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Prevalence and Factors Associated With Perinatal Mortality in Ethiopia Using 2005- 2016 Ethiopian Demographic and Health Surveys

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**BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND
HEALTH SCIENCE
SCHOOL OF PUBLIC HEALTH**

DEPARTMENT OF EPIDEMIOLOGY AND BIOSTASTICS

**PREVALENCE AND FACTORS ASSOCIATED WITH PERINATAL
MORTALITY IN ETHIOPIA USING 2005- 2016 ETHIOPIAN
DEMOGRAPHIC AND HEALTH SURVEYS**

BY: GEDEFAW ABEJE (BSc.)

**A THESIS TO BE SUBMITTED TO THE DEPARTMENT EPIDEMIOLOGY
AND BIOSTASTICS COLLEGE OF MEDICINE AND HEALTH SCIENCES
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FULFILMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTER OF
PUBLIC HEALTH IN EPIDEMIOLOGY.**

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BAHIR DAR, ETHIOPIA

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COLLEGE OF MEDICINE AND HEALTH SCIENCE SCHOOL OF
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DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS

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FULL TITLE OF THE RESEARCH	PREVALENCE AND FACTORS ASSOCIATED WITH PERINATAL MORTALITY IN ETHIOPIA(USING EDHS 2005-2016 DATA SETS)
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Abstract

Background: Perinatal mortality is death from twenty-eight weeks of gestation to the seventh day of birth. Globally 3.3 million stillbirths and 3 million early neonatal mortality occurred every year, and 98% of mortality was in developing world. Perinatal mortality in Ethiopia was reported to be 33 per 1000 births. Despite there were numerous studies conducted in specific local area with about perinatal mortality national representative studies are scarce in Ethiopia.

Objectives: To assess the prevalence and associated factors of perinatal mortality in Ethiopia using EDHS 2005 to 2016.

Methods: Community based Cross-sectional study design was used. EDHS 2005- 2016 data were used to assess the prevalence and factors associated with perinatal mortality with sample of 34,428 births. Weighting has been applied to adjust the difference in the probability of selection. STATA version 14.1 was used for data analysis. Both bivariable and multivariable logistic regression analysis was used to identify factors associated with perinatal mortality in Ethiopia.

Result: This study showed that perinatal mortality rate in Ethiopia was 39 per 1000 birth. Tetanus vaccination of 2+ during pregnancy decreased of perinatal mortality, whereas multiple births, caesarian delivery, birth interval less than 24 months, anemic mother, and large size at birth increased of perinatal mortality. Tetanus vaccination of 2+(AOR=0.80 ;95 % CI: 0.65 , 0.99) , multiple births (AOR =3.35; 95% CI: 2.44 , 4.61), delivered by caesarian section (AOR =2.11; 95 % CI: 1.18 , 3.76) ,having birth interval < 24 months (AOR =2.27; 95 % CI: 1.90 , 2.71) ,anemia of mothers (AOR =1.33; 95 % CI: 1.07 , 1.65),large size baby at births (AOR =1.99; 95 % CI: 1.61 , 2.46), were factors associated with perinatal mortality.

Conclusion: The finding of this study showed that the prevalence of perinatal mortality was high. Tetanus vaccination during pregnancy, types of birth, birth interval, anemia of mother, size of child at birth, mode of delivery, were factors for perinatal mortality. So strengthen the existing maternal, neonatal and child health program to reduce perinatal mortality is crucial.

Key word: perinatal mortality, EDHS, Ethiopia.

List of abbreviations and/or acronyms

ANC	Antenatal Care
AOR	Adjusted Odds Ratio
CI	Confidence Interval
COR	Crude Odds Ratio
CSA	Central Statistical Agency
DHS	Demographic and Health Survey
EDHS	Ethiopia Demographic and Health Survey
FAO	Food and Agriculture Organization
MCSP	Maternal and Child Survival Program
MOH	Ministry Of Health
PM	Perinatal Mortality
PMR	Perinatal Mortality Rate
PHC	Population and Housing Census
SSA	Sub-Saharan Africa
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization

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1. Introduction

1.1. Background

Perinatal mortality (PM) is death from 28 weeks of gestation to the first seven days of life (but not include the seventh day). Perinatal mortality rate (PMR) is calculated as the sum of stillbirths and early neonatal death divided by number of pregnancies of seven or more months' duration (total birth)(1, 2). Perinatal period is the period extending from the gestational age at which the fetus attains 28 completed weeks of gestation to the end of the seventh day of life(3). Perinatal mortality is an indicator which provides information needed to improve the health status of pregnant women and newborns. It is an important indicator of maternal care, health and nutrition, which reflects the quality of available obstetric and pediatric care(4).

The World health organization (WHO) set two goals such as ending preventable newborns deaths and preventable still births(5). By 2030 ,all countries will reach 12 or less newborn death per 1000 live birth and 12 or less still birth per 1000 total birth(5) .Similarly, the sustainable development goal is planned to reduce neonatal mortality as low as 12 per 1000 live births by 2030 (6). By 2035 all countries will reach the target of 10 or less newborn death per 1000 live births and all countries will reach the target of 10 or less stillbirth per 1000 total birth(5).

Ethiopia put strategy to reduce neonatal mortality rate from 28 to 11 /1000 live birth and still birth rate from 18 to 10 per 1000 birth by 2020(7, 8). Targets to be performed to reduce perinatal mortality in Ethiopia by 2020 are:- 95% of pregnant women start first antenatal care(ANC) visit before 16 weeks of gestation and have at least 4 ANC visit, supplement iron for 100% ANC attending women ,100% of women delivered in health facility being observed at least for 24 hours, and 75 % kebeles declare as home delivery free(8).

To achieve the goals there are strategic objectives such as strengthen and invest in care during labour ,birth and the first day and week of life, improve the quality of maternal and newborn care, reach every woman and new born to reduce inequalities or improve equitable access to quality reproductive health services , harness the power of parents ,families and communities, count every newborn (5, 7-9).Despite such goals and strategies PM remains health problem in Ethiopia .Assess the prevalence and factors associated with PM is important to prevent ,control and reduce PM.

1.2.Statement of the problem

Perinatal mortality has remained one of the chief public health challenges in the developing world especially in sub-Saharan Africa (10).

Globally there were 6.3 million perinatal death with PMR of 47 per 1000 births of which 98% of these deaths were in developing countries(4).Worldwide 50% of neonatal death occurs within 24 hours and 75 % were up-to the first seven days of life (11).Perinatal mortality rate in developed region was 10 per 1000 total birth while it was 50 per 1000 total birth in developing countries which indicates PMR was five times higher in developing than developed regions(4).According to the report of save the children globally 2.9 million babies died within 28 days of being born ,of these one million babies died within 24 hours and 1.2 million still birth were stopped heart beating during labor(12). Similarly, there were 2.9 million stillbirths, half of the still birth occurred in the intrapartum period and among 133 million babies born alive each year 2.8 million die in the first week of life(13) .

In Africa PMR was 62 per 1000 total birth and in eastern Africa , middle Africa ,northern Africa ,southern Africa and western Africa PMR were 58 ,75 ,34 ,37 and 76 per 1000 birth respectively(4).Specifically in south Africa province there were 38.7 % macerated, 21.8 % fresh still birth, and 39.4% early neonatal death(14).In Ethiopia PMR was 33 per 1000 pregnancies of seven or more month's duration and also only 32 % of mothers had antenatal care 4⁺ visit and only 26 % give birth at health institution(1). At national level in Ethiopia a study was conducted on perinatal mortality and this study considered birth interval as factor associated with PM. It did not considered other factors(15). Another study in Ethiopia showed that birth interval as factor for perinatal mortality but other factors were not considered(16) .

The first hours , days and week after child birth are a dangerous time for both mother and newborn, most death occurs during or immediately after birth and globally every year three million infants die in the first week of life (17).

Day of birth was dangerous of their lives for women and their children(5). Perinatal mortality had psychological impact on mothers ,that is it had depression impact in post-partum period and the depressed women were 4-5 times more likely to report Suicide and were more likely to being anxious and panicky ,and affect family dynamics including couple's relationship which affect economy by damaging working environment since people in their grieving process decrease their performance at work(18, 19). Greater grief intensity due to perinatal loss was associated with higher pregnancy specific anxiety ,depression , stress and poor intimate partnership(20).

High coverage of care around the time of birth and give care for small and sick newborns would save nearly 3 million lives of newborns and stillbirth each year(5). In Ethiopia there are nationally designed interventions to reduce neonatal mortality such as family planning, antenatal care, iron supplementation ,TT vaccination ,skilled attendant , ,antenatal corticosteroid for preterm labor (7). Despite the above interventions PM is high in Ethiopia.

Different factors could affect the level of PM such as age of the mother, educational status of the mother , ANC, place of delivery ,sex of the child, place of residence ,source of drinking water (21-24). Of these variables age and sex are none modifiable factors but educational statuses of the mother, ANC, place of delivery source of drinking water, place of residence are modifiable factors.

Studies have been conducted at global level and country level as well. In Ethiopia studies that have been conducted in north Shewa(Oromia region), west Gojjam, Jimma University, Tigray regional state (24-27) were at hospital level or community level in specific locality or region on PM and another studies conducted at national level but they considered only birth interval as factor for PM(15, 16).

Therefore this study is intended to assess the prevalence and factors associated with PM at national level by using EDHS representative data sets and considering other variables which fills the gap of national representative study with adequate variables in this regard.

1.3. Significant of the study

Ethiopia is implementing maternal, neonatal and child health (MNCH) programs as priority health agenda to reduce maternal, neonatal and child mortality. To achieve MNCH program or sustainable development goal, identifying risk factors is imperative. The finding of the study could be important for health programmers, health professionals and future researchers in prevention, control and reduction of PM.

For health programmers, the finding of this study is important to design evidence based intervention strategies for reduction, control and prevention of perinatal mortality. Similarly, the finding of this study help health professionals to provide evidence based counseling reduce to perinatal mortality. Identifying modifiable risk factors is important to prevent, control and reduce PM, whereas determining non-modifiable risk factors is helpful for early diagnosis and timely intervention to reduce PM. The finding of this study could also be used as reference for future study.

2. Literature review

2.1. Magnitude of perinatal mortality

Globally every year over 4 million babies died in the first four weeks of life, three-quarter of this death occurred in the early neonatal period that means at first week of life(28). Studies in Unguja (island of Zanzibar) and Mobini hospital of Sabzevar in Iran revealed that PMR was 45.5 per 1000 birth and 16.6 per 1000 birth, respectively (29, 30)

Study from most recent demographic and health survey conducted in 21 sub-Saharan Africa (SSA) countries indicated that the pooled perinatal mortality rate was 34.7 per 1000. With regards to regions, the four sub regions of SSA i.e. eastern Africa, western Africa, southern Africa and in central Africa pooled estimate of PMR was 34.5, 35.7, 30.3 and 30.7 per 1000 birth, respectively(31).

A study in Kenya indicated that there were 1085 perinatal with PMR of 29.8 deaths per 1000 birth. Of the total 1085 perinatal death, 700 were still birth (64.5%) and the remaining 385 (35.5%) were early neonatal deaths (32). Another study in rural province of Equateur (democratic republic of Congo) showed that PMR was 61 per 1000 birth(33). According to the 2016 EDHS, the PMR was reported to be 33 per birth in Ethiopia(34). At national level in Ethiopia a study indicated that PMR was 51.3 per 1000 birth (15). In Tigray a study showed that PMR was 62 per 1000 birth (24). Another community based nested case control studies in north Shewa zone (Oromia region) and west Gojjam PMR was 16.5 and 25.1 per 1000 birth, respectively(25, 26). On the other hand a study conducted in Jimma University indicated that PMR was 98.2 per 1000 birth(27).

2.2. Factors associated with perinatal mortality

2.2.1. Socio-demographic factors

Studies done in Nepal, Afghanistan and Ludhiana (Punjab) findings showed that age of mothers was associated with PM (22, 23, 35). Another study finding in Nigeria showed that mothers whose age ≥ 40 years had high PM compared to mothers < 20 years (21).

Similarly studies finding showed in north Shewa zone (Oromia region) and in Tigray regional state showed that as maternal age increase PM increase (24, 25). With regard to mother age at first birth a study in Africa great lake region indicated that age of the mother at first birth was associated with PM(36). Age of mother at first birth of 30+ years old increase perinatal mortality compared to its counterpart.

Studies conducted in Ludhiana (Punjab) ,Nigeria and Ethiopia showed that place of residence was significantly associated with PM, live in rural area increase risk of perinatal death (21, 22, 37, 38).

A study in Tigray regional state disclosed that maternal occupation was significantly associated with PM, the study indicated that mothers who worked in non agriculture area had significantly higher risk of PM than counterparts (24).

Concerning with education a study conducted in Bangladesh revealed that educational level of the mothers was significantly associated with PM and also this study indicated that paternal level of education was significantly associated with PM, those who had secondary and above level of education had significant effect on PM (39).Another study conducted in Ethiopia showed that mother's level of education had significant effect on perinatal mortality, perinatal mortality significantly decreased when mother's level of education increase to secondary and higher(40) . Wealth index was found to be associated with the level of PM. a study in Ludhiana, Punjab showed that wealth index was significantly associated with PM, the poor were suffered significantly compared to its counterpart(22).Another studies in Tigray regional state and west Gojjam showed that wealth quintile of the family was significantly associated with PM , the risk of having PM was high among poor compared with counterparts (24, 26).

Environmental factors

A study in Tigray regional state revealed that families who were using unprotected drinking water had increasing risk of perinatal death compared to those who used piped water as source of drinking(24).

A study in Tigray regional state showed that perinatal mortality decreased among those who use toilet facility compared to non users (24).Another study conducted in Bangladesh showed that types of cooking fuel was associated with PM(39).Those who use solid fuel were more to have PM.

2.2.2. Maternal related factors

With regard to maternal anemia study conducted in Addis Ababa showed that mothers who had hemoglobin < 11 gm/dl at some time during antenatal period experienced higher PM than those whose hemoglobin 11 gm/ dl or more(41).

A study done in Murmansk County(Russia) showed that smoking during pregnancy increase the risk of PM (42).Another study in Africa great lakes regions indicated that smoking had increased the risk of PM(36).

Likewise, a study in rural population of Dabat health and demographic surveillance site, northwest Ethiopia indicated that mothers who had taken tetanus toxoid vaccination had low risk of PM compared with those who did not take the vaccination (43).A study conducted in India showed that taking two or more tetanus vaccine during decrease perinatal mortality(44)

2.2.3. Fetal or neonatal related factors

A study conducted in Afghanistan indicated that lower birth interval had increased the risk of PM significantly (23).According to other studies conducted in Tigray regional state and rural population of north west Ethiopia ,at Dabat health and demographic surveillance site indicated that birth interval was significantly associated with PM (24, 43).Birth interval of < 24 months significantly increase the risk of PM compared to its counterpart.

Studies done in kassala (eastern Sudan) and rural province of Equateur (democratic republic of Congo) showed that birth order had significant association with PM, those whose birth order of five or more increase the risk of PM, (33, 45)and according to studies in Tigray and west Gojjam birth order was significantly associated with PM, those who had lower number of birth order was more risky for perinatal mortality than its counterpart (24, 26).

In Afghanistan a study revealed being male of the child significantly increases occurrence of out-come variable compared to its counterpart(23).Another secondary analysis in Nigeria revealed that being female significantly reduce occurrence PM compared to being male child (37).In north Shewa zone, Oromia region, Tigray regional state and rural population of northwest Ethiopia at Dabat health and demographic surveillance site showed that sex of the child was associated with PM. (24, 25, 43)

The studies indicated that being male significantly increases the occurrence of PM compared to female counterparts(24, 25, 43).A study in Afghanistan indicated that weight of the neonate was determinant factors of PM. The study disclosed that birth size of being smaller or larger than average of the child was significantly associated with PM (23).Another studies in Nigeria indicates that small or very small baby size at birth was significantly increase PM compared to its counterpart(21, 37).

With regard to birth type ,a study conducted in Afghanistan showed that multiple birth increase the risk of PM (23).Similarly studies in rural province of Equateur (democratic republic of Congo) and Ghana indicated that multiple birth was significantly increase the risk of PM compared to its counterparts(33, 46).Studies in north Shewa (Oromia regional state) and Tigray regional state indicated that being multiple gestation or birth increase the risk of PM (24, 25).Another study in rural population of north west Ethiopia at Dabat health and demographic surveillance site showed that multiple birth significantly increase risk of PM(43)

2.2.4. Health service related factors

In Nepal a study showed that PM had significantly associated with contraceptive utilization ,those who were not utilize contraceptive method significantly increased risk of PM (35).

In Afghanistan, Kassala eastern Sudan ,rural province of equator democratic republic Congo and Bangladesh studies showed that those mothers who used ANC reduce PM(23, 33, 39, 45).

In Afghanistan a study revealed that gave birth in health facility reduce the risk of PM(23). Similarly a study in Unguja island (Zanzibar) showed that gave birth at home significantly increased PM (29)

In Nigeria a study showed that place of delivery was associated with PM (21).Another study in kassala, eastern Sudan indicated that mothers who gave birth in home significantly increased occurrence of PM compared to its counterpart(45).According to studies in northern Shewa ,Oromia region and three districts of west gojjam place of delivery was associated with PM (25, 26).With regard to assistant of delivery in Ludhiana(Punjab)a study showed that delivery assistant had significant association with PM those who delivered by professionals reduced risk of PM(22). In Nigeria mode of delivery was associated with PM(21).Births through caesarian section increase significantly perinatal mortality.

Conceptual framework

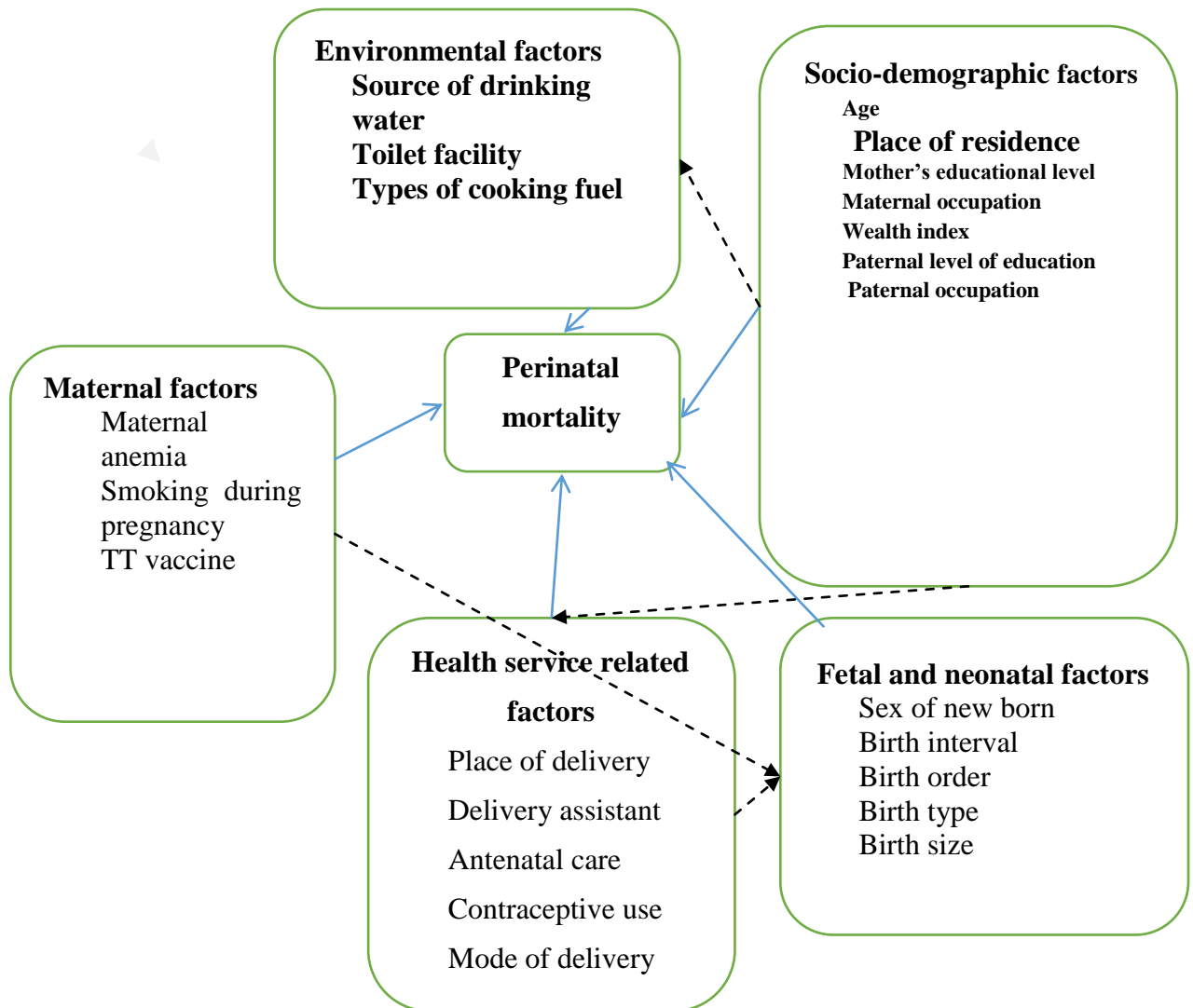


Figure 1.conceptual frame work showing factors associated with perinatal mortality

Adapted after reviewing different literatures (21-25, 29, 33, 35-37, 39, 42, 43, 45-47)

3. Objectives of the study

3.1.General objective

To assess the prevalence and factors associated with perinatal mortality in Ethiopia using EDHS data sets (2005-2016).

3.2.Specific objectives

To describe the prevalence of perinatal mortality in Ethiopia.

To identify factors associated with perinatal mortality in Ethiopia.

4. Methods

4.1. Study design and period

Community based Cross-sectional study design was used to assess the prevalence and factors associated with PM in Ethiopia from December 2 to December 23 / 2020 using EDHS 2005 - 2016 data sets .The survey was conducted from April 27 to August 30 ,2005for 2005 EDHS, from December27 ,2010 to June ,2011 for EDHS 2011 and from January 18,2016 to June 27, for 2016 EDHS(1, 48-50).

4.2. Study area

Ethiopia located in the north eastern part of the Horn of Africa .The country is landlocked ,sharing frontiers with Eritrea to the north and north east ,Djibouti to the east ,Somali to the east and south east ,Kenya to the south ,and south Sudan and Sudan to the west with total area of 1.1 million km² . The country had ten regions and two city administrations and the total population of the country were 114, 963,588in 2020.(51-53).In Ethiopia antenatal care coverage by skilled provider, Birth attended in health facility , coverage of ANC 4+visit , modern contraceptive method utilization were 74 % , 48% , 43 % , and 41 % respectively. While neonatal mortality rate was 30 per 1000 live birth (54).



Figure 2 .map of study area

4.3. Population

4.3.1. Source population

Source population was all birth from reproductive age women within five years of the three consecutive surveys in selected enumeration area.

4.3.2. Study population

Study population was all births from reproductive age women within five years of the three consecutive surveys in selected households.

4.3.3. Sample size

A total of 46,268 women aged 15-49 years were interviewed in the three surveys (14,070 women in 2005 EDHS, 16,515 women in 2011 and 15,683 in 2016 EDHS). In all EDHSs women were asked to report any pregnancy loss and the duration of such pregnancy that occurred within five years preceding the surveys. Information such as pregnancy, pregnancy loss and duration of pregnancy were used to identify the number of live birth, still birth and pregnancies ≥ 28 weeks' gestation. For this study the sample size was 34,428 (weighted) by appending the eligible study subjects from the three consecutive EDHS data sets.

4.4. Sampling procedure

This study used the combined data of 2005, 2011 and 2016 EDHS; which were nationally representative household surveys using two stage probability sampling method which were stratified by geographical regions and by urban and rural areas within each region. All the three surveys sampling methods were similar and routinely collected with the objective of estimating socio-demographic; maternal and child health indicators at national and regional level.

Population and housing census of 1994 conducted by CSA, provide the sampling frame from which EDHS 2005 sample was drawn, and 2007 population and housing census, conducted by the CSA, provided the sampling frame from which the 2011 EDHS and 2016 EDHS sample was drawn. Households were randomly selected and the eligible women were interviewed. Then data of pregnancies ≥ 28 weeks' gestation and birth was extracted from EDHS data sets. Details of the survey methodology, sampling procedure and questionnaires are presented in the respective EDHS reports (1, 49, 50).

4.5.Data collection

Demographic and Health Survey (DHS) has been developed standard questionnaires, which was reviewed and modified frequently that are applied in each country. DHS survey were designed to collect on marriage ,fertility ,family planning .reproductive health and child health .

Women eligible for an individual interview were identified through the household selected in the sample ,2005 ,2011 EDHS were used three questionnaires :-household ,women's ,and man's questionnaires while in 2016 EDHS biomarker and health facility questionnaires were added(1, 48-50). This study analyzes EDHS 2005-2016 survey data which were available on DHS program website https://www.dhsprogram.com/data/dataset_admin/logn_main.cfm.The data were obtained from the demographic and health survey (DHS) data sets, which were available in the measure of DHS program website after authorization. Registration is prerequisite for access to data.

4.6.Variables of the study:

4.6.1. Dependent variable:

Perinatal mortality

4.6.2. Independent variable

Maternal factors: Maternal anemia, smoking, Use contraceptive

Fetal /neonatal factors: Sex of new born, birth interval, birth order, birth type, birth size.

Environmental factors: Source of drinking water, toilet facility and types of cooking fuel.

Socio-demographic factors: Age , place of residence ,maternal occupation ,level of education of the mother ,wealth index ,paternal level of education ,paternal occupation ,and place of residence.

Health service related factors: Place of delivery, delivery assistant, and mode of delivery, antenatal care, and Contraceptive use.

4.7.Operational definitions

Perinatal mortality is death from 28 weeks of gestation to seven days of birth (including 28 week but not include seventh day) among births (55).

4.8.Data quality control

In EDHS the quality of data had been determined mainly by the quality of fieldwork. The quality of data has been maintained by since Ethiopian demographic and health survey used the DHS standard demographic and health survey questionnaires. Interviews were performed using local languages. Prior to the actual data collection, interviewers were trained and a pre-test was performed. Quality also assured by Supervision.

4.9.Data processing and analysis

After STATA version data downloaded from DHS website, important variables from the three data sets (EDHS 2005-2016) were extracted then variables were generated, recoded, labeled, and defined then after the value was given. Women who had no history of birth in the past five years preceding the surveys were dropped. Finally, the extracted data were being combined together. Weighting variable was being created then for this study first set up svyset then weighting was applied to adjust for differences in the probability of selection and interview.

Descriptive and summary statistics were handled using Stata version 14.1 after extraction of data from EDHS data sets. Since EDHS data had hierarchical clustering nature and assumption of independence among observation was being violated, but multilevel not fitted to assess the prevalence and factors associated with PM. Measures of variation for random effect were determined by ICC but LR test $\chi^2 = 0.08$ and Prob $\geq \chi^2 = 0.3899$. And ICC = 0.0028 which is lower than even 10 % this indicated that there is no significant clustering effect on PM. So using binary logistic regression is possible. Variables having p-value less than 0.2 in bivariable analysis were selected for multivariable analysis. In multivariable logistic regression of this study p value < 0.05 or /and 95 % CI which did not include one were considered as significantly associated with perinatal mortality.

4.10. Ethical considerations

Ethical clearance was obtained from college of medicine and health science institutional review board (IRB) committee of Bahir Dar University. And written permission was received from ICF international, DHS after explaining the title of the study and the objective of the study.

5. Result

5.1.Socio-demographic characteristics

From a total of 34, 428 (weighted) study participants, 18,647 (54.16%) were found in the maternal age group of ≤ 29 years old and 30847 (89.6%) of study participants were from rural residents. With regards of education level of partners 17,833 (52.85%) were from those who had no formal education and 3447 (10.01%) were from primary/secondary education level. Of the total births 19,814 (57.55%) were from mothers who had no work and 6713 (19.5 %) from mothers who had agricultural occupation. In case of partner's occupation 1152(3.35%) of birth were from those who had no work and 26,978 (78.36%) had agricultural occupation.

Table 1. Socio demographic characteristics of mothers who were pregnant and give birth during 5 years preceding surveys using EDHS 2005-2016 (n=34,428) in Ethiopia.

Variable	Categories	Weighted frequency	Percent
Year of interview	2016	11071	32.16
	2011	12,076	35.08
	2005	11,281	32.77
Current age in year	≤ 29	18,647	54.16
	30-34	7182	20.86
	35-39	5342	15.52
	40 -44	2337	6.79
	45 -49	920	2.67
Age at first birth	<20	22,248	64.62
	20-29	11,802	34.28
	30 +	378	1.1
Wealth index	Rich	15,475	44.95
	Middle	7304	21.21
	Poor	11,650	33.84

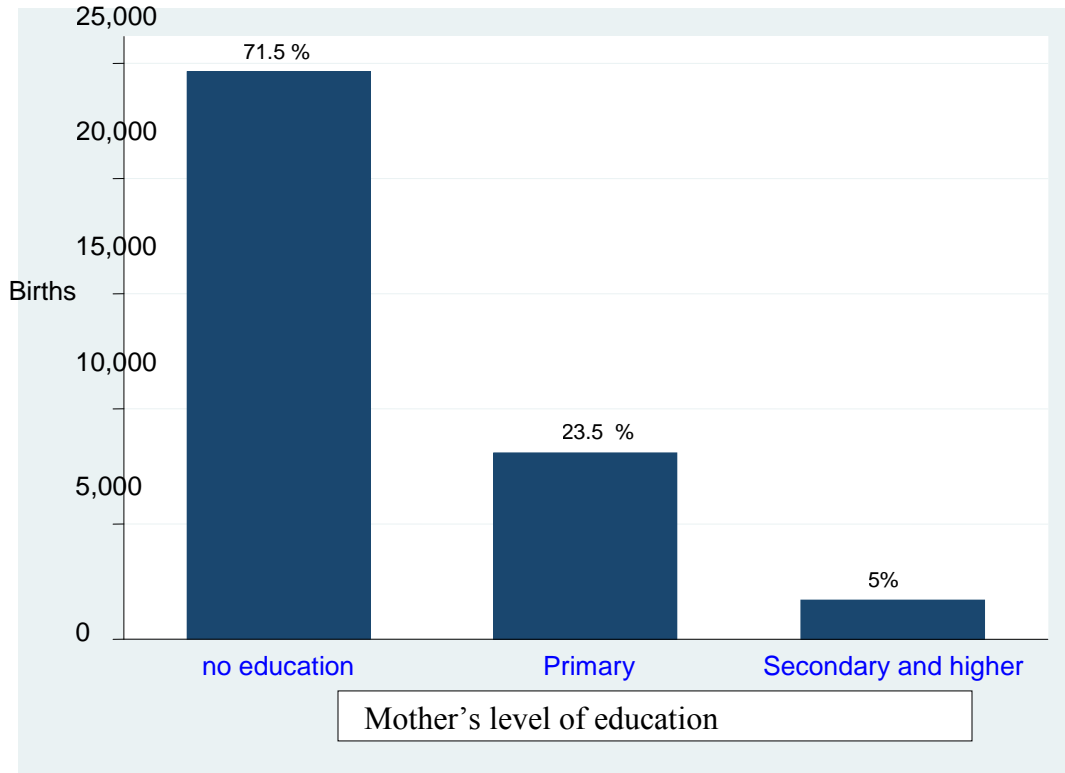


Figure 3. Births based on Mother's level of education

5.2.Environmental characteristics

Concerning to the source of drinking water, 9456 (27.46%) of the study participants were from those who use piped water. While 16601 (48.22%) births were from women who used unprotected water source as drinking water.

Table 2. Environmental factors using EDHS data sets (n=34428) in Ethiopia.

Variable	Category	Weighted frequency	Percent
Source of drinking water	Piped	9456	27.46
	Protected	8372	24.32
	Unprotected	16,601	48.22
Use of toilet facility	Use	17,180	49.9
	Not use	17,248	50.1
types of cooking fuel	Solid	607	1.76
	Non solid	33,821	98.24

5.3.Maternal related characteristics

Seven thousand fifty three (20.48%) births were from anemic mothers and 27375(79.52 %) were from non anemic. Regarding to tetanus vaccination status 11,210 (32.56%) were from those who used 2+ tetanus vaccine and 19,617 (56.98%) not used tetanus vaccine before birth

Table 3. Maternal characteristics using EDHS data sets in Ethiopia.

Variable	Category	Weighted frequency	Percent
Tetanus vaccination	Not use	19617	56.98
	One use	3601	10.46
	2+	11,210	32.56
smoking cigarette	No	34,287	99.59
	Yes	141	0.41

5.4. Fetal or neonatal factors

With regard to size of child at birth 13,605 (39.52%) of perinatal births were average in size and 10,159(29.51%) were small

Table 4.fetal or neonatal characteristics using 2005-2016 EDHS data sets in Ethiopia.

Variable	Category	Weighted frequency	Percent
Sex of child	Male	17,734	51.51
	Female	16,694	48.49
Birth interval	<24 months	10,848	31.51
	>= 24 months	23,580	68.49
Birth order number	<=3	14,969	43.48
	4-5	10,776	31.3
	6+	8683	25.22
Types of birth	Single	32,752	95.13
	Multiple	1676	4.87

5.5. Health service related characteristics

Thirteen thousand three hundred forty eight (38.77%) births were from mothers used contraceptive and 19996 (58.08%) had no antenatal care visit

Table 5. Health service related characteristics mothers using the 2005-2016 EDHS data sets in Ethiopia

Variable	Category	Weighted frequency	Percent
Delivery assistant	Non skilled	28,467	82.69
	Skilled	5961	17.31
Mode of delivery	Vaginal	33,843	98.3
	C/S	585	1.7
ANC	NO	19996	58.08
	YES	14432	41.92

5.6.Perinatal mortality by socio-demographic characteristics

Over the study period (2005-2016) PMR was 39 per 1000 birth (95 % CI: 36.8, 41.0) .One thousand one hundred seventy eight (88.04 %) of perinatal mortality were occurred in rural area .Nine hundred sixty nine 969 (72.42 %) of perinatal mortality were from those uneducated mothers. Of the perinatal mortalities 732(54.7%) were from mothers who had no work.

Table 6. Perinatal mortality by socio demographic characteristics during 5 years preceding surveys in Ethiopia.

Variable	Categories	Perinatal Mortality		PMR/1000
		No	Yes	
Year of interview	2016	10705	366	33
	2011	11525	551	46
	2005	10860	421	37
Current age in year	<= 29	17,900	747	40
	30-34	6,960	222	31
	35-39	5,166	176	33
	40-44	2,209	128	55
	45-49	855	65	71
Age at first birth	<20	21350	898	40
	20-29	11393	409	35
	30 +	347	31	82
Place of residence	urban	3421	160	45
	rural	29669	1178	38
Maternal educational level	No education	23661	969	39
	primary	7791	304	38
	Secondary and higher	1638	65	38
Wealth index	Rich	14918	557	36
	Middle	691	323	44
	Poor	11192	458	39
Smoking cigarette	No	32955	1332	39
	Yes	134	7	50

Parent's education	No education	17803	716	39
	Primary	11951	510	41
	Secondary /higher	3335	112	34
Parent's occupation	No work	1117	36	31
	None agricultural	6052	245	39
	Agricultural	25921	1057	39
Mother occupation	No work	19082	732	37
	None agricultural	6429	284	42
	Agricultural	7579	322	41

5.7.Perinatal mortality by reproductive health and other characteristics during the 5 years preceding the surveys.

Perinatal mortality was 857 among those who did not use the TT vaccine with a rate of 44 per 1000 birth and 367 among those did use 2+TT vaccine with rate 33 per 1000 births . In the case of types of birth, there was 142 perinatal mortality among multiple gestations with a perinatal mortality rate of 85 per1000 birth. Perinatal mortality was 597 in large size child with a perinatal mortality rate of 56 per 1000 birth and 388 in average size child with perinatal mortality rate of 29 per 1000 births.

Table 7. Perinatal mortality by reproductive health and other characteristics during 5 years preceding surveys in Ethiopia.

Variables	Categories	Perinatal-mortality		PMR/1000
		No	Yes	
Source of drinking water	Piped	9072	384	41
	Protected	8049	323	39
	Unprotected	15970	631	38
Use of toilet facility	Use	16526	654	38
	Not use	16564	684	40
Types of cooking fuel	Solid	590	17	28
	Non solid	32500	1321	39
Smoking cigarette	No	32955	1332	39
	Yes	134	7	50
Anemia of mother	Anemic	6744	309	44
	Not anemic	26346	1029	38
Birth order	<=3	14316	653	44
	4-5	10411	365	34
	6+	8363	320	37
Sex of child	Male	16,972	762	45
	Female	16,118	576	36
Birth interval	<24 months	10198	650	60
	>= 24 months	22892	688	29
Contraceptive utilization	Use	12827	521	39
	Not use	20263	817	39
Delivery assistant	Non skilled	27,366	1101	39
	Skilled	5,724	237	40
ANC visit	No	19150	846	42
	Yes	13940	492	34
Place of delivery	home	27433	1098	38
	Health-institution	5656	240	41
Mode of delivery	Vaginal	32550	1293	38
	C/S	540	45	77

Chi squared assumption was checked and all the expected value are greater than 5.

Multicollinearity was checked but there was no Multicollinearity.

5.8. Factors associated with perinatal mortality based EDHS data

In bivariable binary logistic regression analysis variables like types of birth, contraceptive use, tetanus vaccination before birth, mode of delivery, partner's occupation, cooking fuel, birth interval, mother's education level, ANC, anemia of mother and size of child at birth have p-value of < 0.2 were candidate for multivariable logistic regression model.

As a result of multivariable logistic regression analysis shown tetanus injection of two or more (2+) decreased perinatal mortality, whereas multiple births, caesarian delivery, birth interval less than 24 months, anemic mother, and large size at birth increased perinatal mortality.

With regard to tetanus injection taking tetanus vaccine 2+ reduced perinatal mortality by 20% (AOR=0.80; 95% CI: 0.65, 0.99) as compared to those who did not use tetanus vaccine.

With respect to types of birth the odds of perinatal mortality in multiple births were 3.35 times (AOR =3.35; 95% CI: 2.44, 4.61) as compared to single births, and odds of perinatal mortality in caesarian deliveries were 2.11 times (AOR=2.11; 95% CI: 1.18, 3.76) as compared to vaginal deliveries and odds of perinatal mortality in birth interval less than 24 were 2.27 times (AOR =2.27; 95% CI: 1.90, 2.71) as compared to birth interval ≥ 24 months.

In the case of anemia of the mothers perinatal mortality in anemic mothers was increased by 33% (AOR =1.33; 95% CI: 1.07, 1.65) as compared to non-anemic and perinatal mortality among large size perinatal births was increased by 99% (AOR=1.99; 95% CI: 1.61, 2.46) as compared to average size perinatal births (table 8).

Table 8. Bivariable and multivariable logistic regression for factors associated with perinatal mortality in Ethiopia, EDHS (2005-2016).

Variable	Category	PM		COR(95%CI)	AOR(95%CI)	P_value
		Yes	No			
Type of birth	Single	1123	21029	1.00	1.00	
	Multiple	113	720	2.94(2.18 , 3.98)	3.35(2.44 , 4.61)**	<0.001
Contraceptive use	Use	477	9365	0.83(0.70 , 0.98)	0.97(0.80 , 1.19)	0.797
	Not use	759	12383	1.00	1.00	
Tetanus vaccination before birth	Not use	783	11920	1.00	1.00	
	One use	107	2340	0.70(0.51 , 0.95)	0.78(0.57 , 1.06)	0.116
	2+	346	7488	0.70(0.57, 0.86)	0.80(0.65 , 0.99)*	0.044
Mode of delivery	Vaginal	1194	21344	1.00	1.00	
	C/ section	42	404	1.85(1.09 , 3.15)	2.11(1.18 , 3.76)*	0.011
Partner's occupation	No work	33	727	0.78(0.48 , 1.28)	0.71 (0.43 , 1.15)	0.163
	Nonagricultural	225	4346	0.88(0.70 , 1.11)	0.98 (0.75 , 1.26)	0.850
	agricultural	978	16675	1.00	1.00	
Cooking fuel	Non solid fuel	16	483	1.00	1.00	
	solid fuel	1220	21265	1.68(0.96 , 2.93)	1.67(0.84 , 3.32)	0.146
Birth interval	<24months	595	6730	2.07(1.75 , 2.45)	2.27 (1.90 , 2.71)**	<0.001
	>=24months	641	15018	1.00	1.00	
Mother's education level	No education	901	15027	1.00	1.00	
	Primary	273	5395	0.85(0.69 , 1.03)	0.82(0.66 , 0.1.03)	0.086
	Secondary and higher	62	1326	0.78(0.54 , 1.14)	0.79(0.50 , 1.24)	0.302
ANC	Yes	9708	456	0.73(0.61,0.87)	0.82(0.67 , 1.00579)*	0.057
	No	12040	780	1.00	1.00	
Anemia of mother	Anemic	298	4200	1.33(1.07 , 1.65)	1.33(1.07 , 1.65)*	0.010
	Not anemic	938	17548	1.00	1.00	
Size of child at birth	Large	551	6590	2.03(1.65 , 2.50)	1.99 (1.61 , 2.46)**	<0.001
	Average	363	8825	1.00	1.00	
	Small	322	6334	1.24(0.99 , 1.56)	1.14(0.91 , 1.44)	0.251

*Significant at 0.001 < P<0.05, ** =P< 0.001, 1.00: reference, COR: crude odds ratio, AOR: adjusted odds ratio.

Hosmer -Lemeshow goodness of test and Prob > F = 0.9489

6. Discussion

This study attempted to assess the prevalence and associated factors of perinatal mortality in Ethiopia using Ethiopian demographic and health surveys 2005-2016. The result showed that the perinatal mortality rate was 39 per 1000 birth with (95% CI: 36.8 41.0) and tetanus vaccination, types of birth, birth interval, maternal level of anemia, mode of delivery and size of the child at birth were significantly associated with perinatal mortality.

The perinatal mortality rate in this study was 39 per 1000 birth but previous study in Iran perinatal mortality rate was 16.6 per 1000 birth(30). In Kenya perinatal mortality rate was 29.8 deaths per 1000 birth which was lower than this finding (32).

previous studies in Zanzibar perinatal mortality were 45.5 per 1000 birth (29) .Perinatal mortality in Tigray regional state 62 per 1000 birth(24) and in Jimma university perinatal mortality was 98.2per 1000 birth(27). In this study perinatal mortality was lower than in previous studies, these difference might be due to the previous studies were done in the specific local area with small sample size relative to this study.

The result of the current study showed that multiple births increase the odds of perinatal mortality compared to single birth. The possible justifications were multiple births might have low birth weight and being immature.

This finding is supported with previous studies conducted in Afghanistan ,Democratic Republic of Congo, Ghana (23, 33, 43, 46) ,and studies conducted in north Shewa and Tigray regional state (24, 25)and in north west Ethiopia (43).

In this study use of tetanus vaccination of two or more (2+) during pregnancy decreased the odds of perinatal mortality compared to not use tetanus vaccine .The possible reason might be due to using tetanus 2+ vaccine prevent tetanus .This finding is supported by study conducted north west Ethiopia (43) and study conducted in India (44) .

Babies delivered by caesarian section increased the odds of perinatal mortality compared to vaginally deliver. The reason might be negative perception to caesarian section among pregnant women, which lead to a late referral to a health care facility for emergency caesarian section after experiencing life-threatening complication at home or elsewhere. This finding is supported by a previous study conducted in Nigeria (21).

In the present study birth interval was one of the predictors of perinatal mortality. The finding was birth interval less than 24 months were significantly associated with increased perinatal mortality and this is consistent with previous studies conducted in Afghanistan ,Tigray regional state and north west Ethiopia (23, 24, 43) . The reason might be maternal depletion if the gap after preceding birth was less than 24 months. The frequency of pregnancies and periods of lactation leads to deterioration in the mother's nutritional status and this might lead to fetal loss and premature birth.

In this study maternal anemia was significantly associated with perinatal mortality. Maternal anemia was significantly associated with increased perinatal mortality. This study is supported with the previous study conducted in Addis Ababa(41). This might be due to low birth weight and preterm birth effect of anemia. The current study revealed that birth size had a significant influence on perinatal mortality in Ethiopia; large birth size had higher odds of perinatal mortality than average size birth. This might be due to the fact that large babies were more faced for birth injury, respiratory distress due to birth asphyxia. This study is supported with previous study in Afghanistan(23)

7. Strength and limitation

Strength

This study use nationally representative 2005-2016 Ethiopian demographic and health survey data sets and use large sample size, which enhance inference for the entire country level. The study, applied sampling weights to ensure the representativeness of the sample. Therefore, this study is important to assess prevalence and factors associated with perinatal mortality in Ethiopia.

Limitation

The limitation is that the study was based on the mother's recall of events that took place for the past five years preceding the surveys, which is subjected to recall bias.

8. Conclusion

The study showed that the prevalence of perinatal mortality in Ethiopia was high despite there is reduction of perinatal mortality in 2016 Ethiopian demographic health survey compared to the 2005. The final multivariable logistic analysis showed that factors found to be predictors of perinatal mortality were types of birth, tetanus vaccination, mode of delivery, birth interval, maternal anemia, and size of the child at birth.

9. Recommendations

Based on the major findings of the study the following recommendations are forwarded:

For health care providers: Health professionals better to counsel about family planning to increase birth interval. Community based education on the relevance tetanus vaccination during antenatal care visit, counsel about healthy diet and iron supplementation is better to be strengthening to prevent anemia. And it is better to refer early for emergency caesarian section, give emphasis to multiple gestations and large size child to early detect and manage complications related to multiple gestations and large size child.

For mothers: Mothers better to use planed or elective caesarian section to improve perinatal mortality.

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11. Annex

11.1. Annex i: Data extraction sheet

Central Stastical Agency, 2000-2016 Ethiopia Demographic and Health Surveys

Title: prevalence and factors associated with perinatal mortality in Ethiopia using EDHS data sets 2020/21

The variables important for this specific research were extracted based on the following format.

No	Variables	Explanation (codes)
1	Maternal education	No education(1) ,primary(2),secondary and above(3),
2	Paternal education	No education(1) ,primary(2),secondary and higher(3)
3	wealth index	Poor(1), middle(2),rich(3)
4	Age of the mother	<29 (1),30-24 (2),35-39(3) ,40-44(4) ,45-49(5)
6	Cigarette smoking	No (0) ,Yes (1)
7	Residence	Urban(0),rural(1)
8	Sex of the child	Male(0),female(1)
9	Types of birth	Single (0) multiple (1)
12	Birth size	Large (1) ,averageb (2) small (3)
13	Delivery assistance	Skilled (0),non skilled (1)
14	Mode of delivery	Cessorian section(0),vaginal (1)
15	Birth interval	<24 months (1) >=24 months (2)
16	Age of mother at 1st birth	< 20 (1),20-29 (2),30+(3)
17	Birth order	1=3 and below ,2=3-5 ,and 3= 6+
18	Antenatal care visits	No (0), Yes (1)
19	Delivery place	Home(0),health facility(1)
21	Type of birth	0 = single, 1 = multiple
22	Maternal occupation	No work(0),non agricultural(1),agricultural (2)
23	Contraceptive utilization	0 =no ,1 =yes
24	TT vaccine	Never (1) 1 TT(2) 2+TT(3)
25	Types of cooking fuels	Non solid(0) ,solid (1)
26	Toilet facilities of mother	0 = use toilet facility 1 = not use toilet facility
27	Source of drinking water	1= piped water, 2 = protected well, 3 = unprotected well

11.2. Annex ii: Declaration

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF HEALTH SCIENCES

DEPARTMENT OF EPIDEMIOLOGY AND BIostatISTICS

I undersigned, MPH student declare that this thesis was my original work in the partial fulfillment of the requirement for the degree of Master of Public Health in epidemiology.

Name: Gedefaw Abeje

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Date: _____

Date: _____

Submitted to: Zelalem Alamiraw (MPH, Asse,t Professor) ,and Gizachew Tadese (MPH ,Epidemiology),college of medicine and health sciences ,School of Public Health , Bahir Dar University.

Date of submission _____

11.3. Annex iii: Advisor’s approval form

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF HEALTH SCIENCES

DEPARTMENT OF EPIDEMIOLOGY AND BIostatISTICS

I hereby certify that I have supervised, read, and evaluated this thesis titled “**prevalence and factors associated with perinatal mortality in Ethiopia (using EDHS 2000-2016 data sets)**” by **Gedefaw Abeje** prepared under my guidance. I recommend the thesis be submitted for submission.

Advisor’s name	Signature	Date
1. Mr. Zelalem Alamiraw	_____	_____

Co-Advisor’s name	Signature	Date
1. Mr. GizachewTadesse	_____	_____

Department Head	Signature	Date
1. Mr. Ababayehu Bitew	_____	_____

11.4. Annex iv. Examiners' approval form

BAHIR DAR UNIVERSITY
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS

As members of the board of examiners, we examined this thesis entitled “**prevalence and factors associated with perinatal mortality in Ethiopia using 2005-2016 EDHS data sets**” by **Gedefaw Abeje**. We hereby certify that the thesis/dissertation is accepted for fulfilling the requirements for the award of the degree of “Masters in Epidemiology and Biostatistics”.

Board of examiners

_____	_____	_____
External examiner's name	Signature	Date
_____	_____	_____
Internal examiner's name	Signature	Date
_____	_____	_____
Chair person's name	Signature	Date