although it was reported that prelactoreal feeds were given to the newborn infants, all the mothers initiated breastfeeding at birth (Katepa, et al., 2015). In this piece of literature, already there is a mixture of feeding breastfeeding and prelactoreal feeding at a very stage of infants.

Prelactoreal feeding remains widely practiced in Sub-Saharan Africa with an overall prevalence of 32·2 % despite the negative impact of prelactoreal feeding on the growth and development of children (Berde & Ozcebe, 2017).

2.4.4 Exclusive Breastfeeding

Exclusive breastfeeding means that the infant receives only breast milk. No other liquids or solids are given – not even water – apart from oral rehydration solution, or drops or syrups of vitamins, minerals or medicines. According to WHO recommendations infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development, and health (WHO, 2019).

To consider children who are breastfed from mothers living with HIV, the WHO recommends that mothers known to be living with HIV should be provided with lifelong ART or ARV drug prophylaxis interventions to reduce HIV transmission through breastfeeding. It is further suggested that mothers are known to be living with HIV (and whose infants are HIV uninfected or of unknown HIV status) should exclusively breastfeed their infants for the first six months of life, introducing appropriate complementary foods thereafter and continue breastfeeding for the first 12 months of life (WHO, 2016).

The efficacy of the new WHO guidelines on maternal combination antiretroviral therapy (cART) during pregnancy, throughout breastfeeding for 1 year and then cessation of breastfeeding (COB); this approach during the first six months of exclusive breastfeeding has been demonstrated, but the efficacy of this approach beyond six months is not well documented (Ngoma, et al., 2015). In a trial conducted in Lusaka, Zambia to evaluate the effect of early breastfeeding cessation on growth found that early growth is compromised in uninfected children born to HIV-infected Zambian mothers. Continued breastfeeding partially mitigates this effect through 15 months. However, the effect of breastfeeding on growth in HIV-exposed infants was not well described (Arpadi, et al., 2009). A study in Tanzania which aimed to determine factors affecting exclusive breastfeeding and the relationship between feeding practices and the nutritional status of infants found that exclusively breastfed children had significantly higher Height-for- Age Z score than children who were not exclusively breastfed (Safari, et al., 2013)

Despite breastfeeding prevalence being high in Zambia (98%); there are 73% of children less than age 6 months are given breast milk only but not exclusively breastfed for the full 6 months as required (CSO, 2014). This puts young children at risk of infections like diarrhoea which inhibits good growth. Moreover, foods introduced mainly consist of plain starch porridge which has fewer nutrients than breast milk, thus contributing to early growth faltering (NFNC, 2015).

A cross-sectional study in Ethiopia introduced another element to breastfeeding, which is the involvement of fathers in the practice of breastfeeding. Infant and young child feeding promotion efforts have largely targeted mothers, but fathers have often been overlooked. Everyone has a role in helping women overcome the barriers to breastfeeding success. Fathers can be one of the most powerful allies in helping aspiring breastfeeding mothers succeed (Abera, et al., 2017). This is in line with what Tembo et al. (2015) observed that support received from spouse, mothers, and grandmothers may have had gaps due to insufficient knowledge of exclusive breastfeeding among them.

2.4.5 Duration of Breastfeeding

Breastfeeding has many health benefits, both in the short term and the longer term, to infants and their mothers. Cognitive development is improved by breastfeeding, and infants who are breastfed and mothers who breastfeed have lower rates of obesity. Other chronic diseases that are reduced by breastfeeding include diabetes (both type 1 and type 2), obesity, hypertension, cardiovascular disease, hyperlipidemia, and some types of cancer (Binns, et al., 2016). A study which aimed to assess whether breastfeeding duration was associated with intelligence quotient (IQ), years of schooling, and income at the age of 30 years; revealed that the durations of total breastfeeding and predominant breastfeeding (breastfeeding as the main form of nutrition with some other foods) were positively associated with IQ, educational attainment, and income (Victora, et al., 2015).

While the benefits of breastfeeding are well known, the association between the duration of breastfeeding and nutritional health outcomes tend to vary. Evidence from Pennsylvania shows that initiation and duration of breastfeeding are associated with fewer reported acute illnesses at 6-months of age and diarrheal illness and/or constipation episodes at 6 and 12 months. Children who received breastmilk for longer than 6 months also had lower odds of overweight/obesity or obesity at age three years (Pattison, et al., 2019).

Modifiable behavioral factors, such as mother's attitudes, breastfeeding plan, and norm are found to be stronger predictors of breastfeeding duration compared with physiological factors, such as breastfeeding exclusivity and initiation (Susiloretni, et al., 2019). In a study among children under five years old in Zambia, duration of breastfeeding was established to be among the major predictors of stunting, aside from sex and age of the child; mother's age and level of education; wealth status; improved source of drinking water (Mzumara, et al., 2018).

Prolonged breastfeeding is sometimes linked to stunting, for instance in the study among Nepalese children suggests that the poorest households and prolonged breastfeeding (more than 12 months) led to increased risk of stunting and severe stunting (Tiwari, et al., 2014). A study in Ethiopia clarifies that the evidence of adverse growth effect disappears when nutritional adequacy of complementary foods is controlled. The severity of stunting due to inadequacy decreases as breastfeeding is prolonged (Atsheha, et al., 2015).

2.4.6 Complementary Feeding

Complementary feeding is defined as the process starting when breast milk alone or infant formula alone is no longer sufficient to meet the nutritional requirements of infants, and therefore, other foods and liquids are needed, along with breast milk or a breast-milk substitute. The target range for complementary feeding is generally taken to be 6–23 months (WHO, 2008).

In Sri Lanka, a study to determine the nutritional status of children aged 6-24 months and describe the associated feeding practices; found that stunting and underweight were common in children who received complimentary food before completing 6 months. However, there was no statistically significant relationship between the age of introduction of complementary feeding and the nutritional status (Ubesekara, et al., 2015).

Therefore, children should not be introduced too early and too late to semi-solid and solid foods, but rather follow the guidance by the World Health Organization.

The growth of children often declines with the introduction of complementary foods around the age of 6 months and continues to decline up to 24 months that have greater implications for health during adulthood. Poor breastfeeding and child feeding practices augmented by a very early introduction of nutritionally inadequate and contaminated complementary foods are major factors contributing to persistent child malnutrition (Muhimbula & Issa-zacharia, 2010).

The age interval beginning at about six months is an especially vulnerable time for children when they are being weaned from breast milk to conventionally used cultural foods (Hayes, et al., 2017). What is clear is that complementary feeding requires strict adherence to the timeliness, feeding appropriate and nutritious complementary foods.

The World Health Organization (WHO), amplifies that complementary feeding should be timely, meaning that all infants should start receiving foods in addition to breast milk from 6 months onwards. It should be adequate, meaning that the complementary foods should be given in amounts, frequency, and consistency and using a variety of foods to cover the nutritional needs of the growing child while maintaining breastfeeding (WHO, 2019).

2.4.7 Frequency of feeding complementary foods

Because of their efficacy in promoting growth in severely or moderately malnourished infants and their ease of use, simple production, and relatively low price, ready-to-use fortified spread (FS) or micronutrient-fortified maize–soy flour (likuni phala [LP]) might have a potential as complementary foods in the sub-Saharan setting. In Malawi, a study was conducted to compare the efficacy of FS with that of a traditionally used complementary food in promoting health and preventing the development of undernutrition. Results suggested that one-year-long complementary feeding with FS does not have a significantly larger effect than LP on mean weight gain in all infants, but it is likely to boost linear growth in the most disadvantaged individuals and, hence, decrease the incidence of severe stunting (Phuka, et al., 2008).

In a longitudinal study of complementary food intake in a large cohort of Zambian infants, revealed that greater amounts of dietary diversity and intake of iron-rich/iron-fortified foods at 6 months of age were key independent predictors of subsequent growth to 18 months (Mallard, et al., 2014).

Increase the number of times that the child is fed complementary foods as he/she gets older. The appropriate number of feedings depends on the energy density of the local foods and the usual amounts consumed at each feeding. For the average healthy breastfed infant, meals of complementary foods should be provided 2-3 times per day at 6-8 months of age and 3-4 times per day at 9-11 and 12-24 months of age, with additional nutritious snacks (such as a piece of fruit or bread or chapatti with nut paste) offered 1-2 times per day, as desired. Snacks are defined as foods eaten between meals-usually self-fed, convenient and easy to prepare. If energy density or amount of food per meal is low, or the child is no longer breastfed, more frequent meals may be required (PAHO; WHO, 2003).

2.4.8 Dietary Diversity

There has been established evidence on the relationship between dietary diversity and a child's nutritional status. Using the DHS data from 11 countries, Arimond and Ruel found that dietary diversity was significantly associated with Height-for-age, either as a main effect or in an interaction, in all but one of the countries analyzed. Their findings suggested that there is an association between child dietary diversity and nutritional status that is independent of socioeconomic factors and that dietary diversity may indeed reflect diet quality (Arimond & Ruel, 2002).

Household agricultural production diversity affects the diets and nutrition of young children living in rural farming communities in sub-Saharan Africa. There exists a positive relationship between production diversity and height for age Z-scores and stunting among older children aged 24–59 months (Kumar, et al., 2015). According to a study conducted Zambia to investigate whether dietary diversity and micronutrient adequacy were independently associated with subsequent growth, revealed that dietary diversity has a positive effect on subsequent linear growth apart from that of micronutrient adequacy (Mallard, et al., 2016).

There is clear evidence that demonstrates the association between dietary diversity and the nutritional status of children. Increasing dietary diversity for children reduces the risk of stunting and improves growth after growth faltering in children (Busert, et al., 2016; Chua, et al., 2012; Krasevec, et al., 2017).

2.5 Morbidity (fever, acute respiratory infections, cough, and diarrhoea)

There is profound evidence on the negative association between morbidity and nutritional status of infants and children. However, there are variations on how each infectious disease-related to the three nutritional outcomes (stunting, wasting and underweight) in infants and children.

Saha, et al. (2008) showed that morbidity during infancy was negatively associated with a gain in weight particularly during the second half of infancy. However, the study could not confirm the association between morbidity, particularly diarrhea and linear growth in children. Similar findings were reported in Ethiopia where children with a history of diarrheal morbidity in the previous 2 weeks preceding the date survey were found with higher odds of developing wasting (Derso, et al., 2017).

Infectious diseases can lead directly to child malnutrition on four ways: firstly, infections can increase a child's energy or nutrient requirements, making it difficult for them to consume sufficient food; secondly, infections common in low-income settings can reduce the capacity of child's body to absorb energy or nutrients from food; thirdly, infections can reduce food consumption by reducing appetite; fourthly and finally, parents often withhold food and fluids from sick children, this can lead to undernutrition through restricted food intake (Commonwealth of Australia, 2014).

In summary, various studies demonstrated the existence of evidence on the association between feeding practices and stunting. However, stunting varies by type of feeding on one country to another. While many studies have been done on feeding practices, most of them tend to narrow the focus to one type or few selected feeding practices. Hence, the present study had a relatively broader focus on more than one form of feeding practices and their influence on child stunting in the context of sociodemographic characteristics.

2.6 Conceptual Framework

The feeding practices are influenced by various factors ranging from social-cultural, demographic and socio-economic factors. For instance, early introduction to breastfeeding within one hour of birth (feeding infants with colostrum-first milk) is influenced by beliefs, taboos and social norms which tend to vary from one society to another.

Evidence shows that due to various cultural beliefs and taboos, initiation of breastfeeding gets delayed for three or more days. Elderly female family members play a role in the initiation of breastfeeding and giving of prelactoreal feed. Infants are fed on diluted milk or cow's milk or goat's milk during this period (Walia, et al., 2009).

It was conceptualized that feeding practices and their subsequent influence on child stunting cannot be discussed in isolation, but about the existing maternal socio-demographic context. According to the conceptual framework (in Figure 1), the mother's socio-demographic characteristics have a bearing on the type of feeding adopted. This may also depend on how informed the mother's education level and how informed the mother is concerning proper infant feeding. How frequent the child is fed may also depend on economic status (availability of adequate and variety nutritious food), and depend on the employment status of the mother (working or not working). For working mothers, the feeding of a child may be largely influenced by feeding practices by a child-minder.

Culture and religion also shape the pattern of feeding due to cultural norms and religious beliefs identified with the mother. The presence of infections may influence child feeding in twofold: the child may have an infection in the process of feeding practices devoid of observing high levels of hygiene. On the other hand, infections that are independent of feeding practices may disturb the normal feeding pattern in a child.

Collectively, the feeding practices in the context of maternal socio-demographic characteristics and the presence of infections influence the nutritional status of a child (in this case, stunting).

The pre-birth factors comprise the socio-demographic factors such as the mother's body mass index (BMI), mother's education, mother's marital status, household wealth quintile, childbirth order, ethnicity, religion, place of residence and maternal employment status. There are also post-birth factors affecting stunting which mainly comprise the feeding practices such as initiation of breastfeeding; prelactoreal breastfeeding; exclusive breastfeeding; duration of breastfeeding; and bottle feeding. In addition to feeding practices, infections (diarrhea, fever, and cough) are very crucial in influencing child stunting.

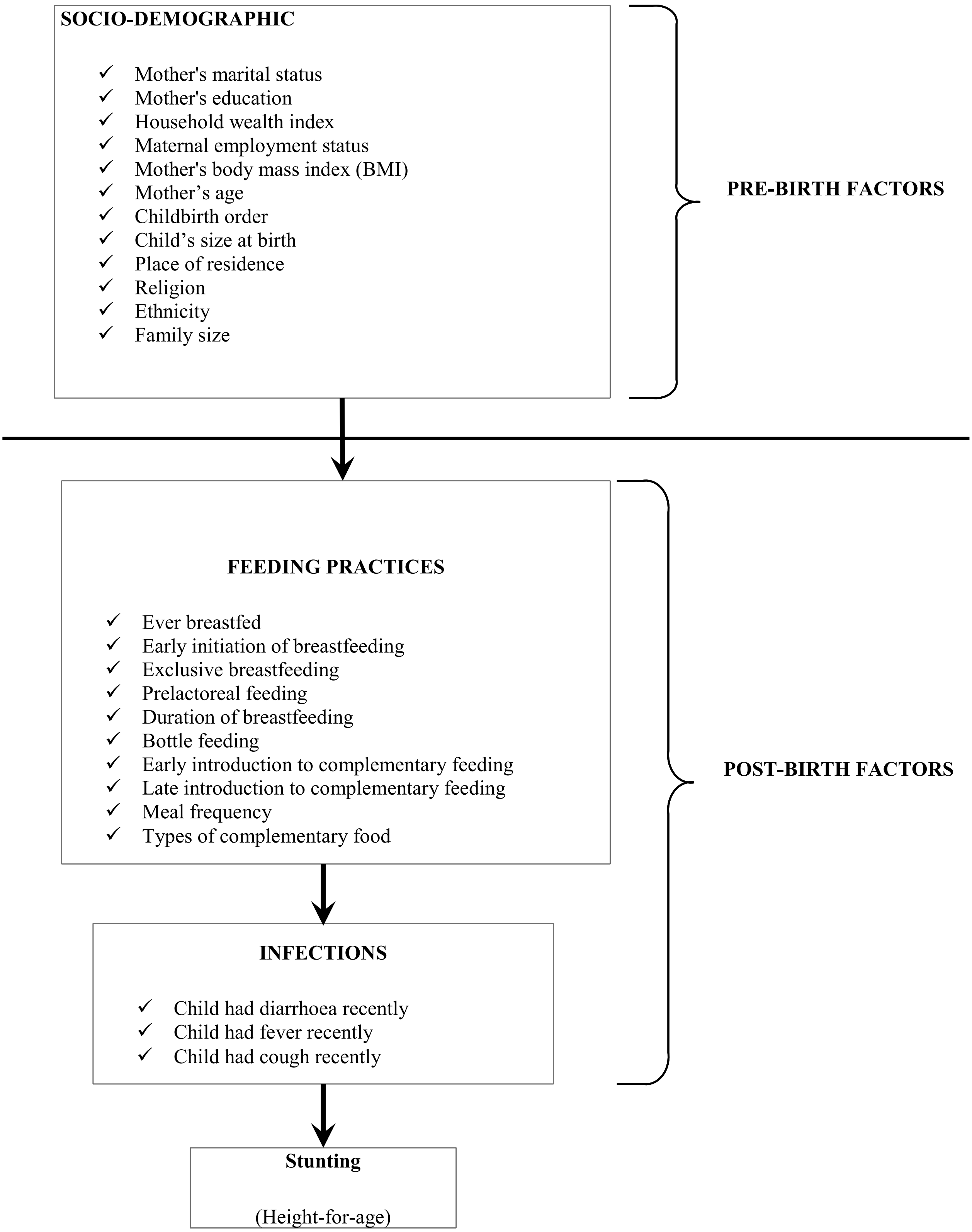

Figure 1: Conceptual Framework: Feeding Practices and Child Stunting

CHAPTER THREE: METHODOLOGY

This chapter presents the procedures and approaches undertaken in the study. It explains, in brief, the source and nature of the data used, how it was managed and analyzed. Further, it explains how the sample was derived and the variables used in the analysis. Finally, the data quality issues, ethical considerations, and study limitations are also highlighted.

3.1 Data source

This study used secondary data of the 2013-14 Zambia Demographic and Health Survey which was conducted from August 2013 to April 2014 by the Central Statistical Office (CSO) in partnership with the Ministry of Health as well as the University Teaching Hospital (UTH)-Virology Laboratory, the Tropical Diseases Research Centre (TDRC), and the Department of Population Studies at the University of Zambia (UNZA).

The ZDHS 2013/14 was a nationally representative sample which resulted in 16,516 completed interviews with women age 15-49 and 14,993 completed interviews (CSO, 2014). The ZDHS 2013/14 survey collected various information using three types of questionnaires namely, household, woman's and man's questionnaires. More specifically for this study, the woman's questionnaire provides various information on maternal characteristics such as age, sex, marital status, education levels, employment status, ethnicity, and religion among others. The data on a child is obtained from the woman's questionnaire as it contains variables on postnatal care, breastfeeding, woman's nutritional status and that of a child (including height for age otherwise known as stunting).

The notable limitations of the data were the reporting and recall bias, especially age, height, and other retrospective data which heavily depend on the memory of past events. The DHS data is cross-sectional (it is collected at a single point in time, that is, it captures what is happening at that point – a snapshot). The relationships can be drawn from the data but can neither explain why something happens nor link cause and effect.

Before drawing the sample and performing any analysis, the data were assessed for age heaping which often occurs when there is a tendency to not report the correct age because of not knowing an exact age or preference to report another age (Siejel & Swanson, 2004).

3.2 Ethical considerations

The DHS Program is the custodian of DHS datasets. The DHS data is that it is freely available to download, after filling in an application form that can be found on the Measure DHS website (https://dhsprogram.com/data/new-user-registration.cfm). The researcher followed this procedure and upon approval from the ICF macro, the ZDHS 2013/14 dataset was downloaded for use in this study. It is worth noting that informed consent is obtained from each of the respondents interviewed in DHS surveys.

3.3 Analysis of the Sample

In the beginning, all children from age 0 to 59 months were selected. The criteria for selection were that: a child ought to be aged 0 to 23months old, a child who had information on height measurements, and a child living with the mother in the past two years.

The KR file (child file) had a total of 13, 457 cases; with 12,311 children aged 0 to 59 months while 1,146 had missing records on age. Figure 2 illustrates how the study sample was derived.

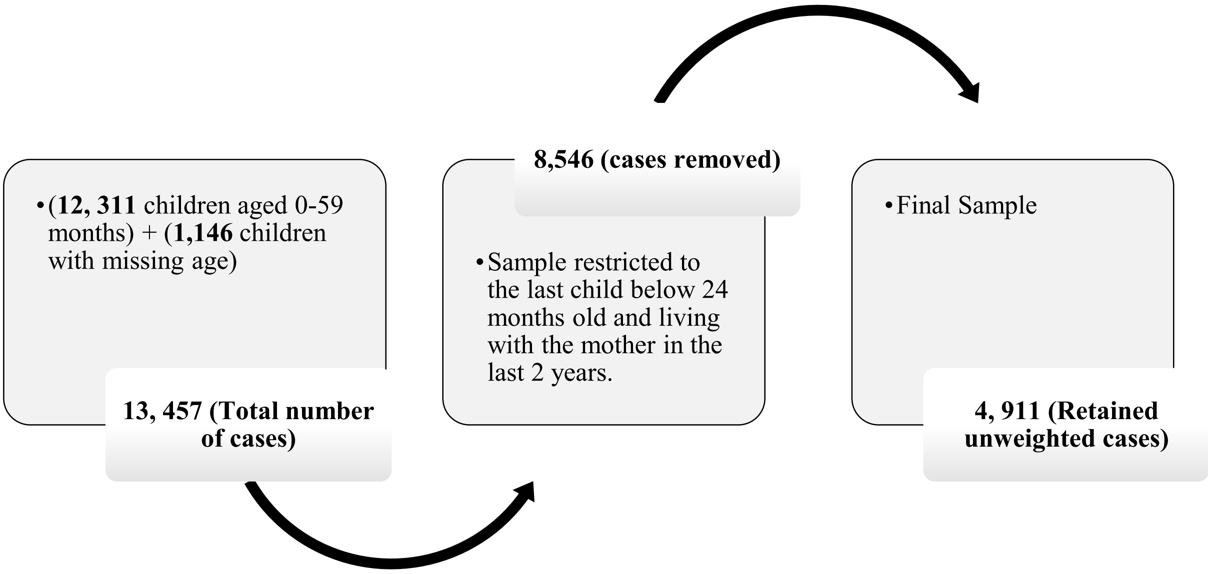

Figure 2: Sample Derivation

3.4 Identification of variables

Guided by the conceptual framework, this sub-section explains how the dependent and independent variables were identified and their operational definitions.

3.4.1 Dependent variable

The dependent variable to capture stunting is height-for-age, a variable that was created from height-for-age Z scores (HAZ). If the HAZ is 2 standard deviations below the population median, the child is classified as stunted according to the WHO growth reference standards (WHO, 2006).

To assess the nutritional status of children concerning the reference population, Z-scores (standard deviation scores) were employed. Z score is defined as:

Z-score = (observed individual value – median value of the reference population)/ (Standard deviation of value in the reference population). A binary variable was created which defined stunting, “0 = not stunted” (if Z-score was greater than -2 SD), and “1 = stunted” (if Z- the score was less than and equal to -2 SD).

3.4.2 Independent variables

The independent variables were operationally defined in five broad categories namely, child variables, contextual variables, maternal variables, feeding variables, and morbidity variables. For details on how the variables were coded and their level of measurement (see, Annex I).

3.4.3 Child Variables

Age: This was the age of a child in months ranging from 0 to 23 months.

Sex: An indicator of whether a child was male, or female as reported in the birth history.

Birth size: Size of the child at birth was classified as small or very small, and average or larger, and was based on the mother’s report of the relative size of the child at birth. The birth size as perceived by the mother was preferred to the actual size which tends to have a lot of missing values as it is recall a variable (Croft, et al., 2018).

Birth Order: The order a child is born in the family.

3.4.4 Contextual Variables

Place of residence: Referred to whether the place was a rural area or urban area.

Wealth index: Was a composite measure of a household's cumulative living standard in terms of poor, middle and rich.

Ethnicity: The specific classification of the ethnic group to which the respondent belonged.

Religion: The specific classification of the religious group to which the respondent associated himself or herself.

3.4.5 Maternal Variables

Mother's age: The age of women in their reproductive ages ranging from 15 to 49.

Mother's marital status: The percentage of women according to the current status of marriage.

Mother's education: The percent distribution of women age 15 to 49 by the highest level of schooling attended or completed.

Mother's Body Mass Index: The percentage of men age 15–49 by nutritional status based on specific body mass index (BMI) levels as to normal or obese or overweight or underweight.

Mother's work status: An indicator of whether the mother is currently working.

Mother's work mobility: An indicator of whether the mother is working at home or away from home.

3.4.6 Feeding Variables

Prelactoreal feeding: An indicator of whether a newborn child was fed with liquid or solid food other than breast milk.

Initiation of breastfeeding: An indicator of how long it took for a child to be breastfed immediately after birth.

Types of feeding: A composite feeding indicator in terms of not breastfeeding, exclusive breastfeeding and breastfeeding while giving water, liquids, other milk or solids.

Breastfeeding duration: An indicator of how long a child was breastfed.

Bottle feeding: The percentage of all children under 2 years who drank from a bottle with a nipple yesterday during the day or night before the survey.

3.4.7 Morbidity Variables

The child had diarrhea: An indicator of whether the child had diarrhea recently.

The child had a fever: An indicator of whether the child had a fever recently.

The child had cough: An indicator of whether the child had a cough recently.

3.5 Unit of Analysis

The unit of analysis is the children aged 0 to 23 months old. The children's data file (Children's Recode - KR) was used for analysis. This dataset has one record for every child of interviewed women, born in the five years before the survey.

3.6 Statistical Analysis

Weighting data: Since the ZDHS data is a survey data, considerations were made about the complex design features of the sample to adjust for disproportionate sampling and nonresponse. The "weight variable" was computed as follows: COMPUTE Weight = v005/1000000, where v005 is the women's sample weight. Then the complex samples analysis (CSA) plan was created. This step allows selecting stratification and clustering variables and to define input sample weights. The "variable v021" was the Primary Sampling Unit (this is the enumeration area or sample cluster). The "variable v022" was the strata (sample strata for sampling errors). The weight variable (v005/1000000) was also plugged into the CSA plan. The CSA plan was applied to every tabulation.

Statistical analyses were carried out using the Statistical Package for the Social Science version 23. The statistical analysis was done at three levels:

(a) *Univariate analysis*: This is an analysis which deals with each single variable to describe the data of the study but did not deal with cause or relationship. The sample characteristics displayed were frequencies (both weighted and unweighted) and percentages.

(b) *Bivariate analysis*: This is a statistical method was used to describe the relationship between two nominal or ordinal variables. The Pearson Chi-square test was used to show the statistical significance of the association between the dependent variable and each independent variable. The variable was regarded as significant if the *p*-value is less than 0.05 ($p < 0.05$).

(c) *Multivariate analysis*: (logistic regression analysis) was used to assess the influence of each of the predictor variables on the dependent variable (stunting). Logistic regression is multiple regression but with an outcome variable that is a categorical variable and predictor variables that are continuous or categorical. In logistic regression, we predict the probability of an outcome (Y) occurring given known values of several predictor variables (Xs) (Field, 2009). The logistic regression equation from which the probability of Y is predicted by several variables is given by:

$$\boldsymbol{P(Y) = \frac{1}{1 + e^{-(b0 + b1X1i + b2X2i \ldots + bnXni)}}}$$

Where $P(Y)$ is the probability of Y occurring, e is the base of natural logarithms, (b_0) is a constant, a predictor variable (X_1) and a coefficient (or weight) attached to that predictor (b_1), (X_2) is a second predictor variable corresponding to coefficient (b_2) and (X_n) is a predictor variable corresponding to coefficient (b_n).

Logistic regression allows one to predict a discrete outcome such as group membership from a set of variables that may be continuous, discrete, dichotomous, or a mix. This technique was used for its popularity and flexibility in making no assumptions about the distributions of the predictor variables; the predictors do not have to be normally distributed, linearly related to the dependant variable, or of equal variance within each group (Tabachnick & Fidell, 2013).

Assumptions for logistic regression: Logistic regression does not make assumptions concerning the distribution of scores for the predictor variables; however, it is sensitive to high correlations among the predictor variables (multicollinearity). Outliers can also influence the results of logistic regression (Pallant, 2005). To assess the predictors for multicollinearity, a simple regression was performed, and multicollinearity diagnostics was requested. To determine the presence or absence of multicollinearity, the variance inflation factor (VIF) or tolerance value was used. For tolerance, very small values (less than .10), suggest the possibility of multicollinearity. For VIF, values above 10, indicate the presence of multicollinearity. The multicollinearity diagnostics showed no indication of a high correlation among predictors (see, Annex II).

Limitations of statistical modeling: Regression analyses reveal relationships among variables, but do not imply that the relationship to be causal. A strong relationship between variables could stem from many other causes including the influence of other unmeasured variables (Jeon, 2015).

Building the model

The building of the logistic regression model essentially began by performing initial bivariate analyses of stunting (dependant variable) to each predictor. This was to identify and evaluate how each predictor is associated with an explanatory variable. Based on the bivariate analyses performed earlier, the majority of the predictors appeared to have a significant association with stunting.

An estimate of the odds ratio corresponding to a one-unit increase in the value of the independent variable can be obtained by exponentiating the estimated logistic regression coefficient. If the model contains only a single predictor, the result is an estimate of the unadjusted odds ratio. If the fitted logistic regression model includes multiple predictors the result is an adjusted odds ratio. In general, the adjusted odds ratio represents the multiplicative impact of a one-unit increase in the predictor variable on the odds of the outcome variable being equal to 1 (that is an event occurring), holding all other predictor variables constant (Heeringa, et al., 2010).

The model estimation proceeded through a step-by-step process by adding sets of predictors to the model in their categories according to the conceptual framework. The adjusted odds ratios (AORs) with their corresponding confidence intervals at 95% were reported.

Goodness-of-fit of model: To assess how well the chosen model fitted the data, the Hosmer-Lemeshow goodness-of-fit statistic was requested. The model was evaluated as a good model if the Hosmer– Lemeshow statistics produced was a nonsignificant chi-square, otherwise, the model was evaluated as poor if the Hosmer– Lemeshow statistics produced was a significant chi-square.

CHAPTER FOUR: RESULTS

This chapter begins by presenting the results from the data quality assessment. Thereafter, it proceeds to present the results from the univariate, bivariate and multivariate analyses. Figure 3 shows the age distribution in single months. The age was ranging from 0 to 59 months. The aim was to assess note any observable spike in the age which would be an indication of age heaping.

In the event of age heaping, strong smoothing procedures may be required to smoothen the data. However, since there were no major observable spikes, age grouping was suggested and undertaken to smoothen the minor age variations that may exist in age reporting.

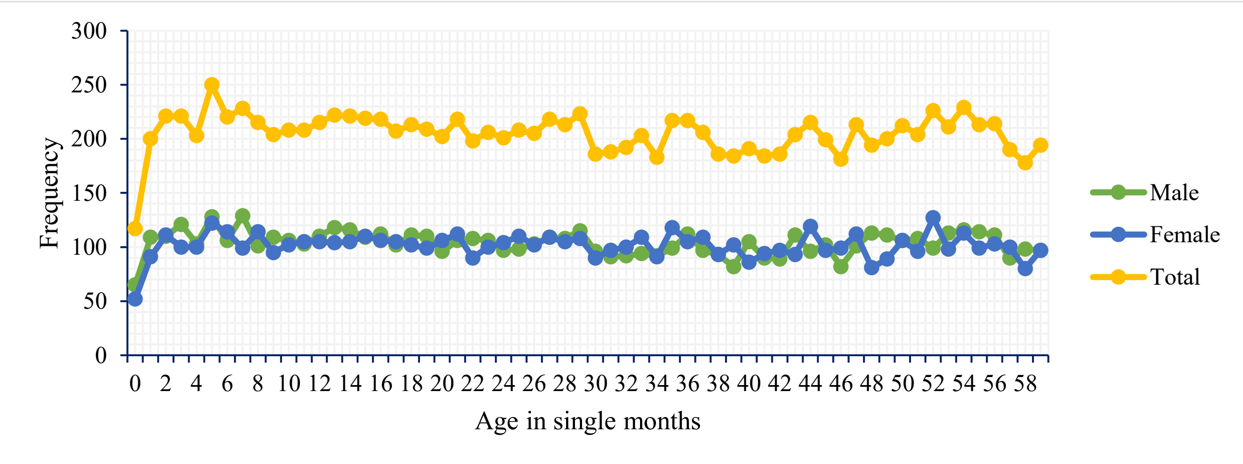

Figure 3: Distribution of age of a child in single months by sex

4.1 Characteristics of a study population

Table 1 shows descriptive statistics presented by percentages, weighted and unweighted frequencies. The study took a total sample of 4,911 children whose ages ranged from 0 to 23 months. Male and female children were nearly equal in the sample, 50.7%, and 49.3% respectively. Most of the children (26.6%) were in the age group 12-17 months.

Nearly 67% of children resided in the rural areas while 33% of their counterparts were in the urban areas. The results by wealth index show that most of the children (48.1%) were from poor households compared to the rich (31.5%) and the middle (20.4%). More than half of the children (54.3%) were born from mothers with a primary level of education and the least were children whose mothers had a higher level of education.

Table 1: Characteristics of children aged 0 to 23 months by demographic, socio economic and feeding characteristics, Zambia 2014

Variable	Categories	Weighted Count (n)	Unweighted Count (n)	Percent
Nutritional status of a child	Not stunted	2876	2943	64.3%
	Stunted	1594	1557	35.7%
Age in months	0-1	307	313	6.3%
	2-3	434	435	8.9%
	4-5	444	441	9.1%
	6-8	624	657	12.8%
	9-11	626	606	12.8%
	12-17	1299	1277	26.6%
	18-23	1153	1182	23.6%
Sex of child	Female	2408	2387	49.3%
	Male	2479	2524	50.7%
Size of a child at birth	Very large	302	266	6.3%
	Larger than average	1222	1165	25.3%
	Average	2797	2894	58.0%
	Smaller than average	432	443	9.0%
	Very small	72	81	1.5%
Birth order of a child	First	1049	1074	21.5%
	2nd - 4th	2259	2248	46.2%
	5th or more	1578	1589	32.3%
Place of residence	Urban	1625	1783	33.3%
	Rural	3262	3128	66.7%
Wealth index	Rich	1542	1426	31.5%
	Middle	996	1098	20.4%
	Poor	2350	2387	48.1%
Ethnic grouping	Bemba	2035	2140	42.7%
	Lozi	455	680	9.6%
	Lunda	313	327	6.6%
	Nyanja	1058	926	22.2%
	Tonga	900	713	18.9%
Religious grouping	Other	36	32	0.7%
	Catholic	777	767	16.0%
	Protestant	4043	4083	83.0%
	Muslim	15	14	0.3%
Mother's age in 5-year groups	15-19	637	658	13.0%
	20-24	1254	1251	25.7%
	25-29	1215	1229	24.9%
	30-34	913	911	18.7%
	35-39	594	582	12.1%
	40-44	240	242	4.9%
	45-48	35	38	0.7%
Mother's current marital status	Never in union	497	576	10.2%
	Married	3969	3885	81.2%
	Living with partner	32	36	0.7%
	Widowed	68	77	1.4%
	Divorced	206	224	4.2%
	Separated	116	113	2.4%
Mother's highest education level	Higher	183	178	3.7%
	Secondary	1524	1560	31.2%
	Primary	2651	2638	54.3%
	No education	522	529	10.7%
Mother's Body Mass Index (BMI)	Normal	3507	3581	72.3%
	Obese	199	188	4.1%
	Overweight	712	664	14.7%
	Underweight	429	438	8.9%
Mother currently working	No	2323	2207	47.7%
	Yes	2548	2688	52.3%
Mother working at home or away	At home	631	642	23.2%
	Away from home	2086	2222	76.8%
First 3 days gave child any liquids other than breast milk	No	4622	4627	94.6%
	Yes	265	284	5.4%
When child put to the breast	Immediately	2870	2929	59.7%

Variable	Categories	Weighted Count (n)	Unweighted Count (n)	Percent
	First hr	378	345	7.9%
	>1hr	1408	1398	29.3%
	First day	96	103	2.0%
	In days	59	59	1.2%
	Not breastfeeding	753	756	15.4%
Currently breastfeeding	Still breastfeeding	4134	4155	84.6%
	Not breastfeeding	753	756	15.4%
	Exclusive breastfeeding	915	894	18.7%
Breastfeeding practices	+Water	171	179	3.5%
	+Liquids	48	45	1.0%
	+Other Milk	25	27	0.5%
	+Solids	2976	3010	60.9%
	>6months	3368	3385	70.4%
Duration of breastfeeding in months	6months	225	233	4.7%
	<6months	1193	1190	24.9%
Drank from the bottle with a nipple yesterday/last night	No	4646	4678	95.2%
	Yes	232	223	4.8%
The child had diarrhoea in the last 2 weeks	No	3767	3769	77.2%
	Yes	1110	1133	22.8%
The child had a fever in the last 2 weeks	No	3739	3763	76.7%
	Yes	1136	1138	23.3%
The child had a cough in the last 2 weeks	No	3619	3648	74.3%
	Yes	1249	1246	25.7%

4.2 Initiation of breastfeeding

According to Table 2, there were significant differences between urban and rural areas in terms of putting the children to the breast after they are born. The percentage of children who were put to breast immediately they were born in rural areas was nearly twice that of their counterparts in urban areas, 39.7% compared to 19.9% ($p < 0.05$).

The initiation of breastfeeding showed significant variation in the mother's level of education. The majority of children (33%) who were put to the breast immediately after birth were those whose mothers had a primary level of education compared to 19% among those with secondary, 6% among those with no education; and least (2%) among mothers with higher education. There are significant variations in the initiation of breastfeeding by wealth status. The practice common among the poor (28.1%), while it was at 18.8% among the rich and 12.8% among those in the middle category ($p < 0.05$).

There were significant differentials by ethnic grouping regarding when a child was put to the breast. The percentage of children who were put to the breast immediately after birth was 24.8% among the Bemba, 12.9% among the Nyanja, 12.6% among the Tonga, 5.8% among the Lozi and 3.7% among the Lunda. Nearly half of the children (49.2%) were put breast immediately after birth ($p < 0.05$).

Table 2: Initiation of breastfeeding by age, sex, place of residence, mother's education and wealth index, Zambia 2014

Background Characteristics		Immediately		First hr		>1hr		First day		In days		Chi-Square	P-Value
		n	Percent	n	Percent	n	Percent	n	Percent	n	Percent		
Age in months	*0-1*	183	3.8	21	0.4	88	1.8	8	0.2	3	0.1	21.31	0.620
	2-3	272	5.6	38	0.8	112	2.3	6	0.1	3	0.1		
	4-5	251	5.2	35	0.7	137	2.8	11	0.2	5	0.1		
	6-8	350	7.3	46	1.0	197	4.1	10	0.2	10	0.2		
	9-11	371	7.7	50	1.0	172	3.6	19	0.4	6	0.1		
	12-17	776	16.1	108	2.2	358	7.4	19	0.4	19	0.4		
	18-23	668	13.9	80	1.7	344	7.2	22	0.5	12	0.2		
Sex of child	*Female*	1433	29.8	192	4.0	674	14.0	50	1.0	26	0.5	3.00	0.557
	Male	1437	29.9	186	3.9	734	15.3	45	0.9	33	0.7		
Size of child at birth	*Very large*	159	3.4	37	0.8	86	1.8	8	0.2	2	0.0	116.19	0.000*
	Larger than average	759	16.0	118	2.5	293	6.2	23	0.5	10	0.2		
	Average	1662	35.0	164	3.5	855	18.0	45	0.9	31	0.7		
	Smaller than average	244	5.1	21	0.4	141	3.0	11	0.2	9	0.2		
	Very small	27	0.6	4	0.1	28	0.6	4	0.1	7	0.1		
Birth order of a child	*First*	567	11.8	80	1.7	337	7.0	24	0.5	25	0.5	32.40	0.000*
	2nd - 4th	1382	28.7	181	3.8	596	12.4	41	0.9	19	0.4		
	5th or more	922	19.2	117	2.4	475	9.9	31	0.6	15	0.3		
Place of residence	*Urban*	959	19.9	157	3.3	413	8.6	24	0.5	29	0.6	31.01	0.000*
	Rural	1911	39.7	221	4.6	995	20.7	72	1.5	30	0.6		
Wealth index	*Rich*	903	18.8	152	3.2	398	8.3	22	0.5	25	0.5	39.44	0.000*
	Middle	615	12.8	62	1.3	286	6.0	11	0.2	12	0.2		
	Poor	1352	28.1	164	3.4	724	15.0	63	1.3	22	0.5		
Ethnic grouping	*Bemba*	1163	24.8	179	3.8	594	12.7	46	1.0	26	0.6	76.40	0.000*
	Lozi	270	5.8	33	0.7	123	2.6	16	0.3	9	0.2		
	Lunda	175	3.7	12	0.3	102	2.2	13	0.3	6	0.1		
	Nyanja	604	12.9	69	1.5	340	7.3	9	0.2	13	0.3		
	Tonga	591	12.6	77	1.6	205	4.4	8	0.2	2	0.0		
Religious grouping	*Other*	23	0.5	1	0.0	10	0.2	0	0.0	0	0.0	90.63	0.000*
	Catholic	479	10.0	70	1.5	197	4.1	17	0.4	5	0.1		
	Protestant	2358	49.2	303	6.3	1192	24.8	77	1.6	50	1.0		
	Muslim	5	0.1	0	0.0	6	0.1	1	0.0	4	0.1		
Mother's age in 5-year groups	*15-19*	355	7.4	57	1.2	197	4.1	11	0.2	10	0.2	30.86	0.158
	20-24	744	15.5	95	2.0	366	7.6	20	0.4	18	0.4		
	25-29	711	14.8	109	2.3	332	6.9	26	0.5	12	0.2		
	30-34	552	11.5	70	1.5	249	5.2	14	0.3	10	0.2		
	35-39	359	7.5	34	0.7	168	3.5	15	0.3	7	0.1		
	40-44	132	2.7	11	0.2	81	1.7	8	0.2	2	0.0		
	45-48	16	0.3	2	0.0	15	0.3	2	0.0	0	0.0		
Mother's current marital status	*Never in union*	293	6.1	36	0.7	147	3.1	8	0.2	7	0.1	21.28	0.381
	Married	2336	48.6	309	6.4	1146	23.8	78	1.6	45	0.9		

Background Characteristics		Immediately		First hr		>1hr		First day		In days		Chi-Square	P-Value
		n	Percent	n	Percent	n	Percent	n	Percent	n	Percent		
	Living with partner	19	0.4	2	0.0	7	0.2	3	0.1	0	0.0		
	Widowed	40	0.8	9	0.2	16	0.3	1	0.0	1	0.0		
	Divorced	111	2.3	12	0.2	67	1.4	5	0.1	4	0.1		
	Separated	71	1.5	11	0.2	25	0.5	2	0.0	2	0.1		
Mother's highest education level	*Higher*	106	2.2	14	0.3	37	0.8	3	0.1	10	0.2	56.82	0.000*
	Secondary	912	19.0	136	2.8	412	8.6	22	0.4	12	0.2		
	Primary	1565	32.6	198	4.1	776	16.1	56	1.2	31	0.7		
	No education	282	5.9	30	0.6	182	3.8	15	0.3	6	0.1		
Mother's Body Mass Index (BMI)	*Normal*	2061	43.2	273	5.7	1015	21.3	71	1.5	43	0.9	19.14	0.085
	Obese	116	2.4	18	0.4	49	1.0	5	0.1	6	0.1		
	Overweight	414	8.7	63	1.3	196	4.1	10	0.2	4	0.1		
	Underweight	256	5.4	21	0.4	137	2.9	6	0.1	5	0.1		
Mother currently working	*No*	1364	28.4	195	4.1	669	14.0	35	0.7	22	0.5	10.20	0.037*
	Yes	1497	31.2	180	3.8	736	15.4	60	1.2	38	0.8		
Mother working at home or away	*At home*	351	13.1	49	1.8	192	7.1	19	0.7	13	0.5	6.76	0.149
	Away from home	1244	46.5	145	5.4	598	22.3	43	1.6	25	0.9		
First 3 days gave child any liquids other than breast milk	*No*	2805	58.3	365	7.6	1336	27.8	75	1.6	38	0.8	261.17	0.000*
	Yes	65	1.3	13	0.3	72	1.5	21	0.4	21	0.4		

*. The Chi-square statistic is significant at the .05 level.

4.3 Months of breastfeeding (Duration)

Overall, 70.4% of children were breastfed for more than six months, 24.9% of children were breastfed for less than six months and 4.7% were breastfed for exactly six months (see, Figure 4).

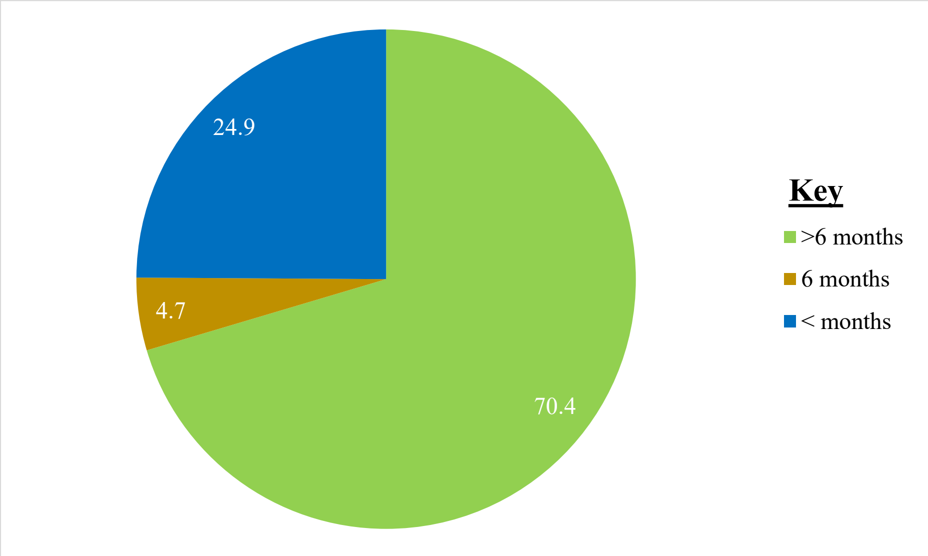

Figure 4: **Overall percentage of months of breastfeeding, Zambia, 2014**

According to the results shown in Table 3, there were significant differences between rural and urban areas in terms of how long a child was breastfed. Among children who were breastfed for more than six months, a higher percentage was in rural (47.7%) compared to 22.7% in urban. Children who were breastfed for less than six months were 8.1% and 16.8% for urban and rural areas respectively ($p < 0.05$). The highest percentage (58%) of breastfeeding for more than six months was recorded among children whose mothers were married and it was least (0.3%) among children whose mothers were living with a partner (cohabiting) ($p < 0.05$).

The wealth status of individuals tends to exert influence on how they respond to certain practices; hence it was worth considering in observing patterns of the duration of breastfeeding. The duration of breastfeeding showed variation by wealth status. The practice of breastfeeding beyond six months declined as the wealth status improved from poor to rich. As the results show 34.4% among the poor, 14.5% among the middle and least (about 21.5%) among the rich ($p < 0.05$). The presence of diseases is a significant factor in how long a child is breastfed. Breastfeeding for more than six months was 20% among children with diarrhea, 18.8% among children with fever and 19.8% among children with cough ($p < 0.05$).

Table 3: Months of breastfeeding by demographic, socio-economic and morbidity characteristics, Zambia 2014

Background Characteristics		>6months n	>6months Percent	6months n	6months Percent	<6months n	<6months Percent	Chi-Square	P-Value
Sex of child	*Female*	1673	34.9	117	2.4	580	12.1	0.87	0.647
	Male	1696	35.4	109	2.3	613	12.8		
Place of residence	*Urban*	1087	22.7	95	2.0	388	8.1	9.24	0.010*
	Rural	2282	47.7	131	2.7	806	16.8		
Wealth index	*Rich*	1029	21.5	75	1.6	387	8.1	9.95	0.041*
	Middle	694	14.5	60	1.3	229	4.8		
	Poor	1645	34.4	90	1.9	578	12.1		
Ethnic grouping	*Bemba*	1400	30.0	94	2.0	504	10.8	9.95	0.269
	Lozi	300	6.4	26	0.6	123	2.6		
	Lunda	221	4.7	18	0.4	69	1.5		
	Nyanja	728	15.6	45	1.0	252	5.4		
	Tonga	645	13.8	30	0.6	207	4.4		
Religious grouping	*Other*	26	0.6	0	0.0	8	0.2	5.71	0.456
	Catholic	535	11.2	42	0.9	185	3.9		
	Protestant	2785	58.4	181	3.8	993	20.8		
	Muslim	10	0.2	2	0.0	3	0.1		
Mother's current marital status	*Never in union*	307	6.4	36	0.7	143	3.0	26.04	0.004*
	Married	2778	58.0	169	3.5	953	19.9		
	Living with partner	17	0.3	2	0.0	10	0.2		
	Widowed	44	0.9	7	0.1	15	0.3		
	Divorced	138	2.9	9	0.2	50	1.0		
	Separated	85	1.8	4	0.1	22	0.5		
Mother's highest education level	*Higher*	121	2.5	10	0.2	39	0.8	9.43	0.151
	Secondary	1017	21.3	72	1.5	397	8.3		
	Primary	1867	39.0	129	2.7	620	13.0		
	No education	362	7.6	15	0.3	133	2.8		
Mother currently working	*No*	1543	32.3	115	2.4	614	12.9	12.43	0.002*
	Yes	1813	38.0	110	2.3	575	12.0		
Mother working at home or away	*At home*	441	16.5	31	1.2	147	5.5	0.83	0.662
	Away from home	1488	55.8	87	3.3	474	17.8		
Child had diarrhoea in last 2 weeks	*No*	2404	50.3	171	3.6	1116	23.4	244.34	0.000*
	Yes	956	20.0	54	1.1	76	1.6		
Child had fever in last 2 weeks	*No*	2461	51.5	165	3.5	1036	21.7	93.11	0.000*
	Yes	899	18.8	59	1.2	156	3.3		
Child had cough in last 2 weeks	*No*	2411	50.6	167	3.5	974	20.4	48.16	0.000*
	Yes	945	19.8	58	1.2	213	4.5		

*. The Chi-square statistic is significant at the .05 level.

4.4 Breastfeeding Practices

According to Table 4, about 49% of children in the 18-23 months were not being breastfed. The percentage of children who were not breastfeeding declined by birth order of children from 18.1% in the first birth order to 11.9% among children in the fifth and above birth order. Children who were not breastfed were more in urban (24.1%) than in rural areas (11.1%). There was a common practice of not breastfeeding children among the rich (24.1%) and lowest among the poor (11.1%). Children whose mothers were working were more likely not breastfed, about 16% compared to 15% whose mothers were not working. The majority of children (34%) who drank from the bottle with nipple were not breastfed ($p < 0.05$).

Exclusive breastfeeding in the earliest age group (0-1) was above 90% and was declining with the age of a child. There was a notable sharp decline in exclusive breastfeeding between the age group 4-5 and the age group 6-8 months. Exclusive breastfeeding was at 19.4% in rural compared to 17.4% in urban areas. Children among the rich were less exclusively breastfed (17.9%) compared to 19.8% among the middle and 18.8% among the poor ($p < 0.05$).

The practice of breastfeeding combined with solid foods was being introduced quite early before six months (in this case 39.3% were children in the age group 4-5 months). Expectedly after six months, there was an increasing percentage but showing variations in the children who were breastfed combined with solids food. This practice was common both in rural and urban areas but relatively higher in rural (64.3%) than in urban areas (54.1%) ($p < 0.05$).

The practice of breastfeeding combined with giving solids food to children was generally practiced in all wealth categories with more than half doing so in each category. However, this was highly practiced by those in the poorest wealth index (69.8%) ($p < 0.05$). This type of breastfeeding was also common among children whose mothers were working, unlike their counterparts whose mothers were not working (62.5% compared to 59.2%). Similarly, the percentage of breastfeeding and giving solid foods was relatively higher among children whose mothers were working away from home compared to children whose mothers were working at home, 64% and 57.8% respectively ($p < 0.05$)

Table 4: Feeding practices by demographic, socio-economic and morbidity characteristics, Zambia 2014

Background Characteristics		Not breastfeeding		Exclusive breastfeeding		+Water		+Liquids		+Other Milk		+Solids			
		n	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*Chi-Square*	*P-Value*
Age in months	*0-1*	4	1.2	289	94.3	9	3.0	1	0.4	2	0.6	2	0.5	4727.72	0.000*
	2-3	5	1.2	369	85.1	19	4.5	4	0.8	6	1.5	30	7.0		
	4-5	7	1.6	201	45.2	47	10.5	11	2.5	4	0.8	175	39.3		
	6-8	16	2.6	41	6.5	45	7.3	14	2.2	6	1.0	501	80.4		
	9-11	27	4.3	4	0.7	13	2.1	6	1.0	2	0.4	573	91.6		
	12-17	133	10.2	8	0.6	27	2.1	8	0.6	4	0.3	1119	86.1		
	18-23	561	48.6	2	0.2	10	0.9	4	0.3	0	0.0	576	50.0		
Sex of child	*Female*	352	14.6	434	18.0	89	3.7	18	0.8	10	0.4	1505	62.5	9.15	0.103
	Male	401	16.2	480	19.4	82	3.3	30	1.2	15	0.6	1471	59.3		
Size of child at birth	*Very large*	60	19.8	59	19.7	6	2.1	5	1.6	2	0.8	169	56.1	40.59	0.004*,
	Larger than average	213	17.4	235	19.2	50	4.1	11	0.9	3	0.2	711	58.2		
	Average	385	13.8	516	18.5	99	3.5	22	0.8	17	0.6	1757	62.8		
	Smaller than average	78	17.9	77	17.8	14	3.3	6	1.4	1	0.3	256	59.2		
	Very small	11	15.4	17	23.3	0	0.0	3	4.6	0	0.2	40	56.4		
Birth order of a child	*First*	190	18.1	191	18.2	41	3.9	8	0.8	12	1.1	606	57.7	40.96	0.000*
	2nd - 4th	374	16.6	424	18.8	83	3.7	26	1.2	9	0.4	1343	59.4		
	5th or more	188	11.9	299	19.0	47	3.0	13	0.8	4	0.3	1027	65.1		
Place of residence	*Urban*	392	24.1	283	17.4	35	2.2	23	1.4	13	0.8	880	54.1	161.57	0.000*
	Rural	361	11.1	632	19.4	136	4.2	25	0.8	12	0.4	2096	64.3		
Wealth index	*Rich*	374	24.3	275	17.9	25	1.6	28	1.8	13	0.8	826	53.5	207.50	0.000*
	Middle	152	15.3	197	19.8	35	3.5	10	1.0	6	0.6	596	59.8		
	Poor	226	9.6	443	18.8	111	4.7	9	0.4	6	0.3	1555	66.2		
Ethnic grouping	*Bemba*	302	14.8	369	18.1	83	4.1	23	1.1	7	0.3	1251	61.5	24.47	0.223
	Lozi	73	16.1	89	19.6	18	3.9	3	0.6	4	1.0	268	58.8		

Background Characteristics		Not breastfeeding		Exclusive breastfeeding		+Water		+Liquids		+Other Milk		+Solids			
		n	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*Chi-Square*	*P-Value*
	Lunda	53	17.0	60	19.1	11	3.5	1	0.3	3	1.1	184	58.9		
	Nyanja	156	14.8	181	17.1	25	2.4	13	1.2	3	0.3	680	64.2		
	Tonga	143	15.9	186	20.6	26	2.9	8	0.9	7	0.8	530	58.9		
Religious grouping	*Other*	3	7.2	9	26.1	1	2.7	0	0.0	0	0.0	23	63.9	38.95	0.001*
	Catholic	111	14.3	136	17.5	19	2.4	3	0.4	6	0.8	502	64.6		
	Protestant	626	15.5	764	18.9	150	3.7	44	1.1	19	0.5	2440	60.4		
	Muslim	9	60.0	3	22.1	1	5.4	0	0.0	0	2.6	2	9.9		
Mother's current marital status	*Never in union*	73	14.7	112	22.6	17	3.3	4	0.7	4	0.7	287	57.8	36.39	.066
	Married	596	15.0	730	18.4	144	3.6	37	0.9	21	0.5	2441	61.5		
	Living with partner	10	31.8	7	22.9	1	2.2	2	5.8	0	1.3	12	36.0		
	Widowed	14	20.4	11	15.9	1	1.4	0	0.0	0	0.0	43	62.3		
	Divorced	33	16.1	37	18.1	5	2.6	3	1.4	0	0.0	127	61.8		
	Separated	26	22.9	17	14.6	4	3.4	2	1.7	0	0.0	66	57.5		
Mother's highest education level	*Higher*	70	38.0	21	11.5	2	1.1	0	0.2	7	3.9	83	45.4	185.51	0.000*
	Secondary	289	19.0	314	20.6	44	2.9	18	1.2	13	0.9	846	55.5		
	Primary	337	12.7	482	18.2	101	3.8	24	0.9	2	0.1	1706	64.3		
	No education	57	10.9	96	18.4	24	4.6	6	1.1	3	0.5	337	64.6		
Mother currently working	*No*	355	15.3	476	20.5	87	3.7	21	0.9	8	0.4	1376	59.2	13.13	0.022*
	Yes	394	15.5	435	17.1	84	3.3	27	1.1	17	0.7	1591	62.5		
Mother working at home or away	*At home*	118	18.7	120	19.0	18	2.8	11	1.7	0	0.0	365	57.8	21.59	0.001*
	Away from home	293	14.0	353	16.9	70	3.4	16	0.8	18	0.9	1336	64.0		
First 3 days gave child any liquids other than breast milk	*No*	654	14.1	881	19.1	165	3.6	41	0.9	18	0.4	2863	62.0	142.89	0.000*
	Yes	99	37.3	34	12.8	5	2.0	7	2.7	7	2.7	113	42.5		
Drank from bottle with nipple yesterday/last night	*No*	673	14.5	905	19.5	165	3.6	48	1.0	11	0.2	2845	61.2	235.13	
	Yes	79	34.0	8	3.4	6	2.5	0	0.1	14	6.1	125	53.9		
Child had diarrhoea	*No*	550	14.6	870	23.1	131	3.5	29	0.8	19	0.5	2167	57.5	212.42	0.000*

Background Characteristics		Not breastfeeding		Exclusive breastfeeding		+Water		+Liquids		+Other Milk		+Solids			
		n	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*n*	*Percent*	*Chi-Square*	*P-Value*
	Yes	195	17.6	44	4.0	40	3.6	19	1.7	6	0.5	807	72.7		
Child had fever	*No*	553	14.8	818	21.9	127	3.4	27	0.7	19	0.5	2194	58.7	113.27	0.000*
	Yes	191	16.8	95	8.4	44	3.9	21	1.8	6	0.5	780	68.7		
Child had cough	*No*	516	14.3	779	21.5	110	3.1	25	0.7	21	0.6	2167	59.9	94.24	0.000*
	Yes	226	18.1	132	10.6	61	4.8	23	1.8	4	0.3	804	64.4		

*. The Chi-square statistic is significant at the .05 level.

4.5 Bivariate analysis of factors associated with stunting

This section presents the results of the bivariate analysis between stunting and each of the independent variables to establish the existence of a statistical association using the Chi-Square test. However, the evidence of the existence of association does not imply proof that a causal relationship exists.

Table 5According to Table 5, the results showed that 35.7% of children aged 0 to 23 months old were stunted. The stunting pattern was increasing with age and it was highest (12.8%) among children in the age group 18 to 23 months. There was a significant association between the age of a child and whether the child would be stunted, χ^2 (6) = 428.64, $p < .05$.

There were significant differences in the percent of stunted children between males and females, 20.1% and 15.5% respectively. Sex of a child was found to be associated with the nutritional status of a child, χ^2 (1) = 41.81, $p < .05$.

The majority (21.3%) of children with the average size at birth were stunted. The perceived size of a child at birth was significantly associated with stunting, χ^2 (4) = 61.87, $p < .05$.

Children in rural areas had higher stunting levels at 25.4% compared to their counterparts in urban areas at 10.2%. It was established that a relationship exists between child stunting and whether a child residing in the rural area or urban area, χ^2 (1) = 15.93, $p < .05$.

The nutritional status followed a certain pattern according to the wealth category in which a child was found. There was a declining pattern in stunting as wealth status improved from poor to rich. The differentials in stunting were that the children in the poor wealth category had the highest stunting rate at 18.7%, followed by children among the rich category at 9.6% and 7.4% among children in the middle wealth category. There was a significant association between wealth status and the nutritional status of a child, χ^2 (2) = 18.52, $p < .05$.

The differentials in stunting by the mother's education level were that children whose mothers had primary level of education had the highest level of stunting at 20.7%. Children whose mothers had secondary level of education were at 9.9% level of stunting, those whose mothers had no education were at 4.3% and least (0.8%) level of stunting among children whose mothers had higher or tertiary education. The relationship between stunting and mother's education was statistically significant, χ^2 (3) = 30.18, $p < .05$.

About one in four stunted children were found among those whose mothers had normal body mass index. The body mass index of the mother was associated with whether her child would be stunted, χ^2 (3) = 33.29, $p < .05$.

Stunting was highest (24.8%) among children who were breastfed and being given solid foods at the same time. The level of stunting among children who were not breastfed was at 7.2%, and 2.3% among children who were exclusively breastfed. Breastfeeding practices showed a significant relationship with stunting, χ^2 (5) = 229.57, $p < .05$.

The duration of breastfeeding was found to have a significant association with stunting, χ^2 (2) = 229.57, $p < .05$. Surprisingly, 31.2% of children who were breastfed for more than six months were stunted, 3.1% of children were breastfed for less than six months were found to be stunted, and 1.3% of children who were breastfed for exactly 6 months were stunted. These results called for controlling for other variables which may be suspected to influencing the duration of breastfeeding. Even after controlling for other variables such as the presence of diarrhea, presence of cough, presence of fever and size at birth among others, the relationship was still retained. It implied that the duration of breastfeeding was not influenced by any other variables, $p <.05$.

The relationship between bottled feeding and stunting was statistically significant, χ^2 (1) = 5.61, $p < .05$. There was evidence of the association between morbidity (presence of infection) and whether the child would be stunted. For example, diarrhea, χ^2 (1) = 7.32, $p < .05$ and fever, χ^2 (1) = 4.86, $p < .05$.

Thus, from the bivariate analysis, it was established that stunting was significantly associated with the age of a child, sex of a child, perceived size at birth, place of residence, wealth status, mother's education, mother's body mass index, breastfeeding practices, duration of breastfeeding, bottled feeding and the presence of infections such as diarrhea and fever.

Table 5: Stunting by demographic, socio-economic and feeding characteristics, Zambia 2014

Background Characteristics		Not stunted		Stunted			
		n	Percent	n	Percent	*Chi-Square*	*P-Value*
Age in months	*0-1*	191	4.3	20	0.4	428.64	0.000*
	2-3	335	7.5	56	1.3		
	4-5	342	7.7	56	1.3		
	6-8	434	9.7	136	3.0		
	9-11	365	8.2	221	4.9		
	12-17	700	15.7	532	11.9		
	18-23	509	11.4	573	12.8		
Sex of child	*Female*	1542	34.5	694	15.5	41.81	0.000*
	Male	1333	29.8	900	20.1		
Size of child at birth	*Very large*	212	4.8	57	1.3	61.87	0.000*
	Larger than average	726	16.5	355	8.1		
	Average	1659	37.6	941	21.3		
	Smaller than average	208	4.7	183	4.1		
	Very small	30	0.7	38	0.9		
Birth order of a child	*First*	602	13.5	338	7.6	5.54	0.063
	2nd - 4th	1377	30.8	710	15.9		
	5th or more	896	20.0	546	12.2		
Place of residence	*Urban*	992	22.2	457	10.2	15.93	0.000*
	Rural	1883	42.1	1137	25.4		
Wealth index	*Rich*	936	20.9	427	9.6	18.52	0.000*
	Middle	605	13.5	333	7.4		
	Poor	1335	29.9	834	18.7		
Ethnic grouping	*Bemba*	1205	27.7	642	14.8	2.25	0.690
	Lozi	261	6.0	139	3.2		
	Lunda	185	4.3	100	2.3		
	Nyanja	609	14.0	363	8.4		
	Tonga	538	12.4	308	7.1		
Religious grouping	*Other*	26	0.6	7	0.2	7.36	0.061
	Catholic	461	10.3	244	5.5		
	Protestant	2366	53.1	1335	30.0		
	Muslim	14	0.3	2	0.0		
Mother's age in 5-year groups	*15-19*	358	8.0	217	4.8	11.03	0.088
	20-24	773	17.3	394	8.8		
	25-29	736	16.5	363	8.1		
	30-34	525	11.7	315	7.0		

Background Characteristics		Not stunted		Stunted			
		n	Percent	n	Percent	*Chi-Square*	*P-Value*
	35-39	327	7.3	211	4.7		
	40-44	137	3.1	82	1.8		
	45-48	21	0.5	14	0.3		
Mother's current marital status	*Never in union*	290	6.5	153	3.4	3.74	0.587
	Married	2348	52.5	1291	28.9		
	Living with partner	19	0.4	9	0.2		
	Widowed	40	0.9	22	0.5		
	Divorced	117	2.6	74	1.7		
	Separated	61	1.4	46	1.0		
Mother's highest education level	*Higher*	121	2.7	36	0.8	30.18	0.000*
	Secondary	953	21.3	440	9.9		
	Primary	1501	33.6	925	20.7		
	No education	297	6.7	191	4.3		
Mother's Body Mass Index (BMI)	*Normal*	2068	46.4	1152	25.8	33.29	0.000*
	Obese	126	2.8	51	1.1		
	Overweight	456	10.2	199	4.5		
	Underweight	218	4.9	191	4.3		
Mother currently working	*No*	1376	30.9	745	16.7	0.46	0.496
	Yes	1492	33.5	843	18.9		
Mother working at home or away	*At home*	385	15.4	205	8.2	0.74	0.391
	Away from home	1208	48.4	700	28.0		
First 3 days gave child any liquids other than breast milk	*No*	2728	61.0	1514	33.9	0.01	0.922
	Yes	148	3.3	81	1.8		
When child put to breast	*Immediately*	1677	38.1	955	21.7	1.91	0.753
	First hr	231	5.2	115	2.6		
	>1hr	840	19.1	455	10.3		
	First day	53	1.2	27	0.6		
	After one day	36	0.8	17	0.4		
Breastfeeding practices	*Not breastfeeding*	367	8.2	320	7.2	229.57	0.000*
	Exclusive breastfeeding	659	14.7	102	2.3		
	+Water	111	2.5	43	1.0		
	+Liquids	28	0.6	17	0.4		
	+Other Milk	19	0.4	2	0.0		
	+Solids	1691	37.8	1110	24.8		
Duration of breastfeeding in months	*>6months*	1790	40.8	1370	31.2	302.34	0.000*
	6months	153	3.5	61	1.4		
	<6months	876	20.0	137	3.1		
Drank from bottle with nipple yesterday/last night	*No*	2723	61.0	1529	34.3	5.61	0.018*

Background Characteristics		Not stunted		Stunted			
		n	**Percent**	**n**	**Percent**	***Chi-Square***	***P-Value***
	Yes	152	3.4	59	1.3		
Child had diarrhoea in last 2 weeks	*No*	2236	50.1	1182	26.5	7.32	0.007*
	Yes	637	14.3	410	9.2		
Child had fever in last 2 weeks	*No*	2208	49.5	1177	26.4	4.86	0.028*
	Yes	664	14.9	415	9.3		
Child had cough in last 2 weeks	*No*	2079	46.6	1193	26.8		
	Yes	788	17.7	396	8.9	3.44	0.063
	Total	**2867**	**64.3**	**1589**	**35.7**		

*. The Chi-square statistic is significant at the .05 level.

4.6 Binary logistic regression analyses

The binary logistic regression analyses were performed to establish the influence of each predictor variable in predicting stunting. The set of variables categorized in five blocks was introduced into the model at different intervals using the enter method.

Model one

The first model was developed using the child variables (age, sex, size at birth and birth order) to predict stunting (refer to Annex III).

The odds of being stunted were 12.7 times for children in the age category 18 -23 months compared to their counterparts in the age group 0-1 months, (AOR=12.66, 95% CI: 6.11, 26.23). The odds of being stunted were 1.4 times more likely for a male child compared to a female child, (AOR=1.41, 95% CI: 1.17, 1.68). A child with very small body size at birth was 4.8 times more likely to be stunted than a child with a very large size at birth, (AOR= 4.80, 95% CI: 2.22, 10.38) all other factor held constant.

The test of the model for good fit was that Hosmer and Lemeshow (H–L) test was non-significant χ^2 (8) = 7.70, p = .46), an indication that the model was quite a good fit. The pseudo R square values (Cox & Snell, Nagelkerke) of .111 and .151 was a demonstration that between 11.1% and 15.1% of the variability in stunting was explained by a set of variables in model one. The overall prediction success was 65.5% compared to 63.5% in the constant only model. The Wald criterion demonstrated that age, sex, and size at birth made a significant contribution to predicting stunting.

Model two

In addition to the child variables (age, sex, size at birth and birth order), the second model included the contextual variables (place of residence, wealth index, ethnicity, and religion). Refer to Annex IV.

The general observation was that there was sustained association with stunting among the variables such as age, sex, size at birth. There was a slight change in the odds of being stunted among children in the age group 18-23 months, for example, 13.1 times, a slight change from 12.7 times observed earlier in model one. Children in rural areas had 1.1 higher odds of being stunted than children in urban areas. However, the results were not statistically significant, (AOR=1.07, 95% CI: .79, 1.45). Children in the poor wealth category were 1.3 times more likely to be stunted compared to their rich counterparts (AOR=1.34, 95% CI: .96, 1.88), but not statistically significant.

The overall success of correctly predicting stunting improved to 67.9% from 66.8% observed in model one. The model was quite a good fit as the Hosmer and Lemeshow (H–L) test was non-significant χ^2 (8) = 5.36, p = .72. The results showed the pseudo R square values (Cox & Snell, Nagelkerke) of .118 and .162 which meant that between 11.8% and 16.2% of the variability in the stunting was explained by variables in model two.

Model three

In the third model, maternal variables namely mother's: age, marital status, education, body mass index, work status, and work mobility were introduced (refer to Annex V). However, these variables explained about 1.1% of the variance in stunting, as the overall model predictive power increased to 67.9% from 66.8% observed in model two. With the inclusion of maternal variables into the model, the child variables (age, sex, and birth size) continued to show significant contribution to the model and their odd ratios did not show substantial changes.

Children whose mothers had primary level of education had 1.8 times higher odds of being stunted compared to their counterparts whose mothers had had higher education levels, (AOR=1.76, 95% CI:1.02, 3.04). Children whose mothers had no education had 1.7 times higher odds of being stunted compared to those whose mothers had a higher education level, [AOR=1.73, 95% CI: .93, 3.20). However, this was not significant. Children whose mothers were underweight had 1.5 higher odds of being stunted compared with children whose mothers had normal body mass index, AOR=1.46, 95% CI: 1.07, 1.98). In other words, children whose mothers were underweight were 46% more likely to be stunted compared with those children whose mothers had normal body size. A child whose mother was obese had 52% lower odds of being stunted than a child whose mother had a normal body size (AOR=.48, 95% CI: .25, .92).

The Hosmer and Lemeshow (H–L) test yielded a χ^2 (8) = 3.11, p = .93 and was insignificant, suggesting that model three was fit to the data well. The pseudo R square values (Cox & Snell, Nagelkerke) of .126 and.173 meant that between 12.6% and 17.3% of the variability in stunting was explained by the variables in model three.

Therefore, among the maternal factors, only the mother's education and mother's body mass index significantly contributed to predicting the nutritional status of children.

Model four

The feeding variables of prelactoreal feeding, initiation of breastfeeding, types of feeding, breastfeeding duration and bottle feeding were entered into the model (refer to Annex VI). The contribution of each variable was tested while controlling for previous variables at the point of entry. None of the feeding variables showed a unique contribution to the prediction of the stunting, thus the slight decline in the overall model predictive power improved from 67.9% observed in model three to 67.6%. The Hosmer and Lemeshow (H–L) suggested that the model fitted well with the data, χ^2 (8) = 2.835, p = .94. The pseudo R square values (Cox & Snell, Nagelkerke) yielded .130 and .178, suggesting that between 13% and 17.8% variability in stunting was explained by variables in model four.

With the inclusion of feeding variables, the odds of stunting among children in the age group 18-23 months relative to their counterparts in the age group 0-1 month, showed a slight change from 13 times observed in model three to 15 times. The variables such as age, sex, size at birth, mother's education and mother's body mass index continued to contribute significantly to predicting stunting while controlling for all other variables.

Model five

In the context of the conceptual framework, the fifth model included all blocks of the variables namely, child variables, contextual variables, maternal variables, feeding variables and morbidity variables (refer to Annex VII).

Full model

The full model included only those variables which were statistically significant namely variables, child variables included age, sex, size at birth, mother's body mass index (BMI) and cough.

In the full logistic regression model, the factors associated with child stunting were:

(a) Individual child variables, including children aged 9-11 months (AOR=8.91, 95% CI: 1.13, 70.47), children aged 12-17months were 10.4 times more likely to be stunted those aged 0-1 month, (AOR=10.43, 95% CI: 1.33, 81.80). Children in the age group 18-23 months had 17 times higher odds of being stunted than those in the age group 0-1 months, (AOR=16.95, 95% CI: 2.13, 13478). Male children were associated with 45% chances of being stunted compared to female children, (AOR=1.45, 95% CI: 1.20, 1.74). The smaller than the average size of a child at birth, the more likely were they associated with stunting, average (AOR=2.05, 95% CI: 1.34, 3.13), smaller than average (AOR=3.24, 95% CI: 1.97, 5.33), and very small (AOR=5.61, 95%, CI: 2.50, 12.58).

(b) Maternal characteristics, children whose mothers had primary level of education were 1.8 times more likely to be stunted compared to children whose mothers had a higher level of education (AOR=1.81, 95% CI: 1.02, 3.21). The children whose mothers were underweight had 46% higher chances of being stunted than their counterparts whose mothers had normal body size (AOR=1.46, 95% CI: 1.07, 2.00); and children whose mothers were obese had lower odds of being stunted (AOR=.49, 95% CI: .25, .95).

(c) Morbidity characteristics, children who had cough were associated with stunting (AOR=.77, 95% CI: .62, .96).

According to the full logistic regression model shown in Table 6, child stunting was significantly associated with the age of a child, sex of a child, size of a child at birth, mother's level of education (primary level), mother's body mass index (underweight) and the presence of cough. The overall predictive power of the full model was 68.2%, an improvement from the 67.6 observed in model four. The Hosmer and Lemeshow (H–L) test yielded an insignificant χ^2 (8) = 11.43, p = .18, suggesting that the model was a good fit. The pseudo R square values (Cox & Snell, Nagelkerke) of .133 and .181, indicating that the final model explained between 13.3% and 18.1% variability in child stunting.

Table 6: Predictors of child stunting

Variables	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.65	0.42	1.92	2.41	0.12	[0.84-4.37]
4-5	0.75	0.42	2.12	3.17	0.07	[0.93-4.85]
6-8	1.55	1.05	4.72	2.17	0.14	[0.60-37.21]
9-11	2.19	1.05	8.91	4.30	0.04**	[1.13-70.47]
12-17	2.34	1.05	10.43	4.97	0.03**	[1.33-81.80]
18-23	2.83	1.06	16.95	7.16	0.01**	[2.13-134.78]
Sex of child						
Female			Ref			
Male	0.37	0.09	1.45	15.40	0.00**	[1.20-1.74]
Size of child at birth						
Very large			Ref			

Variables	β	S.E.	AOR	Wald	Sig.	95% CI
Larger than average	0.42	0.23	1.52	3.28	0.07	[0.97-2.39]
Average	0.72	0.22	2.05	11.07	0.00**	[1.34-3.13]
Smaller than average	1.18	0.25	3.24	21.38	0.00**	[1.97-5.33]
Very small	1.72	0.41	5.61	17.55	0.00**	[2.50-12.58]
Mother's highest education level						
Higher			Ref			
Secondary	0.47	0.29	1.59	2.63	0.11	[0.91-2.79]
Primary	0.59	0.29	1.81	4.05	0.04**	[1.02-3.21]
No education	0.62	0.33	1.86	3.52	0.06	[0.97-3.54]
Mother's Body Mass Index (BMI)						
Normal			Ref			
Obese	-0.71	0.34	0.49	4.48	0.03**	[0.25-0.95]
Overweight	0.04	0.14	1.04	0.07	0.79	[0.78-1.38]
Underweight	0.38	0.16	1.46	5.77	0.02**	[1.07-2.00]
Child had cough in last 2 weeks						
No			Ref			
Yes	-0.26	0.11	0.77	5.23	0.02**	[0.62-0.96]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**328.00**	**53**	**<.01**	
Hosmer and Lemeshow (H–L):			**11.43**	**8**	**0.18**	
Nagelkerke R-Square (R2):		**18%**				
-2 Log likelihood:		**2699.63**				

CHAPTER FIVE: DISCUSSION

This study examined the feeding practices associated with stunting among children aged 0 to 23 months using the secondary data from the 2013-14 Zambia Demographic and Health Survey. Bivariate analyses were performed (using the Pearson chi-square test of significance). Those variables which showed significant relationship were noted and were included in the final multivariate model (binary logistic regression) to assess if they remained associated with stunting with the inclusion of other variables in the final model. The variables included in the analysis were: age of a child, sex, size at birth and birth order, place of residence, wealth index, ethnicity and religion, mother's: age, mother's marital status, mother's education, mother's body mass index, mother's work status and work mobility, prelactoreal feeding, initiation of breastfeeding, types of feeding, breastfeeding duration and bottle feeding.

According to multivariate results, stunting was associated with the age of a child, sex and size at birth were found to be more influential among other variables. Other significant factors included mother's education (primary level), mother's body mass index (BMI), duration of breastfeeding (less than six months) and cough. For this section, the discussion focused on the mentioned significant variables.

Age of a child

Stunting was significantly associated with a child's age where the odds of being stunted were increasing with age. This meant that the risk of being stunted was higher as the child became older. This finding of the current study shows consistency with several similar studies such as a systematic review conducted in Sub-Saharan Africa where it was established that nutritional status including stunting, wasting and underweight were associated with a child's increase in age (Akombi, et al., 2017). In a Mozambique study, it was found that childhood stunting was found to progressively rise with an increase in age up to the age of 24 months (García Cruz, et al., 2017). Evidence from other studies in Ghana and Zambia showed consistency with this finding (Wemakor & Mensah, 2016; Bupe, et al., 2015).

Sex of a child

In this study, the sex of a child was found to be a strong predictor of stunting where male children were more likely to be stunted than female children. A study in Nigeria similarly reported that male children were more inclined to being stunted than females (Akombi, et al., 2017). Various studies (Chirande, et al., 2015; Musbah & Worku, 2016; Kokeb & Delelegn, 2017) have reported the risk of stunting being significantly higher among male children compared to females in the same age bracket. Contrary to the finding of this present and other studies presented here, a study in Southern Ethiopia demonstrated that female children were more likely to be stunted relative to males (Dereje & Ayele , 2015). This agrees with a study in Pakistan which pointed out that female children were found to be more likely to be stunted in a ratio of 70% to 30% (Batool, et al., 2012). A study in Ethiopian highlighted that all three forms of malnutrition (wasting, stunting and underweight) were more prevalent among boys than girls. This was attributed to the fact that boys are more vulnerable to health inequalities than their female counterparts in the same age groups and increased attention being paid to female children, as well as reduced care and attention for older and weaned children (Solomon & Amare, 2013).

Size at birth

This study established that the smaller the perceived size of children at birth, the higher the risk of being stunted. Children who were perceived to be average in size, smaller than average or very small were significantly associated with stunting. This finding is consistent with evidence from a study in Tanzania which similarly showed that children whose mothers perceived them to be small or very small at birth were found to be at a relatively higher risk of being stunted (Chirande, et al., 2015). A study conducted in Zambia also pointed out that stunting increased with decreasing reported size at birth: 53.2 percent of children who were born small (very small/smaller than average) were likely to be stunted compared to those born with average and large size (Bupe, et al., 2015). Maternal preconception nutritional status influences both offspring linear growth and risk of stunting across the first 1000 days. Therefore, maternal undernutrition before pregnancy plays an important role in child linear growth at two years of age (Young, et al., 2018). In line with the conceptual framework used in this study, broadly, the maternal nutritional factors would be among the pre-birth factor having a bearing on the nutritional outcome of the children.

Mother's education

This study depicted that stunting was significantly associated with children whose mothers had a primary level of education. Evidence demonstrates the existence of a strong association between maternal education and the nutritional outcomes in children. Children born to less educated women suffer more from malnutrition which manifests as underweight, wasting and stunting in children (Negash, et al., 2015). A study involving three countries (Malawi, Tanzania, and Zimbabwe) showed that the threshold level of maternal education that is necessary to make a significant reduction in child malnutrition. For example, maternal education was significantly associated with reduced odds of being underweight at the junior secondary level and above in Malawi and Tanzania and at the highest category of maternal education in Zimbabwe (Makoka & Masibo, 2015). Two separate studies from Ethiopia demonstrated the significant role of maternal education in the feeding practices and the subsequent effect on children's nutritional status. Maternal education and its pathways were found to be relevant and robust in explaining chronic malnutrition (Azeze & Huang, 2014). Poor maternal education was significantly associated with inadequate dietary diversity and meal frequency (Melkam , et al., 2013).

Mother's body mass index (BMI)

The mother's body mass index is a good indicator of the nutritional status of the mother. The first 1,000 days, from conception to two years of age, is a critical window of growth and development. Exposures to dietary, environmental, hormonal, and other stressors during this period have been associated with an increased risk of adverse health outcomes. (Karakochuk, et al., 2018). The present study depicted that children whose mothers were underweight were more at risk of being stunted than children whose mothers had normal body size.

Studies suggest that the mother's body mass index (BMI) is a critical determining factor of child undernutrition and is influenced by maternal nutrition. For this reason, attention must be paid to the nutrition for the mothers during the prenatal and postnatal period is essential to improve child growth. The consequences of maternal undernutrition evident through low maternal BMI makes the fetus liable to poor growth leading to intrauterine growth retardation (Akombi, et al., 2017). A study from Nepal similarly reported that women with lower BMI were found to have higher odds of having stunted children than those with a normal or overweight BMI (Gaire, et al., 2016). Another study (Tigga & Sen, 2016) postulated the existence of high correlations between the mother's BMI and *Z*-scores of the height of child. This finding typifies the importance of the mother's nutritional status which subsequently has a bearing on the child's anthropometry indicators, in the current case stunting.

Duration of breastfeeding

Duration of breastfeeding is usually never left out in the studies on stunting given its importance in the life of children with an emphasis on exclusive breastfeeding. However, in the present study, the duration of breastfeeding had no association with stunting. In Namibia, childhood stunting was found to be critically higher for children with too short breastfeeding duration (less than 12 months) and longer breastfeeding duration (more than 18 months) (Mtambo, et al., 2016). Different evidence in a study from Nigeria established that children who were breastfed for more than 12 months were more likely to be severely stunted than those breastfed for less than 12 months (Akombi, et al., 2017). While encouraging long duration of breastfeeding are important to support normal growth in children (Comba, et al., 2019), among mothers in the poorest quintiles, breastfeeding beyond 12 months tends to contribute to stunting as a result of interaction between wealth status and duration of breastfeeding (Nisachol , et al., 2018).

Cough

Among the three morbidity indicators (diarrhoea, fever, and cough) used in the present study, the only cough was found to be associated with stunting. In India, stunting was found to be associated with children who were reported to have at least one coughing episode within the last month before the study (Huey, et al., 2019). This relationship was also reported in a Colombian study in which stunting was associated with a 44% increased incidence of days with cough and fever (Dekker, et al., 2010).

On the contrary, in Ghana, only diarrhoea and fever were consistently found to be associated with poor linear growth (Wirth, et al., 2017). Other evidence from Uganda suggests that diarrhea is a complicated factor associated with severe acute malnutrition and is a strong predictor of mortality among children (Grenov, et al., 2019).

5.1 Strength and limitations of the study

The major strength of this study is that it is based on a topical issue (nutrition) which at the moment is among the national health priorities in Zambia (MOH, 2019). The other strength lies in the use of a national representative secondary survey dataset (ZDHS) to demonstrate the predictors of stunting. In addition to the representativeness of the data used in the current study, the ZDHS a high-quality dataset on health with elements of international comparability because of inputs from international experts.

Despite the highlighted strengths, the study acknowledges certain limitations. While the study only demonstrates the association of stunting with some factors, this does not prove causality and it for this reason that the interpretation of results must be taken with caution. The indicators on a child were based on women's report (recall variables) which included perceived size at birth, diets or feeding, the presence of diarrhoea, fever, and cough. These variables may be subject to reporting or recall biases. Finally, stunting is influenced by complex factors, therefore feeding practices alone may not fully explain stunting.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

Tackling nutrition is on the global agenda as reaffirmed in the Rome Declaration on Nutrition, hereinafter referred to as the Second International Conference on Nutrition (ICN2) of November 2014. The emphasis is pressed on the first 1,000 days, from the start of pregnancy to two years of age by promoting and supporting adequate care and feed practices, including exclusive breastfeeding during the six months and continued breastfeeding until two years of age and beyond with appropriate complementary feeding (FAO, 2015). In Zambia, malnutrition continues to be a widespread problem requiring an advocacy approach for improved nutrition in the country (NFNC, 2017).

6.1 Conclusion

In the present study, it was established that the age of the child, sex and size at birth were consistently influential factors associated with child stunting. Other factors included the mother's primary education level, mother's body mass index (BMI), and the presence of cough.

The risk of stunting was found to be increasing the age of a child. The most dominant category was 18 – 23 months where stunting was 8 times higher than the reference age group (0 -1 month). A male child had 1.5 higher odds of being stunted than a female counterpart. Children whose mothers had a primary level of education were found to be associated with stunting.

Children whose mothers were underweight were at a higher risk of being stunted. The compromised mother's body mass index may result in the inter-generational cycle of malnutrition in children.

6.2 Recommendations and policy implications

The findings of the present study will inform policy strategies aimed at reducing stunting among children in Zambia. Based on the findings of this study, the following are recommended:

1) There is a need to initiate and support existing programs promoting maternal preconception nutrition with emphatic messages on the first 1,000 days of critical nutrition to the mother and the unborn child. This will help control the number of children with a small size at birth. To further strengthen this agenda, ensuring food security is very important in improving the nutritional status of the mother at pregnancy and subsequently the nutrition of a child.

2) At the postnatal stage, there is a need to continue promoting, supporting and protecting exclusive breastfeeding intervention programmes.
3) Since the stunting level is stubbornly high in Zambia, there is a need to set a counter high target to reduce malnutrition and deliberately increase budget allocation to improve women's nutrition, birth outcomes, and early infant nutrition.
4) Besides, there is a need to take a multisectoral approach to the interventions against stunting, as it is a nutritional problem influenced by multifaceted factors including feeding practices. Therefore, this requires taking stock of all relevant sectors or actors and narrow down the interventions to specific drivers of stunting across the identified sectors including the sectors responsible for health, agriculture, nutrition, social security, finance, and national development planning among others. While the Government has acknowledged nutrition as a national priority, there is a need to invest in nutrition and appreciate the transformational role that nutrition plays in sustainable social and economic development in line with Sustainable Development Goal target two (SDG2).
5) There is a need to strengthen the community-based intervention to maternal and child nutrition education. This should include developing the Mother's Guide to nutrition in a very basic, readable and illustrative way to provide advice on nutrition. The message packaging should appeal to specific settings of women including education level, local language and mainstreaming mothers with disabilities. The delivery of nutritional education should be inclusive taking different forms such as community-based, home-based and healthcare facility-based among other approaches.

Further research should be conducted to investigate the relationship between the education of a childminder and stunting. A childminder spends a considerable amount of time with a child, therefore, his or her attributes including education, feeding and hygienic practices may have a bearing on the nutritional status of a child.

ANNEXES

Annex I Codebook for variables used in the Analysis

Variable	Measurement level	Code	Label
Stunting	Nominal	0	Not stunted
		1	Stunted
Child age group	Nominal	0	0-1
		1	2-3
		2	4-5
		3	6-8
		4	9-11
		5	12-17
		6	18-23
Sex of child	Nominal	0	Female
		1	Male
Perceive size at birth	Nominal	0	Very large
		1	Larger than average
		2	Average
		3	Smaller than average
		4	Very small
Birth order of a child	Nominal	0	First
		1	2^{nd}-4^{th}
		2	5^{th} or more
Place of residence	Nominal	0	Urban
		1	Rural
Wealth index	Nominal	0	Rich
		1	Middle
		2	Poor
Ethnicity	Nominal	0	Bemba
		1	Lozi
		2	Lunda
		3	Nyanja
		4	Tonga
Religion	Nominal	0	Other
		1	Catholic
		2	Protestant
		3	Muslim
Mother's age group	Nominal	0	15-19
		1	20-24
		2	25-29
		3	30-34

Variable	Measurement level	Code	Label
		4	35-39
		5	40-44
		6	45-48
		7	7. 45-48
Mother's marital status	Nominal	0	Never in union
		1	Married
		2	Living with partner
		3	Widowed
		4	Divorced
		5	Separated
Mother's education	Nominal	0	Higher
		1	Secondary
		2	Primary
		3	No education
Mother's Body Mass Index (BMI)	Nominal	0	Normal
		1	Obese
		2	Overweight
		3	Underweight
Mother is currently working	Nominal	0	No
		1	Yes
Mother's work mobility	Nominal	0	At home
		1	Away from home
Prelactoreal feeding	Nominal	0	No
		1	Yes
Initiation of breastfeeding	Nominal	0	Immediately
		1	First hr
		2	>1hr
		3	First day
		4	After one day
Breastfeeding practices	Nominal	0	Exclusive breastfeeding
		1	Not breastfeeding
		2	+Water
		3	+Liquids
		4	+Other Milk
		5	+Solids
Breastfeeding duration	Nominal	0	>6months
		1	6months
		2	<6months
Bottle feeding	Nominal	0	0. no
		1	1. yes
Child had diarrhea		0	No

Variable	Measurement level	Code	Label
	Nominal	1	Yes
Child had fever	Nominal	0	No
		1	Yes
Child had cough	Nominal	0	No
		1	Yes

Annex II Multicollinearity Diagnostics

Variable	Collinearity Statistics Tolerance	VIF
Age in months	.214	4.681
Sex of child	.992	1.009
Size of child at birth	.975	1.026
Birth order of a child	.419	2.387
Place of residence	.467	2.141
Wealth index	.417	2.396
Ethnic grouping	.903	1.107
Religious grouping	.980	1.020
Mother's age in 5-year groups	.427	2.344
Mother's current marital status	.964	1.037
Mother's highest education level	.679	1.474
Mother's Body Mass Index (BMI)	.969	1.032
Mother currently working	.974	1.027
Mother working at home or away	.967	1.034
First 3 days gave child any liquids other than breast milk	.952	1.051
When child put to breast	.941	1.062
Currently breastfeeding	.208	4.805
Breastfeeding practices	.198	5.055
Duration of breastfeeding in months	.204	4.910
Drank from bottle with nipple yesterday/last night	.849	1.178
Child had diarrhoea in last 2 weeks	.876	1.141
Child had fever in last 2 weeks	.829	1.207
Child had cough in last 2 weeks	.844	1.184

Annex III Child Variables (Model One)

Variables	Model 1					
	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.57	0.41	1.77	1.89	0.17	[0.78-3.98]
4-5	0.69	0.41	1.99	2.88	0.09	[0.90-4.41]
6-8	1.32	0.39	3.76	11.75	0.00	[1.76-8.02]
9-11	1.90	0.38	6.71	25.05	0.00	[3.18-14.13]
12-17	2.08	0.37	7.97	31.44	0.00	[3.86-16.23]
18-23	2.54	0.37	12.66	46.68	0.00	[6.11-26.23]
Sex of child						
Female			Ref			
Male	0.34	0.09	1.41	13.73	0.00	[1.17-1.68]
Size of child at birth						
Very large			Ref			
Larger than average	0.48	0.23	1.61	4.47	0.03	[1.04-2.50]
Average	0.80	0.21	2.23	14.67	0.00	[1.48-3.35]
Smaller than average	1.29	0.25	3.65	27.72	0.00	[2.25-5.90]
Very small	1.57	0.39	4.80	15.89	0.00	[2.22-10.38]
Birth order of a child						
First			Ref			
2nd - 4th	0.13	0.14	1.13	0.84	0.36	[0.87-1.48]
5th or more	0.20	0.14	1.23	2.14	0.14	[0.93-1.61]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**270.72**	**13**	**<.01**	
Hosmer and Lemeshow (H–L):			**7.7**	**8**	**0.46**	
Nagelkerke R-Square (R2):		**15%**				
-2 Log likelihood:		**2756.91**				

Annex IV Child variables and contextual variables (Model Two)

Variables	Model 2					
	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.58	0.42	1.78	1.93	0.16	[0.79-4.03]
4-5	0.71	0.41	2.03	3.03	0.08	[0.91-4.51]
6-8	1.34	0.39	3.84	12.03	0.00	[1.79-8.21]
9-11	1.94	0.38	6.96	25.79	0.00	[3.29-
12-17	2.10	0.37	8.17	31.96	0.00	[3.94-
18-23	2.58	0.37	13.13	47.67	0.00	[6.32-
Sex of child						
Female			Ref			
Male	0.35	0.09	1.41	14.00	0.00	[1.18-1.70]
Size of child at birth						
Very large			Ref			
Larger than average	0.49	0.23	1.63	4.67	0.03	[1.05-2.55]
Average	0.77	0.21	2.17	13.43	0.00	[1.43-3.28]
Smaller than average	1.26	0.25	3.51	25.73	0.00	[2.16-5.71]
Very small	1.58	0.40	4.85	15.72	0.00	[2.22-
Birth order of a child						
First			Ref			
2nd - 4th	0.13	0.14	1.14	0.88	0.35	[0.87-1.49]
5th or more	0.17	0.14	1.19	1.45	0.23	[0.90-1.57]
Place of residence						
Urban			Ref			
Rural	0.07	0.16	1.07	0.19	0.66	[0.79-1.45]
Wealth index						
Rich			Ref			
Middle	0.22	0.17	1.25	1.78	0.18	[0.90-1.72]
Poor	0.29	0.17	1.34	2.96	0.09	[0.96-1.88]
Ethnic grouping						
Bemba			Ref			
Lozi	-0.12	0.16	0.89	0.59	0.44	[0.65-1.21]
Lunda	-0.11	0.18	0.89	0.41	0.52	[0.63-1.26]
Nyanja	-0.05	0.13	0.95	0.16	0.69	[0.73-1.23]
Tonga	-0.11	0.13	0.90	0.67	0.41	[0.69-1.16]
Religious grouping						
Other			Ref			
Catholic	1.06	0.75	2.88	2.00	0.16	[0.66-
Protestant	1.18	0.74	3.27	2.55	0.11	[0.76-
Muslim	-19.69	16390.40	0.00	0.00	1.00	[0.00-.]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**290.48**	**23**	**<.01**	
Hosmer and Lemeshow (H–			**5.36**	**8**	**0.72**	
Nagelkerke R-Square (R2):		**16%**				
-2 Log likelihood:		**2737.15**				

Annex V Child, contextual and maternal variables (Model Three)

Variables	Model 3					
	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.61	0.42	1.84	2.14	0.14	[0.82-4.18]
4-5	0.71	0.41	2.04	3.05	0.08	[0.92-4.54]
6-8	1.34	0.39	3.81	11.81	0.00	[1.72-8.17]
9-11	1.92	0.38	6.82	25.12	0.00	[3.22-14.45]
12-17	2.09	0.37	8.08	31.39	0.00	[3.82-16.77]
18-23	2.57	0.37	13.10	47.20	0.00	[6.22-27.30]
Sex of child						
Female			Ref			
Male	0.35	0.09	1.42	13.89	0.00	[1.12-1.70]
Size of child at birth						
Very large			Ref			
Larger than average	0.46	0.23	1.59	4.07	0.04	[1.02-2.49]
Average	0.74	0.21	2.09	11.94	0.00	[1.32-3.17]
Smaller than average	1.19	0.25	3.27	22.37	0.00	[2.02-5.35]
Very small	1.60	0.40	4.97	15.81	0.00	[2.22-10.95]
Birth order of a child						
First			Ref			
2nd - 4th	0.18	0.16	1.20	1.20	0.27	[0.82-1.65]
5th or more	0.22	0.23	1.24	0.93	0.33	[0.82-1.93]
Place of residence						
Urban			Ref			
Rural	0.05	0.16	1.05	0.09	0.77	[0.72-1.43]
Wealth index						
Rich			Ref			

Variables	Model 3					
	β	S.E.	AOR	Wald	Sig.	95% CI
Middle	0.06	0.17	1.06	0.11	0.74	[0.72-1.49]
Poor	0.09	0.19	1.10	0.24	0.62	[0.72-1.58]
Ethnic grouping						
Bemba			Ref			
Lozi	-0.14	0.16	0.87	0.70	0.40	[0.62-1.20]
Lunda	-0.12	0.18	0.89	0.45	0.50	[0.62-1.26]
Nyanja	-0.05	0.13	0.95	0.14	0.70	[0.72-1.24]
Tonga	-0.08	0.13	0.92	0.39	0.53	[0.72-1.20]
Religious grouping						
Other			Ref			
Catholic	1.08	0.75	2.94	2.07	0.15	[0.62-12.76]
Protestant	1.22	0.74	3.39	2.70	0.10	[0.72-14.52]
Muslim	-19.96	16139.55	0.00	0.00	1.00	[0.02-.]
Mother’s current age						
Mother’s age	0.00	0.01	1.00	0.00	0.97	[0.92-1.02]
Mother's current marital status						
Never in union			Ref			
Married	-0.17	0.21	0.84	0.68	0.41	[0.52-1.27]
Living with partner	-0.29	0.63	0.75	0.21	0.65	[0.22-2.57]
Widowed	-0.15	0.42	0.86	0.13	0.72	[0.32-1.96]
Divorced	-0.12	0.28	0.89	0.17	0.68	[0.52-1.55]
Separated	0.27	0.34	1.31	0.61	0.44	[0.62-2.57]
Mother's highest education level						
Higher			Ref			
Secondary	0.44	0.27	1.56	2.61	0.11	[0.92-2.66]
Primary	0.57	0.28	1.76	4.10	0.04	[1.02-3.04]
No education	0.55	0.31	1.73	3.02	0.08	[0.92-3.20]
Mother's Body Mass Index (BMI)						

Variables	Model 3					
	β	S.E.	AOR	Wald	Sig.	95% CI
Normal			Ref			
Obese	-0.73	0.33	0.48	4.91	0.03	[0.22-0.92]
Overweight	0.04	0.14	1.04	0.08	0.78	[0.72-1.38]
Underweight	0.38	0.16	1.46	5.75	0.02	[1.02-1.98]
Mother currently working						
No			Ref			
Yes	-0.13	0.19	0.88	0.50	0.48	[0.62-1.26]
Mother working at home or away						
No			Ref			
Yes	0.11	0.11	1.12	1.02	0.31	[0.92-1.40]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**311.45**	**37**	**<.01**	
Hosmer and Lemeshow (H–L):			**3.11**	**8**	**0.93**	
Nagelkerke R-Square (R2):		**17%**				
-2 Log likelihood:		**2716.19**				

Annex VI Child, contextual, maternal and feeding variables (Model four)

Variables	Model 4					
	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.62	0.42	1.86	2.19	0.14	[0.82-4.23]
4-5	0.71	0.42	2.04	2.87	0.09	[0.89-4.66]
6-8	1.43	1.05	4.18	1.87	0.17	[0.54-32.47]
9-11	2.05	1.05	7.79	3.84	0.05	[1.00-60.63]
12-17	2.22	1.04	9.22	4.54	0.03	[1.19-71.25]
18-23	2.71	1.05	14.97	6.64	0.01	[1.91- [illegible]
Sex of child						
Female			Ref			
Male	0.36	0.09	1.43	14.72	0.00	[1.19-1.73]
Size of child at birth						
Very large			Ref			
Larger than average	0.45	0.23	1.56	3.73	0.05	[0.99-2.46]
Average	0.74	0.22	2.10	11.95	0.00	[1.38-3.21]
Smaller than average	1.20	0.25	3.33	22.53	0.00	[2.03-5.48]
Very small	1.72	0.41	5.59	17.52	0.00	[2.50-12.51]
Birth order of a child						
First			Ref			
2nd - 4th	0.15	0.16	1.16	0.82	0.36	[0.84-1.60]
5th or more	0.17	0.23	1.19	0.57	0.45	[0.76-1.85]
Place of residence						
Urban			Ref			
Rural	0.07	0.16	1.07	0.20	0.66	[0.78-1.47]
Wealth index						
Rich			Ref			
Middle	0.04	0.18	1.05	0.06	0.80	[0.74-1.48]
Poor	0.05	0.19	1.06	0.08	0.77	[0.73-1.53]
Ethnic grouping						
Bemba			Ref			
Lozi	-0.13	0.16	0.87	0.67	0.41	[0.63-1.21]
Lunda	-0.10	0.18	0.90	0.31	0.58	[0.63-1.29]
Nyanja	-0.03	0.14	0.97	0.05	0.83	[0.74-1.27]
Tonga	-0.08	0.14	0.92	0.35	0.55	[0.71-1.20]
Religious grouping						
Other			Ref			
Catholic	1.05	0.75	2.86	1.96	0.16	[0.66-12.42]
Protestant	1.20	0.74	3.32	2.61	0.11	[0.77-14.23]
Muslim	-20.07	16169.48	0.00	0.00	1.00	[0.00-.]
Mother's current age						
Mother's age	0.00	0.01	1.00	0.00	0.95	[0.98-1.02]
Mother's current marital status						
Never in union			Ref			
Married	-0.15	0.21	0.86	0.53	0.47	[0.57-1.30]
Living with partner	-0.27	0.64	0.76	0.19	0.67	[0.22-2.65]
Widowed	-0.12	0.42	0.89	0.08	0.77	[0.39-2.03]
Divorced	-0.08	0.29	0.92	0.09	0.77	[0.53-1.61]

Variables	Model 4					
	β	S.E.	AOR	Wald	Sig.	95% CI
Separated	0.24	0.35	1.27	0.48	0.49	[0.64-2.51]
Mother's highest education level						
Higher			Ref			
Secondary	0.46	0.29	1.58	2.54	0.11	[0.90-2.76]
Primary	0.58	0.29	1.79	3.95	0.05	[1.01-3.18]
No education	0.59	0.33	1.80	3.18	0.07	[0.94-3.42]
Mother's Body Mass Index (BMI)						
Normal			Ref			
Obese	-0.71	0.34	0.49	4.43	0.04	[0.26-0.95]
Overweight	0.04	0.14	1.04	0.07	0.79	[0.78-1.37]
Underweight	0.37	0.16	1.45	5.44	0.02	[1.06-1.97]
Mother currently working						
No			Ref			
Yes	-0.11	0.19	0.89	0.37	0.55	[0.62-1.29]
Mother working at home or away						
No			Ref			
Yes	0.11	0.11	1.11	0.85	0.36	[0.89-1.39]
First 3 days gave child any liquids						
No			Ref			
Yes	0.01	0.28	1.01	0.00	0.99	[0.58-1.73]
When child put to breast						
Immediately			Ref			
First hr	0.03	0.20	1.03	0.02	0.88	[0.70-1.52]
>1hr	-0.14	0.11	0.87	1.62	0.20	[0.71-1.08]
First day	0.01	0.36	1.01	0.00	0.97	[0.50-2.04]
In days	-0.44	0.44	0.65	1.00	0.32	[0.27-1.52]
Breastfeeding practices						
Exclusive breastfeeding			Ref			
Not breastfeeding	0.04	0.30	1.04	0.02	0.90	[0.58-1.86]
+Water	0.35	0.34	1.42	1.10	0.30	[0.74-2.76]
+Liquids	-0.85	0.62	0.43	1.89	0.17	[0.13-1.43]
+Other Milk	-1.61	1.17	0.20	1.91	0.17	[0.02-1.97]
+Solids	0.04	0.26	1.04	0.03	0.87	[0.63-1.73]
Duration of breastfeeding in months						
>6months			Ref			
6months	0.08	0.28	1.08	0.07	0.79	[0.63-1.86]
<6months	0.15	0.95	1.16	0.02	0.88	[0.18-7.41]
Drank from bottle with nipple yesterday/last night						
No			Ref			
Yes	0.04	0.25	1.04	0.03	0.86	[0.64-1.71]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**321.41**	**50**	**<.01**	
Hosmer and Lemeshow (H–L):			**2.84**	**8**	**0.94**	
Nagelkerke R-Square (R2):		**17%**				
-2 Log likelihood:		**2706.22**				

Annex VII Child, contextual, maternal and feeding variables (Model five)

Variables	β	S.E.	AOR	Wald	Sig.	95% CI
Age in months						
0-1			Ref			
2-3	0.65	0.42	1.92	2.41	0.12	[0.84-4.37]
4-5	0.75	0.42	2.12	3.17	0.07	[0.93-4.85]
6-8	1.55	1.05	4.72	2.17	0.14	[0.60-37.21]
9-11	2.19	1.05	8.91	4.30	0.04	[1.13-70.47]
12-17	2.34	1.05	10.43	4.97	0.03	[1.33-81.80]
18-23	2.83	1.06	16.95	7.16	0.01	[2.13-134.78]
Sex of child						
Female			Ref			
Male	0.37	0.09	1.45	15.40	0.00	[1.20-1.74]
Size of child at birth						
Very large			Ref			
Larger than average	0.42	0.23	1.52	3.28	0.07	[0.97-2.39]
Average	0.72	0.22	2.05	11.07	0.00	[1.34-3.13]
Smaller than average	1.18	0.25	3.24	21.38	0.00	[1.97-5.33]
Very small	1.72	0.41	5.61	17.55	0.00	[2.50-12.58]
Birth order of a child						
First			Ref			
2nd - 4th	0.14	0.16	1.15	0.75	0.39	[0.84-1.59]
5th or more	0.19	0.23	1.21	0.68	0.41	[0.77-1.88]
Place of residence						
Urban			Ref			
Rural	0.07	0.16	1.07	0.19	0.66	[0.78-1.47]
Wealth index						
Rich			Ref			
Middle	0.05	0.18	1.05	0.07	0.79	[0.74-1.48]
Poor	0.04	0.19	1.04	0.05	0.83	[0.72-1.51]
Ethnic grouping						
Bemba			Ref			
Lozi	-0.14	0.16	0.87	0.71	0.40	[0.63-1.20]
Lunda	-0.11	0.18	0.90	0.37	0.54	[0.63-1.28]
Nyanja	-0.02	0.14	0.98	0.03	0.86	[0.75-1.27]
Tonga	-0.05	0.14	0.95	0.15	0.70	[0.72-1.24]
Religious grouping						
Other			Ref			
Catholic	1.08	0.75	2.94	2.04	0.15	[0.67-12.87]
Protestant	1.24	0.75	3.46	2.77	0.10	[0.80-14.96]
Muslim	-20.08	16048.52	0.00	0.00	1.00	[0.00-.]
Mother's current age						
Mother's age	0.00	0.01	1.00	0.03	0.87	[0.98-1.02]
Mother's current marital status						
Never in union			Ref			
Married	-0.14	0.21	0.87	0.47	0.49	[0.57-1.31]
Living with partner	-0.26	0.64	0.77	0.16	0.69	[0.22-2.71]

Variables	β	S.E.	AOR	Wald	Sig.	95% CI
Widowed	-0.11	0.43	0.90	0.06	0.80	[0.39-2.07]
Divorced	-0.07	0.29	0.94	0.05	0.82	[0.53-1.64]
Separated	0.25	0.35	1.28	0.52	0.47	[0.65-2.53]
Mother's highest education level						
Higher			Ref			
Secondary	0.47	0.29	1.59	2.63	0.11	[0.91-2.79]
Primary	0.59	0.29	1.81	4.05	0.04	[1.02-3.21]
No education	0.62	0.33	1.86	3.52	0.06	[0.97-3.54]
Mother's Body Mass Index (BMI)						
Normal			Ref			
Obese	-0.71	0.34	0.49	4.48	0.03	[0.25-0.95]
Overweight	0.04	0.14	1.04	0.07	0.79	[0.78-1.38]
Underweight	0.38	0.16	1.46	5.77	0.02	[1.07-2.00]
Mother currently working						
No			Ref			
Yes	-0.11	0.19	0.89	0.36	0.55	[0.62-1.29]
Mother working at home or away						
No			Ref			
Yes	0.11	0.11	1.12	0.97	0.33	[0.89-1.40]
First 3 days gave child any liquids other than breast milk						
No			Ref			
Yes	0.02	0.28	1.02	0.00	0.95	[0.59-1.75]
When child put to breast						
Immediately			Ref			
First hr	0.02	0.20	1.02	0.01	0.91	[0.69-1.51]
>1hr	-0.11	0.11	0.89	1.16	0.28	[0.72-1.10]
First day	0.02	0.36	1.02	0.00	0.96	[0.50-2.05]
In days	-0.38	0.44	0.69	0.73	0.39	[0.29-1.62]
Breastfeeding practices						
Exclusive breastfeeding			Ref			
Not breastfeeding	0.09	0.30	1.09	0.09	0.77	[0.61-1.96]
+Water	0.41	0.34	1.51	1.48	0.22	[0.78-2.93]
+Liquids	-0.76	0.62	0.47	1.49	0.22	[0.14-1.59]
+Other Milk	-1.64	1.17	0.19	1.96	0.16	[0.02-1.93]
+Solids	0.08	0.26	1.08	0.09	0.76	[0.65-1.79]
Duration of breastfeeding in months						
>6months			Ref			
6months	0.08	0.28	1.08	0.08	0.78	[0.63-1.86]
<6months	0.23	0.95	1.25	0.04	0.81	[0.19-8.12]
Drank from bottle with nipple yesterday/last night						
No			Ref			
Yes	0.02	0.25	1.02	0.01	0.94	[0.62-1.67]
Child had diarrhoea in last 2 weeks						
No			Ref			
Yes	-0.05	0.11	0.95	0.19	0.67	[0.76-1.19]
Child had fever in last 2 weeks						

Variables	β	S.E.	AOR	Wald	Sig.	95% CI
No			Ref			
Yes	0.00	0.11	1.00	0.00	0.97	[0.80-1.24]
Child had cough in last 2 weeks						
No			Ref			
Yes	-0.26	0.11	0.77	5.23	0.02	[0.62-0.96]
Summary statistics (block):			χ^2	*df*	*p*	
Likelihood Ratio test:			**328.00**	**53**	**<.01**	
Hosmer and Lemeshow (H–L):			**11.43**	**8**	**0.18**	
Nagelkerke R-Square (R2):		**18%**				
-2 Log likelihood:		**2699.63**				

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