DETERMINANTS OF PERINATAL MORTALITY: A MATCHED CASE CONTROL STUDY, IN JIMMA UNIVERSITY SPECIALIZED HOSPITAL, ETHIOPIA

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ABSTRACT

BACKGROUND: Although being newborn is not a disease, large numbers of children die soon after birth or born died (stillbirth). In many countries including Ethiopia major changes are taking place in the area of maternal and child health to achieve the goals set out on international declarations and country commitments. Early neonatal death which accounts around one third of the total child death is not decreasing as needed and even increasing in some countries which is also true for perinatal mortality.

OBJECTIVE: The main objective of the study was to assess trend and identify factor associated with perinatal mortality among perinatal age groups from January 1st, 2011to December 30th, 2014

METHOD: Facility based matched case control study was employed using four year data from JUSH perinatal deaths and early neonatal records. The cases were stillbirths and early neonatal deaths and controls were live births and early neonates discharged or stayed alive up to their seven days. A total of 1,593 (531 cases and 1062 controls) subjects constituted the sample size for this study. The number of stillbirth cases were 429 and 858 were selected as a control for these group and early neonatal death was recorded in 102 of the cases for whom 204 controls were selected. In order to identify the independent predictors of perinatal mortality, a number of covariates were entered in a conditional multiple logistic regression model based on set criteria. Sub group analysis was also conducted for early neonatal deaths and stillbirths to see their specific predictors. stata version 12 was used to conduct the analysis.

RESULT: From total birth occur within the study period the overall rate of perinatal mortality were 87.4 with C-I (82.7, 92.1). 467 (87.9) of cases and 348 (32.8) of controls had at least one obstetrics complication. The odds of having PND among mothers with at least one obstetrics complications was 8.4 times as much as those who didn't have obstetric complications (OR; 8.4 ; 95% CI: 4.4 – 16.0) ; while in the sub group analysis the odds of stillbirth and ENND was 10.4, and 4.4 times as much for those with at least one obstetric complications compared to those without complication.

CONCLUSION AND RECOMMENDATION: Birth weight, having at least one complication, uterine rapture, obstructed labor were the independent predictors of PND. Generally to decrease PND activities should have to be done on assessing the causes and reducing identified maternal complications.

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ACRONYMS

1. **ANC:-** Antenatal care
2. **APH:-** Antepartum Hemorrhage
3. **ENND:-** Early Neonatal Death
4. **JUSH:-** Jimma University Specialized Hospital
5. **MDG:-** millennium Development Goal
6. **PMR:-** Perinatal Mortality Rate
7. **PND:-** Perinatal Mortality
8. **WHO:-** World Health Organization
9. **UN:-** United Nation
10. **USA:-** United States of America
11. **UK :-** United kingdom
12. **EDHS :-** Ethiopian Demographic Health Survey
13. **MPH:-** Master of Public Health
14. **MOH:-** Matched Odds Ratio
15. **NGO:-** Non Governmental Organization
16. **UR :-** uterine rapture
17. **OL :-** obstructed labor
18. **VLBW :-** very low birth weight
19. **LBW:-** low birth weight

CHATER ONE

Background

1.1 Introduction

Perinatal mortality is defined by the World Health Organization as the demise of a fetus in utero after the age of viability, during labor or within the first 7 days of extra-uterine life. This definition allowed each country to supply its own data based on the nationally accepted age of viability of that country. While the World Health Organization, the International Stillbirth Alliance and some developed countries utilize 22 weeks as their age of viability and a loss at that gestational age reported as perinatal mortality (1).Country like Ethiopia, viability age is greater than 28 weeks or 7mounths are considered for their report (2).

One of the most vital Millennium Development Goals (MDG) set by the United Nations (UN) is to reduce child mortality by two-thirds by the year2015; MDG-4 (3). Neonatal mortality accounts for more than half of all infant and roughly 45% of under-five deaths. Three-quarters of all neonatal deaths occur in the first week of life which is the perinatal period .Therefore, achieving MDG-4 will certainly require a substantial reduction in PNMRs in high mortality countries and reducing deaths in the first week of life was essential to progress. While under-5 mortality rates are improving in many countries worldwide, neonatal mortality rates have shown much less progress and currently account for more than 42% of under five deaths, up from 37% in the year 2000 when the Millennium Development Goals (MDGs) were set.(4 ,5,6).

In Ethiopia the significant decline in infant mortality rate in the last two decades was because of the significant decline in late neonatal and post neonatal mortality .In both hospital and community based studies in which there were no evidences that support reduction of early neonatal mortality in particular and perinatal mortality in general (2, 9).

Perinatal and neonatal mortality are steamed from poor maternal health, inadequate care during pregnancy, inappropriate management of complications during pregnancy and delivery, poor hygiene

during delivery and the first critical hours after birth, and lack of newborn care so they are directly linked with quality of health service during pregnancy, peripartum and in the first month of the neonates' therefore this rates are used as an important indicators of the health status of a country (1). It is widely recognized that MDG 5 which aimed to improve maternal health has shown the least progress among all MDGs. Since Maternal mortality is strongly correlated with stillbirth and neonatal out comes , increasing attention for early neonatal and stillbirth interventions will increasing investment for mothers and will accelerate progress for these inextricable maternal, fetal, newborn and child health outcomes alongside (7, 8).

Given that there are many countries with very low childbirth-related mortality rates, it is clear that high childbirth-related mortality burdens are not inevitable. Rational bolstering of health systems saves lives, even in lower income settings where resources are limited (10).

1.2 Statement of the problem

The perinatal period is the most vulnerable period in the life of an individual, the rate of death during this period is higher than at any other period of life and it is equal to the rate of death over the next forty year period. Globally about 136 million births occur every year, and of these approximately 3.7 million die during the neonatal period and 3.3 million are stillbirths but in many societies still neonatal deaths and stillbirths are not perceived as a problem (11, 1).

Global estimates show that the PMR in developed regions of the world is about 10 per 1000 total births compared to 50 per 1000 total births in less developed regions. In which perinatal mortality rate in developing countries is three to five folds than that of developed countries. Low and middle income countries account for over 99% of these perinatal deaths. Worse still, for every newborn baby that dies, at least another twenty newborns suffer birth injuries, complications arising from preterm birth or other neonatal conditions (12, 13, 3).

Unlike early neonatal deaths, stillbirths are not just a low-income country problem. Rates in the UK and USA have decreased by only 1% per year for the past 15 years and stillbirths now account for two-thirds of perinatal deaths in the UK (14).

In 2009 the estimated number of global stillbirths was 2.6 million compared with 3.0 million in 1995. The worldwide stillbirth rate has declined by 14%, from 22.1 stillbirths per 1000 births in 1995 to 18.9 stillbirths per 1000 births in 2009.Two thirds of all stillbirths occur in just two regions: South-East Asia and Africa. In African there was only an annual decline of less than 1% (0.7%) (15).

the south central Asian countries account for the highest numbers of neonatal deaths but the countries with highest rates are generally in sub-Saharan Africa and only Ten countries account for 75% of all neonatal deaths, with India, China, Pakistan and Nigeria leading the pack, in which Ethiopia is one of the ten and the progress of reducing the neonatal mortality rate remains virtually stagnant in sub Saharan region. According to UN data, an average annual decline of 7% would now be needed to put sub-Saharan Africa on track for MDG 4 and six countries are on track for achieving MDG 4: Cape Verde, Eritrea, Mauritius, Seychelles, and, most recently, Botswana and Malawi (32, 12, & 16)

The 2006 WHO estimate in Ethiopia there were a total of 168,000 perinatal deaths making the PMR 57/1000 total births. Of which stillbirths and early neonatal deaths were account 58,000 and 110,000 respectively. According the Ethiopian EDHS 2011 report the perinatal mortality has increased from 37 in 2005 to 46 per 1000 births. Among the regions Benishangul Gumuz have the highest mortality followed by Amhara and Tigray with rate of 58.1, 54.7 and 51.4 respectively and Affar have the lowest perinatal mortality rate in the country which is 19.9per 1000 live births. Oromia have a rate of 44.7 per 1000 births (1, 2).

Both Early neonatal deaths and stillbirths occur during the perinatal period have obstetric origins (17). Existing studies reveled that age of the mother, socioeconomic status, maternal education, ANC utilization, complications during pregnancy and childbirth, pregnancy duration and weight at birth, multiple births, sex, and position at birth are risk factors for perinatal death.

Neonatal mortality has important socioeconomic consequences. Although the economic cost of such health problems is difficult to measure because newborn deaths often go unreported (18). Most of social costs are on women in whom there is an increase vulnerability of women with perinatal death to experience negative life changes, psychological and social consequences such as depression, worse relationships with their husband and feeling guilty (19).

The Ethiopian government was one of the first in Africa to make a strong commitment to the MDGs and reaching each of the MDG targets is central to its national development strategy. Even though the government is working in collaboration with other NGOs to address those goals at community and facility level (16), the perinatal mortality is increasing (2).

Although about 99% of the perinatal deaths happen in low and middle income countries, most of researches focus on the 1% perinatal deaths occurring in developed nations. Information on perinatal deaths in most low and middle income countries is scanty (20). Similarly, In Ethiopia even if there is high neonatal and infant mortality which is mainly resulted due to early neonatal mortality and having increasing trend of perinatal death there are very few published studies on perinatal mortality in the country. In Jimma hospital that serves us a referral for the southwest of Ethiopia there is only one descriptive perinatal audit done from 1990 – 1999.

The purpose of this study is to understand the trend of perinatal death for the past four years and the various factors associated with the death in JUSH. It is hoped that the results of this study will improve all concerned bodies understanding on the factors associated to perinatal mortality in hospitals with in the country and serves as an important tool for any possible intervention aimed at improving newborns survival and achieving goals of the country.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

The perinatal mortality rate (PMR) is determined by including all stillbirths and neonatal deaths in a given time period over the total number of births multiplied by thousand. The perinatal mortality indicator plays an important role in providing the information needed to improve the health status of pregnant women, mothers and newborns. That information allows decision-makers to identify problems, track temporal and geographical trends and disparities and assess changes in public health policy and practice. Documentation of perinatal deaths as well as identification of their major causes is also a crucial first step for their prevention. However, information on deaths in most LMIC is scanty (1, 8).

2.1 Prevalence and trend of perinatal mortality

On the study conducted in Hawasa referral hospital the stillbirth to ENND ratio were 7:1 , the trend was almost stable in three years period: 80, 86 and 86 per 1000 total births from (21).

EDHS data revealed that the PMR remained stable in about fifteen years. Nearly 30% reduction was observed in 2005 from the 2000 EDHS. However, the 2011 EDHS showed that the PMR was on rise (2).Has increased from 37 in 2005 to 46 per 1000 live births in 2011 which the ratio of ENND to stillbirth is close to 1:2 (2). From the three DHS data of the country (2000, 2005 and 2011) logarithmically, the neonatal mortality rate showed a slow decline of 1.9% per annum during the period. The decline for the log of early neonatal mortality rate was even slower at 0.9% per annum during the same period (22).

2.2 FACTORS ASSOCIATED WITH PERINATAL MORTALITY

A Multilevel Analysis of Prospective Follow up Study done in Jimma Zone revealed that neonate born from a mother in rural have 1.08 times more risk of dying during neonatal period than urban neonates (38).

The study on eastern Uganda also shows, Residence of Urban have 2.7 times increased risk of PND than the rural residents. Specifically for stillbirth and early neonatal death the odds was almost similar to that of PND which is 2.9 and 2.5 more than the rural residents respectively (24). Similarly on the study done in Nigeria, rural residents have a slight higher chance of dying during perinatal period than the urban AOR 1.74 (23).

In Ethiopia according to the EDHS 2011 Infant mortality is higher for births to mothers under age 20 than for mothers in the older age groups (2). similarly a study based on the Nigeria 2008 demographic and health survey observed that, neonates born to mothers aged younger than 20 years had significantly higher risk of mortality than those born to mothers aged 20–29 years, 30–39 years, and 40–49 years with HR of 4.07 (39). In eastern Uganda study, mothers with less than 20 years have two times higher risk PND and three times for stillbirth in contrast it decreases by 20% for early neonatal mortality (OR =0.8) (24).

According to the study done in southern Brazil in two different level of care in the Level III hospital (the top at the hierarchy) PND risk was three times much higher in primiparous mothers (34). On research done in Nigeria Primiparous mother have two times higher risk of PND than mothers having greater than five children (25). The study in England revealed that the association between null parity and stillbirth were seen but the study also observed a 60% increase in risk for mothers with a parity of 3 or higher, suggesting a U-shaped relation between parity and risk of stillbirth (26).

On the study done in Hawasa referral hospital both the crude and adjusted analysis showed that the stillbirth rate was highest among mothers who had no ANC follow up (21). And similarly on the research held in Uganda mothers does not attend Antenatal care are more likely to have PNDS (24), and In the Mexico study, mothers deficient of prenatal care were two times more higher risk of stillbirth (28).

On unmatched case control study done in Zimbabwe revealed that mother with labour complication had higher risk of experiencing perinatal mortality AOR: 8.99) (35).According to the study done in southern brazil in the third level hospital among mothers having Arterial hypertension PND risk was 2.65 much higher than those doesn't have (34) also the Tanzania findings showed that mothers who had

hypertension during pregnancy were almost five times more likely to have a perinatal death compared to those who had no hypertension during pregnancy (29).

The study in Hawasa shows that mothers with APH were 12.2 more likely to have PND, 6.2 much for stillbirth and four fold of risk for early neonatal death (AOR=3.94). Mothers with HDP were at higher risk of having perinatal death (AOR=3.2) and 3.3 much risk of stillbirth. Obstructed labor, mal presentation and cord accident were also risks for stillbirth (21).

The Bangladesh study also shows mother with History of bleeding during pregnancy was strongly associated with increased risk of stillbirth (AOR 22.4) and neonatal death (AOR 19.6) (30)

As a study had shown in Butajira male neonates had 1.6 much odds of than female neonates (31). Similarly a research done in southern Brazil in two different level of care in the Level III hospital (the top at the hierarchy) PND risk was increased two-fold in male infants (34). And a study in Nigeria shows females have 43% much lower risk of dying during perinatal period with AOR 0.57 (25).

According to the study done in Tanzania birth weight less than 2500 grams were two times more risky for PND (29). On a study done on Hawasa low birth weight had 1.7 times increase risk of stillbirth and for stillbirth and early neonatal death 2.8 and 2.52 times increased risk mortality respectively (21). Similarly a study done in Zimbabwe, babies with Birth weight less than 2500g have 9.46 much higher risk than the those born with normal birth weight (35).

On the study done in Hawasa gestational age doesn't associate with PND. For stillbirth preterm fetus have three times much more risk than the term but for early neonatal mortality both the crude and adjusted analysis had no association (21). Similarly in the study done in Mexico preterm delivery have four times much higher risk of having stillbirth (33)

A study conducted in low- and middle (Kenya, Zambia, Pakistan, India, Guatemala, and Argentina: a global network) to determine the rates of multiple gestation, stillbirth, and perinatal, neonatal mortality and Perinatal outcomes of multiple-gestation pregnancies shows Multiple-gestation fetuses had a relative risk (RR) for stillbirth of 2.65 and for perinatal mortality RR of 3.98) relative to singletons (41).

CONCEPTUAL FRAME WORK

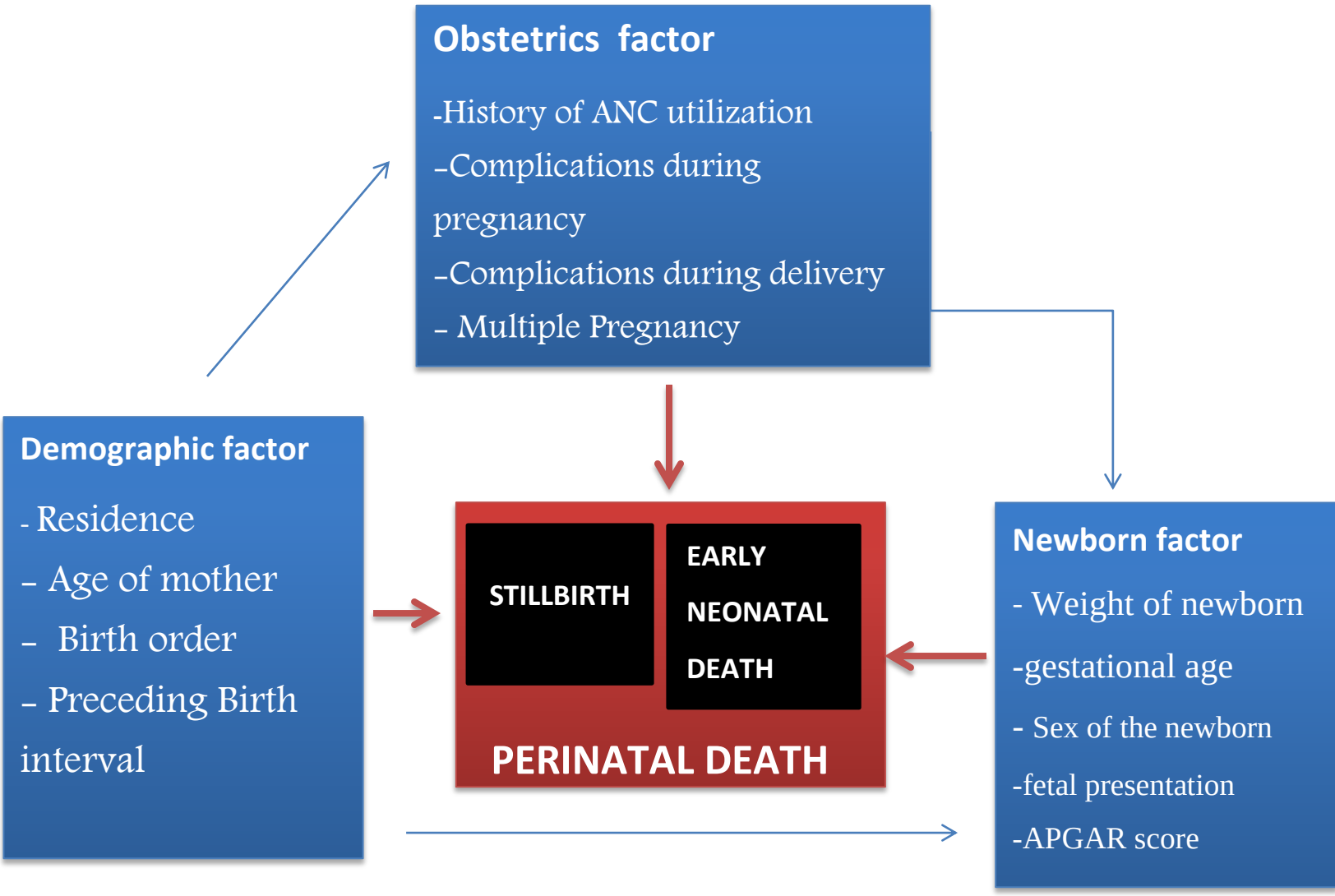

Fig1 conceptual frame work developed after reviewing different literatures.

SIGNIFICANCE OF THE STUDY

The objective of MDG (Millennium Development Goal 4) cannot be attain unless affords are made to reduce neonatal mortality especially early neonatal mortality which happens during the perinatal period. For program managers and policy makers the study will use to show about the trend and factors related to stillbirths, early neonatal deaths specifically and PND in general which helps for intervention and to reduce the figure and meet goals. The study will also benefit the community by informing on factors related to perinatal deaths, which helps to create and increase awareness on PND and its associated factors and finally identify what things have to be done at community level to reduce the risk factors, to decrease deaths and increase child survival, the study will also use for Researchers as a baseline for further investigation

CHAPTER THREE

OBJECTIVES

3.1 General Objective

To determine independent predictors of perinatal mortality, in Jimma University specialized hospital, Ethiopia from January 1st, 2011to December 30th, 2014

3.2 Specific objectives

- To determine independent predictors of perinatal mortality in Jimma University Specialized Hospital, Ethiopia from January 1st, 2011to December 30th, 2014
- To determine independent predictors of in Jimma University Specialized Hospital, Ethiopia from January 1st, 2011to December 30th, 2014
- To determine independent predictors of early neonatal mortality in Jimma University Specialized Hospital, Ethiopia from January 1st, 2011to December 30th, 2014

CHAPTER FOUR

Method & Material

4.1 Study area and period

The study was conducted in Jimma university specialized hospital, Jimma town, Oromiya, which is located 357 kms to south west of Addis Ababa. The town has 2 public hospitals (one specialized teaching hospital) and 13 private clinics, in which all belong to the public health system. The specialized hospital gives different inpatient and outpatient services to the population in the surrounding area of Jimma town. It also provides referral service to the South Western population of the country. It has four major (Medical, Surgery, Gynecology/ obstetrics, and pediatrics) and five other departments (dermatology, ophthalmology, psychiatry, dentistry). The hospital provides postgraduate training in Internal Medicine, Surgery, Gynecology/ obstetrics, Pediatrics, and Ophthalmology. The Pediatric ward has three sub wards, ward A, NRU and neonatology (neonatal ICU), the study was conducted from February 15th – March 15th, 2015

The study period is from January 1st, 2011to December 30th, 2014

4.2 Study design

A facility based matched case control design

4.3.1 Source population

All deliveries that have been attended in the hospital (live births, stillbirth and neonates)

4.3.2 Study population

Cases and controls selected from the source population and meet the inclusion and exclusion criteria listed below.

Study population for cases

Cases: - All randomly selected perinatal deaths in JUSH neonatology ward that occurred in between January 1st, 2011and December 30th, 2014

Study population controls

Controls: - All selected live births and early neonates discharged or stayed alive in JUSH neonatology ward occurred in between January 1st, 2011and December 30th, 2014

4.4 Inclusion and exclusion criteria for both cases and controls

- **Inclusion criteria for cases**
  - All stillbirth deliveries attended in JUSH January 1st, 2011to December 30th , 2014
  - All early neonates died in JUSH neonatology ward January 1st, 2011to December 30th , 2014
  - Neonate having sign of life and died at arrival without intervention.

- **Exclusion criteria for cases**
  - Stillbirths or any terminations of pregnancy > 28 weeks due to congenital malformation which is incompatible with life
  - Early Neonates died due to congenital malformation which is Incompatible with life
  - Deliveries attended other than JUSH

- **Inclusion criteria for controls**
  - All live births attended in JUSH January 1st, 2011to December 30th , 2014
  - All early neonates admitted in JUSH neonatology ward and survived their seventh day from January 1st, 2011 to December 30th, 2014

- **Exclusion criteria for controls**

    - Early Neonates having congenital malformation which is Incompatible with life
    - Deliveries attended other than JUSH
    - Neonates discharged before their seventh day

4.5 Sample size determination

For the calculation of trend all death was taken from registration books and reports.

Sample size for factor associated with perinatal death was calculated using open EPI version 303. Among variables (gestational age, birth weight, parity, maternal history of having obstetric complication, fetal presentation,) that are associated with perinatal death taken from the study done in Hawasa referral hospital,(21) , birth weight was found to give the largest sample size with OR of 1.7 and prevalence of birth weight 1.5 - 2.5 among the controls was 7.1, taking 95% level of confidence, 80% power and 1:2 ratio of cases to controls, the total sample size determined was 1593 (531 cases and 1062 controls).

Variable	Prevalence among controls %	OR	#Case	#control	Total
fetal presentation(trans)	1.2	11.6	65	130	195
Gestational age	87.1	0.5	183	366	549
Birth wt < 1.5	0.7	16.2	73	145	218
Birth wt 1.5-2.5	7.1	1.7	531	1062	1593
obstetric complication (HPD)	6.4	3.2	101	201	302
obstetric complication (APH)	2.2	12.2	36	72	108

4.6 Sampling procedure

All perinatal death' s identification number (card number) occurred in between January 1st, 2011and December 30th, 2014 was taken from daily registry books and entered to SPSS for selection of cases using computer generated simple random sampling method.

Controls of stillbirths were selected from live births and controls of early neonatal deaths were selected from those early neonates admitted to JUSH neonatology ward and discharged or stayed alive up to their seventh day. Since the specific time is not written on the registry books for matching the cases with controls, the two controls were selected from the same period registration books one before and after each case for both stillbirth and early neonatal death. Simple random sampling without replacement method were used for replacing missed or lost charts of case and the next nearest chart was used to replace missed or lost chart' s of controls.

4.7 Data collection technique

After reviewing relevant literatures record reviewing tool were prepared in English. During data collection primary, daily registry books were reviewed and selection of cases and controls was done from the registration books then the cards of both the selected cases and controls was traced from the archive using card numbers found in the registration book. For stillbirths and live births maternal cards was used for data collection and for early neonates their own cards was assessed, when there were missing data on the early neonates card, their maternal cards was trace using the date of admission, diagnosis of the neonate and name of the mother.

4.8 Study variables

4.8.1 Dependent variables

Perinatal mortality

Stillbirth

Early neonatal death

4.8.2 Independent variables

- Demographic variables (residence- Age of mother, Birth order ,Preceding Birth interval, Sex of the newborn

- Newborn factor (Weight of newborn and gestational age at birth)
- Obstetric factors (history of ANC utilization and pregnancy related complications

4.9 Operational definition

Pregnancy complication: - if the mother have one of the any type of pregnancy related complications
Urban : - places listed as a town in the south west Ethiopia by central statistics agency of the country.
Rural : - Other than those listed in urban

4.10 Definition of terms

Live birth: - is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered (2).

Stillbirth: - or fetal death is death prior to the complete expulsion or extraction from its mother of a product of conception after 28 weeks of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles (2).

Neonate: - newborn within 28 days of live (2).

Early neonate: - newborn within seven days of live
Perinatal rate: - Is the sum of stillbirths and early neonatal deaths divided by the summation of live births and stillbirth, expressed per 1,000.
Neonatal mortality rate: - number of early neonatal death / total number of live birth *1000 (2).
Low birth weight: is defined as a birth weight of alive born infant of less than 2,500 g

4.10 Data Quality Assurance

For data collection six nurses from the hospital were recruited to collect data from JUSH maternal and neonatal records after two day training given focusing on the objective of the study and MPH student will

supervise and facilitate the data collection process. The principal investigator coordinated the overall activity of the study. During data collection supervisor will check how the data collectors are doing their task and solve on sight problems. At the end of each data collection day the principal investigators were also checked the completeness of the data collection tool**.** Template scheme for data entry was developed into Epidata Version 7 and pre-tested for ranges, skipping patterns and allowed. Data was entered daily by the principal investigator and those out of range data' s was checked again and corrected**.** Mortality numbers obtained from the registries was cross checked with each month report.

4.11 Data processing and analysis

Trends were calculated for each year by dividing all death occurred each year total births (still birth + live birth) within the same year and confidence interval was calculated manually using the formula of estimating C-I for single population proportion.

The collected data were entered on EPI data and exported to stata version 12 for cleaning, processing and analysis. Descriptive analysis was used to quantify Causes and describe the study populations in relation to demographic and other relevant variables. First bivariate conditional logistic regression was done to select variables for multi variable conditional logistic regression for all outcome variables and all variables having P-value ≤ 0.25 during bivariate analysis was considered as candidates for the multi variable logistic regression analysis for all dependent variables. After the multi variable logistic regression analysis variables having p-values <0.05was taken as statistical significance for each stillbirth, early neonatal and perinatal mortality. The degree of association between independent and dependent variables was assessed using matched Adjusted odds ratio (MOR) which is obtained by treating each matching category as a unique stratum unlike the ordinary odds ratio(ad/bc) with 95% C-I

Since the data uses secondary data there were missing values, the variable having large percent of missing value was birth interval 1238 (77.7) , the rest have <5% of missing (table 1). Therefore birth interval was dropped from the analysis and complete data analysis was done for the rest of variables.

Table: 1 Percentage of missing values among variables, JUSH, Ethiopia, 2011-2014.

Variable	Missed values (%)
Residence (n = 1567)	**26 (1.6)**
Mother's age (n = 1570)	**23 (1.4)**
No children (n = 1536)	**57 (3.58)**
Birth interval (n = 355)	**1238 (77.7)**
Birth Weight (n = 1586)	**7 (.44)**
1st min ARGAR score (n = 1579)	**14 (0.88)**
5th min APGAR score (n = 1579)	**14 (0.88)**
Multiple pregnancy (n = 1580)	**13 (0.82)**
Fetal presentation (n = 1565)	**28 (1.8)**
ANC (n = 1552)	**41 (2.6)**

4.12 Ethical clearance

Ethical clearance was taken from Jimma University ethical review committee to the JUSH. Permission and support letter were taken from JUSH to specific departments. Only cad numbers was written on the data collection tool and information's that was obtained from the study subjects were not used for other purpose except in this study to ensure the Confidentiality of the study subject's.

4.13 Dissemination plan

Results of this study was presented to JU department of population and family health and disseminated to JUSH, Jimma health office and NGOs working on maternal and child health care. Attempts will also be made to present it on scientific conferences and publish it on national or international scientific journal.

CHAPTER FIVE

RESULT

During the study period, there were a total of 13,947 live births, 1161 still births and 1,320 perinatal deaths making the overall perinatal mortality rate (PMRs) 87.4 / 1000 birth with 95% C-I of (82.7, 92.1). The study also investigated each year trend in the rate of perinatal mortality 77.5 (64.5, 90.5), 85.7 (71.7, 99.7), 83.2(69.2, 97.2), 105(90, 120) from 2011 to 2014 respectively, PMR to have an increasing trend though a slight decrement was noticed in 2013 compared to the year before (fig 2). From the total perinatal death Stillbirths accounted for about 80.7% of PMR.

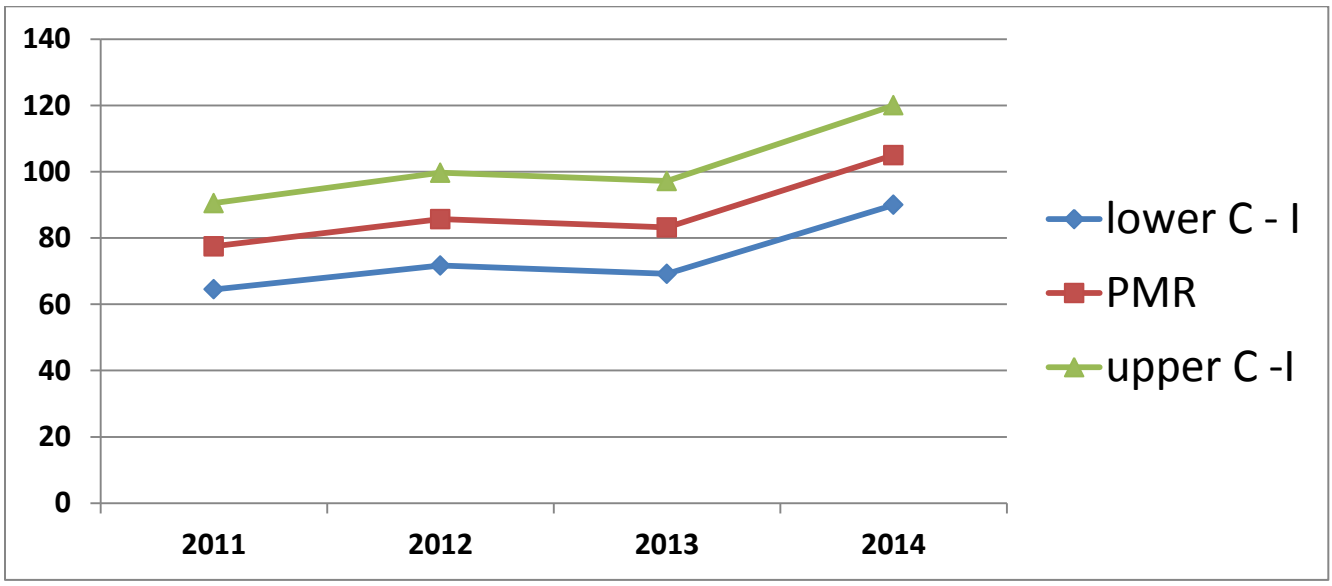

Fig: 2 trend of perinatal mortality during the study period JUSH, Ethiopia, 2011-2014.

From the total of 531 deceased perinatal (cases) and 1062 controls studied, 404 (76.1) of cases and 636 (59.9) of controls were from rural areas. The mean age of their mother among the cases was 26.7 years (SD +_ 6.58), and among the controls 26.94 years (SD +_ 5.99), the range from 20 – 34 was the most common age group in both the case and controls. Primigravida mothers were 175 (32.9) in the control and 470 (44.3) in cases (table 2).

Table 2: Demographic characteristics of cases and controls. JUSH, Ethiopia, 2011-2014.

characteristics	Category	Cases (531)	Controls (1062)
residence	Urban	104 (19.6)	423 (39.8)
	Rural	404 (76.1)	636(59.9)
Mother's age	15 – 19	40 (7.5)	74(7.0)
	20 – 34	393 (74.0)	806 (75.9)
	35 – 50	92 (17.3)	165 (15.5)
Birth order	1^{st}	175 (32.9)	470 (44.3)
	2^{nd} – 4^{th}	191(36.0)	405 (38.1)
	≥ 5^{th}	128 (24.1)	167 (15.7)
Newborn weight	<1500 g	27 (5.1)	9 (0.85)
	1500- 2499g	154 (29.0)	107 (10.1)
	≥ 2500g	343 (64.6)	946 (89.1)
Gestational GA	28 -36wk	256 (48.2)	143 (13.5)
	37-42wk	245 (46.1)	886 (83.4)
	≥ 42wk	30 (5.6)	33 (3.1)
Sex of the	Male	339 (63.8)	543 (51.1)
	Female	192 (36.2)	519 (48.9)

Maternal history of at least one complication was high in percent among the cases which is 467 (87.9 %). Complication happened during pregnancy and delivery were mostly seen among the cases especially uterine rapture which is 121 (22.8 %) among the cases and only 13 (1.2%) among the controls also 160 (30.1%) abstracted labor registered among cases and 92 (8.7%) among the control groups (Table 3).

Table 3: Obstetric characteristics of perinatal deaths (cases) and controls, JUSH, Ethiopia, 2011-2014.

Characteristics	Category	Cases 531 (%)	Controls n=1062 (%)
ANC	No	117 (22.0)	102 (9.6)
	Yes	382 (71.9)	951 (89.5)
Fetal Presentation	Cephalic	341 (64.2)	906 (66.5)
	Breech	87 (16.4)	73 (6.9)
	Transverse	54 (10.2)	31 (2.9)
	Others	18 (3.4)	37 (3.5)
Complication	No	64 (12.1)	714 (67.2)
	Yes	467 (87.9)	348 (32.8)
Multiple pregnancy	No	447 (84.2)	1,005 (94.6)
	Yes	71 (13.4)	57 (5.4)
Antepartum Hemorrhage	No	446 (84.0)	1,018 (95.9)
	Yes	85 (16.0)	44 (4.1)
Hypertensive disorder	No	465 (87.6)	1,025 (96.5)
	Yes	66 (12.4)	37 (3.5)
Obstructed Labor	No	371 (69.9)	970 (91.3)
	Yes	160 (30.1)	92 (8.7)
Uterine Rapture	No	410 (77.2)	1,049 (98.8)
	Yes	121 (22.8)	13 (1.2)
Infection	No	490 (92.3)	1,041 (98.0)
	Yes	41 (7.7)	21 (1.9)
Pregnancy Related Complication	No	480 (90.4)	1,036 (97.6)
	Yes	47 (8.9)	26 (2.4)
PROM	No	516 (97.2)	1,050 (98.9)
	Yes	15 (2.8)	12 (1.1)
Cord problem	No	481 (90.6)	1,049 (98.8)
	Yes	50 (9.4)	13 (1.2)
Mal presentation	No	383 (72.1)	964 (90.8)
	Yes	148 (27.9)	98 (9.2)
Malposition	No	492 (92.7)	978 (92.1)
	Yes	39 (7.3)	84 (7.9)

From total deliveries attended 57.1 % were spontaneous vaginal delivery, the rest were C/S 38.5% and distractive delivery which accounts 3.8%. Among stillbirths around 21.7 % had positive fetal heart beat during first contact at delivery. The leading cause of mortality among the early neonates was prematurity accounts 52 (50.98%) (Fig3).

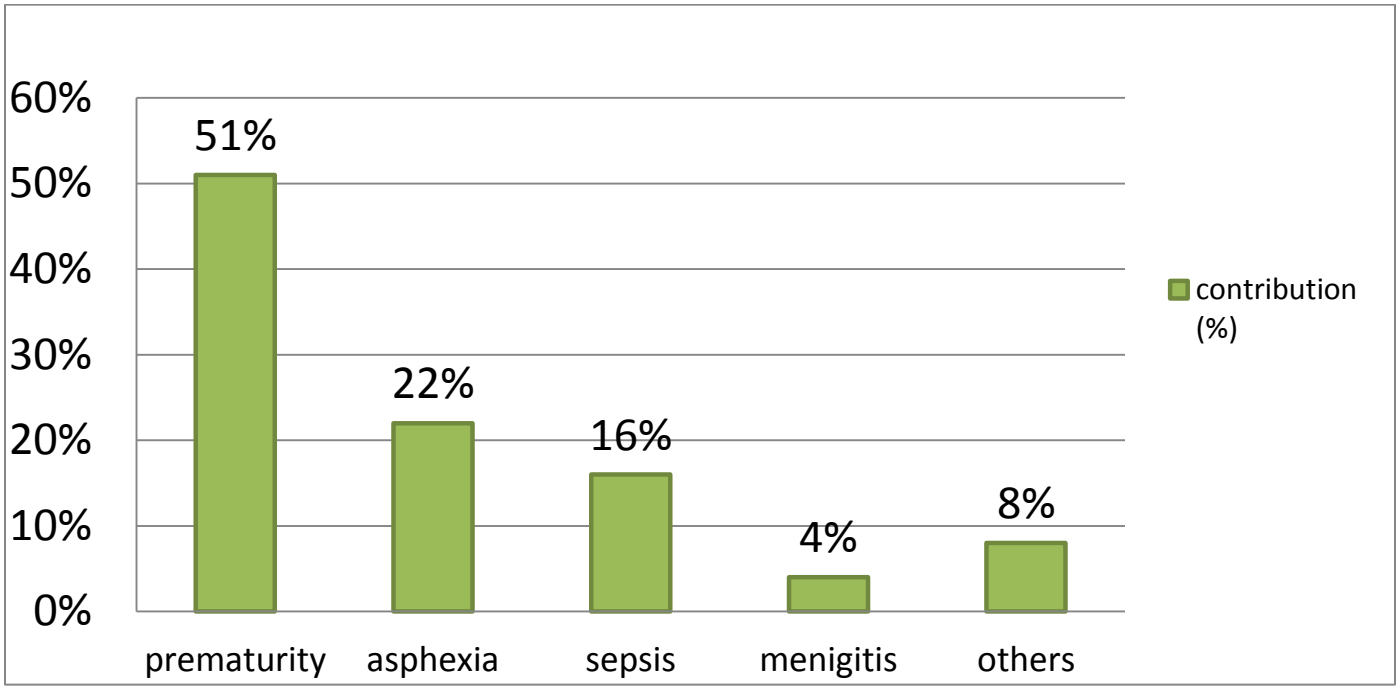

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Fig 3: **Cause of early neonatal deaths among study participants, JUSH, Ethiopia, 2011-2014**

Factor associated with PND, stillbirth and ENND

In the multi variable analysis the odds of PND with newborn's birth weight < 1500g and 1500- 2499g had 6 [(MAOR= 6.4, 95%CI (1.73, 23.75)] and 3 times [(MAOR= 2.97, 95%CI (1.48, 5.97)] as much as birth weight > 2500g. The odds of perinatal death among males were 2.1 more also the odds of PND was 3 times more among mothers who had no history of ANC attendance (Table 4).

Multiple pregnancies had five times more odds of PND, [(MAOR= 5.4, 95%CI (2.53, 11.46)]. The odds of PND among women who had at least one type of complication were 8.4. Specifically, the odds of PND for mothers having APH were 2.6 compared to those who had no bleeding during pregnancy, [(MAOR= 2.63, 95%CI (1.2, 5.7)], similarly the odds of perinatal death was 15, 2.1 and 5.9amond mothers who had UR, OL, CP (Table 4)

Table: 4 multi variable Analyses of factor associated with PND, JUSH, Ethiopia, 2011-2014.

Variables	Category	Cases (531)	Controls(1062)	COR (95% C-I)	MAOR (95% CI)	P.value
Residence	Urban	104 (19.6)	423 (39.8)	1	1	
	Rural	404 (76.1)	636(59.9)	2.6 (1.99, 3.28)	0.85 (0.52, 1.38)	0.512
Parity	1^{st}	175 (32.9)	470 (44.3)	1	1	
	2^{nd} – 4^{th}	191(36.0)	405 (38.1)	1.24 (0.96, 1.59)	0.81 (0.495, 1.33)	0.41
	$\geq 5^{th}$	128 (24.1)	167 (15.7)	1.97 (1.47, 2.64)	1.27 (0.69,2.34)	0.436
Birth weight	≥2500 g	27 (5.1)	9 (0.85)	1	1	
	<1500 g	154 (29.0)	107 (10.1)	8.0 (3.7, 17.4)	6.4 (1.73, 23.75)	0.005*
	1500-2499g	343 (64.6)	946 (89.1)	4.3 (3.2, 5.9)	2.97 (1.48, 5.97)	0.002*
Gestational Age	28 – 36 wk	256 (48.2)	143 (13.5)	1	1	
	37- 42 wk	245 (46.1)	886 (83.4)	.155 (0.12, 0.204)	0.21 (0.12, 0.37)	0.000**
	≥42 wk	30 (5.6)	33 (3.1)	.51 (0.29, 0.885)	0.66 (0.24, 1.81)	0.421
Sex	Male	339 (63.8)	543 (51.1)	1.7 (1.4,2.1)	2.1(1.3,3.3)	
	Female	192 (36.2)	519 (48.9)	1	1	0.002*
ANC	No	117 (22.0)	102 (9.6)	3 (2.18, 4.1)	2.9(1.5,5.4)	0.001*
	Yes	382 (71.9)	951 (89.5)	1	1	
Complication	No	64 (12.1)	714 (67.2)	1	1	
	Yes	467 (87.9)	348 (32.8)	14.6 (10.36, 20.65)	8.36 (4.35, 16.04)	0.000*
Multiple pregnancy	No	447 (84.2)	1005 (94.6)	1	1	
	Yes	71 (13.4)	57 (5.4)	2.7 (1.87, 3.96)	5.39 (2.53, 11.46)	0.000*
APH	No	446 (84.0)	1018 (95.9)	1	1	
	Yes	85 (16.0)	44 (4.1)	4.54 (3.04, 6.79)	2.63 (1.21, 5.70)	0.014*
HTD	No	465 (87.6)	1025 (96.5)	1	1	
	Yes	66 (12.4)	37 (3.5)	3.77 (2.49, 5.7)	1.51 (0.645, 3.52)	0.344
UR	NO	410 (77.2)	1049 (98.8)	1	1	
	Yes	121 (22.8)	13 (1.2)	23.61(12.38,45.02)	15.44 (5.74,41.53)	0.000**
	Yes	160 (30.1)	92 (8.7)	4.26 (3.2, 5.7)	2.14 (1.21, 3.77)	0.009*

Table 4 continued……

Variables	Category	Cases (531)	Controls(1062)	COR (95% C-I)	MAOR (95% CI)	P. value
OL	No	371 (69.9)	970 (91.3)	1	1	
	Yes	160 (30.1)	92 (8.7)	4.26 (3.2, 5.7)	2.14 (1.21, 3.77)	0.009*
Infection	No	490 (92.3)	1041 (98.0)	1	1	
	Yes	41 (7.7)	21 (1.9)	4.1 (2.4, 6.99)	2.229(0.78, 6.37)	0.135
PROM	No	516 (97.2)	1050 (98.9)	1	1	
	Yes	15 (2.8)	12 (1.1)	2.61 (1.195, 5.71)	0.36(0.089, 1.47)	0.154
CP	No	481 (90.6)	1049 (98.8)	1	1	
	Yes	50 (9.4)	13 (1.2)	8.83 (4.59, 16.99)	5.98(2.17, 16.45)	0.001*
mal presentation	No	383 (72.1)	964 (90.8)	1	1	
	Yes	148 (27.9)	98 (9.2)	3.65 (2.75, 4.86)	1.36(0.76, 2.426)	0.306

*= p value < .05, **= p. value <0.001

The odds for being stillbirth was 0.45 and 0.21 as much as to perinatal death among mothers with the age range of 20 – 34 and > 35 years with confidence interval of [(MAOR=0.45, 95%CI(0.15,1.31)] and [(MAOR=0.21,95%CI(0.05, 0.92)] respectively than those born from mothers with age less than 20.The odds of stillbirth also 0.10 and 0.61 among those born at term gestational age and post term gestational age with the true C-I of [(MAOR= 0.10, 95%CI (0.04 , 0.24)] and [(MAOR= 0.61, 95%CI(0.16 , 2.29)] respectively (Table 5).

The odds of stillbirth were 8 times higher among mothers doesn't attend ANC at least once during current pregnancy. But the odds increases with the birth order , those born from multiparous mothers, the odds of stillbirth was 1.2 times much higher [(MAOR= 1.17, 95%CI(0.57 , 2.38)] and for those born from grand multiparous the odds was 3 fold [(MAOR=3.44, 95%CI(1.24 , 9.55)] than the first babies. Similarly the odds was 12 times higher among multiple pregnancies [(MAOR= 12.48, 95%CI (3.81, 40.9)] (Table 5).

Table: 5 multi variable Analyses of factor associated with stillbirth, JUSH, Ethiopia, 2011-2014.

Variable	Category	Cases =429 (%)	Control=858 (%)	COR (95% C-I)	MAOR (95% CI)	p. value
	urban	68 (15.9)	343 (40.0)	1	1	
Residence	Rural	338 (78.8)	514 (59.9)	3.2 (2.39, 4.32)	0.94 (0.47,1.88)	0.862
Mother's Age	15 – 19	24 (5.6)	70 (8.2)	1	1	
	20 – 34	330 (76.9)	674 (78.6)	1.4 (0.89, 2.32)	0.45 (0.15,1.31)	0.143
	≥35	71 (16.6)	107 (12.5)	1.97 (1.13, 3.44)	0.21 (0.05, 0.92)	0.039*
Birth order	1^{st}	141 (32.9)	426 (49.7)	1	1	
	2^{nd} – 4^{th}	147 (34.3)	303 (35.3)	1.44 (1.09, 1.90)	1.17 (0.57, 2.38)	0.675
	≥5^{th}	110 (25.6)	120 (14.0)	2.64 (1.9, 3.65)	3.44 (1.24, 9.55)	0.018*
Birth weight	< 1500 g	5 (1.2)	7 (0.8)	1	1	
	1500 2500g	117 (27.3)	69 (8.0)	2.95 (0.88, 9.9)	2.71(0.011,672.41)	0.723
	≥2500	300 (69.9)	782 (91.1)	0.6 (0.19, 1.92)	1.94(0.0079,475.3)	0.813
Gestational Age	28 -36 wk	202 (47.1)	99 (11.5)	1	1	
	37 – 42 wk	198 (46.2)	734 (85.5)	.13 (0.091, 0.175)	0.10 (0.04, 0.24)	0.000**
	≥42 wk	29 (6.6)	25 (2.9)	.596 (0.32, 1.12)	0.61 (0.16, 2.29)	0.461
Sex	Male	279 ()	461()	1.6 (1.2, 2.1)	1.6 (0.84, 3.1)	0.155
ANC	No	109 (25.4)	82 (9.6)	3.7 (2.7, 5.3)	8 (3.1, 20.7)	0.000**
	Yes	292 (68.1)	775 (90.3)	1	1	
Complication	No	38 (8.9)	586 (68.3)	1	1	
	Yes	391 (91.1)	272 (31.7)	23.6 (14.8, 37.55)	10.44 (3.90, 27.93)	0.000**
Multiple pregnancy	No	370 (86.2)	831 (96.9)	1	1	
	Yes	46 (10.7)	27 (3.1)	3.67 (2.23,6.024)	12.48 (3.81,40.9)	0.000**
APH	No	364 (84.8)	821 (95.7)	1	1	
	Yes	65 (15.2)	37 (4.3)	4.21 (2.69, 6.59)	3.15 (1.11, 8.93)	0.031*
HTD	No	371 (86.5)	828 (96.5)	1	1	
	Yes	58 (13.5)	30 (3.5)	4.15 (2.62, 6.56)	2.87 (0.94, 8.82)	0.065
OL	No	282 (65.7)	788 (91.8)	1	1	
	Yes	142 (33.1)	70 (8.2)	5.15 (3.72, 7.13)	4.34 (1.95, 9.66)	0.000**

Table 5 continued ……

Variable	Category	Cases =429 (%)	Control=858 (%)	COR (95% C-I)	MAOR (95% CI)	p. value
UR	No	321 (74.8)	847 (98.7)	1	1	
	Yes	108 (25.2)	11 (1.3)	26.45(12.89,54.26)	14.03 (4.37, 45.04)	0.000**
CP	No	380 (88.6)	846 (98.6)	1	1	
	Yes	49 (11.4)	12 (1.4)	9.5 (4.81, 18.81)	9.62 (2.75, 33.70)	0.000**
Infection	No	395 (92.1)	844 (98.4)	1	1	
	Yes	34 (7.9)	14 (1.6)	4.86 (2.61, 9.05)	2.82 (0.59, 13.42)	0.193
PROM	No	423 (98.6)	852 (99.3)	1	1	
	Yes	6 (1.4)	6 (0.7)	2.0 (0.65, 6.2)	1.61 (0.14, 18.03)	0.701
Mal presentation	No	300 (69.9)	786 (91.6)	1	1	
	Yes	129 (30.1)	72 (8.4)	4.66 (3.34, 6.5)	2.22 (0.99, 4.996)	0.054

*= p value < .05, **= p. value <0.001

The odds of death were 3.5 much higher in male neonates [(MAOR= 3.5, 95%CI (1.3, 9.5)]. The odds of ENND were 0.05 [(MAOR= 0.05, 95%CI (0.03, 0.76)] among mothers with greater than 20 years (table 6).

Low birth weight neonates had 2.8 more odds of having early death than normal weight newborns [(MAOR= 2.8, 95%CI (1.0, 7.7)]. It also showed that UR, 5th minute Apgar score were independently associated with early neonatal death (Table 6).

Table: 6 Multi variable Analyses factor associated with ENND, JUSH, Ethiopia, 2011-2014.

Variable	category	Case N= 102	Control N=204	COR (95% C-I)	MAOR (95% C-I)	p. value
Mother's Age	< 20 years	16 (15.7)	4 (2)	1	1	
	≥20 years	84 (82.4)	190 (93.1)	0.1 (0.03, 0.36)	0.05 (0.03, 0.76)	0.031*
Birth order	1st	34 (33.3)	44 (21.6)	1	1	
	2nd – 4th	44 (43.1)	102 (50)	.55(0.31, 0.91)	0.34 (0.099, 0.1)	0.099
	>5th	18 (17.6)	47 (23.0)	.51 (0.25, 1.03)	0.6 (0.4, 0.18)	0.411
Birth weight	≥2500g	43 (42.2)	164 (80.4)	1	1	
	<2500g	59 (57.8)	40 (19.6)	4.7 (2.8, 8.1)	2.8 (1.0,7.7)	0.048*
Gestational Age	28 -36wk	54 (52.9)	44 (21.6)	1	1	
	37 – 42 wk	47 (46.1)	152 (74.5)	.23 (0.13, 0.41)	0.37 (0.12, 1.2)	0.097
	≥42 wk	1 (0.98)	8 (3.9)	.09 (0.01, 0.8)	0.04 (0.0008,1.9)	0.101
Sex	Male	60 (58.8)	82 (40.2)	2.16 (1.3, 3.6)	3.5 (1.3, 9.5)	0.014*
1st min APGAR	1-3	25 (24.5)	37 (18.1)	1	1	
	4-6	59 (57.8)	113 (55.4)	.78 (0.43, 1.43)	4.4 (0.76, 25.1)	0.098
	7-10	12 (11.8)	46 (22.5)	.4 (0.18, 0.91)	3.6 (0.38,35.1)	0.263
5th min APGAR score	1-3	9 (8.8)	8 (3.9)	1	1	
	4-6	38 (37.3)	61 (29.9)	.59 (0.22, 1.58)	0.19 (0.02, 1.4)	0.108
	7-10	49 (48.0)	127 (62.3)	0.36 (0.13,0.97)	0.06 (0.004,0.76)	0.03*
complication	No	26 (25.2)	128 (62.7)	1	1	
	Yes	76 (74.5)	76 (37.3)	4.27 (2.5, 7.3)	4.8 (1.5, 15.7)	0.009*
Multiple pregnancy	No	77 (75.5)	174 (85.3)	1	1	
	Yes	25 (24.5)	30 (14.7)	1.77 (1.01,3.11)	1.9 (0.6, 6.4)	0.299
APH	No	82 (80.4)	197 (96.6)	1	1	
	Yes	20 (19.6)	7 (3.4)	5.7 (2.42,13.51)	4.3 (0.8, 21.7)	0.079
HTD	No	94 (92.2)	197 (96.6)	1	1	
	Yes	8 (7.8)	7 (3.4)	2.46 (0.84,7.17)	0.27 (0.03, 2.41)	0.241
OL	No	84 (82.4)	182 (89.2)	1	1	
	Yes	18 (17.6)	22 (10.8)	1.7 (0.89, 3.29)	0.87 (0.16, 4.6)	0.873

Table 6 continued……..

Variable	Categor	Case	Control	COR (95% C-I)	MAOR (95% C-I)	p. value

	y	N= 102	N=204			
UR	No	89 (87.3)	202 (99.0)	1	1	
	Yes	13 (12.7)	2 (0.98)	13 (2.93, 57.6)	18.9 (1.1,325.1)	0.043*
Infection	No	95 (93.1)	197 (96.6)	1	1	
	Yes	7 (6.9)	7 (3.4)	2 (0.7, 5.7)	0.32 (0.03, 3.2)	0.324
PROM	No	93 (91.2)	198 (97.1)	1	1	
	Yes	9 (8.8)	6 (2.9)	3 (1.07, 8.43)	0.99 (0.16, 6.15)	0.995
Mal presentation	No	83 (81.4)	178 (87.3)	1	1	
	Yes	19 (18.6)	26 (12.7)	1.48 (0.81, 2.69)	1.02 (0.23, 4.6)	0.978

*= p value < .05, **= p. value <0.001

CHAPTER SIX

DISCUSSION

The study investigated each year trend in the rate of perinatal mortality in the study period and found that, PMR to have an increasing trend though a slight decrement was noticed in 2013 compared to the year before which is comparable but a bit higher with the three year trend in Hawasa hospital (21) and almost twice the EDHS 2011 estimation (2). The rise in rate of PNM in hospital is mainly due to the health seeking behavior of our society in which they mainly came late (44, 45). Example on this study more than 50% of the total and 87.9 % of the cases have at least one complication and in the community there is also under reporting of new born deaths (1).another hospital was also opened in jimma town since 2012 which will increase the referral of high risk newborns and mothers that make rise the rate in this specific hospital.

The odds of stillbirth were 0.45& 0.21 as much as on fetus born from mother age 20-34and above 35 respectively and odds of ENND were 0.05 as mush as on newborns born form mothers > 20years old compared to mothers with the age of less than 20 . This result is in line with a study based on the Nigeria 2008 demographic and health survey that shows neonates born from mothers aged younger than 20 years had significantly higher risk of mortality than those born to mothers aged 20–29 years, 30–39 years, and 40–49 years (39). On the west Uganda study, less than 20 years old mothers have three times higher risk of stillbirth (24). This is because mainly obstetrics complications are higher on young mothers. Also studies show PND and maternal age have association (2, 24) in which this this study doesn't. This might be because of similarity of mother's age distribution among the cases and controls which is not significantly seen during sub group analysis.

Parity were not significantly associated with ENND in contrary to the study done in Jimma zone and Nigeria that shows primigravida mothers and grand multiparous mothers had higher risk of ENND (39). PND also doesn't associate with parity in this study similarly in study done in Zimbabwe and Tanzania parity had no association with PND in the multivariate analysis (29, 35). In contrary a study done in Brazil on level II hospital primiparous mothers have 1.97 times much higher risk of having PND and in Uganda primiparous mothers have 3.3 much higher risks (24, 34). Scientifically the association of PND

and parity is explained by primiparous mothers have poor maternal adaptation to pregnancy which cause inadequate uterine vascular response to pregnancy hemodynamic demand. These abnormalities result in placental ischemia that leads to release of circulating an-giogenic factors that cause preeclampsia (36).This contradiction might be since this is hospital based study and majority [76 (73.8%)] of the total cases whom their mother had HTD were admitted to hospital before delivery in which the hypertensive disorder is controlled after admission. The other reason is due to methodological and setting difference between this study and the compared studies. The first reason also describe why having HTD doesn't associate PND, stillbirth and ENND in contradiction to different researches conducted in Ethiopia and other developing countries (21, 17, 29).

The odds of PND and stillbirth were 3 and 8 times higher among mothers that had no history of ANC utilization. This is consistent with previous study conducted in Ethiopia and other African countries (35, 24, & 28). There is also literature that shows the effect of ANC on neonatal mortality (38). Specifically this study doesn't show significant association, this might be because there is methodological differances and the compared study looks neonatal mortality in general, this also explains beside the increment in ANC utilization at national and regional level still the neonatal mortality (which three fourth is contributed by early neonatal death) have no change even there is an increasing pattern of early neonatal mortality to late neonatal mortality ratio (22).

Mother having at least one complication had 8, 4.8,10 times more odds of perinatal death ,ENND and stillbirth , similarly study in Zimbabwe shows that mother with labor complication had higher risk of experiencing perinatal mortality AOR: 8.99 (35) . This is because at least having one obstetrics complication and other specific obstetrics complications were mainly seen on the dead newborns.

The odds of perinatal death were 2.6, 15.4, 2.14 and 6 times much higher among newborns from mothers having APH, uterine rapture, obstructed labor and cord accident respectively. Odds of having stillbirth among newborns from mother having APH, uterine rapture, obstructed labor and cord accident were 3, 14, 4 and 9.7, times much higher than those doesn't have the respective complications. The study is in line but a little lower than the study done in Hawasa in which mothers with APH, obstructed labor and cord accident were 12.2, 19.8 and 15.9 more likely to have PND and mothers with APH, obstructed labor and cord accident were 6.2, 7.7 and 18.6 more likely to have stillbirth(21). The reason could be

stillbirth, perinatal or neonatal death increases as a result of severe vaginal bleeding and cord accidents in pregnancy which leads to premature placental separation, consequent hypoxia and metabolic acidosis (37).

Only rapture of uterus had significant association with early neonatal death but the study in Hawasa and Bangladesh shows that APH and obstructed labor have significant effects on ENND (21, 30). This might be in uterine rapture usually the fetuses born still, in case of incomplete rupture and if it happens in the hospital it is possible to have a live baby with high chance to be early neonatal death (37). The difference could be the study in Hawasa includes few variables (GA, parity, birth weight, complication) but this study in addition to above study tries to include demographic and newborn factors, and the Bangladesh study is done on rural community unlike the this study that is done in JUSH which is among the highest hospital in the country.

The odds of PND were 2.1 more among male. This result is supported by a research done in Brazil and Nigeria shows male births have 1.95much higher chance and female births have 43% much lower risk of dying during perinatal period (34, 25). Male neonates had 3.5 much higher odds of being dead during the early neonatal period, this finding goes parallel with studies done in Butajira, Nigeria, Vietnam (31, 40& 23) but sex doesn't have significant effect on stillbirth.

Very low birth weight and low birth weight birth had 6 and 3 times higher odds of perinatal death in line with the Tanzania study in which birth weight less than 2500 grams were two times more risky for PND (29). A study done in Zimbabwe, babies with Birth weight less than 2500g have 9.46 much higher risks than those born with normal birth weight (32). The odds of neonatal death before their seventh day among births < 2500g were 2.8 much higher than NBW neonates .This result is consistent with the study in Hawasa. Similarly studies in Vietnam revealed that LBW neonates have 9.5 much higher risk of ENND (21, 40). In contrary to study in Hawasa this study doesn't show association between stillbirth and birth weight (21).

The odds of being stillbirth were 0.1, 0.6 as much as among term and post term deliveries respectively similarly a study conducted in Hawasa revealed preterm newborns have 3.03 times more chance to born still . Specifically to this study it might be explained that among the preterm deliveries around 69.8% of

them have at least one complication which is higher than the term (44.8%) and post term (64.8%). But the adjusted analysis of preterm deliveries with PND and ENND doesn't s show significant association, which goes parallel with other hospital based study (21). However, study in Jimma zone pre term babies have 2.09 times much higher risk death during the neonatal period, the difference is due study setting, the first two studies are conducted in specialized hospital which have neonatal centers to take care of the preterm neonates but the last study is community based study (29).

The odds of PND and stillbirth were high among multiple pregnancy. In line with a study conducted in low- and middle income countries (Kenya, Zambia, Pakistan, India, Guatemala, and Argentina: a global network) shows multiple-gestation fetuses had a relative risk (RR) of 2.65 for stillbirth and for perinatal mortality rate (PMR) a RR of 3.98 relative to singletons (41). This is because of complications specially seen in mono chorioaminitic multiple pregnancies which are Twin-to-twin transfusion syndrome (TTTS), Twin anemia polycythemia sequence (TAPS), Selective intrauterine growth restriction etc. (42).

The Twin-to-twin transfusion syndrome, Twin anemia polycythemia sequence (TAPS) all this lead to one of the other baby to be selective intrauterine growth restrictions which increases the risk of ENND but this study doesn't show significant association between EEND and multiple gestation which might be explained by the status of the hospital.

Apgar score at 5^{th} min only had significant association with the odds of 0.19 & 0.06 as much as among neonate with score of 4-6 and > 7 respectively than those with Apgar score of < 4 but doesn't show significant associate with 1^{st} min Apgar score. This result contradict whith a study done sao Paulo city, Brazil A positive association was found between neonatal mortality and Apgar score with high significance with VLBW and LBW newborns. The association with Apgar < 4 in the 1^{st} minute for VLBW babies was three-fold greater than LBW, and 35-fold greater than in the $\geq$ 3,000 g group (43). The difference might be due to study design and the control groups for ENND in this study were selected from those admitted and survived their 7^{th} day not from live births. Specifically on this study among the cases 25 (24.5) and 37 (18.1) of controls early neonates had Apgar score <3.

During multi variable analysis in this study residence doesn't show association with PND and stillbirth also doesn't have significant values with ENND but a study done in Jimma zone revealed that neonate born from a mother in rural have 1.08 times more risk of dying during neonatal period than urban

neonates. On the study done in Nigeria, rural residents have a slight higher chance of dying during perinatal period than the urban AOR 1.74 (38, 23).

The reason why rural residences have higher chance of death is due to the three delays but lately in Ethiopia there is expansion of health services especially in the rural areas. Even if there are no literatures that show the effect of ambulance service to perinatal deaths the introduction of the ambulance service especially to rural areas might minimize the delays. There is also study setting difference in which the above studies were community based studies. Specifically for early neonates mainly there time of admission were the first two hour after delivery that indicate they are directly transferred from delivery ward in which the effect of arriving late that mainly seen in rural residences will not be there , both the rural and urban residences arrive equally.

The design of the study which is individually matching of cases and controls with comparable controls for each sub groups, analyzing the sub groups for specific predictors were the strength of this study. Limitations of the study were, since the study uses secondary data, some pertinent variables are not included, selection bias due to hospital based study and matching also the study doesn't control other confounders like health seeking behavior that makes it difficult to generalize that the trend is in rise.

CONCLUSION

The PMR was more than two fold higher than the 2011 EDHS report also it had an increasing trend though a slight decrement seen in 2013 .The major contributor of perinatal death is stillbirth and most of the stillbirth happened before the mother arrive to hospital . The independent predictors of PND were Birth weight, gestational age, sex, ANC, multiple pregnancy, having at least one complication, APH uterine rapture, obstructed labor and CP. Specifically Parity, gestational age, ANC, complication, multiple pregnancies, APH, obstructed labor, uterine rapture, cord accident were the independent risk factors for stillbirth. Age of mother, birth weight, sex, 5^{th} minute Apgar score, having at least one complication and uterine rapture were independently associated with ENND. Since most of mothers having hypertensive disorder were admitted to the hospital before labor, HTD didn't associate with any of the outcome.

RECOMMENDATION

Since most of the still births occur before the mothers arrives hospital health professionals should have to inform pregnant mothers to come to health facilities as early as possible if there is decreasing of fetal quickening (kicking). The ZHO in collaboration with the JUSH should have to work on activities to reduce maternal complications, especially uterine rapture and obstructed labor and the need for ANC utilization. Since most of the complications are independent predictors of PND Programs designed to improve newborn survival should have to give emphasis on identifying and tackling causes of maternal obstetric complication. Finally I recommend to JU, other research organizations and researchers to undergo further study focusing on health care factors for PND and community based study to see the actual magnitude of the death in the community.

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ANNEX 1

TREND AND ASSOCIATED FACTORS OF PERINATAL DEATH IN JIMMA UNIVERSITY SPECIALIZED HOSPITAL

INSTRUCTIONS

(A) Specify the case whether they are still births or early neonatal deaths

(B) Tick on the appropriate answer and write the code of the answer

(C) Make sure all questions are answered as possible

- ✓ Questionnaire No.: .....
- ✓ Card number…….
- ✓ Date of data collection: .....
- ✓ Name of data collector and signature: .....
- ✓ Type of study unit 1 case (specify) ……
  2 control ……..
- ✓ Cause of death the (only for cases & first written cause of death)……
- ✓ Date of death ……..
- ✓ Does the mother admitted before delivery 1. Yes 0. No
- ✓ Death at the hospital (for still birth) 1. Yes 0. No

QUESTIONER FOR PERINATAL DEATH (STILL BIRTH AN EARLY NEONATAL DEATH)

PART I :DEMOGRAPHIC CHARACTERISTICS			
Q. Number	Question	Response	Code
101	Resident	1. Urban 2. Rural	
102	Age of mother		
102	How many children does the mother have including this birth (parity)		
104	What is the interval between this birth and the last birth(>28 weeks of gestation irrespective of the		

	outcome)		
PART II NEWBORN FACTORS			
201	Sex	1. male 2. Female	
202	Age of the newborn in days (if dead age at death , skip if still birth)		
203	Birth Weight of the newborn (weight at admission if birth weight is not available)		
204	1st minute APGAR score(for early neonates)		
205	5th minute APGAR score (for early neonates)		
206	Does the early neonate or still birth multiple pregnancy	1. Yes 0. no	
207	Fetal presentation		
PART II MATERNAL FACTORS			
301	Gestational age at delivery		
302	History of ANC utilization	1. YES 0. NO	
303	If yes to question number 103 how many times does the mother Attend ANC visits		
304	Does the mother have any complication related to the pregnancy(Ante partum or intra partum,)	1. YES 0. NO	
305	If yes to question number 304 what was the complication (list all)		