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Determinants of Exclusive Breastfeeding among Low Birthweight Infants in Ethiopia: A Survey-Based Analysis from the Saving Little Lives – Kangaroo Mother Care Program, 2021

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Abstract

Determinants of Exclusive Breastfeeding among Low Birthweight Infants in Ethiopia: A Survey-Based Analysis from the Saving Little Lives – Kangaroo Mother Care Program, 2021

By Hannah Paige Rogers

Introduction: About 50% of all under-5 mortality occurs during the neonatal period (0-28 days of life). Early and exclusive breastfeeding (EBF) promotion is a cost-effective child survival intervention that provides optimal nutrition for child health and development. By understanding the determinants of EBF at 28 days, future programs and improved policies supporting EBF practices can be developed to improve infant survival.

Objective: The objective of this study is to predict EBF at 28 days among Ethiopia infants using infant, maternal, contextual, socioeconomic, and early feeding variables.

Methods: A total of 501 mother-infant dyads were enrolled in Kangaroo Mother Care in Amhara, Ethiopia. Data collection occurred from June 2018 to May 2019 through surveys delivered to a cohort of mothers, fathers, and caregivers of low birthweight infants at discharge, 7-days post-discharge, and 28-days of life. Logistic regression was conducted to evaluate the infant, maternal, contextual, socioeconomic, and early infant feeding determinants of EBF at 28 days of life. Crude and adjusted prevalence odds ratios (cPOR and aPOR, respectively) were estimated using SAS version 9.4.

Results: The prevalence of EBF was highest at 7-days post-discharge, then dropped to 74% at 28-days post-partum. Multivariate logistic regression showed that infant being a twin or triplet (aPOR 0.64, 95% CI 0.42, 0.98), and mother being a farmer (aPOR 0.57, 95% CI 0.39, 0.85), or having a caesarian or assisted delivery (aPOR 0.50, 95% CI 0.31, 0.80) significantly predicted decreased prevalence odds of EBF at 28 days.

Discussion: Results from our analysis revealed that early EBF practices in Amhara, Ethiopia falls short of Sustainable Development Goal 3.2 which calls for at least 90% of women to practice EBF for at least 6 months. Improving EBF support for mothers of multiples, working mothers, and mothers who had a caesarian or assisted delivery may improve EBF prevalence and infant survival in Ethiopia. Future studies should examine additional factors that can impact EBF in larger samples and in other regions of Ethiopia.

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Table of Contents

ACRONYMS

Acronym	Definition
ANC	Antenatal Care
DHS	Demographic and Health Survey
EBF	Exclusive breastfeeding
EIBF	Early initiation of breastfeeding
ELBW	Extreme low birth weight
KMC	Kangaroo mother care
LBW	Low birth weight
LMIC	Low- and middle-income countries
MCH	Maternal and child health
MUAC	Middle upper arm circumference
PTB	Preterm birth
SAM	Severe acute malnutrition
SLL	Saving Little Lives
VLBW	Very low birth weight
WHO	World Health Organization

CHAPTER I

INTRODUCTION

Globally, nearly half of child deaths occur during the neonatal period, 0 to 28 days of life[1]. In the last 10 years, neonatal mortality rate (NMR) in Ethiopia has improved from 37.9 deaths per 1000 live births (90% confidence interval (CI) 34.2, 42.1 deaths) in 2010 to 27 deaths per 1000 live births in 2020 (90% CI 21.2, 34.1)[1]. Leading causes of neonatal mortality include preterm birth, birth asphyxia, or lack of breathing at birth, infection, and birth defects[2]. Improvements to the NMR in Ethiopia are attributed to improved maternal and child health (MCH) education, MCH awareness, and improved behavioral health practices such as longer intervals between births, having fewer children, improved maternal nutrition, and early and exclusive breastfeeding[3]. While significant progress has been made in reducing neonatal mortality in Ethiopia, it currently falls short of the 2030 child mortality Sustainable Development Goal (SDG), a goal adopted by the United Nations in 2015 as a universal call to action to improve child mortality globally[4]. The goal of SDG 3.2 is to end preventable deaths of newborns and children under 5 years of age by 2030. Additionally, the target aims to specifically reduce neonatal mortality to at least as low as 12 deaths per 1000 live births[5]. It is estimated that 80% of the remaining neonatal deaths can be prevented through simple, affordable, and effective education strategies and interventions aimed at increasing skin-to-skin contact (SSC), access to clean water, hygiene, and sanitation (WASH), and proper nutrition including early initiation of breastfeeding (EIBF) and continued, exclusive breastfeeding (EBF) for at least the first 6 months of life[5].

Early initiation of breastfeeding, initiation of breastfeeding within one hour of birth[6], has been found to improve neonatal outcomes including neonatal mortality by reducing exposure to prelacteal feeding (giving any foods or liquids other than breastmilk during the first three days

after birth[7]) which can make an infant susceptible to illness, improving exposure to colostrum milk (early milk rich in immunoglobulins and lymphocytes[8]) that supports the development of the lymphatic system, and increasing skin-to-skin contact (direct skin-to-skin contact between the mother or caregiver and infant for an uninterrupted 60 minutes during the first 12 weeks and beyond[9]) which supports better physical and developmental outcomes for the baby[10]. A recent study found that the prevalence of early initiation of breastfeeding in Ethiopia was 83.7%[11].

Exclusive breastfeeding, feeding infants only breastmilk for the first 6 months, is vital for supporting favorable maternal health outcomes such as reducing postpartum bleeding[12], reducing the risk of postpartum depression[13], and increasing maternal-infant bonding due to the natural production of oxytocin and prolactin during breastfeeding[14]. Additionally, EBF provides many benefits to the infant including a stronger immune system, lower risk of diarrheal illnesses and gastrointestinal ailments, and lower rates of infant mortality[15]. A 2020 study found that while 83% of infants-initiated breastfeeding within 1 hour of birth, only 47% of infants were exclusively breastfed through the first 6 months[16]. Additionally, a 2021 study found a pooled prevalence (n=45) of EBF at 58% (95% CI 55%-65%) at 6 months in Ethiopia compared to the WHO's 90% prevalence recommendation[17].

Being born with a low birth weight (LBW) (<2000g) significantly increases neonatal mortality risk[18]. One study found that the overall NMR among LBW infants born in Ethiopia was 110 per 1000 live births of which nearly half (42.3%) died in the first week of life[18]. A systematic review conducted in 2020 identified antenatal corticosteroids, single cord, skin cleansing with chlorhexidine, early BCG vaccine, home-based newborn care, and community kangaroo mother care (KMC) with significant reductions of NMR in low- and middle-income countries (LMICs)[19].

KMC is a method of care typically focused on preterm and low birthweight infants being carried by the mother or caregiver with skin-to-skin contact (SSC)[9]. In a 5-country randomized, controlled trial, KMC was associated with significant increases in exclusive breastfeeding (RR 1.50; 95% CI 1.26, 1.78)[20]. While KMC has been associated with significant increases in EBF, there are currently gaps in the research analyzing the specific determinants of EBF among mothers of LBW infants enrolled in these programs. To increase the rate of EBF and support the continued reduction of neonatal mortality among LBW infants, there needs to be a greater understanding of the determinants of EBF among this population. The objective of this thesis is to evaluate what factors are associated with EBF among LBW infants at 28-days postpartum to inform future education and support programs.

CHAPTER II

LITERATURE REVIEW

Global Child Mortality

In 2020, 5.0 million children under 5 years of age died globally[21]. This translates to a death rate of 13,800 child lives lost daily primarily due to preventable and common childhood illnesses such as infectious diseases, pneumonia, diarrhea, and malaria[21]. Due to the importance of nutrition in supporting healthy immune function, undernutrition is estimated to be responsible for nearly half of all child deaths under 5[21]. One study evaluating nutritional status and child survival found that young children (6-60 months) who were mild-to-moderately malnourished (weight-for-age 60%-80% of the reference median) were 2.2 (95% confidence interval (CI) 1.7, 2.8) times more likely to die than better nourished young children [22]. Additionally, young children who were severely malnourished (weight-for-age <60% of the reference median) were 6.8 (95% CI 4.9, 9.4) times more likely to die during the follow-up period than better nourished young children (weight-for-age >80% of the median reference) [22]. Another more recent study (multi-country pooled analysis) found that children identified as having severe acute malnutrition (SAM), defined by a middle upper arm circumference (MUAC) <115mm, had a mortality hazard 3.96 times higher (95% CI 3.19, 4.91) than those without an anthropometric deficit[23]. Additionally, children with both a low weight-for-height <-3 z-score and SAM (MUAC <115mm) had a mortality hazard 8.32 times higher (95% CI 6.11, 11.3) than children without any anthropometric deficit[23].

Neonatal Mortality

The neonatal period is defined as the first 28 days of an infant's life[1]. Globally, 2.4 million of the 5.0 million children under 5 who died globally in 2020 were infants less than 28 days old[1]. While

neonatal mortality has declined by an average rate of 2.6% annually from 1990 to 2020, the percent of neonatal deaths that make up all under-five mortality has increased from 40% to 47% during the same period[1]. The primary causes of neonatal mortality are infection, birth asphyxia, and complications due to preterm birth such as low birth weight (LBW) (weight at birth <2000g) and very low birth weight (VLBW) (weight at birth <1500g)[24].

Low Birth Weight

The WHO defines LBW as weight at birth less than 2000g and VLBW as weight at birth less than 1500g[25]. One study found that LBW and VLBW are significantly associated with neonatal mortality with adjusted odds ratios of 4.55 (95% CI 1.97, 10.50) and 19.24 (95% CI 5.80, 63.78), respectively[26].

Preterm Birth

Preterm birth (PTB) is defined as gestational age at birth <37 weeks[27]. Each year, approximately 15 million babies are born preterm, of which nearly 1 million die due to PTB complications[27], including hypothermia, gastrointestinal problems like necrotizing enterocolitis, metabolism problems like hypoglycemia, and an underdeveloped immune system that can lead to sepsis[28]. Evidence suggests that deaths due to preterm birth complications are preventable through cost-effective care such as providing warmth through skin-to-skin contact (SCC) and early and frequent exclusive breastfeeding[28].

Kangaroo Mother Care

One intervention targeting PTB and LBW infants is Kangaroo Mother Care (KMC) which is a method of care focused on infants being carried by the mother or caregiver with SSC and EBF[9].

In a 5-country randomized, controlled trial, 3,211 infant-mother dyads were assigned to either immediate KMC (intervention) or conventional care (incubator or a radiant warmer until stabilization) and KMC thereafter (control)[29]. In the first 28 days, 12% of the intervention group died, compared to 15.7% in the control group (RR 0.75; 95% CI, 0.64-0.89). Additionally, a systematic review and meta-analysis evaluating 124 studies found that KMC compared to conventional care was associated with 36% lower mortality, 47% lower risk of neonatal sepsis, 88% lower risk of hypoglycemia, 78% lower risk of hypothermia, and 58% lower risk of hospital readmission[30]. Further, KMC was associated with significant increases in exclusive breastfeeding (RR 1.50; 95% CI 1.26, 1.78)[30].

Breastfeeding and Malnutrition

Human breastmilk is the 'gold-standard' for infant feeding[31]. All of an infant's nutritional needs are provided by breastmilk alone for the first 6 months of life and continuing breastfeeding up to 2 years and beyond contributes to optimal infant and child outcomes including reducing neonatal, infant, and child mortality[32, 33]. The 2013 Lancet Series on Maternal and Child Nutrition attributed 11.6% (804,000) of deaths under age 5 to suboptimal breastfeeding (0-23 months)[34]. Breastfeeding interventions focused on early initiation, providing breastmilk within the first hour of life, EBF, and complementary feeding are highly effective at improving maternal, neonatal, infant, and child outcomes at a low-cost[34, 35]. Optimal complementary feeding is providing age-appropriate foods and liquid along with breastmilk from 6 months (when breastmilk alone is no longer sufficient to meet the nutritional requirements of infants) and up to 2 years of life or beyond when breastmilk has ceased[36]. A systematic review conducted in 2015 analyzing optimal breastfeeding practices and infant and child mortality revealed a dose-response association between breastfeeding frequency and all-cause mortality. Infants that were predominantly breastfed, partially breastfed,

and not breastfed had a relative risk of all-cause mortality of 1.48, 2.84, and 14.4 times, respectively, compared to exclusively breastfed infants at 0-5 months[32]. Another systematic review conducted in 2015 found that children 6-11 months who were not breastfed had a mortality risk 1.8 times higher than those who were breastfed and children 12-23 months who were not breastfed had a mortality risk 2.0 times higher than those who were breastfed[32].

Early Initiation of Breastfeeding

Early initiation of breastfeeding (EIBF) has been found to improve several neonatal outcomes including neonatal mortality. A 2018 study in India found that infants who were not breastfed within 1 hour of birth were 2.93 (95% CI [1.89, 4.53]) times more likely to die in the first 28 days than those who were breastfed within one hour[37]. Observed reductions in neonatal mortality from early breastfeeding are explained primarily by reducing infant consumption of prelacteal feeding (providing non-breastmilk foods and liquids prior to initiating breastfeeding), improving exposure to colostrum (early milk rich in immunoglobulins and lymphocytes that stimulate health immune function), and increased exposure to skin-to-skin contact (SSC) which supports better physical and developmental outcomes for the baby[10].

Colostrum

Colostrum, often referred to as “liquid gold”, is nutrient- and antibody-rich breastmilk produced after delivery up to two-weeks postpartum. Due to colostrum being produced in the early postnatal period, early initiation of breastfeeding leads to increased colostrum consumption. Colostrum supports optimal development of an infant’s immune system, growth, and tissue repair factors[8]. Providing colostrum has been found to have a protective role against common childhood illnesses including the common cold, influenza, and respiratory syncytial virus, and long-term benefits

including a lower risk of allergies, chronic disease, and type 2 diabetes[38]. Additionally, when provided to preterm infants, colostrum has been observed to correct growth and maturation delays thereby improving infant outcomes[38].

Exclusive Breastfeeding

EBF is associated with improved maternal outcomes including reducing postpartum bleeding, reduced risk of postpartum depression, and increasing maternal-infant bonding due to the natural production of oxytocin and prolactin during breastfeeding[14]. Additionally, EBF provides many benefits to the infant including a stronger immune system, lower risk of diarrheal illnesses and gastrointestinal ailments, and lower rates of infant mortality[15]. One study saw a 20%reduction in newborn deaths after 6 months of early and exclusive breastfeeding which was attributed to reducing mortality due to neonatal infections and complications of preterm birth[39]. Despite the considerable benefits of EBF and high accessibility, the prevalence of EBF remains low on a global scale at 38% – far from the 2025 Global Nutrition Target to increase the rate of EBF in the first 6 months up to at least 50%[40].

Breastfeeding in Ethiopia

Despite strong evidence supporting the benefits of early and exclusive breastfeeding for infant survival, the prevalence of EBF remains low compared to global recommendations. According to the 2016 Ethiopian Demographic and Health Survey (DHS), 97% of infants in Ethiopia are breastfed at some point in their life. However, the median duration of exclusive breastfeeding among Ethiopian all regions is 2.7 months[16]. A 2020 study found that while 82% of infants (n=5122) initiated breastfeeding within 1 hour of birth, only 47% of infants were exclusively breastfed through the first 6 months[16]. Additionally, a 2021 study found a pooled prevalence

(n=45) of EBF at 58% (95% CI 55%-65%) at 6 months in Ethiopia compared to the WHO's 90% prevalence recommendation[17]. Factors associated with optimal EBF practices include rural residence, being a housewife, delivery at a healthcare facility, and receiving infant feeding and counseling[41]. Conversely, prelacteal feeding and colostrum avoidance are common practices in Ethiopia that cause a delay in breastfeeding initiation which can disrupt optimal breastfeeding practices throughout the breastfeeding period[7,42,43].

Prelacteal Feeding

Prelacteal feeding is defined as giving any food or liquid other than breastmilk during the first three days after birth[7]. Prelacteal feeding is negatively associated with timely initiation of breastfeeding and optimal breastfeeding practices[7]. A systematic review and meta-analysis evaluating prelacteal feeding practices in Ethiopia found the pooled prevalence of prelacteal feeding in Ethiopia to be 25.29% (95% CI [17.43, 33.15]) [7]. Reasons for prelacteal feeding vary but include breast problems, maternal illness, infant feeding problems, cultural practices, and lack of education by which mothers and caregivers believe the infant is thirsty after breastfeeding or that the mother is not producing enough milk to properly feed their infant[44]. One traditional belief in Ethiopia is that male newborns require prelacteal feeding to become healthy and strong which may cause the practice to be performed more commonly among male than female newborns[45]. Prelacteal feeding practices deprive newborns of colostrum which can lead to increased susceptibility to infection and disease and impacts maternal breastmilk production which can lead to the disruption of optimal breastfeeding practices in the neonatal period and beyond[44]. The Ethiopian Ministry of Health estimates that prelacteal feeding practices contribute to 70,000 infant deaths annually (24% of all infant deaths) in Ethiopia[46].

Colostrum Avoidance

Colostrum avoidance includes delayed initiation of breastfeeding, purposely pumping and discarding colostrum, and/or wet nursing[47]. This practice occurs for various reasons including traditional or cultural beliefs, believing it has no nutritional value, believing it makes the infant sick, or believing it is 'bad luck' to the family[43]. In Ethiopia, studies have found a range in the prevalence of colostrum avoidance from 6% to 20.9% depending on the region of Ethiopia, where colostrum avoidance was highest in the Amhara region[48]. One study found that the most common reasons for discarding colostrum in Ethiopia were odd color and consistency (39.2%), belief that it made the infant sick (35.2%), traditional and cultural reasons (17.1%), and infant unable to feed (8.5%)[49]. Determinants of colostrum avoidance include non-formal education status (adjusted odds ratio (aPOR) 3.1; 95% CI, 1.51-6.32), rural residency (aPOR 5.2; 95% CI, 2.60-10.40), primiparity (aPOR 5.1; 95% CI, 2.30-11.57), and lack of breastfeeding counseling during antenatal care (aPOR 2.6; 95% CI, 1.32-5.47)[48]. Alternatively, those who were married (aPOR 4.5; 95% CI, 1.13-18.16), underwent normal delivery (aPOR 5.2; 95% CI, 1.87-20.90), and those who initiated breastfeeding within 1 hour (aPOR 2.79; 95% CI, 0.96-8.16) were less likely to practice colostrum avoidance[49].

Determinants of Breastfeeding

According to a WHO/UNICEF policy brief, determinants of early breastfeeding include socioeconomic status, behavioral and cultural factors of the mother, access to antenatal care, access to breastfeeding counseling and support, and other demographic factors[40]. Determinants of breastfeeding fall into two primary categories: psychological factors including maternal attitudes, education, and support to initiate and continue breastfeeding for up to 2 years and beyond; and physiological factors including maternal nutrition status and maternal and infant morbidity. Additionally, each category can be further broken down into infant characteristics, maternal

characteristics, contextual factors, socioeconomic factors, and early infant feeding practices, each of which impact the ability to practice EBF during the neonatal period (*Figure 1)*.

Infant Characteristics

Infant characteristics that impact the mother's ability to practice early and exclusive breastfeeding include infant birthweight, morbidity, being a multiple, gestational age, and sex. Birthweight has been found to be strongly associated with early and exclusive breastfeeding[50]. As birthweight decreases, infants are weaker and may be less able to successfully breastfeed. Additionally, these infants are more likely to be taken from the mother shortly after birth to receive care making EIBF and EBF more challenging. Next, infant morbidities at birth, including injury during birth or a birth defect can make EIBF and EBF more difficult. For example, an infant born with a cleft lip or cleft palate may not be able to latch to receive breastmilk[51]. Next, being a mother to multiples creates unique challenges to breastfeeding including increased risk of infant morbidity, difficulties in feeding multiple infants at once, and increased demands on the mother[52]. Next, gestational age is correlated with birthweight and infant morbidity. Lastly, infant sex may have cultural implications to breastfeeding that are unique to the mother's context.

Maternal Characteristics

Maternal occupation, education, age, number on antenatal visits (ANC) during pregnancy, parity, and marital status are determinants of early and exclusive breastfeeding. Maternal occupation and education are related and may impact ability to breastfeed depending on the time they must spend away from the infant, intensity of the labor that may impact breastmilk production, knowledge on breastfeeding and its benefits, and income status which can lead to improved healthcare access and increased resources to provide the infant with care [53-56]. Additionally, more ANC visits equip the mother with information and skills necessary to successfully breastfeed[57]. Next, parity is a predictor of maternal experience whereby the more children the mother has, the more likely she will have the skills and education necessary

to practice EIBF and EBF. Lastly, marital status may impact socioeconomic status and is an indicator for familial support which can improve breastfeeding practices.

Contextual Factors

Place of birth, mode of delivery, and ongoing support and counseling throughout the breastfeeding period are predictors of successful EIBF and EBF. Place of birth can influence access to professional birth attendants, breastfeeding counseling and support, and postnatal care each of which increase EIBF and EBF[56,58]. Next, mode of delivery can impact maternal and infant morbidity after birth, maternal and infant separation after birth, and maternal physical and psychological health after birth which can impact early breastfeeding behaviors[56,59]. Lastly, ongoing support and counseling is essential for mothers who are having challenges with breastfeeding.

Socioeconomic Factors

Geography, income, and socio-political status are determinants of early and exclusive breastfeeding because each determine the level of health resources, education, income, and support the mother may be able to receive.

Early Infant Feeding

Early infant feeding practices are essential building blocks for establishing optimal breastfeeding practices that are continued throughout the exclusive breastfeeding period (the first 6 months). Early initiation of breastfeeding within 1 hour of birth has been shown to lead to improved neonatal and maternal health status shortly after birth, improve breastmilk supply, and improve maternal-infant bonding that improve the desire and ability to breastfeed[6,12,16]. Additionally, early initiation leads to decreased prelacteal feeding which has a negative impact on EIBF and EBF[7,42,43,46,60,61] and improves consumption of colostrum which has a positive impact on EIBF and EBF[8,43,48,49,62-65].

Gaps in the Literature

Increasing optimal EBF practices in Ethiopia is a low-cost, highly effective method to reduce neonatal and infant mortality. Multiple recent studies have evaluated the determinants of EBF for the first 6 months, but few studies focus on the determinants of EBF for low birthweight (LBW) infants in Low- and Middle-Income Countries (LMICs). Understanding the determinants of EBF among this high-risk population of babies with LBW will inform future interventions and policies to support optimal EBF to improve LBW infant outcomes, which are currently poor in Ethiopia.

CHAPTER III

METHODS

Saving Little Lives (SLL)

Saving Little Lives at Birth (SLL) is a flagship program initiated in 2021 by the Ethiopian Ministry of Health as part of their initiative to improve maternal and infant health in Ethiopia. The program works in partnership with Emory Ethiopia, Emory School of Nursing, regional, state, and district government health managers in Ethiopia, and a local Ethiopian universities/research institution working to reduce neonatal mortality in Ethiopia. The primary objective of SLL is to reduce preventable neonatal deaths by 35% utilizing evidence-based programs such as KMC.

SLL is nested within an eleven-year longitudinal collaboration between Ethiopia, including Ethiopian research facility, staff, and national-regional government partnerships, and Emory University. As part of SLL's objective to reduce neonatal mortality by 35%, the program has delivered several interventions aimed at improving maternal and child health (MCH): neonatal resuscitation, management of distress, sepsis, and feeding, and effective Kangaroo Mother Care (KMC) and a cross-cutting collaborative quality improvement. Governmental health facilities located in the Amhara region have been selected as the pilot sites for the SLL interventions. Data collection within these sites began in 2021 and will continue through surveys to evaluate program success between pre-intervention and post-intervention through a series of follow-ups. The dataset for this analysis focuses specifically on mother-baby dyads enrolled in the KMC intervention and were followed between post-delivery discharge to 28-days of the infant's life.

Data Collection

Health facilities located in the Amhara Region were identified for inclusion in the KMC program by Emory-Ethiopia staff members. Once identified, they were invited to participate in the KMC program by an introductory letter and a follow-up by an Emory staff member to obtain formal consent to participate in the program. Data collection occurred from 2020 to 2021 through a series of surveys delivered to mothers, fathers, and caregivers of low birthweight infants at discharge, 7 days after discharge, and 28 days of life. Surveys gathered data on key demographic information, maternal and child health indicators specific to each follow up period, data on breastfeeding behaviors, experience, and duration, and data on KMC behaviors, experience, and duration.

Ethics

The KMC intervention was reviewed by Emory's Institutional Review Board (IRB) and both Ethiopia's Amhara Public Health Institute (APHI) and Amhara Regional Health Bureau (ARHB). Letters of permission for study activities were presented to facility leaders prior to data collection and all KMC datasets are deidentified prior to distribution.

Study Population

Women who gave birth to low birthweight infants (<2000g) in selected health facilities in the Amhara region of Ethiopia who were participating in both the SLL program and the KMC initiative were eligible for inclusion. At baseline, 904 women were assessed for eligibility and 501 met study inclusion criteria, including residing in the study area, having a stable infant at initiation, and infant birthweight <2000g (Figure 2).

After eligibility was assessed, 501 mother-infant dyads enrolled in the KMC program after which 495, 293, and 319 dyads remained in the study from discharge, 7 days post-discharge, and after 28

days of life, respectively. From the 7-day post-discharge follow-up to the after 28 days of life follow-up, 26 participants reenrolled in the program (Figure 2).

Data Analysis

For this study, mother-infant dyads (n=319) who participated in the 28 days of life follow-up and provided data on their exclusive breastfeeding practices were used to evaluate the determinants of exclusive breastfeeding at 28 days of life. Dyads were born with a low birthweight <2000g and were enrolled in a KMC program through SLL. The 28 days of life follow-up questions were administered by Emory outcome measurement officers using a tablet that was then uploaded to the server located in Bahirdar, Ethiopia using REDCap.

Outcome Variables

Upon receiving the dataset, it was necessary to clean the data and create clear outcome variables. First, infants who were enrolled in KMC but did not meet the inclusion requirement of being born at a birthweight <2000g were excluded (n=43). Next, the variables representing exclusive breastfeeding at discharge, 7 days post-discharge, and 28 days of life were recoded as a bivariate 'yes/no' variable. Exclusive breastfeeding behaviors were evaluated based on a series of other variables that measured early infant feeding behaviors including the infant's exposure to plain water, breastmilk from another mother, any milk other than breastmilk such as powdered or fresh animal milk or commercially produced infant formula, other fluids (juice, tea, sugar or glucose water, or honey), any foods (semi solids/solids), or others. The infants were reported to be receiving EBF only if mothers or caregivers reported not giving the infant any of the above foods or liquids. However, if one or more of the above foods and liquids were given the infant was reported as not exclusive breastfeeding.

Predictor Variables

To evaluate the determinants associated with EBF among Ethiopian women with a low birthweight infant, we examined selected infant, maternal, contextual socio-demographic, and early infant feeding variables identified in the exclusive breastfeeding conceptual model (Figure 1).

a. Infant Variables

Infant factors included as exposures were birthweight, sex, and multiples. Within the KMC dataset, birthweight was a continuous variable. To evaluate differences between being born LBW (1500-2000 grams) and being born VLBW (<1500g), two categories were created with the ranges that match the definitions for LBW (n=270) and VLBW (n=49). Next, infant's sex remained in two categories (male; female). Lastly, multiples began in three categories (singleton (n=241); twins (n=74); triplets (n=3)) but were grouped into single versus multiple categories (singleton (n=241); multiples (n=77).

b. Maternal Variables

The maternal factors included as exposure variables within this study were: maternal occupation, education, and parity. The maternal occupation variable in the KMC dataset had eight categories (housewife; farmer; skilled labor; unskilled labor; professional; merchant; petty trade; other). For the purposes of this study, we wanted to examine how similar kinds of jobs impacted exclusive breastfeeding. To do so, three categories were created (housewife; farmer; other occupation) to evaluate differences in EBF practices between these groups. Next, parity was originally a continuous variable; thus, the variable was grouped into categories (1st child; 2nd or 3rd child; 4th or greater child).

c. Contextual Variables

The contextual factors included as exposure variables within this study were place of delivery and mode of delivery. Within the KMC dataset, place of delivery had severe categories (home (n=9); government health post (n=109); government health center (n=198); private hospital (n=1); charitable trust or NGO hospital (n=0); other (n=3)). For the purposes of this study, three categories were created (health center (n=197); health post (n=109); other (n=13)). Next, mode of delivery was grouped into three categories (vaginal (n=282); assisted (n=10); and caesarian (n=27). For this study, assisted and caesarian were grouped together to better evaluate difference between spontaneous vaginal delivery and forms of assisted deliveries.

d. Sociodemographic Variables

The sociodemographic factors included as exposure variables within this study were maternal age and family income. Maternal age at delivery (in years) was originally a continuous variable, so categories were created (17-21; 22-35; ≥36) to represent young, moderate, and older mothers. Annual income was a continuous variable with extreme outliers; thus, categories were created using quartile cut-points to represent those in the lowest (≤22,000 Birr (427.43 USD)), lower-middle (22,001-29,000 Birr (427.44 – 563.43 USD)), upper-middle (29,001-39,000 Birr (563.44 – 757.71 USD)), and highest (>39,000 Birr (>757.71 USD) annual wealth quartiles.

e. Early Infant Feeding Variables

To evaluate the effect of early infant feeding practices on EBF, variables representing prelacteal feeding, colostrum, and hours to breastfeeding initiation were evaluated. Unfortunately, data was unavailable for prelacteal feeding. However, the colostrum variable contained data and it was included with the two original categories (colostrum was given; colostrum was not given). Lastly,

hours to breastfeeding initiation began as a continuous variable and was grouped into four categories (1-5 hours (n=45); 6-24 hours (n=75); 25-48 hours (n=43); >48 hours (n=14)),

Statistical Analysis

All analyses were conducted using SAS version 9.4 (SAS Institute Inc. 2013., Cary, NC). We excluded infants who were born with a birthweight greater than 2000g for the study. Descriptive analysis included calculating frequencies and percentages for all categorical variables and mean and median for continuous variables. Unadjusted logistic regression was conducted to determine the association between exclusively breastfeeding at 28 days of the infant's life and each exposure individually.

All variables with significant associations in the bivariate analysis were included in the multivariate logistic regression model and examined as a full model. Additionally, maternal age, maternal education, and family income were retained in the multivariable model as these variables were known predictors of interest based on prior literature. Tests for multicollinearity were conducted using a COLIN macro and multicollinearity was not found as determined by a conditional index of less than 30 in the complete model (conditional index = 27.5). Next, confounding was assessed by comparing the gold standard model against each comparative model where exposure variables were removed one by one. If the odds ratio of the comparative model showed a difference from the gold standard model greater than 10%, we would have evidence of confounding.

CHAPTER IV

RESULTS

Demographic Analysis

In this study, 319 mother-infant dyads were evaluated to assess the determinants of exclusive breastfeeding at 28 days of the infant's life. Most infants were born in the LBW category (n=270 (84.6%)) while some were born VLBW (n=49 (15.4%)) (Table 1). Between birthweight categories, infant and maternal characteristics did not differ greatly, except for maternal occupation being slightly different where those with a LBW infant were more likely to be a housewife (46.6% in the LBW group versus 36.7% in the VLBW group) and those with a VLBW infant were more likely to be a farmer (40.8% in the VLBW group versus 31.7% in the LBW group) (Table 1).

There were significant differences between the LBW and VLBW group with regards to maternal income, hours to breastfeeding initiation, and colostrum feeding (Table 1). The prevalence of lowest-income mothers was higher among VLBW infants (35.7% in the VLBW group versus 24.0% in the LBW group). Additionally, mothers of VLBW infants were less likely to initiate early breastfeeding. Within this sample, the median time to initiate breastfeeding was 12 hours (range 0-72 hours) with 27.2% initiating breastfeeding in the first 5 hours of the infant's life in the LBW group versus 24 hours (range 2-72 hours) with only 10.5% initiating breastfeeding in the first 5 hours of the infant's life and none practicing early initiation within the first hour of life in the VLBW group. Lastly, mothers of VLBW infants were less likely to feeding their infant's colostrum (83.7% in the VLBW group versus 98.0% in the LBW group) (Table 1).

Exclusive breastfeeding practices

Among the study sample, EBF practices were very high at discharge (97.4%) and at 7-days (98.3%) (Table 2). However, at 28 days of the infant's life, EBF decreased to just 76.2% of women. Due to the large drop off in EBF at 28 days, this study focuses on this time point to evaluate the determinants of EBF which can then be used to inform policy, programs, and interventions to improve the continuation of EBF practices between 7 days post-discharge and 28 days of life.

Univariate Logistic Regression Analysis

Unadjusted odds ratios were calculated using logistic regression to determine the association between independent variables and EBF at 28 days of the infant's life (Table 3). Birthweight category (LBW vs. VLBW), multiples category (singleton vs. twin/triplet), maternal occupation category (housewife vs. farmer), mode of delivery (vaginal vs. assisted/caesarian), and hours to breastfeeding initiation category (0-5 hours vs. 25-48 hours and 49-72 hours) were each found to have a significant association with EBF at 28 days of the infant's life (Table 3). These results are very delayed, especially when considering the high rates of EBF at discharge and 7 days post-discharge suggesting that this data needs to be examined further to understand early infant feeding practices.

Infant Characteristics

Infants born VLBW, a birth weight <1500 grams, were 55% less likely to be exclusively breastfed at 28 days of life than infants born LBW, between 1500 and 1999 grams (cPOR=0.45, 95% CI 0.31, 0.66) (Table 3). Infants born as a multiple (twin or triplet) were 50% less likely to be exclusively breastfed at 28 days of life than infants who were born as a singleton (cPOR=0.50, 95% CI 0.33, 0.75) (Table 3). Infant's sex (male vs. female) was not found to have a significant association with EBF at 28 days (cPOR=1.18, 95% CI 0.83, 1.68) (Table 3).

Maternal Characteristics

Among maternal age, occupation, and education status, only maternal occupation as a farmer versus being a housewife was found to be significantly associated with not EBF at 28 days of life (cPOR=0.60, 95% CI 0.40, 0.89) (Table 3). However, as women's age category increased from 17-21 to 22-35 to ≥36 years, they were more likely to practice EBF at 28 days (cPOR=1; cPOR=1.07; cPOR=1.57, respectively) (Table 3).

Contextual Factors

Mode of delivery and place of delivery were evaluated as contextual determinants of EBF. Women who had an assisted or caesarian delivery were found to be 54% less likely than women who had a vaginal delivery (cPOR=0.46, 95% CI 0.40, 0.89) (Table 3). Place of delivery was not found to be a significant determinant of EBF (Table 3).

Sociodemographic Factors

Family income was the only sociodemographic factor evaluated. Family income was analyzed using a continuous bivariate logistic regression model of the income variable categorized into wealth quantiles. While the results were non-significant at alpha=0.1, EBF is expected to increase, on average, by 8% between each wealth quantile (cPOR=1.09, 95% CI 0.91, 1.27) (Table 3).

Early Infant Feeding Practices

Hours to breastfeeding initiation and whether colostrum was given to the infant were evaluated as early infant feeding practices that may have an association with EBF at 28 days of the infant's life. Hours to breastfeeding initiation had a significant association with failure to practice EBF at 28 days if the mother-initiated breastfeeding after one full day of life (25-48 hours

vs 0-5 hours: cPOR=0.38, 95% CI 0.18, 0.79; 49-72 hours vs 0-5 hours: cPOR=0.26, 95% CI 0.09, 0.71). Additionally, mothers who initiated breastfeeding between 6 and 24 hours were, on average, 27% less likely to practice EBF at 28 days (cPOR=0.72, 95% CI 0.36, 1.50) reaffirming the importance of early initiation of breastfeeding. Lastly, giving colostrum to the infant was not found to be a significant determinant of EBF at 28 days (cPOR=0.91, 95% CI 0.35, 2.40) (Table 3).

Multiple Logistic Regression Analysis

Significant predictors in the unadjusted bivariate analysis were evaluated together in a final multivariate logistic model. Additionally, mother's age, mother's education status, and mother's income status were retained in the model. After adjusting for delivering a singleton or twin/triplet, mother's age, mother's occupation, mother's education, mode of delivery, and income category (continuous), delivering a twin or triplet (aPOR=0.64, 95% CI 0.42, 0.98), being a farmer (aPOR=0.57, 95% CI 0.39, 0.85), and having an assisted or caesarian delivery (aPOR=0.50, 95% CI 0.31, 0.80) were significantly associated with lower odds of EBF at 28 days (Table 4).

CHAPTER V

Discussion

This study provided insight into the determinants of EBF practices at 28 days of life. While most mothers practiced EBF at discharge (97.4%) and at 7 days post-discharge (98.3%), there was a large decline in EBF at 28 days of the infant's life (76.2%). The WHO recommends EBF for the first six months of the infant's life[35], so a rapid decline in EBF as early as 28 days of life is concerning. After adjusting for covariates, delivering a twin or triplet, being a farmer, and having an assisted or caesarian delivery were found to significantly decrease the odds of EBF at 28 days.

While the expected prevalence of Ethiopian mothers who are practicing EBF at 28 days is not known from current literature, several prevalence studies report EBF at 6 months to be between 49% and 74% throughout various regions of Ethiopia[16,17,66,67]. Our findings are consistent with a gradual decline in EBF prevalence throughout the first 6 months of the infant's life which is expected in any population. However, these findings emphasize the need to improve EBF support and education programs in Amhara and other regions of Ethiopia so that EBF prevalence at 6 months meets the 90% prevalence recommendation set by the WHO which is currently unmet[17]. Factors associated with optimal EBF practices include infant characteristics, maternal factors, contextual factors, socioeconomic factors, and early infant feeding practices.

Infant Characteristics

Birthweight

Past studies have shown that KMC programs aimed at mothers of LBW infants significantly increase EBF practices[20]. This study evaluated differences in the odds of EBF at 28 days between mothers of LBW and VLBW infants. In our crude and adjusted models, mothers of VLBW infants

were found to be 55% and 30% less likely to practice EBF at 28 days than mothers of LBW infants (cPOR 0.45; aPOR 0.70). Past studies have found that LBW infants are at an elevated risk of neonatal mortality, morbidity, and inhibited growth and development which may make EBF more difficult[30]. KMC programs have been found to significantly improve EBF practices among mothers of LBW infants[9,20,29,30,68]; however, our findings show differences in the effect of these programs between LBW and VLBW infants suggesting that mothers of VLBW require additional support to improve breastfeeding practices among these most vulnerable infants.

Multiples

Past studies show that having a twin or triplet puts the infant at decreased odds of EBF[52,69]. EBF is vital for multiples, particularly because they are at increased risk of PTB, LBW, and neonatal mortality. Being a mother to multiples creates unique challenges to EBF including increased risk of infant morbidity, difficulties in feeding multiple infants at once, and increased demands on the mother[52]. Our results were consistent with these findings by which mothers of twins and triplets were 36% less likely to practice EBF at 28 days than mothers of a singleton. While the rate of twin birth in Ethiopia has been found to be between 1.4% and 2.4% among the total population and the rate of triplet birth to be even more rare, the prevalence of multiples in this study was over 24%. Since twins and triplets are more likely to be born LBW or VLBW, programs should pay special attention to the needs of mothers of multiples when designing programs aimed at improving EBF among LBW and VLBW infants.

Infant Sex

In a previous meta-analysis evaluating the results of 24 studies, mothers of a male newborn were found to be significantly more likely to practice EBF in Ethiopia (OR= 1.31, 95% CI 1.01, 1.68) compared to mothers of a female newborn. Our results showed a nearly opposite, but non-

significant, association where mothers of female newborns were more likely to practice EBF at 28 days (cPOR=1.18 95% CI 0.83, 1.68) than mothers of male newborns. These findings are consistent with cultural factors known in Ethiopia whereby mothers of male newborns are more likely to participate in prelacteal feeding and less likely to practice EBF[45]. Future programs should focus on educating mothers and caregivers on the dangers prelacteal feeding to improve optimal EBF practices and the equal nutritional needs between male and female infants.

Maternal Factors

Maternal Age

Maternal age was not associated with EBF at 28 days among mothers of LBW infants in this study. However, increased maternal age has been associated with increased odds of EBF in past studies due to increased exposure to breastfeeding education and breastfeeding experience with multiple children[53,70]. While our findings are not significant, we did see a slight dose-response between maternal age and EBF where mothers in the 17–21-year-old category were least likely to practice EBF and those ≥36 years old were most likely to practice EBF, overall. It is possible that we would see a greater effect of age on EBF within a larger sample size or by evaluating age as a continuous variable.

Maternal Education

Past studies evaluating the association between maternal education and EBF have been inconsistent. One study found that higher maternal education was associated with lower EBF in Ethiopia while another found increased education with higher EBF[54,71]. These findings highlight that increased maternal education may both support and create challenges with EBF. Mothers who are better educated are more likely to understand the scientific aspects of nutrition, understand the importance of optimal IYCF practices, and may have higher economic status providing more

opportunity for EBF than uneducated mothers. However, increased education is also likely to increase employment opportunities outside of the home making EBF more challenging for working mothers. The results of our study support that more educated mothers are less likely to practice EBF, indicating that these mothers may have additional factors, such as employment, impacting the ability to breastfeed their infant.

Maternal Occupation

Maternal occupations outside of the home have been associated with decreased odds of EBF in many contexts including throughout Ethiopia[53-56]. Our study found that being a farmer was significantly associated with decreased odds of EBF at 28 days. Logically, being a farmer poses unique challenges to new mothers due to the physical demands of farmer which may impact the mother's ability to keep the infant close and may cause a delay or reduction in milk production, especially in cases where the mother's nutritional needs are not fully met. Compared to housewives, farmers in this study were approximately 40% less likely to practice EBF.

Contextual Factors

Place of Delivery

Prior studies show that giving birth in a formal healthcare facility increases a mother's odds of EBF[54]. Our bivariate results do not show an association between place of birth and odds of EBF. These results are likely because most women delivered in a formal health care facility where they were enrolled in KMC.

Mode of Delivery

In the adjusted model, mothers who had an assisted or caesarian delivery were 50% less likely to practice EBF at 28 days. One study evaluating breastfeeding practices among mothers who

delivered via caesarian section reported that these mothers had more problems with infant latching, positioning, and more pain compared to women who delivered vaginally[54]. Additionally, these women reported being more likely to have had an unsuccessful first breastfeeding attempt and were less likely to initiate breastfeeding in the first 24 hours after birth[59]. Breastfeeding challenges among this population may be explained by delayed lactogenesis caused by the physical stress put on the mother's body from having abdominal surgery, as well as physical separation of the mother and baby shortly after birth.

Early Infant Feeding Practices

Hours to Initiate Breastfeeding

Initiating breastfeeding beyond 5 hours was significantly associated with failure to practice EBF at 28 days. Early initiation of breastfeeding within one hour of birth facilitates emotional bonding between mother and baby and stimulates breastmilk production which can improve a mother's experience breastfeeding and lead to improved exclusive breastfeeding practices up to 6 months and beyond. The prevalence of early initiation of breastfeeding in Ethiopia is 75.7%[72]. In our study sample, early initiation within 1 hour was only 4% and initiation within 5 hours of birth was only 25%. Since our population was made up of LBW infants, there may have been a delay between birth and being reunited with the mother that can explain the delay in initiating breastfeeding. Additionally, mothers may not have remembered the exact time when they began initiative breastfeeding if interviews were done days after initiation. Lastly, our data showed initiation up to 72 hours of birth indicating that this question may have been misinterpreted by the women as it is unlikely that infants were not fed for up to 72 days unless they were fed breastmilk substitutes.

Selection Bias

This study included only women enrolled in KMC and infants with a low birthweight less than 2000g. Since women were enrolled in KMC, they were receiving breastfeeding education and support so EBF prevalence may be higher among this population than those who are not enrolled in KMC. Additionally, LBW and VLBW infants may have unique EBF determinants that differ from infants born ≥2000g. Lastly, this study had a high rate of loss to follow-up meaning that a large part of the study sample could not be evaluated at 28 days of the infant's life. Participants who were lost to follow-up may have unique determinants of EBF at 28 days that could not be evaluated in this study. Thus, the study is biased by participants who were able to complete all three follow-up periods. Future programs should observe why many participants were lost to follow-up to see if these women can be supported to complete each of the three follow-ups.

Measurement Bias

Like many survey-based studies, this study was susceptible to measurement bias. It is possible that some survey responses were not accurate due to misinterpreting questions or filling out the survey response fields incorrectly. Additionally, since this study sampled women who were enrolled in KMC and were receiving breastfeeding education and support, our primary outcome, prevalence of exclusive breastfeeding at 28 days of life may be impacted by social desirability bias whereby women may be falsely reporting that they are exclusively breastfeeding their infant solely because they know the importance of EBF.

Strengths

The Saving Little Lives KMC dataset provided strong, longitudinal data at three follow-up periods allowing us to follow EBF practices at discharge, 7 days post-discharge, and 28 days of the infant's

life. Additionally, detailed interview question provided a robust dataset from which a multitude of variables could be examined to determine what determinants influence EBF practices among LBW infants in Ethiopia.

Limitations

The Saving Little Lives KMC dataset was limited by a high loss to follow up rate of over 35.5% between discharge and 28 days of the infant's life which impacted the number of women who could be followed across the study period. Next, the SLL KMC dataset's primary purpose was to collect data on KMC, not EBF practices. Thus, data for some variables related to EBF such as prelacteal feeding were not captured and thus not able to be evaluated. Next, some variables that are commonly linked as a determinant of EBF were not provided in the dataset and could not be evaluated. These variables include geographic residence (urban/rural), distance from health facility, maternal knowledge of breastfeeding, maternal intention to breastfeed, number of antenatal visits attended by the mother, marital status, and gestational age. Without these variables, key determinants of EBF could not be evaluated within LBW Ethiopian infants. Lastly, while some variables could be evaluated, the results suggested that interview questions may have been misinterpreted. For example, our results showed that the number of hours to initiate breastfeeding was between 0 and 72. Waiting 72 hours is very unlikely within this context. For these reasons, while this variable showed significance in the bivariate model, it was not included in the multivariate model as inclusion could induce bias.

Public Health Implications

This study found that having multiples, having an assisted or caesarian delivery, and maternal occupation as a farmer are significant determinants of failure to practice EBF at 28 days of the infant's life. These results highlight the importance of supporting women who are delivering

multiple infants or have undergone an assisted or caesarian delivery by offering breastfeeding counseling and support. Additionally, it is important to establish optimal breastfeeding practices while still in the hospital where support is more accessible. Lastly, programs educating women of the benefits of EBF and ways to practice optimal EBF practices while sustaining a job that makes such practices challenging should be aimed at women whose primary occupation is farming.

Another important note is that while not significant, we did find differences in EBF practices between LBW and VLBW infants. VLBW infants are likely to be more ill than LBW infants and require more neonatal care. Providing breastmilk to these most vulnerable infants is vital to improving neonatal mortality among VLBW infants. Thus, future programs should focus on supporting women of VLBW infants and design strategies to breastfeed weak or ill infants who may have trouble breastfeeding.

By understanding the determinants of EBF among mothers of LBW infants, Ethiopia can implement improved programs and policies that increase the prevalence of EBF within the first 6 months of the infant's life. Increasing EBF practices across Ethiopia will reduce neonatal, infant, and under-five child mortality, increasing quality of life, economic potential, and human capital. Further research should be done to further explore determinants of EBF among mother of LBW to continue the development of informed EBF programs and policies.

References

1. UNICEF. Neonatal mortality. 2021. https://data.unicef.org/topic/child-survival/neonatal-mortality/.
2. WHO. Newborns: improving survival and well-being. 2020.
3. Susuman AS. Child mortality rate in ethiopia. *Iran J Public Health* 2012; **41**(3): 9-19.
4. Collaborators GBDU-M. Global, regional, and national progress towards Sustainable Development Goal 3.2 for neonatal and child health: all-cause and cause-specific mortality findings from the Global Burden of Disease Study 2019. *Lancet* 2021; **398**(10303): 870-905.
5. Tekelab T, Akibu M, Tagesse N, Tilhaun T, Yohanes Y, Nepal S. Neonatal mortality in Ethiopia: a protocol for systematic review and meta-analysis. *Syst Rev* 2019; **8**(1): 103.
6. Beyene MG, Geda NR, Habtewold TD, Assen ZM. Early initiation of breastfeeding among mothers of children under the age of 24 months in Southern Ethiopia. *Int Breastfeed J* 2016; **12**: 1.
7. Temesgen H, Negesse A, Woyraw W, Getaneh T, Yigizaw M. Prelacteal feeding and associated factors in Ethiopia: systematic review and meta-analysis. *Int Breastfeed J* 2018; **13**: 49.
8. Uruakpa F, Ismond, M., Akobundua, E. Colostrum and its benefits: a review. *Nutrition Research* 2002; **22**(6): 755-67.
9. Organization WH. Kangaroo mother care : a practical guide. Geneva: World Health Organization; 2003.
10. Debes AK, Kohli A, Walker N, Edmond K, Mullany LC. Time to initiation of breastfeeding and neonatal mortality and morbidity: a systematic review. *BMC Public Health* 2013; **13 Suppl 3**: S19.
11. Beyene AM, Liben ML, Arora A. Factors associated with the early termination of exclusive breastfeeding among mother-infant dyads in Samara-Logia, Northeastern Ethiopia. *BMC Pediatr* 2019; **19**(1): 428.
12. Sobhy SI, Mohame NA. The effect of early initiation of breast feeding on the amount of vaginal blood loss during the fourth stage of labor. *J Egypt Public Health Assoc* 2004; **79**(1-2): 1-12.
13. Borra C, Iacovou M, Sevilla A. New evidence on breastfeeding and postpartum depression: the importance of understanding women's intentions. *Matern Child Health J* 2015; **19**(4): 897-907.
14. Erickson EN, Carter CS, Emeis CL. Oxytocin, Vasopressin and Prolactin in New Breastfeeding Mothers: Relationship to Clinical Characteristics and Infant Weight Loss. *J Hum Lact* 2020; **36**(1): 136-45.
15. Clinic C. The Benefits of Breastfeeding for Baby & for Mom. 2018. https://my.clevelandclinic.org/health/articles/15274-the-benefits-of-breastfeeding-for-baby--for-mom.
16. Woldeamanuel BT. Trends and factors associated to early initiation of breastfeeding, exclusive breastfeeding and duration of breastfeeding in Ethiopia: evidence from the Ethiopia Demographic and Health Survey 2016. *Int Breastfeed J* 2020; **15**(1): 3.

17. Wake GE, Mittiku YM. Prevalence of exclusive breastfeeding practice and its association with maternal employment in Ethiopia: a systematic review and meta-analysis. *Int Breastfeed J* 2021; **16**(1): 86.
18. Eshete A, Alemu A, Zerfu TA. Magnitude and Risk of Dying among Low Birth Weight Neonates in Rural Ethiopia: A Community-Based Cross-Sectional Study. *Int J Pediatr* 2019; **2019**: 9034952.
19. Kleinhout MY, Stevens MM, Osman KA, et al. Evidence-based interventions to reduce mortality among preterm and low-birthweight neonates in low-income and middle-income countries: a systematic review and meta-analysis. *BMJ Glob Health* 2021; **6**(2).
20. Flacking R, Ewald U, Wallin L. Positive effect of kangaroo mother care on long-term breastfeeding in very preterm infants. *J Obstet Gynecol Neonatal Nurs* 2011; **40**(2): 190-7.
21. UNICEF. Child Mortality - UNICEF DATA. 2022. https://data.unicef.org/topic/child-survival/under-five-mortality/.
22. Schroeder DG, Brown KH. Nutritional status as a predictor of child survival: summarizing the association and quantifying its global impact. *Bull World Health Organ* 1994; **72**(4): 569-79.
23. Schwinger C, Golden MH, Grellety E, Roberfroid D, Guesdon B. Severe acute malnutrition and mortality in children in the community: Comparison of indicators in a multi-country pooled analysis. *PLoS One* 2019; **14**(8): e0219745.
24. Organization WH. Newborn death and illness. 2011. https://www.who.int/pmnch/media/press_materials/fs/fs_newborndealth_illness/en/#:~:text=Causes%20of%20newborn%20death,depending%20on%20their%20care%20configurations.
25. Organization WH. Low birth weight. 2022. https://www.who.int/data/nutrition/nlis/info/low-birth-weight.
26. Yasmin S, Osrin D, Paul E, Costello A. Neonatal mortality of low-birth-weight infants in Bangladesh. *Bull World Health Organ* 2001; **79**(7): 608-14.
27. WHO. Preterm Birth. 2018.
28. Clinic M. Preterm birth - symptoms and causes. 2021.
29. Group WHOIKS, Arya S, Naburi H, et al. Immediate "Kangaroo Mother Care" and Survival of Infants with Low Birth Weight. *N Engl J Med* 2021; **384**(21): 2028-38.
30. Boundy EO, Dastjerdi R, Spiegelman D, et al. Kangaroo Mother Care and Neonatal Outcomes: A Meta-analysis. *Pediatrics* 2016; **137**(1).
31. CDC. Breastfeeding: Why it matters. 2021. https://www.cdc.gov/breastfeeding/about-breastfeeding/why-it-matters.html#:~:text=%E2%80%9CBreastfeeding%20provides%20unmatched%20health%20benefits,mothers%20who%20choose%20to%20breastfeed.%E2%80%9D (accessed February 21 2021).
32. Sankar MJ, Sinha B, Chowdhury R, et al. Optimal breastfeeding practices and infant and child mortality: a systematic review and meta-analysis. *Acta Paediatr* 2015; **104**(467): 3-13.
33. UNICEF. Feeding your baby: When to start with solid foods

. 2019. https://www.unicef.org/parenting/food-nutrition/feeding-your-baby-when-to-start-solid-foods#:~:text=From%20the%20first%20hour%20of,or%20fluids%20during%20this%20period.

34. Lutter CK, Pena-Rosas JP, Perez-Escamilla R. Maternal and child nutrition. *Lancet* 2013; **382**(9904): 1550-1.
35. WHO. Breastfeeding. 2018. https://www.who.int/health-topics/breastfeeding#tab=tab_2.
36. WHO. Complementary Feeding. 2019.
37. Phukan D, Ranjan M, Dwivedi LK. Impact of timing of breastfeeding initiation on neonatal mortality in India. *Int Breastfeed J* 2018; **13**: 27.
38. Bardanzellu F, Fanos V, Reali A. "Omics" in Human Colostrum and Mature Milk: Looking to Old Data with New Eyes. *Nutrients* 2017; **9**(8).
39. Mullany LC, Katz J, Li YM, et al. Breast-feeding patterns, time to initiation, and mortality risk among newborns in southern Nepal. *J Nutr* 2008; **138**(3): 599-603.
40. WHO. 2025 Global Nutrition Targets: Breastfeeding Policy Brief. n.d. https://www.google.com/search?q=global+rates+of+exclusive+breastfeeding&rlz=1C5CHFA_enUS772US772&sxsrf=APq-WBvZ65aBFheFgkXI3JrcJR94aS14lg%3A1645474216633&ei=qPETYryKJv-qqtsPu_KYuAg&ved=0ahUKEwi8_qyRzZH2AhV_lWoFHTs5BocQ4dUDCA4&uact=5&oq=global+rates+of+exclusive+breastfeeding&gs_lcp=Cgdnd3Mtd2l6EAMyBggAEBYQHjIGCAAQFhAeMgUIABCGAzIFCAAQhgMyBQgAEIYDMgUIABCGAzoECCMQJzoECAAQQzoQCC4QsQMQgwEQxwEQ0QMQQzoFCAAQkQI6CAgAEIAEELEDOggIABCxAxCDAToLCC4QgAQQxwEQrwE6CwguEMcBEK8BEJECOgUIABCABDoOCC4QgAQQsQMQxwEQ0QM6CggAEIAEEIcCEBQ6CwguEIAEEMcBENEDOgcIABCABBAKOggIIRAWEB0QHkoECEEYAEoECEYYAFAAWJ08YLs_aAFwAXgAgAHNAYgBjBqSAQYzNC41LjGYAQCgAQHAAQE&sclient=gws-wiz#:~:text=BreastfeedingPolicy%20Brief%20%2D%20WHO,rest%20%E2%80%BA%20bitstreams%20%E2%80%BA%20retrieve.
41. Asfaw MM, Argaw MD, Kefene ZK. Factors associated with exclusive breastfeeding practices in Debre Berhan District, Central Ethiopia: a cross sectional community based study. *Int Breastfeed J* 2015; **10**: 23.
42. Mose A, Abebe H. Prelacteal feeding practice and its determinant factors among mothers having children less than 6 months of age in Bure district, Northwest Ethiopia: a community-based cross-sectional study. *BMJ Open* 2021; **11**(9): e046919.
43. Rogers NL, Abdi J, Moore D, et al. Colostrum avoidance, prelacteal feeding and late breast-feeding initiation in rural Northern Ethiopia. *Public Health Nutr* 2011; **14**(11): 2029-36.
44. Tekaly G, Kassa M, Belete T, Tasew H, Mariye T, Teshale T. Pre-lacteal feeding practice and associated factors among mothers having children less than two years of age in Aksum town, Tigray, Ethiopia, 2017: a cross-sectional study. *BMC Pediatr* 2018; **18**(1): 310.
45. Habtewold TD, Sharew NT, Alemu SM. Evidence on the effect of gender of newborn, antenatal care and postnatal care on breastfeeding practices in Ethiopia: a meta-analysis andmeta-regression analysis of observational studies. *BMJ Open* 2019; **9**(5): e023956.
46. Bayih WA, Mekonen DK, Kebede SD. Prevalence and associated factors of prelacteal feeding among neonates admitted to neonatal intensive care units, North central Ethiopia, 2019. *BMC Public Health* 2020; **20**(1): 1457.
47. Morse JM, Jehle C, Gamble D. Initiating breastfeeding: a world survey of the timing of postpartum breastfeeding. *Int J Nurs Stud* 1990; **27**(3): 303-13.

48. Addisu D, Melkie, A., Bezie, M., Gedefaw, G. Determinants of Colostrum Avoidance among Postpartum

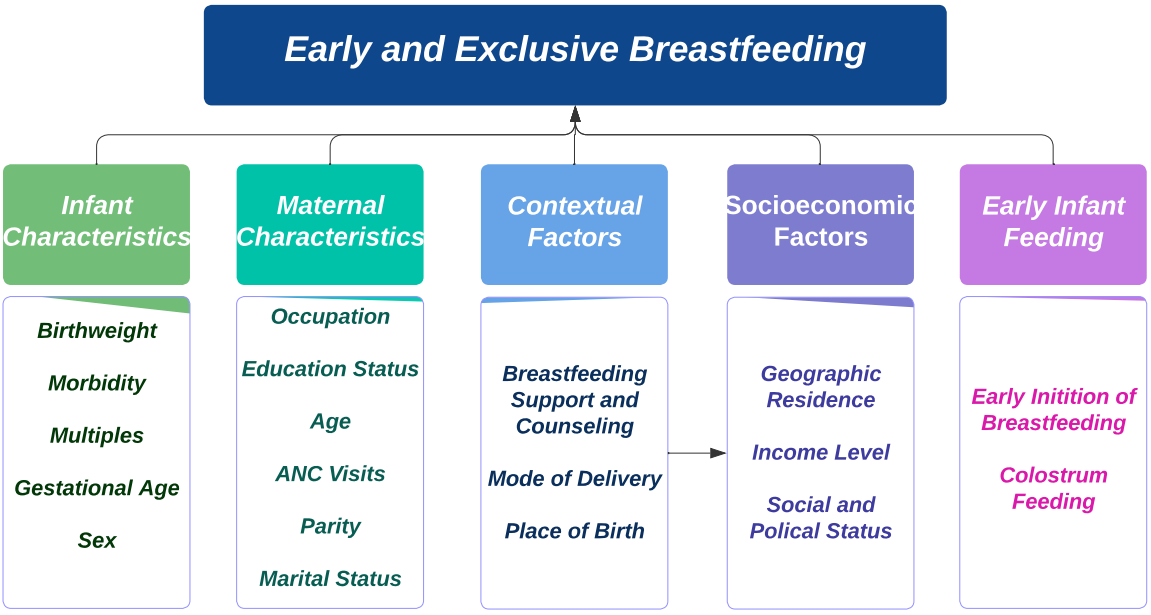
Mothers in North West Ethiopia. *Journal of Midwifery and Reproductive Health* 2019.
49. Ayalew T, Asmare E. Colostrum avoidance practice among primipara mothers in urban Northwest Ethiopia. A cross-sectional study. *BMC Pregnancy Childbirth* 2021; **21**(1): 123.
50. Mamemoto K, Kubota M, Nagai A, et al. Factors associated with exclusive breastfeeding in low birth weight infants at NICU discharge and the start of complementary feeding. *Asia Pac J Clin Nutr* 2013; **22**(2): 270-5.
51. Reilly S, Reid J, Skeat J, et al. ABM clinical protocol #18: guidelines for breastfeeding infants with cleft lip, cleft palate, or cleft lip and palate, revised 2013. *Breastfeed Med* 2013; **8**(4): 349-53.
52. Tahiru R, Agbozo F, Garti H, Abubakari A. Exclusive Breastfeeding and Associated Factors among Mothers with Twins in the Tamale Metropolis. *Int J Pediatr* 2020; **2020**: 5605437.
53. Mundagowa PT, Chadambuka EM, Chimberengwa PT, Mukora-Mutseyekwa F. Determinants of exclusive breastfeeding among mothers of infants aged 6 to 12 months in Gwanda District, Zimbabwe. *Int Breastfeed J* 2019; **14**: 30.
54. Asemahagn MA. Determinants of exclusive breastfeeding practices among mothers in azezo district, northwest Ethiopia. *Int Breastfeed J* 2016; **11**: 22.
55. Ortelan N, Venancio SI, Benicio MHD. [Determinants of exclusive breastfeeding in low birthweight infants under six months of age]. *Cad Saude Publica* 2019; **35**(8): e00124618.
56. Yeneabat T, Belachew T, Haile M. Determinants of cessation of exclusive breastfeeding in Ankesha Guagusa Woreda, Awi Zone, Northwest Ethiopia: a cross-sectional study. *BMC Pregnancy Childbirth* 2014; **14**: 262.
57. Tan ML, Foong SC, Ho JJ, Foong WC, Mohd R, Harun Z. Postpartum women's perception of antenatal breastfeeding education: a descriptive survey. *Int Breastfeed J* 2020; **15**(1): 85.
58. Teka B, Assefa H, Haileslassie K. Prevalence and determinant factors of exclusive breastfeeding practices among mothers in Enderta woreda, Tigray, North Ethiopia: a cross-sectional study. *Int Breastfeed J* 2015; **10**(1): 2.
59. Hobbs AJ, Mannion CA, McDonald SW, Brockway M, Tough SC. The impact of caesarean section on breastfeeding initiation, duration and difficulties in the first four months postpartum. *BMC Pregnancy Childbirth* 2016; **16**: 90.
60. Seyoum K, Tekalegn Y, Teferu Z, Quisido BJE. Determinants of Prelacteal Feeding Practices in Ethiopia: Unmatched Case-Control Study Based on the 2016 Ethiopian Demographic and Health Survey Data. *Midwifery* 2021; **99**: 103009.
61. Wolde TF, Ayele AD, Takele WW. Prelacteal feeding and associated factors among mothers having children less than 24 months of age, in Mettu district, Southwest Ethiopia: a community based cross-sectional study. *BMC Res Notes* 2019; **12**(1): 9.
62. Alemu SM, Alemu YM, Habtewold TD. Association of age and colostrum discarding with breast-feeding practice in Ethiopia: systematic review and meta-analyses. *Public Health Nutr* 2019; **22**(11): 2063-82.
63. Liben ML, Yimer NB, Feleke FW. Nearly one-in-five mothers avoid colostrum in North Wollo Zone, Ethiopia: an institution-based cross-sectional study. *J Nutr Sci* 2021; **10**: e100.

64. M GS, Azene ZN, Mulunesh A, Alamneh TS. Delayed breast feeding initiation increases the odds of colostrum avoidance among mothers in Northwest Ethiopia: a community-based cross-sectional study. *Arch Public Health* 2021; **79**(1): 44.
65. Yeshambel Wassie A, Atnafu Gebeyehu N, Abebe Gelaw K. Knowledge, Attitude, and Associated Factors towards Colostrum Feeding among Antenatal Care Attendant Mothers in Gununo Health Centre, Wolaita Zone, Ethiopia 2019: Cross-Sectional Study. *Int J Pediatr* 2020; **2020**: 3453502.
66. Ayalew T. Exclusive breastfeeding practice and associated factors among first-time mothers in Bahir Dar city, North West Ethiopia, removed: A community based cross sectional study. *Heliyon* 2020; **6**(9): e04732.
67. Alebel A, Tesma C, Temesgen B, Ferede A, Kibret GD. Exclusive breastfeeding practice in Ethiopia and its association with antenatal care and institutional delivery: a systematic review and meta-analysis. *Int Breastfeed J* 2018; **13**: 31.
68. Ariff S, Habib A, Memon Z, et al. Effect of Community-Based Kangaroo Mother Care Package on Neonatal Mortality Among Preterm and Low Birthweight Infants in Rural Pakistan: Protocol for a Cluster Randomized Controlled Trial. *JMIR Res Protoc* 2021; **10**(8): e28156.
69. Whitford HM, Wallis SK, Dowswell T, West HM, Renfrew MJ. Breastfeeding education and support for women with twins or higher order multiples. *Cochrane Database Syst Rev* 2017; **2**: CD012003.
70. Kitano N, Nomura K, Kido M, et al. Combined effects of maternal age and parity on successful initiation of exclusive breastfeeding. *Prev Med Rep* 2016; **3**: 121-6.
71. Tariku A, Alemu K, Gizaw Z, et al. Mothers' education and ANC visit improved exclusive breastfeeding in Dabat Health and Demographic Surveillance System Site, northwest Ethiopia. *PLoS One* 2017; **12**(6): e0179056.
72. Getnet B, Degu A, Yenealem F. Prevalence and associated factors of early initiation of breastfeeding among women delivered via Cesarean section in South Gondar zone hospitals Ethiopia, 2020. *Matern Health Neonatol Perinatol* 2020; **6**(1): 6.
73. Idris SM, Gordiano, A., Tafeng, O., Elgorashi, A. Factors Influencing Exclusive Breastfeeding among Mother with Infant Age 0-6 Months. *International Journal of Science and Research (IJSR)* 2013.
74. Hunegnaw MT, Gezie LD, Teferra AS. Exclusive breastfeeding and associated factors among mothers in Gozamin district, northwest Ethiopia: a community based cross-sectional study. *Int Breastfeed J* 2017; **12**: 30.
75. LMICs definition. https://www.lawinsider.com/dictionary/lmics#:~:text=LMICs%20or%20%E2%80%9CLow%20and%20Middle,to%2Dtime%20by%20the%20OECD.

(accessed April 2, 2022 2022).

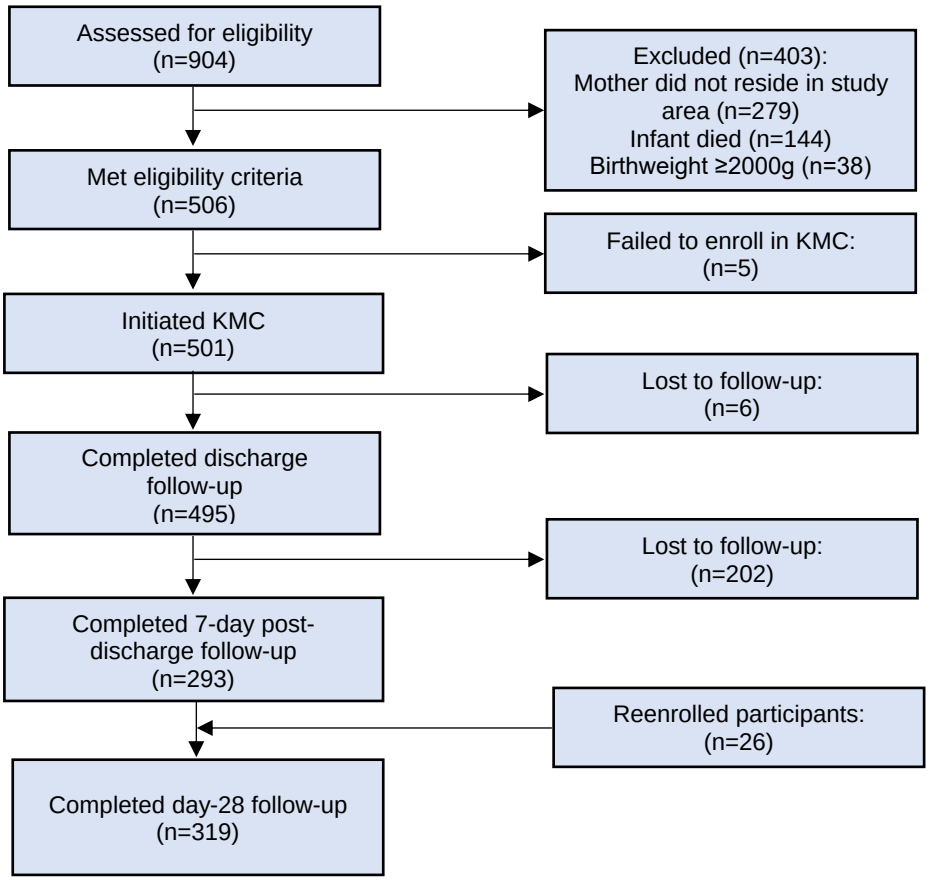
FIGURES

Figure 1: Conceptual Framework



Adapted from: Idris, Gordiano, Tafeng, & Elgorashi[73]

Figure 2: Subject Selection Flow Chart



TABLES

Table 1: Participant Characteristics of infants and mothers of low birthweight infants enrolled in Kangaroo Mother Care in Amhara, Ethiopia

Variable	At 28 days of life	
	LBW (<2000g) (N=270)	VLBW (<1500g) (N=49)
Infant characteristics		
Birthweight		
Median [Min, Max]	1750 [1500, 1990]	1350 [1080, 1490]
Multiples		
Singleton	206 (76.6%)	35 (71.4%)
Twins/triplets	63 (23.4%)	14 (28.6%)
Infant sex		
Male	144 (53.5%)	21 (42.9%)
Female	125 (46.5%)	28 (57.1%)
Maternal characteristics		
Mother's age		
Median [Min, Max]	27.0 [17.0, 40.0]	28.0 [20.0, 37.0]
17-21 years	36 (13.3%)	6 (12.2%)
22-35 years	214 (79.3%)	38 (77.6%)
36-40 years	20 (7.4%)	5 (10.2%)
Mother's work		
Housewife	125 (46.6%)	18 (36.7%)
Farmer	85 (31.7%)	20 (40.8%)
Other occupation	58 (21.6%)	11 (22.4%)
Mother's education		
No education	147 (57.9%)	28 (57.1%)
Some education	107 (42.1%)	21 (42.9%)
Contextual characteristics		
Mode of delivery		
Normal	240 (88.9%)	42 (85.7%)
Assisted/caesarian	30 (11.1%)	7 (14.3%)

Table 1: Participant Characteristics of infants and mothers of low birthweight infants enrolled in Kangaroo Mother Care in Amhara, Ethiopia

Variable	At 28 days of life	
	LBW (<2000g) (N=270)	VLBW (<1500g) (N=49)
Place of birth		
Health center	91 (33.7%)	18 (36.7%)
Health post	167 (61.9%)	30 (61.2%)
Other	12 (4.4%)	1 (2.1%)
Socioeconomic characteristics		
Family income		
Median [Min, Max]	30000 [1500, 350000]	25000 [5000, 80000]
Low	60 (24.0%)	15 (35.7%)
Lower middle	51 (20.4%)	8 (19.0%)
Upper middle	70 (28.0%)	8 (19.0%)
Upper	69 (27.6%)	11 (26.2%)
Early feeding practices		
Breastfeeding initiation		
Median [Min, Max]	12 [0, 72]	24 [2, 72]
0-5 hours	43 (27.2%)	2 (10.5%)
6-24 hours	67 (42.4%)	8 (42.1%)
25-48 hours	38 (24.1%)	5 (26.3%)
49-72 hours	10 (6.3%)	4 (21.1%)
Colostrum		
Yes	264 (98.1%)	41 (83.7%)
No	5 (1.9%)	7 (16.3%)

LBW = Low birthweight; VLBW = Very low birthweight

Table 2: Prevalence of Exclusive breastfeeding practices at study follow-up among mothers of low birthweight infants enrolled in Kangaroo Mother Care

EBF	At discharge	At 7-days post discharge	At 28 days of life
Yes	481 (97.4%)	288 (98.3%)	243 (76.2%)

EBF=Exclusive breastfeeding

Table 3: Unadjusted analysis of factors predicting exclusive breastfeeding at 28 days of life among mothers of low birthweight infants enrolled in Kangaroo Mother Care in Amhara, Ethiopia

	At 28 Days	
Variable	**cPOR**	**95% CI**
Infant Characteristics		
Birthweight		
LBW	Ref.	
VLBW	**0.45**	**(0.31, 0.66)**
Multiples		
Singleton	Ref.	
Twin/triplet	**0.50**	**(0.33, 0.75)**
Infant's Sex		
Male	Ref.	
Female	1.18	(0.83, 1.68)
Maternal Characteristics		
Age		
17-21	Ref.	
22-35	1.07	(0.62, 1.84)
≥36	1.57	(0.69, 3.57)
Occupation		
Housewife	Ref.	
Farmer	**0.60**	**(0.40, 0.89)**
Other	0.92	(0.57, 1.49)
Education		
No education	Ref.	
Some education	0.97	(0.67, 1.41)
Contextual Factors		
Mode of delivery		
Vaginal	Ref.	
Assisted/caesarian	**0.46**	**(0.28, 0.76)**
Place of delivery		
Health Center	Ref.	
Health Post	0.84	(0.58, 1.23)
Other	1.43	(0.55, 3.69)
Sociodemographic Factors		
Income (continuous)	1.08	(0.91, 1.27)
Early Infant Feeding Practices		
Breastfeeding initiation		
0-5 hrs.	Ref.	
6-24 hrs.	0.73	(0.36, 1.50)
25-48 hrs.	**0.38**	**(0.18, 0.79)**
49-72 hrs.	**0.26**	**(0.09, 0.71)**
Colostrum given		
Yes	Ref.	
No	0.91	(0.35, 2.4)

cPOR=Crude Prevalence Odds Ratio; CI=Confidence Intervals; LBW=Low birth weight; VLBW=Very low birth weight

Table 4: Multivariate analysis of factors predicting exclusive breastfeeding determinants at 28 days among mothers of low birthweight infants enrolled in Kangaroo Mother Care in Amhara, Ethiopia

Variable	n	aPOR*	95% CI
Infant Characteristics			
Birthweight category			
LBW (1500-1999g)	270	Ref.	
VLBW (1000-1499g)	49	0.70	0.46, 1.06
Multiples			
Singleton	241	Ref.	
Twins / Triplets	77	**0.64**	**0.42, 0.98**
Maternal Characteristics			
Mother's age at delivery (years)			
17-21	42	Ref.	
22-35	252	0.96	0.55, 1.66
≥ 35	25	1.20	0.53, 2.71
Mother's occupation			
Housewife	143	Ref.	
Farmer	105	**0.57**	**0.39, 0.85**
Other	64	1.02	0.64, 1.61
Mother's Education			
No education	175	Ref.	
Some education	122	0.74	0.50, 1.11
Contextual Factors			
Mode of delivery			
Normal	282	Ref.	
Assisted / Caesarian	37	**0.50**	**0.31, 0.80**
Socioeconomic Factors			
Income (continuous)			
Income	292	1.12	0.96, 1.30

*Each variable was adjusted for all other variables in the Table

aPOR=Adjusted Prevalence Odds Ratio; CI=Confidence Intervals; LBW=Low birth weight; VLBW=Very low birth weight

APPENDIX

Appendix 1: Terms and Definitions

Term	Definition
Colostrum	Early milk rich in immunoglobulins and lymphocytes that stimulate health immune function[8].
Exclusive breastfeeding	Feeding infants only breastmilk, directly from the breast or expressed, without any additional foods or liquids (even water), except drops or syrups containing vitamins, minerals, or medicine[74].
Early initiation of breastfeeding	Initiation of breastfeeding within one hour of birth[6].
Kangaroo Mother Care	A method of care of preterm or low birthweight infants where infants are carried, usually by the mother, with skin-to-skin contact and exclusive breastfeeding to improve infant outcomes[9].
Low-and-middle-income countries	Countries identified by the Organization for Economic Co=operation and Development (OECD) as having low-income or middle-income economies[75].
Low birthweight	Babies who are born weighing less than 2000 grams (4 pounds, 6.6 ounces)[25].
Morbidity	The condition of suffering from a disease or medical condition.
Mortality	Death
Neonatal	An infant who is between 0 and 28 days old.

Prelacteal feed	Giving any solid or liquid foods other than breastmilk during the first 3 days after birth[7].
Prematurity, preterm	Babies who are born alive before 37 weeks. There are a few sub-categories of preterm birth based on at what week gestation the infant was born[27].
Skin-to-skin contact	Direct skin-to-skin contact between the mother or caregiver and infant for an uninterrupted 60 minutes during the first 12 weeks and beyond[9].
Term infant	Infants who are born between 37 and 42 completed weeks of gestation[27].
Sustainable Development Goals	Also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity[4].
Very Low Birthweight	Babies who are born weighing less than 1500 grams (3 pounds, 5 ounces)[25].