**ADDIS ABABA UNIVERSITY**

**COLLAGE OF HEALTH SCIENCES**

**SCHOOL OF PUBLIC HEALTH**

# MATERNAL RISK FACTORS ASSOCIATED WITH TERM LOW BIRTH WEIGHT NEONATES IN PUBLIC HEALTH INSTITUTIONS OF ADDIS ABABA, ETHIOPIA: A CASE-CONTROL STUDY.

**BY: Mahari Yihdego (B.Sc.)**

**A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTERS OF PUBLIC HEALTH IN REPRODUCTIVE AND FAMILY HEALTH (MPH/RH)**

**SEPTEMBER, 2013**

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**ADVISOR**:

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**SEPTEMBER, 2013**

**ADDIS ABABA**

## Declaration

I, undersigned that this thesis is my original work, has never been presented in any other University and that all resources of materials have been acknowledged.

Mahari Yihdego (BSc)

Signature _____ Date _____

This thesis has been submitted for examination with my approval as University Advisor.

Alemayehu Mekonnen (MD, MPH)

Signature _____ Date _____

## Dedication:

I dedicated this thesis work for my beloved mother and father who struggled a lot for my success throughout my entire life and wish them also long life to see and enjoy their fruit.

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## Abbreviations

| | |
|---|---|
| ANC: | Antenatal Care |
| AOR: | Adjusted Odds Ratio |
| BMI: | Body Mass Index |
| COR: | Crude Odds Ratio |
| CSA: | Central Statistical Authority |
| CI: | Confidence Interval |
| EDHS: | Ethiopia Demographic and Health Survey |
| ETB: | Ethiopian Birr |
| HIV: | Human Immunodeficiency Virus |
| IUGR: | Intra Uterine Growth Retardation |
| IPV: | Intimate Partner Violence |
| KDS-HRC: | Kersa Demographic Surveillance and Health Research Centers |
| LBW: | Low Birth Weight |
| LMP: | Last Menstrual Period |
| MDG: | Millennium Development Goal |
| MPH: | Master of Public Health |
| MUAC: | Mid-Upper Arm Circumference |
| NGO: | Non-Governmental organization |
| PIH: | Pregnancy Induced Hypertension |
| PT: | Preterm |
| RH: | Reproductive Health |
| SGA: | Small for Gestational Age |
| SPSS: | Statistical Package for Social Sciences |
| UN: | United Nations |
| UNDP: | United Nations Development Program |
| UNICEF: | United Nations Children Fund |
| WHO: | World Health Organization |

## Abstract

**Background**: Birth weight plays an important role in infant morbidity, mortality, development, and future health of the child. Weight at birth is directly influenced by general level of health status of the mother. Maternal environment is the most important determinant of birth weight. Despite the profusion of many researches there are considerable confusions and controversies about the factors that have independent effects on low birth weight. Moreover, most of the studies conducted do not exclude preterm babies who are biologically exposed of being with low birth weight. Therefore, studying the maternal risk factors for only term low birth weight neonates will be more helpful in identifying the specific associated modifiable factors.

**Objective**: The aim of this study was to determine maternal risk factors associated with low birth weight among term neonates in selected public health facilities of Addis Ababa city government.

**Methods:** Facility based unmatched case-control study was carried out from April to July 2013. Mothers' of 139 low birth weight (<2500gm: cases) and 278 normal birth weight (≥2500gm: controls) neonates were included in the study from randomly selected public health institutions of Addis Ababa. Information on socio-demographic, nutritional status, obstetric factors, domestic violence, depression & life style were collected using a pre-tested structured questionnaire through face to face interview, actual measurements and record review. Data were entered and analyzed using Epi Info and SPSS statistical packages respectively. Descriptive and analytic statistical computations were made and P value of less than 0.05 was considered significant.

**Results:** The Mean birth weight among the cases and controls were 2199.5gm (S.D±252.79) and 3229.98 (S.D±449.73) respectively. In the final model, less than 4 ANC visits (AOR: 2.76, 95%CI 1.32-5.77), not taking iron-folic acid supplementation (AOR: 2.89, 95%CI: 1.32-6.34), gestational weight gain less than 8.0 Kg (AOR: 7.01, 95%CI: 3.31-14.78), maternal Mid-Upper Arm Circumference (MUAC) less than 23cm (AOR: 1.94, 95%CI: 1.01-3.73), maternal height less than 155cm (AOR: 2.74, 95%CI: 1.32-5.66), antenatal depression of any degree (AOR: 3.45, 95%CI: 1.29-9.23) and domestic violence of any type (AOR: 6.45, 95%CI 2.41-17.28) were found to be statistically significant with term low birth weight.

**Conclusions and recommendations:** With all the strengths and limitations of the study we can conclude there are factors associated with term low birth weight such as, ANC, iron supplementation, MUAC, Height depression and violence. It may not be possible to address all these issues at once, but early and optimum antenatal visits by prospective mothers, conducting awareness programs through the mass media focusing on proper nutritional care during pregnancy could alleviate many of these problems.



**Key words**: LBW, Full term, maternal risk factors, case-control and public health institutions of Addis Ababa

## Acknowledgment

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# 1. INTRODUCTION:-

## 1.1. Background information

Low birthweight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams irrespective of gestational age. This is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies. More than 20 million infants worldwide, representing 15.5% of all births, are born with low birthweight, 95.6% of them in developing countries. Birth weight plays an important role in infant mortality and morbidity, development, and future health of the child. Low birth weight (LBW) is a significant risk factor for adverse health outcomes including many childhood diseases. The associations between LBW and a greatly elevated risk of infant mortality and other physical and neurologic impairments are well established. Thus, prevention of LBW is a major public health priority.[2]

Birth weight is governed by two major processes: duration of gestation and intrauterine growth rate. LBW is thus caused by either a short gestation period or retarded intrauterine growth (or a combination of both). Prematurity is usually defined as a gestational age of less than 37 weeks. Although intrauterine growth retardation (IUGR), which is also referred to as "small-for-gestational-age" or "small-for-dates," has no generally accepted standard definition, the following are commonly used: birth weight less than $10^{th}$ (or $5^{th}$) percentile for gestational age; birth weight less than 2500 g and gestational age greater than or equal to 37 weeks; and birth weight less than 2 standard deviations below the mean value for gestational age. [11]

In 1976, the WHO (World Health organization) defined LBW as birth weight less than 2,500 grams. Low birthweight is closely associated with fetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life. Many factors affect the duration of gestation and fetal growth, and thus, the birthweight. They relate to the infant, the mother, or the physical environment and play an important role in determining the birthweight and the future health of the infant. [2, 9]

Mortality among low-birth-weight children contributes to higher rate of overall childhood mortality especially during the early period of life. Therefore, the purpose of this study was to identify the maternal risk factors associated with term LBW among women who gave birth in public institutions of Addis Ababa.

## 1.2. Statement of the problem

LBW is an important indicator of reproductive health and general health status of population. LBW is considered the single most important predictor of infant mortality, especially of deaths within the first month of life. It continues to remain a major public health problem worldwide especially in the developing countries. [12]

There is significant variation in LBW incidence across the main geographic regions, ranging from 6% to 18%. Nearly 80% of all intrauterine growth retarded newborns who are low birthweight and full term are born in Asia. About 15% and 11% are born full term with low birthweight and intrauterine growth retardation in middle and western Africa respectively. Low birthweight levels in sub-Saharan Africa are around 13% to 15%, with little variation across the region as a whole.[2, 3]

In Ethiopia, studies conducted in the year 2000 in Addis Ababa and 2010 in Kersa Demographic Surveillance and Health Research Centers (KDS-HRC) showed that the prevalence & incidence of LBW was 8.8% and 28.3%, respectively.[10, 22] Similarly according to Ethiopian Demographic Health Survey (EDHS) 2011 among children born with a reported birth weight, 11.4% weighed less than 2.5 kilograms which is slightly higher than the national prevalence, 10.8%. Low birth weight was found with higher proportion among children of the youngest mothers, age less than 20 (13%) and older mothers, age 35-49 (17%), and children of birth order six and above (16 percent). The birth weight of a child also varies by place of residence. 17% of births in rural areas, compared with 9% in urban areas, have a reported birth weight less than 2,500 grams.[12]

The study conducted in Addis Ababa[22] used retrospective data from a tertiary teaching hospital. Clients who visited such hospitals are usually referred by other hospitals or health centers. Therefore, they are different from those who give birth in the usual clinical setting. The study conducted around Jimma[23] used weight measured up to the 7$^{th}$ day after delivery. The measurement obtained on the 7$^{th}$ day is different from the measurement that would be obtained within one hour of birth. Therefore, they are not true reflection of birth weight.

Moreover, premature infants and intrauterine growth retarded infants should be studied as separate groups because they show different patterns of growth, morbidity and mortality. From a programmatic viewpoint these differences have enormous implications on intervention strategies and limitations of the approach of nutritional recovery in early childhood. However, most of the

studies conducted do not exclude preterm deliveries which are biologically exposed to get delivered being with low birth weight. Therefore, studying the maternal risk factors for only term low birth weight is more helpful in identifying the specific associated modifiable factors.

## 1.3. Rationale of the study

LBW is considered the single most important predictor of infant mortality, especially of deaths within the first month of life. It continues to remain a major public health problem worldwide and especially in the developing countries. Despite the profusion of studies over the last four decades that have investigated the causes of LBW world widely, the conclusions are often controversial. As well as the determinant factors could also vary from country to country and from region to region. So it is mandatory to identify and localize the determinant factors associated with term LBW in the specific study area.

The findings of this study could help us to show the modifiable maternal risk factors associated with term low birth weight in the city and may in general help the health management at higher levels and in particular those looking after the health institutions in the city. The findings of this study could enhance the capacity to look for possible alternative solutions after identifying significant modifiable risk factors for LBW and in turn will help in enhancing primarily the health of the mother and her baby and alleviating associated factors for term LBW. It may also contribute to increase in the knowledge about maternal risk factors associated with term LBW in the areas by concerned bodies including the health institution staffs so as to develop strategies to alleviate this problem.

Identification of maternal risk factors associated with LBW will also be essential in order to guide program planning, and organizing care for mothers and their newborns. It is expected that identifying those risk factors will enable to reverse the increasing trend of LBW in Ethiopia particularly in Addis Ababa and there by its immediate and long term consequences.

The finding of this study may also provide policy makers and NGOs with relevant information in developing appropriate strategies to promote and maintain the health of both the mother and her baby in particular and the family and society in general. Moreover, this study will serve as a reference for further studies.

# 2. LITERATURE REVIEW

## 2.1. Definition

Birthweight is the first weight of the fetus or newborn obtained after birth. For live births, birthweight should preferably be measured within the first hour of life, before significant postnatal weight loss has occurred. [11]

In 1976, the 29th World Health Assembly agreed on the following definition: "Low birthweight is a weight at birth of less than 2,500 g (up to and including 2,499 g) irrespective of gestational age." This replaced the earlier definition of 2,500 g or less. The WHO definition of low birthweight mainly serves for comparative health statistics and is not appropriate for clinical care. For clinical purposes, individual countries may choose alternative cut-off values. [2]

According to international statistical classification of disease and health related problems, tenth revision LBW can be classified under three categories:-

1. ***Low birth weight*** is defined as less than 2500 grams (up to and including 2499g)
2. ***Very low birth weight*** is less than 1500 g (up to and including 1499g)
3. ***Extremely low birth weight*** is less than 1000 g (up to and including 999 g).

The definitions of 'low', 'very low', and 'extremely low' birth weight do not constitute mutually exclusive categories. [2]

## 2.2. Factors associated with low birth weight

The causes of LBW have been the focus of a vast number of investigations over the last few decades, and with the general availability of fairly accurate infant weighing devices, birth weight and its determinants have come under intense global scrutiny. As a result, it is now acknowledged that many factors can influence the length of gestation or the rate of intrauterine growth, i.e., that the causality of LBW is multi-factorial. Nonetheless, there is considerable confusion and controversy about the factors that have independent effects on LBW.[11] Some of the factors are discussed below.

### 2.2.1. Age of the mother

Pregnancy outcomes, including birth weight and gestational age, are generally less favorable among adolescents and women over 35 years of age; however, there is considerable controversy

as to whether age itself is an independent determinant of either intrauterine growth or gestational duration. Age is closely associated with parity, which must therefore be controlled in attempts to isolate the independent impact of age. Furthermore, young adolescents (those within 1 or 2 years of menarche) have not completed growing, are likely to have a lower weight-for-height than older women, and may consume fewer calories and other nutrients. Because their pregnancies are often unwanted or unplanned, they are often late in seeking antenatal care. Increased cigarette smoking, alcohol consumption, and drug use among teenagers may also put them at risk. [11]

The results of studies in maternal age as independent factor are conflicting. According to broad meta-analysis maternal age does not appear to be an important independent determinant of intrauterine growth or gestational duration. Although age and particularly a very young age, may exert indirect effects by influencing height, weight, nutrition, cigarette smoking, as well as alcohol and drug abuse, no direct causal effect can be demonstrated. Older women may not be at increased risk because of their age alone, but age >35 years may augment the impact of other risk factors.[11]

However, recent studies have showed that there is significant association between maternal age and LBW. According to a study conducted in Malawi, maternal age was significantly associated with LBW.[8] Similarly according to Ethiopian DHS 2011, LBW was more common among children of the youngest mothers, age less than 20 (13 percent) and older mothers and age 35-49 (17 percent).[12] In Gondar association of LBW with maternal age was shown. The incidence of LBW was being higher among young mothers (<20). Teenagers have higher rates of adverse obstetric outcomes, particularly the delivery of low birthweight or preterm infants.[6] Similarly a case control study conducted in Tigray region, Ethiopia found the risk of delivering a baby with LBW was nearly three folds higher for women aged below 18 years of age compared to women in age group 18-34 years with (Adjusted OR=3.08, CI 1.07, 11.7). On the other hand a mother above 34 years of age was not found to be statically significant. [47]

In summery based on the available data considering maternal age as an independent factor for LBW is controversial.

### 2.2.2. Socioeconomic status of the mother

Socioeconomic status mainly encompasses factors such as education (usually maternal), occupation (usually paternal), and family income. When making an association there are important variables that require control. Women of low socioeconomic status in developed countries are more likely to be members of racial/ ethnic minorities and may be more likely to smoke cigarettes, have shorter birth intervals, make less use of antenatal care, and have a higher incidence of systemic and genital tract infection. In developing countries, such women are likely to be shorter and thinner and to consume fewer calories and other nutrients during pregnancy. Thus the absence of an independent effect of socioeconomic status does not rule out its role as an indirect cause of prematurity or IUGR. [11]

A broad meta-analysis study had concluded that socioeconomic status has no independent effect on intrauterine growth. However, in multivariate analysis of a study conducted in Malawi the significant factors were education and wealth index. Compared to mothers who had attained at least secondary level of education, mothers who had no formal education were 29% (Adjusted odds ratio (AOR) = 1.29 [95% CI 1.07, 1.57]) more likely to bear children who had LBW. Compared to mothers who were in the 5th wealth quintile (the non-poor), mothers who were in the 1$^{st}$ and 4$^{th}$ quintiles were 42% (AOR=1.42 [95%CI 1.19, 1.71]) more likely, and 19% (AOR=0.81 [95% CI (0.66, 0.99)] less likely, respectively, to bear children who had LBW. [8, 11]

Similarly a recent prospective study conducted in Kersa, Ethiopia has found that more LBWs were observed among women who were uneducated, rural resident, and poorer than their counterparts. LBW was significantly associated with rural residence and poor wealth status (p, 0.05 for both). [10] However, regarding the occupational status of mothers the chance of delivering low birth weight was not different among not employed for cash and unskilled laborer with the reference category employed for cash with (Crude OR = 1.3, [95% CI: (0.87, 6.9)] and (adjusted OR = 1.24, [95% CI: (0.63, 4.5)] respectively in a recent case control study conducted in Tigray region, Ethiopia.[47] Depending on the result of different studies it is difficult to conclude that socioeconomic status as an independent factor especially after controlling confounders.

### 2.2.3. Marital status

Marital status or, more broadly, parental cohabitation, is closely linked to socioeconomic status. Any effect on intrauterine growth or gestational duration thus might operate in the mother through a psychological mechanism, e.g., stress, independently of her socioeconomic status. Demonstration of an independent effect depends, therefore, on controlling for the same variables as for socioeconomic status, in addition to controlling for racial/ ethnic origin. [11]

Evidence from broad meta-analysis showed that marital status (or cohabitation) is an independent determinant of either intrauterine growth or gestational duration was inconclusive. None of the studies that had a bearing on this factor came from developing countries, however, and no firm conclusions can be drawn about its role there. However, recent studies have showed contrary results. A hospital based study in northern Tanzania revealed that unmarried women were almost twice more likely to give birth to LBW neonates than the married ones (OR=1.65; (95% CI=1.25-2.17)) contributing to about 5% of all low birth weights. In the case control study conducted in Tigray mothers who were currently not married (never married/divorced/widowed) had over 2 times chance of delivering LBW baby compared to currently married ones. However, the difference was not statistically significant on the multiple logistic regressions (adjusted OR = 2.22, CI: 0.69, 11.5). Similarly, a hospital based study conducted in Gondar reported that marital status was not significantly associated with LBW in its multivariate analysis. [47, 11]

From the available previous and recent studies most of them haven't found significant association between marital status and LBW after controlling the potential confounders.

### 2.2.4. Parity and birth interval

There is general agreement that pregnancy outcomes are more favorable for multiparae than primiparae; grand multiparity, however, is often believed to constitute a risk. Several factors may confound the association between parity and intrauterine growth or gestational duration. In particular, primiparae tend to be younger than multiparae. Grand multiparity may also be associated with racial/ethnic origin, socioeconomic status, cigarette smoking, alcohol consumption, and genital infection. In addition, as mothers of high parity are likely to have had shorter intervals since their previous pregnancy, birth (or pregnancy) interval should also be controlled.

A national representative study conducted in Malawi has revealed that mothers who had ever given birth to 1 child were 80% (AOR=1.80 [95%CI 1.54, 2.10]) more likely to bear children who had LBW compared to mothers who had ever given birth to 5 or more children. Meanwhile, mothers who had 3-4 children were 24% (AOR=0.76 [95%CI 0.64, 0.90]) less likely to bear children who had LBW compared to those who had ever given birth to 5 or more children.[8] Similarly, in a hospital based study in Gondar, Ethiopia, compared to parity of 1–4 and 5–6; primipara and parity of $7^{+}$ had more LBW babies.[6] In summery even after controlling the potential confounders many studies has found significant association between parity and LBW.

A short interval since the previous birth might lead to poor pregnancy outcome. Nutritional depletion would be the most obvious biological mechanism for such an effect, but inadequate physiological (e.g., hormonal) recovery could arise for other reasons. In any case, identification of an independent effect of birth interval on intrauterine growth or gestational duration requires adequate control for numerous other factors. Short intervals are more likely among grand multiparae, certain racial or ethnic groups, and the poor; thus parity, racial/ethnic origin, and either socioeconomic status or its important correlates (especially height, cigarette smoking, and alcohol consumption) also require adequate control. Accordingly, broad meta-analysis had revealed that it seems unlikely that short pregnancy intervals are an important cause of IUGR, in both developed and developing countries. [11]

However, a recent community based study in rural Karnataka, India had reported that birth interval, 2 years [OR 2.4], emerged as significant risk factors on multivariate analysis.[5] Similarly, recent study in Tigray region had reported the mean inter-pregnancy interval <18 months was a significantly related with the chance of having low birth weight babies by two fold higher than that of inter pregnancy birth interval >18 months with (Crude OR=2.11, CI:1.9, 6.34).[47] Consequently, findings from previous studies are controversial.

### 2.2.5. Antenatal care attendance

Antenatal care could have a beneficial impact on intrauterine growth or gestational duration, either by diagnosis and timely treatment of pregnancy complications (such as toxemia, gestational hypertension or diabetes, antepartum hemorrhage, or cervical incompetence) or by eliminating or reducing modifiable risk factors. The results of the assessment indicate that those

risk factors that seem most amenable to such an impact include caloric intake, cigarette smoking, alcohol consumption, and malaria prophylaxis or treatment. The stage in pregnancy at which a woman is first seen for antenatal care, the numbers of visit and the quality of the care might be of great importance, because the effects of many pregnancy complications and risk factors could then be substantially mitigated, if attended to early in gestation, adequate number of visits and quality care are fulfilled. [11]

Even though most of the studies found significant association between ANC and LBW there are studies which found the reverse. Accordingly in the analysis of adequacy and quality of prenatal care of a study conducted in Brazil showed that a significant difference between groups ($p < 0.001$) was observed regarding only to the number of adequate prenatal care visits by gestational age, with a higher frequency of inadequate care related to LBW (31.3%) in relation to the control group (19.3%). However, in multivariable analysis by logistic regression for evaluation of prenatal care quality was applied and no associations with low birth weight were found considering the adjusted and non adjusted models. No influence of prenatal care quality on the association with other factors and LBW was observed. [9]

On the other hand a study conducted in Tigray showed that the chance of delivering LBW babies among mothers with no ANC follow up was about over seven and half times that of mothers who attended ANC at least once, and this difference was statistically significant (adjusted OR=7.64, CI: 2.97, 7.7). Further analysis among mothers who had ANC attendance yielded the number of ANC visits to be an independent factor associated with birth weight. Mothers who had an ANC visit of less than four during pregnancy had increased odds of having a LBW baby by three folds than mothers with four or more ANC visits (adjusted OR=2.88, CI: 1.14, 7.37). Unlike number of ANC attendance, pregnancy trimester at first ANC visit was not found to be associated with low birth weight delivery. [47] Similarly a cohort study conducted in Haromaya, Ethiopia has showed more LBW babies were observed among women who never followed antenatal care than those who attended one or more times. [10] Depending on the result of different studies (local and international) it is difficult to conclude that antenatal care attendance as an independent factor especially after controlling confounders.

### 2.2.6. Nutritional factors

Maternal nutritional status both before and during pregnancy is a well-recognized determinant of birth outcomes. Only two indicators, namely maternal pre pregnancy body mass index and weight gain during pregnancy have shown consistent positive associations with infant birth weight. Reports from developed and developing countries show that maternal anthropometric measurements are associated with birth outcome. [7]

Maternal weight prior to conception reflects nutritional stores potentially available to the growing fetus. A study conducted in India had revealed pregnant women who weighed less than 60 kg gave birth to neonates with the mean birth weight of 2.7 kg, while subjects who weighed more than 75 kg gave birth to heavier neonates (3.6 kg). Similarly, pre pregnancy maternal weight of <45 Kg was important determinant of low birth weight with OR: 4.41, CI95% 2.30-8.40.[12] Weight gain during pregnancy would be expected to affect intrauterine growth. Studies from several developing countries report an average weight gain during pregnancy of 6 kg, compared with 11 kg in developed countries.[24] A case-control study which was conducted in Botucatu city, Brazil showed that inadequate weight gain being less than 5 kg (OR: 2.63,95% CI 1.35-5.00, p=0.004) was associated with LBW.[9] Meanwhile, women with normal weight gain gave birth to babies with the mean birth weight of 3.3 kg, while pregnant women with low gestational weight gain gave birth to babies with the mean birth weight of 2.5 kg.[7] Similarly a cohort study conducted in Kersa-Haromaya, Ethiopia has revealed that LBW was significantly associated to MUAC less than 23 cm (OR 1.6, 95% CI 1.19, 2.19). [10]

### 2.2.7. Maternal anemia

Maternal anemia is a common problem in pregnancy, particularly in developing countries. According to the study conducted in Pakistan the relationship between maternal anemia and perinatal outcome in a cohort of 629 pregnant women from October 2001 to 2002. Of these, 313 were anemic (hemoglobin < 11 g/L). Perinatal outcomes included preterm delivery, low birth weight, intrauterine growth retardation, perinatal death, low APGAR scores and intrauterine fetal death. The risk of preterm delivery and low birth weight among the anemic women was 4 and 1.9 times more respectively than the non-anemic women. The neonates of anemic women also

had 1.8 times increased risk of having low APGAR scores at 1 minute and there was a 3.7 greater risk of intrauterine fetal death among the anemic women than the non-anemic women. [21]

### 2.2.8. Maternal Height

A mother's height during pregnancy is determined by three factors: her genetic potential for growth; her state of skeletal maturity; and the effect of environmental influences during the period of skeletal immaturity. These factors differ in their modifiability. Genetic potential is presumably fixed, but delayed child-bearing among young adolescents and, over the long term, general improvements in nutrition might be achieved by interventions. [11]

Diminished maternal height may well be one of the causes of the increased rate of LBW in many developing countries, whether caused by a true difference in genetic potential or prior stunting during the mother's childhood. However, because tall women are heavier and consume more calories than short women, and because pre-pregnancy weight and gestational nutrition may independently affect birth weight, these are potential confounders and should be controlled in assessing the independent effect of height. Another potentially important confounder is age, since adolescents who have not completed their growth will be shorter, on average, than more physiologically mature women, and because adolescence may also be independently related to birth weight or gestational age. Finally, socioeconomic status is another important confounding variable that should be controlled, because women of lower socioeconomic status tend to be shorter than those of higher status and may be prone to impaired fetal growth or earlier delivery independent of their shorter stature.[11]

According to a community based study in rural India among the studied risk factors, maternal height <140cm were significantly associated with birth weight on univariate logistic regression analysis with crude OR 6.8, (95% CI 3.5–13.3), p 0.001.[5] Similarly a study conducted in Azerbaijan clearly showed that taller pregnant women (more than 155 cm) gave birth to significantly heavier and normal babies (mean birth weight 3.6 kg) when compared to shorter women (mean birth weight 2.6 kg).[7]

As discussed above the maternal height taken as a reference in different studies which were found to be significantly associated with LBW highly varies. These variable findings make difficult to conclude that a certain fixed height level is independently related with LBW. There

are few studies which conclude that short mothers are expected to deliver lighter babies than their counter parts. However, many of the studies have concluded maternal stature is independently associated with LBW.

### 2.2.9. Domestic violence and depression

Low-income women with mental health problems and a history of domestic abuse were 12 times as likely to give birth to a LBW child, a new U-M and University of Pittsburgh study shows. While the strongest impact on the child involved both factors, either factor increases the risk significantly. In this study of Michigan mothers, those who were physically abused had a 10-fold risk of having low birth weight infants, and the risk was eight-fold if they had mental health conditions, such as post-traumatic stress disorder or depression. Violence against women occurs in every socioeconomic level. This study's analysis combined with other research suggests that violence occurring around the time of pregnancy is a significant predictor of adverse infant outcomes for women who already are at risk due to the problem of poverty, including food insufficiency; the researchers say. [20]

Findings about risk for low birth weight in relation to intimate partner violence (IPV) have been mixed, but a recent systematic review revealed an association between IPV with low birth weight. A meta analysis reviewing concluded the association between abuse during pregnancy and low birth weight that, overall, women reporting physical, emotional, or sexual violence had 1.4 times greater odds of giving birth to a low birth weight infant than non abused women. [17] An association between physical abuse and adverse pregnancy outcome has been found in some controlled studies, but not in others. Apart from causing direct physical injury, abuse may affect the pregnancy indirectly by leading to anxiety, increased stress and increased smoking and alcohol use in pregnancy. [19]

It is well known that battered women and women who were sexually abused in childhood suffer more often from anxiety, and some studies indicate that psychological distress is associated with poor pregnancy outcome. [18]

## CONCEPTUAL FRAMEWORK

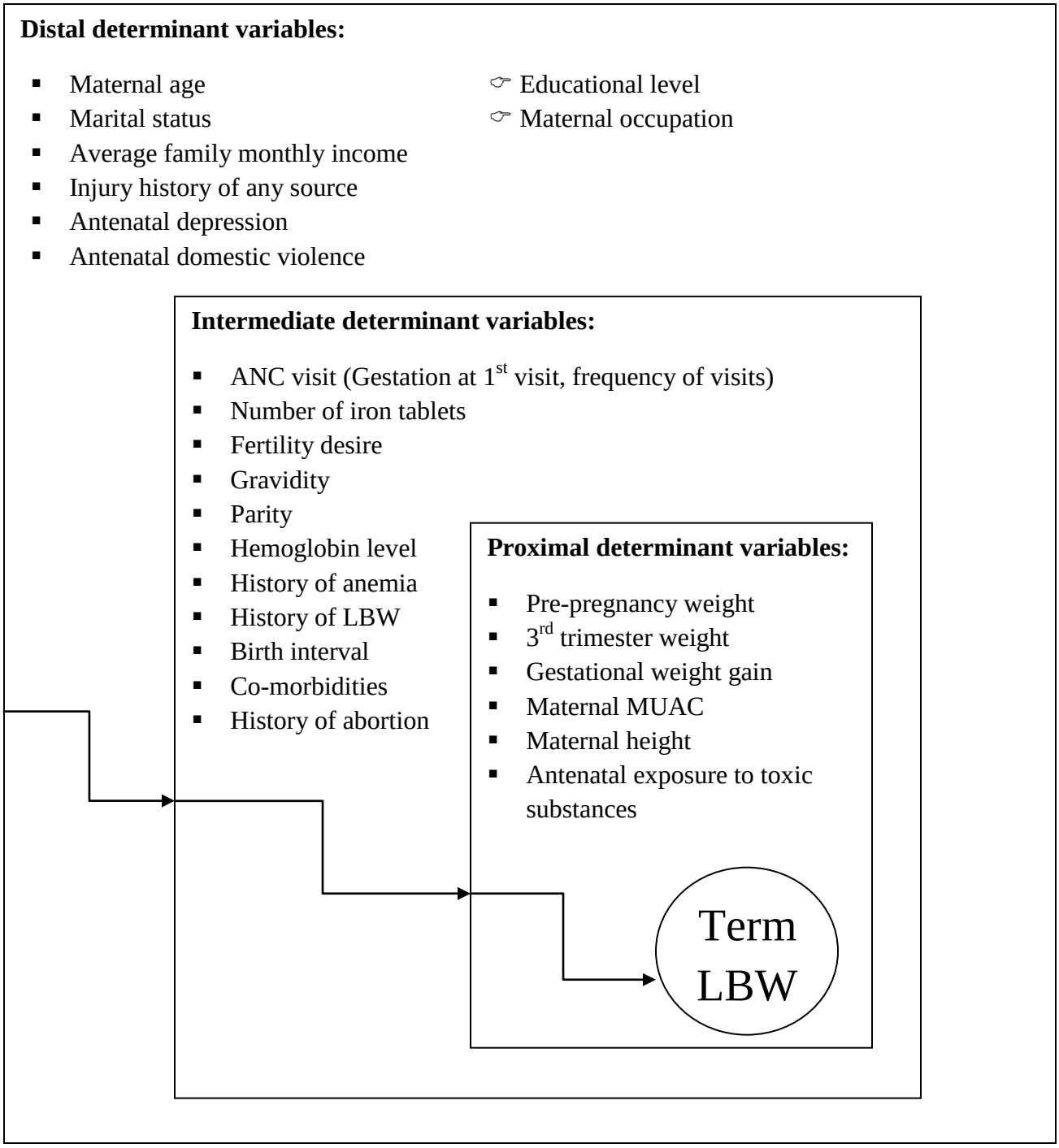


**FIGURE 1:** ***Conceptual Frame-work on maternal risk factors associated with low birth weight at full term. (Developed by the authors after reviewing various literatures.)***

# 3. Objectives and Hypothesis

## 3.1. General objective

- The aim of this study was to determine the maternal risk factors associated with low birth weight among term neonates in selected public health facilities of Addis Ababa city government from April 2013 to July 2013.

## 3.2. Specific objectives

- To identify the socio-demographic factors associated with term low birth weight.
- To determine the current and past obstetric related factors associated with term low birth weight.
- To identify the association of maternal anthropometry with term low birth weight
- To assess the maternal co-morbidities associated with term low birth weight.

## 3.3. Hypothesis of the study

The overall null hypothesis of this research was “there is/are no maternal risk factor/s associated with term low birth weight”; while the overall alternate hypothesis was “there is/are maternal risk factor/s associated with term low birth weight”. These predictions were then tested by gathering and analyzing the required data and the hypotheses was either supported or refuted on the basis of the finding.

Specifically, the null hypotheses of this research were “the socio-demographic factors, birth interval, pre-pregnancy weight, gestational weight gain, height of the mother, antenatal care attendance, pregnancy intention, domestic violence, and depression is/are not a risk factor/s for term low birth weight”; while the alternate hypotheses were “the socio-demographic factors, birth interval, height of the mother, pre-pregnancy weight, gestational weight gain, antenatal care attendance, pregnancy intention, domestic violence, and depression is/are risk factor/s for term low birth weight”.

# 4. Methods and materials

## 4.1. Study area and period

The study was conducted in Addis Ababa city, Ethiopia. Addis Ababa is capital city of Ethiopia. In the town there are ten administrative sub-cities. According to central statistics agency (CSA) 2007 Addis Ababa has a population of 2,738,248 and of these 1,304,518 (47.6%) were Males 1,433,730 (52.4%) are Females. Addis Ababa has an annual population growth rate of 2.1%.[12]

According to the Addis Ababa city health bureau report Addis Ababa has 10 governmental and 34 private maternity and child hospitals and 37 government health centers. However, only 8 governmental and 19 private maternity and child hospitals were functional in giving delivery service. Similarly, majority of the government health centers (31) were giving delivery service.[16] The study was conducted from April 2013 to July 2013.

## 4.2. Study Designs

A facility based unmatched case-control study design was used.

## 4.3. Population

### 4.3.1. Inclusion criteria

- Singleton live births
- Term delivery (37-42 weeks of gestation)

### 4.3.2. Exclusion criteria

- Any form of visible sever birth defect
- Mothers who couldn't provide verbal consent for participation in the study

### 4.3.3. Source population

The source population was all women of any age visiting the health facilities for a delivery service during the study period.

### 4.3.4. Study population.

The cases were mothers who gave birth to a term LBW (<2500grams) neonate at the randomly selected health centers and hospitals of Addis Ababa that fulfilled the inclusion criteria. The controls were consecutive two mothers who gave birth to a term normal birth weight (>=2500grams) neonate at the randomly selected health centers and hospitals during the same period and place as the cases.

## 4.4. Sample size and sampling technique

### 4.4.1. Sample size

Maternal age of <18, maternal height, gestational age and maternal weight during pregnancy were considered in order to calculate the required sample size. To calculate sample size all the above exposure variables were considered and maternal weight during pregnancy was chosen as an independent variable since it gave maximum sample size as compared to other exposure variables.

The sample size was determined using a formula for two population proportions and calculated by OpenEpi version 2.3 statistical software package by considering that the percent of controls exposed (>60 Kg) among the controls of 18% (main exposure variable) which is estimated from other study, 95% CI, 80% power of the study and control to case ratio of 1:2 with 2.06 odds ratio. [3]

$$n_1 = \frac{\left[ Z_{\frac{\alpha}{2}} \sqrt{\left(1+\frac{1}{r}\right)\bar{P}(1-\bar{P})} + Z_{\beta}\sqrt{P_1(1-P_1)+\frac{P_2(1-P_2)}{r}} \right]^2}{(P_1-P_2)^2}$$

Accordingly, after adding 10% for non response rate 147 cases and 294 controls (a total sample size of 441) were planned to be involved in all study areas. However, in the actual data collection only 94.6% of the planned total sample size had participated in the actual study. Consequently, 139 cases and 278 controls were involved.

**TABLE 1: Sample size calculation scenario**

| Factors considered for calculating sample size | Assumption of proportion of mothers with LBW | | Confidence level | Power | OR | No of cases | No of controls |
|---|---|---|---|---|---|---|---|
| | Percent of controls exposed (%) | Percent of cases with exposure (%) | | | | | |
| Maternal age <18 | 11.0 | 25.98 | 95% | 80% | 2.84 | 85 | 169 |
| Gestational age <37 weeks | 23.08 | 53.34 | 95% | 80% | 3.81 | 34 | 67 |
| Maternal Height <150 cm | 10.0 | 22.55 | 95% | 80% | 2.62 | 109 | 217 |
| Maternal Weight at pregnancy <60 Kg | 18.0 | 31.14 | 95% | 80% | 2.06 | 134 | **267** |

### 4.4.2. Sampling procedure:

From the functional (which had been given delivery service) 8 public hospitals and 31 health centers in Addis Ababa; 4 public hospitals and 4 health centers were selected by sample random sampling. From the 2011/12 (2004 E.C) annual report of randomly selected health institutions, 74.5% and 26.5% LBW neonate deliveries were attended in hospitals and health centers respectively. Accordingly, the sample size was proportionally allocated for hospitals and health centers based on the number of LBW neonates delivered in each health institution. Regarding hospitals the same trend was used while for health center the same numbers of samples were allocated for each health center as there was no much difference in the number of LBW neonates among the institutions. All cases and subsequent two eligible controls in the study sites were included in the study. Non respondents for controls were replaced by the subsequent controls delivered to make the case to control ratio even.

**TABLE 2: Sampling procedure of hospitals**

| Institution | Number of LBW in 2011/12 | Proportion of LBW | Sample allocated | Number of cases | Number of controls |
|---|---|---|---|---|---|
| Gandhi Hospital | 885 | 38.5% | 129 | 43 | 86 |
| Black lion Hospital | 424 | 18.5% | 60 | 20 | 40 |
| St. Paul Hospital | 544 | 24% | 78 | 26 | 52 |
| Yekatit 12 Hospital | 430 | 19% | 63 | 21 | 42 |
| **Total** | **2,283** | **100%** | **330** | **110** | **220** |

**Sampling technique**

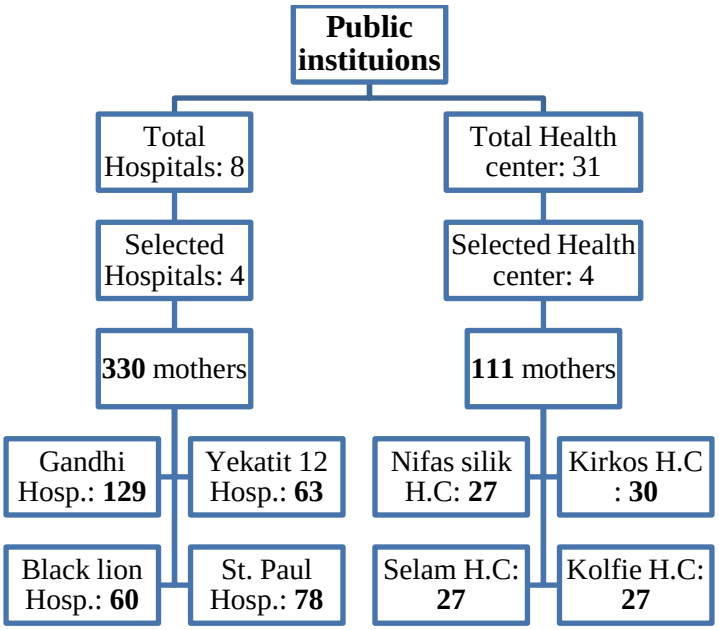


**FIGURE 2: Schematic presentation of Sampling technique and procedure**

## 4.5. Measurement and variables

### 4.5.1. Study Variables

**Dependent variables**

- Full term birth weight

**Independent variables**

- Socio-demographic factors
  - ✓ Socio-economic status (Education, income, & occupation)
  - ✓ Maternal age
  - ✓ Marital status
- Maternal obstetric history
  - ✓ Parity
  - ✓ Birth intervals
  - ✓ History of abortion
  - ✓ Pregnancy intention
- Maternal morbidity during pregnancy
  - ✓ Pregnancy induced hypertension
  - ✓ Hyperemesis gravidarum
  - ✓ Chronic diseases
- Nutritional factors
  - ✓ Maternal MUAC
  - ✓ Maternal height
  - ✓ Pre-pregnancy weight
  - ✓ Gestational weight gain
  - ✓ Anemia
- Toxic exposures during pregnancy
  - ✓ Alcohol consumption
  - ✓ Cigarette smoking
  - ✓ Khat chewing
- ANC visit (gestation at first visit & frequency of visits)
- Antenatal maternal Depression
- Intimate partner violence during pregnancy

### 4.5.2. Data collection instrument

Data were collected through a face to face maternal interview using structured questionnaire, medical records review of the mother & her newborn. Birthweight of each child was measured in grams using pretested and pre-calibrated weight scale within one hour of delivery. Maternal MUAC and height were also measured with tape measure. [10] Gestational age was calculated from ultrasound-reading record, if available, or from last menstrual period (LMP) of the mother;

interviews were made using structured questionnaire, prepared in English and translated in to Amharic after mother's condition was stabilized; which is her vital signs were checked before the interview. Weight gain during pregnancy was calculated by subtracting weight of the mother at 12 gestational weeks or before from weight of the mother at term, considering negligible weight gain up to 12 weeks of gestation. [14] Mothers' depression status was measured with a tested scale called "Center for Epidemiologic Studies-Depression Scale". Information related to domestic violence was also collected from respondents without any degree of depression based on the WHO multi-country study domestic violence against woman.

### 4.5.3. Data collection procedure

The principal investigator had trained data collectors and supervisors for two consecutive days on how to fill the questionnaire. Study guides, role-plays (demonstration) were used on how to measure weight of the baby, MUAC & height of the mother and on how to take informed consent, how to approach participants. Ethical procedures and general information on LBW and objective of the study were also explained.

We had communicated with the head of the labor ward to facilitate data collection and assist in the process of patient identification that fulfills the inclusion criteria by requesting the health care providers (physicians, nurses or any case manager) working in the labor ward.

Eight midwife nurses/data clerks, one data clerk for each health institution, had extracted the required data from the mother through an interview, from medical record charts and actual measurements. The principal investigators and two health officers had supervised the data collection process to check for the daily activities, consistency and completeness of the questionnaire and gave appropriate support during the data collection process.

## 4.6. Data quality management

To assure the quality of data, data collectors and supervisors were trained and regular supervisions and follow-ups were made by supervisors and the principal investigator. In addition, regular check-up for completeness and consistency of the data was made on every other day basis. The questionnaire was translated in to Amharic and back translated in to English by translators who are blind to the original questionnaire.

Weight of the neonates was measured within one hour after delivery naked or in minimal clothing using standard, regularly calibrated scales with a measurement accuracy of at least 10gm. [11]

MUAC and height of the mothers were measured twice by an inelastic tape meter to the nearest millimeter and the average of the two measurements was taken with 0.5cm and 1cm largest acceptable difference between repeated measurements for MUAC and height respectively.[47]

### 4.6.1. Pretest

The questionnaire was pre-tested on 5% of total sample size i.e. on 22 newborns for about five days using Amharic questionnaire in mothers who deliver in health institution other than the randomly selected health facilities which have similar characteristics with the study subjects. Consequently, data collection instruments were refined based on the feedbacks obtained from the pretest.

## 4.7. Data processing and analysis

Data were entered and analyzed using Epi Info version 7.0 statistical software and SPSS version 17.0 statistical packages respectively. Consequently, data were checked for inconsistencies, missing values and outliers then analysis was performed using SPSS. The data were summarized and descriptive statistics were computed for all variables according to their type. Frequency, mean and standard deviation were obtained for continuous variables while the categorical variables were assessed by computing frequencies and percentages. Significance was determined using crude and adjusted odds ratios with 95% confidence intervals.

To assess the association between the different predictor variables with the dependant variable, first bivariate relationships between each independent and outcome variable was analyzed using a binary logistic regression model. Those independent variables found to be significant with p-value less than 0.05 at the bivariate level were further analyzed using three separate regression models. Variables were categorized into three as proximal determinants, intermediate determinants and distal determinants based on their causal effect to the outcome variable. At the end, those variables found to be significant ($p < 0.05$) in the three separate model were further analyzed in the final model.

## 4.8. Operational definition

- **Gestational weight gain**: The weight gain as a result of pregnancy which is calculated by subtracting the weight prior pregnancy or in the first trimester of pregnancy from the last weight measured at the 3rd trimester.
- **Weight prior pregnancy**: It is the weight of the mother in Kg before the recent pregnancy or prior 12 weeks of gestation of the current pregnancy.
- **Visible sever birth defect**: A birth defect which is visible with a naked eye of the examiner and believed to have a significant direct effect on the weight measurement of the newborn (either to increase or decrease) such as, anencephaly, hydrocephalus and amputated limb/s etc…
- **Educational status**: refers to the level of education attended by the respondent during the time of survey.
- **Marital status**: it was recoded as married or in union for respondents who were living together and not married or not in union for respondents who were single, divorced or widowed during the time of survey.
- **The Center for Epidemiologic Studies Depression Scale**

1. If the score is 22 or higher, the patient may be suffering from a major depression.
2. If the score is 15 to 21, the patient may be suffering from mild to moderate depression.
3. If the score is below 15, this test does not indicate that the patient is depressed.

## 4.9. Standard definition

- **Preterm**: It is when an infant is born before 37 completed weeks of gestational age.
- **Term**: It is when an infant is born in between 37-42 completed weeks of gestational age
- **Low birth weight**: It is a weight of a new born baby measured within one hour of delivery and is less 2500 grams.
- **Gestational age**: Gestational age of the fetus is the elapsed time since conception and is measured from the first day of the last menstrual period or using ultra sound.
- **Parity**: The number of full term children previously borne by a woman, excluding miscarriages or abortions in early pregnancy, but including still births.
- **Gravidity**: The number of pregnancies (completed or incomplete) experience by a woman.

## 4.10. Ethical consideration

Ethical clearances were obtained from the research and ethics committee (REC) of school of Public Health, Addis Ababa regional health bureau and federal hospitals. Official and support letters were also produced from federal minster of health and Addis Ababa Regional Health bureau to respective hospitals and health centers.

The research objective was explained to potential participants by the data collectors; and then when the potential participant showed interest, informed consent was obtained. For these purposes information sheet and consent form was attached to each questionnaire and explained for each study participant that participation is voluntary and confidential. The right of the respondent to withdraw from the interview or not to participate was respected. Participants were clearly told about not participating in the study will not have any effect in the different services they would receive. Identification of informants was possible only through specific identification numbers.

Study participants with depression of any degree were excluded from evaluation for intimate partner violence believing that it might exacerbate the situation/depression. Meanwhile, they were sent to a psychiatric clinic for further evaluation and treatment. Furthermore, women who faced IPV were counseled & informed that services (medical & legal) are available if needed.

## 4.11. Dissemination of results

The results of the study will primarily be submitted and presented to the school of public health, as a partial fulfillment of MPH/RH. Similarly, the results will be shared to federal minster of health, regional health bureau, each study sites and other responsible bodies. The result will also be presented in different seminars, meeting, conferences and workshops. Moreover, efforts will be made to publish the findings of the study in scientific journals.

# 5. Results

## 5.1 Socio-demographic characteristics of respondents

A total of 417 mothers (139 cases and 278 controls) who gave birth to a live baby in randomly selected public health institution were included in the study yielding 94.6% response rate. The mean age of all respondents was 26.55 (S.D ±5.08) while it was 25.72 (S.D ±5.84) and 26.97 (S.D ±4.61) for cases and controls respectively. Majority of respondents (233, 55.9%) were in the age group of 25-34 years followed by the age group 24 years and below (152, 36.5%). However, majority (66, 47.5%) of the cases were in the age group of 24 years and below. Regarding educational level of the all mothers, the majority 163 (39.1%) had high school & above, followed by 156 (37.4%) primary school. The remaining 99 (23.7%) were uneducated. From the 99 uneducated respondents 60 (21.6%) of them were from the control group while 39 (28.1%) were from the case. (Table 3)

Majority (282, 67.6%) of the overall respondents were an Orthodox Christianity followers followed by Islam followers (84, 20.1%). Similarly majority of the cases (105, 75.5%) and controls (177, 63.7%) were Orthodox Christian followers followed by Islam followers constituting 12.9% (18) and 23.7% (66) of the cases and controls respectively. Regarding marital status, 369 (88.5%) were married or in union (Cases, 115 (82%) & controls 254 (91.4%)) and 48 (11.5%) were not in union (cases, 24 (17.3%) & controls, 24(8.6%)). (Table 3)

With respect to respondents (mothers) occupation majority of the cases 61 (43.9%) and nearly half of the controls 136 (48.9%) were house wives followed by employees (Private or governmental) constituting 43 (30.9%) cases and 91 (32.7%) controls. From the 369 married/in union women 74 (64.3%) of the cases and 171 (67.3%) of the controls husband were employees (government or private) while 15 (13%) of the cases and 56 (22%) of the controls were merchants. The remaining 14.4% were categorized as others which include daily laborer, farmer, unemployed and student. (Table 3)

The mean average monthly income for the cases and controls was 1710.83 ETB (S.D ±1176.02) and 2488.02 ETB (S.D ±1478.99) respectively. Out of 349 (83.7%) respondents who replied to their average monthly income, 67 (55.8%) of the cases and 78 (34.1%) of the controls had an

average monthly family income of ≤1500 ETB while 21 (17.5%) of the cases and 90 (39.3%) of the controls had an average monthly family income of ≥2501 ETB. (Table 3)

**TABLE 3: Socio-demographic characteristics of the respondents by birth weight, Addis Ababa, Ethiopia, 2013 (n=417)**

| Maternal characteristics | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Age of the mother** | | | | | | |
| <=24 Years | 66 | 47.5 | 86 | 30.9 | 152 | 36.4 |
| 25-34 Years | 58 | 41.7 | 175 | 63.0 | 233 | 55.9 |
| ≥35 Years | 15 | 10.8 | 17 | 6.1 | 32 | 7.7 |
| **Educational status of mother** | | | | | | |
| Uneducated | 38 | 27.3 | 60 | 21.6 | 98 | 23.5 |
| Primary school | 52 | 37.4 | 104 | 37.4 | 156 | 37.4 |
| High school & above | 49 | 35.3 | 114 | 41.0 | 163 | 39.1 |
| **Religion of mother** | | | | | | |
| Orthodox Christian | 105 | 75.5 | 177 | 63.7 | 282 | 67.7 |
| Islam | 18 | 12.9 | 66 | 23.7 | 84 | 20.1 |
| Protestant | 15 | 10.8 | 28 | 10.1 | 43 | 10.3 |
| Catholic | 1 | 0.7 | 7 | 2.5 | 8 | 1.9 |
| **Marital status** | | | | | | |
| Married/In union | 115 | 82.7 | 254 | 91.4 | 369 | 88.5 |
| Currently not in union | 24 | 17.3 | 24 | 8.6 | 48 | 11.5 |
| **Mothers' occupation** | | | | | | |
| House wife | 61 | 43.9 | 136 | 48.9 | 197 | 47.2 |
| Employee (Private & Gov't) | 43 | 30.9 | 91 | 32.8 | 134 | 32.2 |
| Merchant | 6 | 4.3 | 14 | 5.0 | 20 | 4.8 |
| Unemployed + student | 13 | 9.4 | 25 | 9.0 | 38 | 9.1 |
| Others (Daily laborer & farmer) | 16 | 11.5 | 12 | 4.3 | 28 | 6.7 |
| **Husband occupation*** | | | | | | |
| Employee (Private & Gov't) | 74 | 64.3 | 171 | 67.3 | 245 | 66.4 |
| Merchant | 15 | 13 | 56 | 22.0 | 71 | 19.2 |
| Others (Daily laborer & farmer) | 26 | 22.6 | 27 | 10.6 | 53 | 14.4 |
| **Average monthly income**** | | | | | | |
| ≤1500 Birr | 67 | 55.8 | 78 | 34.0 | 145 | 41.6 |
| 1501-2500 Birr | 32 | 26.7 | 61 | 26.7 | 93 | 26.6 |
| ≥2501Birr | 21 | 17.5 | 90 | 39.3 | 111 | 31.8 |

N.B: * Husband occupation n=369; ** Average monthly income n=349

## 5.2. Past obstetric characteristics of the respondents

Past obstetric history is considered to be related with birth outcome. Some of the past obstetric factors were assessed in this study. The mean gravidity of all respondents was 2.09 (S.D ±1.32), 1.94 (S.D ±1.31) for the cases and 2.17 (S.D ±1.32) for the controls. Gravidity (occurrences of all pregnancy) was categorized into three. The index children were their first pregnancy for majority of the cases, 72 (51.8%) and the controls, 110 (39.6%). The mean parity of the cases 1.58 (S.D ±0.96) was slightly lower than the mean parity 1.84 (S.D ±1.14) of the controls. Majority of the cases, 89 (64%) and controls, 142 (51.1%) had gave birth to their first baby (index child). (Table 4)

Regarding the history of delivering to low birth weight neonate, out of the total 164 respondents, 19 (44.2%) of the cases and 13 (10.7%) of the controls had believed that they had delivered a low birth weight neonate previously. History of abortion was also assessed for the respondents who had experienced more than one pregnancy. The mean frequency of abortion in the cases, 1.33 (S.D ±0.64) and controls, 1.35 (S.D ±0.62) was almost similar. Out of the total 235 respondents, almost half (33 (49.3%)) of the cases and 66 (39.3%) of the controls had history of abortion in their life time. Out of the 99 respondents who had experienced abortion, majority of the cases, 25 (75.8%) and the controls, 47 (71.2%) had only one incident of abortion. Birth interval was also assessed in months for respondents who had two or more live births. The mean birth interval duration of the cases, 30.5 (S.D ±21.75) was lower than that of the controls which was 37.18 (S.D ±25.5). From the total 180 candidate respondents, more than half (24, 52%) of the cases and nearly quarter (35, 26.1%) of the controls had an interval of less than 24 months. (Table 4)

**TABLE 4**: **Past obstetrics characteristics of the respondents by birth weight, Addis Ababa, Ethiopia, 2013.**

| Maternal characteristics | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Gravidity (n=417)** | | | | | | |
| Gravida 1 | 72 | 51.8 | 110 | 39.6 | 182 | 43.6 |
| Gravida 2-4 | 61 | 43.9 | 156 | 56.1 | 217 | 52.1 |
| Gravida ≥5 | 6 | 4.3 | 12 | 4.3 | 18 | 4.3 |
| **Parity (n=417)** | | | | | | |
| Para 1 | 89 | 64.0 | 142 | 51.1 | 231 | 55.4 |
| Para 2-4 | 48 | 34.5 | 127 | 45.7 | 175 | 42.0 |
| Para ≥5 | 2 | 1.4 | 9 | 3.2 | 11 | 2.6 |
| **History of low birth weight (n=164)** | | | | | | |
| YES | 19 | 44.2 | 13 | 10.7 | 32 | 19.5 |
| NO | 24 | 55.8 | 108 | 89.3 | 132 | 80.5 |
| **History abortion (n=235)** | | | | | | |
| YES | 33 | 49.3 | 66 | 39.3 | 99 | 42.1 |
| NO | 34 | 50.7 | 102 | 60.7 | 136 | 57.9 |
| **Number of abortion (n=103)** | | | | | | |
| 1 | 25 | 75.8 | 47 | 71.2 | 72 | 72.7 |
| ≥2 | 8 | 24.2 | 19 | 28.8 | 27 | 27.3 |
| **Birth interval (n=180)** | | | | | | |
| <24 months | 24 | 52.2 | 35 | 26.1 | 59 | 32.8 |
| ≥24 months | 22 | 47.8 | 99 | 73.9 | 121 | 67.2 |

## 5.3. Characteristics of the new born (index child)

In this study 417 term newborns were included. The overall sex distribution of the newborns was dominated by males, 231 (55.4%). Among the 139 cases the male to female ratio was 1:1.04 while among the 278 controls the male to female ratio was 1:1.36. The mean birth weight was 2199.5gm (S.D±252.79) for the low birth weighed neonates and 3229.98 (S.D±449.73) for the normal birth weighed neonates. Cognizant to this, the overall birth weight was within the range of 1200gm to 4600gm. The mean gestational age at delivery was 38.52 (S.D ±1.31) for low birth weight neonates and 39.1 (S.D ±1.35) for normal birth weight neonates. Majority of the cases, 110 (79.1%) and the controls, 193 (69.4%) were delivered in less than 40 weeks of gestation (37-39.99 weeks). The proportion of cases (29 (20.9%)) delivered in gestation of 40 weeks and above, was lower compare to the controls (85 (30.6%)). With respect to mode of delivery, data

was retrieved from medical charts. As a result, more than three-fourth (n=109, 78.4%) of the cases and nearly two-third (n=180, 64.7) of the controls had delivered vaginally. (Table 5)

**TABLE 5: Characteristics of the newborns by birth weight, Addis Ababa, Ethiopia, 2013.**

| Newborn characteristics | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Sex of the newborns** | | | | | | |
| Male | 71 | 51.1 | 160 | 57.6 | 231 | 55.4 |
| Female | 68 | 48.9 | 118 | 42.4 | 186 | 44.6 |
| **Gestational age at delivery** | | | | | | |
| 37-39 weeks | 110 | 79.1 | 193 | 69.4 | 303 | 72.7 |
| ≥40 weeks | 29 | 20.9 | 85 | 30.6 | 114 | 27.3 |
| **Mode of delivery** | | | | | | |
| Vaginal delivery | 109 | 78.4 | 180 | 64.7 | 289 | 69.3 |
| Instrumental delivery | 10 | 7.2 | 42 | 15.1 | 52 | 12.5 |
| Caesarian section | 20 | 14.4 | 56 | 20.1 | 76 | 18.2 |

## 5.4. Current pregnancy characteristics of respondents

Current pregnancy history is considered among the various factors which could positively or negatively affect weight at birth. Consequently, some of the factors were assessed in this study. Antenatal care was one of the factors explored. 381 (91.4%) of the respondents had received antenatal care (ANC) from skilled provider. The proportion of respondents who had received antenatal care was higher for controls (95%) compared to cases (84.2%). The mean duration at first ANC visit in months was 4.03 (S.D ±1.54) for cases and 3.9 (S.D ±1.43) for controls. Out of the 381 who had received ANC, majority of the cases, 75 (64.1%) and controls, 153 (58.0%) made their first visit to health facility for ANC service in their 2$^{nd}$ trimester and beyond (>3 gestational months). Beside duration at first visit the issue of frequency of visits also matters. The mean frequency of visits was 4.08 (S.D ±1.41) for cases and 4.53 (S.D ±1.43) for controls. The proportion of respondents who had less than 4 visits was higher for cases (33.3%) compared to the controls (20.1%). Regarding the intention to get pregnant for the index pregnancy, from

the total 417 respondents, one-half (n=70, 50.4%) of the cases and one-fourth (n=73, 26.3%) of the controls revealed that the index pregnancy was conceived unintentionally (either mistimed or unwanted). (Table 6)

**TABLE 6: Characteristics of ANC follow-up among respondents during the index pregnancy by birth weight, Addis Ababa, Ethiopia, 2013.**

| Maternal characteristics | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **ANC attended (n=417)** | | | | | | |
| YES | 117 | 84.2 | 264 | 95.0 | 381 | 91.4 |
| NO | 22 | 15.8 | 14 | 5.0 | 36 | 8.6 |
| **Gestation at first visit (n=381)** | | | | | | |
| ≤3 months | 42 | 35.9 | 111 | 42.0 | 153 | 40.2 |
| >3 months | 75 | 64.1 | 153 | 58.0 | 228 | 59.8 |
| **Frequency of ANC visits (n=381)** | | | | | | |
| <4 visits | 39 | 33.3 | 53 | 20.1 | 92 | 24.1 |
| ≥4 Visits | 78 | 66.7 | 211 | 79.9 | 289 | 75.9 |
| **Pregnancy intended (n=417)** | | | | | | |
| YES | 69 | 49.6 | 205 | 73.7 | 274 | 65.7 |
| NO | 70 | 50.4 | 73 | 26.3 | 143 | 34.3 |

### 5.4.1. Components of ANC

Measuring the components of antenatal care is essential for assessing the quality of ANC services. As a result some components ANC were assessed in the study. Among 379 respondents who had attended ANC, 96 (82.8%) of the cases and 223 (84.8%) of the controls took iron tablets during the index pregnancy. Respondents were categorized into three depending on the number of days they took iron. Accordingly, from the total 381 respondents, majority of the cases, 63 (53.8%) and controls, 169 (64.0%) took iron for more than 30 days. Use of drugs to control intestinal parasites during pregnancy was not common among the two groups; 8 (7.1%) of the cases and 10 (3.8%) of the controls took intestinal parasite drugs during the index pregnancy. Moreover, blood pressure measurement, weight measurement, blood and urine sample were also assessed among the various ANC components. In both cases and controls, more than 97% of the respondents had received each of the specified services. (Table 7)

**TABLE 7: Characteristics of ANC components among respondents by birth weight, Addis Ababa, Ethiopia, 2013**

| Components of ANC service | Birth weight <2500gm. (n=117) | | ≥2500gm. (n=264) | | Total (n=381) | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| **BP measured (n=381)** | | | | | | |
| YES | 117 | 100 | 263 | 99.6 | 380 | 99.7 |
| NO | 0 | 0.0 | 1 | 0.4 | 1 | 0.3 |
| **Weight measured (n=381)** | | | | | | |
| YES | 114 | 97.4 | 260 | 98.5 | 374 | 98.2 |
| NO | 3 | 2.6 | 4 | 1.5 | 7 | 1.8 |
| **Blood sample taken (n=381)** | | | | | | |
| YES | 117 | 100 | 262 | 99.2 | 380 | 99.5 |
| NO | 0 | 0.0 | 2 | 0.8 | 2 | 0.5 |
| **Urine sample taken (n=381)** | | | | | | |
| YES | 117 | 100 | 263 | 99.6 | 380 | 99.7 |
| NO | 0 | 0.0 | 1 | 0.4 | 1 | 0.3 |
| **Iron tablet prescribed/offered (n=381)** | | | | | | |
| YES | 96 | 82.8 | 223 | 84.8 | 319 | 84.2 |
| NO | 21 | 17.2 | 41 | 15.2 | 62 | 15.8 |
| **Total no of days took (n=381)** | | | | | | |
| No iron tabs | 33 | 28.2 | 43 | 16.3 | 76 | 20.0 |
| ≤30 Days | 21 | 17.9 | 52 | 19.7 | 73 | 19.2 |
| >30 Days | 63 | 53.8 | 169 | 64.0 | 232 | 60.8 |
| **Intestinal drugs prescribed/offered (n=373)** | | | | | | |
| YES | 8 | 7.1 | 10 | 3.8 | 18 | 4.8 |
| NO | 105 | 92.9 | 250 | 96.2 | 355 | 95.2 |

As part of the assessment for ANC components, information about if they were informed of signs of pregnancy related complications by care providers were also gathered. Consequently, from the total 374 respondents, eight in every ten (85.2%) cases and nine in every ten (91.9%) controls who received ANC reported that they were informed of signs of pregnancy complications during their ANC visit. Among respondents who were informed of signs of pregnancy complications (n=336) at ANC visits for the index pregnancy, nine in every ten (89.9%) of the cases and 93.3% of the controls were informed of vaginal bleeding. Similarly, almost nine in every ten (88.8%) of the cases and 86.6% of the controls were informed of vaginal gush or fluid. More than half (63.3%) of the cases and two-third (68.9%) of the controls were informed of sever head ache as a sign of pregnancy complication. *One-half (51.0%) of the cases and more than one-half (57.6%) of the controls, and 58.2% of the cases and 67.6% of the

controls were informed of blurred vision and abdominal pain as signs of pregnancy complications respectively. Fever was the least reported component among both groups (cases-40.8% & controls-43.7%) as possible signs of pregnancy complications followed by others (edema, back pain, and any type of problem) which accounts 18.4% of the cases and 11.8% of the controls. (Figure 3)

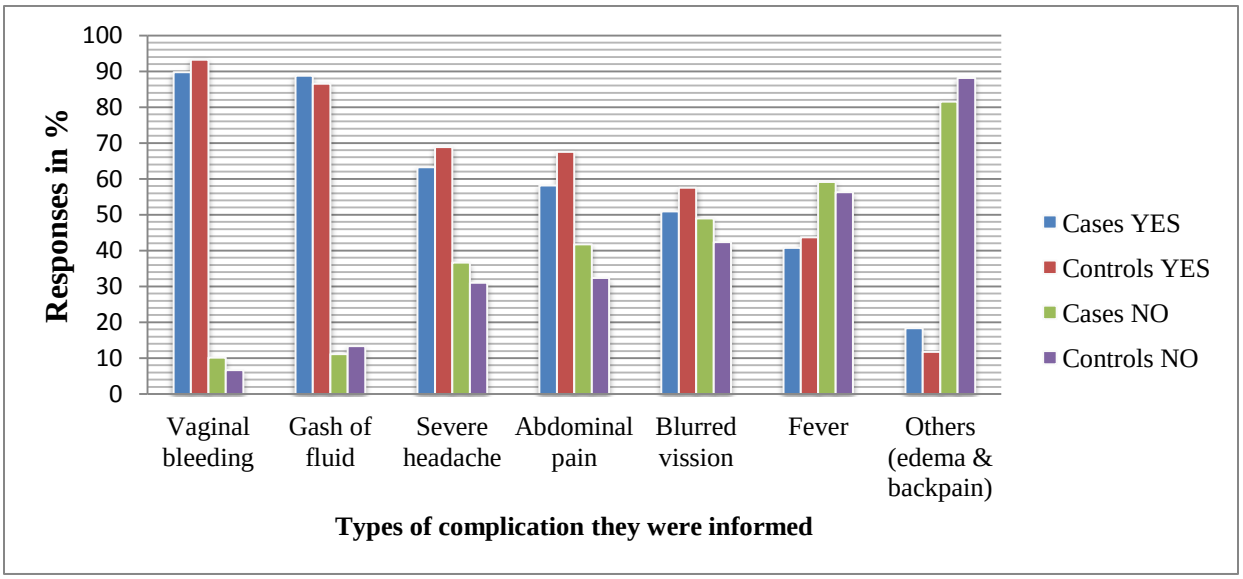


**FIGURE 3: The proportion of responses about information on pregnancy related complications among respondents, Addis Ababa, Ethiopia, 2013**

### 5.4.2. Co-morbidities during pregnancy

Co-morbidities during pregnancy such as, hypertension, diabetes and hyperemesis gravidarum (excessive vomiting) were evaluated. From the total 409 respondents, 11 (8%) of the cases and 15 (5.5%) of the controls were diagnosed with pregnancy induced hypertension (either preeclampsia or eclampsia). Gestational diabetes was found to be rare in both the cases, 1 (0.7%) and controls, 6 (2.2%). From the total 413 respondents, more than half, (53.3%) of the cases and one-third (37.4%) of the controls had history of excessive vomiting during the index pregnancy. Moreover, 27 (19.6%) of the cases and 26 (9.5%) of the controls had faced to an injury of any cause while they were pregnant to the index child. (Table 8)

**TABLE 8: Pregnancy co-morbidity & pregnancy intention among respondents by birth weight, Addis Ababa, Ethiopia, 2013**

| Maternal co-morbidities | Birth weight <2500gm. (n=139) | | Birth weight ≥2500gm. (n=278) | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| **Pregnancy induced hypertension (n=409)** | | | | | | |
| YES | 11 | 8 | 15 | 5.5 | 26 | 6.4 |
| NO | 126 | 92.0 | 257 | 94.5 | 383 | 93.6 |
| **Gestational diabetes (n=409)** | | | | | | |
| YES | 1 | 0.7 | 6 | 2.2 | 7 | 1.7 |
| NO | 135 | 99.3 | 267 | 97.8 | 402 | 98.3 |
| **Excessive vomiting (n=413)** | | | | | | |
| YES | 72 | 53.3 | 104 | 37.4 | 176 | 42.6 |
| NO | 63 | 46.7 | 174 | 62.6 | 237 | 57.4 |
| **Injury of any source (n=413)** | | | | | | |
| YES | 27 | 19.6 | 26 | 9.5 | 53 | 12.8 |
| NO | 111 | 80.4 | 249 | 90.5 | 360 | 87.2 |

## 5.5. Antenatal exposure to toxic substances

Consumption of toxic substances during pregnancy might adversely affect intrauterine growth. Consequently, this study had tried to explore some of the toxic substances which can adversely affect weight at birth. Alcohol consumption, cigarette smoking and Khat chewing was among the substances evaluated. Unfortunately, other than for history of alcohol consumption only few responses were able to retrieve regarding exposure; which was difficult to analyze.

Regarding exposure to alcohol containing drinks, from the total 417 respondents, higher proportion (n=47, 33%) of cases compared to controls (n=61, 21%) had consumed alcohol containing drinks during the index pregnancy. The amount of consumption was assessed by asking how frequent they averagely drank throughout the pregnancy. From those 108 respondents who had consumed alcohol drinks 14 (29.8%) of the cases and 26 (42.6%) of the controls reported they had consumed in average once a month throughout the pregnancy. Meanwhile, 33 (70.2%) of the cases and 35 (57.4%) of the controls reported they had consumed in average once or more a week throughout the pregnancy. (Table 9)

**TABLE 9: Exposure status of respondents to toxic substances during the index pregnancy by birth weight, Addis Ababa, Ethiopia, 2013.**

| Maternal exposure status to toxic substance | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Alcohol consumed** | | | | | | |
| Never | 92 | 66.2 | 217 | 78.0 | 309 | 74.1 |
| Once a week or more | 33 | 23.7 | 35 | 12.6 | 68 | 16.3 |
| Once a month | 14 | 10.1 | 26 | 9.4 | 40 | 9.6 |
| **Khat chewed** | | | | | | |
| Never | 126 | 90.6 | 270 | 97.1 | 396 | 95.0 |
| Once a week or more | 11 | 7.9 | 7 | 2.5 | 18 | 4.3 |
| Once a month | 2 | 1.4 | 1 | 0.4 | 3 | 0.7 |
| **Smoked cigarette** | | | | | | |
| Never | 133 | 95.7 | 276 | 99.3 | 09 | 98.1 |
| Once a week or more | 6 | 4.3 | 2 | 0.7 | 8 | 1.9 |
| **Partner smoked cigarette (n=369)** | | | | | | |
| Never | 102 | 88.7 | 240 | 94.5 | 342 | 92.7 |
| Once a week or more | 13 | 11.3 | 14 | 5.5 | 27 | 7.3 |
| **Anyone smoked cigarette** | | | | | | |
| Never | 123 | 88.5 | 270 | 97.1 | 393 | 94.2 |
| Once a week or more | 16 | 11.5 | 8 | 2.9 | 24 | 5.8 |

### 5.6. Maternal nutritional status proxy

Maternal nutritional status both before and during pregnancy is a recognized determinant of birth outcomes. Cognizant to this, the study had assessed some of the nutritional status indicators. Data on anthropometric measurements (MUAC & Height), weight before/at first trimester and at third trimester, and gestational weight gain was computed. Data on status of anemia was also retrieved by asking if they were told that they had anemia and from record of hemoglobin level.

The median pre-pregnancy/first trimester weight was 52Kg for the cases and 55Kg for the controls. The pre-pregnancy weight was categorized into two based on the overall median which was 54Kg. Accordingly, from the total 351 respondents, more than one-half (n=66, 58.6%) of the

cases and nearly one-half (114, 47.5%) of the controls had pre-pregnancy/first trimester weight less than or equal to the overall median (54Kg). The median weight during the third trimester (last measurement) was 58Kg for the cases and 63.8Kg for the controls. The third trimester weight was also categorized into two based on the overall median which was 62Kg. From the total 369 respondents two-third (n=74, 66.1%) of the cases and below one-half (115, 44.7%) of the controls had third trimester weight below or equal to the overall median (62Kg). Gestational weight gain of 351 respondents was also computed by subtracting the third trimester weight from the pre-pregnancy/first trimester weight. The median gestational weight gain of the cases (5.50Kg) was lower nearly by one-third compared to the median gestational weight gain of the controls (9.0Kg). Similarly, gestational weight gain was categorized into two depending on the overall median which was 8.0Kg. Accordingly, the proportion of cases (n=94, 84.7%) below or equal to the overall gestational weight gain median was much higher compared to the controls (n=110, 45.8%). (Table 10)

As part of anthropometric measurement MUAC and height of the respondents was also measured. Based on this finding, the mean height was 158.28cm (S.D ±6.49) for the cases and 161.99cm (S.D ±6.40) for the controls. After reviewing literatures, respondents were categorized into two using 155cm as cut of point. As a result, one out of three cases (n=51, 36.7%) and one out of six controls (n=48, 17.3%) height was below or equal to 155cm. The mean MUAC of the cases and controls was 21.91cm (S.D ±2.81) and 23.56cm (S.D ±2.59) respectively. Respondents were categorized into two categories based on the overall mean which was 23cm. Higher proportion of the cases (n=71, 51.1%) compared to the controls (n=80, 28.8) had MUAC size below the mean (23cm). (Table 10)

With respect to status of anemia, 32 (23.4%) of the cases and 35 (12.8%) of the controls had reported that they were told that they had anemia. Hemoglobin level which was measured prior delivery was registered from medical records. The mean hemoglobin level of the case (11.91mg/l) was slightly lower compared to the mean level of the controls (12.25). The hemoglobin level was categorized into two using the overall mean as the cut of point (12.14mg/l). From the total 413 records majority of the cases, 81 (60.0%) and less than one-half of the controls, 122 (43.5%) had hemoglobin level below the overall mean. (Table 10)

**TABLE 10: Nutritional status of respondents by birth weight, Addis Ababa, Ethiopia, 2013.**

| Maternal nutritional status | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Pre-pregnancy weight (n=351)** | | | | | | |
| ≤54Kg | 65 | 58.6 | 114 | 47.5 | 179 | 51.0 |
| >54Kg | 46 | 41.4 | 126 | 52.5 | 172 | 49.0 |
| **Third trimester weight (n=369)** | | | | | | |
| ≤62Kg | 74 | 66.1 | 115 | 44.7 | 189 | 51.2 |
| >62Kg | 38 | 33.9 | 142 | 55.3 | 180 | 48.8 |
| **Gestational weight gain (n=351)** | | | | | | |
| ≤8.0Kg | 94 | 84.7 | 110 | 45.8 | 204 | 58.1 |
| >8.0Kg | 17 | 15.3 | 130 | 54.2 | 147 | 41.9 |
| **Mothers' height (n=417)** | | | | | | |
| ≤155cm | 51 | 36.7 | 48 | 17.3 | 99 | 23.7 |
| >155cm | 88 | 63.3 | 230 | 82.7 | 318 | 76.3 |
| **Mothers' MUAC (n=417)** | | | | | | |
| <23cm | 71 | 51.1 | 80 | 28.8 | 151 | 36.2 |
| ≥23cm | 68 | 48.9 | 198 | 71.2 | 266 | 63.8 |
| **Hemoglobin level (N=413)** | | | | | | |
| <12.14mg/l | 81 | 60.0 | 122 | 43.9 | 203 | 49.2 |
| ≥12.14mg/l | 54 | 40.0 | 156 | 56.1 | 210 | 50.8 |
| **History of anemia (N=411)** | | | | | | |
| YES | 32 | 23.4 | 35 | 12.8 | 67 | 16.3 |
| NO | 105 | 76.6 | 239 | 87.2 | 344 | 83.7 |

## 5.7. Antenatal depression status and domestic violence

Antenatal depression of the respondents was assessed and classified with a pretested scale prepared by Center for Epidemiologic Studies (CES). Based on the numbers they score, respondents were leveled as severely to moderately depressed and not depressed. From the total 417 respondents, majority of both the cases, 93 (66.9%) and the controls, 255 (91.7%) had no antenatal depression. The proportion of cases (n=46, 33.1%) with antenatal depression of any grade was four times higher compared to the controls (23, 8.3%). (Table 11)

Regarding domestic violence during the index pregnancy data were collected for the respondents without any degree of depression based on the WHO multi-country study on women's health and

domestic violence against women. Accordingly, type of domestic violence was classified into three; physical, emotional and sexual violence. The proportion of cases (n=30, 33.7%) who ever faced physical violation during the index pregnancy was higher compared to the controls (n=15, 6.1%). Similarly, the proportion of emotional violence (cases: 39.3% vs. controls: 5.7%) and sexual violence (cases: 20.2% vs. controls: 1.2%) was higher among cases compared to the controls. (Table 11)

**TABLE 11: Antenatal depression and domestic violence status of respondents by birth weight, Addis Ababa, Ethiopia, 2013.**

| Maternal depression status and domestic violence | Birth weight | | | | Total (n=417) | |
|---|---|---|---|---|---|---|
| | <2500gm. (n=139) | | ≥2500gm. (n=278) | | | |
| | No | % | No | % | No | % |
| **Depression status** (N=417) | | | | | | |
| No depression | 93 | 66.9 | 255 | 91.7 | 348 | 83.5 |
| Moderate to severe depression | 46 | 33.1 | 23 | 8.3 | 69 | 16.5 |
| **Domestic violence of any type** | | | | | | |
| Yes | 37 | 41.6 | 24 | 9.8 | 61 | 18.3 |
| No | 52 | 58.4 | 220 | 90.2 | 272 | 81.7 |
| **Physical violence** | | | | | | |
| YES | 30 | 33.7 | 15 | 6.1 | 45 | 13.5 |
| NO | 59 | 66.3 | 229 | 93.9 | 288 | 86.5 |
| **Emotional violence** | | | | | | |
| YES | 35 | 39.3 | 14 | 5.7 | 49 | 14.7 |
| NO | 54 | 60.7 | 230 | 94.3 | 284 | 85.3 |
| **Sexual violence** | | | | | | |
| YES | 18 | 20.2 | 3 | 1.2 | 21 | 6.3 |
| NO | 70 | 79.8 | 241 | 98.8 | 312 | 93.7 |

## 5.8. Logistic regression analysis (bivariate and multivariate) of maternal determinant factors for term low birth weight

### 5.8.1. Distal determinant variables

As part of the logistic regression analysis variables such as age, educational level, marital status, average monthly family income, injury of any source, depression status and domestic violence were categorized and analyzed as distal determinant variables for LBW at term. Consequently, other than level of education the remaining variable had shown significant association with term low birth weight in the bivariate analysis. However, in the 1st model multivariate logistic regression only age, average monthly family income, injury of any source, depression status and intimate partner violence had shown significant association.

According to the multiple logistic regression, the odds of delivering to a term low birth weight neonate were higher by more than two folds (AOR=2.21, 95%CI: 1.32-3.71) among the age group of ≤24 years compared to the age range of 25-34 years. Respondents with the lower average monthly family income (≤1500 Birr) were three times (AOR=3.36, 95%CI: 1.71-6.58) more likely to deliver a term low birth weight neonates compared with the respondents of higher average monthly income (≥2501 Birr). Antenatal depression status was assessed using a tested scale and analyzed under two categories named as depression of any grade (moderate to severe) and no depression. As a result, the odds of delivering to a LBW neonate was more than four times higher (AOR=4.11, 95%CI: 2.08-8.15) among respondents with depression of any grade compared with respondents who were free of depression during the index pregnancy.

Domestic violence among the respondents who were free of depression was assessed. Respondents were asked if they were ever physically, emotionally and sexually violated throughout the index pregnancy. However, to make it more meaningful the variables were recoded into domestic violence of any type. Accordingly, it was statistically significant in all models. The odds of delivering to a LBW neonate was nearly six times higher (AOR=5.95, 95%CI: 2.94-12.04) among respondents who reported they were violated (physically, emotionally or/& sexually) during the index pregnancy compared to their counterparts. (Table 12)

**TABLE 12: Logistic regression analysis of distal determinant variables by birth weight, Addis Ababa, Ethiopia, 2013.**

| Variables | Birth Weight | | | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|---|
| | <2500gm | | ≥2500gm | | | |
| | No | % | No | % | | |
| **Age** | | | | | | |
| ≤24 Years | 66 | 47.5 | 86 | 30.9 | **2.32 (1.50-3.59)** | **2.21 (1.32-3.71)** |
| ≥35 Years | 15 | 10.8 | 17 | 6.1 | **2.66 (1.25-5.67)** | 1.68 (0.63-4.50) |
| 25-34 Years | 58 | 41.7 | 175 | 63.0 | 1 | 1 |
| **Educational level** | | | | | | |
| Uneducated | 38 | 27.3 | 60 | 21.6 | 1.47 (0.87-2.50) | |
| Primary level | 52 | 37.4 | 104 | 37.4 | 1.16 (0.73-1.87) | |
| Secondary & above | 49 | 35.3 | 114 | 41.0 | 1 | |
| **Marital status** | | | | | | |
| Married/In union | 115 | 82.7 | 254 | 91.4 | 1 | 1 |
| Not married/in union | 24 | 17.3 | 24 | 8.6 | **2.21 (1.20-4.05)** | 1.12 (0.50-2.50) |
| **Mothers occupation** | | | | | | |
| House wife | 61 | 43.9 | 136 | 48.9 | 1 | |
| Employee (Private & Gov't) | 43 | 30.9 | 91 | 32.8 | 1.05 (0.66-1.69) | |
| Merchant | 6 | 4.3 | 14 | 5.0 | 0.96 (0.35-2.61) | |
| Unemployed + student | 13 | 9.4 | 25 | 9.0 | 1.16 (0.56-2.42) | |
| Others (Daily laborer & farmer) | 16 | 11.5 | 12 | 4.3 | **2.97 (1.33-6.66)** | |
| **Avg. monthly income** | | | | | | |
| ≤1500 Birr | 67 | 55.8 | 78 | 34.0 | **3.68 (2.07-6.55)** | **3.36 (1.71-6.58)** |
| 1501-2500 Birr | 32 | 26.7 | 61 | 26.7 | **3.25 (1.19-4.26)** | **3.32 (1.16-4.64)** |
| ≥2501Birr | 21 | 17.5 | 90 | 39.3 | 1 | 1 |
| **History of injury** | | | | | | |
| Yes | 27 | 19.6 | 26 | 9.5 | **2.33 (1.30-4.17)** | **2.46 (1.23-4.92)** |
| No | 111 | 80.4 | 249 | 90.5 | 1 | 1 |
| **Depression status** | | | | | | |
| Depression of any degree | 93 | 66.9 | 255 | 91.7 | **5.48 (3.15-9.54)** | **4.11 (2.08-8.15)** |
| No depression | 46 | 33.1 | 23 | 8.3 | 1 | 1 |
| **Domestic violence of any type** | | | | | | |
| Yes | 37 | 41.6 | 24 | 9.8 | **6.52 (3.59-11.84)** | **5.95 (2.94-12.04)** |
| No | 52 | 58.4 | 220 | 90.2 | 1 | |

**Key: COR**= Crude odds ratio **AOR**= Adjusted odds ratio **CI**= Confidence interval

### 5.8.2. Intermediate determinant variables

Past and current obstetrics history and pregnancy related co-morbidities were categorized and analyzed as intermediate determinant variables for term LBW. Gravidity, parity, history of giving birth to LBW neonate, birth interval, ANC attendance, gestation at first ANC visit, frequency of ANC visits, pregnancy intention, excessive vomiting and injury of any source were among the variables which significant association with the outcome variable in the bivariate analysis. Consequently, those listed variables were reentered in the second model of multivariate logistic regression and variables such as, history of giving birth to LBW neonate, birth interval, frequency of ANC visits, pregnancy intention, excessive vomiting and injury of any source had also shown significant association in the multivariate logistic analysis.

The odds of delivering to LBW neonate was eight folds higher (AOR=8.05, 95%CI: 2.85-22.77) for mothers who had reported that they gave birth a LBW neonate in their previous experience. Meanwhile, mothers with birth interval of less than 24 months were nearly three times (AOR=2.91, 95%CI: 1.20-7.05) more likely to deliver a term low birth weight neonates than their counterparts. The odds of delivering to LBW neonate among those who had attended ANC and had less than four visits was two folds higher (AOR=2.01, 95%CI: 1.14-3.56) than their counterparts. Regarding to fertility desire, respondents with mistimed or unwanted pregnancy were nearly two times (OR=1.89, 95%CI: 1.13-3.16) more likely to deliver a LBW neonate. (Table 13)

On the other hand, the odds of delivering to a LBW neonate was nearly two folds (AOR=1.82, 95%CI: 1.09-3.01) higher among the respondents who suffered in excessive vomiting during the index pregnancy. Similarly, those who reported that they were told they have anemia during the pregnancy were two times higher (OR=2.13, 95%CI: 1.11-4.09) to deliver a LBW neonate compared to their counterparts. The likelihood of delivering to a LBW neonate was nearly two and half times higher (OR=2.45, 95%CI: 1.31-4.58) among respondents who never consumed iron tablets compared to the respondents who took iron tablets for at least 60 days. (Table 13)

**TABLE 13: Logistic regression analysis of intermediate determinant variables by birth weight, Addis Ababa, Ethiopia, 2013.**

| Variables | Birth Weight <2500gm No | % | ≥2500gm No | % | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|---|
| **Gravidity** | | | | | | |
| Gravida 1 | 72 | 51.8 | 110 | 39.6 | **1.674 (1.10-2.55)** | 1.01 (0.46-2.21) |
| Gravida 5 & above | 6 | 4.3 | 12 | 4.3 | 1.28 (0.46-3.56) | 1.81 (0.32-10.44) |
| Gravida 2-4 | 61 | 43.9 | 156 | 56.1 | 1 | 1 |
| **Parity** | | | | | | |
| Para 1 | 89 | 64.0 | 142 | 51.1 | **1.66 (1.08-2.54)** | 0.15 (0.01-1.87) |
| Para 5 & above | 2 | 1.4 | 9 | 3.2 | 0.58 (0.12-2.82) | 0.23 (0.02-3.13) |
| Para 2-4 | 48 | 34.5 | 127 | 45.7 | 1 | 1 |
| **Hx of LBW** | | | | | | |
| Yes | 19 | 44.2 | 13 | 10.7 | **6.58 (2.86-15.12)** | **8.05 (2.85-22.77)** |
| No | 24 | 55.8 | 108 | 89.3 | | 1 |
| **Hx of abortion** | | | | | | |
| Yes | 33 | 49.3 | 66 | 39.3 | 1.50 (0.85-2.65) | |
| No | 34 | 50.7 | 102 | 60.7 | 1 | |
| **Birth interval** | | | | | | |
| <24 months | 24 | 52.2 | 35 | 26.1 | **3.09 (1.54-6.18)** | **2.91 (1.20-7.05)** |
| ≥24 months | 22 | 47.8 | 99 | 73.9 | 1 | 1 |
| **Hx of ANC follow-up** | | | | | | |
| Yes | 117 | 84.2 | 264 | 95.0 | 1 | |
| No | 22 | 15.8 | 14 | 5.0 | **3.55 (1.75-7.17)*** | |
| **Gestation at 1st ANC** | | | | | | |
| ≤3 months | 42 | 35.9 | 111 | 42.0 | 1 | |
| >3months | 75 | 64.1 | 153 | 58.0 | 1.30 (0.83-2.03) | |
| **ANC visit frequency** | | | | | | |
| <4 Visits | 39 | 33.3 | 53 | 20.1 | **1.991 (1.22-3.24)** | **2.01 (1.14-3.56)** |
| ≥4 visits | 78 | 66.7 | 211 | 79.9 | 1 | 1 |
| **Pregnancy intention** | | | | | | |
| Yes | 69 | 49.6 | 205 | 73.7 | 1 | 1 |
| No | 70 | 50.4 | 73 | 26.3 | **1.67 (1.03-2.71)** | **1.89 (1.13-3.16)** |
| **History of excessive vomiting** | | | | | | |
| Yes | 72 | 53.3 | 104 | 37.4 | **1.912 (1.261-2.900)** | **1.82 (1.09-3.01)** |
| No | 63 | 46.7 | 174 | 62.6 | 1 | 1 |
| **History of PIH** | | | | | | |
| Yes | 11 | 8 | 15 | 5.5 | 1.503 (0.881-2.563) | |
| No | 126 | 92.0 | 257 | 94.5 | 1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **History of Gestational DM** | | | | | | |
| Yes | 1 | 0.7 | 6 | 2.2 | 0.330 (0.039-2.766) | |
| No | 135 | 99.3 | 267 | 97.8 | 1 | |
| **History of Anemia** | | | | | | |
| Yes | 32 | 23.4 | 35 | 12.8 | **2.081(1.233-3.541)** | **2.13 (1.11-4.09)** |
| No | 105 | 76.6 | 239 | 87.2 | 1 | 1 |
| **No of days Fe took** | | | | | | |
| 0 days | 33 | 28.2 | 43 | 16.3 | **2.06(1.20-3.53)** | **2.45 (1.31-4.58)** |
| 1-30 days | 21 | 17.9 | 52 | 19.7 | 1.08 (0.60-1.94) | 0.93 (0.47-1.81) |
| ≥31 days | 63 | 53.8 | 169 | 64.0 | 1 | 1 |
| **Hemoglobin level** | | | | | | |
| <12.14gm/l | 81 | 60.0 | 122 | 43.9 | **1.92 (1.26-2.91)** | 1.43 (0.85-2.42) |
| ≥12.14 gm/l | 54 | 40.0 | 156 | 56.1 | 1 | 1 |

*=Since a constant term was specified, the variable was removed from the multivariate analysis.

### 5.8.3. Proximate determinant variables

Weight during pre-pregnancy/1st trimester, gestational weight gain, MUAC, height, alcohol consumption, Khat chewing, cigarette smoking, exposure to cigarette smokes from partner or anyone residing with the respondent was the variables categorized and analyzed as proximate determinants. However, very few respond to cigarette smoking and Khat chewing that they were exposed. As a result, both variables were excluded from the analysis.

All except pre-pregnancy weight were significantly associated with outcome variable in the bivariate analysis. However, only gestational weight gain, maternal MUAC, maternal height and exposure to cigarette smokes from anyone residing with respondent were significant in the third multivariate regression model.

The odds of delivering to a LBW neonate was six times higher (AOR=6.05, 95%CI: 3.30-11.09) among respondents with gestational weight gain of ≤8.0Kg than their counterparts. Respondents with <23cm MUAC measurement were nearly two times (AOR=1.93, 95%CI: 1.14-3.27) more likely to deliver a LBW neonate than their counterparts. Similarly, the odds of delivering to a LBW neonates was nearly two and half (AOR=2.44, 95%CI: 1.36-4.39) higher for the respondents with height of ≤155cm compared to their counterparts. On the other hand, the odds of delivering to a LBW neonate was more than three and half times (AOR=3.70, 95%CI: 1.19-11.43) higher among respondents who were exposed to cigarette smokes from anyone else residing in the same house. (Table 14)

**TABLE 14: Logistic regression analysis of proximate determinant variables by birth weight, Addis Ababa, Ethiopia, 2013.**

| Variables | Birth Weight | | | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|---|
| | <2500gm | | ≥2500gm | | | |
| | No | % | No | % | | |
| **Gestational age** | | | | | | |
| 37-40 weeks | 110 | 79.1 | 193 | 69.4 | **1.67 (1.03-2.71)** | 1.39 (0.77-2.51) |
| ≥40 weeks | 29 | 20.9 | 85 | 30.6 | 1 | 1 |
| **1st trimester wt** | | | | | | |
| ≤54Kg | 65 | 58.6 | 114 | 47.5 | 0.64 (0.406-1.01) | 1.47 (0.87-2.48) |
| >54Kg | 46 | 41.4 | 126 | 52.5 | 1 | 1 |
| **Gestational wt gain** | | | | | | |
| ≤8Kg | 94 | 84.7 | 110 | 45.8 | **6.54 (3.68-11.62)** | **6.05 (3.30-11.09)** |
| >8Kg | 17 | 15.3 | 130 | 54.2 | 1 | 1 |
| **Mothers MUAC** | | | | | | |
| <23cm | 71 | 51.1 | 80 | 28.8 | **2.58 (2.58-3.94)** | **1.93 (1.14-3.27)** |
| ≥23cm | 68 | 48.9 | 198 | 71.2 | 1 | 1 |
| **Mothers height** | | | | | | |
| ≤155cm | 51 | 36.7 | 48 | 17.3 | **2.78 (1.75-4.42)** | **2.44 (1.36-4.39)** |
| >155cm | 88 | 63.3 | 230 | 82.7 | 1 | 1 |
| **History alcohol consumption** | | | | | | |
| Never | 92 | 66.2 | 217 | 78.0 | 1 | 1 |
| Once a month | 33 | 23.7 | 35 | 12.6 | 1.270 (0.635-2.542) | 1.25 (0.51-3.06) |
| Once or more a week | 14 | 10.1 | 26 | 9.4 | **2.224 (1.303-3.795)** | 1.43 (0.70-3.92) |
| **History of partner smoking** | | | | | | |
| Never | 102 | 88.7 | 240 | 94.5 | 1 | 1 |
| Once or more a week | 13 | 11.3 | 14 | 5.5 | **6.226 (1.240-31.258)** | 1.18 (0.44-3.16) |
| **History of Anyone smoking** | | | | | | |
| Never | 123 | 88.5 | 270 | 97.1 | 1 | 1 |
| Once or more a week | 16 | 11.5 | 8 | 2.9 | **4.390 (1.830-10.532)** | **3.70 (1.19-11.43)** |

### 5.8.4. The final model

After variables were analyzed based on the above listed three models, variables which yield P-value <0.05 were reanalyzed in the final model. In the final model, only frequency of ANC visits, number of iron tablet, gestational weight gain, MUAC, height, depression status and domestic violence of any type were found to be statistically significant with term LBW.

The odds of delivering a LBW neonate among those who had attended ANC and had less than four visits was more than two and half folds higher (AOR=2.76, 95%CI: 1.32-5.77) than their counterparts. Similarly, respondents who didn't took iron tablets during the index pregnancy were nearly three times (AOR=2.89, 95%CI: 1.32-6.34) more likely to deliver a low birth neonate compared to the respondents who took for 60 days or more.

The odds of delivering to a LBW neonate was seven times higher (AOR=7.01, 95%CI: 3.33-14.78) among respondents with gestational weight gain of ≤8.0Kg than their counterparts. Respondents with <23cm MUAC measurement were nearly two times (AOR=1.94, 95%CI: 1.01-3.73) more likely to deliver a LBW neonate than their counterparts. Similarly, the odds of delivering to a LBW neonates was more than two and half (AOR=2.74, 95%CI: 1.32-5.66) higher for the respondents with height of ≤155cm compared to their counterparts. Meanwhile, the odds of delivering to a LBW neonate was nearly three and half times higher (AOR=3.45, 95%CI: 1.29-9.23) among respondents with depression of any grade compared with respondents who were free of depression during the index pregnancy.

Domestic violence of any type was also statistically significant with the outcome variable. The odds of delivering to a LBW neonate was nearly six and half times higher (AOR=6.45, 95%CI: 2.41-17.28) among respondents who reported they were violated physically, emotionally or/& sexually by their partner during the index pregnancy compared to their counterparts. (Table 15)

**TABLE 15: Final model of determinant variables by birth weight, Addis Ababa, Ethiopia, 2013.**

| Variables | Birth Weight | | | | COR (95% CI) | AOR (95% CI) |
|---|---|---|---|---|---|---|
| | <2500gm | | ≥2500gm | | | |
| | No | % | No | % | | |
| **Age** | | | | | | |
| ≤24 Years | 66 | 47.5 | 86 | 30.9 | **2.32 (1.50-3.59)** | 0.72 (0.36-1.43) |
| ≥35 Years | 15 | 10.8 | 17 | 6.1 | **2.66 (1.25-5.67)** | 2.20 (0.53-9.10) |
| 25-34 Years | 58 | 41.7 | 175 | 63.0 | 1 | 1 |
| **Avg. monthly income** | | | | | | |
| ≤1500 Birr | 67 | 55.8 | 78 | 34.0 | **3.68 (2.07-6.55)** | 2.00 (0.93-4.3) |
| 1501-2500 Birr | 32 | 26.7 | 61 | 26.7 | **3.25 (1.19-4.26)** | 2.05 (0.90-4.68) |
| ≥2501Birr | 21 | 17.5 | 90 | 39.3 | 1 | 1 |
| **Depression status** | | | | | | |
| Depression of any degree | 93 | 66.9 | 255 | 91.7 | **5.48 (3.15-9.54)** | **3.45 (1.29-9.23)** |
| No depression | 46 | 33.1 | 23 | 8.3 | 1 | 1 |
| **Domestic violence** | | | | | | |
| Yes | 37 | 41.6 | 24 | 9.8 | **6.52 (3.59-11.84)** | 6.45 (2.41-17.28) |
| No | 52 | 58.4 | 220 | 90.2 | 1 | |
| **ANC visit frequency** | | | | | | |
| <4 Visits | 39 | 33.3 | 53 | 20.1 | **1.991 (1.22-3.24)** | **2.76 (1.32-5.77)** |
| ≥4 visits | 78 | 66.7 | 211 | 79.9 | 1 | 1 |
| **Fertility desire** | | | | | | |
| Yes | 69 | 49.6 | 205 | 73.7 | 1 | 1 |
| No | 70 | 50.4 | 73 | 26.3 | **1.67 (1.03-2.71)** | 1.49 (0.78-2.85) |
| **History of excessive vomiting** | | | | | | |
| Yes | 72 | 53.3 | 104 | 37.4 | **1.912 (1.261-2.900)** | 1.70 (0.91-3.17) |
| No | 63 | 46.7 | 174 | 62.6 | 1 | 1 |
| **History of Anemia** | | | | | | |
| Yes | 32 | 23.4 | 35 | 12.8 | **2.081(1.233-3.541)** | 1.84 (0.82-4.11) |
| No | 105 | 76.6 | 239 | 87.2 | 1 | 1 |
| **No of days Fe took** | | | | | | |
| 0 days | 33 | 28.2 | 43 | 16.3 | **2.06(1.20-3.53)** | **2.89 (1.32-6.34)** |
| 1-30 days | 21 | 17.9 | 52 | 19.7 | 1.08 (0.60-1.94) | 0.91 (0.40-2.08) |
| ≥31 days | 63 | 53.8 | 169 | 64.0 | 1 | 1 |
| **Gestational wt gain** | | | | | | |
| ≤8Kg | 94 | 84.7 | 110 | 45.8 | **6.54 (3.68-11.62)** | **7.01 (3.33-14.78)** |
| >8Kg | 17 | 15.3 | 130 | 54.2 | 1 | 1 |
| **Mothers MUAC** | | | | | | |
| <23cm | 71 | 51.1 | 80 | 28.8 | **2.58 (2.58-3.94)** | **1.94 (1.01-3.73)** |
| ≥23cm | 68 | 48.9 | 198 | 71.2 | 1 | 1 |
| **Mothers height** | | | | | | |
| ≤155cm | 51 | 36.7 | 48 | 17.3 | **2.78 (1.75-4.42)** | **2.74 (1.32-5.66)** |
| >155cm | 88 | 63.3 | 230 | 82.7 | 1 | 1 |
| **History of Anyone smoking** | | | | | | |
| Never | 123 | 88.5 | 270 | 97.1 | 1 | 1 |
| Once or more a week | 16 | 11.5 | 8 | 2.9 | **4.390 (1.830-10.532)** | 1.96 0.48-7.95) |

## 6. Discussion

Many studies have revealed that mother's condition is a determinant factor for birth weight. The aim of this study is primarily to identify those specific maternal risk factors associated with LBW at term. Consequently, after controlling for possible confounders seven of the factors (frequency of ANC visits, iron supplementation, gestational weight gain, maternal MUAC, Maternal height, antenatal depression and antenatal domestic violence) have shown an independent effect in determining birth weight in the final model.

Antenatal care could have a beneficial impact on intrauterine growth, either by diagnosis and timely treatment of pregnancy complications or by eliminating or reducing modifiable risk factors.[11] The number and duration of ANC visits are the factors the really matter even among the attendants. There is a large gap between a single antenatal visit and optimum ANC, which would require follow up visits and several preventive interventions. In this study only the frequency of ANC visits have shown statistically significance. The odds of delivering a term LBW neonate among those who had attended ANC and had less than four visits was more than two and half folds higher (AOR=2.76, 95%CI: 1.32-5.77) than their counterparts. This is in line with studies done in Gaza and Tigray region with OR=2.88, 95% CI: 1.14, 7.37 and OR 2.84, 95% CI: 1.4–4.1 respectively.[47, 32] Other studies has also found similar relation.[11, 28] This finding also shows that the standard number of visits recommended by WHO is critical to follow.

Previous studies have reported benefits to maternal and infant health through antenatal supplementation with iron-folic acid supplements and multiple micronutrients.[30, 45] A case-control study in Karachi has shown that mothers who did not take iron supplements during pregnancy had increased odds of having an LBW baby (OR: 2.88; 95% CI: 1.83–4.54).[30] Similar to the above studies in this study not taking iron tablet supplementations is statistically significant with delivering to a LBW neonate (AOR: 2.89, 95%CI: 1.32-6.34)**.** However, in Kramer's broad meta-analysis none except one reported a significant effect of iron intake on gestational-age-adjusted birth weight. This could be due to the methodological difference as they were experimental.[11] Moreover, in this study the assessment of numbers of days that they took iron depends on the memory of respondents which makes it liable to recall bias. None the less, this finding could be a baseline for further study using appropriate method.

Poor nutrition is a known cause of LBW, especially in developing countries.[25] In his classic review published three decades ago, Kramer[11] concluded that maternal nutritional factors both before and during pregnancy account for 50% of cases of LBW in many developing countries.

MUAC, height and gestational weight gain were among the variables which were used as proxy of maternal nutritional status and show statistical significance with term LBW even after controlling potential confounders.

Maternal height could affect intrauterine growth through either genetic or environmental (physical) mechanisms.[11] In this study height was directly measured in centimeters and dichotomized as ≤155cm and 155cm. Consequently, the odds of delivering to a LBW neonates is more than two and half (AOR: 2.74, 95% CI: 1.32-5.66) higher for the respondents with height of ≤155cm compared to their counterparts. This finding is in line with studies done in Sudan and Tigray with OR 1.52 (95%CI 1.05 –2.20) and AOR: 2.43, (95%CI: 0.99-9.13) respectively.[24, 47] Because tall women are heavier and consume more calories than short women, and because pre-pregnancy weight and gestational nutrition may independently affect birth weight this may not be surprising. However, these factors should be controlled to see the independent effect of height as they are potential confounders.

A MUAC of less than 23cm was considered to be a sign of poor nutrition. MUAC doesn't vary much during pregnancy and is therefore an appropriate measure of nutritional status than BMI. In this study respondents with <23cm MUAC measurement were nearly two times (AOR=1.94, 95%CI: 1.01-3.3.73) more likely to deliver a LBW neonate than their counterparts. This finding is consistence with a study done in Kersa, Ethiopia where MUAC less than 23 cm was significantly associated with LBW (OR 1.6, 95% CI 1.19, 2.19).[10] In the contrary, study done in Khartoum, Sudan hadn't show significant association with LBW (RR 1.02 CI 0.63 –1.65).[24] This could be due to the influence of demographic difference among the study participants.

WHO recommends that women in developing countries gain at least 1 kg per month during the last two trimesters of pregnancy, resulting in a weight gain of at least 6 Kg.[46] In this study gestational weight gain was dichotomized based on the mean gestational weight gain. Similarly, the odds of delivering to a LBW neonate was seven times higher (AOR=7.01, 95%CI: 3.33-14.78) among respondents with gestational weight gain of ≤8.0Kg than their counterparts. This

finding is found to be consistence with other similar studies.[7, 14, 29, 31, 33] Since maternal caloric intake and nutritional stores (mostly fat) are the sole source for fetal energy requirements, weight gain during pregnancy would be expected to affect intrauterine growth.[11]

Increasing maternal stress and depression have been found to reduce infant birthweight in some reports. Findings from our study revealed that the odds of delivering to a LBW neonate was nearly three and half times higher (AOR=3.45, 95%CI: 1.29-9.23) among respondents with depression of any grade compared with respondents who were free of depression during the index pregnancy. This finding is in line with a study conducted in Bangladesh and USA with AOR 2.24 95% CI 1.37-3.68 and AOR 1.65 95% 1.12-2.42 respectively .[26, 37] Meanwhile, the random-effects meta-analysis showed that antenatal depression was significantly associated with LBW (RR=1.18; 95% CI, 1.07–1.30).[35] This could be due to depression might increase metabolic expenditure, loss of appetite and vomiting leading to a lower gestational weight gain, and hence a smaller fetus, for a given caloric intake. However, in a longitudinal study in United Kingdom[39] and a population based study in Sweden[38] concluded that birth weight at term did not deteriorate despite the women's impaired mental health during pregnancy. Differing study populations, sample sizes, study designs, and varying measures of depression might explain discrepant findings among studies. Meanwhile, our study had faced a methodological pitfalls-the major one being when the measurements were made during postpartum (before discharge) which faced with the problem of deciding between cause and effect: did depression cause retarded baby or did the birth of a premature or IUGR infant lead to increased maternal depression or enhanced recall of prior stressful events? Even though respondents were asked by the screening scale about their depression status seven days prior to their delivery to minimize the bias, there is still a methodological gap.

Violence against women is difficult to measure for various reasons, the fact that some women are unwilling to disclose violence, because of social stigma or cultural sanctioning of violence. Some studies suggested that pregnancy often triggers domestic violence or exacerbates a pre-existing problem and more over the pattern of violence may change with assaults directed to the abdomen, breasts and genitals. In our study after adjusting for possible confounders, domestic violence was significantly associated with term LBW with AOR: 6.45, 95%CI: 2.41-17.28 among respondents who reported they were violated physically, emotionally or/& sexually by

their partner during the index pregnancy. This finding is consistent but higher with a meta-analysis (AOR: 1.4, 95%CI 1.10-1.80)[42], prospective cohort study in Uganda (RR: 3.10, 95%CI 2.60-4.20)[40] and case-control study in Iran (AOR: 3.78, 95%CI 2.86-5.00)[36]. More mothers of low birthweight neonates were abused compared with controls in many studies, but the association was not statistically significant in case-control studies in Tigray[3], Norway (OR 1.37, 95% CI 0-63-2.99)[41], USA (OR: 1.74, CI95% 0.56-5.42)[31] and population based study in Carolina (OR: 1.0, CI95% 0.80-1.20).[43] The difference between our findings and previous studies might be due to methodological differences in definition and assessment of the exposure, means of data collection (interview or questionnaire), and differences in prevalence of violence (affecting both power to detect associations and classification of participants into abused and non abused categories). Interviews yield higher prevalence rates than self-administered questionnaires, [40] and more than one opportunity to interview study participants gives higher response rates. However, our study had also a limitation as abuse was determined by a single assessment after delivery, thereby women could not be comfortable with disclosure at single exposure though their trust was tried to build-up by the midwife data collectors who were staff members of the study sites. The clinical implication is that optimally abuse should be assessed at each prenatal care visit or at least once each trimester. Abuse should also be assessed at delivery, since some women may not have obtained prenatal care, but underreporting at delivery should be expected.[31]

On the other hand, some of the variables (marital status, age, average monthly income, educational level, pregnancy induced hypertension, pre-pregnancy weight, parity and fertility desire) hadn't shown statistically significance association with term LBW. Consequently, I would like to discuss and reason out some of the variables.

Even though marital status was significant in the 2nd model it couldn't show significance association in the final model. This could be due to that more than 88% of the study participants had responded that they were married/in union which may affect the power to detect association. As well as, the proportion of married/in union respondents is questionable as we believe it was exposed to social desirability bias.

Despite that the proportion of younger respondents was relatively higher among cases compared to controls age couldn't show statistical significance in the final model. A study in Tigray has

shown a statistical significance with low birth weight.[47] However, the cutoff point of the age group was referring for those who were <18 years old. In our study respondents <18 years old were very few which makes it impractical to make it a cutoff point. This could be due to that pregnancy in cities like Addis Ababa occurs in later life as there are relatively higher amount contraceptive users.

Income is believed to be an indirect determinant factor for LBW. The prospective cohort study in Kersa, Haramaya showed that babies born to women who were poor were more likely (OR 2.1; 95% CI: 1.42, 3.05) to be LBW in that district.[10] On the contrary, average family income in this study didn't show statistically significant association with term LBW (OR: 2.00, 95%CI 0.93-4.3) in the final model; though it was marginal statistically significant. This might be due to the method that we use to assess wealth status which was average monthly family income might not be quite enough to measure the disparities among the study participants. Furthermore, over adjustment bias might be introduced as income was further analyzed in the final model.

Pregnancy induced hypertension (PIH) is known to be determinant factor for LBW regardless of the gestational age. However, we can't find any association between PIH and LBW at term even in the bivariate regression model. The finding is in line with a case control study done in Botucatu city in Brazil.[9] On the contrary, the finding is inconsistence with a recent record review study in China and a case-control study in India specifically done for term LBW.[14, 34] This could be due to perhaps the lower proportion of respondents with PIH in both cases and controls (6.4%) which could possibly affect the power to detect association. Moreover, these controversies invites for further study which helps to confirm as PIH is associated with LBW at term as it is believed PIH shortens the gestation.

Pregnancy intention status was determined by asking women to recall their feeling at the time of conception. Both mistimed and unwanted was categorized as unintended pregnancy. Recent studies which assess the relation between pregnancy intention and LBW are scarce. In our study though pregnancy intention showed significant association in the bivariate and 2$^{nd}$ multivariate logistic model, it was unable to persist in the final model. However, being not significant doesn't mean it is worthless. The proportion of respondents who reported that the index pregnancy was unintended is alarming (34.3%). This situation makes it more shocking when we remind you this

much unintended pregnancy happened in Addis Ababa where contraceptive users (62.5%) are relatively plenty than any region in the country.[12]

Birth interval and history of low birth weight were statistically significant in the bivariate logistic regression model. However, we can't show you their independent effect on low birth weight at term as they were excluded from the multivariate logistic regression model for the reason that only 45% of the sample size was explained (the index child for 55% of the study participants was their first experience).

## 7. Strengths and limitations of the study

### 7.1. Strengths of the study

- The study design used was relatively better (but not best) as low birth weight is multi-factorial.
- To minimize recall bias, we reviewed patients' medical records to confirm some important exposure status variables such as patients' hypertensive status, reproductive history, antenatal history, and weight during pregnancy.
- The use of primary data and actual measurements with validated questionnaire was also the strength of the study.
- The study includes and assessed possible independent variables which allow controlling of potential confounders.
- Data collectors were maternity ward staff members of each study site which we believed enhanced a response rate and made respondents confident to disclose even sensitive issues.

### 7.2. Limitations of the study

In the study, there are several limitations which we have to acknowledge.

**General limitations:**

- As the study design was a facility based case-control study selection and recall bias might be introduced.
- Social desirability bias might also be introduced for some variables by the respondents as they were interviewed in the health facilities.

- The design does not permit for distinction between cause and effect relationships in the associations.
- Generalizability is also limited to the populations from which the sample was drawn, which are public health institutions.

**Specific limitations:**

- Average monthly family income was used as an indicator of economic status which might not explain the actual economic status of the study participants.
- Data on the some variables (e.g. income, education, parity) were self-reported. To the extent that survey participants misreported, our results may be biased.
- We are not sure about the exact iron tablet supplements women took during pregnancy and with what frequency. When questioned, women were unsure of the number and type of iron tablet supplements provided by health workers during pregnancy.
- For respondents with no ANC follow-up and when medical records were not available pregnancy weight was self-reported. As a result, women are likely to misreport and our results may be biased.
- In this study, depression status and intimate partner violence was assessed using self-report measures and was at only one time point during postpartum. Self-report ratings may reflect subjective response biases; however, recall bias to depression status is unlikely to have affected results given that participants were asked to report on emotional status over the past one week.

## 8. Conclusions

The aim of this study was to identify the independent maternal risk factors associated with full term low birth weight neonates. This study has shown neonates born to women who had three or less ANC visits, did not take iron tablet supplementation, experienced antenatal domestic violence and antenatal depression status were more likely to be LBW. Furthermore, gestational weight gain less than 8Kg, maternal MUAC less than 23cm and maternal height less than 155cm were also found to be determinant factors for term LBW.

## 9. Recommendations

Effective and large-scale practical interventions to prevent LBW will have enormous impact on the health and productivity of individuals and society, particularly in those regions like Ethiopia where the prevalence of LBW is high. Based on our findings our recommendations are as follow.

- Pregnancy often represents the first opportunity for a woman to establish contact with the health system. Through ANC, it is possible to identity a women who are at risk of having LBW baby. Despite there was a relatively high ANC coverage in the study site, suboptimum number of ANC visits was found to be an independent determinant factor for term LBW. In this regard, health care providers should emphasize in ensuring that women return after their first ANC visit and reduce dropout. By reducing the number of dropouts pregnant mothers will have the opportunity to get the services which benefit their health and offspring. Moreover, health facilities should further study or utilize available research findings on possible reasons why clients fail to return their next visits and the quality of the services they offer.
- The result of our study suggests that routine antenatal iron tablet supplementation for a minimum 31 days is an independent factor for LBW at term. Such a program is easily implementable intervention to apply and could potentially represent a high-impact for the health of both women and newborns. Despite reports of high coverage of iron tablet supplementation, problems such as inadequate supply and poor compliance needs a due attention.
- Since the sites providing prenatal care in this study had no standardized behavioral or psychosocial assessment protocols and no standardized intervention strategies, maternal depressive symptoms during pregnancy need to be addressed. Policies aimed at the detection and effective management of depressive symptoms during pregnancy cannot only reduce the burden on mothers but is an important preventive action for both LBW and the physical and mental health of offspring.
- Another implication of this study is that screening for domestic violence during pregnancy might assist health care providers to predict which women are at risk of LBW delivery. Pregnant women should be universally screened for depression and provided guideline-level treatment before childbirth.

- With respect to nutritional status and LBW, we found LBW asit is believed to be an intergenerational problem. Intervention at any point has the potential to break the cycle of intergenerational under-nutrition and low birthweight. As resources are scarce, programs designed to increase pre-pregnancy weight and weight gain during pregnancy should be given priority. More widespread use of contraception among young adolescents may thus have an indirect effect on LBW by delaying pregnancy until they are taller and better nourished. Furthermore, improved dietary intake should be promoted among pregnant women and food supplements need to reach undernourished pregnant women.

It may not be possible to address all these issues at once, but early and optimum antenatal visits by prospective mothers, conducting awareness programs through the mass media focusing on proper nutritional care during pregnancy could alleviate many of these problems. Reducing and preventing LBW requires a commitment to implement long-term strategies.

## Further research:

Finally, further studies should be conducted with a larger sample size to verify the findings of this study. More focused studies need to be conducted that tackle certain group of variables independently.

- Create nationally appropriate growth curves for pregnant women which identifies cut-offs for weight and weight gain which will give good birthweight and maternal fat store outcomes.
- Interdisciplinary research teams are needed to provide a more holistic understanding of the pregnancy, violence and depression relationships.
- There is a need for well designed RCTs that assess the effect of multiple micronutrients on birth outcomes. The need for RCTs are especially urgent in developing countries like Ethiopia, i.e., among populations with high rates of LBW due to IUGR and where nutrient deficiencies do not occur in isolation and multiple micronutrient deficiencies are common.

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# ANNEX-I

## A: Information Sheet

**Addis Ababa University**
**College of Health Sciences**
**School of Public Health**

Greetings! My name is _____. I am here representing a team to conduct interviews among mothers who gave birth to a live baby (either low birth weight or normal birth weight) about the risk factors associated with term low birth weight. Low birth weight is defined as birth weight less than 2,500 grams. More than 20 million infants are born each year weighing less than 2500 g, accounting for 17% of all births in the developing world. Similarly, according to Ethiopian DHS 2011 11% weighed less than 2.5 kilograms. Birth weight plays an important role in infant mortality and morbidity, development, and future health of the child. Weight at birth is directly influenced by general level of health status of the mother.

The main objective of the study is to identify the risk factors associated with term low birth weight in Addis Ababa city. The interview is supposed to get administered within this facility immediately after delivery when mother's condition is stabilized.

Overall, as we speak now, this study is being simultaneously conducted in randomly sampled governmental and private health institutions within Addis Ababa city. The study, primarily, will rely on interviewer-guided questions of eligible delivered mothers. It is an interview and may include measurement of your height and MUAC. Your child weight will also be taken from medical records. Other than those mentioned measurements nothing will be taken from you or your child. It is believed that the interview might be tiresome as you were in labor. As a result, prior to the interview we will make sure first that your health condition has stabilized by checking your vital signs.

The interview is consent-based, voluntary, confidential, private and of approximately half an hour's duration. Other than a general serial code, your name and other identification aspects are not going to be recorded on the interview sheet. Everything you are going to tell will get kept strictly confidential and private. You will not get obliged to respond to one or more of the specific questions that you do not want to respond to. But so long as you find it reasonably convincing, it undoubtedly is going to be more helpful when all of the questions of the interview

set will get completed. The study was reviewed and cleared by the relevant official bodies at all levels.

When you participate in the study there mightn't be an immediate benefit to you & to your child. However, based on the findings of the interview we will let you know any problem and risk factors that endangers the health of you and your child. The finding of this study could also provide policy makers, governmental and nongovernmental organizations with relevant information in developing of appropriate strategies to promote and maintain the health of both the mother and her baby in particular and the family and society in general. The aggregate final result is going to get shared to the pertinent decision makers at all levels. Therefore, participation in the study is seen as vital citizenry and societal opportunities as well as contributions.

For more details: Contact Mahari Yihdego (Principal investigator) with +251-923-299457

## B. CONSENT FORM (English version)

Now, I can only start asking you the set of specific questions after I have confirmed your willingness. As I have told you before your participation is fully voluntary. If you think that you have got enough information, and you don't have any ambiguity and hesitation about the study you will be welcomed to be part of the study participants as respondent. I would like to remind you again that you have the right to withdraw from the study at any place and point of time. Not participating or withdrawing will not have any effect on the services that you are expected to get. Having saying these I kindly ask you to take active part and contribute to the study.

**Are you willing to participate in the study?** (Interviewer: Please mark with "✓" in the box provided to confirm respondent's permission.)

1. **YES:** --------- ☐ **Signiture:** _____Continue interviewing
2. **NO:** --------- ☐ Give thanks to the participant and go to the next participant.

Interviewer's Name: _____ Code: _____ Signature: _____

Supervisor's Name: _____ Code: _____ Signature: _____

**Date: _____**

## Maternal risk factors associated with low birth weight babies

Note the inclusion criteria from clinical records:

- Is the child born single 1: YES 2: NO
- Is the child born at term 1: YES 2: NO
- Is the child free of any visible major birth defect 1: YES 2: NO

**If "No" to any of the inclusion criteria, thank the mother and stop the interview.**

| **Health institution/facility type/ interviewee codes** | | _____/_____/_____ | | |
|---|---|---|---|---|
| **S.No** | **Coding categories** | **Questions and filter** | **Skip** | **Code** |
| **Section I. New borne characteristics** | | | | |
| 101 | Birth weight of the baby in grams? | Birth weight in gm: _____ | | |
| 102 | What is the sex of the newborn? | Male _____ 1 | | |
| | | Female _____2 | | |
| **Section II. Characteristics of mother** | | | | |
| 201 | How old were you at your last birth day? | Age in completed years: _____ | | |
| 202 | Have you ever attended school? | Yes-------1 | | |
| | | No--------2 (if no skip) | 204 | |
| 203 | What is the highest grade you completed?<br>Elementary school: Grade 1-8<br>Secondary school: Grade 9-12/$10^{+2}$<br>Collage & above: Vocational and above | Primary school: 1 | | |
| | | Secondary school: 2 | | |
| | | College and above: 3 | | |
| 204 | What is your religion? | Orthodox ----------1 | | |
| | | Catholic ----------2 | | |
| | | Protestant ----------3 | | |
| | | Muslim ----------4 | | |
| | | Others (Specify) _____ | | |

| S.No | Coding categories | Questions and filter | | | Skip | Code |
|---|---|---|---|---|---|---|
| 205 | What is your occupation? That is, what kind of work you mainly do? | Farmer ----------1 | | | | |
| | | Student ----------2 | | | | |
| | | Merchant ----------3 | | | | |
| | | Housewife ----------4 | | | | |
| | | Government employee-----5 | | | | |
| | | Private sector employee----6 | | | | |
| | | Unemployed----------7 | | | | |
| | | Others (Specify) _____ | | | | |
| 206 | What is your current marital status? | Single/never married-------- 1 | | | 208 | |
| | | Married/living together----- 2 | | | | |
| | | Divorced/separated--------- 3 | | | 208 | |
| | | Widowed ---------- 4 | | | 208 | |
| 207 | What is your husband's/partner's occupation? That is, what kind of work does he mainly do? | Farmer ----------1 | | | | |
| | | Student ----------2 | | | | |
| | | Trader ----------3 | | | | |
| | | Government employee -----4 | | | | |
| | | Private sector employee -----5 | | | | |
| | | Unemployed----------6 | | | | |
| | | Others (Specify) _____ | | | | |
| 208 | How much is your average family income per month. | Monthly income in birr: _____ | | | | |
| | | I do not know ----------99 | | | | |
| 209 | What type of latrine do you use? | Modern flash toilet---------- 1 | | | | |
| | | Ventilated improved pit latrine-------2 | | | | |
| | | Pit latrine----------3 | | | | |
| | | Public latrine----------4 | | | | |
| | | Use bushes, fields----------5 | | | | |
| 210 | In your household is there: A television? A mobile telephone? A couch/Sofa set? A refrigerator? A washing machine? A bicycle? A motorcycle or motor scooter? A car or truck? | | YES | NO | | |
| | | Television | 1 | 2 | | |
| | | Mobile phone | 1 | 2 | | |
| | | Couch | 1 | 2 | | |
| | | Refrigerator | 1 | 2 | | |
| | | Washing machine | 1 | 2 | | |
| | | Bicycle | 1 | 2 | | |
| | | Motorcycle/scooter | 1 | 2 | | |
| | | Car/truck | 1 | 2 | | |

| S.No | Coding categories | Questions and filter | | | Skip | Code |
|---|---|---|---|---|---|---|
| 211 | Where do you use to live? | | YES | NO | | |
| | | Private house-------- | 1 | 2 | 213 | |
| | | Rented house-------- | 1 | 2 | | |
| | | With family---------- | 1 | 2 | 213 | |
| 212 | If rented how much do you pay per month? | _____Birr | | | | |
| 213 | Number of members per sleeping rooms? | One per sleeping room----------1 | | | | |
| | | Two per sleeping room ----------2 | | | | |
| | | Three per sleeping room----------3 | | | | |
| | | Four per sleeping room----------4 | | | | |
| | | Five and more per sleeping room----5 | | | | |
| **Section III. Obstetric history** | | | | | | |
| 301 | What is your gravidity? That is any pregnancy occurred. | Gravidity: _____ | | | | |
| 302 | What is parity of the mother? That is any delivery that passed 28 weeks of gestation. | Parity: _____ | | | If she was Gravida-I skip to 401 | |
| 303 | Have you ever had given birth to a live singleton baby with birth weight less than 2500 g. | Yes ---------- 1 | | | | |
| | | No ---------- 2 | | | | |
| | | Do not remember ---------99 | | | | |
| 304 | Have you ever had an abortion? | Yes ----------1 | | | | |
| | | No ----------2 | | | 306 | |
| 305 | How many abortions did you have? | Number of abortions: _____ | | | | |
| 306 | What is the inter-pregnancy interval of the last pregnancy with the current pregnancy? Please calculate in months? | Inter-pregnancy interval in months: _____Months | | | | |
| **Section IV. Current pregnancy history**<br>**If the mother had ANC follow-up, fill the required data from the ANC card when available.** | | | | | | |
| 401 | What was the gestational age at delivery, in weeks? Please calculate from the last menstrual period of the mother or record from ultrasound reading if available. | Gestational age at delivery in weeks: _____ | | | | |
| 402 | How did you give birth? That is mode of delivery. | Vaginal delivery----------1 | | | | |
| | | Assisted delivery----------2 | | | | |
| | | Cesarean section----------3 | | | | |

| S.No | Coding categories | Questions and filter | Skip | Code |
|---|---|---|---|---|
| 403 | Have you ever weighed prior your pregnancy (recent one) or prior 12 gestational weeks of your current pregnancy? | Yes ---------- 1 | | |
| | | No ---------- 2 | 405 | |
| | | Do not remember ---------99 | 405 | |
| 404 | If yes what was your weight in kg? | Weight of the mothers: _____ | | |
| | | Do not remember ---------99 | | |
| 405 | Have you ever been weighed in your current third trimester pregnancy? | Yes ---------- 1 | | |
| | | No ---------- 2 | 407 | |
| | | Do not remember ---------99 | 407 | |
| 406 | What was your weight in the last weight measurement taken? | Weight of the mothers: _____ | | |
| | | Do not remember ---------99 | | |
| 407 | Have you visit any health institution for ANC services for the current pregnancy? | Yes ---------- 1 | | |
| | | No ---------- 2 | 413 | |
| 408 | How many months pregnant were you when you first received antenatal care services for this pregnancy? | Months: _____ | | |
| | | Do not remember ---------99 | | |
| 409 | How many times did you receive antenatal care during your current pregnancy? | Number of visits: _____ | | |
| 410 | By whom were you getting most of the ANC services? | Medical doctor----------1 | | |
| | | Health officer----------2 | | |
| | | Nurse or midwife----------3 | | |
| | | More than one health professionals- 4 | | |
| | | Other (Specify): _____ | | |
| | | Do not remember ---------99 | | |
| 411 | As part of your antenatal care during this pregnancy, were any of the following done at least once? | Service / YES / NO | | |
| | Was your weight measured? | Weight / 1 / 2 | | |
| | Was your BP measured? | BP / 1 / 2 | | |
| | Did you give a urine sample? | URINE / 1 / 2 | | |
| | Did you give a blood sample? | BLOOD / 1 / 2 | | |
| 412 | During (any of) your antenatal care visit(s), were you told about the signs of pregnancy complications? | Yes ----------1 | | |
| | | No ----------2 | 414 | |
| | | Do not remember ---------99 | 414 | |

| S.No | Coding categories | Questions and filter | | | Skip | Code |
|---|---|---|---|---|---|---|
| 413 | Which signs of pregnancy complications were you told about? | | YES | NO | | |
| | | Vaginal bleeding | 1 | 2 | | |
| | | Vaginal gush of Fluid | 1 | 2 | | |
| | | Severe head ache | 1 | 2 | | |
| | | Blurred vision | 1 | 2 | | |
| | | Fever | 1 | 2 | | |
| | | Abdominal pain | 1 | 2 | | |
| | | Other (specify): _____ | | | | |
| 414 | During this pregnancy, were you given or did you buy any iron tablets? | Yes ---------- 1 | | | | |
| | | No ---------- 2 | | | 416 | |
| | | Do not remember ---------99 | | | 416 | |
| 415 | During the whole pregnancy, for how many days did you take the tablets? | No of Days: _____ | | | | |
| | | Do not remember ---------99 | | | | |
| 416 | During this pregnancy, did you take any drug for intestinal worms? | Yes ---------- 1 | | | | |
| | | No ---------- 2 | | | | |
| | | Do not remember ---------99 | | | | |
| 417 | Have you ever been told that you have chronic hypertension? | Yes ---------- 1 | | | | |
| | | No ---------- 2 | | | | |
| | | Do not remember ---------99 | | | | |
| 418 | During this pregnancy, have you been told that you have developed pregnancy induced hypertension? | Yes ----------1 | | | | |
| | | No ----------2 | | | | |
| | | Do not remember ---------99 | | | | |
| 419 | During your current pregnancy, have you been told that you have anemia? | Yes ---------- 1 | | | | |
| | | No ---------- 2 | | | | |
| | | Do not remember ---------99 | | | | |
| 420 | What was her hemoglobin level on her current pregnancy, if available? | _____g% | | | | |
| 421 | Have you ever been told that you have Diabetes Mellitus? | Yes ----------1 | | | | |
| | | No ----------2 | | | | |
| | | Do not remember ---------99 | | | | |

| S.No | Coding categories | Questions and filter | Skip | Code |
|---|---|---|---|---|
| 422 | During your current pregnancy, have you been told that you have developed gestational diabetes mellitus? | Yes ----------1 | | |
| | | No ----------2 | | |
| | | Do not remember ---------99 | | |
| 423 | During this pregnancy, did you have any history of vaginal bleeding prior to the onset of labor or delivery? | Yes ----------1 | | |
| | | No ----------2 | | |
| | | Do not remember ---------99 | | |
| 424 | Did you have any history of trauma or injury, during your current pregnancy period? Probe for all kind of traumas. | Yes ----------1 | | |
| | | No ----------2 | | |
| | | Do not remember ---------99 | | |
| 425 | When you got pregnant, did you want to get pregnant at that time? | Yes ---------- -1 | | |
| | | No ----------2 | | |
| | | Do not remember ---------99 | | |
| **Section V. Life-style/personal habits during pregnancy** | | | | |
| 501 | During your pregnancy, did you take drinks containing alcohol? | Yes ---------- -1 | | |
| | | No ----------2 | 503 | |
| | | Do not remember ---------99 | 503 | |
| 502 | How often were you taking alcohol drinks? | Daily----------1 | | |
| | | 3 times per week----------2 | | |
| | | 1 times per week---------- 4 | | |
| | | Once a month----------5 | | |
| 503 | During your current pregnancy, did you ever chew Khat? | Yes ---------- -1 | | |
| | | No ----------2 | 507 | |
| | | Do not remember ---------99 | 507 | |
| 504 | How often were you chewing khat? | Daily----------1 | | |
| | | 3 times per week----------2 | | |
| | | 1 times per week---------- 4 | | |
| | | Once a month----------5 | | |
| 505 | During your current pregnancy, did you ever smoke? | Yes ---------- -1 | | |
| | | No ----------2 | 507 | |
| | | Do not remember ---------99 | 507 | |
| 506 | How often were you smoking? | Daily----------1 | | |
| | | 3 times per week----------2 | | |
| | | 1 times per week---------- 4 | | |
| | | Once a month----------5 | | |
| **Ask the question number 507 & 508 only for women who are married/living together by checking question number 206.** | | | | |
| 507 | Does your husband/partner smoke cigarettes beside you while you were pregnant? | Yes ---------- -1 | | |
| | | No ----------2 | 511 | |
| | | Do not remember ---------99 | 511 | |

| | | | | |
|---|---|---|---|---|
| 508 | How often was he smoking? | Daily----------1 | | |
| | | 3 times per week----------2 | | |
| | | 1 times per week---------- 3 | | |
| | | Once a month----------4 | | |
| 509 | Is there any other person at home who smokes cigarette beside you while you were pregnant? | Yes ---------- -1 | | |
| | | No ----------2 | 601 | |
| | | Do not remember ---------99 | 601 | |
| 510 | How often was he or she smoking? | Daily----------1 | | |
| | | 3 times per week----------2 | | |
| | | 1 times per week---------- 3 | | |
| | | Once a month----------4 | | |
| **Section VI: Maternal anthropometric measurements** | | | | |
| 601 | MUAC of the mother in cm? | MUAC: _____cm | | |
| 602 | Height of the mother in cm? | Ht: _____ cm | | |

## **Section VII**: **Assessment maternal Antenatal Depression**

As you have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today. If you have any question or ambiguity you can ask the facilitator.

| **S. No** | **For the following 20 items, please select the choice that best describes how you have felt over the past week:** | **Rarely or none of the time (<1 day)** | **Some or a little of the time (1-2 days)** | **Occasionally or a moderate amount of the time (3-4 days)** | **Most or all of the time (5-7 days)** | **Answer code** |
|---|---|---|---|---|---|---|
| 701 | I was bothered by things that usually don't bother me. | | | | | |
| 702 | I did not feel like eating; my appetite was poor. | | | | | |
| 703 | I felt that I could not shake off the blues even with the help from my family and friends. | | | | | |
| 704 | I felt that I was not as good as other people. | | | | | |
| 705 | I had trouble keeping my mind on what I was doing. | | | | | |
| 706 | I felt depressed. | | | | | |
| 707 | I felt that everything I did was an effort. | | | | | |
| 708 | I felt hopeless about the future. | | | | | |
| 709 | I thought my life had been a failure. | | | | | |
| 710 | I felt fearful. | | | | | |
| 711 | My sleep was restless. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 712 | I was unhappy. | | | | | |
| 713 | I talked less than usual. | | | | | |
| 714 | I felt lonely | | | | | |
| 715 | People were unfriendly. | | | | | |
| 716 | I did not enjoy life. | | | | | |
| 717 | I had crying spells. | | | | | |
| 718 | I felt sad. | | | | | |
| 719 | I felt that people disliked me. | | | | | |
| 720 | I could not get "going". | | | | | |
| | **TOTAL Score** | | | **Stage** | | |

**Section VIII: Assessment of intimate partner violence during the index pregnancy**

| **Ask question number 800 for women who are married or in-union and WITHOUT depression of any degree only by checking question number 206 and section 7 respectively.** | | | | | | |
|---|---|---|---|---|---|---|
| 800 | While you were pregnant did your partner had ever: | | Once:----3 | More than once: ------4 | | |
| | a) Slapped, pushed or shoved you? | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | b) Hit you with fist, kicked, dragged or/and threatened you with a weapon or used a weapon? | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | c) Physically forced you to have sexual intercourse against your will? | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | d) Forced you to perform any sexual acts you found it humiliating or degrading? | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | e) Have you ever made sexual intercourse because you were afraid of what your partner might do? | | 3 | 4 | | |
| | | | 2 | | | |
| | e) Say or do something to humiliate you in front of others? | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | f) Insult you or makes you feel bad about yourself. | Yes | 3 | 4 | | |
| | | No | 2 | | | |
| | g) Intimidate or scared you on purpose? (Eg. Yelling and smashing things) | Yes | 3 | 4 | | |
| **Thank you for your participation and cooperation!** | | | | **Time at the end of interview**: _____:_____ | | |

# Annex II: Amharic version consent form and questionnaire

## ሀ. የመረጃ ቅጽ

ሰላም ጤና ይስጥልኝ። ስሜ _____ ይባላል።

ዛሬ እዚህ የተገኘሁት ከሚጠበቀው የክብደት መጠን በታች ይዘው ለሚወለዱ ህጻናት የእናቶች አጋላጭ ምክንያቶችን የሚያጠና ቡድን በመወከል ነው። ከሚጠበቀው የወሊድ ክብደት መጠን በታች ማለት የህጻኑ/ኗ በወሊድ ግዜ ያለው/ት ክብደት ከ 2.5 ኪ.ግ ያነሰ ሲሆን ነው። በአለማችን በየዓመቱ ከ20 ሚልዮን በላይ ጨቅላዎች በወሊድ ጊዜ ከሚጠበቀው የክብደት መጠን በታች ይዘው ይወለዳሉ። የችግሩ ስፋት በታዳጊ ሀገራት የከፋ ሲሆን 17% ይደርሳል። በተመሳሳይ እንደ ማእከላዊ ስታቲስቲክስ ኤጀንሲ 2011 እ.አ.አ. ሪፖርት በኢትዮጵያ ከሚወለዱ ህጻናት መካከል 11% በወሊድ ጊዜ ከሚጠበቀው የክብደት መጠን በታች ይዘው ይወለዳሉ። በወሊድ ግዜ የሚኖረው የክብደት መጠን በህጻናት ህመምና ሞት፣ እድገትና የመጪው የጤናቸው ሁኔታን በመወሰን ላይ ትልቅ ሚና ይጫወታል። የእናትየዋ የጤና ሁኔታ ለህጻኑ/ኗ በወሊድ ግዜ ለሚኖረው/ራት የክብደት መጠን ቀጥተኛ ተጽዕኖ አለው።

የጥናቱ ዋና አላማ በአዲስ አበባ ከተማ ከሚጠበቀው የክብደት መጠን በታች ይዘው ለሚወለዱ ህጻናት የእናቶች አጋላጭ ምክንያቶችን በመለየት ምክንያቶቹን መከላከል ወይም ማሻሻል የሚያስችሉ መንገዶችን ማበጀት ነው። ቃለ-መጠይቁ እናቶች ከወለዱ በሷላ የጤና ሁኔታቸውን ሲረጋጋ የሚደረግ ሲሆን በተመሳሳይ ሠዓትም ይህ ጥናት በአዲስ አበባ በሚገኙ የተመረጡ የጤና ተቋማት እየተካሄደ ይገኛል። ጥናቱ በዋናነት ከተመረጡ የወለዱ እናቶች በሚደረግ ቃለ-መጠይቅ ላይ የተመሰረተ ነው። ጥናቱ ከአንቺ ጋር የሚደረግ ቃለመጠይቅን እንዲሁም የአንቺን ቁመትና የላይኛውን-እጅሽን ዙሪያ መጠን መለካትን ያካትታል። በተመሳሳይ የልጅሽን የክብደት መጠን ከህክምና ካርዱ ላይ ይወሰዳል። ከላይ ከተገለጹት የልኬት ዓይነቶች በስተቀር ሌላ የምርመራ ዓይነት በአንቺም ሆነ በልጅሽ ላይ አይደረግም። ምጥ ላይ ስለነበርሽ ቃለ-መጠይቁ አድካሚ ሊሆንብሽ እንደሚችል ይታመናል። ስለሆነም ከቃለ-መጠይቁ በፊት የጤና ሁኔታሽን መስተካከሉን/መረጋጋቱን እናረጋግጣለን።

ቃለመጠዩቁ የአንቺን ስምምነትንና ፍቃደኝነትን መሰረት ያደረገ፣ሚስጠራዊነቱ የተጠበቀ እና ብቻዎን ሁነው የሚደረግ ሲሆን በግምት ግማሽ ሰዓት ይወስዳል። ከመለያ ቁጥሮች (ኮዶች) በስተቀር ስምሽ ወይም የአንቺን ማንነት ሊገልጹ የሚችሉ ነገሮች በመጠይቁ ቅጽ ላይ አይመዘገቡም። መመለስ የማትፈልግያቸውን ጥያቄዎች መልስ እንዲትሰጪ አትገደዲም። ይሁን እንጂ አሳማኝ ሆኖ እስካገኘሺው ድረስ ሁሉም የመጠይቅ ክፍሎች ተሟላተው ቢመለሱ የበለጠ ጠቃሚ እንደሚሆን አያጠራጥርም። ይህ ጥናት በየደረጃው ከሚመለከታቸው አካላት ህጋዊ ፍቃድ ያገኘ ነው።

በጥናቱ ላይ ተሳታፊ በመሆንሽ ወዲያዉኑ ጥቅም ላታገኚ ትችይ ይሆናል። ሆኖም ግን ከቃለ-መጠይቁ በሚገኘው ውጤት መሰረት ለአንቺና ለልጅሽ የጤና ሁኔታ አስጊ የሆኑ ችግሮችና ለሚከታተልሽ የህክምና ባለ ሞያ እንሳውቅልሻለን፤ ከሚጠበቀው የወሊድ ጊዜ አጋላጭ የሆኑ ምክንያቶችን ደግሞ እንነግርሻለን። በተጨማሪም የዚህ ጥናት ግኝት ለህግ አውጪዎች ፣ መንግስታዊና መንግስታዊ ላልሆኑ ድርጅቶች ጠቃሚ የሆኑ መረጃዎችን በማቅረብ በዋነኝነት የእናቶችንና የልጆቻቸውን ጤንነት ለማሻሻልና ለማስጠበቅ እንዲሁም ለመላው ቤተሰብና ለጠቅላላው ማህበረሰብ ይጠቅማል ብለን እናስባለን። በመጨረሻም በዚህ ጥናት የተገኙ መረጃዎች ለሚመለከታቸው አካላት እንዲዳረስ ይደረጋል። ስለዚህ በጥናቱ መሳተፍሽ እንደ ዜግነት እና ማህበረሰባዊ መልካም አጋጣሚና አስተዋጽኦ ሆኖ ይታያል።

ዝርዝር መረጃ ካስፈለገሽ የጥናቱ ዋና መሪ አቶ መሓሪ ይሕደጎ በስልክ ቁጥር 0923299457 ማነጋገር ትችያለሽ።

## ለ. የስምምነት ማረጋገጫ ቅጽ

አሁን ወደ መጥይቁ ልገባ የምችለው አንቺ ፈቃደኛ መሆንሽን ካረጋገጥኩ በኃላ ብቻ ነው። ቅድም እንደነገርኩሽ ተሳትፎሽ በፍቃደኝነት ላይ የተመሰረተ ነው። ከመረጃው ቅጽ በቂና ግልጽ የሆነ መረጃ አግኝቻለሁኝ የምትዪ ከሆነ የጥናቱ አካል ለመሆን ተጋብዘሻል። በየትኛውም ጊዜና ቦታ ጥናቱን አቋርጠሽ መውጣት እንደምትችዪ በድጋሜ ላስታውስሽ እወዳለሁኝ። በጥናቱ ባለመሳተፍሽ ወይም መሀል ላይ በማቋረጥሽ፡ ማግኘት የሚገባሽ አገልግሎቶችን ላይ ተጽዕኖ የለዉም። ይህን ካልኩኝ በጥናቱ ንቁ ተሳትፎ በማድረግ አስተዋጽኦ እንድታደርጊ በትህትና እጠይቅሻለሁ።

በጠቅላላው አሁን ከብራራሁልሽ መረጃ ጥያቄ አለሽ?

1. አዎ፡ (**መረጃ ሰብሳቢ፡** ለጥያቄዋን በቂ ማብራርያ ይስጡ።)
2. የለም፡ (**መረጃ ሰብሳቢ፡** ወደ ፍቃደኝነት መጠይቅ ይሂዱ።)

በጥናቱ ለይ ለመሳተፍ ፈቀደኛ ነሽ? (መረጃ ሰብሳቢ፡ እባክዎትን በተዘጋጀው ሳጥን የራይት (✓) ምልክት ያድረጉ)

1. **የለም፣ ለመሳተፍ ፍቃደኛ አይደለሁም** ☐
   (ምስጋና በማቅረብ መጠይቁን ያቁሙ)
2. **አዎ፣ ለመሳተፍ ፍቃደኛ ነኝ** ☐ **ፊርማ፡** _____
   (ተሳትፏቸውን በማድነቅ መጠይቁን ይቀጥሉ)

የመጠይቅ አድራጊው ስም፡ _____ ኮድ፡ _____ ፊርማ፡ _____

የሱፐርቫይዘሩ ስም፡ _____ ኮድ፡ _____ ፊርማ፡ _____

ቀን፡ _____

# ከሚጠበቀው የክብደት መጠን በታች ለሚወለዱ ህጻናት የእናቶች ኢጋላጭ ምክንያቶች

**ማስታወሻ:** የምልመላ መለኪያዎች ከሕክምና ካርድ በማየት መሟላታቸውን ያረጋግጡ።

- ህጻኑ/ኗ ብቻዉን/ዋን ነው የተወለደው/ችው? 1: አዎ 2: አይደለም
- ህጻኑ/ኗ መወለድ ባለበት/ባት ቀን ነው የተወለደው/ችው? 1: አዎ 2: አይደለም
- ህጻኑ/ኗ ሲወለድ/ስትወለድ ከሚታይ ከባድ የሆነ የአካል ጉዳት ነጻ ነው/ች? 1: አዎ 2: አይደለም

**ለአንዱም የምልመላ መልኪያዎችን አይደለም የሚል መልስ ካለ እናትየዋ አመስግነው ቃለ-መጠይቁን ያቁሙ።**

| **ጤና ተቋም/የተቋም ዓይነት/ የተጠያቂው ኮድ** | | _____/_____/_____ | | |
|---|---|---|---|---|
| **ተ.ቁ** | **ጥያቄዎችና ማብራሪያዎች** | **የመልስ አማራጮች** | **ይሂዱ** | **የመልስ ኮድ** |
| **ክፍል I. የህጻኑ መለያ ባህርያቶች የሚዳስስ** | | | | |
| 101 | ህጻኑ/ኗን ሲወለድ/ስትወለድ ክብደቱ/ትዋ በግራም ስንት ነበር? | ክብደቱ/ትዋ በግራም: _____ | | |
| 102 | የህጻኑ/ዋ ጾታ ምንድን ነው? | ወንድ _____ 1 | | |
| | | ሴት _____2 | | |
| **ክፍል II. የእናትየዋ ማህበራዊና አካባብያዊ መለያ ባህርየቶችን የሚዳስስ** | | | | |
| 201 | ዕድሜሽ ስንት ነው? | (በሙሉ ዓመት): _____ | | |
| 202 | ትምህርት-ቤት ገብተሽ ማንኛውም መደበኛ ትምህርት ተከታትለሻል? | አዎ ----------1 | | |
| | | አይደለም ----------2 | 204 | |
| 203 | ያጠናቀቅሺው ከፍተኛ የመደበኛ ትምህርት ደረጃ ስንት ነው?<br>**መጀመርያ ደረጃ፡** ክፍል 1-8<br>**ሁለተኛ ደረጃ፡** ክፍል 9-12/10[+2]<br>**ኮሌጅና ከዛበላይ፡** የቴክኒክ ሞያና ከዛበላይ | መጀመርያ ደረጃ: ----------1 | | |
| | | ሁለተኛ ደረጃ: ----------2 | | |
| | | ኮሌጅና ከዛበላይ: ----------3 | | |
| 204 | የሚትከተይው ሀይማኖት ምንድን ነው? | ኦርቶዶክስ ----------1 | | |
| | | ካቶሊክ ----------2 | | |
| | | ፕሮቴስታንት ---------- 3 | | |
| | | ሙስሊም ---------- 4 | | |
| | | ሌላ (ይገለጽ) _____ 88 | | |
| 205 | አዘውትረሽ የምትሠሪው ስራ ምንድ ነው? | ገበሬ ----------1 | | |
| | | ተማሪ ----------2 | | |
| | | ነጋዴ ----------3 | | |
| | | የቤት እመቤት ----------4 | | |
| | | የመንግስት ሠራተኛ ---------- 5 | | |
| | | የግል ሠራተኛ ---------- 6 | | |
| | | ስራ የሌላለት ---------- 7 | | |
| | | ሌላ (ይገለጽ) _____ 88 | | |

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | የመልስ አማራጮች | | | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|---|---|
| 206 | ወቅታዊ የትዳር ሁኔታሽ ምን ይመስላል? | ላጤ/ፍጹም ያላገባች ---------- 1 | | | 208 | |
| | | ያገባች/አብረው የሚነሩ ---------- 2 | | | | |
| | | የተፋታች/የተለያየች ---------- 3 | | | 208 | |
| | | ባልዋ የሞተባት ---------- 4 | | | 208 | |
| 207 | ባለቤትሽ/የንሮ አጋርሽ አዘውትሮ የሚሰራው ስራ ምንድ ነው? | ገበሬ ----------1 | | | | |
| | | ተማሪ ----------2 | | | | |
| | | ነጋዴ ----------3 | | | | |
| | | የመንግስት ተቀጣሪ ---------- 4 | | | | |
| | | የግል ተቀጣሪ ---------- 5 | | | | |
| | | ስራ የሌለው ---------- 6 | | | | |
| | | ሌላ (ይገለጽ) _____ 88 | | | | |
| 208 | አማካይ የወር ገቢሽ/ገብያቹ በብር ስንት ይሆናል? | አማካይ የወር ገቢ መጠን በብር: _____ | | | | |
| | | አላውቅም---------- 99 | | | | |
| 209 | በመኖርያ ቤትሽ/ቤታቹ የምትጠቀሚው መጸዳጃ ምን ዓይነት ነው? | ዘመናዊ የወሃ ማፋሰሻ ያለው----------1 | | | | |
| | | የሽታ ማውጫ ያለው ሽንት ቤት---------- 2 | | | | |
| | | የሽታ ማውጫ የሌለው ሽንት ቤት---------- 3 | | | | |
| | | የህዝብ ሽንት ቤት---------- 4 | | | | |
| | | ሜዳ/ጫካ ላይ ---------- 5 | | | | |
| 210 | በቤትሽ_____(ስም እየጠሩ) አለ? ቴሌቭዥን? ተንቀሳቃሽ ስልክ? ሶፋ? ማቀዝቀዣ (ፍሪጅ)? የልብስ ማጠቢያ ማሽን? ብስክሌት? ሞተር ሳይክል? መኪና? | | አዎ | አይደለም | | |
| | | ቴሌቭዥን | 1 | 2 | | |
| | | ተንቀሳቃሽ ስልክ | 1 | 2 | | |
| | | ሶፋ | 1 | 2 | | |
| | | ማቀዝቀዣ | 1 | 2 | | |
| | | የልብስ ማጠቢያ ማሽን | 1 | 2 | | |
| | | ብስክሌት | 1 | 2 | | |
| | | ሞተር ሳይክል | 1 | 2 | | |
| | | መኪና | 1 | 2 | | |
| 211 | የምትኖሪበት/የምትኖርበት ቤት ባለቤትነቱ የማን ነው? | | አዎ | አይደለም | | |
| | | የራሴ/የኛ ቤት | 1 | 2 | 213 | |
| | | ተከራይቹ | 1 | 2 | | |
| | | የቤተሰቦቹ | 1 | 2 | 213 | |
| 212 | ተከራይተሽ የምትኖሪ ከሆነ የቤት ክራይ በወር ስንት ብር ትከፍያለሽ/ትከፍላላቹ? | _____ብር | | | | |
| 213 | በአንድ መኝታ ቤት ስንት የቤተሰብ አባላት ትተኛላቹሁ? | አንድ ----------1 | | | | |
| | | ሁለት ----------2 | | | | |
| | | ሦስት ----------3 | | | | |
| | | አራት ---------- 4 | | | | |
| | | አምስትና ከዛበላይ ---------- 5 | | | | |

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | የመልስ አማራጮች | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|
| **ክፍል III. የስነ-ወሊድ ታሪክና ሁኔታ የሚዳስስ** | | | | |
| 301 | እስካሁን ስንት ጊዜ አርግዘሻል?<br>ይሄ ማለት ሁሉም የእርግዝና ብዛት ያካትታል። | የእርግዝና ብዛት: _____ | | |
| 302 | እስካሁን የወሊድሺው ብዛት ስንት ነው?<br>ይሄ ማለት ሁሉም ከ28 የእርግዝና ሳምንታት በላይ የተወለዱትን ብዛት ያጠቃልላል። | የወሊድ ብዛት: _____ | የእርግዝናዋ ብዛት አንድ ከሆነ ወደ 401 ይሂዱ | |
| 303 | ከዚህ በፊት ከ 2500 ግራም በታች የሚመዘን ህጻን ወልደሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 304 | ውርጃ ወይም ጽንስ መቋረጥ አጋጥሞሽ ያወቃል? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 306 | |
| | | አላስታዉስም ---------- 99 | 306 | |
| 305 | ያጋጠመሽ የጽንስ መቋረጥ ብዛት ስንት ነበር? | የጽንስ ማቋረጥ ብዛት: _____ | | |
| 306 | አሁኑ የወለድሺው/ሻት ልጅና የመጨረሻው ልጅሽ የስንት ወራት ልዩነት አላቸው? | _____ (በወራት) | | |
| **ክፍል IV. የአሁን እርግዝና ታሪክና ሁኔታ ሚዳስስ**<br>**እናትየዋ የእርግዝና ክትትል ታደርግ ከነበረ አንድ አንድ ጥያቄዎች ከክትትል ካርዱ ይሙሉ።** | | | | |
| 401 | ህጻኑ/ዋ በስንተኛው የእርግዝና ሳምንታት ተወለደ/ች?<br>እባክዎትን “ከLMP” ያስሉት ወይም የአልትራሳውንድ ንባብ ካለ ከንባቡ ይሙሉት። | **የተወለደበት/ችበት የእርግዝና ሳምንታት:** | | |
| | | “ከLMP” የተሰላ፡ _____ ሳምንታት | | |
| | | ከአልትራሳውንድ የተሰላ፡ _____ ሳምንታት | | |
| 402 | አሁኑ የወለደችው በምን ዓይነት መንገድ ነበር?<br>**(ማስታወሻ፤ ከካርድ ይሙሉት)** | በማህጸን/በተለመደው ----------1 | | |
| | | በመሳርያ በመታገዝ ----------2 | | |
| | | በቀዶ ጥገና ---------- 3 | | |
| 403 | ከማርገዝሽ በፊት ወይም በመጀመርያዎቹ 3 የእርግዝና ወራት የክብደትሽ መጠን ተለክተሽ ነበር? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 405 | |
| | | አላስታዉስም ---------- 99 | 405 | |
| 404 | (አዎ ከ ሆነ መልስዋ) የክብደትሽ መጠን ስንት ኪሎግራም ነበር? | የክብደት መጠን በ ኪ.ግ: _____ | | |
| | | አላስታዉስም ---------- 99 | | |
| 405 | በአሁኑ ሰወስተኛው ዙር/ክፍል እርግዝናሽ (7 ወር እና ከዛበላይ) የክብደትሽ መጠን ተለክተሽ ነበር? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 407 | |
| | | አላስታዉስም ---------- 99 | 407 | |
| 406 | (አዎ ከሆነ መልስዋ) ለመጨረሻ ግዜ የተለካሺው የክብደትሽ መጠን ስንት ኪሎግራም ነበር? | የክብደት መጠን በ ኪ.ግ: _____ | **Gestational weight gain**: _____Kg | |
| | | አላስታዉስም ----------99 | | |

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | መልሶች | | | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|---|---|
| 407 | በአሁኑ የእርግዝናሽ ወቅት የእርግዝና ክትትል ለማድረግ ወደ ጤና ተቋም ሂደሽ ታውቂያለሽ? | አዎ ---------- 1 | | | | |
| | | አይደለም ---------- 2 | | | 414 | |
| 408 | የመጀመርያው ክትትል ስታደርጊ የስንት ወር እርጉዝ ነበርሽ? | ወር: _____ | | | | |
| | | አላስታዉስም ----------99 | | | | |
| 409 | በአሁኑ እርግዝናሽ ወደ ጤና ተቋም የእርግዝና ክትትል ለማድረግ የሄድሽበት ጠቅላላ ብዛት በቁጥር ስንት ነበር? | የክትትል ብዛት: _____ | | | | |
| | | አላስታዉስም ----------99 | | | | |
| 410 | የእርግዝና ክትትል አገልግሎት በብዛት ይሰጥሽ የነበረ በለሞያ የስራ መአርግ ምን ነበር? | ሐኪም/ዶክተር ----------1 | | | | |
| | | ጤና መኮነን ---------- 2 | | | | |
| | | ነርስ/አዋላጅ ነርስ ----------3 | | | | |
| | | አላስታዉስም ----------99 | | | | |
| | | ሌላ (ይገለጽ) _____ 88 | | | | |
| 411 | በአሁኑ እርግዝናሽ እንደ አንድ የእርግዝና ክትትል አገልግልግሎት ብያንስ አንዴ፡ የክብደት መጠን ተለክተሽ ነበር? የደም ግፍት መጠን ተለክሽ ነበር? የሽንት ናሙና ሰጥተሽ ነበር? የደም ናሙና ሰጥተሽ ነበር? | | አዎ | አይደለም | | |
| | | ክብደት | 1 | 2 | | |
| | | የደም ግፊት | 1 | 2 | | |
| | | የሽንት ናሙና | 1 | 2 | | |
| | | የደም ናሙና | 1 | 2 | | |
| 412 | በአሁኑ የእርግዝና ክትትል ጊዜ ስለ የእርግዝና አደገኛ ምልክቶች ተነግሮሽ ነበር? | አዎ ---------- 1 | | | | |
| | | አይደለም ---------- 2 | | | 414 | |
| | | አላስታዉስም ---------- 99 | | | 414 | |
| 413 | የተነገሩሽ የእርግዝና አደገኛ ምልክቶች ምን ነበሩ? | | አዎ | አይደለም | | |
| | | በማህጸን ደም መፍሰስ | 1 | 2 | | |
| | | የንሽርት ዉሃ ቀድሞ መፍሰስ | 1 | 2 | | |
| | | ከባድ የራስ ምታት | 1 | 2 | | |
| | | የዓይን ብዥታ | 1 | 2 | | |
| | | ትኩሳት | 1 | 2 | | |
| | | ከባድ የሆድ ቁርጠት | 1 | 2 | | |
| | | አላስታዉስም ---------- 99 | | | | |
| | | ሌላ (ይገለጽ) _____ 88 | | | | |
| 414 | በዚህኛው የእርግዝናሽ ወቅት የአይረን እንክብል ተሰጥቶሽ ወይም ገዝተሽ ታውቂያለሽ? **(የአይረን እንክብሉ ያሳይዋት)** | አዎ ---------- 1 | | | | |
| | | አይደለም ---------- 2 | | | 416 | |
| | | አላስታዉስም ---------- 99 | | | 416 | |
| 415 | በጠቅላላው የእርግዝናሽ ወቅት የአይረን እንክብል ለስንት ቀናት ያህል ወሰደሽ? | የቀናት ብዛት፡ _____ | | | | |
| | | አላስታዉስም ---------- 99 | | | | |

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | መልሶች | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|
| 416 | በዚህኛው የእርግዝናሽ ወቅት ለሆድ ትላትል የሚሆን መድሃኒት ተሰጥቶሽ ወይም ገዝተሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 417 | ከዚህ በፊት የደም ግፊት በሽታ እንዳለሽ በሐኪም ተነግሮሽ ያውቃል? **(ማስታወሻ፤ ከካርድ ያረጋግጡ)** | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 418 | በአሁኑ እርግዝናሽ በእርግዝና ምክንያት የሚነሳ የደም ግፊት በሽታ አለብሽ ተብለሽ ነበር? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 419 | በዚህ የእርግዝናሽ ወቅት የደም ማነስ አለብሽ ተብለሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 420 | በዚህ የእርግዝናዋ ወቅት የደም መጠንዋ (Hgb) ስንት ነበር **(ከካርድ ይሞላ)**? | _____ግራም% | | |
| 421 | ከዚህ በፊት የስኳር በሽታ እንዳለሽ በሐኪም ተነግሮሽ ያውቃል? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 422 | በአሁኑ እርግዝናሽ በእርግዝና ምክንያት የሚነሳ የስኳር በሽታ አለብሽ ተብለሽ ነበር? **(ማስታወሻ፤ ከካርድ ያረጋግጡ)** | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 423 | በአሁኑ እርግዝናሽ በእርግዝና ምክንያት የሚነሳ ከመጠን ያለፈ የማስመለስ በሽታ ታምመሽ ወይም አለብሽ ተብለሽ ነበር? **(ማስታወሻ፤ ከካርድ ያረጋግጡ)** | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 424 | በዚህ እርግዝናሽ የትኛዉም የአካል አደጋ ወይም ጉዳት አጋጥሞሽ ያውቃል? (ለሁሉም ዓይነት ጉዳቶች ያውጣጡ) | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |
| 425 | የአሁኑ እርግዝና ፈልገሽ ወይም በፈለግሽው ጊዜ ነበር ያረገዝሺው? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | | |
| | | አላስታዉስም ---------- 99 | | |

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | መልሶች | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|
| **ክፍል V. የእኗኗር ዜይቤና ግላዊ ልማዶች የሚዳስስ** | | | | |
| 501 | በአሁኑ እርግዝናሽ ወቅት አልኮልነት ያለቸው መጠጦች ጠጥተሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 503 | |
| | | አላስታዉስም ---------- 99 | 503 | |
| 502 | በምን ያህል ግዜ ትጠጪ ነበር? | ሁሉ ግዜ ---------- 1 | | |
| | | በሳምንት ሦሥቴ ---------- 2 | | |
| | | በሳምንት አንዴ ---------- 4 | | |
| | | በወር አንዴ ---------- 5 | | |
| 503 | በአሁኑ እርግዝናሽ ወቅት ጫት ቅመሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 505 | |
| | | አላስታዉስም ---------- 99 | 505 | |
| 504 | በምን ያህል ግዜ ትቅሚ ነበር? | ሁሉ ግዜ ---------- 1 | | |
| | | በሳምንት ሦሥቴ ---------- 2 | | |
| | | በሳምንት አንዴ ---------- 4 | | |
| | | በወር አንዴ ---------- 5 | | |
| 505 | በአሁኑ እርግዝናሽ ሲጋራ አጭሰሽ ታውቂያለሽ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 507 | |
| | | አላስታዉስም ---------- 99 | 507 | |
| 506 | በምን ያህል ግዜ ታጨሺ ነበር? | ሁሉ ግዜ ---------- 1 | | |
| | | በሳምንት ሦሥቴ ---------- 2 | | |
| | | በሳምንት አንዴ ---------- 4 | | |
| | | በወር አንዴ ---------- 5 | | |
| **ማስታወሻ፤ ጥያቄ 507 እና 508 ለባለትዳሮች/አብረው ለሚኖሩ ብቻ የሚጠየቅ ስለሆነ ከመጠየቅዎ በፊት ጥያቄ ቁጥር 206 በማየት የትዳር ሁኔታዋን ያረጋግጡ።** | | | | |
| 507 | ባለቤትሽ ወይም አብሮሽ የሚኖር በአሁኑ እርግዝናሽ አጠገብሽ ሁኖ ሲጋራ ያጨስ ነበር? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 509 | |
| | | አላስታዉስም ---------- 99 | 509 | |
| 508 | በምን ያህል ግዜ ያጨስ ነበር? | ሁሉ ግዜ ---------- 1 | | |
| | | በሳምንት ሦሥቴ ---------- 2 | | |
| | | በሳምንት አንዴ ---------- 4 | | |
| | | በወር አንዴ ---------- 5 | | |
| 509 | እቤትሽ ውሰጥ በአሁኑ እርግዝናሽ ሌላ ሲጋራ የሚያጨስ ሰው ነበረ? | አዎ ---------- 1 | | |
| | | አይደለም ---------- 2 | 601 | |
| | | አላስታዉስም ---------- 99 | 601 | |
| 510 | በምን ያህል ግዜ ያጨስ/ታጨስ ነበር? | ሁሉ ግዜ ---------- 1 | | |
| | | በሳምንት ሦሥቴ ---------- 2 | | |
| | | በሳምንት አንዴ ---------- 4 | | |
| | | በወር አንዴ ---------- 5 | | |

| **ክፍል VI: የእናትየዋ የስነ-ምግብ ልኬት** | | | |
|---|---|---|---|
| 601 | የእናትየዋ የ”MUAC” ልኬት በሴ.ሜ? | “MUAC”: _____ ሴ.ሜ | |
| 602 | የእናትየዋ የቁመት ልኬት በሴ.ሜ? | ቁመት: _____ ሴ.ሜ | |

**ክፍል VII**: **የእናት የድብርት መጠን ልኬት**

በቅርቡ እርጉዝ በነበርሽበት ጊዜ ይሰሙሽ የነበሩ ስሜቶችን ማወቅ እንሻለን። ስለሆነም እባክሽን ባለፉት **ሰባት ቀናቶች** ***(የዛሬውን ብቻ ሳይሆን)*** ይሰማሽ የነበሩ ስሜቶችን ካሉት አራት አማራጮች የሚጠጋጋዉን መጠን በተዘጋጀው ክፍት ቦታ የራይት ምልክት (✓) አድርጊ። ያልገባሽ ወይም ግር ያለሽ ነገር ካለ መረጃ ሰብሳቢዉን መጠየቅ ትችያለሽ።

| **ተ.ቁ** | **እባክዎትን ለሚከተሉት 20 መስፈርቶች <u>ባለፈው ሳምንት</u> የተሰማዎትን ስሜት በደንብ ይገልጸዋል የሚሉትን አማራጭ ይምረጡ።** | **የትኛውም ቀን አልተሰማኝም (ከአንድ ቀን ያነሰ)** | **የተወሰኑ ወይም ትንሽ ቀናቶች ተሰምቶኛል (1-2 ቀን)** | **የሳምንቱ ግማሽ የሚሆን ተሰምቶኛል (3-4 ቀን)** | **የሚበዛውን ወይም ሁሉም ቀናቶች ተሰምቶኛል (5-7 ቀን)** | **የመልስ ውጤት** |
|---|---|---|---|---|---|---|
| 701 | ከዚህ በፊት በማያስጨንቁኝ ነገሮች ባለፈው ሳምንት ስጨነቅ ነበር። | | | | | |
| 702 | ምግብ መብላት ተስኖኝ ነበር። | | | | | |
| 703 | የሚሰማኝ የሀዘን ስሜት በቤተሰቦቼም ሆነ በጓደኞቼ እገዛ ይለቀኛል ብዬ አላስብም ነበር። | | | | | |
| 704 | እንደ ሌሎች ሰዎች ብቁ ነኝ ብዬ አላስብም ነበር። | | | | | |
| 705 | ለምሰራቸው ስራዎች ትኩረት ማድረግ ያስቸግረኝ ነበር። | | | | | |
| 706 | የድብርት ስሜት ይሰማኝ ነበር። | | | | | |
| 707 | ሁሉም የምሰራው ስራ ልፋት ሆኖ ይሰማኝ ነበር። | | | | | |
| 708 | ስለመጪው ጊዜ ተስፋ የመቁረጥ ስሜት ይሰማኝ ነበር። | | | | | |
| 709 | እስካሁኑ ያሳለፍኩት ጊዜ (ህይወቴን) ውድቀት መስሎ ይሰማኝ ነበር። | | | | | |
| 710 | ፍራት ፍራት ይለኝ ነበር። | | | | | |
| 711 | ሥላማዊ እንቅልፍ አልተኛም ነበር | | | | | |
| 712 | ደስተኛ አልነበርኩም። | | | | | |
| 713 | በአብዛኛው ጊዜ ከምናገረው መጠን ባነሰ ስናገር ወይም ዝም ስል ነበር። | | | | | |
| 714 | የብቸኝነት ስሜት ይሰማኝ ነበር። | | | | | |
| 715 | ሰዎች ለኔ የሚመቹ/የሚሰማሙ አልነበሩም። | | | | | |

| ተ.ቁ | እባክዎትን ለሚከተሉት 20 መስፈርቶች ባለፈው ሳምንት የተሰማዎትን ስሜት በደንብ ይገልጸዋል የሚሉትን አማራጭ ይምረጡ። | የትኛውም ቀን አልተሰማኝም (ከአንድ ቀን ያነሰ) | የተወሰኑ ወይም ትንሽ ቀናቶች ተሰምቶኛል (1-2 ቀን) | የሳምንቱ ግማሽ የሚሆን ተሰምቶኛል (3-4 ቀን) | የሚበዛውን ወይም ሁሉንም ቀናቶች ተሰምቶኛል (5-7 ቀን) | የመልስ ውጤት |
|---|---|---|---|---|---|---|
| 716 | ህይወት ለኔ አስደሳች አልነበረችም። | | | | | |
| 717 | አለቅስ ነበር። | | | | | |
| 718 | ሀዘን ይሰማኝ ነበር። | | | | | |
| 719 | ሰዎች ጠልተውኛል ብዬ አስብ ነበር። | | | | | |
| 720 | ነገሮችን እንዳሰብኩት ማስኬድ አልቻልኩም ነበር። | | | | | |
| | **ድምር ውጤት** | | | **የድብርት ደረጃ** | | |

## ክፍል VIII፡ በ ባለቤት/የንሮ ኣጋር የሚደርስ ጾታዊ ጥቃት የሚዳስስ

| ተ.ቁ | ጥያቄዎችና ማብራሪያዎች | መልሶች | | | ይሂዱ | የመልስ ኮድ |
|---|---|---|---|---|---|---|
| **ማስታወሻ፡ ጥያቄ 800 <u>የድብርት ደረጃቸው 3</u> ለሆነና ለባለትዳሮች/አብረው ለሚኖሩ ብቻ የሚጠየቅ ስለሆነ ከመጠየቅዎ በፊት የድብርት ደረጃቸውንና ወቅታዊ የትዳር ሁኔታቸውን ያረጋግጡ።** | | | | | | |
| 800 | በአሁኑ የእርግዝና ወቅት ባለቤትሽ/የንሮ ኣጋሪሽ .....? | | **አንድ ጊዜ ብቻ፡ 3** | **ከአንድ ጊዜ በላይ: 4** | | |
| | ሀ. ገፍትሮሽ ወይም በጥፊ መቶሽ ያውቃል | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | ለ. በቦክስ፣ በካልቾ መቶሽ እና/ወይም ጎቱቶሽ፣ በመሳርያ አስፈርርቶሽ ወይም አደጋ አድርሶብሽ ያውቃል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | ሐ. በሰዎች ፊት ክብርሽን የሚነኩ ንግግሮችን ተናግሮሽ ወይም ድርጊት ፈጽሞብሽ ያውቃል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | መ. ሰድቦሽ ወይም ስለራስሽ መጥፎ ስሜት እንዲሰማሽ አድርጎ ያውቃል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | ረ. ሆን ብሎ አስደንግጦሽ ወይም አስፈራርቶሽ ያውቃል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | ሠ. አንቺ ሳትፈልጊ ጉልበቱን በመጠቀም ወይም በማስገደድ የግብረ-ስጋ ግንኙነት አድርጋችኋል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| | ሸ. አንቺ የማትፈሊጊው የግብረ-ስጋ ግንኙነት ዓይነት እንድታደርጉ አስገድዶሻል? | አዎ | 3 | 4 | | |
| | | አይደለም | 2 | | | |
| **ለነበረን ቆይታና ላሳየሺኝ ቀና ትብብር በእኔና በጥናቱ ቡድን ስም ላመሰግንዎት እወዳለሁ!** | | | | | | |

## ANNEX III: All models of determinant variables by birth weight, Addis Ababa, Ethiopia, 2013.

| Variables | 1st model | 2nd model | 3rd model |
|---|---|---|---|
| | COR (95% CI) | AOR (95% CI) | AOR (95% CI) |
| **Age** | | | |
| ≤24 Years | **2.32 (1.50-3.59)** | **2.21 (1.32-3.71)** | 0.72 (0.36-1.43) |
| ≥35 Years | **2.66 (1.25-5.67)** | 1.68 (0.63-4.50) | 2.20 (0.53-9.10) |
| 25-34 Years | 1 | 1 | 1 |
| **Avg. monthly income** | | | |
| ≤1500 Birr | **3.68 (2.07-6.55)** | **3.36 (1.71-6.58)** | 2.00 (0.93-4.3) |
| 1501-2500 Birr | **3.25 (1.19-4.26)** | **3.32 (1.16-4.64)** | 2.05 (0.90-4.68) |
| ≥2501Birr | 1 | 1 | 1 |
| **Depression status** | | | |
| Depression of any degree | **5.48 (3.15-9.54)** | **4.11 (2.08-8.15)** | **3.45 (1.29-9.23)** |
| No depression | 1 | 1 | 1 |
| **Domestic violence** | | | |
| Yes | **6.52 (3.59-11.84)** | **5.95 (2.94-12.04)** | **6.45 (2.41-17.28)** |
| No | 1 | 1 | |
| **ANC visit frequency** | | | |
| <4 Visits | **1.991 (1.22-3.24)** | **2.01 (1.14-3.56)** | **2.76 (1.32-5.77)** |
| ≥4 visits | 1 | 1 | 1 |
| **Fertility desire** | | | |
| Yes | 1 | 1 | 1 |
| No | **1.67 (1.03-2.71)** | **1.89 (1.13-3.16)** | 1.49 (0.78-2.85) |
| **History of excessive vomiting** | | | |
| Yes | **1.912 (1.261-2.900)** | **1.82 (1.09-3.01)** | 1.70 (0.91-3.17) |
| No | 1 | 1 | 1 |
| **History of Anemia** | | | |
| Yes | **2.081(1.233-3.541)** | **2.13 (1.11-4.09)** | 1.84 (0.82-4.11) |
| No | 1 | 1 | 1 |
| **No of days iron took** | | | |
| 0 days | **2.06(1.20-3.53)** | **2.45 (1.31-4.58)** | **2.89 (1.32-6.34)** |
| 1-30 days | 1.08 (0.60-1.94) | 0.93 (0.47-1.81) | 0.91 (0.40-2.08) |
| ≥31 days | 1 | 1 | 1 |
| **Gestational wt gain** | | | |
| ≤8Kg | **6.54 (3.68-11.62)** | **6.05 (3.30-11.09)** | **7.01 (3.33-14.78)** |
| >8Kg | 1 | 1 | 1 |
| **Mothers MUAC** | | | |
| <23cm | **2.58 (2.58-3.94)** | **1.93 (1.14-3.27)** | **1.94 (1.01-3.73)** |
| ≥23cm | 1 | 1 | 1 |
| **Mothers height** | | | |
| ≤155cm | **2.78 (1.75-4.42)** | **2.44 (1.36-4.39)** | **2.74 (1.32-5.66)** |
| >155cm | 1 | 1 | 1 |
| **History of Anyone smoking** | | 1 | |
| Never | 1 | **3.70 (1.19-11.43)** | 1 |
| Once or more a week | **4.390 (1.830-10.532)** | 1 | 1.96 (0.48-7.95) |