ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Effect of Interpregnancy Interval on Adverse Birth Outcome in Gondar and Bahir Dar Referral Hospitals, North West Ethiopia: Case Control Study

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By: Aman Yesuf (B.Sc.)

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Acronyms and abbreviations

AAU	Addis Ababa University
ANC	Ante Natal Care
AOR	Adjusted Odds Ratio
APH	Ante Partum Hemorrhage
BMI	Body Mass Index
COR	Crude Odds Ratio
C/S	Cesarean Section
CI	Confidence Interval
DHS	Demographic and Health Surveys
DM	Diabetes Mellitus
EDHS	Ethiopian Demographic and Health Survey
FANTA	Food and Nutrition Technical Assistance Project
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
HIV	Human Immunodeficiency Virus
IPI	Inter Pregnancy Interval
IQR	Inter Quartile Range
IUGR	Intra-Uterine Growth Restriction
Kg/m2	Kilogram per meter squire
LBW	Low Birth Weight
LMP	Last Menstrual Period
MI PRAMS	Michigan's Pregnancy Risk Assessment Monitoring System
MPH	Master of Public Health
OR	Odds Ratio
PIH	Pregnancy Induced Hypertension
PPH	Post Partum Hemorrhage
PROM	Premature Rupture of Membrane
REC	Research and Ethical Committee
Rh	Rhesus
RR	Relative Risk

RVI	Retro Viral Infection
SD	Standard Deviation
SGA	Small for Gestational Age
SVD	Spontaneous Vaginal Delivery
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Abstract

Background: Study findings on inter-pregnancy interval and its effect on birth outcome are contradictory. Some studies report that it is a risk factor for adverse perinatal outcome while others say it has no association. Still less attention has been given to the way in which changes in family planning related behavior may affect adverse birth outcome. Identifying the interpregnancy interval at which risk of adverse birth outcome is occurred may benefit developing countries to prioritize family planning services.

Objective: To asses effect of short interpregnancy interval on adverse birth outcome in Gondar and Bahir Dar teaching- referral hospitals, Ethiopia.

Methods: Unmatched case control study design was used in a sample of 548 mothers who gave birth two or more times in Gondar and Bahir Dar teaching-referral hospital, Ethiopia. Cases were mothers who gave birth to LBW or preterm or stillbirth and controls were mothers who gave normal birth weight or term or live birth. Data were processed and analyzed using EPI Info and SPSS statistical software. A logistic regression was performed to identify the independent effect of interpregnancy interval on adverse birth out come.

Result: The median of interpregnancy interval for cases and controls were 32 and 38 months, respectively. The odd of adverse birth outcome was 2.36 (95% CI = 1.36, 4.08) for women having interpregnancy interval less than 24 months compared with the interval 24 and above. The odd of low birth weight was 2.67 (95% CI = 1.36, 5.01) when interpregnancy interval was less than 24 months compared to the interval 24 and above months. The odd of preterm birth was 2.92 (95% CI = 1.39, 6.12) for women having interpregnancy interval less than 24 months. Multivariate analysis showed that women who had interpregnancy interval less than 24 months were about 2.5 times more likely in resulting stillbirth compared to the interval 24 and above.

Conclusion: Interpregnancy interval less than 24 months had a significant effect on adverse birth outcome. So birth spacing education, counseling, and services should be given to women not to be pregnant before 24 months; as adverse birth outcome reduction strategies.

1. Introduction

1.1 Background

Both short and long intervals between pregnancies have been associated with increased risk of several adverse perinatal outcomes, such as preterm birth, low birth weight (LBW), small for gestational age (SGA), and perinatal death [1, 2]

Globally 15 million babies are born too soon every year. More than one in ten babies was born preterm, affecting families all around the world. Over one million children die each year due to complications of preterm birth. Many survivors face a lifetime disability, including learning disabilities and visual and hearing problems [3]. Preterm birth rates are increasing in almost all countries. Prematurity is the leading cause of newborn deaths (babies in the first 4 weeks of life) and the second leading cause of death after pneumonia in children under the age of five [3, 4]. Newborn deaths represented 8.2% and 13.6% of the burden of disease in Sub-Saharan Africa and South Asia, respectively [5].

The World Health Organization estimates that each year there is 4 million stillbirths and another 4 million newborns die in the first month of life. Of these deaths, an estimated 98% occur in developing countries [6]. Birth weight is a major determinant of infant survival, mortality, and health outcomes later in life. Babies weighing less than 2500 grams at birth are termed as LBW, irrespective of their gestational age. LBW may be because of prematurity (gestational age less than 37 weeks) or intra-uterine growth retardation (IUGR) or both. The LBW babies are at a higher risk of morbidity and mortality in the immediate newborn period [7].

According to UNICEF, low birth weight rates were 7%, 16% and 19%, respectively, in industrialized, developing and least developed countries in 2005 [8].

The Ethiopian Demographic and Health Survey, 2011 showed the perinatal mortality rate is 46 per 1,000 pregnancies of seven or more months of gestation. Among children born in the five years before the survey with a reported birth weight, 11% were under weight [9].

In Ethiopia, study done in Addis Ababa health institutions showed that 7.1%, 7.2% and 3.1% preterm birth, LBW and still birth, respectively. Stillbirth rate is an important indicator of access to and quality of antenatal and delivery care. Stillbirth prevalence at community level is typically less than 1% in more developed parts and could exceed 3% in less developed regions [10].

1.2 Statement of the problem

Although timing and spacing of pregnancy is important for the health and survival of the newborn and the mother, unintended pregnancy and short birth interval are still among the contributing factors for the high maternal and child mortality in developing countries including Ethiopia. Researchers have shown that family planning can reduce about 10% of child deaths by eliminating inter-birth intervals of less than two years [1, 11].

According to EDHS 2011 report, the median birth interval is 34 months (25 months of interpregnancy interval), implying that half of non-first births to women in Ethiopia occur less than three years after a previous birth or pregnant before 25 months after a previous birth. Twenty percent of births have an interval of less than two years, and 9 percent of births are less than 18 months apart. Thirty-six percent of births occur 24-35 months after the previous birth and 44 percent are at least three years apart. The median birth interval ranges from 26.7 months in Somali to 53.0 months in Addis Ababa; and 39.1 months for Amhara [9].

Several studies with arbitrarily defined interpregnancy interval reported that short interpregnancy intervals are associated with an increased risk of several adverse perinatal outcomes such as LBW, small for gestational age (SGA), and preterm birth [6, 12-14].

The aim of this study was to determine the effect of short interpregnancy interval (based on WHO cut point) on adverse birth outcome.

1.3 Rational of the study

Findings from studies evaluating associations between short interpregnancy interval and adverse birth outcome such as low birth weight, preterm birth and still birth have been contradictory. Several studies have reported that short interpregnancy intervals are associated with an increased risk of several adverse perinatal outcomes such as LBW, SGA, and preterm birth [6, 12-15]. Some studies have attributed the higher risk of poor pregnancy outcomes to factors associated with higher reproductive risk such as maternal socio-demographic characteristics and lifestyle, rather than causally related to, short interpregnancy intervals [16]. In contrast, other studies have reported that birth to pregnancy interval has no association in causing adverse birth outcome [10, 17].

Previous research in this area has several methodological differences, such as study design, lack of control for potential confounding factors, dichotomization of the measure of birth spacing on the basis of an arbitrarily defined cut point, and use of birth interval (time elapsed between the woman's last delivery and the birth of the index child) instead of interpregnancy interval (time elapsed between the woman's last delivery and the conception of the next pregnancy) as the measure of birth spacing. The use of birth intervals overestimates the risk of adverse perinatal outcomes for very short intervals between pregnancies [14]

There is a scarcity of published studies in Ethiopia and specifically in the area so this study were conducted in Amhara region, Gondar and Bahir Dar teaching-referral hospital the aim, to assess the effect of interpregnancy interval on adverse birth outcome. Furthermore it is an important public health issue to be addressed in line with Millennium Development Goal 4.

2. Literature review

2.1 Birth spacing

The World Health Organization (WHO) and other international organizations recommend that individuals and couples should wait after a live birth, the recommended interval before attempting the next pregnancy (i.e. birth-to-pregnancy interval) is at least 24 months in order to reduce the risk of adverse maternal, perinatal and infant outcomes. Recent studies supported by the United States Agency for International Development (USAID) suggested that an interval of 3–5 years might help to reduce these risks even further. After a miscarriage or induced abortion, the recommended minimum interval to next pregnancy should be at least six months in order to reduce risks of adverse maternal and perinatal outcomes [18, 19].

Interpregnancy intervals less than 12 months were more common among women who were younger; those who started prenatal care later, and had lower number of prenatal visits, as well as among women with history of miscarriage or whose previous pregnancy was complicated by low birth weight, fetal death, or early neonatal death [14].

In Nigeria socio-demographic variables such as, current age of mothers, the survival status of preceding child, age at first marriage, ethnicity, sex preference and parity, have significant difference in birth interval [20].

According to EDHS 2011report, the median birth interval is 34 months, implying that half of non-first births to women in Ethiopia occur in less than three years after a previous birth. Twenty percent have an interval of less than two years, and 9 percent of births are less than 18 months apart. Thirty-six percent of births occur 24-35 months after the previous birth and 44 percent are at least three years apart [9].

The median birth interval increases with age, ranging from 28.5 months for births to women aged 15-19 to 38.7 months for births to women aged 40-49. There are no substantial differences in the median birth interval by the child's sex or birth order. However, the median birth interval is 6 months shorter if the previous child died than if the previous child is still alive. The median birth interval ranges from 26.7 months in Somali to 53.0 months in Addis Ababa. The median

number of months since the preceding birth among non first births is longest for births to women who have gone to secondary school (53.8 months) than those who have no secondary education. The shortest median birth interval is for births to women with no education (33.3 months). There is no substantial difference in the median birth interval by wealth quintiles, although births to women in the highest wealth quintile have the longest median birth interval (38.9 months) [9].

A study done by Yohannes Dibaba analysis of birth intervals for women with non first births showed that 27% of births occurred within less than 24 months, 33% occurred between 24 and 35 months and only 35% of births occurred between 36 and 59 months after a previous birth; and women who were rural residents, husbands' occupation being student and daily worker, breast feeding for 7 to 12, 13 to 23 and 24 or more months, non use of modern contraceptives and highest wealth quartile were found to be significant predictors of short birth interval length [11].

A study done in health institutions at Addis Ababa sowed that there were 8.4% mothers who had a birth interval of less than 12 months and 23.9% had birth to pregnancy interval less than 24 months. However, 20.7% had greater than 72 months and 29.2% has greater than 60 months birth to pregnancy interval. The median birth interval was 40 months ranging from 2 to 99 months [10].

A case control study done in South Wollo zone reported that the median birth interval in the study area was 31.4 months, about 24% of mothers with age group 20-34 years had birth interval 48 months or more while only 8.0% had interval below 15 months. Similarly, about 22% of mothers with age 35 years or more had birth interval 48 months or more while 7.9% of them had birth interval less than 15 months. It was also found that 33% of mothers aged 20-34 years and 31.6% of mothers aged 35 years or more had birth interval 24-35 months. All mothers with age 19 years or less had birth interval 48 months or more. However, the absolute number of births was very low (only two) for this age group [21].

2.2 Adverse birth out come

Globally More than 10% of babies are born preterm, a figure that is rising, and complications due to preterm birth are the leading cause of newborn deaths and the second leading cause of child deaths [4].

More than 1.1 million children die every year due to complications of being born too soon, and many others experience a lifetime of disability. Approximately 80% of preterm births occur between 32 and 37 weeks of gestations, and most of these babies survive when they receive essential newborn care; 75% of deaths of preterm babies can be prevented without intensive care [4]. Preterm birth affects 12% of all births in US [22].

In 2010 a cross sectional institute base study done in Addis Ababa showed that prevalence of preterm birth was about, 7.1% [10].

Worldwide an estimated 2.7 million of third-trimester stillbirths occur every year, of which 98% occur in low and middle income countries. Nigeria and Pakistan have the highest stillbirth rates (42 and 47 per 1000 births, respectively) and Finland and Singapore have the lowest (each 2 per 1000 births). And approximately 1.2 million stillbirths occur during labour; these are known as intrapartum stillbirths. The risk of intrapartum stillbirth is 24 times higher for an African woman than for a woman in a high-income country [4].

In high-income countries, one in every 200 pregnant women reaching 22 weeks' gestation will have a stillborn baby [15]. In the United States during 2002, there were approximately 26,000 stillbirths, a rate of 6.4/1,000 total births. Black women have more than twice the rate of stillbirth of white women [23]. Stillbirth prevalence at community level is typically less than 1% in more developed parts and could exceed 3% in less developed regions. The rate in Sub-Saharan Africa is 32 per1000 births [10].

In Ethiopia according to the EDHS, 2011report the overall perinatal mortality rate was 46 still births per 1000 live births increased from 37 still births per 1,000 live births in the 2005 DHS

[9]. A study done at Tikur Anbessa Hospital has shown a stillbirth rate of 53.3/1000 births and contributed to 77.2% of gross perinatal mortality [10].

More than 20 million infants worldwide, representing 15.5 per cent of all births are born with low birth weight, 95.6 per cent of them in developing countries. The level of low birth weight in developing countries is 16.5% more than double the level in developed regions (7%). Half of all low birth weight babies are born in South-central Asia, where more than a quarter (27%) of all infants weighs less than 2,500 g at birth. Low birth weight levels in sub-Saharan Africa are around 15%. Central and South America have, on average, much lower rates (10%), while in the Caribbean the level (14%) is almost as high as in sub-Saharan Africa. About 10% of births in Oceania are low birth weight births [1].

According to EDHS 2011 only 5% of children in Ethiopia are weighed at birth. Among children born in the five years before the survey with a reported birth weight, 11 percent weighed less than 2.5 kilograms [9]. The study done in Addis Ababa health institution reported the rate of low birth weight was 7.2% [10]. A study done in Gondar teaching hospital the incidence of low birth weight (birth weight < 2 500 g) and very low birth weight (birth weight < 1 500 g) was 15.4% and 2.6% respectively [24].

2.3 Interpregnancy interval and adverse birth outcome

Several studies have reported that short interpregnancy intervals are associated with an increased risk of several adverse perinatal outcomes such as LBW, SGA, and preterm birth [12-14, 25]. In addition, short intervals between pregnancies have been implicated as a risk factor for perinatal death in some but not all studies. Fewer studies have shown that long interpregnancy intervals are also associated with these risks [13, 14]. Infants with a birth interval of 27 to 32 months had the lowest risks of adverse perinatal outcomes. Shorter and longer birth intervals were associated with higher risks. These associations persisted when the data were stratified according to and controlled for the biologic, socio-demographic, and behavioral risk factors [6].

The review done by Conde-Agudelo found that the optimal birth-to-conception interval for prevention of adverse perinatal outcomes is 18 to 59 months. There were no differences in the

risk of adverse perinatal outcomes such as low birth weight, preterm birth and SGA between women with intervals 24 to 59 months and those with 18-23 months. Less clear is the association between both short and long interpregnancy intervals and the risk of fetal and early neonatal death. However, long interpregnancy intervals, possibly greater than 59 months, were independently associated with an increased risk of preeclampsia [26].

Compared with infants conceived 18–23 months after a previous birth, infants conceived less than 6 months after a birth faced about 50% increase in risk of both early neonatal death and fetal death, 80–100% increased risk for LBW or very LBW or preterm birth or very preterm birth, and 30% increase in risk of SGA. Moreover, infants conceived 6–11 months after a birth were 15–33% more likely to suffer any of the adverse perinatal outcomes considered. The minimal increase in the risk for adverse perinatal outcomes is associated with intervals of 12–17 months (3–8%). On the other hand, infants conceived 60 months or more after a birth had about 20% increased risk of early neonatal death, fetal death, LBW, preterm birth, and SGA, and a 15% increased risk of very LBW and very preterm birth [14].

Moderate evidence was found that an IPI of < 12 months increases the risk of stillbirth, early neonatal death, preterm birth and low birth weight [27]. A study done by Conde-Agudelo reported Adjusted odds ratio (AOR) of 1.54 in 95% CI of [1.28, 1.83] and 1.24 with 95% CI [1.14, 1.35] for stillbirths of 20 weeks' gestation among women with IPIs of less than 6 months and 6–11 months, respectively [14].

A study done in Latin America reported that compared to infants with a birth interval of 27-32 months, infants with a birth interval less than 15 months had a significant risk for preterm delivery, very preterm delivery, small for gestational age, fetal death, and neonatal death [6]

Studies done in US reported that A J-shaped relationship between interpregnancy interval and adverse birth outcomes persisted to all age groups, wherever the data supported the stratified analysis. The optimal interpregnancy interval for preventing adverse birth outcomes appeared to be approximately 18-23 months, departing from which the risk for adverse birth outcomes

increased, although the increase was not appreciable unless the interpregnancy interval was shorter than 6 months or longer than 5 years [28].

MI PRAMS reported no significant differences between short, optimal, and long interpregnancy intervals for infant mortality, low birth weight, premature rupture of membranes, premature delivery, birth defects [29].

Infants born to women with interpregnancy intervals shorter than 6 months had higher risk of preterm birth, LBW and SGA compared with infants born to women with intervals of 18 to 23 months. Likewise, women with intervals of 6 to 17 months were 8% to 23% more likely to give birth to infants with these adverse outcomes. Infants conceived 60 months or more after a birth had higher risk for preterm birth, LBW, and SGA [13].

Study done in Nigeria showed that long Interpregnancy interval is unlikely to have any marked direct effect on the outcome of pregnancy [30]. The DHS working paper states the increased risk of low birth weight and small size at birth due to a short birth to pregnancy interval is limited to intervals of less than 18 months [25].

There are many reasons to suspect that a short birth interval could adversely affect nutritional status of the mother or the child. For the mother, a short birth interval may give her insufficient time to recover from the nutritional burden of pregnancy. If the mother reserves have been depleted, it is theorized that a longer interpregnancy interval would allow for repletion prior to the next conception. However, this theory of maternal depletion and repletion does not take into account the nutritional impact of breastfeeding [31].

EDHS 2011 Ethiopian report showed that, short birth intervals substantially reduce children's chances of survival, especially intervals of less than two years. For example, children born less than two years after the preceding birth are 2.5 times as likely to die within the first year of life and within the first five years of life as children born three years after the preceding birth [9].

A cross sectional study done in Addis Ababa health institution birth to pregnancy interval showed none significant association to adverse perinatal outcomes [10].

2.4 Socio- demographic and reproductive health factors of adverse birth outcome

A study done in Jimma reported that babies born to those families who earn monthly income below 100 birr had 87% higher risk of being low birth weight compared with those who earn 300 birr or more **[32].**

Study done by Anjum et al. teenage pregnancy, low family in-come (OR = 5.13), number of antenatal visits (OR = 4.08), source of income (mother, father or both) and maternal illiteracy had statistically significant association with low birth weight outcome. Pregnancy induced medical ailments like gestational diabetes, hypertension, renal disorders, use of drugs, smoking and addiction were significantly associated with LBW delivery. Maternal height, weight, body mass index (BMI), pervious bad obstetric history were also associated with low birth weight outcome. It has been shown that the birth weight increases with parity (up to 4 – 5 births) but declines thereafter [7]. In India mothers below the age of 20 years had higher risk of delivering low birth weight baby compared to those aged above 20 years (P = 0.005, AOR = 1.36) [33].

The DHS working paper in Zimbabwe reported that, multiple-birth children are 11 times more likely to have a low birth weight than singleton births. Higher maternal BMI is associated with lower likelihood of low birth weight. Also, female births are significantly more likely to have low birth weight than male births. Controlling for the characteristics of the mother and child, none of the household socioeconomic or environmental characteristics is significantly associated with low birth weight [17].

Extremes of maternal childbearing age have been associated with adverse pregnancy outcomes. The incidence of LBW births has been described to follow a “U” shaped curve with high numbers of LBW births at the extremes of age. There is an indication of increased risk of preterm/IUGR births for unmarried women. Associations between HIV infections, tobacco users were higher on preterm/LBW births [34].

The Study done by Mullally et al. showed that high alcohol intake was associated with preterm birth, very preterm birth and low birth weight outcomes on univariate analysis. The association with very preterm birth remained after controlling for socio-demographic confounding factors [8].

Study done in Addis Ababa health institution reported that, mothers with secondary education level were less likely to have LBW with OR 0.5. And mothers with history of PPH in the preceding delivery and pregnancy complication to current pregnancy have shown a statistical significant association to LBW with OR 3.5 and OR 4.5, respectively. Mothers who are unable to read and write had highest rate of preterm delivery. Deliveries that happened following contraceptive failure have high preterm birth but not statistically significant. The presence of any form of pregnancy complication in the current pregnancy had a statistically significant association to preterm birth [10].

Study done in Gondar university hospital reported there was a statistically significant difference in the birth weights between primiparous (AOR= 5.68; 95%CI: 2.20, 14.66),but multiparous mothers and maternal age, residence and sex of the newborn were not significantly associated with LBW [35]. In Sira Lanka maternal age below 19 years had no significant association to deliver low birth weight baby [36].

A systematic review and mat analysis on risk factors of stillbirth in high income countries a review article showed that overweight and obesity, increases in the odds of stillbirth by 23% and 60%, respectively. No association between stillbirth and low maternal weight (BMI < 25 kg/m2. Any smoking during pregnancy (based on maternal reporting in early pregnancy) was associated with a 36% increase in the odds of stillbirth. Maternal age older than 35 years is associated with an increase of 65% in the odds of stillbirth and the risk increases with increasing age, doubling the odds for women older than 40 years. Heavy smoking (≥10 cigarettes per day) showed almost a doubling of the odds of stillbirth (aOR 1.86) [15, 23].

A study done in Zimbabwe reported that young mothers were less likely than older women (RR= 0.73) to deliver a stillborn infant. In contrast, women above 35 years had a 59% increased risk of stillbirth and 43% increase in the likelihood of delivering a macerated stillbirth. Rural women had a 24% increased risk of stillbirth compared with women who resided in urban areas. Women who did not receive prenatal care consistently had over a 2.3-fold increase in the risk of stillbirth of any type. Compared to a normal vaginal delivery, breech deliveries were over 4.7 times more likely to be stillbirth, while births by Cesarean section were less likely to result in any type of stillbirth. Delivery by instrumentation was 2.2 times more likely to result in a fresh stillbirth than was normal vaginal delivery [37].

Review done in developed countries showed that, black women consistently have had approximately twice the risk of stillbirth of white women [23].

A study done in Addis Ababa health institution reported that, Muslims have the lowest (0.4%) stillbirth rate. Maternal age has no significant association with stillbirth. Similarly, the study reported that past medical and obstetric history, preceding birth outcome, complication of labor, current pregnancy outcomes and birth to pregnancy interval were less likely to have stillbirth delivery. Mothers with elementary and secondary educational status compared with those who are unable to read and write (OR 0.2 and 0.4, respectively) are less likely to have stillbirth delivery. Among infants born with congenital malformations 44.4% were stillbirths with OR 27. Among those mothers who had pregnancy complications of the current pregnancy, 10.7% had ended in stillbirth, the presence of pregnancy complications to index (current) pregnancy had statistically significant association with stillbirth with OR=4.7 [10].

Study done in Tanzania reported that complications during delivery such as placenta abruption and previa have been directly associated with low birth weight [38].

2.5 Summary

Globally a considerable number of babies are born preterm, a figure that is rising, and complications due to preterm birth are the leading cause of newborn deaths and the second leading cause of child deaths. And estimated 2.7 million third-trimester stillbirths occur every

year, 98% in low and middle income countries. More than 20 million infants worldwide, representing 15.5 per cent of all births are born with low birth weight, 95.6 per cent of them in developing countries.

A number of studies have reported that short interpregnancy intervals are associated with an increased risk of several adverse perinatal outcomes such as low birth weight (LBW), small for gestational age (SGA), and preterm birth. Studies done in US and Latin America reported that A J-shaped relationship between interpregnancy interval and adverse birth outcomes persisted.

The DHS working paper states the increased risk of low birth weight and small size at birth due to a short birth to pregnancy interval is limited to intervals of less than 18 months [25].

A study done in Addis Ababa reported that birth to pregnancy interval showed none significant association to adverse perinatal outcomes [10].

However, most studies used different intervals as a reference group and as exposure and the methodology used were different and therefore the reported findings are inconsistent. So this study was aimed to determine the effect of short interpregnancy interval based on WHO recommendation cut point which is less than 24 months on adverse birth outcome by controlling confounders.

2.6 *Conceptual Frame work*

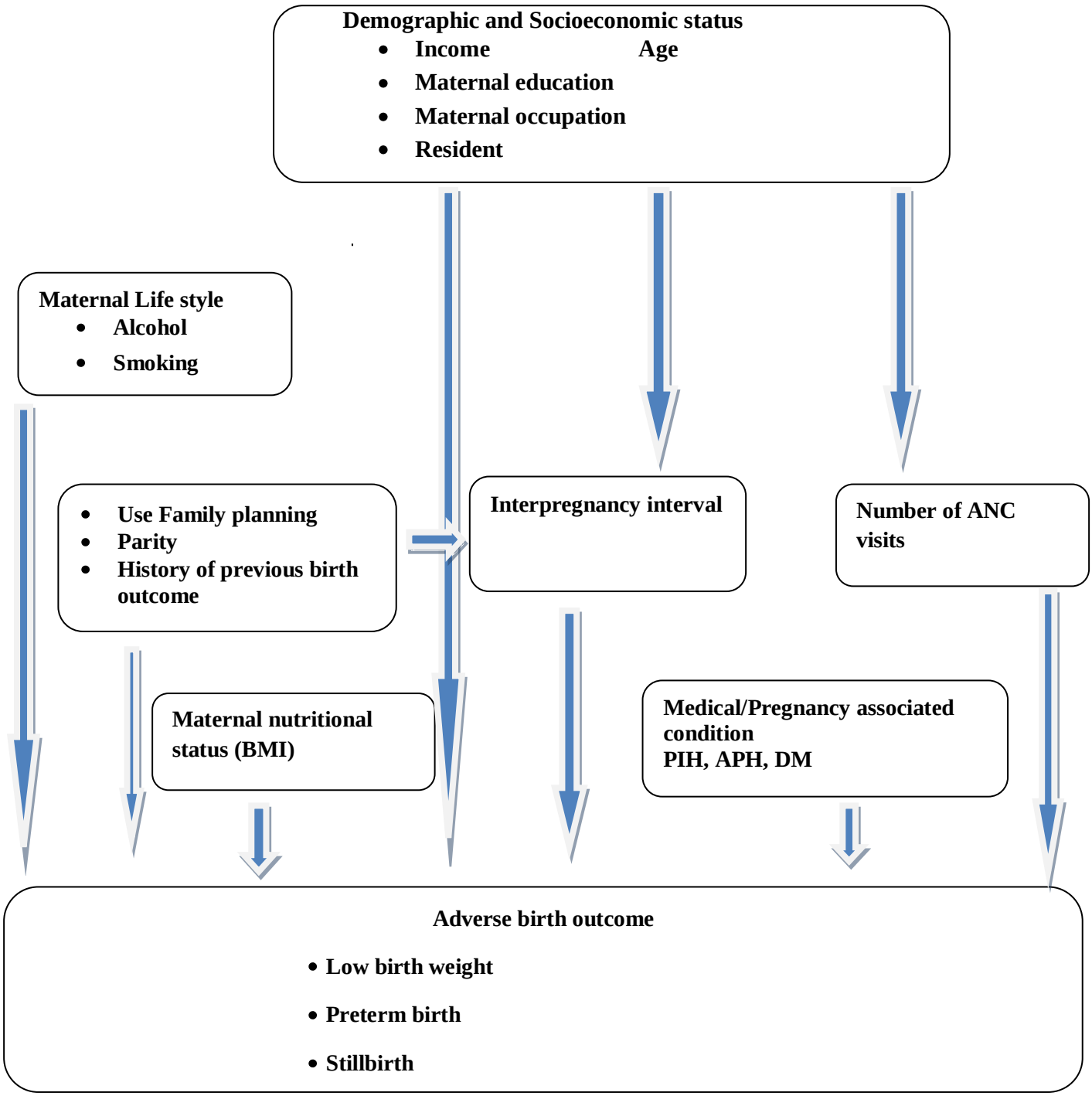

Figure 1: Influence of potential confounding factors associated with interpregnancy interval and adverse birth outcomes based on a conceptual hierarchical model.

3. Objectives

3.1 General objective:

To determine the effect of short interpregnancy interval on adverse birth outcome in Gondar and Bahir Dar referral hospital, North West Ethiopia

3.2 Specific objectives

1. To determine effect of short interpregnancy interval on low birth weight
2. To determine effect of short interpregnancy interval on preterm birth
3. To determine effect of short interpregnancy interval on stillbirth

4. Methodology

4.1. Study design

The study design was health institution based unmatched case control. It tested the null hypothesis that short interpregnancy interval has no effect on adverse birth outcome, against the alternative hypothesis; too soon interpregnancy interval risk factor for adverse birth outcome.

Cases: mothers who gave birth of LBW or preterm or stillbirth with previous history of birth.

Control: mothers who gave birth of normal weight, term and live birth with previous history of birth.

4.2. Study area and period

The study was conducted in Gondar and Bahir Dar teaching-referral hospitals. Bahir Dar is the capital city of the Amhara National Regional State in the Federal Democratic Republic of Ethiopia. It is located in North West Ethiopia at 11" 38'N, 37" 10'E on the southern side of Lake Tana (where Blue Nile river starts) and 565 Km far from Addis Ababa. The altitude of the city is about 1801m above mean sea level. The city covers an area of 16,000 hectares. [39].

Bahir Dar teaching- referral hospital is found in Bahir dar city. The Hospital provides delivery services 24 hours a day, 7 days a week. The hospital provides about 472 deliveries in a month.

Gondar teaching referral hospital is located in North Gondar Zone at about 727 kilometers Northwest of Addis Ababa and 194 Km far from regional city, Bahir Dar. The hospital provides delivery services 24 hours a day, 7 days a week. The hospital provides about 540 deliveries in a month.

The study period was Feb.10 – April 30, 2013.

4.3. Study population

4.3.1. Source/ study population

All mothers who gave non first birth after 28 weeks gestational ages in Gondar and Bahir Dar teaching referral hospitals were source population. The study populations were mothers who gave birth at least the 2nd time after 28 weeks of gestational age in Gondar and Bahir Dar teaching-referral hospitals.

4.3.2. Inclusion and exclusion criteria

4.3.2.1. Inclusion criteria

- ✓ All Mothers attending the hospitals and gave singleton birth.
- ✓ All mothers attending the hospitals who gave birth at least for the second time and who had no abortion in the preceding pregnancy.

4.3.2.2. Exclusion criteria

- ✓ Mothers who have had abortion in the preceding pregnancy. (Since mothers who had abortion have recommended IPI of 6 months).

4.3.3. Sample size

The number of cases and controls to be enrolled for the study was calculated based on the sample size formula for unmatched case control studies. The total number of cases and controls were calculated by applying the formula; taking type one error to be 5%, and 80 % power

$$n_1 = \frac{\left[z_{\alpha/2}\sqrt{(1+1/r)\bar{p}\bar{q}} + z_{\beta}\sqrt{p_1q_1 + p_2q_2/r} \right]^2}{(p_1 - p_2)^2}$$

Where;

- n_1= number of mothers who delivered a baby with adverse birth outcome (stillbirth or low birth weight or preterm birth), (**case)**

- n_2= number of mothers who delivered normal birth (normal birth weight, live and term birth) , **(control)**
- r= the ratio of cases to control
- $\bar{p} = \frac{p_1 + r \times p_2}{r+1}$; $\bar{q} = 1 - \bar{p}$
- $P1 = \frac{p_2}{P2 + \frac{1-P2}{OR}}$
- P_1= proportion of mothers who had short interpregnancy interval among mothers delivered of adverse birth outcome.
- P_2=proportion of mothers who had short interpregnancy interval among mothers of giving normal birth.
- α =Type one error(0.05)
- $z_{\alpha/2}$= Critical value at 95 % level of significance
- $z_{1-\beta}$= standard normal distribution value corresponding to power

In Addis Ababa the frequency of exposure (short IPI) among normal birth weight, live and term birth were 23.47%, 23.45% and 23.52% respectively [10].

In Latin America Infants with a birth interval less than 15 months had odds ratios of 2.31 (95% CI=2.20-2.43) for preterm delivery, 2.40 (95% CI=2.14-2.69) for fetal death, 1.8 (95% CI=1.78, 1.9) for low birth weight [6, 14].

Taking the three OR and the expected frequency of exposure (short IPI) among normal birth weight, term and live birth and α = 0.05 (two sided), β = 0.20, and r = 2.
By applying the formula written above as well as Epi-Info 3.5.1 the sample size is summarized below (Table 1).

Table 1: Sample size calculation summary

Variables	OR	P2(exposure in not ill)	Cases (n1)	Controls (n2)	Total (n)
Low birth weight	1.80	23.47%	176	352	**528**
Preterm birth	2.31	23.45%	85	170	**255**
Stillbirth	2.40	23.52%	78	156	**234**

Since the study assessed the three outcomes the maximum sample size was used. Adding 5% allowance for non response, the total number of cases required were 185 (number of mothers who gave adverse birth outcome; either stillbirth or low birth weight or preterm birth). The expected number of controls was 370 as the case to control ratio is 1:2. The minimum sample size required was, therefore, **555** mothers.

Separate analysis was done for low birth weight, preterm birth and stillbirth by considering each as cases (outcome) with all controls as the case to control ratio of 1:4

4.3.4. Sampling procedure

The number of subjects selected from each hospital was according to the cases load during the study period. All mothers who fulfill the inclusion criteria and gave birth of LBW or preterm or still birth were included as cases. And two consecutive controls were selected after a case was identified from the same institution.

4.4 Data Collection

4.4.1 Data Collection Tools and Measurement

A structured questionnaire was developed for other than nutrition question by reviewing different literatures. The questionnaire was prepared originally in English and then translated to Amharic and back to English. Data was collected through interviewer administered questionnaire; measurement (birth weight) and document review (Rh factor, ultra sound). The interview process was administered in Amharic language. Data collection was conducted by six well trained data collectors who are health workers (midwives) and two supervisors, one health officer and the principal investigator supervised six data collectors. Data collectors were recruited by their

experience on data collection and for being regular time worker in the delivery rooms. The questionnaire was pre-tested outside the study area before one week; the main data collection process was commenced.

Household food security level was determined using standardized set of questions derived from version 3 of the household food insecurity access scale measurement guide [40]. This guide consists of nine occurrence questions that represent a generally increasing level of severity of food insecurity (access), and nine "frequency of occurrence "questions that are asked as a follow up to each occurrence question to determine how often the condition determined. In this study we used only the nine occurrence questions. The collected responses were coded as 0 or 1. Household food security was categorized in to 4 food security categories according to their insecurity severity.

Table 2 : Classification of household based on their food security status using HFIAS

Category	Food security status	Criteria
1	Food secure	Q1=0 or Q2=1 and all other Q=0
2	Mildly food insecure	Q2 or Q3=1 and all other Q = 0
3	Moderately food insecure	Q4 or Q5 or Q6=1 and all other Q=0
4	Severely food insecure	Q7 or Q8 or Q9=1

Household dietary diversity score were used. Twelve food groups were recommended by FANTA [41] but we used the common nine foods to assess the dietary diversity score of households. Mean consumption scores were used as discrete quantitative variables. Mean consumption score of the sample population were categorized as; high and low dietary diversity.

4.4.2 Data Collection Procedure

Data collectors (midwives) check the mother's history card or ask about parity and abortion in the preceding pregnancy for inclusion of study participants. Status of the newborn was checked immediately after delivery to rule out stillbirth. Weight of the newborns was measured using a baby weighing scale and recorded in grams. Birth weight was taken within 2 hours after delivery, naked and before taking anything per mouth. Gestational age was estimated from the calculation

based on first day of the last menstrual period but the ultrasound scan estimate was taken for cases and controls if the dates were uncertain and if available on the card.

The above criteria were done first to identify cases and controls. Interview and record review were done to measure explanatory variables.

Birth to pregnancy interval was calculated by counting the time period from the start of the index pregnancy (as evidenced by LMP) and the date of the preceding birth calculate to the nearest month. If the mother was not able to remember her LMP date; the interval between the birth of the preceding pregnancy and the index child was consider and changed to interpregnancy interval by subtract gestational age (based on ultra sound if any).

4.4.3 Study Variables

Outcome variables

Adverse birth outcome either of LBW or preterm birth or stillbirth, Low birth weight, Preterm birth and stillbirth

The main explanatory variables were inter-pregnancy interval (the time period between the birth of the previous child and conception of the index child). In order to control for confounding, data were collected on variables related to demographics and socioeconomic characteristics, maternal reproductive history, maternal medical history, household food security, household dietary diversity and life style (smoking and alcohol).

4.4.4 Operational definitions

Low birth weight: birth weight of less than 2,500 grams and live birth

Preterm birth: is a baby born before 37 completed weeks of pregnancy and live birth.

Still birth: is defined as intrauterine death of a fetus weighing at least 500 grams after 28 completed weeks of gestation occurring before the complete expulsion or extraction from its mother [1].

Interpregnancy interval: the time period between the birth of the previous child and conception of the index child

Short interpregnancy interval: a woman who become pregnant before 24 months.

Birth interval: is defined as the length of time between two successive live births [19].

4.4.5 Data quality Assurance

Several data quality measures were considered to keep the validity of the study. The data collection instrument; questionnaire, was pre-tested in the study area within two health center and 20 participants, 10 from each. Two days training was given to data collectors to be familiar with the objective, on the standard procedures of weight measurement, on IPI calculation, to standardize their interviewing technique and to ask question in consistent manner. Questionnaires were prepared in English then translated in to Amharic language for data collection. To check whether the translation was consistent with the English version the questionnaire was back translated to English by someone other than the investigator. The data collection process was closely monitored by supervisors and the principal investigator, who checked every questionnaire meticulously so that all incomplete and inconsistent forms were identified. As a result errors were corrected. And also during data management, storage, cleaning and analysis consistency and completeness were checked.

4.5 Data Processing and Analysis

Data was entered and cleaned in Epi Info for windows version 3.5.1 and exported to SPSS version 16 statistical software. Interpregnancy interval was grouped as less than 24 months (short) and 24 or above months (normal).

Principal component analysis was used to construct wealth index using household asset data. The wealth index was created for urban and rural areas separately after identifying the common asset data.

Frequency was conducted to describe the data used in the study followed by a bi-variate logistic regression analysis to examine the impact of interpregnancy interval and other risk factors on adverse birth outcome without adjusting for other covariates.

Potential interactions among exposure variables i.e. interpregnancy intervals and other risk factors were assessed. Multivariate logistic regression model was performed and checks assumption, then after, to identify whether interpregnancy interval is the significant independent

determinant of adverse birth outcome adjusted odds ratios and 95% confidence interval was used.

All variables with p- value less than or equal to 0.05 during bi-variate analysis were included in the multivariate logistic regression model. Odds ratio with 95% confidence intervals (CIs) were used to test the significance of the association after multivariate analysis.

4.6 Ethical Considerations

Ethical clearance was obtained from Addis Ababa University, School of Public health REC before the start of field work. The official letter of co-operation was written to Amhara region health office from AAU, School of Public Health. And Amhara regional health office wrote to Gondar and Bahir Dar teaching-referral hospital. On top of that, all individuals interviewed were requested for verbal consent. In order to assure confidentiality mothers name weren't written on the questionnaire. All the participants in the questionnaire were told about their participation would be on voluntary basis. Privacy of clients was maintained. Moreover, respondents were clearly told about the study and the variety of information need from them. Data collectors were trained to provide necessary health education to the respondents about fertility control and its importance after completing the data collection procedure.

4.7 Dissemination Plan

The final report of this research will be presented and submitted to School of Public Health, Addis Ababa University, as partial fulfillment of MPH degree in Epidemiology. The summary of the final report will be submitted to the Ministry of Health, Amhara regional health office, health administrative Office of the institution, and other stake holders who have a keen interest on the subject matter. The study result will also be published in national or international journals.

5. Results

5.1 Description of the Study Subjects

5.1.1 Socio demographic and socio-economic characteristics of study participants

Data was obtained on 183 (98.9%) of cases and 365 (98.6%) controls, making the overall response rate of 98.4%.

The mean (SD) of age for cases and controls were 29.66 (±5.65) and 29.0 (±4.67) years respectively. About 69% of case and 82.5% control were in the age group of 21-35. The proportion of cases in the age group greater than 35 was higher (26.8%) than controls (16.2%). Similarly proportion of cases in the age group below 20 was higher (4.4%) than controls (1.4 %). More than 96% of cases and controls were married. About 94% of cases and control each were Amhara by ethnicity and 90.2% of cases and 83.3% of controls were followers of orthodox in religion, followed by 9.3% of cases and 14.5% of controls were Muslim. About 45% of cases and 74% controls reside in urban areas.

Concerning educational status 104 (56.8%) of cases and 99 (27.1%) of controls had no education, 35 (19.1%) of cases and 90 (24.7%) of controls primary education, 26 (14.2%) cases and 97 (26.6%) controls secondary and 11 (6.0%) cases and 57 (15.6%) controls tertiary education.

About 94 (51.4%) of cases and 207 (56.7%) controls were housewives, 22 (12%) of cases and 90 (24.7%) of controls were government or private employers and 63 (34.4%) of cases and 63 (17.3%) controls were traders or farmers.

Forty eight (26.2%) cases and 61 (16.7%) controls were in the lowest wealth quintile and 25 (13.7%) of cases and 87 (23.8%) controls were in the highest wealth index category (Table 3).

Table 3: Socio demographic and economic characteristics of women delivering non first birth in Gondar and Bahir Dar referral hospitals, 2013

Demographic and Socio-economic variables	**Cases n (%) N = 183**	**Controls n (%) N = 365**	**Total n (%) N = 548**
Age			
20 or less	8 (4.4)	5 (1.4)	13 (2.4)
21-34	126 (68.9)	301 (82.5)	427 (77.9)
35^{+}	49 (26.8)	59 (16.2)	108 (19.7)
Marital status			
Married	177 (96.7)	352 (96.4)	529 (96.5)
Single	6 (3.3)	13 (3.6)	19 (3.5)
Religion			
Orthodox	165 (90.2)	304 (83.3)	469 (85.6)
Muslim	17 (9.3)	53 (14.5)	70 (12.8)
Protestant	1 (0.5)	7 (1.9)	8 (1.5)
Ethnicity			
Amhara	172 (94.0)	344 (94.2)	516 (94.2)
Tigray	11 (6.0)	20 (5.5)	31 (5.7)
Resident			
Urban	82 (44.8)	270 (74.0)	352 (64.2)
Rural	101 (55.2)	95 (26.0)	196 (35.8)
Educational status			
No education	104 (56.8)	99 (27.1)	203 (37.0)
Only read and write	7 (3.8)	22 (6.0)	29 (5.3)
Primary	35 (19.1)	90 (24.7)	125 (22.8)
Secondary	26 (14.2)	97 (26.6)	123 (22.4)
Tertiary	11 (6.0)	57 (15.6)	68 (12.4)
Maternal occupation			
Housewife	94 (51.4)	207 (56.7)	301 (54.9)
Gov't or private employee	22 (12.0)	90 (24.7)	112 (20.4)
Farmer or trader	63 (34.4)	63 (17.3)	126 (23.0)
Other	4 (2.2)	5(1.4)	9 (1.6)
Wealth quintile			
Lowest	48 (26.2)	61 (16.7)	109 (19.9)
Second	50 (27.3)	100 (27.4)	150 (27.4)
Middle	29 (15.8)	41 (11.2)	70 (12.8)
Fourth	31 (16.9)	76 (20.8)	107 (19.5)
Highest	25 (13.7)	87 (23.8)	112 (20.4)

5.1.2 Description of Interpregnancy interval of study subjects

The median of interpregnancy interval for cases and controls were 32 and 38 months respectively. The overall median of interpregnancy interval was 37 months. The inter quartile range (IQR) for cases and controls were 26 and 25 months respectively.

There were 3 (1.6%) cases had an interpregnancy interval of less than 6 months but no controls. Seven (3.8%) of cases and 10 (2.7%) controls had an interpregnancy interval of 6-11 months. Eleven (6%) cases and 10 (2.7%) controls, 19 (10.4%) cases and 23 (6.3%) controls had interpregnancy interval 12-17 and 18-23 months, respectively. Forty (21.9%) cases and 43 (11.8%) controls had interpregnancy interval less than 24 months. On the other hand 115 (62.8%) cases and 266 (72.9%) controls and 28 (15.3%) cases and 56 (15.3%) controls had interpregnancy interval of 24-62 and greater than 63 months, respectively (Fig. 2)

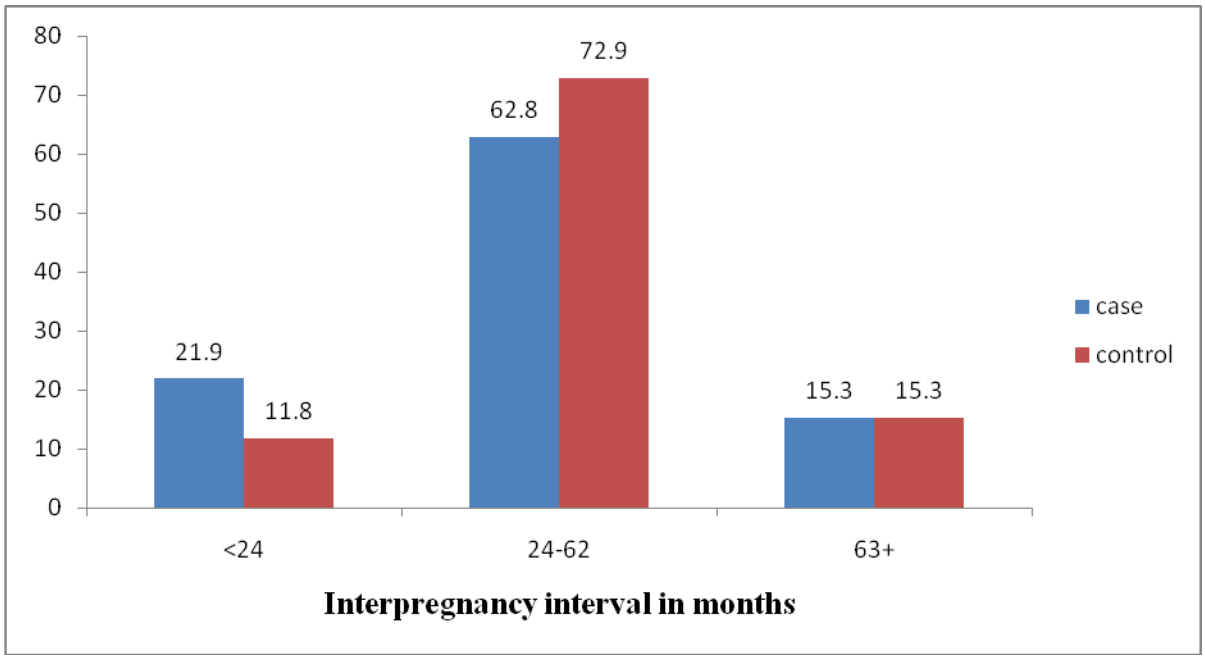

Figure 2: Inter pregnancy intervals of women delivered non first birth in Gondar and Bahir Dar referral hospitals, 2013

5.1.3 Adverse birth outcome of study subjects

The mean (SD) for birth weight in grams and gestational age in weeks for cases were 2387 (±632) and 36.3 (±3.2), respectively. The corresponding values for controls were 3120 (±368) and 39.6 (±1.6), respectively. Low birth weight accounted higher proportion, 88 (48.1%) of adverse birth outcome among cases, followed by pre-term deliveries (81 (44.3%)) and still birth (78 (42.6%)). Among the low birth weight, 64 (72.7%) were preterm deliveries. Higher proportion of fetal death, 53 (67.9%) was observed in women who had term gestational age (Table 4).

Table 4: Distribution of adverse birth outcome among cases in Gondar and Bahir Dar referral hospitals, 2013

Adverse birth outcome	**Number (%)**
Low birth weight	88 (48.1)
Preterm delivery	81 (44.3)
Stillbirth	78 (42.6)
Low birth weight and preterm delivery	64 (35)

5.1.4 Household food insecurity scale and household dietary diversity

The mean (SD) and median for household dietary diversity score (out of 0-9) for cases were 3.61 (±1.86) and 3.0 respectively. The corresponding values for controls were 4.14 (±1.8) and 4.0, respectively. And the overall mean (SD) and median were 3.96 (±1.83) and 4.0 respectively. More than half (55.2%) of cases and 142 (38.9%) controls had low household dietary diversity score. About 8.2% of cases and 4.9% controls and 15 (8.2%) cases and 8 (2.2%) controls had mild food insecurity and moderate or severe food insecurity respectively (Table 5).

Table 5: Household food security and household dietary diversity characteristics of women delivering non first birth in Gondar and Bahir Dar referral hospitals, 2013

Variables	Cases n (%) N= 183	Controls n (%) N= 365	Total n (%) N= 548
Household Food Insecurity Scale (HFIS)			
Food secure	153 (83.6)	339 (92.9)	492 (89.8)
Mildly food insecure	15 (8.2)	18 (4.9)	33 (6.0)
Moderately or severely food insecure	15 (8.2)	8 (2.2)	23 (4.2)
Household Dietary Diversity Scale(HDD)			
High	82 (44.8)	223 (61.1)	305 (55.7)
Low	101 (55.2)	142 (38.9)	243 (44.3)
Mean (SD)	3.61 (±1.86)	4.14 (±1.8)	3.96 (±1.83)
Median	3.0	4.0	4.0
IQR	3.0	2.0	2.0

5.1.5 Obstetrics, gynecological and medical history of study participants

Sixty five (35.5%) cases and 181 (49.6%) controls had parity of one, while 51 (27.9%) cases and 54 (14.8%) controls were with parity of 4 and above.

Concerning preceding child's status, 9 (5%) of cases and 5 (1.4%) of controls were preterm. Based on the mothers report, 20 (11.6%) of cases and 32 (9.2%) controls had preceding child with smaller than average birth weight. Stillbirth of preceding child was observed in 4 (2.2%) of cases and 10 (2.7%) controls respectively.

Forty four (24%) of cases and 49 (13.4%) controls had no ANC follow up to the index pregnancy. Among women who had ANC follow up to the index pregnancy, 62 (33.9%) cases and 109 (29.9%) controls had ANC follow up of 1-3 times and 76 (41.5%) cases and 207 (56.7%) controls had 4 and above visits. Thirty five (19.1%) of cases and 40 (11.0%) of controls did not plan the current pregnancy; 91 (49.7%) and 99 (27.1%) controls had pregnancy complications. Among the pregnancy complications, APH was found 31 (34.1%) in cases and 8 (8.1%) controls; uterine rupture and cervical incompetence were found only among cases.

Majority of cases and controls have positive RH type. Fifty four (29.5%) cases and 79 (21.6%) controls had delivered by cesarean section. The male to female ratio of newborns were 1.7:1 and 1.4:1 for cases and controls, respectively. Nine (4.9%) of cases and 15 (4.1%) controls delivered

congenitally malformed baby. Higher proportions of case; (43.3 %) than control; (29.9 %) drink alcohol like tella, areki, beer, draft and woyn during the index pregnancy (Table 6).

Table 6: Obstetrics, gynecological and medical history of women delivering non first birth in Gondar and Bahir Dar referral hospitals, 2013

Characteristics	Cases n (%)	Controls n (%)	Total n (%)
Gravidity			
2-3	105 (57.4)	264 (72.3)	369 (67.3)
4^{+}	78 (42.6)	101 (27.7)	179 (32.7)
Parity			
1	65 (35.5)	181 (49.6)	246 (44.9)
2-3	67 (36.6)	130 (35.6)	197 (35.9)
4^{+}	51 (27.9)	54 (14.8)	105 (19.2)
Preceding child gestational age			
Pre-term (28-36 wks)	9 (5.0)	5 (1.4)	14 (2.6)
Term (37-42 wks)	170 (95.0)	350 (98.6)	520 (97.4)
Preceding child birth weight			
Smaller than average	20 (11.6)	32 (9.2)	52 (10.0)
Average or greater than average	152 (88.4)	316 (90.8)	468 (90.0)
Is preceding birth still birth			
Yes	4 (2.2)	10 (2.7)	14 (2.6)
No	179 (97.8)	355 (97.3)	534 (97.4)
Chronic medical illness of the mother			
Yes	20 (10.9)	42 (11.5)	62 (11.3)
No	163 (89.1)	323 (88.5)	486 (88.7)
Current pregnancy planed			
Yes	148 (80.9)	325 (89.0)	473 (86.3)
No	35 (19.1)	40 (11.0)	75 (13.7)
No. of ANC follow up			
None	44 (24.0)	49 (13.4)	93 (17.0)
1-3	62 (33.9)	109 (29.9)	171 (31.2)
4^{+}	76 (41.5)	207 (56.7)	283 (51.6)
RH type			
Positive	170 (92.9)	320 (87.7)	490 (89.4)
Negative	12 (6.6)	43 (11.8)	490 (89.4)
Don't known	1 (0.5)	2 (0.5)	3 (0.5)
Have pregnancy complication			
Yes	91 (49.7)	99 (27.1)	190 (34.7)
No	92 (50.3)	266 (72.9)	358 (65.3)
Type of complication			
APH	31 (34.07)	8 (8.08)	39 (20.53)
PIH	15 (16.48)	21 (21.21)	36 (18.95)
PROM	21 (23.08)	27 (27.27)	48 (25.26)
Poly hydraminos	4 (4.4)	14 (14.14)	18 (9.47)
Hyper emesis	15 (16.48)	32 (32.32)	47 (24.74)
Uterine rupture	5 (5.49)	---	5 (2.63)
Cervical incompetence	6 (6.6)	---	6 (3.16)
Methods of delivery			
Vaginal	117 (63.9)	267 (73.2)	384 (70.1)
Cesarean section	54 (29.5)	79 (21.6)	133 (24.3)
Instrumental	8 (4.4)	12 (3.3)	20 (3.6)
Augmentation or induction	4 (2.2)	7 (1.9)	11 (2.0)
Sex of baby			
Male	116 (63.4)	215 (58.9)	331 (60.4)
Female	67 (36.6)	150 (41.1)	217 (39.6)
Congenital malformation			
Yes	9 (4.9)	15 (4.1)	24 (4.4)
No	174 (95.1)	350 (95.9)	524 (95.6)
Drinking alcohol during pregnancy			
Yes	79 (43.2)	109 (29.9)	188 (34.3)
No	140 (56.8)	256 (70.1)	360 (65.7)

5.2 The Effect of Interpregnancy Interval on Adverse Birth Outcome

5.2.1. Results for the Bi-variate Analysis

The odds of adverse birth outcome among women aged 20 years or less and 35 years and above were higher compared to women in the age group 21-34 years old [(OR = 3.82, 95% CI: 1.23-11.91) and (OR = 1.98, 95% CI: 1.29-3.06), respectively]. Rural women were 3.5 times more likely to deliver a baby with adverse outcome ($p< 0.0001$). Women who had tertiary, secondary and primary education had 82%, 74% and 63% lower risk of delivering a child with adverse outcome, respectively compared with non educated women.

Bi-variate analysis also showed that the odds of adverse birth outcome was 0.54 (95% CI= 0.32, 0.91) and 2.2 (95% CI= 1.44, 3.37) for women who were government or private employee and farmer or trader compared to housewives women, respectively. The odds of adverse birth outcome were 0.64 (95% CI = 0.38, 1.06), 0.9 (95% CI = 0.49, 1.65), 0.52 (95% CI = 0.3, 0.91) and 0.37 (95% CI = 0.2, 0.66) for the second, the middle, the fourth and highest wealth quintiles, respectively compared to households in the lowest wealth quintile.

Women who had moderate or severe food insecurity faced adverse birth outcome compared with food secured household women (OR = 4.15, 95% CI: 1.73-10.01). Women with lower household dietary diversity were 93% higher in resulting adverse birth outcome compared to women with higher household dietary diversity (OR = 1.93, 95% CI: 1.35-2.77) (Table 7).

Table 7: Demographic, socio-economic and household food security factors associated with adverse birth outcome; Gondar and Bahir Dar referral teaching hospitals, 2013

Exposure Variables	Cases n (%) N= 183	Controls n (%) N= 365	COR (95% CI)	p-value
Age				
20 or less	8 (4.4)	5 (1.4)	3.82 (1.23, 11.91)	0.021*
21-34	126 (68.9)	301 (82.5)	1	
35^{+}	49 (26.8)	59 (16.2)	1.98 (1.29, 3.06)	0.002*
Residence				
Urban	82 (44.8)	270 (74.0)	1	
Rural	101 (55.2)	95 (26.0)	3.50 (2.41, 5.09)	< 0.0001*
Educational status				
No education	104 (56.8)	99 (27.1)	1	
Only read and write	7 (3.8)	22 (6.0)	0.30 (0.12, 0.74)	0.009*
Primary	35 (19.1)	90 (24.7)	0.37 (0.23, 0.60)	< 0.0001*
Secondary	26 (14.2)	97 (26.6)	0.26 (0.15, 0.43	< 0.0001*
Tertiary	11 (6.0)	57 (15.6)	0.18 (0.09, 0.37)	< 0.0001*
Maternal occupation				
Housewife	94 (51.4)	207 (56.7)	1	
Gov't or privat employee	22 (12.0)	90 (24.7)	0.54 (0.32, 0.91)	0.021*
Farmer or trader	63 (34.4)	63 (17.3)	2.2 (1.44, 3.37)	< 0.0001*
Other	4 (2.2)	5(1.4)	1.76 (0.46, 6.71)	0.407
Wealth quintile				
Lowest	48 (26.2)	61 (16.7)	1	
Second	50 (27.3)	100 (27.4)	0.64 (0.38, 1.06)	0.080
Middle	29 (15.8)	41 (11.2)	0.9 (0.49, 1.65)	0.731
Fourth	31 (16.9)	76 (20.8)	0.52 (0.3, 0.91)	0.022*
Highest	25 (13.7)	87 (23.8)	0.37 (0.2, 0.66)	0.001*
HFIS				
Food secure	153 (83.6)	339 (92.9)	1	
Mildly food insecure	15 (8.2)	18 (4.9)	1.85 (0.91, 3.76)	0.091
Moderately or severely food insecure	15 (8.2)	8 (2.2)	4.15 (1.73, 10.01)	0.001*
HDDS				
High	82 (44.8)	223 (61.1)	1	
Low	101 (55.2)	142 (38.9)	1.93 (1.35, 2.77)	< 0.0001*

*Significant at 0.05

Interpregnancy interval, Obstetrics, gynecological and medical history

Bi-variate analysis showed that the odds of adverse birth outcome among women who had interpregnancy interval less than 24 months was about 2 times higher compared to interpregnancy interval 24 and above months (OR = 2.01, 95% CI: 1.31 -3.36).

Women who had gravidity 4 and above were about 2 times more likely in resulting adverse birth outcome compared with women gravidity 2-3 ($p<0.0001$). Similarly women with parity 4 and

above had about 2.6 times more likely higher risk of adverse birth outcome compared with parity one women ($p< 0.0001$).

Bi-variate analysis also showed that the odds of adverse birth outcome was 0.52 (95% CI= 0.32, 0.85) for those who planed current pregnancy compared to women who were not planed and the odds of adverse birth outcome was 2.45 (95% CI=1.51, 3.97) when the women has no ANC follow up compared to women who have 4 and above ANC follow up. The odd of adverse birth outcome was 2.66 (95% CI=1.84, 3.85) for those who have pregnancy complications like APH, PIH, Poly hydraminos, uterine rupture, cervical incompetence, PROM and hyper emesis compared to women who haven't pregnancy complication.

The odd of adverse birth outcome was 1.78 (95% CI=1.23, 2.58) for women who drank alcohol like local 'tella', 'areki', beer, and woyn compared to women who didn't drink.

There was no significant difference between cases and controls concerning RH type, methods of delivery, sex of the baby and congenital malformation, preceding adverse birth outcome, chronic medical illness (Table 8)

Table 8: Interpregnancy interval, obstetrics, gynecological and medical history factors associated with adverse birth outcome; Gondar and Bahir Dar referral teaching hospitals, 2013

Variables	Cases n (%) N= 183	Controls n (%) N= 365	COR (95% CI)	p-value
IPI in months				
Less than 24	40 (21.9)	43 (11.8)	2.01 (1.31, 3.36)	0.002*
24 and above	143 (78.1)	322 (88.2)	1	
Gravidity				
2-3	105 (57.4)	264 (72.3)	1	
4^+	78 (42.6)	101 (27.7)	1.94 (1.34, 2.82)	< 0.0001*
Parity				
1	65 (35.5)	181 (49.6)	1	
2-3	67 (36.6)	130 (35.6)	1.44 (0.95, 2.16)	0.083
4^+	51 (27.9)	54 (14.8)	2.63 (1.63, 4.23)	< 0.0001*
Chronic medical illness				
Yes	20 (10.9)	42 (11.5)	0.94 (0.54, 1.66)	0.840
No	163 (89.1)	323 (88.5)	1	
Current pregnancy planed				
Yes	148 (80.9)	325 (89.0)	0.52 (0.32, 0.85)	0.009*
No	35 (19.1)	40 (11.0)	1	
No. of ANC follow up				
None	44 (24.0)	49 (13.4)	2.45 (1.51, 3.97)	< 0.0001*
1-3	62 (33.9)	109 (29.9)	1.55 (1.03, 2.33)	0.035*
4^+	76 (41.5)	207 (56.7)	1	
Have pregnancy complication				
Yes	91 (49.7)	99 (27.1)	2.66 (1.84, 3.85)	< 0.0001*
No	92 (50.3)	266 (72.9)	1	
Drinking alcohol				
Yes	79 (43.2)	109 (29.9)	1.78 (1.23, 2.58)	0.002*
No	140 (56.8)	256 (70.1)	1	

*Significant at 0.05

5.2.2. Results of Multivariate Analysis

To identify the independent effect of main exposure variable; short interpregnancy interval on adverse birth outcome, a multivariate logistic regression model was fitted with the variable having a p- value < 0.05 in the bi-variate logistic regression analysis.

To derive the adjusted odds ratio, four models were developed. Primarily adjusted for demographic and socio-economic variables and found that the odd of adverse birth outcome was 2.13 (95% CI=1.27, 3.57) for women having interpregnancy interval less than 24 months compared to women having 24 and above months.

Including household food security variable to the model showed that short interpregnancy interval had still an effect on adverse birth outcome. The odd of adverse birth outcome was 2.13 (95% CI = 1.26, 3.58) when interpregnancy interval was less than 24 months compared to the interval 24 and above months.

Adding obstetric variables to the model also showed interpregnancy interval had an effect on adverse birth outcome. The odd of adverse birth outcome was 2.36 (95% CI = 1.36, 4.08) for women having interpregnancy interval less than 24 months compared to the interval 24 and above.

The effect of adverse birth outcome persists even after adding behavioral variable (alcohol taking) to the model. The odd of adverse birth outcome was 2.37 (95% CI = 1.36, 4.10) for women having interpregnancy interval less than 24 months compared to the interval 24 and above (Table 9).

Table 9*:* Interpregnancy interval and adverse birth outcome among women delivered non first birth; Gondar and Bahir Dar referral teaching hospitals, 2013

Exposure Variables	**Cases n (%) N= 183**	**Controls n (%) N= 365**	**COR (95% CI)**	**AOR (95% CI)**
IPI in months				
Less than 24	40 (21.9)	43 (11.8)	**2.01 (1.31, 3.36)***	**2.37 (1.36, 4.10)***
24 and above	143 (78.1)	322 (88.2)	1	**1**

* Significant at 0.05

- AOR - after adjusting for demographic, socio-economic, household food security, obstetric and alcohol characteristics.

5.3 The Effect of Short Interpregnancy Interval on low birth weight

5.3.1 Results for the Bi-variate Analysis

Bi-variate analysis showed that the odd of low birth weight among women who had interpregnancy interval less than 24 months was about 2.5 times higher compared to interpregnancy interval 24 and above months (OR = 2.5, 95% CI: 1.4 - 4.45) (Table 11).

Among demographic and socio-economic variables there were a significant difference in maternal age (p=0.029), resident (p<0.0001), educational status (p=0.004) and maternal occupation (p=0.002) between cases and controls. But there were no statistically significant difference on marital status and wealth index between cases and controls.

The bi-variate analysis also showed that household food insecurity, number of ANC follow up and having pregnancy complication has a significant effect on low birth weight. And parity, sex of the baby, preceding pregnancy complication, and chronic medical illness had no effect on low birth weight (Table 10).

Table 10: Selected socio-economic, household food security and obstetrics factors associated with low birth weight; Gondar and Bahir Dar referral hospitals, 2013

Exposure Variables	Low birth weight n (%) N = 88	Normal birth weight n (%) N = 365	Total n (%) N = 453	p-value
Age				0.029*
20 or less than	5 (5.7)	5 (1.4)	10 (2.2)	
21-34	64 (72.7)	301 (82.5)	365 (80.6)	
35^{+}	19 (21.6)	59 (16.2)	78 (17.2)	
Residence				< 0.0001*
Urban	46 (52.3)	270 (74.0)	316 (69.8)	
Rural	42 (47.7)	95 (26.0)	137 (30.2)	
Educational status				0.004*
No education	41 (46.6)	99 (27.1)	140 (30.9)	
Only read and write	4 (4.5)	22 (6.0)	26 (5.7)	
Primary	23 (26.1)	90 (24.7)	113 (24.9)	
Secondary	13 (14.8)	97 (26.6)	110 (24.3)	
Tertiary	7 (8.0)	57 (15.6)	64 (14.1)	
Maternal occupation				0.002*
Housewife	45 (51.1)	207 (56.7)	252 (55.6)	
Gov't or private employee	11 (12.5)	90 (24.7)	101 (22.3)	
Farmer or trader	28 (31.8)	63 (17.3)	91 (20.1)	
Other	4 (4.5)	5 (1.4)	9 (2.0)	
HFIS				0.001*
Food secure	71 (80.7)	339 (92.9)	410 (90.5)	
Mildly food insecure	7 (8.0)	18 (4.9)	25 (5.5)	
Moderately or severely food insecure	10 (11.4)	8 (2.2)	18 (4.0)	
Parity				0.155
1	34 (38.6)	181 (49.6)	215 (47.5)	
2-3	36 (40.9)	130 (35.6)	166 (36.6)	
4^{+}	18 (20.5)	54 (14.8)	72 (15.9)	
No. of ANC follow up				0.026*
None	21 (23.9)	49 (13.4)	70 (15.5)	
1-3	31 (35.2)	109 (29.9)	140 (30.9)	
4^{+}	35 (39.8)	207 (56.7)	242 (53.4)	
Have pregnancy complications				< 0.0001*
Yes	53 (60.2)	99 (27.1)	152 (33.6)	
No	35 (39.8)	266 (72.9)	301 (66.4)	

*significant at 0.05

5.3.2. Results of Multivariate Analysis

To derive the adjusted odds ratio, three models were developed. Primarily adjusted for socio-economic variables and found that the odd of low birth weight was 2.34 (95% CI = 1.27, 4.32) for women having interpregnancy interval less than 24 months compared to women having 24 and above months.

Adding household food security variable to the model also showed interpregnancy interval had an effect on low birth weight. The odd of low birth weight was 2.3 (95% CI = 1.24, 4.29) for women having interpregnancy interval less than 24 months compared to the interval 24 and above.

Finally including obstetric variables to the model also showed that short interpregnancy interval had an effect on low birth weight. The odd of low birth weight was 2.67 (95% CI = 1.36, 5.01) when interpregnancy interval was less than 24 months compared to the interval 24 and above months (Table 11).

Table 11: Interpregnancy interval and low birth weight *among* women delivered non first birth; Gondar and Bahir Dar referral teaching hospitals, 2013

Exposure Variables	**Low birth weight n (%) N= 88**	**Normal birth weight n (%) N=365**	**Total n (%) N=453**	**COR (95% CI)**	**AOR (95% CI)**
IPI in months					
Less than 24	22 (25.0)	43 (11.8)	65 (14.3)	**2.5 (1.4, 4.45)***	**2.67 (1.36, 5.01)***
24 and above	66 (79.5)	322 (88.2)	388 (85.7)	1	1

* Significant at 0.05

- AOR- after adjusting for demographic, socio-economic, household food security and obstetric characteristics.

5.4 The Effect of Short Interpregnancy Interval on Preterm Delivery

5.4.1. Results for the Bi-variate Analysis

Bi-variate analysis showed that the odd of preterm delivery among women who had interpregnancy interval less than 24 months was about 2.5 times higher compared to interpregnancy interval 24 and above months (OR = 2.46, 95% CI: 1.35, 4.46) (Table 13).

Among demographic and socio-economic variables there were a significant difference in maternal age (p=0.018), resident (p<0.0001), educational status (p=0.011) and maternal occupation (p=0.017) between cases and controls. But there were no statistically significant difference on marital status and wealth index between cases and controls.

The bi-variate analysis also showed that household food insecurity, parity, preceding child gestational age, number of ANC follow up and having pregnancy complication has a significant effect on preterm delivery. And sex of the baby, chronic medical illness had no effect on preterm delivery (Table 12).

Table 12: Selected demographic and socio-economic, household food security and obstetric factors associated with preterm delivery; Gondar and Bahir Dar referral hospitals, 2013

Exposure Variables	Preterm n (%) N=81	Term n (%) N=365	Total n (%) N=446	p-value
Age				0.018*
20 or less than	5 (6.2)	5 (1.4)	10 (2.2)	
21-34	58 (71.6)	301 (82.5)	359 (80.5)	
35^{+}	18 (22.2)	59 (16.2)	77 (17.3)	
Residence				< 0.0001*
Urban	42 (51.9)	270 (74.0)	312 (70.0)	
Rural	39 (48.1)	95 (26.0)	134 (30.0)	
Educational status				0.011*
No education	38 (46.9)	99 (27.1)	137 (30.7)	
Only read and write	3 (3.7)	22 (6.0)	25 (5.6)	
Primary	19 (23.5)	90 (24.7)	109 (24.4)	
Secondary	14 (17.3)	97 (26.6)	111 (24.9)	
Tertiary	7 (8.6)	57 (15.6)	64 (14.3)	
Maternal occupation				0.017*
Housewife	45 (55.6)	207 (56.7)	252 (56.5)	
Gov't or private employee	10 (12.3)	90 (24.7)	100 (22.4)	
Farmer or trader	23 (28.4)	63 (17.3)	86 (19.3)	
Other	3 (3.7)	5 (1.4)	8 (1.8)	
HFIS				< 0.0001*
Food secure	65 (80.2)	339 (92.9)	404 (90.6)	
Mildly food insecure	5 (6.2)	18 (4.9)	23 (5.2)	
Moderately or severely food insecure	11 (13.6)	8 (2.2)	19 (4.3)	
Parity				0.025*
1	28 (34.6)	181 (49.6)	209 (46.9)	
2-3	33 (40.7)	130 (35.6)	163 (36.5)	
≥ 4	20 (24.7)	54 (14.8)	74 (16.6)	
Preceding child gestational age				0.017*
Pre-term (28-36 wks)	5 (6.2)	5 (1.4)	10 (2.3)	
Term (37-42 wks)	75 (93.8)	350 (98.6)	425 (97.7)	
No. of ANC follow up				0.035*
None	19 (23.5)	49 (13.4)	68 (15.2)	
1-3	27 (33.3)	109 (29.9)	136 (30.5)	
4^{+}	35 (43.2)	207 (56.7)	242 (54.3)	
Have pregnancy complications				< 0.0001*
Yes	54 (66.7)	99 (27.1)	153 (34.3)	
No	27 (33.3)	266 (72.9)	293 (65.7)	

*significant at 0.05

5.4.2. Results of Multivariate Analysis

To derive the adjusted odds ratio, three models were developed. Primarily adjusted for socio-demographic and economic variables and found that the odd of preterm delivery was 2.3 (95% CI = 1.23, 4.32) for women having interpregnancy interval less than 24 months compared to women having 24 and above months.

Adding household food security variable to the model also showed that interpregnancy interval had an effect on preterm delivery. The odd of preterm birth was 2.27 (95% CI = 1.19, 4.32) for women having interpregnancy interval less than 24 months compared to the interval 24 and above.

The effect of preterm delivery increases even after adding obstetric variables to the model. The odd of preterm birth was 2.92 (95% CI = 1.39, 6.12) for women having interpregnancy interval less than 24 months compared to the interval 24 and above (Table 13).

Table 13: Interpregnancy interval and preterm delivery *among* women delivered non first birth; Gondar and Bahir Dar referral teaching hospitals, 2013

Exposure Variables	Preterm n (%) N=81	Term n (%) N=365	Total n (%) N=446	COR (95% CI)	AOR (95% CI)
IPI in months					
Less than 24	20 (24.7)	43 (11.8)	63 (14.1)	**2.46 (1.35, 4.46)***	**2.92 (1.39, 6.12)***
24 and above	61 (75.3)	322 (88.2)	383 (85.9)	1	1

*significant at 0.05

- AOR - after adjusting for socio-demographic, socio-economic, household food security and obstetrics characteristics.

5.5 The Effect of Short Interpregnancy Interval on stillbirth

5.5.1. Results for the Bi-variate Analysis

Bi-variate analysis showed that women who had interpregnancy interval less than 24 months have about 2 times more likely in resulting stillbirth compared to women having interpregnancy interval 24 and above (COR = 1.93, 95% CI: 1.02 -3.65) (Table 15).

Among demographic and socio-economic variables there were a significant difference in maternal age ($p=0.001$), resident ($p<0.0001$), educational status ($p<0.0001$), maternal occupation ($p<0.0001$) and wealth quintile ($p=0.016$) between cases and controls. But there were no statistically significant difference on marital status between cases and controls.

The bi-variate analysis also showed that household dietary diversity, parity, index pregnancy plan, ANC follow up, having pregnancy complications, methods of delivery and drinking alcohol during pregnancy has a significant effect on stillbirth. And sex of the baby, preceding pregnancy complication, chronic medical illness and congenital malformation had no effect on stillbirth (Table 14).

Table 14: Selected socio-demographic and economic, household dietary diversity, obstetrics and alcohol taking factors associated with stillbirth; Gondar and Bahir Dar referral hospitals,2013

Exposure Variables	Stillbirth n (%) N = 78	Alive birth n (%) N = 365	Total n (%) N = 443	p-value
Age				0.001*
20 or less than	3 (3.8)	5 (1.4)	8 (1.8)	
21-34	49 (62.8)	301 (82.5)	350 (79.0)	
35^{+}	26 (33.3)	59 (16.2)	85 (19.2)	
Resident				< 0.0001*
Urban	26 (33.3)	270 (74.0)	296 (66.8)	
Rural	52 (66.7)	95 (26.0)	147 (33.2)	
Educational status				< 0.0001*
No education	56 (71.8)	99 (27.1)	155 (35.0)	
Only read and write	2 (2.6)	22 (6.0)	24 (5.4)	
Primary	9 (11.5)	90 (24.7)	99 (22.3)	
Secondary	8 (10.3)	97 (26.6)	105 (23.7)	
Tertiary	3 (3.8)	57 (15.6)	60 (13.5)	
Maternal occupation				< 0.0001*
Housewife	38 (48.7)	207 (56.7)	245 (55.3)	
Gov't or private employee	9 (11.5)	90 (24.7)	99 (22.3)	
Farmer or trader	31 (39.7)	63 (17.3)	94 (21.2)	
Wealth quintile				0.016*
Lowest	20 (25.6)	61 (16.7)	81 (18.3)	
Second	20 (25.6)	100 (27.4)	120 (27.1)	
Middle	16 (20.5)	41 (11.2)	57 (12.9)	
Fourth	14 (17.9)	76 (20.8)	90 (20.3)	
Highest	8 (10.3)	87 (23.8)	95 (21.4)	
HDDS				< 0.0001*
High	25 (32.1)	223 (61.1)	248 (56.0)	
Low	53 (67.9)	142 (38.9)	195 (44.0)	
Parity				< 0.0001*
1	25 (32.1)	181 (49.6)	206 (46.5)	
2-3	25 (32.1)	130 (35.6)	155 (35.0)	
4^{+}	28 (35.9)	54 (14.8)	82 (18.5)	
Pregnancy planed				0.011*
Yes	61 (78.2)	325 (89.0)	386 (87.1)	
No	17 (21.8)	40 (11.0)	57 (12.9)	
No. of ANC follow up				0.007*
None	21 (26.9)	49 (13.4)	70 (15.8)	
1-3	25 (32.1)	109 (29.9)	134 (30.2)	
4^{+}	32 (41.0)	207 (56.7)	239 (54.0)	
Have pregnancy complications				0.016*
Yes	32 (41.0)	99 (27.1)	131 (29.6)	
No	46 (59.0)	266 (72.9)	312 (70.4)	
Methods of delivery				0.003*
Vaginal	40 (51.3)	267 (73.2)	307 (69.3)	
Cesarean section	29 (37.2)	79 (21.6)	108 (24.4)	
Instrumental	6 (7.7)	12 (3.3)	18 (4.1)	
Augmentation/ induction	3 (3.8)	7 (1.9)	10 (2.3)	
Drink alcohol during pregnancy				0.001*
Yes	39 (50.0)	109 (29.9)	148 (33.4)	
No	39 (50.0)	256 (70.1)	295 (66.6)	

*Significant at 0.05

5.4.2 Results of Multivariate Analysis

To derive the adjusted odds ratio, four models were developed. Primarily adjusted for socio-demographic and socio-economic variables and found that women having interpregnancy interval less than 24 months had no significant effect in resulting stillbirth compared to women having interpregnancy interval 24 and above months (AOR=1.94; 95% CI: 0.93, 4.02).

Including household dietary diversity in the model showed women who had interpregnancy interval less than 24 months still didn't have a significant effect in delivering stillbirth compared to women having 24 and above months (AOR= 1.99, 95% CI: 0.95, 4.2).

Adding obstetric variables to the model showed interpregnancy interval had an effect on stillbirth. The odd of stillbirth was 2.5 (95% CI = 1.13, 5.56) for women having interpregnancy interval less than 24 months compared to the interval 24 and above.

Finally including alcohol taking variable in the final model showed interpregnancy interval had an effect on stillbirth. Women who had interpregnancy interval less than 24 months were 2.5 times more likely in resulting stillbirth compared to the interval 24 and above (AOR= 2.5; 95% CI: 1.12-5.55) (Table 15).

Table 15: Interpregnancy interval and stillbirth among women delivered non first birth; Gondar and Bahir Dar referral teaching hospitals, 2013

Exposure Variables	Stillbirth n (%) N= 78	Alive birth n (%) N=365	Total n (%) N=443	COR (95% CI)	AOR (95% CI)
IPI in months					
Less than 24	16 (20.5)	43 (11.8)	59 (13.3)	**1.93 (1.02, 3.65)***	**2.5 (1.12, 5.55)***
24 and above	62 (79.5)	322 (88.2)	384 (86.7)	1	1

*significant at 0.05

- AOR - after adjusting for demographic, socio-economic, household dietary diversity, obstetric and alcohol taking characteristics.

6. Discussion

This study assessed the effect of interpregnancy interval on adverse birth outcome crudely which means the independent effect of interpregnancy interval less than 24 months on low birth weight or preterm delivery or stillbirth; and asses separately the independent effect of interpregnancy interval on low birth weight, preterm birth and stillbirth. Two referral teaching hospitals were included in the study.

Results of this study suggest that short (less than 24 months) interpregnancy intervals is independently associated with a significant increase in risk of adverse birth outcome i.e. either of low birth weight or preterm birth or stillbirth in Gondar and Bahir Dar referral teaching hospital. Mothers with interpregnancy interval less than 24 months were about 2.4 times increased risk of adverse birth outcome; either of low birth weight or preterm birth or stillbirth compared with mothers having 24 and above months. And also clearly indicate that short (less than 24 months) interpregnancy interval was independently associated with a significant increase in risk of low birth weight, preterm birth and stillbirth.

Interpregnancy interval and adverse birth outcome

The data from our study revealed that after adjusting for possible confounders, women with interpregnancy intervals less than 24 months were at increased risk of LBW or preterm birth or stillbirth. According to the WHO Technical Consultation on Birth Spacing, after a live birth, the recommended interval before attempting the next pregnancy (i.e. birth-to-pregnancy interval) is at least 24 months in order to reduce the risk of adverse maternal, perinatal and infant outcomes [19].

Interpregnancy interval and low birth weight

Our results suggest that the length of the interval between pregnancies less than 24 months had a substantial effect on the risk of delivering low birth weight infant among mothers in Gondar and Bahir Dar referral teaching hospitals.

This is in line with study done in Pakistan, Latin America and DHS working paper [6, 7, 12, 14, 25]. Some investigators have attributed the higher risk of poor adverse birth outcome to several factors associated with short intervals, such as low socioeconomic status, adverse outcome of the previous pregnancy, failure to use health care services or inadequate use of such services, unplanned pregnancies, and other behavioral determinants [42]. Nevertheless, it is unlikely that the associations were entirely due to these factors because our study and other large ones [6, 7, 12, 25] adjusted for the great majority of them.

A cross sectional study done in Addis Ababa showed interpregnancy interval shorter than 18 and 24 months had no significant effect for low birth weight [10]. This is inconsistent with our study. The inconsistency could be due to the methods they used, lack of controlling confounders like socio-economic status and household food security (maternal nutrition).

The Pregnancy Risk Assessment Monitoring System report showed that no significant differences between short, optimal, and long interpregnancy intervals for low birth weight and preterm birth [29]. This difference might be the variables they considered for confounding include only maternal age, education, marital status, insurance status, parity, and pregnancy intendedness they were not consider pregnancy complications and nutrition as a confounder.

Interpregnancy interval and Preterm birth

The data from our study revealed that women with interpregnancy interval less than 24 months had about 3 times higher risk of resulting preterm delivery compared with women having 24 and above interval after controlling socio-economic, household food security and obstetric factors. This also implies infants conceived less than 24 months after a preceding birth were at increased risk for preterm birth. This is consistent with studies done in Latin America [6, 12]. Unlike our finding, a study in Addis Ababa showed that interpregnancy interval has no effect on preterm birth[10]. The inconsistency with our result could be as similar as the reason mentioned above for low birth weight.

Interpregnancy interval and Stillbirth

The bi-variate analysis showed women with interpregnancy interval less than 24 months had about 2 times more likely delivering stillbirth.

According to the finding of the study, infants conceived less than 24 months after a preceding birth were 2.5 times increased risk for stillbirth compared with the interpregnancy interval of greater than 24 months. Study done in Latin America including black Americans reported that infants conceived less than 12 months after a preceding birth were at increased risk of fetal death [14]. Other study done in Latin America reported that compared with infants with a birth interval of 27-32 months, infants with a birth interval less than 15 months had odd ratio of 2.40 (95% CI: 2.14-2.69) for fetal death [6]. This is consistent with our study.

Cross sectional study done in Addis Ababa reported that the odd of stillbirth among women with interpregnancy interval less than 24 months was 1.98 (95% CI= 0.6, 6.3) which implies interpregnancy interval had no effect on stillbirth [10]. This is inconsistent with our finding. The difference might be the methods they used (small sample of cases), not considering confounders like wealth index, maternal occupation and nutrition.

Researchers suggest that the association between short interpregnancy intervals and adverse birth outcomes may be due to several mechanisms. In undernourished mothers, nutritional depletion may contribute to intrauterine growth retardation during pregnancies that are preceded by a short interpregnancy interval. Short intervals may also affect birth outcomes by not allowing sufficient time for "physiologic recovery" from the previous pregnancy. That is, physiologic mediators such as the lagged effect(s) from hormonal and other changes associated with the previous pregnancy and/or childbirth may affect the course of the subsequent pregnancy if the interpregnancy interval is too short [12, 16, 37].

So this study will have implication to avert adverse birth outcome among women who deliver for the second time and more.

7. Strength and limitation of the study

7.1 Strength of the study

Using case control study design, controlling many confounders like socio-economic status, nutrition based on household food insecurity and household dietary diversity and applying principal component analysis to construct wealth index were considered as strength of this study.

7.2 Limitations of the study

Some limitations should be considered when the results of this study are interpreted. First, our study is not population-based. Rather, it was based in only two referral teaching hospitals found in Amhara region and therefore, caution should be used when generalizing our results to other populations.

Second, most of the associations described for comparison were in reports from developed countries with different cut points of interpregnancy interval.

Third, we were unable to evaluate other potential confounders for the relation between interpregnancy interval and adverse birth outcomes such as psychosocial status of the mother, BMI of the women before pregnancy and environmental factors.

Fourth, inaccuracy of gestational age estimated from the date of last menstrual period is a well-recognized problem in epidemiological research addressing interpregnancy intervals. And using gestational age estimated from ultrasound for mothers of unable to know last menstrual period date might have different results on gestational age. Frequency of occurrence question was not included to measure food security which helps to differentiate level of food security.

8. Conclusions

From this study, considering all limitations, it can be concluded that Interpregnancy interval shorter than 24 months are associated with an increased risk of adverse birth outcome which is low birth weight, preterm and fetal death in Gondar and Bahir Dar teaching-referral hospital; after controlling for socio demographic, socioeconomic, perinatal care, obstetric & medical complications, household food security, and behavioral or alcohol variables.

9. Recommendations

Policy makers provide assistance to strengthen birth spacing education, counseling, and services as integral elements of adverse birth outcome reduction strategies.

At community level in the area: there is a need to empower individuals with knowledge on risks of short interpregnancy interval with adverse birth outcome so that they can make fully informed reproductive health/family planning decisions.

Longitudinal studies that take more potential confounding factors into account and covering different parts of the country should be carried out in order to generalize the finding to the whole country.

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11. Annexes

11.1 Patient information sheet (English)

Hello. How are you? My name is _____. I live in this town. Now I am a research team member of Addis Ababa University. I am here today to collect data for the study on the interval between births and conception; and its risk on neonate low birth weight, preterm birth and still birth in Bahir Dar town. The objective of the study is to see or identify the relation between the interval between births and conception and neonate low birth weight, preterm birth and still birth. We are collecting data from mothers who are giving birth at least for the second time. You were selected to participate in this study just by chance/ because you have at least second birth. The questions are simple and focus only on the interval (in months) between the preceding child and conception of this neonate, your socio economic and demographic condition, current pregnancy, life style and your past medical, obstetric and gynecologic history ,dietary history. It will take about 30 minutes to finish the interview. I assure you that the information you provide me is completely confidential and will not be shared with anyone else without your consent. I will not keep a record of your name or any identifying information. You have a right to stop the interview at any time, or to skip any question that you do not want to answer. By doing so you will face no other problem or the care that is given to you will not be changed in any form.

I would like to assure you that all the information that you give me will be used only for research purpose. You have full right to refuse the interview. But the information that you will give me is quite useful to achieve the objective of the study and to bring change in the service provision for women.

In case if you have any question you can contact the principal investigator Mr. Aman Yesuf mobile phone +251920569262.

Are you willing to participate in the study?

1- Yes 2 – No

If the answer is yes, thanks! Read the following paragraph, make it to be signed and conduct the interview. If the answer is no, Thanks! Proceed to the next eligible client.

11.2 Patient Consent form (English)

I have received sufficient information about the project, I have had opportunities to ask questions and these questions have been answered to my satisfaction. I consent voluntarily to this study and I understand I have the right to withdraw at any time without any consequence on the type of medical care or any other public service I receive.

Signature _____ Date (E.C.) _____

11.3 Questionnaire (English version)

INTERVIEW INFORMATION

DATE OF INTERVIEW |__|__| Day |__|__| Month |__|__||__|__| Year

TIME STARTED |__|__| Hour |__|__| Minutes

TIME ENDED |__|__| Hour |__|__| Minutes

RESULT * |__|

IDENTIFICATION NUMBER _____

HEALTH FACILITY (NAME AND NUMBER) _____

INTERVIEWER NAME _____

SUPERVISOR _____

CHECKED BY _____

*RESULT CODES:

1=COMPLETED 4=REFUSED 7=OTHER (SPECIFY) _____

2=NOT AVAILABLE 5=PARTLY COMPLETED
3=POSTPONED 6=INCAPACITATED

No	Inclusion criteria	Yes/ No
1	Give birth at least for 2nd time	
2	Give birth after 28 wks of gestation	
3	Case A- Low birth weight / B- Preterm / C- Still birth /	

No	Exclusion criteria	Yes / No
2	Deliver twins, triplets & more	
3	Had abortion in the preceding pregnancy	

Participant: Case ---------- 1
Control ---------- 2

Study participants are included as **cases** if all exclusion criteria answers' are **'No'** and all inclusion criteria are **'Yes'**.

Study participants are included as **controls** if all exclusion criteria answers' are **'No'** and if inclusion criteria **Q 1 and Q 2 are 'Yes'.**

Section I. Information on Economic and Socio Demographic characteristics of parents			
No	**Question**	**Categories**	**Skip**
101	What is your marital status?	Married ……..…….. 1 Divorced ……..…… ……...… 2 Separated …….……..…… 3 Widowed ……..…… 4	
102	What is your religion?	Orthodox ……..…. 1 Muslim ……. 2 Protestant ……. 3 Other (Specify) 89	
103	Where is your resident?	Rural …… 1 Urban…… 2	
104	What is your ethnicity?	Amhara……..…..……1 Tigray ……..……...…….. 2 Oromo…….…..……3 Guragie……4 Other(specify) ……..… 89 No response ……..…. 99	
105	How old are you?	Years (age in completed Years) [ ][ ]	
106	What is your age at first marriage?	Age in completed years [ ][ ]	
107	What is the highest grade you completed?	Elementary (grade 1-8) ……..…… 1 Secondary (grade 9-12)…….…….. 2 Tertiary (college and university)…….. 3 Only read and write ……..…… 4 No Education ……..….. 5 No Response ……... 99	
108	Does your household have:	YES NO Electricity? . . . . ……. 1 2 A watch/clock? . . . .….. 1 2 A radio? . . . .…. 1 2 A television? . . . . ….... 1 2 A mobile telephone? . . . . …….…. 1 2 A non-mobile telephone? . . . ……. 1 2 A refrigerator? . . . . . .…….…. 1 2 A table? . . . . . .…..... 1 2 A chair? ` . . . . 1 2 A bed with cotton/sponge/spring mattress? ……. 1 2 An electric mitad? . . . . …… 1 2 A kerosene lamp/pressure lamp? . . . 1 2	
109	Does any member of this household own:	YES NO A bicycle? . . . . ….. .1 2	

		A motorcycle or motor scooter? ….. 1 2 An animal-drawn cart? . . ……... 1 2 A car or truck? . . . . . ….. 1 2	
110	Does any member of this household own any agricultural land?	YES . . . ….. 1 NO . . . . . 2 → 112	
111	How many (LOCAL UNITS) of agricultural land do members of this household own? LOCAL UNITS _____ (SPECIFY) IF 95 OR MORE CIRCLE '95'	LOCAL UNITS [ ][ ] [ ] 95 OR MORE LOCAL UNITS …… 95 DON'T KNOW …….. 98	
112	Does this household own any livestock, herds, other farm animals, or poultry?	YES …..….. 1 NO . . . . . 2 → 114	
113	How many of the following animals does this household own? IF NONE, ENTER '00'. IF MORE THAN 95, ENTER '95'. IF UNKNOWN, ENTER '98'.	Milk cows, oxen or bulls? . . . . . [ ][ ] Horses, donkeys, or mules? . . . . . [ ][ ] Goats? . . . . . [ ][ ] Sheep? . . . . . [ ][ ] Chickens? . . . . . [ ][ ] Beehives …….. [ ][ ] Camels? . . . . . [ ][ ]	
114	Does any member of this household have a bank or microfinance saving account?	YES …..….. 1 NO 2	
115	What is your occupation?	House wife ……. 1 Government employee ……... 2 Student ……..…. 3 Farmer..... 4 Both Housewife and farmer ……... 5 Privet Employee ……..... 6 Other (Specify) ……..…… 89 No response ……..……. 99	
116	What is your husband occupation?	Government employee …….. 1 Merchant ……... 2 Farmer..... 3 Privet Employee ……..….. 4 Daily worker ……..……..…….. 5 Other (Specify) ……...…… 89 No response ……..…… 99	
Section-II- Information on Maternal Obstetric, Medical History and Breast Feeding			
201	How many times you were pregnant including abortion?	Two ……..…….. 1 Three ……..……..... 2	

		≥ Four ……..…….. 3	
202	How many times you give birth excluding abortion?	One …… 1 Two ……..…….. 2 Three ……..……..…….. 3 ≥ Four ……..…….. 4	
203	When was your LMP date?	/_____ /_____/2004	
204	Date of delivery of the preceding child (in Ethiopian calendar)	/_____ /_____ /2005	
205	What is the interval between the preceding and the index pregnancy? In months? In years? (use Q no 203 & 204) (completed months)	☐☐	
206	If Q no 205 is less than 24 months, Reason for conceive before 24 months	_____	
207	Is the preceding birth a still birth?	Yes ……..… 1 → **208** No ……..…….. 2 → **209**	
208	Could you tell me date of delivery of the still birth?	/_____/_____/_____/ → **214**	
209	Is the preceding child alive today?	Yes …… 1 No …….....…. 2	
210	What was the gestational age of the preceding child at birth?	Month ☐☐ Wk ☐☐	
211	When was born the preceding child, was he/she very large, larger than average, average, smaller than average, or very small?	Very large ……....…..…….. 1 Grater than average ……...…….. 2 Average ……....…..…….. 3 Smaller than average ……...…… 4 Very small ……...…… 5 Don't know ……...……. 98	
212	For how long breast feed the preceding child?	Less than 6 months ……..…….. 1 7-12 Months ……..…….. 2 13-23 months ……..…….....….. 3 More than 24 months ……..…….… 4	
213	What was the preceding child sex?	Male …….. 1 Female ……..…… 2 No response …….…… 99	
214	Which illness do you have? (multiple responses are possible)	Diabetes mellitus ……..…… 1 Cardiac Disease ……..….. 2	

		Hypertension ……... 3 Renal Disease ……..… 4 RVI …….. 5 Has no any illness …….. 6 Other(Specify) ……. 89	
Section III Information on Current pregnancy			
301	Does the current pregnancy planed?	Yes ……..……..….. 1 No ……..……..……. 2 No response ……..……..... 99	
302	Did you take any type of modern family Planning methods before you conceived this neonate?	Yes ……..…… 1 No …… 2 → **304** No response ……..... 99	
303	Do you tell me the method you had used?	Pills ……..…….. 1 Injectables……..…….. 2 Implants …… 3 Others (specify) ……..…… 89 No response ……... 99	
304	Do you tell me the reason why you did not take (space) contraceptives?	I wanted a child soon ……..….. 1 I had no information on contraceptives…. 2 Contraceptives were not available …..….. 3 Other (specify) ……..….. 89	
305	Did you have ANC history for this specific pregnancy?	Yes ……..…. 1 No ……... 2 → **308** Don't know…….……..…….. 98 No response …… 99	
306	When was your 1st visit?	Within 16 weeks of pregnancy…… 1 From 17-28 weeks of pregnancy ……..…. 2 After 28 Weeks of pregnancy……... 3 Don t now ……...…… 98 No response ……..……. 99	
307	How many times did you visit a Health facility for ANC while you were pregnant this child?	Only once ……..…….. 1 2 -3 times …… 2 4 times …… 3 5 **and** more than 5 times ……..…. 4 Don t know ……..... 98 No Response ……. 99	
308	What type of complication this pregnancy has? (multiple responses are possible)	APH ……...….. 1 Poly hydraminos……..…….. 2 Cervical incompetence ……..… 3 PIH……..….. 4 PROM ……..……. 5 Hyper emesis……..…… 6 Has no any complication...……..... 7	

309	What was the method of delivery?	Vaginal ……..… 1 Cesarean section ……... 2 Instrumental ……..… 3 Augmentation or Induction……... 4 No response……..…. 99	
310	Is the neonate born alive?	YES ……..…… 1 NO ……..…….. 2 No response ……..…… 99	
311	Does the child has congenital malformation?	Yes ……..…… 1 No ……..……..…… 2 No response…… 99	
312	What is the sex of new born?	Male …… 1 Female …… 2 No response …… 99	
Section- IV -Household Food Insecurity Access Scale (HFIAS) Measurement			
401	In the past four weeks, did you worry that your household would not have enough food?	Yes ……..…… 1 No ……..…….. 2	
402	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	Yes …… 1 No ……..…….. 2	
403	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	Yes ……..……..…… 1 No …… 2	
404	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	Yes …… 1 No ……..…….. 2	
405	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	Yes …… 1 No …… 2	
406	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?	Yes …… 1 No …… 2	
407	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	Yes …… 1 No ……..…….. 2	
408	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	Yes …… 1 No ……..…….. 2	

409	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	Yes …… 1 No ……. 2	
Section –V- Household dietary diversity Now I would like to ask you about the types of foods that you or anyone else in your household ate **yesterday during the day and at night** either separately or combined with other foods.			
501	Any bread, rice, pasta, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat?	Yes ……..……..... 1 No…….……..... 2 Don't know …….……..…….. 98	
502	Any potatoes, bulla, kocho or any other food made from roots or tubers?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
503	Any vegetables?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
504	Any fruits?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
505	Any beef, pork, lamb, goat, rabbit wild game, chicken, duck, or other birds, liver, kidney, heart, or other organ meats?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
506	Any eggs?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
507	Any fresh or dried fish or shellfish?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
508	Any foods made from beans, peas, lentils, or nuts?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
509	Any cheese, yogurt, milk or other milk products?	Yes ……..... 1 No…….…….... 2 Don't know ……..…….. 98	
Section -VI- Information on the Mother behavior (life style)			
601	Do you smoke cigarette?	Yes ……..…… 1 No ……..……..…….. 2 → Q604 No response ……..…. 99	

602	Did you smoke while you were pregnant this neonate?	Yes ……..…… 1 No ……..…….. 2 → No response…… 99	Q 604
603	How many cigarettes you smoke per a day?	1 – 3 ……..…. 1 4 – 6 ……..…. 2 7 – 9 ……...……. 3 >10 ……...……... 4 Do not know……..…... 98 No response ……..…… 99	
604	Did you drink alcohol? such as Araki tella etc.	Yes ……..... 1 No ……..…….... 2 → No response……..…… 99	End
605	Did you drink while you were pregnant this neonate?	Yes ……..... 1 No ……..…….... 2 → No response……..…… 99	End
606	What type of alcohol?	Beer/draft……... 1 Local areki/ tella……..…….. 2 Wayne ……...…….. 3 Other specify ……..…… 89 No response ……..……... 99	

Thank You Very Much!!

11.4 Participants information from mother's card (English)

Fill from mother's card

No	**Questions**	**Categories**	**Skip**
1	RH factor	Negative ---------- 1 Positive ---------- 2	
2	Birth weight (in gram)	☐☐☐☐	
3	Last menstrual period date	/_____/_____/_____/	
4	Gestational age (calculated from LMP) (In completed weeks)	☐☐	
5	Gestational age (from U/S if any) (In completed weeks)	☐☐	

11.5 Patient information sheet (Amharic Version)

ቃለመጠይቁ ከመደረጉ በፊት የተሳታፊዎች ፈቃደኝነት መጠየቂያ ቅጽ፡፡

ጤና ይስጥልኝ፡ እኔ ---------- እባላለሁ፡፡ ከዚህ ከተማነው የምኖረው አሁን ደግሞ የአዲስ አበባ ዩኒቭሪሲቲ ጥናትና ምርምር አንዱ አባል ነኝ፡፡ ዛሬ ከዚህ የመጣሑት በውልደት እና እርግዝና መካከል ያለውን ጊዜ እና ይህ ጊዜ ለሚወለደው ጨቅላ ህፃን ክብደት ማነስ፣ ያለጊዜ መወለድ፣ እና ማህጸን ውስጥ ጠፍቶ መወለድ ጋር ያለውን ግንኙነት ለማወቅ የሚያስችል ጥናት ለማጥናት ነው፡፡ እናም መረጃ ቢያንስ ለሁለተኛ ጊዜ ከሚወልዱ እናቶች ለመሰብሰብ ነው፡፡ እርስዎ ቢያንስ ለሁለተኛ ጊዜ በመውለድዎ ለዚህ ጥናት እንዲሳተፉ ተመርጠዋል፡፡ ጥያቄዎቹ ቀለል ያሉ ሆነው የሚያተኩሩት ከውልደት እስከ እርግዝና ያለውን ጊዜ፣ ኢኮኖሚያዊና ማህበራዊ ሁኔታ ፣ስለአሁኑ እርግዝና፤ ስለ እርስዎ ጠቅላላ የጤና ሁኔታና ከእርግዝና ጋር ተያይዘው የመጡ የጤና ችግሮች እና የመሳሰሉ ጉዳዮች ይዳስሳሉ፡፡

ባጠቃላይ መጠይቁ 20 ደቂቃ ይወስዳል፡፡ የምትሰጡኝ መረጃ ሚስጥራ የተደበቀና ያለእናንተ ፈቃድ ማንም ሊያየው አይችልም፡፡ የእረስዎን ማንነት የሚገልጽ መረጃ ፈጽሞ አይመዘገብም፡፡ መጠይቁ ሳይ በማንኛውም ሰአት የማስቆምና መመለስ የማትፈልጊውን ጥያቄ የማለፍ መብት የተጠበቀ ሲሆን ይህን በማድረግሽ ደግሞ ለምታገኚው የጤና አገልግሎት ምንም አይነት ተጽኖ አያደርስም፡፡ ከእርሶ የሚገኘው መረጃ ሁሉ ለጥናት አገልግሎት ብቻ የሚውል ነው፡፡ ለዚህ ጥናት ያለመሳተፍ ሙሉ መብት አልዎት ግን ከእርሶ የሚገኘው መረጃ ለወደፊት ለእናቶች ለሚሰጠው የጤና አገልግሎት እጅግ በጣም አስፈላጊ ነው፡፡

ስለ ጥናቱ ለመጠየቅ የሚፈልጉት ማንኛውንም አይነት ጥያቄ ካለ መጠየቅ ይቻላል። ስዚህ ጥናት ስመሳተፍ ፈቃደኛ ነዎት?

1. አዎ 2. አይደለሁም

መልሱ አዎ ከሆነ በጣም አመሰግናለሁ። ከዚህ በታች የሚገኘውን አንቀጽ በማንበብ የጥናቱ ተሳታፊ ፈርመው መጠይቁ ይቀጥላል።

መልሱ አልፈልግም ከሆነ አመሰግናለሁ በማለት መጠይቁ ከዚህ ላይ ይቆማል።

11.6 Patient Consent form (Amharic Version)

የጥናቱ ተሳታፊ ፈቃድ ማረጋገጫ ቅፅ

የጥናቱ አላማና ተግባር ተብራርቶልኝ፣ በማንኛውም ሰአት ጥያቄ መጠየቅና ስጥያቄየም መልስ እንደሚሰጠኝ ተነግሮኛል፡፡ ስጥናቱ መረጃ በእኔ ፈቃደኝነት የምሳተፍ መሆኑ እና በማንኛውም ጊዜ ጥያቄውን ማቋረጥ እንደምችል፤ በመቋረጡም እኔ ስማገኘው የህክምና አገልግሎት ምንም አይነት ተጽኖ እንደማያመጣ ተገልጾልኝ በጥናቱ ስመሳተፍ ተስማምቻለሁ፡፡

ፊርማ ---------- ቀን ----------

11.7 Questionnaire (Amharic Version)

ክፍል አንድ፡ አጠቃላይ ኢኮኖሚያዊና ማህበራዊ ሁኔታን በሚመለከት፡			
ተ.ቁ	መጠይቅ	ዝርዝር መልስ	ይለፉ
101	የትዳር ሁኔታ?	ያገባች ..... 1 የተፋታች..... 2 ሳትፋታ ከባለቤቷጋር ተለያይታ የምትኖር ..... 3 የሞተባት..... 4	
102	ሀይማኖትዎ ምንድነው?	ኦርቶዶክስ ክርስቲያን..... 1 ሙስሊም..... 2 ፕሮቴስታንት..... 3 ሌላ (ይገለጽ) 89	
103	የመኖሪያ አካባቢዎ የት ነው?	ገጠር ..... 1 ከተማ 2	
104	ብሔርዎ ምንድን ነው?	አማራ ..... 1 ትግሬ ..... 2 ኦሮሞ ..... 3 ጉራጌ ..... 4 ሌላ (ይገለጽ) ..... 89 ለዚህ ጥያቄ መልስ መስጠት አልፈልግም..... 99	
105	ዕድሜዎት ስንት ነው?	በአመት ይገለጽ	
106	ለመጀመሪያ ጊዜ ሲያገቡ እድሜዎት ስንት ነበር?	በአመት ይገለጽ	
107	የትምህርት ደረጃ ?	አንደኛ ደረጃ (ከ1-8ኛ ክፍል) ..... 1 ሁለተኛ ደረጃ (ከ9-12ኛ ክፍል) ..... 2 ኮሌጅ ወይም ዩኒቨርሲቲ ያጠናቀቀች..... 3 ማንበብና መፃፍ ብቻ የምትችል ..... 4 ምንም ትምህርት አልተማርኩም..... 5	

		ስዚህ ጥያቄ መልስ መስጠት አልፈልግም..... 99	
108	በቤታችሁ ውስጥ የሚከተሉት ዕቃዎች አሉ?	አዎ የለም የኤሌክትሪክ መብራት 1 2 የግድግዳ ሰዓት 1 2 ሬድዮ 1 2 ቴሌቭዥን 1 2 ሞባይል ስልክ 1 2 የቤት ስልክ 1 2 ፍሪጅ 1 2 ጠረጴዛ 1 2 ወንበር 1 2 አልጋ ከነ የፕፕ/ስፕንጅ/ ስፕሪንግ ፍራሽ 1 2 የኤሌክትሪክ ምጣድ 1 2 የነዳጅ መብራት 1 2	
109	ከቤተሰብ አባላት ውስጥ የሚከተሉት ዕቃዎች ያለው አለ?	አዎ የለም ሳይክል 1 2 የሞተር ሳይክል 1 2 ጋሪ(የእንስሳት) 1 2 መኪና 1 2	
110	ከቤተሰብ አባላት ውስጥ የእርሻ መሬት ያለው አለ?	አዎ..... 1 የለም ..... 2 →	112
111	የቤተሰብ አባላቱ ምን ያህል (በአካባቢው መለኪያ) የእርሻ መሬት አላችሁ? የአካባው መለኪያ ይገለጽ ---------- 95 እና ከዚያም በላይ ከሆነ 95 ያክብቡ	በአካባቢው መለኪያ [ ][ ] . [ ] 95 እና ከዚያም በላይ በአካቢው መለኪያ.....95 አይታወቅም 98	
112	በቤታችሁ ውስጥ የእርሻ ከብቶች፣ የመጓጓዣ እንሳት እና የመሳሰሉት አሉ?	አዎ .....1 የለም ..... 2 →	114

113	ምን ያህል የሚከተሉት እንስሳት አሏችሁ? ከሌለ ፣ 00 ይዳፉ ከ95 በላይ ከሆነ ፣95 ይዳፉ የማይታወቅ ከሆነ 98 ይዳፉ	ላም፣በሬ ..... ፈረስ፣አህያ፣በቅሎ ..... ፍየል ..... በግ..... ዶሮ ..... የንብ ቀፎ ..... ግመል	
114	ከቤተሰብ አባላት ውስጥ የባንክ ቁጠባ ደብተር ወይም ማይክሮ ፋይናንስ ሂሳብ ያለው አለ?	አዎ ..... 1 የለም 2	
115	ስራዎት ምንድን ነው?	የቤት እመቤት ..... 1 የመንግስት ሰራተኛ ..... 2 ተማሪ ..... 3 አርሶ አደር ..... 4 የቤት እመቤት እና አርሶ አደር ..... 5 የግል ተቀጣሪ ..... 6 ሌላ (ይገለጽ) ..... 89 ለዚህ ጥያቄ መልስ መስጠት አልፈልግም..... 99	
116	የባለቤትዎት ስራ ምንድን ነው	የመንግስት ሰራተኛ ..... 1 ነጋዴ ..... 2 ገበሬ ..... 3 የግል ተቀጣሪ ..... 4 የቀን ሰራተኛ ..... 5 ሌላ(ይገለጽ) ..... 89 ለዚህ ጥያቄ መልስ መሥጠት አልፈልግም 99	
ክፍል ሁለት: የእናት የእርግዝና፣ የህክምና ታሪክ እና ጡት ማጥባትን በሚመለከት			
201	ጠቅላላ ስንት ጊዜ አርገዘዎል ?(ይህን ጨምሮ)	ሁለት..... 1 ሶስት..... 2 አራትና ከዚያ በላይ 3	
202	ስንት ልጅ አለሽ?(ይህን ሳይጨምር)	አንድ ..... 1 ሁለት ..... 2 ሦስት..... 3	

		አራትና ከዚያ በላይ 4	
203	የመጨረሻ የወር አበባ ያዩበት ቀን መቼ ነበር? (በኢትዮጵያ አቆጣጠር)	/_____ / _____/2004	
204	ከዚህ በፊት የተወለደው ህፃን የተወለደበት ቀን መች ነው?	/_____ /_____/_____/	
205	ከዚህ በፊት በተወለደው ልጅና ይህ ጨቅላ ህፃን ከተረገዘበት ቀን ጀምሮ ያለው ጊዜ በወር (ከጥያቄ ቁጥር 204 እና 205 በማስላት)	☐☐	
206	ለጥያቄ ቁ. 205 መልስ 24 ወር በታች ከሆነ 24 ወር በፊት ያረገዝሽበት ምክንያት ምንድን ነው?		
207	በዚህ ጨቅላ ህፃን እና ከዚህ በፊት በተወለደው መካከል በእናት ሆድ ውስጥ ጠፍቶ የተወለደ ነበር?	አዎ ..... 1 → 208 የለም ..... 2 → 209	
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