Determinants of Preterm Birth among Newborns Delivered in Bahir Dar City Public Hospitals, North West Ethiopia

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Abstract

Background: Globally about 15 million newborns are born preterm every year. Over one million of them die due to complications related to prematurity. Preterm birth was a leading cause of neonatal death in Ethiopia. One in four of neonatal deaths in Ethiopia were due to prematurity related complications. But studies to identify determinants of preterm birth in the study area are limited.

Objective: To identify determinants of preterm birth among newborns delivered in Bahir Dar city public hospitals, North West Ethiopia in 2019.

Method: An institutional based unmatched case control study was conducted in 314 samples with 105 cases and 209 controls among newborns delivered in Bahir Dar city public hospitals. The sample size was calculated by Epinfo version7. All individual cases were selected consecutively. For each cases two controls were selected by using systematic random sampling technique. Data was collected using interviewer administrated structured questioners. The collected data was entered into Epinfo version 7 and then exported to SPSS version 20. Independent variables with p-value less than 0.2 in the bi-variable analysis were entered into multivariable logistic regression model. Statistical significance level was declared at p-value less than 0.05. Model assumption were checked by Hosmer-lemeshow goodness-of-fit test.

Result: The study identified; low birth interval AOR = 2.28 (95 % CI= 1.18- 4.42), lower number of ANC visit AOR = 3.89 (95 % CI =2.17- 6.97), previous history of preterm birth AOR = 5.69 (95 % CI =1.93- 16.66), premature rapture of membrane AOR = 3.58 (95 % CI =1.11-11.54), preeclampsia/eclampsia AOR = 2.86 (95 % CI =1.01- 8.08), lower level hemoglobin level AOR = 3.89 (95 % CI =2.01- 7.51) were positively associated with preterm birth.

Conclusion: Previous history of preterm births, preeclampsia and premature rapture of membrane, fewer number of antenatal care visit, lower birth interval, and lower hemoglobin level were found determinants of preterm birth. Therefore encouraging women to attend four or more antenatal care visits, health education on the importance of birth spacing and anemia prevention and treatment may help to prevent preterm birth.

Background

Preterm birth refers to babies born alive before 37 weeks of pregnancy are completed. Sub-categories of preterm birth, based on weeks of gestational age are: extremely preterm(< 28weeks) very preterm (28 to < 32 weeks), moderate to late preterm (32 to < 37 weeks) (1).

Prematurity is the leading cause of newborn deaths (babies in the first 4 weeks of life) and now the second leading cause of death after pneumonia in children under 5 years of age. Many survivors are face a lifetime of disability, including learning disabilities, cerebral palsy, intellectual impairment, chronic lung disease, non-communicable disease, visual and hearing problems(2).

Preterm birth (PTB) is an increasingly common complex condition with multiple risk factors and has substantial medical, psychological, economic and social impacts (3).

To prevent and improve survival of preterm birth, different interventions have been implemented which need huge financial capacity. Some of the interventions include antenatal corticosteroid, antibiotic, kangaroo mother care, immediate intensive care unit, family planning and long term complex health need cares. These interventions lead to a huge economic burden for the family and the community at large through implementations of policies, strategies and programs (2, 4). Globally and also nationally, there are different policies, strategies and programs which work on prevention and care of preterm birth. The global community made commitment through the sustainable development goals (SDGs) and women and child initiatives (5). The government of Ethiopia also showed its commitment to improve the care given for newborns and preterm births through inclusion of high impact life-saving neonatal interventions in its health sector transformation plan and newborn and child survival strategy (6, 7).

The estimated global preterm birth was 14·84 million (10·6%) in 2014. Twelve million (81·1%) of these preterm births occurred in Asia and sub-Saharan Africa. Over one million children die each year due to complications of preterm birth (2). Regional preterm birth rates ranged from 13·4% in North Africa to 8·7% in Europe(8). Death rate due to prematurity ranges from 5–18% across 184 countries (9). According to UN report, Ethiopia was among the five country which responsible for 50% of all newborn deaths in the World (10). The EMDHS 2019 estimates showed that 30 newborns die per 1000 live birth in Ethiopia(11). One in four of neonatal deaths in Ethiopia were due to prematurity related complications (12). Preterm babies were at high risk to serious illness or death during the neonatal period and those who survive were suffer from consequence of prematurity like breathing difficulties, feeding problems, jaundice, cerebral palsy, mental retardation, visual and hearing impairments, poor health and growth. The family and the society also suffer from economic burden of preterm birth(4).

The risk factors for preterm birth were; hypertensive disorders of pregnancy, maternal height < 1.50 m, PROM, anemia, urethral tract infection, maternal age < 20, birth interval < 2 years and multiple pregnancy were significantly associated with preterm birth (PTBs) (13–17).

There are barriers for implementation and scale up of interventions in low and middle income countries and the interventions also based on income level of the country. These barriers cause difficulty to expand and give qualified health care throughout the health system (18, 19).

In Ethiopia different interventions are being implemented to prevent preterm birth. To address maternal and child health problems, Ethiopian government set national heath extension program at different levels. But the death of neonates and consequences of preterm birth is not decreasing as needed (6).

The goal of national newborn and child survival strategy by 2020 reduce neonatal mortality rate from 28 to 11/1000 livebirth (7). But 2019 EMDHS showed that neonatal mortality rate was still high (30/1000 livebirth) (11) and major cause of death was PTB related complications (12). And also there is no recent study this area on the risk factors of preterm birth. Therefore, the major aim of this study was to identify

factors associated with PTB in Bahir dar city public hospitals, North West Ethiopia. This study will be help full to prevent preterm births by identifying its determinants and design appropriate interventions.

The findings of the study will help health care providers to understand determinants of preterm birth and on what to focus to prevent it.

Method And Materials

Study design and period

An institutional based unmatched case control study was conducted from September, 1 to October, 31, 2019 G.C.

Study area and population

In Bahir Dar city there are three public hospitals and four private hospital. The study was conducted in Bahir Dar city public hospitals. Those hospitals were located at different part of the city. Felege hiwot comprehensive specialized hospital was located at northern end of the Bahir Dar city near Lake Tana, Tibebe Ghion specialized hospital was located at southern end of the Bahir Dar city and Adis Alem hospital was located at eastern part of the Bahir Dar city. In Bahir Dar city 348,429 people living in this city, according to central statistical agency (CSA). Study population for cases were all newborns delivered before 37 weeks of gestation in Bahir Dar city public hospitals during the study period. Study population for controls were all newborns delivered ≥ 37 weeks of gestation in Bahir Dar city public hospitals during the study period. A total of 312 participants were involved in the study. This study excludes, Newborns with unknown last menstrual period (LMP) or absence of ultrasound evidence at the time of study period and also induced termination of pregnancy.

Measurements

Dependent variable was preterm birth where as   independent variables includes socio demographic variables such as maternal age, residences, maternal occupation, marital status, educational status. Obstetrics variables includes gravidity, parity, inter pregnancy interval, number of ANC visit, APH, preeclampsia/eclampsia., PROM, oligohydramnios, polyhydramnios history of abortion, history of preterm birth. Medical variables includes anemia, malaria and HIV/AIDS, STI, UTI.

Data collection tools and procedure

Data was collected using interviewer administrated structured questioner. The questioner was developed after relevant literature reviews (17, 20, 21). The questionnaire was prepared first in English then translated to Amharic and the Amharic version was used to collect the data. Before the actual data collection, the questionnaire was pretested among 5% of the sample size Client chart was review by using data extraction format to retrieve medical information and mother`s test that might not be captured by

the interviewer. The data was collect by 6 diploma nurses that of three data collector on each shift, supervises by one BSC nurses.

Data processing and analysis

After the completion of data collection, the raw data was entered in to a computer using EPI INFO version 7 computer software package for editing, cleaning, coding, and check incompleteness and consistency. Finally, the data was exported to SPSS version 23 for analysis. Descriptive analysis, including frequencies and percentages were done and presented in tables and figures. Bi-variable logistic regression analysis was done and also multivariable logistic regression analysis was used to determine the independent predictors of preterm birth. Variables having P-value less than 0.2 in the Variable analysis were remained in the multivariable model to control the effect of confounders. The 95% CI used to show the accuracy of data analysis. P value < 0.05 considered as statistically significant.

Ethical Consideration

Ethical clearance was obtained from institutional review board (IRB) of Bahir Dar University College of medicine and health sciences, school of public health, department of reproductive health and population studies. Ethical clearance letter was obtained from Amhara public health institution (APHI) and submitted to each of the three hospitals. Verbal consent was taken from each participant after explaining the aim of the study.

Results

Socio demographic characteristics of mothers

From a total 314 proposed samples, 312 mothers (104 cases and 208 controls) participated in the study, which means 99.3% response rate for both cases and controls. The median age of the mother with preterm birth was 25.00 ₉ 9 IQR and that of median age the mothers with term birth was 25.50 ₈8 IQR. More than half the respondents 55(53%) of mothers with preterm birth and 125(60%) of mothers with term birth were living in urban. Around 50% of cases and controls attended formal education. And also 39(37.5%) of cases and 84(40%) of controls were farmers (Table 2).

Obstetric history of mothers

In this study 79(76%) of mothers with preterm birth and 162(77.9%) of mothers with term birth were multigravida and 50(48%) of mothers in cases 58(27.9%) of mothers in controls were had short birth interval (less than 2 years). Forty five (43.3%) of mothers in cases and 146(70%) of mothers in control had at least four and above ANC visits. In this study 11(10.6%) of cases and 6(3%) of controls had premature rapture of membrane (PROM). Furthermore, 12(11.5%) of mothers in case and 9(4.3%) of mothers in control groups had exposed to preeclampsia/ eclampsia. ninety (18.3%) of cases and 6(2.9%) of controls had history of preterm birth (Table 3).

Medical conditions of mothers

In this study, 38(36.5%) of mothers in case and 23(11.1%) of mothers in controls had low hemoglobin level (<11 g/dl). Twenty one (20.2%) of mothers in the cases and 24(11.5%) of mothers in the controls had ureteral tract infection (UTI) (Table 4).

Factors associated with preterm birth

In the bi-variable binary logistic regression analysis model, there were nine variables with p-value less than 0.2 that entered into the multivariable logistic regression analysis model. In multivariable logistic regression analysis; birth interval, number of ANC visit, history of preterm birth, PROM, preeclampsia/eclampsia and hemoglobin level were found associated with preterm birth.

Short birth interval was positively associated with preterm birth. The odds of PTB among mothers who had birth interval < 2 years were 2.28 times higher as compared to those mothers who had birth interval >/= 2 years (AOR = 2.28, 95 % CI= 1.18- 4.42).

Number of ANC was significantly associated with preterm birth. The odds of PTB among mothers who had < 4 ANC visit were 3.89 times higher as compared to those mothers who had >/= 4 ANC visits (AOR= 3.89, 95 % CI =2.17- 6.97).

History of previous preterm birth was significantly associated with preterm birth. The odds of PTB among mothers who had previous history of preterm birth were 5.69 times higher as compared to those mothers who had not previous history of preterm birth (95 % CI =1.93- 16.66).

 Premature rapture of membrane (PROM) was significantly associated with preterm birth. The odds of PTB among mothers who had PROM were 3.58 times higher as compared to those mothers who had not PROM (AOR=3.58, 95 % CI =1.11-11.54).

Preeclampsia/eclampsia was positively associated with preterm birth. The odds of PTB among mothers who had preeclampsia/eclampsia were 2.86 times higher as compared to those mothers who had not preeclampsia/eclampsia (AOR=2.86, 95 % CI =1.01- 8.08).

Hemoglobin level was strongly associated with preterm birth. The odds of PTB among mothers who had hemoglobin level <11 g/dl were 3.89 times higher as compared to those mothers who had hemoglobin level >/=11 g/dl (AOR =3.89, 95 % CI =2.01- 7.51).

Discussion

The present study showed that maternal and medical factors were significantly associated with PTB. These included; previous history of PTB, hemoglobin level, preeclampsia/eclampsia, PROM, birth interval and number of ANC visits.

In this study, previous history PTB was associated with preterm birth. The odds of PTB among women who had history of PTB was 6 times higher compared to women who did not had history of previous PTB. This finding was supported with study done in Jimma (17) Malawi (22) and Iran (14). This may be due to stress, women who had history of PTB in the past may be anxious of the next birth, this may induce PTB, which is biologically plausible to be determinant of PTB.

The present study showed that the odds of PTB among mothers who had PROM were 4 times higher when compared to those mothers who had not PROM. This finding agree with the studies conducted in Deber Markos (23), Jimma (17), Kenya (16), Iran and Rural China (14, 24). The possible reason may be due to the fact that PROM elevate fetal plasma interleukin-6, initiating Synthesis of prostaglandinE2, which indicating that this fetal response may trigger preterm labor and delivery strongly with within 48 to 72 hours.

The current study also found that the number of ANC visits during pregnancy was another significant determinant of PTB. The odds of PTB among mothers who had less than 4 ANC visit were 4 times higher as compared to those mothers who had greater than or equal 4 ANC visit.   This finding was supported by other similar studies conducted in Jimma (17), Tigray (25), Tanzania (15) and rural China (24). This could be due to the fact that women with regular ANC follow up may have more chance to early detection of severe diseases or obstetrics complications and appropriate case management might be done.

This study also showed that birth interval was significantly associated with PTB. The odds of PTB among mothers who had birth interval less than 2 years were 2 times higher as compared to those mothers who had birth interval greater than or equal to 2 years. This finding agrees with the study done in Addis Ababa (21) and Jimma (17). This might be due to mothers with short birth interval are not physiologically, psychologically and economically well prepared to grow and accept the next coming new born, so they are at higher risk of PTB compared to those women having longer birth interval.

In this study hemoglobin level was associated with preterm birth. The odds of PTB among mothers hemoglobin level <11 g/dl were 4 times higher compared to mothers who had hemoglobin level >/=11 g/dl. This finding was supported by other similar studies conducted in Debre Markos (23) Tigray (20) and Malawi (22). Biologically anemia (<11gm/dl) causes for hypoxia, which can induce maternal and fetal stress, which stimulate the production of the corticotrophin-releasing hormone and enhances prostaglandin production, that lead to the initiation of preterm labor.

In this study preeclampsia/eclampsia was positively associated with preterm birth. The odds of PTB among mothers who had Preeclampsia/eclampsia were 3 times higher as compared to those mothers who had not Preeclampsia/eclampsia. This finding agree with the study conducted in Gondar (26), Jimma (17), Tanzania (15) and Iran (14). This could be due to hypertensive diseases that affects utero-placental blood flow which leads to intrauterine growth restriction this condition leads to changing balance of synthetic and metabolizing enzymes and hence greater prostaglandin availability that causes PTB delivery. The other reason might be due to complications of preeclampsia/eclampsia can cause

vascular damage to the placenta, which induces the oxytocin receptors, results in preterm labor and delivery.

Moreover, this study revealed that there is not statistically significant association between alcohol consumption during pregnancy and PTB. This finding is not supported by the study conducted in Tigray (20). The discrepancy might be done to under-reported of alcohol consumption by women in the current study area due to the fear of stigmatization and impact of sociocultural grounds.

Limitation of the study

This study had its own limitation, some variables like substances use was difficult to measure the amount.

Conclusion

According to this study the risk of developing preterm birth was high for those women with previous history of preterm birth, less than four of ANC visit, birth interval < 2 years, PROM, preeclampsia/eclampsia and hemoglobin level < 11g/dl.

Hospitals and health care providers should give due attention for early detection of mothers with previous history of PTBs. Therefore, reassurance of women with previous history of PTBs and early treatment for medical problems like preeclampsia/eclampsia and infection during pregnancy should be strengthen to improve the health of the mothers as well as the new born babies.

Health care providers should encourage all pregnant mothers to attend four or more ANC visits

Health care providers should give health education focused on the importance of birth spacing for at least 2 years.

Furthermore, Bahir Dar city public hospitals and their health care providers should focused on anemia prevention and treatment during pregnancy are recommended to prevent PTB.

Researchers should be identify further detail extra independent variable that leads to preterm birth.

Acronym And Abbreviations

ANC Ante-Natal Care

AOR Adjusted Odds Ratio

COR Crude Odds Ratio

EPI INFO Epidemiological Information

GA Gestational Age

HIV Human Immuno-deficiency Virus

HTN Hypertension

LNMP Last Normal Menstrual Period

MUAC Med Upper Arm Circumference

PIH Pregnancy Induced Hypertension

PTB Preterm Birth

SD Standard Deviation

SPSS Statistical Package for Social Science

UNICEF United Nation International Child Emergency Found

WHO World Health Organization

Declarations

Ethical approval and consent to participate

Procedures followed were in accordance with the ethical standards of the responsible committee from the Ethical Review Board of Bahir Dar University. Following the approval, Official letter of co-operation was written to for Bahir Dar city public hospitals. From those participants who is agreed to be included in the study verbal consent was taken.

Availability of data and material

The data supporting this finding can be available at any time with request.

Consent to Publish

Verbal agreement and consent have been made between the authors on when and where to publish the manuscript

Competing interests

The authors declare that they have no competing interests.

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This is from a developing country; our salary couldn't cover the fee for publication. This paper is original and has a great impact on to design prevention strategy for policymaker and it will be used as the base line data for future researchers. Therefore, we request your journal to publish this paper free

Authors' contribution

The first Author conceived the idea of the study, prepared the study proposal, collected data in the field performed the data analysis and drafted the manuscript. The second Author assisted with the preparation of the proposal and the interpretation of data, participated in data analysis, and critically reviewed the manuscript. The third and fourth authors participated in critical comments of the proposal and manuscript preparation. All authors read and approved the final manuscript

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Tables

Table 2: Socio demographic characteristics of mothers Bahir Dar city public hospitals, North West Ethiopia, 2019 (n=312).

Variables	Case n (%)	Control n (%)
Age		
<20 years	25 (24.0)	39 (18.8)
20-34 years	72 (69.2)	152 (73.1)
35-49 years	7 (6.7)	17 (8.2)
Place of residence		
Urban	55 (52.9)	125 (60.1)
Rural	49 (47.1)	83 (39.9)
Educational status		
Can't read & write	37 (35.6)	71 (34.1)
No formal education but read & write	9 (8.7)	11 (5.3)
Primary & secondary school	50 (48.1)	102 (49.0)
College & above	8 (7.7)	24 (11.5)
Maternal occupation		
House wife	32 (30.8)	55 (26.4)
employee	33 (31.7)	69 (33.2)
Farmer	39 (37.5)	84 (40.4)
Marital status		
Married	84 (80.8)	170 (81.7)
Single	11 (10.6)	27 (13.0)
Widowed/divorced	9 (8.7)	11 (5.3)

Table 3: Obstetric history of mothers in Bahir Dar city public hospitals, North West Ethiopia, 2019 (n=312).

Variables	Case n (%)	Control n (%)
Gravidity		
Premigravida	25 (24.0)	46 (22.1)
Multigravida	79 (76.0)	162 (77.9)
Parity		
Nuliparity	24 (23.1)	52 (25.0)
Multiparity	80 (76.9)	156 (75.0)
Birth interval		
No presiding birth	25(24.0)	52 (25.0)
< 2 years	50 (48.1)	58 (27.9)
>/= 2 years	29 (27.9)	98 (47.1)
Number of ANC visit		
None	5 (4.8)	12(5.8)
< 4 visit	54 (51.9)	50 (24.0)
>/= 4 visit	45 (43.3)	146 (70.2)
PROM		
Yes	11 (10.6)	6 (2.9)
No	93 (89.4)	202 (97.1)
Antepartum hemorrhage		
Yes	4 (3.8)	5(2.4)
No	100 (96.2)	203 (97.6)
Gestational DM		
Yes	1 (1.0)	3 (1.4)
No	103 (99)	205 (98.6)
Pregnancy induced hypertion		
Yes	2 (1.9)	5 (2.4)
No	102 (98.1)	203 (97.6)
Preeclampsia/eclampsia		
Yes	12 (11.5)	9 (4.3)
No	92 (88.5)	199 (95.7)

Hyperemesis gravidarum		
Yes	6 (5.8)	13 (6.3)
No	98 (94.2)	195 (93.8)
History of abortion		
Yes	12 (11.5)	15 (7.2)
No	92 (88.5)	193 (92.8)
History of preterm birth		
Yes	19 (18.3)	6 (2.9)
No	85 (81.7)	202 (97.1)

Table 4. Medical condition of mothers in Bahir Dar city public hospitals, North West Ethiopia, 2019 (n=312).

Variables	Case n (%)	Control n (%)
Hemoglobin level		
<11 g/dl	38 (36.5)	23 (11.1)
>/=11 g/dl	66 (63.5)	185 (88.9)
HIV		
Positive	3 (2.9)	4 (1.9)
Negative	101 (97.1)	204 (98.1)
Malaria		
Yes	7 (6.7)	9 (4.3)
No	97 (93.3)	199 (95.7)
Urethral tract infection		
Yes	21 (20.2)	24 (11.5)
No	83 (79.8)	184 (88.5)
Sexual transmitted infection		
Yes	10 (9.6)	14 (6.7)
No	94 (90.4)	194 (93.3)
Chronic hypertension		
Yes	6 (5.8)	11 (5.3)
No	98 (94.2)	197 (94.7)

Table 5: Factors associated with preterm birth among newborns delivered in Bahir Dar city public hospitals, North West Ethiopia, 2019 (n=312).

Variables	Case n	Control n	Crude OR (CI)	Adjusted OR (CI)	p-value
Residence					
Urban	55	125			
Rural	49	83	0.74 (0.46, 1.19)	1.12(0.59- 2.10)	0.721
Birth interval					
No presiding birth	25	52	1.62 (0.86-3.05)	1.69 (0.82-3.45)	
<2 years	50	58	2.91 (1.66-5.10)	2.28 (1.18- 4.42)	0.014
>/=2 years	29	98			
Number of ANC					
None	5	12	1.35 (0.45-4.04)	1.86 (0.56-6.13)	
< 4 visits	54	50	3.26 (1.99-5.33)	3.89 (2.17-6.97)	< 0.001
>/=4 visits	45	146			
History of abortion					
Yes	12	15	1.67 (0.75- 3.73)	1.66 (0.67-4.10)	0.270
No	92	193			
Previous history of PTB					
Yes	19	6	7.52 (2.90-19.50)	5.69 (1.93- 16.66)	0.002
No	85	202			
PROM					
Yes	11	6	3.98 (1.42-11.09)	3.58 (1.11, 11.54)	0.033
No	93	202			
Urethral tract infection					
Yes	21	24	1.94 (1.02- 3.68)	1.61 (0.72- 3.61)	0.281
No	83	184			
Preeclampsia/eclampsia					
Yes	12	9	2.88 (1.17- 7.08)	2.86 (1.01- 8.08)	0.047
No	92	199			
Hemoglobin level					
<11 g/dl	38	23	4.63 (2.56- 8.34)	3.89 (2.01- 7.51)	< 0.001
>/=11 g/dl	66	185			