WOLKITE UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF STATISTICS

PREVALENCE AND FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT AMONG NEONATAL BORN IN GURAGE ZONE: A CASE OF ATAT GENERAL HOSPITAL.

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ABSTRACT

The Main purpose of this research is that statistically to analysis the causes of low birth weight among neonatal born because of it affects newborn. The objective of this study was to identify and study the effect of the factors associated with low birth weight among neonatal Born at Atat general hospital.

The main independent variables included in this research are educational level of mother, birth order of newborn, diet during pregnancy, multiple child status, occupations status, economics status, malaria status, age in years, place of residence and birth weight of baby

For this research 84 sample were selected from 3012 women found in Atat general hospital. The statistical methods that are used in this study were descriptive statistics like frequency table and inferential statistics like chi-square test and binary logistic regression.

The result of binary logistic regression revealed that malaria status, birth order of newborn, diet during pregnancy, multiple child status and birth weight of baby statistically significant predictors of low birth weight. To ensure an improved factor of the services in Atat general hospital improving women's education level would play a great role in enhancing low birth weight services.

Key words: Descriptive analysis, chi-square test, binary logistic regression that are used to Analysis the model on low birth weight among neonatal born.

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List of Acronym

ELBW: Extremely Low Birth Weight

LBW: Low Birth Weight

MLBW: Moderate Low Birth Weight

NBW: Normal Birth Weight

PTB: Pre-Term Birth

SGA: Small for Gestational Age

SNNPR: South Nation Nationality of people Region

UNICEF: United Nations International Children's Emergency Fund

VLBW: Very Low Birth Weight

WHO: World Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Low birth weight is defined as a weight of newborns at birth less than 2500 gram by World Health Organization. More than 20 million infants are born with low birth weight in worldwide (Weise. A et al. ,2019 and United Nations., 2019).

Low birth weight is an indicator of a public health problem and also, an important predictor of newborn health and survival (Unicef., 2004). Globally, each year an estimated 2.9million babies die in their first months of life. More than 80% of neonatal mortality occurs among low birth weighted newborns in southern Asia and Sub-Saharan Africa (Unicef et al., 2004, Trends in maternal mortality: 1990 to 2013, WHO et al. ,2019). Birth weight is the most important criteria for determining the neonatal and infant's morbidity and mortality. Babies with low birth weight are more vulnerable to risks as compared with normal weighted newborns. From low-middle income countries; systemic reviews revealed that those newborns with low birth weight were increased risk of neonatal morbidity and mortality (Berhan Y., 2013).

Low birth weight is not only a predictor of prenatal morbidity and mortality, but studies have found that it also increases the risk for non-communicable diseases such as diabetes mellitus and cardiovascular diseases in later life (Int J Epidemiol et al., 2011&WHO et al., 2019). Studies have shown that newborn with low birth weight demonstrates growth retardation and persistent short stature in their life. In most cases, this is linked with abnormal growth hormone secretion and it is associated with poorer school performance (Bertrais S et al. 2001& Chatelain P et al. ,2007)

Globally, neonatal mortality accounts for 40 percent of all deaths among children less than five years. Seventy-five percent of neonatal deaths occur during the first week of life, and between 25 to 45 percent occur within the first 24 hours. Preterm birth is the most common direct cause of newborn mortality. Preterm birth and Small for Gestational Age (SGA) which are the reasons for low birth weight (LBW) are important indirect causes of neonatal deaths, contributing 60 to 80 percent of all neonatal deaths globally (UNICEF&WHO., 2004). Worldwide, the main causes of

neonatal deaths are infections 35 percent, preterm birth 28 percent and asphyxia 23 percent (Lawn Katarzyna, & Cousens., 2006).

In Africa infections contributes 39 percent, prematurity 25 percent and asphyxia 24 percent. Low birth weight underlies majority of these deaths and links to maternal health, nutrition and infections such as Malaria and human immune deficiency. Low birth weight and preterm birth are major determinants of perinatal survival, infant morbidity and mortality as well as risk of developmental disabilities and illnesses throughout future lives. Birth weight has emerged as the leading indicator of infant health and welfare and the fundamental focus of infant health policy (Agarwal& Chaudhary. V .2012). Babies born with LBW are more likely to have health problems and slower development from immediately after birth to later in life.

According to Ethiopian demographic health survey 2011, 29.1% newborns were reported as low birth weight and it associated with maternal educational status, lack antenatal care during pregnancy, maternal age at delivery and medical illness during pregnancy (Alemu T et al., 2016). A study conducted on causes of neonatal mortality in southwest Ethiopia shown that low birth weight babies were two times more likely to die when compared to newborns with weight ≥ 2500g (Plos ONE et al., 2014). Study findings revealed that low birth weight was resulted from poor maternal health service utilization preconception and during pregnancy. It is important to ensure that every pregnant woman and newborn have access to good quality care and life-saving interventions (Sangamon R et al., 2015). Therefore, the study was aimed to determine the prevalence and factors associated with low birth weight among neonatal at Atat general hospital garage zone Southern Ethiopia.

1.2. Statement of problem

According to the World Health Organization definition infant with birth weight less than 2,500g are low birth weight. Out of 121 million births in a year 23 million has LBW and high proportion of who are found in developing countries (Nigusie B et al., 2014). Babies born low birth weight are 37 percent more likely to die during infancy compared to those of normal weight if other factors are held constant.

Low birth weight is also associated with many socio-economic factors such as place of residence, education, mothers' age and occupation, birth order, family income and many maternal conditions such as nutritional status, cigarette smoking and health status (Bodeau-Livinec, 2011).

This study helps to provide solution for problem and helps to achieve sustainable development goals by reducing child mortality rate if use this study as baseline and further study done in future.

The question that initiates for this study is:

- What is the prevalence of low birth weight among neonatal born at Atat general hospital?
- What factors are associated with low birth weight among neonatal born at Atat general hospital?

1.3. Objectives of the study

1.3.1. General objective of the study

The General objective of the study would be to assess the prevalence and factor associated with Low Birth Weight among the neonatal born at Atat general hospital.

1.3.2. Specific objectives of the study

In line with general objective the specific objectives will be:

- To determine the prevalence of low birth weight among neonatal born at Atat general hospital.
- To determine the factors associated with low birth weight among neonatal Born at Atat general hospital.

1.4. Significance of the study

The research is all about the prevalence and factor associated with low birth weight among neonatal born at Atat general hospital. The completion of this research has the following advantages.

- The result of this study serves as a baseline for other wide studies as well as for planning health intervention to improve the wellbeing of children and women in Gurage zone, Cheha woreda in particular.
- The study would provide useful information that will inform health facilities prepare special care for LBW neonates, most dies within 24 hours of delivery due to absence of adequate and special care.
- Identification of maternal risk factors associated with LBW is also essential in order to guide program planning, and organizing care for mothers and their newborns.
- The finding of this study supplemented that appropriate family planning service utilization prevent unintended pregnancy and helps to space birth interval.
- As result of this study showed unintended pregnancy and short birth interval was significantly associated with low birth weight of newborn. Thus, quality family planning service has great contribution to prevent low birth weight among newborns.

1.5. Scope of the study

The purpose of this study is to determine the prevalence and factors associated with low birth weight among neonatal born at Atat general hospital. This will help to make recommendations for action to reduce the occurrence of the problem.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Definition of low birth weight

Birth weight is a precursor for many health outcomes. It explains child mortality and later morbidity. It is also an intermediate endpoint of maternal lifestyles and health status. It is a powerful predictor of an individual baby's survival. Generally, the lower the birth weight, the higher the risk of infant mortality. Due to its implications on health outcomes, birth weight is dichotomized; 'Low birth weight' (LBW) as a category of babies weighting less than 2500 grams at birth and 'Normal birth weight (NBW) which is a birth weight of greater than 2500 grams (WHO, 2004).

LBW do occur because an infant is born too early in pregnancy (pre-term birth (PTB)) or is born at full-term but is growth restricted. It is estimated that about two-thirds of LBW infants are born preterm (Dunkel Schetter et al., 2012). LBW is sometimes further divided into three categories; moderate low birth weight (MLBW (1500-2499 g)), very low birth weight (V LBW (1000-1499 g)) and extreme low birth weight (E LBW (less than 1000 g)). In 2010, PTB was the second leading cause of child deaths worldwide (Liu et al., 2012) and Malawi had the highest prevalence of PTB in the world (Blencowe et al. ,2012).

Information on associated factor of LBW in Ethiopia is scarce. But different study finding was documented at different time and place on prevalence of LBW. Study conducted on birth weight in bahir dar town, Ethiopia document the prevalence of LBW to 21.23% in bahir dar (Gebremedhin G et al., 2015). This study aimed to assess the prevalence and factor associated of LBW among deliveries in Atat General Hospital which could be very helpful to design appropriate measures to counteract the problem.

Various studies have shown LBW to be a significant cause of infant morbidity and mortality (McCormick, 1985). For instance, McCormick found that LBW babies are typically 20 or more times more likely to die than NBW babies. It is also reported that about 38% of child mortality that occurs in the first month is directly related to birth weight (Nazari et al., 2013), and that between 60-80% of all neonatal deaths is attributed to low birth weight (Sachdeva et al., 2013).

2.2. Socio-demographic risk factors

Socio-demographic factors such as maternal age, socioeconomic status/family income, ethnicity and education. These are highly complex. They have their own predictor effect. Furthermore, they interact with behavioral and health related factors.

2.2.1. Maternal age

Studies conducted worldwide have provided evidence that maternal age is an important independent risk factor for LBW. LBW infants were more likely than NBW children to be born from women aged less than 20 years or greater than 35 years (Reime et al., 2006; Makgoba et al., 2012; Li et al., 2013; Negandhi et al., 2014; Dahlui et al. 2016). The overall prevalence was 7.8% with LBW proportion of 8.6%, 5.7%, and 11.3% in ages <25, 25-34, and 35-39 years respectively. Compared to 19-35-year age group, the women of age group more than 35 years were 5 times more likely to give birth to LBW. However, as regards women older than 35 years, it is speculated that pregnancy complications are responsible for LBW.

2.2.2. Education

Education remain a significant risk factor for LBW. The higher the education level of the mother the lower the risk of giving birth to LBW infants (Taha et al., 2012; Mohammad et al., 2014; Demelash et al., 2015). A 2016 study conducted in Nigeria by Dahlui and colleagues showed that the prevalence of LBW infants had an inverse association with educational level in women and the proportion of LBW was 14.9% among women without education, 8.0% among those with primary education, and 7.7% among those with high school or higher. In developing countries, the odds of giving birth to LBW infants among illiterate mothers was 1.5 times that of literate mothers (Mahumud et al., 2017).

Education level influences birth outcomes in a number of ways; age and economic activities. Young women are typically of lower education status and this lower age group is a strongly associated with high risk of LBW. Secondly, women of low education find it difficult to get well-paying jobs which offers better medical insurance. Low education also limits uptake of health services, hence low educated mothers are less likely to take adequate health care including prenatal care due to lack of capacity to make right decisions about their health and health of unborn child (Silvestrin et al., 2013). In short, minimum of high school level of education is important for better health care utilization and birth outcomes.

2.2.3. Socioeconomic status/family income

One of the factors influencing health status of the populations is the socio-economic level. It is measured using different variables most of which are income and occupation.

Women of low SES have poorer health and more likely to give birth to LBW infants than their counterparts (Lund et al., 1999; Demelash et al., 2015). Income variable is a known risk factor for LBW as disadvantaged circumstances may lead to inadequate access to healthcare, poor nutrition, low educational attainment, more smoking and drug abuse, and more stress which all contribute to poor fetal growth (Mohammad et al., 2014).

Income may also affect prevalence of LBW offspring by its influence on perinatal factors. Mothers of low income tend to have no or poor health insurance which result in poor health seeking behaviors and consequently having poor birth outcome including low birth weight (Mahmoodi et al., 2013). However, the association between offspring birth weight and income may be confounded by Age and race. Young women generally have lower socioeconomic status when compared to older women.

2.2.4. Ethnicity

Previous studies showed that certain groups of people are at more risk of giving birth to LBW infants (Dahlias et al., 2016). Even though it is not clear why there are racial differences in prevalence of LBW, it is postulated that behavioral, environmental, socioeconomic, genetic, and/or physiologic risk factors are responsible for the differences (Valero de Bernabé et al., 2004).

In a study conducted by (Makgoba et al., 2012), they found that women of non-white racial origin had higher risk of LBW infants than their counterparts. The black populations delivered smaller babies than white population did despite the former having significant higher average body mass index than the latter.

2.3. Growth in LBW children

Do LBW infants grow normally? What are the consequences of LBW on body size, composition, strength and cognitive development? Attaining full growth potential is 40 especially important for women and girls in order to break the intergenerational cycle of LBW and have fewer delivery complications.

Maternal height is not only a reflection of genetic make-up, but also reflects her dietary history. From societal, community and individual standpoints, adolescents and adults born with LBW generally have less strength and lower lean body mass resulting in decreased work capacity and lost productivity, which may cost nations billions of dollars (Martorell et al., 1998).

According to one in four Very Low Birth Weight (VLBW) children and one in six SGA children had motor problems. It was found that there were no sex differences in motor problems in the VLBW group and for SGA children, the increased risk of motor problems was particularly in manual dexterity in boys.

CHAPTER THREE

3. DATA COLLECTION AND METHODOLOGY

3.1. Study area

This study will be conducted the hospital's service mainly Cheha woreda in the Gurage zone in SNNPR. The hospital began it is operation in 1969, Georgian Calendar. The hospital is located 175 km southwest of Addis Ababa, 17 km from the town of wolkite on the road to Hosanna.

The hospital has 97 beds. In addition, there are 44 beds in the maternity waiting home 11 beds in the nutrition rehabilitation unit and 5 beds in neonatal unit. Normal deliveries return to their area within 24 hours or stay in the postnatal Room.

3.2. Study design

Study design would be to assess the prevalence and factor associated with low birth weight among neonatal born and study will be conducts at Atat general hospital from in 2012 E.C.

3.3. Target population

The research study would be carried out on the low birth weight among neonatal born at Atat general hospital during the study period. The number of target population is N=3012 low birth weight newborn in Attat general hospital from in 2012 E.C.

3.4. Method of data collection

For this study the researcher was collected by using both primary source and secondary source of data collection. Primary source this data was collected by self-administer questionnaire, face to face interview and researcher himself would collect directly from women of age 15 to 49 who live in Atat general hospital. List of questions are arranging in predetermined sequence for a predetermine purposes depend on the freedom of the respondent offers response. secondary source this data is obtained from records and reports especially official data that is recorded for administrative purpose.

3.5. Inclusion and Exclusion criteria

3.5.1. Inclusion criteria

A mother who had given birth to a singleton live neonate at the Atat general hospital and willing to consent during the study was considered for the study.

- Women who gave birth during the study period
- With low birth weight and normal birth weight with no missing the most important information.

3.5.2. Exclusion criteria

- Women who give birth of preterm baby
- multiple pregnancies
- Maternal death following delivery
- serious illness in which the mother was unable to respond

3.6. Sample size determination and sampling technique

3.6.1. Sample size determination

Sample size, we understand a group of subjects that are selected from the general population and is considered a representative of the real population for that specific study.

In conducting researches that requires taking sample we always the strategy of deciding sample size. The decision is important because taking too large sample cause the west of resources while too small reduces the useful information.

The sample size will be calculated using an assumed proportion (p) of 21.23% from the prevalence of LBW in a previous study conducted Amhara region in bahir dar, Ethiopia (Gebremedhin G et al., 2015), considering 5% non-response rate. In this study the sample size will determine by using proportions, for categorical data.

Normally the sample size determination requires four factors which is:

1. Desired level of precision
2. Level of significance
3. Margin of error 5%
4. Estimated proportions

Since $Z\alpha/_2$ $=z_{0.025}$ =1.96, α = The significance level = 0.05 and d = The margin error=0.09

P= Proportion in the target population estimated to have LBW, P =0.2123.

Q= Proportion in the target population estimated to have abnormal LBW =1-P=1-0.2123=0.7877.

The sample size determination formula adopt for this study is:

$$n_o=\left(\frac{Z\alpha/_2}{d}\right)^2 * pq \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(1)}$$

Where: $n_{o=}$Initial sample size n = The overall sample size, N = total population size, $Z\alpha_{/2}$ =Tabulated normal distribution and d= The margin error

$$n_o=\frac{(1.96)^2(0.2123)(0.7877)}{(0.09)^2}=80$$

Since the non-respondents of 5% were added to calculate sample size.

n=80+4 = 84

When $\frac{no}{N}$ is < 0.05 it needs adjustment, but when it is 5%>n_o, n_o=n, no need of adjustment

- **Otherwise**

$n = \frac{n_o}{1+{n_o}/_N}$(Cochran, (1997): the sample size determination and sampling theory of 3rd Edition.)

$\frac{84}{3012}$ =0.028 or 2.8% which is greater than alpha (0.05) since it doesn't need adjustments.

Generally based on our number of sample size we distribute the questionnaires to the population of women by selecting 84 samples from the population of women Atat general hospital.

3.6.2. Sampling technique

Sampling technique is a system of taking sample selection from large population with the purpose of getting information of those large populations from the sample observation by statistical technique. Simple random sampling (SRS) was employed to select study participants, because of there is no heterogeneity regarding to this research study.

3.7. Variable of the study

3.7.1. Dependent variable

Dependent variable is variable which explains that the variable whose value is used to estimate by independent variable (Variable which is affected by independent variable).

Table 3.1: Description of the response variable for this study

Response variable	Representation of variable	Categories
Low birth weight	Y	0=" Doesn't have low birth weight" (>=2500gm)
		1=" Having low birth weight" (<2500gm)

3.7.2. Independent variable

Independent Variables are defined as a characteristic that we (ones who are conducting the experiment) manipulate to identify a particular factor, and also known as factor or prediction variable.

Table 3.2: The independent variables listed below

- **Socio-demographic factors:** Age, Residence, Education Level of Mother & Birth Order newborn.
- **Labor characteristics:** Occupation of mothers, Economic status, Birth weight of baby.
- **Mothers health status:** Malaria status, Diet during pregnancy & Multiple child status.

Table 3.2.1: The independent variables and their categories of Socio-demographic characteristics of women at Atat general hospital.

Demographic characteristics	Categories	Code
Age in years	<20 years	0
	20-35 years	1
	>35 years	2
Residence	Urban	0
	Rural	1
Education level of mother	No formal education	0
	Primary (1-8)	1
	Secondary (9-10)	2
	Higher	3
Birth order newborn	One	0
	Two	1
	More than two	2

Table3.2.2: The independent variables and their categories of health characteristics women at Atat general hospital.

Mother Health status	Categories	Code
Malaria status	No	0
	Yes	1
Diet during pregnancy	Well eat	0
	Under eat	1
Multiple child status	No	0
	Yes	1

Table 3.2.3: The independent variables and their categories of labor characteristics of women at Atat general hospital.

labor characteristics	Categories	Code
Birth weight of baby	>2500gm	0
	<2500gm	1
Economic status	Rich	0
	Middle	1

	Poor	2
Occupation status	Governmental employee	0
	House wife	1
	Agricultural work	2
	Other	3

3.8. Method of data analysis

The method of collecting data will analyze by using descriptive statistics and inferential statistics.

3.8.1. Descriptive statistics

The techniques most of describing the characteristics of the sample and the major study variables are displayed in the form of frequency distribution, percentage, proportion and diagrammatic representation such as Bar chart, Pie-chart, Histogram and Cross-Tabulation.

3.8.2. Inferential statistics

Inferential statistics is statistical method that deals with making inference or conclusion about population based on data obtains from a limited number of observations that come from the population. Inferential statistics consists of estimation and the hypothesis testing. The most appropriate methods are Chi-square test of independence and binary logistic Regression.

3.8.3. Chi-square test of independence

Chi-square test for independence, the test is applied when the data have two or more categorical variables from a single population. It is used to determine whether there is an association between the two variables.

Assumption of chi-square test of independence

- The sample must be randomly selected from the population.
- The population must be normally distributed to the variables
- The expected frequency of each category must be at least 5.
- The observation must be independent of each other.

The chi-square test statistics is given by:

$X^2{}_{cal}=\frac{\sum_{i=1}^{R}\sum_{j=1}^{C}(Oij-Eij)^2}{Eij}$ = ~$X_\alpha{}^2$ $((r-1)\ (c-1))$…….... (2)

Where: Eij = is the expected frequency,Oij = is observed frequency, $(R-1)(C-1)$= Degree of freedom, Ri-Number of rows and Cj -Number of columns

$Eij=\frac{Ri*Cj}{N}$…… (3)

Hypothesis for Chi-square test of independence

H_O=there is no association between the dependent and explanatory variables

H_1= there is association between the dependent and explanatory variables

Critical region: - $X_\alpha{}^2(r-1)(c-1)$, where r and c are number of levels for one categorical variable.

If level of significance is greater than p-value, or If$X^2{}_{cal}$>X^2tab, we reject the null hypothesis H_0. We conclude that there is association between the dependent and explanatory variables.

3.8.4. Introduction to Logistic Regression model

Regression methods have an integral component of any data analysis concerned with describing the relationship between a response variable and one or more explanatory variables. It is often the case that the outcome variable is categorical, taking on two or more values. Logistic regression model can be used mainly for two reasons. The first is from a mathematical point of view, it is an extremely flexible and easily used function, and the second it leads itself to meaningful interpretation (Hosmer and Lemeshow, 2011). When the outcome variable is binary or dichotomous many distribution functions have been proposed for use. In order to valid the analysis the model should satisfy the binary logistic regression model.

Binary logistic regression

Binary logistic regression is the form of regression which is used when the dependent variable is dichotomous and the independent variables are of any type.

It allows the effects of the explanatory variables (infant sex, age in years, residence, marital status, and others) to be assessed across the logit models and provides estimates of the significance.

Many response variables are binary, represent the success and failure outcomes by 1 and 0.

Y= a neonate is a having low birth weight

$$y = \begin{cases} 1 = \text{the presence of low birth weight} \\ o = \text{absence of low birth weight} \end{cases}$$

We view y as a realization of a random variable Y that can take the values one and zero with probabilities π and 1 − π, respectively. The distribution of Y is called a Bernoulli distribution with parameter π, and can be written in compact form as:

$$\Pr(Y = y) = \pi^{y}\pi^{1-y} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

It is fairly easy to verify by direct calculation that the expected value and variance of Y are $E(Y)$ $=\pi$, and $var\ (Y) = \pi(1-\pi)$ .This special case for binomial distribution with n=1.

The binary logistic regression model is defined as

$$\pi(x) = \frac{\exp(^{\beta 0+\beta 1x1+\beta 2x2+\cdots+\beta kxk)}}{1+exp^{(\beta 0+\beta 1x1+\beta 2x2+\cdots+\beta kxk)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Where: β_0 = the constant of the equation

$\beta 1, \beta 2, \ldots, \beta_k$ = the coefficients of the i[th] predictor

$X1, X2, \ldots, Xk$ = are independent variables in the model

Assumption of binary logistic regression

- The dependent variable must be dichotomous.
- A binary response Y is then independent of x
- Transformed linear will be done using logit function.
- The outcomes are independent and mutually exclusive.
- The dependent variable should be categorical (qualitative).

The general model for binary logistic regression is as follows:

$$\text{Log it } (\pi i) = \log\left(\frac{\pi i}{1-\pi i}\right) = \left(\exp\left(\beta_0 + \beta_1 x_1 + \ldots.. + \beta_k x_k\right)\right)$$

Which means that exp^{Bj} where (j=1, 2…k) is factor by which the odds of occurrence of success change by a unit increase is the j^{th} independent variables.

If we take the natural logarithm of odds ratio, we obtain estimated model given by:

$$ln\left(\frac{\pi i}{1-\pi i}\right) = zi = \beta 0 + \beta 1x1 \ldots \beta kxki$$

Where: pi= probability of normal low birth weight.

$1 - pi$ = a probability of abnormal low birth weight.

Odds and Odds Ratio

Logistic regression analysis utilizes odds and odds ratio. The odds of success are simply the ratio of probability of success π (the probability that having low birth weight, y=1) to probability of failure 1- π (the probability that doesn't having low birth weight, y=0). That is,

$$odds = \frac{\pi i}{1-\pi i} \ldots\ldots (6)$$

Where: πi =the probability of success, i.e., normal low birth weight and $1 - \pi i$=the probability of failure, i.e., abnormal low birth weight

Interpret: The odds are non-negative with value greater than one when a success is more likely than a failure.

The odds ratio, denoted by OR, is defined as the ratio of the odds for y=1 to the odds for y=0 and is given by:

$$OR = \frac{\pi(1)}{1-\pi(1)} * \frac{1-\pi(0)}{\pi(0)} \ldots\ldots (7)$$

Interpret: Odds ratio is an estimate of the risk of an exposed group relative to a control group or unexposed (reference) group. Odds ratio less than 1 indicates negative relationship and odds ratio greater than 1 indicates positive relationship and odds ratio equal 1 indicates no difference between exposed and control group.

3.9. Parameter Estimation for Logistic Regression

The most commonly used methods of estimating the parameter of a logistic regression model is the method of maximum likelihood (ML) estimation. The method of maximum likelihood estimation yields to estimate values for the unknown parameters which maximize the probability of obtaining the observed set of data.

Consider the logistic model $P(X_1) = \frac{e^{X\beta}}{1+e^{X\beta}}$, since observed values of Y say, Y_i's $(i = 1, 2 \ldots n)$ are independently distributed as binomial and, the maximum likelihood function of Y is given by:

$$L(\beta|Y) = \prod_{i=1}^{n} p(Y_i|X_{i1}, X_{i2} \ldots . X_{ik}) = \prod_{i=1}^{n} \left[\frac{e^{X\beta}}{1+e^{X\beta}}\right]^{Y_i} \left[\frac{1}{1+e^{-X\beta}}\right]^{1-y_i} \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The maximum likelihood estimates the parameters is found by the derivation of the log likely hood function with respect to each" β_j" and given as:

$$\frac{dlogL\left(\beta \mid Y\right)}{d\beta j} = 0,\ j = 1, 2 \ldots \ k$$

3.10. Applying and Building Logistic Regression

Variable selection

The several computational techniques for generating subset regression models and illustrate criteria for evaluating the model are all possible regression which requires that the analysis if all regression equations involving one candidate regressor, two candidate regressor and so on. And the second is step wise-type procedures which consists forward selection, back ward elimination and step-wise regressor. In this study we use step –wise regression.

Step-wise regression

Step-wise regression is a modification of forward selection in which at each step all regressor entered in to the model are reassessed and also, it is a combination of forward selection and backward elimination procedure. It has advantage in terms of the number of subset models check before each subset size is decided.

The criteria for a variable in the model may vary one problem to other and from one scientific discipline to another. The rational for minimizing the number of the variables in the model is that

result model is more likely to be numerically stable and more easily generalized. The more variables included in the model, the greater estimated standard errors become and the dependent variable model becomes an observed data.

3.11. Goodness-of-fit of the Model

Measures of goodness of fit are statistical tools used to explore the extent to which the fitted response obtained from the postulated model compares with the observed data. Clearly, the fit is good if there is a good agreement between the fitted and the observed data.

3.11.1. Statistical tests of the overall fit

Likelihood-Ratio Test

The likelihood ratio test statistic (LRT) is the most common test for assessment of overall goodness of fit of logistic regression model. The likelihood-ratio test is used to test the ratio of the maximized value of the likelihood function for the full model (L_{ful}) over the maximized value of the likelihood function for the reduced model (L_{red}). It tests that the parameters in the full model are equal zero. It is compared with a X^2 distribution with one degree of freedom. This log transformation of the likelihood functions yields a chi-squared statistic.

The likelihood-ratio goodness-of-fit test statistic is given by:

$$G^2 = -2\text{Log}\left(\frac{L_O}{L1}\right) = -2Log(L_O - L1) \quad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Where: L_0 and L_1 are the log likelihood function of the reduced and full model, respectively (Hosmer and Lemeshow, 2011).

Statistical hypothesis of Likelihood ratio test

$H_O: \beta_j = 0$ (the coefficient no associated with the predictor).

$H_1: \beta_j \neq 0$ (the coefficient associated with the predictor).

Since the p-value is less than at a given level of significance we will reject H_O and we conclude that the predictor has an effect on the choice of response variable.

Hosmer-Lemeshow Test

A commonly used test of the overall fit of a model to the observed data is the Hosmer-Lemeshow test. Hosmer-Lemeshow goodness of fit test divides subjects into deciles based on predicted probabilities and constructs a "goodness -of-fit" statistic by comparing the observed and predicted number of events in each group. The differences between the observed number and expected number (calculated by summing predicted probabilities based on the model) in each group are then assessed using a chi-square test.

The Hosmer-Lemeshow goodness-of-fit test statistic is given by:

$$\hat{C} = \sum_{j=1}^{g}\left(\frac{(Oj_Ej)^2}{Vj}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where: $Ej = n\pi j$, $Vj = n\pi j\,(1 - \pi j)$, g is the number of groups, Oj is observed number of events in the kth group, Ej is expected number of events in the jth group, and Vj is a variance correction factor for the jth group.

Statistical hypothesis of Homers' and lemeshow Test

H_O= Model is not good to fit the data

H_1= model is good to fit the data

If the difference between the observed number of events and what is expected by the model is large, then the statistic $\hat{C}$ becomes large and there will be evidence against the null hypothesis that the model is adequate to fit the data. Assuming that the null hypothesis that the model fits well $\hat{C}$ has an approximate chi-square distribution with g-2 degrees of freedom (Hosmer and Lemeshow, 2011).

3.11.2The R Square Statistic

A number of measures have been proposed in logistic regression as an analogy to R^2 in multiple linear regressions. The Cox and Snell measure is based log-likelihoods and considers sample size. The maximum value that the Cox and Snell R^2attain is less than 1. The NagelkerkeR^2 is an adjusted version of the Cox and Snell R^2 and covers the full range from 0 to 1, it is often preferred.

Therefore, in this study R^2statistic to indicate how useful the explanatory variables are in predicting the response variables were used.

$$R_{js}{}^2 = 1 - e^{\left[-\frac{2}{n}[D(model\ without\ the\ variable) - D(model\ with\ the\ variable)]\right]}$$

The Nagelkerke measure is as follows:$R_N{}^2 = \frac{R_{cs}{}^2}{R_{MAX}{}^2}$,

Where $R_{MAX}{}^2 = 1 - \exp[2(n)^{-1} D(model\ without\ the\ variable)]$

3.11.3. Statistical tests of individual parameters

Wald test

The Wald test is also an alternative test which is commonly used to test the significance of the individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in logistic regression analysis that a particular logit (effect) coefficient is zero (Agresti, 1996).

The Wald test is obtained by comparing the maximum likelihood estimate of the parameter" β_j" to an estimate of its standard error.

The Wald goodness-of-fit test statistic is given by:

$$w = \left(\frac{\hat{\beta} j}{s.e(\hat{\beta} j)}\right)^2 \text{..... (13)}$$

Statistical hypothesis for Wald test

$H_O : \hat{\beta} j = 0$ (the coefficient no associated with the predictor).

$H_1 : \hat{\beta} j \neq 0$ (the coefficient associated with the predictor).

If $w > X^2$ we will rejectH_O at a given level of significance and we conclude that the independent variables X_i has a significant effect on the Probability of success (binary response).

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

The objective of this Chapter is to describe and make analysis about the effect of major socio-demographic characteristics, labor characteristics and health characteristics on low birth weight among neonatal born. In this study, the analysis consists of two sections. In the first section, descriptive analysis is presented using SPSS; in the second section, the results obtained from binary logistic regression analysis are presented using SPSS software.

4.1 Descriptive Analysis

Descriptive analysis is a process of describing a given set of data by tables and summary calculations. In this study, the researchers employed cross tabulation to describe both dependent and independent variables.

Table 4.1 percentage of low birth weight among neonatal born.

	frequency	Percent
Doesn't have low birth weight	46	54.76
Having low birth weight	38	45.24

In the above tabular value from 84 respondent 46(54.76%) doesn't have low birth weight among neonatal born and 38(45.24%) respondents are having low birth weight among neonatal born.

From table 4.2 below there is association between multiple child status, birth weight of baby and birth order of new born those are significance and their P -value less than α-value where as there are no association between rate of age in years, place of residence, educational level of mother, occupations status, economics status, diet during pregnancy and malaria status) those are insignificant p-value greater than α-value.

Table 4.2 Summary of descriptive statistics and Result of Chi-square test of independence Association of low birth weight among neonatal born with selected explanatory variables

Variables	Categories	Low birth weight; among neonatal born			Chi-square	Df	P-value
		Doesn't have low birth weight	Having low birth weight	Total			
		Count (%)	Count (%)	Count (%)			
Age in years	<20	10(21.7%)	9(23.7%)	19(22.6%)	0.479	2	0.787
	20-35	26(56.5%)	23(60.5%)	49(58.3%)			
	>35	10(21.7%)	6(15.8%)	16(19.0%)			
Residence	Urban	21(45.7%)	21(55.3%)	42(50.0%)	0.769	1	0.381
	Rural	25(54.3%)	17(44.7%)	42(50.0%)			
Educational level of mother	No formal education	12(26.1%)	6(15.8%)	18(21.4%)	1.551	3	0.671
	Primary education	16(34.8%)	15(39.5%)	31(36.9%)			
	Secondary education	11(23.9%)	9(23.7%)	20(23.8%)			
	Higher education	7(15.2%)	8(21.1%)	15(17.9%)			
Birth order of new born	One	11(23.9%)	12(31.6%)	23(27.4%)	8.240	2	0.016
	Two	22(47.8%)	7(18.4%)	29(30.5%)			
	More	13(28.3%)	19(50.0%)	32(38.1%)			
Diet during pregnancy	Well eat	29(63.3%)	27(71.1%)	56(66.7%)	0.601	1	0.438
	Under eat	17(37.0%)	11(28.9%)	28(33.3%)			
Multiple child status	No	29(63.0%)	33(86.8%)	62(73.8%)	6.097	1	0.014
	Yes	17(37.0%)	5(13.2%)	22(26.2%)			
Birth weight of baby	>2500gm	37(80.4%)	21(55.3%)	58(69.0%)	6.169	1	0.013
	<2500gm	9(19.6%)	17(44.7%)	26(31.0%)			
Economics status	Rich	9(19.6%)	7(18.4%)	16(19.0%)	0.080	2	0.961
	Middle	24(52.2%)	21(55.3%)	45(53.6%)			
	Poor	13(28.3%)	10(26.3%)	23(27.4%)			
Occupations status	House wife	13(28.3%)	9(23.7%)	22(26.2%)	3.510	3	0.319
	Agriculture work	14(30.4%)	13(34.2%)	27(32.1%)			
	Governmental employee	5(10.9%)	9(23.7%)	14(16.7%)			
	Other	14(30.4%)	7(18.4%)	21(25.0%)			
Malaria status	No	38(82.6%)	26(68.4%)	60(76.2%)	2.309	1	0.129
	Yes	8(17.4%)	12(31.6%)	20(23.8%)			

Based on table 4.2, the proportion of having low birth weight among neonatal born with age groups: less than 20 years, 20 -35 years, and greater than 35 years were 9(23.7%), 23(60.5%) and 6(15.8%) and the proportion of doesn't have low birth weight among neonatal born with age group: less than 20 years, 20 -35 years, and greater than 35 years were 10(21.7%), 26(56.5%) and 10(21.7%), respectively.

The proportions of having low birth weight among neonatal born based on place of residence categories: urban and rural, were 21(55.3%) and 17(44.7%) and the proportions of doesn't have low birth weight among neonatal born based on place of residence categories: urban and rural, were 21(45.7%) and 25(54.3%), respectively.

The proportions of having low birth weight among neonatal born based on educational level of mother's who are no formal education 12(26.1%), primary education 16(34.8%), secondary education 11(23.9%) and higher education 7(15.62) doesn't have low birth weight and while those educational level of mother's who are no formal education 6(15.8%), primary education 15(39.5%), secondary education 9(23.7%) & higher education 8(21.1%) as well as having low birth weight.

The proportions of having low birth weight among neonatal born based on birth order of new born categories one 12(31.6%) two 7(18.4%) and more 19(50.0%) and the proportions of doesn't have low birth weight among neonatal born based on birth order of new born categories one 11(23.9%) two22(47.8%) and more13(28.3%) respectively.

The proportions of having low birth weight among neonatal born based on economics status categories rich 7(18.4%) middle 21(55.3%) and poor 10(26.3%) and the proportions of doesn't have low birth weight among neonatal born based on economics status categories rich 9(19.6%) middle 24(52.2%) and poor 13(28.3%) respectively.

The proportions of having low birth weight among neonatal born based on occupations status categories house wife 9(23.7%) agriculture work 13(34.2%) governmental employee 9(23.7%) and other 7(18.4%) and the proportions of doesn't have low birth weight among neonatal born based on occupations status categories house wife 13(28.3%) agriculture work 14(30.4%) governmental employee 5(10.9%) and other 14(30.4%) respectively.

The proportions of having low birth weight among neonatal born based on multiple child status categories no 33(86.8%) and yes 5(13.2%) and the proportions of doesn't have low birth weight among neonatal born based on multiple child status categories no (63.0%) and yes 17(37.0%) respectively.

The proportions of having low birth weight among neonatal born based on malaria status categories no 26(68.4%) and ye 12(31.6%) and the proportions of doesn't have low birth weight among neonatal born based on malaria status categories no 38(86.6%) and yes 8(17.4%) respectively.

The proportions of having low birth weight among neonatal born based on birth weight of baby status categories greater than 2500gm 21(55.3%) and less than 2500 17(44.7%) and the proportions of doesn't have low birth weight among neonatal born based on birth weight of baby categories greater than 2500gm 37(80.4%) and less than 2500gm 9(19.6%) respectively.

The proportions of having low birth weight among neonatal born based on diet during pregnancy categories well eat 27 (71.1%) and under eat 11(28.9%).and the proportions of doesn't have low birth weight among neonatal born based on diet during pregnancy categories well eat 29(63.0%) and under eat 17(37.0%) respectively.

4.2. Binary Logistic Regression Model Analysis

Binary logistic regression model was used to analyze the relationships between the low birth weight among neonatal born and each of independent variables which are incorporated in the model. The analysis was employed by using SPSS and the output of the software is interpreted as follows:

4.2.1. Model Adequacy Checking

Hosmer And Lemeshow Test

Assessing the overall significance of a statistical model is essential in order to get valuable information from the data that we have collected for the research.

After a logistic regression model has been fitted, a global test of goodness of fit of the resulting model should be performed it is necessary to see the appropriateness, adequacy and usefulness of the fitted model.

Table 4.3 Result of hosmer and lemeshow test

Step	Chi-square	Df	Sig
1	6.619	8	0.578

In the case of Hosmer-Lemeshow test we say that the model is good fit if P- value is insignificant (P- values greater than α=0.05) and not good fit if p-value is significant (p-values is less than α=0.05). Since from this table the p-value= 0.578 is greater than α=0.05, the statistical level of insignificance and it implies that not reject the null hypothesis (Ho). So, we conclude that the model is a good fit of data.

Table 4.4 Omnibus tests of model coefficients

		Chi-square	Df	Sig
Step1	Step	44.780	17	0.000
	Block	44.780	17	0.000
	Model	41.238	17	0.000

H_O: $\beta_1 = \beta_2 = \ldots. = \beta_K = 0$

Ha: at least one coefficient is different from zero.

From the above table, the p-value (0.000) is less than α=0.05, the statistical level of significance and it implies that we reject the null hypothesis (Ho), and accept the alternative hypothesis. Therefore, we Conclude that at least one coefficient is significantly different from zero.

Table 4.5 model summary

Step	-2log likelihood	Cox & snell R square	Nagelkerke R square
1	70.2905	0.413	0.553

From this table 4.4 the Cox and Snell R Square is 41.3% and Nagelkerke R Square is 55.3 % of the variability is explained by explanatory variable i.e., the model which includes the explanatory variables explains between 41.3% and 55.3 % of low birth weight among neonatal born.

4.2.2 Interpretation of the results from the Binary Logistic Regression model

As can be seen in Table 4.6, all the independent variables incorporated in the binary logistic regression model had statistically significant effect on low birth weight.

Table 4.6 Results of the binary logistic regression model

Variables	Categories	B	S. E	Wald	Df	Sig	Exp(B)	95% CI EXP(B)	
								Lower	upper
Intercept		0.609	1.541	0.156	1	0.693	1.838		
Age	20-35	1.036	1.213	0.729	1	0.393	2.818	0.261	30.389
	> 35	0..328	1.002	0.107	1	0.743	1.388	0.195	9.888
	<20(Ref)								
Residence	Rural	0.108	0.765	0.020	1	0.888	0.114	0.249	4.987
	Urban (Ref)								
Educational level of mother	Primary	-2.363	1.305	3.279	1	0.070	0.094	0.007	1.215
	Secondary	-0.333	0.970	0.118	1	0.731	0.717	0.107	4.794
	Higher	0.021	1.011	0.000	1	0.983	1.022	0.141	7.406
	no formal (Ref)								
Birth order of new born	Two	0.762	0.878	0.753	1	0.385	2.143	0.383	11.988
	>Two	-2.782	1.085	6.578	1	0.010	0.062	0.007	0.519
	One (Ref)								
Diet during pregnancy	under eat	3.0266	1216	6.196	1	0.013	20.612	1.903	223.282
	Well eat (Ref)								
Multiple child status	Yes	3.401	1.238	7.2550	1	0.006	29.983	2.651	339.139
	No (Ref)								
Birth weight of baby	<2500	-2.344	0.869	7.277	1	0.007	0.096	0.017	0.527

	>2500 (Ref)								
Economics status	Middle	-1.682	1.283	1.720	1	0.190	0.186	0.015	2.298
	Poor	-2.099	1.134	3.423	1	0.064	0.123	0.013	1.133
	Rich (Ref)								
Occupations status	Agricultural	-0.400	0.906	0.195	1	0.659	0.671	0.114	3.956
	governmental	0.947	0.891	1.131	1	0.288	2.579	0.450	14.783
	Others	2.182	1.184	3.397	1	0.065	8.865	0.871	90.232
	House wife (Ref)								
Malaria status	Yes	-2.996	1.163	6.635	1	0.010	0.050	0.005	0.480
	no (Ref)								

Ref =Reference Category

From table 4.6 above, the variables in the equation which fit the model for the logistic regression were only those which are statistically significant to the model i.e., those who have P-values less than 0.05 which are multiple child status, malaria status birth order of new born, diet during pregnancy and birth weight of baby, are statistically significant**.**

- ⇨ Since the equation is written in the form of the legit of the odd the success probability to the failure one.

$$ln\left(\frac{\pi i}{1-\pi i}\right) = zi\ = \beta 0 + \beta 1x1 \ldots \beta kxki$$

$$Zi\ =\ 0.609 - 2782X1 + 3.026X2 + 3.401X3 - 2.344X4 - 2.996X5$$

Where: - βo is constant.

β_1, β_2, ... βn are the parameter estimator.

Z_i = (0 if the respondents are satisfied (doesn't having low birth weight), 1 otherwise

X1= (birth order of new born, 1= for two category, 2= more than two category and 0= for one and as reference category)

X_2= (diet during pregnancy, 1= for under eat category, 0= for well eat and as reference category)

X_3= (multiple child status, 1= for yes category, 0= for no and reference category)

X_4 = (birth weight of baby, 1= <2500 category, 0= for >2500 and reference category)

$X_{5=}$ (malaria status,1=for yes category, 0=for no and reference category)

We can interpret the odds ratio of birth order of new born of women, who are said to be more than two order new born categories obtained in the above table using the reference category on one birth order new born. Women who are more than two birth order to get child are (OR=0.062;95% CI 0.007-0.519) times less likely to women who are one birth order category.

For the variable diet during pregnancy, the reference category is response well eat category. The odds ratio of women who are says it is under eat to get food are (OR =20.612, 95% CI 1.903-223.282) times more likely for women who are say it is well eat category.

For the variable multiple child status, the reference category is response no category. Women who are say I have multiple child status (yes)s are (OR=29.983; 95% CI 2.651-339.139) times more likely to women's who are no multiple child status.

For the variable birth weight of baby, the reference category is response greater than 2500 gm category. Women who are say birth weight of baby less than 2500gm are (OR=0.096;95% CI 1.0.017-0.527) times less likely to women's who are birth weight of baby greater than 2500gm category.

For the variable malaria status, the reference category is no category. women who are say exists (yes) are (OR=0.050;95% CI 0.005-0.489) times less likely to women who are no malaria status.

Wald test:

since Wald test is used to test the statistical significance of individual coefficient (β) in the model and the test statistic is a chi-square statistic.

The hypothesis to be tested is:

To conclude that the given coefficient is statistically significant to model, we see two things:

- ✓ The chi-square (Wald) statistics must be greater than tabulated statistic $(\chi 2_{\alpha\ /\ 2, n\ -\ 1})$
- ✓ P- Values of coefficients are less than the level of significance, α=0.05.

For birth weight of baby less than 2500gm category = $\beta_{1,}$ from the parameter estimation above; the chi-square statistics (Wald) =7.277 is greater than$X^2_{0.05,\ 1}$=6.169 the p-values for less than 2500gm category (β_1) =0.013 is less than 0.05 level of significance. Thus, based on this result we see that the coefficient of birth weight of baby less than 2500gm is statistically significant to the model.

4.3 Discussion of the results

This study provides information to identify the well-known factors that influence low birth weight based on prevalence and factors associated wight low birth weight among neonatal born in atat general hospital. The value from 84 respondent 46(54.76%) doesn't have low birth weight among neonatal born and 38(45.24%) respondents are having low birth weight among neonatal born.

To identify some determinant to know the use of low birth weight among neonatal born, in this research there were many total populations and the behavior of this many total populations was estimated based on the sample size 84 selected.

The chi-square test was carried out to determine the association between low birth weight and individual independent variables. as a result, birth order of new born, multiple child status and birth weight of baby were statistical significantly associated with low birth weight at 5%level of significance.

This study had focused on Binary logistic regression model of the determinants of low birth weight among neonatal born in atat general hospital. The explanatory variables that identified as determinant factors of low birth weight among neonatal born were: malaria status (yes), birth order of new born (more than two birth order), multiple child status(yes), diet during pregnancy (under eat) and birth weight of baby (less than 2500gm) were statistical significantly associated with low birth weight among neonatal born at 5% level of significance

CHAPTER FIVE

RECOMMENDATION AND CONCLUSION

5.1 Recommendation

This study tries to identify the factors affecting the prevalence and factors associated low birth weight among neonatal born on the study area. Based on result of our study we could recommend the following ways of solution to reduce factors that affect the low birth weight among neonatal born. All societies and concerned bodies must understand that existence of low birth weight and educational of women are the main determinant factors for the existence of low birth weight in the study area.

There should be the bodies (group of organization) that share enough and essential information is necessary for this area.

5.2 CONCLUSION

Since the aim of to study the existence of low birth weight among neonatal born is to improve the health of newborn it would be essential to study the factors that can improve the performance of the service.

From the result of our study there is association between existence of having low birth weight among neonatal born and doesn't have low birth weight among neonatal born.

Therefore, we conclude that the major factors are: -

- educational level of mothers (secondary education),
- birth order of new born (more than two),
- multiple child status(yes),
- diet during pregnancy (under eat) and birth weight of baby(2500gm)

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QUESTIONNARIES

WOLKITE UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

consent sheet

good morning, good afternoon according to the situation.

our name is_____, _____&_____we came from wolkite university. we are third year statistics students. I am fourth year midwifery student. we want to study about the prevalence and associated factors with low birth weight among neonatal born in attat general hospital. we will ask you some questions regarding my study. we will keep your confidentiality. if you don't agree, nothing will happen to you.

- **Mothers health status**

1. Malaria A. yes B.no
2. Diet during pregnancy A. well eat B. under eat
3. Multiple child status A.no B. yes

- **Socio-demographic factors**

1. How old are you? A. less than20 years B. Moderate 20-35 years C. Greater than35 years
2. Place of residence A. urban B. rural
3. Birth order of new born A.one B. two C.more than two
4. Educational level of mothers A.no formal education B. primary education C. Secondary education D. higher education

- **Labor characteristics**

1. Birth weight of your newborn (grams)_____?
2. Occupation of mothers A. house wife B. agriculture employee C. governmental employee D. Others

3. Economic status A. poor B. middle C. rich