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Adverse Birth Outcomes and its Associated Factors Among Mothers With Premature Rupture Of Membrane Who Delivered At Specialized Hospitals in Amhara Region, Ethiopia: A Facility Based Cross-Sectional Study

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BAHIR DAR UNIVERSITY
COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF REPRODUCTIVE HEALTH AND
POPULATION STUDIES

**ADVERSE BIRTH OUTCOMES AND ITS ASSOCIATED FACTORS
AMONG MOTHERS WITH PREMATURE RUPTURE OF MEMBRANE
WHO DELIVERED AT SPECIALIZED HOSPITALS IN AMHARA
REGION, ETHIOPIA: A FACILITY BASED CROSS-SECTIONAL STUDY.**

BY:

ABEBE ABRHA (BSc)

APRIL, 2022

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A THESIS SUBMITTED TO DEPARTMENT OF REPRODUCTIVE HEALTH AND
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MARCH 2022
BAHIR DAR, ETHIOPIA

Declaration

This is to certify that the thesis entitled “adverse birth outcomes and its associated factors among mothers with PROM who delivered at specialized hospitals in Amhara region, Ethiopia: a facility based cross-sectional study”, submitted in partial fulfillment of the requirements for the degree of masters of public health in reproductive health department of reproductive health and population studies, Bahir Dar university, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

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Approval of Dissertation/Thesis for Defense

I hereby certify that i have supervised, read, and evaluated this thesis/dissertation entitled "adverse birth outcomes and its associated factors among mothers with PROM who delivered at specialized hospitals in Amhara region" by Abebe Abriha Alene prepared under my guidance. I recommend the thesis/dissertation be submitted for oral defense.

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Board of Examiners

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I would like to say thanks from my bottom heart to the almighty God. My deepest gratitude goes to my wife and my friends for their continuous support.

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Table of contents

Contents

Acknowledgment	vi
Table of contents	iv
List of tables	vi
List of figures	vii
List of Acronyms	viii
Abstract	ix
1 Introduction	1
1.1 Background	1
1.2 Statement of the problem	3
1.3 Significance of the study	5
2 Literature review	6
2.1 Magnitude of the problem	6
2.2 Factors associated with adverse birth outcome among PROM.	7
2.2.1 Socio-Demographic Characteristics	7
2.2.2 Health service utilization factors	7
2.2.3 Maternal medical Factor	8
2.2.4 Obstetrics characteristics	9
2.2.5 Neonatal characteristics	10
3 Conceptual framework	11
4 Objectives of the study	12
4.1 General Objective	12
4.2 Specific Objectives	12
5 Methods	13
5.1 Study area and period	13
5.2 Study design	13
5.3 Source population	13
5.4 Inclusion and Exclusion criteria	13
5.4.1 Inclusion criteria	13
5.4.2 Exclusion criteria	13
5.5 Sample size determination	14
5.6 Sampling technique and procedure	15

5.7	Data collection procedure and tool	17
5.8	Operational definition and definition of terms	17
5.9	Variables	18
5.9.1	Dependent Variables	18
5.9.2	Independent Variables	18
5.10	Data quality Assurance	18
5.11	Data Management and Analysis	18
5.12	Ethical consideration	19
6	Result	20
6.1	Socio demographic profile of participant	20
6.2	Medical factor and Health service utilization factor	21
6.3	Obstetric factor	22
6.4	Factors associated with Adverse birth outcome	23
7	Discussion	25
7.1	Strengths and limitation of the study	28
7.1.1	Strength of the study	28
7.1.2	Limitation of the study	28
8	Conclusion and Recommendation	29
8.1	Conclusion	29
8.2	Recommendation	29
9	Reference	30
	Annex I: English version questionnaire	36

List of tables

Table 1 Sample size calculation factors associated with adverse birth outcome among PROM mothers in Amhara region, Ethiopia 2022.....	14
Table 2 The socio-demographic characteristics of mother’s diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)	20
Table 3 The health service and medical characteristics of mother’s diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)	21
Table 4 The obstetric factors of mother’s diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)	22
Table 5 Multivariable analysis Adverse birth outcome and associated factors of mother’s diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538).....	24

List of figures

Figure 1 conceptual framework that shows adverse birth outcome and its associated factors among PROM mothers at Amhara region, Ethiopia 2022 (2, 56, 70, 77, 95, 96)	11
Figure 2 Sampling procedure and techniques to select mothers with PROM in Amhara region specialized hospitals, Ethiopia, 2022.....	16

List of Acronyms/abbreviations

ANC:	Antenatal Care
ABO:	Adverse birth outcome
AOR:	Adjusted Odds Ratio
APH:	Ant Partum Hemorrhage
CI:	Confidence Interval
CS:	Caesarian Section
DM:	Diabetes Mellitus
GA:	Gestational Age
NRFHR	None Reassuring Fetal Heart rate
PNA	Perinatal Asphyxia
PROM:	Premature Rupture of Membrane
RDS	Respiratory Distress Syndrome
RH:	Reproductive Health
SVD:	Spontaneous Vaginal Delivery
UTI:	Urinary Tract Infection
WHO:	World Health Organization

Abstract

Background: Adverse birth outcomes are the leading causes of neonatal mortality worldwide. Ethiopia is one of the countries struggling to reduce neonatal mortality in different strategies but, still the neonatal mortality is remaining high due to many reasons. Despite adverse birth outcome is public health problem in Ethiopia, the contribution of Premature rupture of membrane for adverse birth outcome is neglected and not well explained in our country.

Objective: To assess birth outcomes and associated factors among mothers with PROM at Specialized Hospitals in Amhara Region, Ethiopia, 2022.

Methods: Institution based cross sectional study design was applied among 538 mothers with PROM at Amhara region specialized hospitals. We used systematic sampling techniques to select the medical charts diagnosed with Premature rupture of membrane and give birth in the hospital within the period from July 08, 2019, to July 07, 2021. The data were collected by using checklist, entered Epi Data version 3.1 and analyze by SPSS version 23. Binary logistic regression model was used to see the association between independent and dependent variable. P-value <0.05 was used to declare as statistically significant. The AOR with 95% CI was used to measure the strength of association.

Result: - Adverse birth outcome among Premature rupture of membrane mothers was 33.1% (95% CI 29.2-37.2). Rural residence [AOR=2.94, 95% CI :1.73-4.97], have history urinary tract infection [AOR=6.87, 95% CI (2.77-17.01)], anemia [AOR=7.51, 95% CI (2.88- 19.62)], previous history of adverse birth outcome [AOR=3.54, 95% CI (1.32-9.47)] and less than two years inter pregnancy interval [AOR=6.07, 95% CI (2.49-14.77)] were directly associated with adverse birth outcome.

Conclusion: - The adverse birth outcome was high in Amhara region as compared the world health organization estimated figure and target the target is less than 15%. History of previous adverse birth outcome, rural residency, Urinary tract infection, Anemia and shorter Inter pregnancy interval had association with adverse birth outcome among PROM mothers. Therefore, close follow-up for the mothers who had previous adverse birth outcome, early screening and treatment of urinary tract infection, anemia prevention and maximize birth interval is important to prevent adverse birth outcome.

Key words: Adverse Birth Outcome, PROM, Amhara Region

1 Introduction

1.1 Background

Premature rupture of membranes (PROM) is a rupture of the membranes after the 28th week of gestation and before the onset of labor. After occurring PROM, we expect the birth outcomes include live birth (full term or preterm birth), stillbirth, sex, birth weight and congenital malformations. Adverse birth outcome is defined as stillbirth, low birth weight, preterm birth, and congenital anomalies (1, 2).

According to the world health organization (WHO) Stillbirth is a baby, who dies after 28 weeks of pregnancy. PROM is the cause for still birth due to umbilical cord prolapse and compression or placental abruption. During cord compression it can lead as placental or pulmonary gas exchange impairment leading to hypoxemia, respiratory disease syndrome and hypercarbia. The consequence of inadequate blood perfusion and tissue oxygenation lead to brain damage, damage to other organs and it cause death. women with PROM have a higher risk for non-reassuring fetal heart and stillbirth (3-6).

Congenital anomalies can be defined as structural or functional anomalies that occur during intrauterine life. Also called birth defects, congenital deformation, or congenital malformations, these conditions develop prenatally and may be identified before or at birth. rupture of membrane causes pulmonary hypoplasia, positional deformities of the hands and feet, and Potter's faces due to placental hypoperfusion or shortage of oxygen and blood to brain (7-9).

Preterm is defined as babies born alive before 37 weeks of pregnancy are completed. One of the most common complications of PROM is early delivery or preterm birth. Preterm babies can suffer lifelong effects such as cerebral palsy, mental retardation, visual and hearing impairments, and poor health and growth (10-14).

Low birth weight (LBW) is defined by the World Health Organization as weight at birth < 2500 g (5.5 lb.). There is significant fluctuation in the number of low birth weight across regions and within state; however, the great figure of low-birth-weight births happen in low- and middle-income countries. The occurrence of PROM is responsible for a large number of premature births, low birth weight stillbirth and perinatal death (15, 16).

In the past few decades, there has been an impressive decline in the mortality of children younger than 5 years worldwide. neonatal health becomes the agenda of Sustainable Development Goals (SDGs) with an entitled target of reducing neonatal mortality below 12 per 1,000 live births by 2030. Child mortality has been reduced by 53% over this period. However, the reduction in neonatal mortality has been much slower and stillbirth was neglected.

Four coverage targets are proposed for 2020-2025, The indicators are: - four or more antenatal care contacts, births attended by skilled health personnel, postnatal care within 2 days and care for both small and sick newborns. However, achieving this goal requires increased efforts to enable continued improvements in child survival, especially in the high-burden regions of south Asia and sub-Saharan Africa (11, 17-19).

Ethiopia has been implementing different strategies and programs to realize the neonatal health targets set in the HSTP and SDGs, National Newborn and Child Survival Strategy (NCSS), community and facility based Integrated Management of Neonatal and Childhood Illnesses (IMNCI), new-born corners and Neonatal Intensive Care Units (NICU), introduction of new service like Kangaroo Mother Care (KMC), initiation and implementation of Early childhood development (ECD) interventions, strengthening the immunization program, Maternal and Newborn Health Roadmap, Community Based Neonatal Care (CBNC), Nutrition Program, safe mother hood program and Health Service Quality Improvement Program but, still the neonatal death are remaining high.

In Ethiopia training manuals and guidelines like Basic Emergency Obstetric & Newborn Care were prepared to make health professionals competent in managing a woman with obstetric emergencies including PROM. Ethiopia is one of the fast-track sub-Saharan African countries in reducing under-five mortality. However, the reduction in neonatal and perinatal mortality continues to be a major challenge, and with a rate of 33 deaths per 1000 births, neonates and children's still continue to die of easily preventable and treatable disease (20, 21).

1.2 Statement of the problem

Adverse birth outcomes is the leading cause of neonatal morbidity and mortality in the world and it is still continues as a public health problem mainly in developing countries (22-24). Globally 20% of stillbirth, 33% of prematurity, 21 % of early neonatal death and 2% of congenital anomalies related with PROM. Approximately 22% of women experienced adverse birth outcome due to PROM (2, 25-28).

Globally, 2.6 million stillbirths occur annually Half of all stillbirths (1.3 million) occur during labour and birth process 98% of stillbirths take place in low and middle-income countries and 2.4 million children died in the first month of life approximately 6,700 neonatal deaths every day. One third of all neonatal deaths occurring within the first day after birth, and close to three-quarters occurring within the first week of life. Fifteen million babies are born too prematurely each year and more than a million of them die immediately after birth; many other suffer from lifelong physical, neurological, or educational disabilities. Worldwide 8 % of newborns born with congenital anomalies.(29-31)

In the African Region, 1.12 million newborn deaths occur annually. Perinatal mortality rate is 34.7 per 1000 births, Sub-Saharan Africa (SSA) has one of the highest levels of perinatal mortality in the world. Preterm births account 12% of the live births in sub-Saharan Africa. preterm birth is the leading cause of death among children, accounting for 18% of all deaths among children aged under 5 years and 35% of all deaths among newborns (aged <28 days). The study has found that the overall prevalence of birth defects in sub-Saharan African countries among newborn infants is 20.4 per 1000 total births (3-5).

In Ethiopia adverse birth outcome among PROM was range from 18% to 33.5% (27). According to the 2016 Ethiopian Demographic and Health Survey (EDHS) report the overall rate of stillbirth in Ethiopia was found to be 9.2 per 1000 births. It was highest in the Amhara region 50 per 1000 and lowest in Dire-Dawa region 0 per 1000 total births. Ethiopia is one of the countries with the highest perinatal mortality rate in the world with a rate of 33/1000 births. Prematurity-related complications have contributed to about 30% of neonatal deaths in Ethiopia. (10-14, 32-34).

According to findings from different reviewed literatures, the proportion of congenital anomalies varied from study to study but the average proportion of congenital anomalies in Ethiopia is 2% (7-9, 35-37).

Different studies revealed that different factors could contribute for adverse birth outcome; for instance, socio-demographic characteristics such as residence, age, inadequate prenatal care, sexually transmitted infections, gravidity, birth interval, history of adverse birth outcome (ABO), prolonged and obstructed labor and caesarean section delivery (38, 39)

Adverse birth outcomes have significant health consequences on emotional and economic costs on families. It can be a devastating life event for women and their partners it has also direct effect of future productive generation. The neonates that have adverse birth outcome suffers for lifelong physical, neurological, and educational disabilities (22, 24, 26, 27).

The Adverse births outcomes are the leading cause of neonatal mortality worldwide especially in developing countries. Ethiopia is one of the countries struggling to reduce neonatal mortality in different strategies but, still the neonatal mortality is remaining high due to many reasons. PROM is one of the complications can cause stillbirth, prematurity, fetal distress, cord compression, congenital deformation and early neonatal death and it is the major public health problem in Ethiopia but, the contribution of PROM for adverse birth outcome is not well explained.

The birth outcome in PROM is very important to decrease neonatal mortality and for better management and prevention of complications. Investigate the public health problem are important for planning and implementing proper interventions. Therefore, the aim of this study is to assess birth outcomes and its associated factors among PROM mothers who gave birth at specialized hospitals, Amhara region, Ethiopia.

1.3 Significance of the study

The factors of adverse birth outcomes among premature rupture of membranes will be identified, it will be a good source of knowledge for public health experts to understand the implication of adverse birth outcome among women with premature rupture of membrane.

It helps to improve the outcome by preventing and treating the factors of adverse birth outcomes and this type of research helps to reduce perinatal mortality.

The finding of this study will be used as an input for policy makers and programmers to plan and implement the strategies that can avert adverse birth outcome and neonatal death rate across the country.

The study enhance my statistical knowledge and it will create the chance for me to understand the entire scientific methodology of research.

2 Literature review

2.1 Magnitude of the problem

The magnitude of the adverse birth outcome among PROM varies in different countries PROM is the cause for 21.4% of prenatal mortalities. The study conducted in America, India, China, Nigeria, and Europe shows premature rupture of membrane cause for 14% to 63% of adverse birth outcome and neonatal mortality. Up to 50% preterm births and 80% maternal clinical and subclinical infections have been associated with PROM worldwide with a fourfold increased risk of fetal mortality (1, 40-43).

Premature rupture of membrane generally affects 5% to 15% of all pregnancies worldwide with a relatively higher incidence in Africa. Every year more than 2.6 million estimated stillbirths occur globally almost all the stillbirths (98%) occurred in low- and middle-income countries (LMICs) and nearly three fourth (77%) of the total stillbirths were in Sub-Saharan Africa and South Asia. The NMR was higher than that of the Africa continent (27 deaths per 1,000 live births) and nine times higher than the developed countries (3 deaths per 1,000 live births), yet like the sub-Sahara African countries (29 deaths per 1000 live births). The study shows adverse birth outcome in sub-Saharan countries range from 17-42% from the total birth. The study conducted in Nigeria and Uganda shows adverse birth outcome among PROM is 18% and 25% (2, 25, 44-46).

Ethiopia is one of the world's highest neonatal mortality rates (NMR) (28.1 per 1000 live births) in 2016. Premature rupture of membrane is one of the major causes of adverse birth outcome, which is stillbirth, prematurity, congenital anomalies, and low birth weight. In Ethiopia the incidence of PROM ranges from 5%-14%. According to recent studies conducted in different parts of the country, the prevalence of adverse birth outcomes among mothers with PROM deliveries in Ethiopia ranges from 18.2% to 32.5%. The study conducted in south maternal and fetal outcomes among premature rupture of membrane shows 33.5%.The burden of PPROM ranges from maternal and neonatal mortality and morbidity to countrywide economic loss due to drug expense, hospitalization, absenteeism from the work, and expense to the health professionals (10, 12-14, 32, 33, 47, 48).

2.2 Factors associated with adverse birth outcome among PROM.

2.2.1 Socio-Demographic Characteristics

Numerous studies have been conducted to investigate socio-demographic factors that influence adverse birth outcomes. Maternal age is a common socio-demographic factors that contribute to adverse birth outcomes (49). The study conducted in (America, France, Indonesia, India & Nigeria) shows mothers age greater than 29 years was positively associated with adverse birth outcome. Findings from a similar study carried out to investigate teenage pregnancy and adverse birth outcomes in 11 countries with underage (under 16 years of age) in; Malawi, Congo, Comoros, Zimbabwe, Equatorial Guinea, Mozambique, Gabon, Pakistan, Indonesia, Mauritania, and Botswana showed that women with less than 16 years of age were twofold at risk of adverse birth outcome as compared to older women between 18 and 29 years of age. The different studies conducted in Ethiopia showed that older maternal age is positively associated with higher stillbirth rates, prematurity, early neonatal death, and congenital deformation (3-5, 25-27, 49-51).

Residency is another common socio-demographic factors that contribute to adverse birth outcomes Study conducted in (Jimma, Gondar, Dessie, Bahirdar and Hosahena) reported that women who come from a rural area had an increased risk of adverse birth outcomes than those from comes an urban area (2, 25-27, 52-54).

2.2.2 Health service utilization factors

Antenatal care follow-up (ANC) has been shown to influence birth outcomes and it is associated with premature rupture of membrane. The study conducts in different countries (Egypt, Canada, Pakistan, Ghana, and India) Mothers who had no ANC follow-up had more risk of having adverse birth outcome than those who had at least one ANC follow up visits. The study conducts different part of Ethiopia shows Premature rupture of membrane and adverse birth outcomes which is stillbirth, prematurity, congenital deformation and early neonatal death increased among mothers who had no ANC visits compared than had ANC follow-up visit (1, 2, 22, 24, 26, 55-60).

2.2.3 Maternal medical Factor

The study in China, Nigeria and Uganda shows the Mothers with hemoglobin level < 11 g/dl were more likely to have adverse birth outcomes than those with hemoglobin level ≥ 11 g/dl (45, 61). The study in Dessie Referral Hospital, Negest Elene Mohammed Memorial Hospital, Southern Nation Nationalities Region, Ethiopia; and Adwa General Hospital in northern Ethiopia also showed that mothers with hemoglobin level below < 11 g/dl were more likely to have adverse birth outcomes than those with hemoglobin level ≥ 11 g/dl or above (25, 27, 56, 62).

Sexually transmitted disease is one of the factors for stillbirth and neonatal death. There was a higher rates of adverse birth outcome among the offspring of women with syphilis than women without syphilis (63, 64).

Urinary tract infections one of the main factors contributed to occurrence of preterm labour and adverse birth outcome. Different studies showed urinary tract infection positively associated with adverse birth outcome (65-68). The other studies conducted in different countries that shows there is no association between urinary tract infection and adverse birth outcome (69).

Mother infected with HIV (human immunodeficiency virus) had greater likelihood of premature rupture of membranes and different studies shows HIV is positively associated with adverse birth outcome (70-73). The other studies conducted in different countries that shows there is no association between HIV and adverse birth outcome (1, 27)

Diabetes Mellitus (DM) is one of the factors for adverse birth outcome among PROM mothers. The study conducted in (Iran, America, Pakistan, Bangladesh, Saudi, and Ethiopia) shows that diabetes mellitus increases the risk of having PROM, other maternal, neonatal, and fetal complications (74-77). In the study conducted in Iran shows no association gestational DM with PROM on adverse birth outcomes (78).

2.2.4 Obstetrics characteristics

Different study shows the mothers have multiple birth greater likelihood of premature rupture of membranes and adverse birth outcome than primigravida mothers (40, 48, 79, 80). In contrast the study conducted in Saudi shows prim gravidity negatively associated with PROM and adverse birth outcome (81) .

Onset of labour after occurring of PROM is essential for the outcome of birth different studies shows induced labour significantly associated with adverse birth outcome than the mothers had spontaneous labour (82, 83).

Color of liquor amniotic fluid condition is one of the indicators for fetal condition the study conducted in different countries that shows meconium-stained color of amniotic fluid significantly associated with Adverse birth outcome (2, 17, 40, 80, 84).

About Mode of delivery mothers who delivered by cesarian section had greater likelihood of premature rupture of membranes and adverse birth outcome than the mothers who delivered by spontaneous vaginal delivery (1, 40, 43).

History of Adverse Birth Outcome (ABO) chance of developing an abnormal birth outcome among mothers with a previous history of child-related adverse birth outcome by four times higher than those mothers who had not the history adverse birth outcome (25, 27, 48). The study conducted in Shire town of North Ethiopia showed that those mothers with the previous history of child related adverse birth outcome are at greater risk than the mothers who had no previous history of adverse birth outcome (2, 26, 55). Most poor obstetrics histories are recurrent (56, 85).

Mothers with inter-pregnancy interval of less than two years more likely develop adverse birth outcome than women with inter-pregnancy interval of two and above years. The studies in Indonesia, India, Tanzania and Ethiopia adverse birth outcome were more among women with inter-pregnancy interval less than 24 months compared to mothers with inter-pregnancy interval greater than 24 months (45, 86, 87) (2, 27, 57).

Women who had history of vaginal bleeding or antepartum hemorrhage in current pregnancy were significantly associated with the premature rupture of membrane and adverse birth outcome (2, 41, 47, 58).

The study conducted in America, India, Brazil, Nigeria, and Ethiopia shows mothers have Preeclampsia/eclampsia in current pregnancy were significantly associated with the premature rupture of membrane and adverse birth outcome (11, 51, 57, 83, 88).

Length of PROM or duration of PROM to delivery is one of the factors for adverse birth outcome. The study shows conducted in different countries shows the mother have PROM in delivering greater than 24 hours more likely to experience adverse birth outcome than those with a duration of PROM in delivering less than 24 hours (2, 25, 55, 85, 86).

2.2.5 Neonatal characteristics

Sex of the baby is one of the neonatal factors for adverse birth outcome. The risk of mortality and morbidity has been found to be higher in male subjects compared to females during the perinatal period, infancy, and childhood. The risks of stillbirths, and early neonatal mortality were higher among male infants than their female. In high-income nations, boys are at a greater risk of neonatal and infant mortality than girls (89-91). In contrast several recent studies have reported higher neonatal and infant mortality in females compared to males in south Asia (92, 93).

3 Conceptual framework

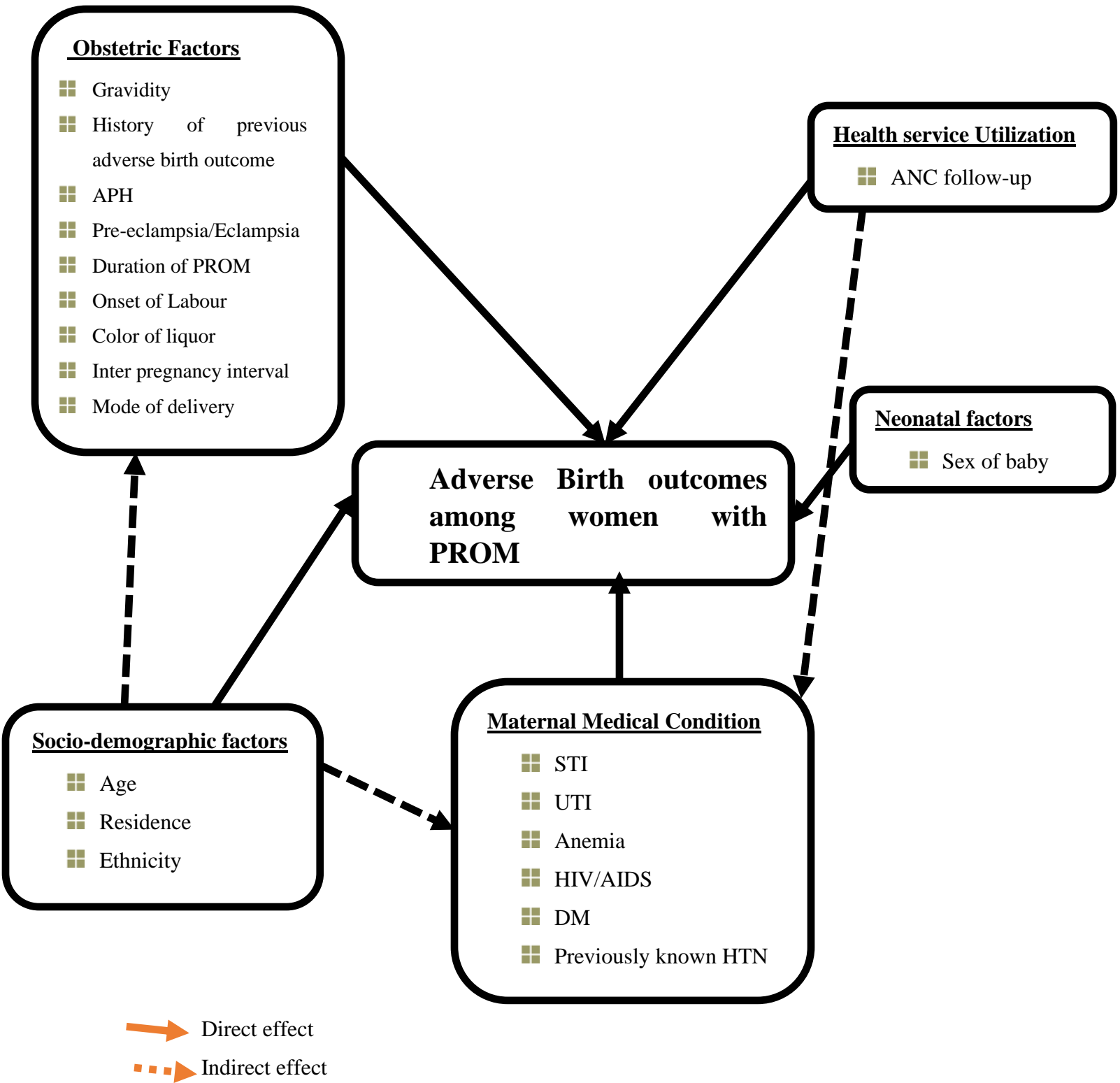


Figure 1 conceptual framework that shows adverse birth outcome and its associated factors among PROM mothers at Amhara region, Ethiopia 2022 (1, 2, 54, 68, 75, 94)

4 Objectives of the study

4.1 General Objective

To assess adverse birth outcomes and its associated factors among PROM mothers who delivered in specialized hospitals Amhara region, North Ethiopia, 2022.

4.2 Specific Objectives

- ❖ To determine the proportion of adverse birth outcomes among PROM mothers
- ❖ To identify factors of adverse birth outcome among PROM mothers.

5 Methods

5.1 Study area and period

This study was conducted in Amhara regional state specialized hospitals from October 01-30,2021. Amhara region is one of the largest regions in Ethiopia and there are around 24 million people live in the region. There are 52 primary hospital, 9 general Hospital and 8 specialized hospitals in Amhara region. Comprehensive specialized hospital covering a population of 3.5–5 million people. The hospitals that give tertiary level of care including all obstetric emergencies and neonatal intensive care the hospitals serve as referral center from general and primary hospital. The study was conducted in the labor and delivery in four specialized hospitals: Debre Brihan specialized Hospital, Debre Tabor specialized Hospital, Felege Hiwot specialized Hospital, and Debre Markos specialized Hospitals which are found in Amhara region, Ethiopia. Based on monthly DHIS 2 report the average institutional delivery services of a month in 2013 EFY (Ethiopian fiscal year) in those four hospitals are 400/month and 10 PROM case per month.

5.2 Study design

Facility based cross sectional study was conducted.

5.3 Source and study population

Source Population: All mothers diagnosed with PROM at specialized hospitals from July 08, 2019, to July 07, 2021, were as source of population.

Study population: All mothers diagnosed with PROM at selected hospitals (Debre Brihan specialized Hospital, Debre Tabor specialized Hospital, Felege Hiwot specialized Hospital, and Debre Markos specialized Hospitals) were as study population.

5.4 Inclusion and Exclusion criteria

5.4.1 Inclusion criteria

All medical records of pregnant women diagnosed with PROM and give birth in the hospital within the period from July 08, 2019, to July 07, 2021, was included.

5.4.2 Exclusion criteria

Medical records that lack the information of birth outcome, gravidity, neonatal weight, gestational age, and duration of PROM were excluded.

5.5 Sample size determination

The sampling size was calculated by using a single population proportion formula by considering the assumption $Z_{\alpha/2}$ = critical value for normal distribution at 95% confidence level which equals to 1.96 (z value at $\alpha = 0.05$), P (Estimated proportion) = 33.5% is taken from previous study conducted at Mizan Aman hospital (48), d (margin of error) = 0.05 and the calculated sample size was 350 (Three hundred fifty).

$$n \approx \frac{z_{\alpha/2}^2 \cdot p \cdot (1 - p)}{d^2}$$

To determine sample size for factors associated with adverse birth outcome among premature rupture of membrane the sampling size was determined using Epi Info version 7. The sample size was determined using the following assumptions 95% CI & 80% of power. We used double proportion formula for sample size collection and used previous research variables highly associated with the outcome variable.

Table 1 Sample size calculation factors associated with adverse birth outcome among PROM mothers in Amhara region, Ethiopia 2022.

Variables		Power	% Of outcome among un-exposed	AOR	Calculated sample size	Reference
Residence	Urban	80%	9%	1	315	(48)
	Rural			3.1		
ANC follow up status	Yes	80%	27%	1	359	(57)
	No			2.1		
Gravidity	Primigravida	80%	9.5%	1	336	(2)
	Multigravida			2.8		

By comparing two samples size the large sample took and we used 1.5 design effect to this study finally the participants were 538 (five hundred thirty-eight) mothers with PROM were included.

5.6 Sampling technique and procedure

There are eight specialized hospitals in the Amhara region. we used the lottery method to select the study hospitals. The study was conducted on selected hospitals Debere Tabor, Debre Markos, Felege Hiwot and Debre Brihan specialized hospital. The required sample size was allocated proportionally based on last two-year PROM cases. Based on monthly DHIS 2 (Demographic health information system) report annual PROM case report of these four hospitals during last two years 2020/21 was Felege Hiwot= 384 PROM case Debre Tabor= 192 PROM case Debre Markos = 392 PROM case Debre Brihan= 152 PROM cases.

We were collected two-year data retrospectively from July 08, 2019, E.C to July 07, 2021. All medical records of pregnant women diagnosis with PROM during this period was included then we were used systematic sampling to select the study subjects.

All PROM mothers at specialized hospitals in Amhara region (Debere Tabor, Debre Markos, Felege Hiwot, Debre Brihan, Gondar, Tibebe Gion, Dessie, Dessie and Woldia specialized Hospitals)

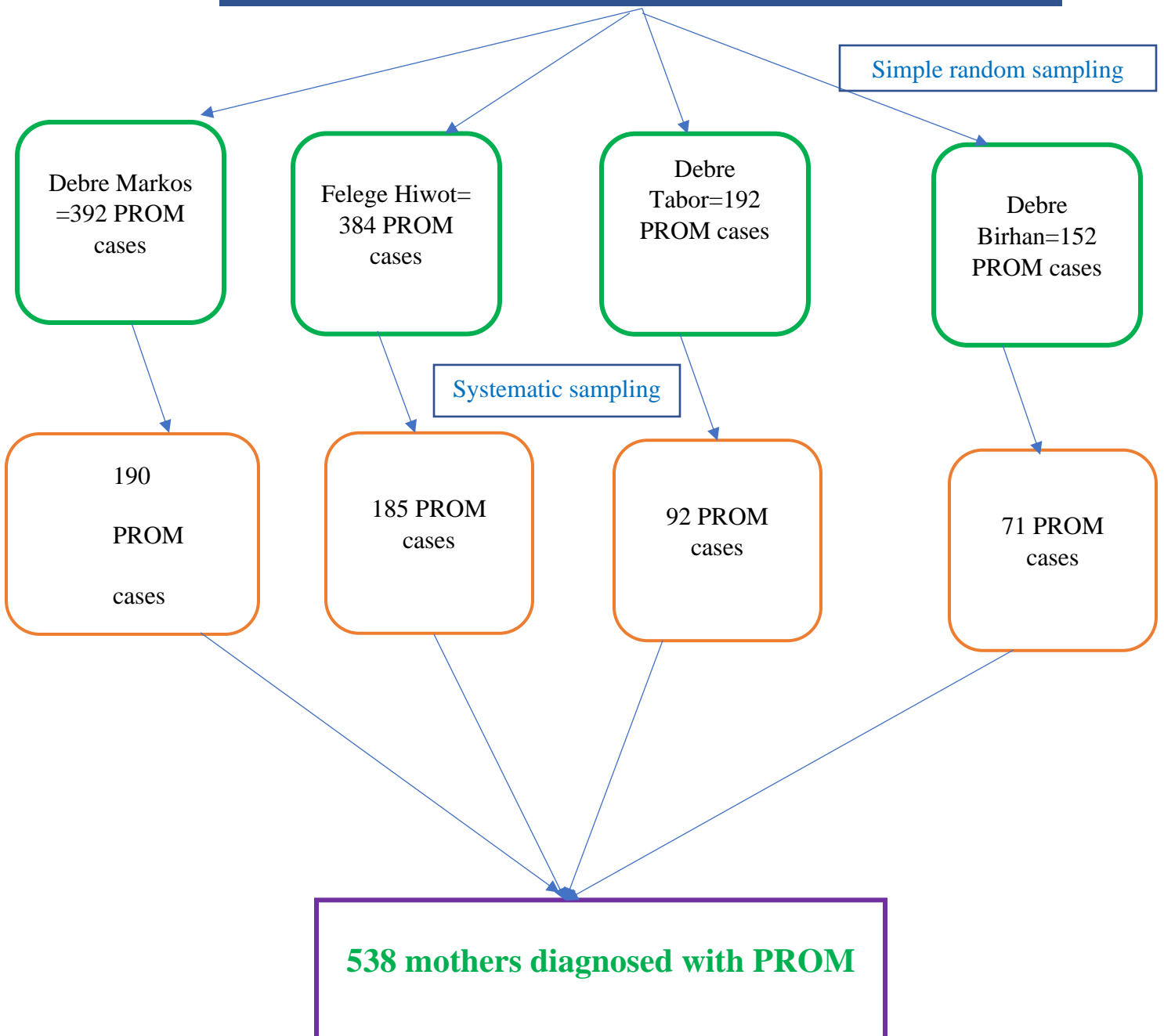


Figure 2 Sampling procedure and techniques to select mothers with PROM in Amhara region specialized hospitals, Ethiopia, 2022.

5.7 Data collection procedure and tool

The data collection check list was developed from different literatures (47, 95, 96). The checklist had four parts, namely socio-demographic variables, Health service utilization, obstetric history, maternal and fetal outcomes. All the necessary information for the study were filled to the prepared checklist. The records included information on subjects' demographics, vital signs, laboratory test result, history of PROM, duration of PROM, hospital stay, mode of delivery, and weight of baby at birth, etc.

One day training was given to four data collectors (Hospital matrons) and four supervisors (Hospital quality officers) prior to the beginning of data collection. Data collectors was collected the data from medical chart by using checklist. The role of the supervisors was checking the quality of data and the process of data collection.

5.8 Operational definition and definition of terms

Adverse birth outcome: - Women had at least one of the following; still birth, preterm baby, Congenital deformation and low birth weight (24).

preterm birth: - less than 37 gestational weeks at birth

Congenital anomalies can be defined as structural or functional anomalies that occur during intrauterine life.(97)

Gestational age: the age of the fetus counting from the last normal menstrual period.

Sexually transmuted disease: - if the mothers had at least one of the following syphilis, vaginal discharge & gonorrhea.

Anemia: - A pregnant women whose hemoglobin level <11g/dl was considered as anemic (58).

Still birth: - is birth of a baby born with no signs of life at or after 28 weeks of gestation.

Perinatal mortality- defined as stillbirth or early neonatal death before hospital discharge.

Low birth weight: - birth weight <2500gm (16).

5.9 Variables

5.9.1 Dependent Variables

Adverse birth outcome Yes (stillbirth, prematurity, low birthweight, and congenital deformation)

No (Normal birth without adverse outcome)

5.9.2 Independent Variables

- **Socio-demographic variables** (Age and residence)
- **Obstetric factors** (Gravidity, History of Abortion, History of previous ABO, Duration of PROM, Onset of Labour, Color of liquor, Inter pregnancy interval, Mode of delivery and sex of baby)
- **Maternal medical factors** (Urinary tract infection, sexually transmitted disease, HIV/AIDS, DM & Anemia)
- **Health service utilization factors** (ANC service utilization)

5.10 Data quality Assurance

After final Preparation of data extraction checklist, To ensure the quality of the data and checking the existence of required variable, before the actual data collection, pretest was done in Felege Hiwot specialized hospitals on 5% records of patient document to identify problems with the checklist and procedures of data collection then appropriate modifications was made on the checklist two days intensive training was given for data collectors, continues supervision of data collection process, and carefully checking of collected data with cross checking of charts had a great contribution to keep data quality.

5.11 Data Management and Analysis

The data were entered using EPI data and analysis by SPSS. After the data explored and cleaned, descriptive analyses such as percentages, frequency distribution and measures of central tendency was conducted. Then bivariate analyses between dependent and independent variables were performed using bivariate logistic regression. Finally, those variables showed association at p-value less than 0.2 were considered into multivariable logistic regression analyses to control possible confounding variable and to identify independent predictor variable of adverse birth outcomes. During the analysis, 0.05 p-values and 95% confidence interval (CI) was used to declare statistical significance.

5.12 Ethical consideration

The study was undertaken after the proposal approved by the institute review Board College of Medicine and Health Science of Bahir Dar University and Amhara Public Health Institution (APHI) before the start of the study. To protect patient confidentiality, the name of mothers on the record was excluded from the extracted data. Thus, the information obtained from the records will be anonymous.

6 Results

6.1 Socio-demographic profile of participant

A total of 538 mothers with a complication of PROM were participated in the study with 95% response rate. The mean age was 27 years with standard deviation of ± 5 . Most of the mothers 206 (38.3%) were in the age group of 25-29, teenage mothers were 40 (7.4%). Majority of the mothers 349 (64.9%) were urban residents. Regarding to ethnicity 509 (94.6%) mothers were from Amhara (Tabel 2).

Table 2 The socio-demographic characteristics of mother's diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)

Variables	Categories	Frequency	Percent (%)
Maternal Age	15-19	40	7.4
	20-24	148	27.5
	25-29	206	38.3
	30-34	90	16.7
	35-39	43	8
	40-44	11	2
Residence	Urban	349	64.9
	Rural	189	34.1
Ethnicity	Amhara	509	94.6
	Oromo	19	3.5
	Others	10	1.9

6.2 Medical and Health service utilization factor

Most of the mothers 518 (96.3%) had at least one ANC follow-up. 108 (20.1%) mothers had diagnosis of urinary tract infection, 114 (21.2%) had anemia, 7 (1.3%) mothers were HIV positive, 10 (1.9%) of mothers had history of other STI, and 9 (1.7%) mothers had history of known DM (Table 3).

Table 3 The health service and medical characteristics of mother's diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)

Variables	Categories	Frequency	Percent (%)
ANC follow-up	Yes	518	96.3
	No	20	3.7
HIV status	Positive	7	1.3
	Negative	531	98.7
UTI	Yes	108	20.1
	No	430	79.9
History of STI	Yes	10	1.9
	No	528	98.1
History of DM	Yes	9	1.7
	No	529	98.3
History of previous HTN	Yes	2	0.4
	No	536	96.6
Anemia	Yes	114	21.2
	No	424	78.8

6.3 Obstetric factor

Among the study participants 222 (41.2%) were primigravida. 39 (7.2%) had history of previous adverse birth outcome. Two hundred seven (38.4%) mothers had less than two years birth interval, seven (1.3%) of mothers had APH, 22 (4.1%) mothers had pre-eclampsia/eclampsia. 379 (70.4%) of mothers-initiated labour spontaneously. 368 (68.4%) mothers had spontaneous vaginal delivery, 133 (24.7%) delivered by C/S (Table 4).

Table 4 The obstetric factors of mother's diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)

Variables	Categories	Frequency	Percent (%)
Number of pregnancies	Primigravida	222	41.2
	2-3	223	41.5
	≥4	93	17.3
Interpregnancy interval	< 2years	207	38.4
	≥ 2years	109	20.2
Ante partum hemorrhage	Yes	7	1.3
	No	531	98.7
Pre-eclampsia/Eclampsia	Yes	22	4.1
	No	516	95.9
Onset of labour	Spontaneous	379	70.4
	Induced	159	29.6
Color of liquor	Clear	462	85.9
	Meconium S.	65	12.1
	Blood stained	11	2
Mode of delivery	SVD	368	68.4
	C/S	133	24.7
	Instrumental	37	6.9
Duration of PROM to reach hospital	<12 hrs.	294	54.6
	>12 hrs.	244	55.4
Total duration of PROM to delivery	<24 hrs.	327	60.8
	>24 hrs.	211	39.2

6.4 Factors associated with Adverse birth outcome

On bivariate analysis residency, gravidity, birth interval, history of abortion, anemia, UTI, and previous history of adverse birth outcome were candidate variables for multi-variable analysis at the P-value less than 0.2. On multivariable analysis residency, birth interval, UTI, Anemia, and previous history of Abortion were significantly associated with adverse birth outcome at the P-value less than 0.05.

Multivariable logistic regression analysis showed that mothers who lived in rural area had higher odds of encountered adverse birth outcomes as compared to those who lived in urban area, [AOR=2.94, 95% CI (1.73-4.97)]. The mother who had urinary tract infection were 7 times more likely to experience adverse birth outcome than those mothers who didn't had urinary tract infection [AOR=6.87, 95% CI (2.77-17.01)]. Similarly, mothers with hemoglobin level less than 11 gm/dl were encountered adverse birth outcomes 7 times more likely than those mothers with hemoglobin level greater or equal to 11 gm/dl [AOR=7.51, 95% CI (2.88- 19.62)]. The mother who had history of previous adverse birth outcome were 4 times more likely to experience adverse birth outcome than those mothers who didn't had previous history of adverse birth outcome [AOR=3.54, 95% CI (1.32-9.47)]. There were higher odds of adverse birth outcome among women who had less than two years inter pregnancy interval as compared to those who had more than two years inter pregnancy interval AOR=6.07, 95% CI (2.49-14.77) (Table 5).

Table 5 Multivariable analysis Adverse birth outcome and associated factors of mother's diagnosis with PROM at Amhara, region specialized hospitals from July 08, 2019, to July 07, 2021, (n=538)

Variables		Adverse birth outcome		COR (95% CI)	AOR (95% CI)
		Yes	No		
Residency	Rural	85	104	2.25(1.55-3.27) **	2.94 (1.73-4.97) *
	urban	93	256	1	1
UTI	Yes	79	29	9.11 (5.63-14.74) **	6.87 (2.77-17.01) **
	No	99	331	1	1
Hemoglobin	<11gm/dl	94	20	19.01 (11.11-32.6) **	7.51 (2.87-19.62) **
	>11gm/dl	84	340	1	1
History of Abortion	Yes	44	25	4.4 (2.59-7.48) *	1.59 (0.73-3.43)
	No	134	335	1	1
History of previous adverse birth outcome	Yes	31	8	9.27 (4.16-20.66) **	3.54 (1.32-9.47) **
	No	147	352	1	1
Interpregnancy interval	<2years	113	94	11.90 (5.87-24.09) **	6.07 (2.49-14.77) **
	> 2years	10	99	1	1
Gravidity	2-3	73	150	1.51 (1.00-2.29)	1.19 (0.15-9.49)
	≥4	51	42	3.77 (0.25-0.68) *	0.9 (0.44-1.81)
	Primigravida	54	168	1	1

*p<0.05, **p<0.01

7 Discussion

The main objective of this study was to assess the adverse birth outcome among PROM mothers. This study finding showed that the prevalence of adverse birth outcome among PROM mothers was (33.1% (95% CI 29.2-37.2) the finding was higher than WHO estimation of adverse birth outcome. WHO estimates that the prevalence of adverse birth outcome is approximately 15.5% (7% for most developed countries and 18.5% for developing countries (98). Out of the adverse birth outcome (60%) of the outcome were prematurity, (26%) were LBW, (9%) were stillbirth and (5%) were with visible congenital anomalies. The finding of this study was in line with the study conducted at Mizan Aman in southern part of Ethiopia was 31% (47). However, the current finding is lower than the study conducted in Egypt 61.3% (1). The lower adverse birth outcome in the current study might be smokers on Egypt study accounts 10% of the study participants and 15% of the study participants were teenagers however, smokers and teenage pregnancies are more risk for adverse birth outcome (99). on the other hand, the finding of this study was greater than the study conducts in China 14% and Germany 25% (95% CI 1.02-2.55) (100). This indicates that these are major public health problems in the study area. It might be shortage of facility access, advance care of the facilities, socio-economic status and awareness of prevention and early management of PROM related complications.

This study revealed that the odds of pregnant women with rural resident to have adverse birth outcome were 3 times higher compared to their counter parts of women with urban residents. This findings were supported with the previous studies conducted in Ethiopia (Wollo, Hosahena & Arbaminch) and Uganda (48, 79, 101). In the other hand the study conducted at Gondar shows that there is no association between rural residence and adverse birth outcome (96). It would have been more ideal, in developing country like Ethiopia maternal health care service distribution were not equal in the urban and rural residence. Also, the awareness of the rural mothers about maternal care services is low compared to the urban mothers. Agricultural pesticide and insecticide exposure increases adverse birth outcomes by 5-9% may it be one of the cause for rural area (102).

Mothers have urinary tract infection were positively associated with adverse birth outcome than the mothers without urinary tract infection and the finding of the current study was concurrent with previous study conducted in India and Debre tabor (57) shows mothers had urinary tract infection positively associated with adverse birth outcome (65). The study conducted in Uganda

significant independent predictors associated with lower odds of PROM were no history of urinary tract infection (AOR = 0.5, 95% CI: 0.22-0.69) (69). In the other hand the study conducted at southern Ethiopia there is no association between urinary tract infection and adverse birth outcome (62) . Urinary tract infections are potential reservoirs for bacteria that cross to the vagina and ascend through the cervical canal to the membranes where they cause localized inflammation. The bacteria produce several proteolytic enzymes such as collagenase and gelatinase that can cause local weakening of the membranes. Also, the subsequent prostaglandin production resulting from localized inflammation leads to occult contractions with increased shearing stress at the cervical os resulting into premature rupture of membrane and it may lead to preterm labor (giving birth too early) and low birth weight (65). adverse birth outcomes which could be prevented by antimicrobial treatment. Hence pregnant women should be screened for bacteriuria and treated if results are positive.

Our study also found women who had anemia more odds of developing adverse birth outcome as compared than the mothers who didn't had anemia the finding of the current study was concurrent with previous study conducted in different countries Indonesia, Bangladesh and Canada that anemia was a significant risk factor for adverse birth outcome (58, 103, 104) different literature suggests that lower level of hemoglobin is associated with up to a threefold increased risk of adverse birth outcome(2, 105). Low level of hemoglobin or anemia causes a decreased amount of oxygen transported to the tissues, potentially increasing the risk of premature rupture of membranes due to hypoxia in the tissues. Anemia can lead to hypoxia in the tissues, may not grow to a healthy weight, may arrive early (preterm birth), or have a low birth weight and anemia of iron deficiency may increase serum concentrations of norepinephrine, causing fetal distress (100). The reason could be linked to the effect of anemia on the oxygen bearing capacity and its transportation to the placental site for the fetus.

The mothers with a previous history of adverse birth outcome positively associated with current adverse birth outcome. This finding was inline a study conducted in Shire town of North Ethiopia, Uganda and China (38, 69). The previous history of adverse birth outcome increased risk of cardiovascular and metabolic diseases and they may have the chance of adverse birth outcome in the future pregnancy (106). Preconception care intervention is one of the recommended evidence-based practice to solve the occurrence of similar abnormal birth outcome

in subsequent pregnancies. One study showed the need and uptake of preconception care are higher among women with previous history of adverse birth outcome (107).

The finding of our study shows Short inter-pregnancy interval is also found to be a determinant of adverse birth outcome. The odds of having an adverse birth outcome on mother having of inter-pregnancy interval less than two years were 6.07 times greater as compared than the mothers having birth-interval more than two years. This finding is in an agreement with the other studies conducted in Southern Ethiopia, Uganda and America (69, 95, 108). This can happen because of the negative effect of a short inter-pregnancy period on Mom's body, which does not have enough time to replace nutrient stores before becoming pregnant again, so, obstetrics-related services are important to prevent nutritional deficiencies and other infectious diseases. On the other side, one study conducted in Addis Ababa shows there is no association between short pregnancy interval and adverse birth outcomes and also a recent study concluded that there are no links between short inter-pregnancy intervals and poor neonatal outcomes (109).

7.1 Strengths and limitation of the study

7.1.1 Strength of the study

We used validated tool for this study.

7.1.2 Limitation of the study

Some useful variables are not found in medical records like contraceptive use. Selection bias might be there, it could affect the accuracy of the data collected as the participants were sampled from specialized hospitals. This might be to underestimation of the prevalence of adverse birth outcome mothers who deliver at home and lower levels of health delivery or private health facility were not included in this study.

8 Conclusion and Recommendation

8.1 Conclusion

The prevalence of adverse birth outcome was high in Amhara region as compared than world health organization estimated figure and target. History previous adverse birth outcome, rural residency, Urinary tract infection, Anemia and Inter pregnancy interval have association with adverse birth outcome among PROM mothers. Therefore, close follow-up for the mothers who had previous adverse birth outcome, early screening and treatment of urinary tract infection, anemia prevention and maximize birth interval is important to prevent adverse birth outcome.

8.2 Recommendation

For hospitals

Routine screening and treatment of urinary tract infection, working on anemia prevention and management, counsel the mothers to maximize birth interval during postnatal period and encourage immediate postpartum family planning.

For Regional Health Breau

Avail laboratory tests for diagnosis of UTI, avail family planning methods to maximize birth spacing, early identification and management of adverse birth outcome, promote anemia prevention, expand access of specialty care to the rural area.

For researchers

Further research is needed in different areas and setup for full understanding of adverse birth outcome among premature rupture of membrane mothers.

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APPENDICES

Checklist

Title of the Research Project: Adverse birth outcome and its associated factors among PROM mothers.

Name of Advisers: - Endalkachew Worku & Gizachew Worku

Name of Principal Investigator: Abebe Abrha

Name of Organization: Bahir Dar University

Date-----Hospital name-----Data collector name-----

Code-----

1. Socio-demographic factors

SN		Response	Skip
SD1	Age (in year)	-----	
SD2	Ethnicity	1.Amhara 2.Oromo 3.Tigray 4. Others	
SD3	Residence	1.Urban 2.Rural	

2. Obstetric, Medical and Health services utilization

SN	Obstetric	Response	Skip
OB1	Gravidity	-----	
OB2	History of Sexually transmitted Infections.	1.Yes 2.No	
OB3	UTI	1.yes 2.No	
OB4	History of Diabetes Mellitus	1.yes 2.No	
OB5	History of previously known HTN	1. Yes 2. No	
OB6	History of Abortion	1. yes 2. No	
OB7	History of Previous adverse birth outcome (Stillbirth, low birth weight, preterm birth, and congenital anomalies)	1.Yes 2.No	
OB8	Inter-birth interval	1. Primigravida 2. <2years 3. >2 years	
OB9	Have ANC follow-up	1.Yes 2. No	
OB10	HIV status	1. Positive 2. Negative	
OB11	Current APH	1.yes 2.No	
OB12	Current Pre-Eclampsia/Eclampsia	1.yes 2.No	
OB13	Onset of labour	1. Spontaneous 2. Induced	

OB14	Color of liquor	1. Clear 2. Meconium stained 3. Blood stained	
OB15	Mode of delivery	1. Vaginal Delivery 2. Ceserian section 3. Instrumental delivery	
OB16	Duration of PROM (from rupture until to reach health facility)	1. < 12 hours 2. ≥ 12 hours	
OB17	Duration of PROM to delivery.	1. < 24 hours 2. ≥ 24 hours	
OB18	Level of Hemoglobin	-----	

4. Fetal outcome

S/N	Variables	Response	code
FO1	Birth outcome	1. Normal 2. Prematurity 2. Congenital anomalies 4. Stillbirth 5. low birth weight	
FO2	Current Adverse birth outcome	1. Yes 2. No	
FO3	Neonatal birth weight at birth	-----	
FO4	Gestational Age	-----	
FO5	Sex of baby	1. Male 2. female	