SCHOOL OF GRADUATE STUDIES

PREVALENCE OF PRETERM PREMATURE RUPTURE OF MEMBRANES AND ASSOCIATED FACTORS AMONG PREGNANT WOMEN ADMITTED TO WOLKITE UNIVERSITY COMPREHENSIVE SPECIALIZED HOSPITAL, WOLKITE, CENTRAL ETHIOPIA

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FEBRUARY, 2026

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Prevalence of Preterm Premature Rupture of Membranes and associated Factors among Pregnant Women Admitted to Wolkite University Comprehensive Specialized Hospital, Wolkite, Central Ethiopia

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As members of the Board of Examiners of the Certificate of Specialty in Obstetrics and Gynecology, Thesis open defense examination, we have read and evaluated this thesis prepared by Dr. Kefele Desta, and examined the candidate. We hereby certify that; the thesis is accepted for fulfilling the requirements for the award of the Certificate of Specialty in Obstetrics and Gynecology.

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ACKNOWLEDGEMENTS

First of all, I want to express my gratitude and appreciation to Wolkite University Comprehensive Specialized Hospital; College of Medicine and Health Sciences, Department of Obstetrics and Gynecology for allowing me to do this research report on this topic.

Secondly, I also express my appreciation and want to say thanks to my advisor Dr. Rabi Ali (MD, Assistant Professor of Obstetrics and Gynecology and Urogynecologist) and Dr. Teshome Gensa (Assistant Professor of Reproductive Health) for their indispensable support and guidance during the development of this research report.

Thirdly, I say thanks to my staff who were indebted in this research plan and helped me by providing advice and being on my side during this research report development.

Finally, I thank my Almighty God for his divine protection and guidance in my life.

ABBREVIATIONS AND ACRONYMS

ANC: Antenatal Care

EDHS: Ethiopia Demographic and Health Survey

GA: Gestational Age

PPROM: Preterm Premature Rupture of Membranes

PROM: Premature Rupture of Membranes

PTB: Preterm Birth

RDS: Respiratory Distress Syndrome

SDGs: Sustainable Development Goals

SOGC: Society of Obstetricians and Gynecologists of Canada

SPSS: Statistical Package for the Social Sciences

SSA: Sub-Saharan Africa

STI: Sexually Transmitted Infection

TPROM: Term Premature Rupture of Membranes

USA: United States of America

UTI: Urinary Tract Infection

VE: Vaginal Examination

WHO: World Health Organization

WKUCSH: Wolkite University Comprehensive Specialized Hospital

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ABSTRACT

Preterm premature rupture of membranes (PPROM) is a common obstetric complication associated with significant maternal and perinatal morbidity and mortality. This study assessed the prevalence and associated factors of PPROM among 199 pregnant mothers admitted to Wolkite University Comprehensive Specialized Hospital, Central Ethiopia, from December 2025 to January 2026. An institutional-based cross-sectional study was conducted using systematic random sampling. Data collected via interviewer-administered questionnaires and chart reviews were analyzed using multivariable logistic regression. The overall prevalence of PPROM was 11.6% (95% CI: 7.1–16.1). Factors significantly associated with PPROM included a history of abortions (AOR=5.7, 95% CI: 1.725–18.921), urinary tract infection (AOR=4.3, 95% CI: 1.074–17.4), a history of vaginal bleeding in the current pregnancy (AOR=18.07, 95% CI: 3.7–87), and residing in rural areas (AOR=3.54, 95% CI: 1.18–10.61). The prevalence of PPROM in this setting is high. To mitigate this burden, the hospital should transition toward universal, laboratory-based screening for infections and provide intensified surveillance for mothers with high-risk obstetric histories.

CHAPTER 1. INTRODUCTION

1.1. Background to the Study

Preterm Premature Rupture of Membranes (PPROM) is defined as the spontaneous rupture of fetal membranes before the onset of labor and 28 weeks to 37 weeks of gestation (Kuba and Bernstein, 2018; Gutema et al., 2023; Tsegaye et al., 2023a). This obstetric condition affects approximately 3% of pregnancies worldwide and is a leading known cause of preterm birth, contributing to 25–30% of cases (Addisu et al., 2020b). The fetal membranes, comprising the amnion and chorion, form a protective barrier around the fetus, retaining amniotic fluid that cushions against trauma, prevents umbilical cord compression, and supports fetal lung and skeletal development (Telayneh et al., 2023). When these membranes rupture prematurely, the loss of amniotic fluid increases risks such as infection, preterm labor, and neonatal complications, making PPROM a significant public health concern globally, especially in resource-limited settings (Abouseif et al., 2018).

Globally, preterm birth, often triggered by PPROM, accounts for 35% of neonatal deaths, exceeding one million deaths annually, and is the second leading cause of mortality in children under five (Aregawi et al., 2019; Liang et al., 2024). In Ethiopia, where the lower limit for viability and preterm classification is often considered 28 weeks gestation in practice (Gutema et al., 2023), PPROM prevalence varies widely, ranging from 1.4% to 23.5% across regions (Tiruye et al., 2021). This variation reflects differences in healthcare access, socioeconomic conditions, and risk factor prevalence. PPROM is implicated in 90% of neonatal deaths linked to preterm birth in Ethiopia, alongside maternal complications such as chorioamnionitis and puerperal sepsis (Addisu et al., 2020b). The etiology of PPROM is multifactorial and includes ascending genital tract infections, a history of previous PPROM, low socioeconomic status, smoking, nutritional deficiencies, and multiple gestations, although the precise mechanisms leading to membrane weakening are not fully elucidated (Wahabi et al., 2024; Kuba and Bernstein, 2018).

The amniotic sac, often called the "bag of water," plays a critical role in fetal protection and development. After 16 weeks of gestation, amniotic fluid is primarily fetal urine, supporting fetal movement and breathing essential for lung and chest

maturation (Assefa et al., 2023). PPROM disrupts this environment, leading to oligohydramnios, which can cause cord compression, reduced placental blood flow, and long-term neonatal sequelae like cerebral palsy, limb deformities, and respiratory distress syndrome (Emagneneh et al., 2025). In Ethiopia, approximately 320,000 babies are born preterm annually, with PPROM as a primary contributor, exacerbating the country's high neonatal mortality rates (Aregawi et al., 2019).

Despite its significant impact, robust and setting-specific data on PPROM prevalence and determinants in many parts of Ethiopia remain scarce. The 2016 Ethiopia Demographic and Health Survey (EDHS) indicated that only 28% of pregnant women reported receiving information about pregnancy complications like PPROM during antenatal care (ANC), suggesting potential gaps in awareness and preventative counseling (Assefa et al., 2023; CSA, 2016). While studies from centers like Jimma (Assefa et al., 2023) and Debre Tabor (Addisu et al., 2020b) highlight the association of PPROM with adverse perinatal outcomes, regional differences and the challenges within under-resourced healthcare systems necessitate localized investigation. At Wolkite University Comprehensive Specialized Hospital (WKUCSH) in Central Ethiopia, the specific burden of PPROM among admitted pregnant women is currently unknown. This lack of data hinders the development of targeted prevention and management strategies. This study aims to address these gaps by assessing the prevalence and associated factors of PPROM among pregnant women admitted to WKUCSH. By generating local evidence, this research seeks to enhance the understanding of PPROM within a resource-limited context, ultimately contributing to improved maternal and neonatal outcomes.

1.2. Statement of the Problem

Premature Rupture of Membranes (PROM) is a significant obstetric complication affecting 5–10% of all pregnancies worldwide. However, when it occurs before 37 weeks of gestation (PPROM), it complicates approximately 3% of pregnancies globally and is a primary cause of preterm birth (Tiruye et al., 2021; Kuba and Bernstein, 2018). It contributes to over 1 million neonatal deaths annually, with 60% occurring in Sub-Saharan Africa and South Asia (Aregawi et al., 2019; Liang et al., 2024). In Ethiopia, PPROM is estimated to be responsible for roughly one-third of preterm births, a major contributor to the nation's high neonatal mortality rate (Tsegaye et al., 2023b; Tiruye et al., 2021). Hundreds of thousands of infants suffer complications of prematurity yearly, significantly increased by PPROM-associated risks like neonatal sepsis, respiratory distress syndrome (RDS), and intraventricular hemorrhage (Addisu et al., 2020b). Furthermore, PPROM leads to serious maternal complications, including chorioamnionitis, placental abruption, endometritis, and puerperal sepsis, increasing maternal morbidity, mortality risk, and healthcare costs (Tiruye et al., 2021). Despite the severity of these risks, national data reveals a systemic gap in preventative care: according to the 2016 Ethiopia Demographic and Health Survey (EDHS), only 28% of pregnant women received counseling regarding pregnancy complications like PPROM during their antenatal care.

At the local level, Wolkite University Comprehensive Specialized Hospital (WKUCSH) serves a vast catchment area of over 4 million people in Central Ethiopia. Prior to this research, the specific magnitude and clinical drivers of PPROM at this facility were unknown, hindering the development of targeted management strategies. This study identified a local prevalence of 11.6% (95% CI: 7.1–16.1%), a rate nearly four times the global average. Furthermore, the identification of potent, modifiable factors such as urinary tract infections (AOR=4.3), antepartum vaginal bleeding (AOR=18.07), a history of abortion (AOR=5.7), and the geographic disadvantage of rural residence (AOR=3.54) highlights a critical public health gap in this setting. Women living in rural areas carry an added burden likely driven by transportation delay, heavy physical workloads, and limited access to early maternal intervention.

1.3. Significance of the Study

Addressing Preterm Premature Rupture of Membranes (PPROM) is crucial for making progress in maternal and child survival globally and nationally. This study, focused on Wolkite University Comprehensive Specialized Hospital (WKUCSH), holds significant potential to contribute to this effort in several ways:

Clinical Practice Improvement: By determining the prevalence of PPROM and identifying specific, locally relevant risk factors (e.g., infection types, ANC adequacy, and nutritional status), the findings will provide clinicians at WKUCSH with vital evidence. This can inform the development or refinement of screening protocols, targeted preventative interventions (like infection treatment or nutritional support), and optimized management strategies for women with PPROM, potentially reducing maternal and perinatal morbidity and mortality.

Hospital Resource Allocation and Management: Understanding the burden of PPROM will enable hospital administrators to better plan and allocate resources. For instance, if high rates are found, it could justify strengthening infection prevention and control measures, enhancing ANC services to improve early detection and education, or ensuring adequate staffing and supplies for managing PPROM and associated preterm labor and neonatal complications.

By establishing critical baseline data for Central Ethiopia, this study provides regional and national health authorities with the evidence-based insights necessary to develop targeted policies and programs aligned with Sustainable Development Goal 3 to reduce preterm birth and neonatal mortality. Academically, it fills a significant knowledge gap in the Ethiopian context, serving as a foundational reference for future research into the prevention and management of PPROM in resource-constrained environments. Furthermore, the research offers a profound community impact by informing clinical interventions that alleviate the severe economic and emotional burdens placed on families, ultimately improving survival rates and societal well-being. In essence, this study successfully bridges the gap between the global problem of PPROM and the urgent need for context-specific evidence, driving tangible improvements in maternal and fetal health at WKUCSH while contributing to Ethiopia's broader public health efforts.

1.4. Objectives of the Study

General Objective:

To assess the prevalence of preterm premature rupture of membranes and identify associated factors among pregnant women admitted to Wolkite University Comprehensive Specialized Hospital, Wolkite, Central Ethiopia, from December 2025 to January 2026.

Specific Objectives:

To determine the prevalence of preterm premature rupture of membranes among pregnant women admitted to Wolkite University Comprehensive Specialized Hospital during the study period.

To identify the associated factors of preterm premature rupture of membranes among pregnant women admitted to Wolkite University Comprehensive Specialized Hospital.

1.5. Scope of the Study

This research investigates the prevalence and associated factors of Preterm Premature Rupture of Membranes (PPROM) among pregnant women admitted to Wolkite University Comprehensive Specialized Hospital in Central Ethiopia. The study encompasses all eligible pregnant women admitted to the hospital's high-risk and labor and delivery wards who reached a gestational age of 28 weeks and above during the study period. By determining the prevalence of PPROM within this group and systematically comparing the clinical and demographic profiles of women with and without the condition, this research aims to identify the specific risk factors relevant to this specialized clinical setting.

Key variables examined include:

- Socio-demographic characteristics: Age, residency (urban/rural), educational status, marital status, average monthly family income.
- Obstetric history: Parity, gravidity, history of previous PPROM, history of abortion.
- Current pregnancy factors: Antenatal care (ANC) attendance (number of contacts), multiple gestation, presence of urinary tract infection (UTI), vaginal bleeding during the current pregnancy, documented anemia, maternal MUAC.
- Behavioral factors: Smoking status.

Data collection methods involved face-to-face interviews using a structured questionnaire and the abstraction of relevant information from patients' medical records (antenatal care cards, admission notes). The study is limited to this hospital setting and time frame. It excludes women with intrauterine fetal death (IUFD), lethal congenital anomalies, unknown gestational age (e.g., unknown Last Menstrual Period [LMP] and no first-trimester or early second-trimester ultrasound documentation), women who are too critically ill or mentally unstable to participate in the interview portion of data collection, and women who decline to give consent,to ensure a targeted analysis of PPROM's burden and risk factors in this specific population.

CHAPTER 2. LITERATURE REVIEW

2.1. Introduction

Preterm Premature Rupture of Membranes (PPROM), defined as the spontaneous rupture of fetal membranes before labor onset and prior to 37 weeks of gestation, is a major obstetric complication linked to preterm birth and perinatal morbidity (Pisoh et al., 2021). Globally, PPROM contributes significantly to neonatal mortality, particularly in low-resource settings where healthcare access is limited (Tiruye et al., 2021). This review synthesizes existing literature on PPROM's magnitude, associated factors, and complications, providing a foundation for understanding its burden and determinants among pregnant women at Wolkite University Comprehensive Specialized Hospital in Central Ethiopia.

2.2. Prevalence and Public Health Magnitude of PPROM

Preterm Premature Rupture of Membranes (PPROM) is a significant obstetric complication with a substantial global public health impact. Its prevalence varies widely across regions, reflecting disparities in healthcare access, socioeconomic conditions, and risk factor profiles. Globally, PPROM affects approximately 3% of all pregnancies and is a leading cause of preterm birth, accounting for up to one-third of such cases (Tsegaye et al., 2023b). In high-income countries like the United States, the prevalence is consistently between 2–3% (ACOG, 2018). However, rates are considerably higher in low and middle-income countries, with reported prevalence of 3.3% in Nigeria, 4.1% in Egypt, and as high as 19.2% in parts of China (Pisoh et al., 2021).

In Ethiopia, the prevalence of PPROM shows significant regional variation, with studies reporting rates from as low as 1.4% in Addis Ababa's teaching hospitals to as high as 23.5% in the Harari Region (Assefa et al., 2023; Tiruye et al., 2021). This wide range underscores the need for localized data to understand context-specific drivers.

The magnitude of PPROM is primarily understood through its role as a direct precursor to preterm birth—the world's leading cause of neonatal mortality. Annually, 15 million babies are born preterm, and over one million of these deaths are linked to complications of prematurity, many of which are initiated by PPROM (Aregawi et al.,

2019; Liang et al., 2024). In Sub-Saharan Africa, including Ethiopia, where preterm birth rates are among the highest globally, PPROM is responsible for 25–30% of cases (Addisu et al., 2020b). In Ethiopia alone, approximately 320,000 preterm births occur annually, with PPROM significantly exacerbating adverse outcomes like neonatal sepsis, respiratory distress, and long-term neurodevelopmental disabilities (Sokas et al., 2022). The burden extends to maternal health, with complications such as chorioamnionitis and puerperal sepsis increasing maternal morbidity and mortality. Given this profound impact, understanding the local prevalence and associated factors at facilities like Wolkite University Comprehensive Specialized Hospital is critical for developing targeted interventions.

2.3. Factors Associated with Preterm Premature Rupture of Membranes

The etiology of PPROM is multifactorial, involving a complex interplay of socio-demographic, obstetric, medical, and behavioral factors.

Socio-demographic Factors: Low socioeconomic status, limited educational attainment, and rural residence have been linked to an increased risk of PPROM, often mediated by poor nutrition, delayed healthcare-seeking, and higher exposure to infections (Tiruye et al., 2021). Maternal age, particularly at the extremes (adolescence or advanced maternal age), has also been identified as a potential risk factor in some studies.

Obstetric and Gynecological Factors: A previous history of PPROM is one of the strongest predictors, increasing the risk of recurrence by 4–6 times, potentially due to underlying cervical incompetence or persistent tissue weaknesses (Tiruye et al., 2021). Similarly, a history of abortion, particularly if involving cervical instrumentation, may increase PPROM odds by causing cervical trauma or introducing infection (Getnet et al., 2023). Multiple gestations (e.g., twins) elevate the risk nearly sixfold due to uterine overdistension and increased intrauterine pressure (Aregawi et al., 2019). Vaginal bleeding in pregnancy and polyhydramnios are also recognized risk factors.

Medical and Behavioral Factors: Infections are a primary driver of PPROM. Urinary Tract Infections (UTIs) are particularly common, found in 15–25% of PPROM cases, as bacteria can produce proteases that weaken the fetal membranes (Gutema et al., 2023). Other infections like sexually transmitted infections (STIs) and bacterial

vaginosis also contribute. Chronic medical illnesses such as hypertension or diabetes can compromise placental function and increase PPROM risk (Aregawi et al., 2019). Nutritional status, often measured by Mid-Upper Arm Circumference (MUAC), is crucial; maternal undernutrition is associated with weakened membrane integrity. Behavioral factors like cigarette smoking and substance use are known to increase risk.

Furthermore, inadequate Antenatal Care (ANC) is a significant factor. In Ethiopia, the lack of an ANC visit during the current pregnancy is a strong, independent predictor of premature rupture of membranes. National pooled data indicate that women who had no ANC visit had an Odds Ratio (OR) of 2.87 (95% CI: 1.34, 6.14) for PPROM compared to those who attended ANC, as it represents a missed opportunity for screening and treating infections, providing nutritional counseling, and educating women on the danger signs of pregnancy (Tiruye et al., 2021).

2.4. Complications of Preterm Premature Rupture of Membranes

PPROM leads to significant maternal and fetal complications. Maternal risks include chorioamnionitis (13–60%), placental abruption (9–12%), and puerperal sepsis, with infection rates rising at earlier gestational ages (Sudha and Biradar, 2023). Neonatal outcomes are equally severe, with PPROM linked to 60% of preterm deliveries and 10–15% of perinatal deaths (Enjamo et al., 2022). Common neonatal complications include respiratory distress syndrome (RDS), sepsis, and cord compression due to oligohydramnios, with risks peaking when rupture occurs before 24 weeks (Challacombe et al., 2025). In Ethiopia, these complications contribute to 26% of neonatal deaths from preterm birth, underscoring PPROM's public health urgency (Tiruye et al., 2021).

2.5. Conceptual Framework

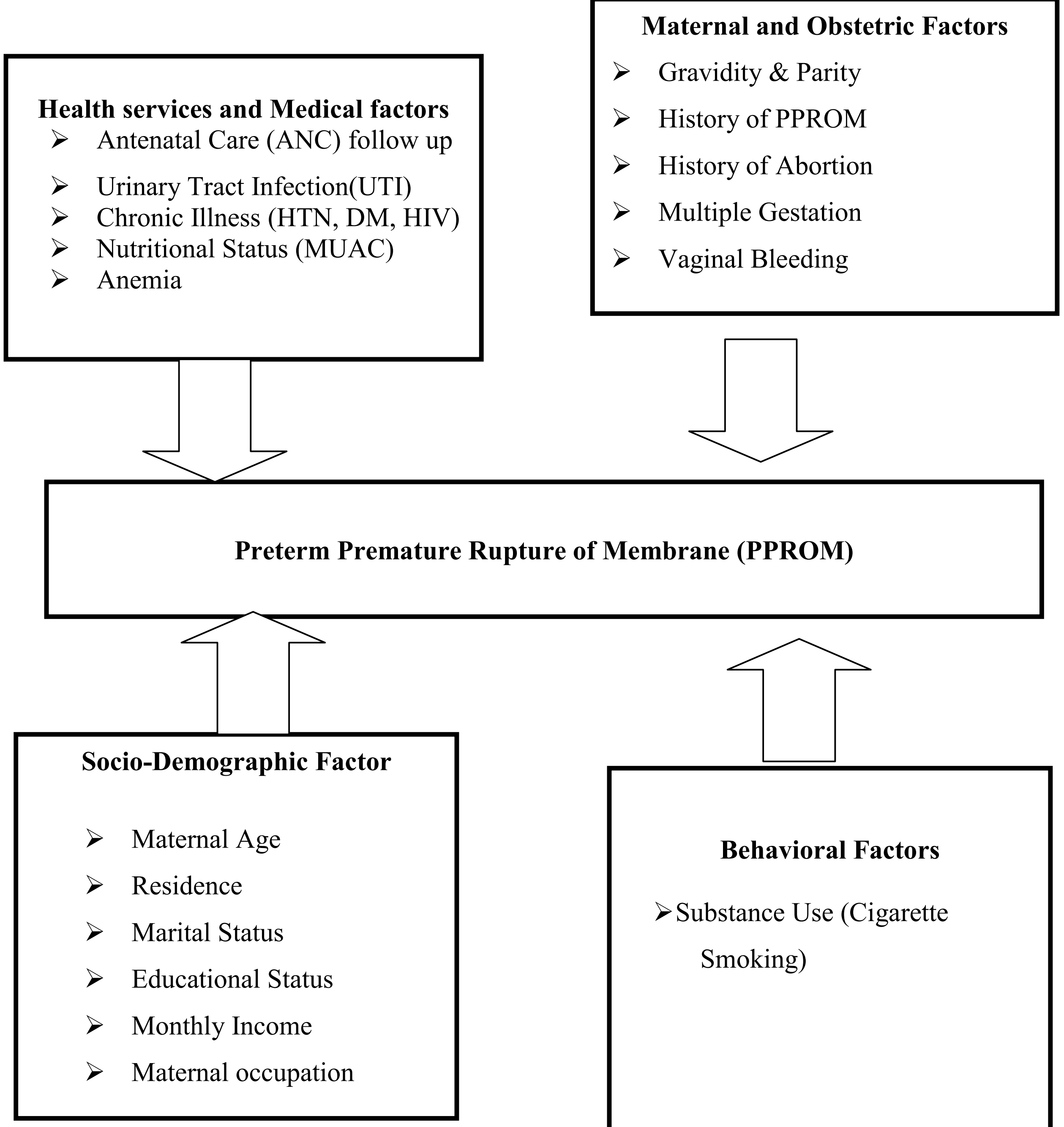

Figure 1. Conceptual framework of factors associated with Preterm Premature Rupture of Membranes (PPROM).

CHAPTER 3. MATERIALS AND METHODS

3.1. Study Area and Period

The study was conducted at Wolkite University Comprehensive Specialized Hospital, which is the only referral and teaching hospital in the Gurage zone, Central Ethiopia region. The hospital is located in Gubreye sub-city, on the Gubreye-Butajira road, 14 km away from Wolkite town and 158 km southwest of the capital city, Addis Ababa. It is situated at an altitude between 1910 and 1935 meters above sea level and has a sunny climate. The hospital is expected to provide health services to more than four million people living in the region and neighboring districts of the Oromia region. It was inaugurated on July 29, 2011 E.C.

The hospital has around 226 healthcare professionals, 307 administrative staff, and 350 beds, including a maternal intensive care unit, pharmacies, and clinical laboratory facilities. The Department of Gynecology and Obstetrics includes a gynecology emergency unit, outpatient unit, referral clinic, ANC follow-up unit, labor and delivery ward, post-natal care unit, high-risk maternity unit, gynecology ward, operation room, and ICU. There are 27 midwives in the hospital. This study was conducted from December 2025 to January 2026.

3.2. Study Design

An institutional-based cross-sectional study design was employed.

3.3. Population

3.3.1. Source Population: Pregnant women who were attending Wolkite University Comprehensive Specialized Hospital (WKUCSH) for obstetric care.

3.3.2. Study Population: All pregnant women admitted to the high-risk, labor, and delivery ward at Wolkite University Comprehensive Specialized Hospital for birth or pregnancy-related issues during the defined study period.

3.4. Eligibility Criteria

3.4.1. Inclusion Criteria: All pregnant mothers (Gestational Age greater than or equal to 28 weeks) admitted to the high-risk, labor, and delivery ward during the study period.

3.4.2. Exclusion Criteria: Women with unknown gestational age (e.g., unknown Last Menstrual Period [LMP] or no first-trimester or early second-trimester ultrasound documentation), women who are too critically ill or mentally unstable to participate in the interview portion of the data collection, and women with lethal fetal congenital anomalies are excluded.

3.5. Sample Size Determination and Sampling Procedure

For the first objective (prevalence), the sample size was calculated using the single population proportion formula:
$n = (Z\alpha/2)^2 * P(1-P) / d^2$

Where:
n = Minimum sample size
Z = Standardized normal distribution value for 95% confidence level (1.96)
d = Margin of error tolerated (5% or 0.05)
P = Prevalence of PPROM, taken as 13.67% (0.1367) from a study in Debre Tabor, Ethiopia (Addisu et al., 2020b).

$n = (1.96)^2 * 0.1367(1-0.1367) / (0.05)^2 = 181$
Adding a 10% non-response rate (18), the final sample size is 199.

For the second objective (associated factors), sample size was calculated using Epi Info statistical software based on variables from previous studies.

Table 1. Sample size calculation for second objective

Assumptions	**Variables**	**AOR (95% CI)**	**% of an outcome on unexposed**	**% of an outcome on exposed**	**Sample size with a 10% non-response rate**	**Reference**
CI=95% Power=80% Ratio=1:1	Vaginal bleeding: No, Yes	2.62 (1.23-5.57)	12.2	26.2	119	(Tsegaye et al., 2023a)
	UTI: No, Yes	6.33 (3.26-12.29)	8.2	45.2	130	
	MUAC: <23cm, ≥23 cm	7.18 (3.71-13.91)	7.5	36.5	110	

Finaly, the larger sample size (199) was taken.

Wolkite University Comprehensive Specialized Hospital was selected purposively as it is the only specialized referral and teaching hospital in the Gurage zone. To ensure a representative sample, the sampling interval (K) was determined by dividing the total estimated source population (N=600) by the calculated sample size (n=199). This resulted in a sampling interval of K=3. During the study period from December 2025 to January 2026, I established a sampling frame consisting of all pregnant women admitted to the high-risk and labor and delivery wards with a gestational age ≥28 weeks for pregnancy-related issues. A systematic random sampling technique was then executed: the first participant was selected using a random start (by picking a number between 1 and 3), and subsequently, every third eligible woman was enrolled upon admission until the target sample size of 199 was achieved. This rigorous approach allowed for an unbiased selection of participants throughout the varying shifts and admission peaks of the hospital's obstetric department.

3.6. Study Variables

3.6.1. Dependent Variable: Preterm Premature Rupture of Membranes (PPROM)

3.6.2. Independent Variables:

Socio-demographic characteristics: Age, residency (urban/rural), educational status, marital status, average monthly family income.

Obstetric history: Parity, gravidity, history of previous PPROM, history of abortion.

Current pregnancy factors: Antenatal care (ANC) attendance (number of contacts), multiple gestation, presence of urinary tract infection (UTI), vaginal bleeding during current pregnancy, documented anemia, maternal MUAC.

Medical Factors: Presence of Chronic Illness (e.g., Hypertension, Diabetes, HIV).

Behavioral factors: Smoking status.

3.7. Operational Definitions

PPROM: Spontaneous rupture of fetal membranes before labor onset and prior to 37 weeks of gestation (between 28+0 and 36+6 weeks), confirmed by sterile speculum examination.

History of PPROM: A self-reported or documented occurrence in a previous pregnancy where the fetal membranes ruptured before the onset of labor and before 37 weeks of gestation.

History of abortion: Any spontaneous or induced pregnancy termination occurring before the 28-week viability threshold recognized in Ethiopian clinical standards. Maternal history was primarily identified through participant recall and, wherever feasible, substantiated by cross-referencing medical records, ANC cards, and hospital admission notes to ensure clinical consistency.

Chorioamnionitis: A clinical diagnosis based on maternal fever, uterine tenderness, maternal or fetal tachycardia, and/or foul-smelling amniotic fluid.

Urinary Tract Infection (UTI): Documented diagnosis of UTI during the current pregnancy based on clinical symptoms and/or laboratory confirmation (urinalysis) in the medical record.

Vaginal Bleeding: Any antepartum hemorrhage, specifically abruptio placentae, occurring after 28 weeks' gestation but prior to labor or membrane rupture. Identified via maternal report and clinical records, this variable focuses on the abruption-thrombin pathway.

Low MUAC: Mid-Upper Arm Circumference < 23 cm.

Anemia in Pregnancy: Hemoglobin level < 11 g/dL documented in the medical record during the current pregnancy.

Gravidity: The total number of pregnancies, including abortions and ectopic pregnancies. Twin pregnancies are considered as one.

Parity: The total number of deliveries after 28 weeks of gestation, including stillbirths.

Preterm birth: A baby born before 37 completed weeks but after 28 completed weeks of gestation.

Perinatal mortality: Fetal death after 28 weeks of gestation or death of a newborn within the first seven days of life.

Residence: Participants were categorized as 'Urban' if they resided within recognized municipal boundaries with access to centralized health infrastructure, and 'Rural' if they resided in peripheral kebeles or farming communities. This variable serves as a proxy for the 'triple delay' in obstetric care—delay in seeking care, reaching the facility, and receiving timely intervention.

3.8. Data Collection

Data was collected using a structured, interviewer-administered questionnaire prepared by reviewing relevant literature. The questionnaire was categorized into sections: sociodemographic characteristics, past and current obstetric and gynecological history, medical history, and behavioral factors. The questionnaires were prepared in English and translated into the local language for the interviews.

Data was collected using a multi-pronged approach involving face-to-face interviews, physical measurements, and medical record abstraction. Women with intrauterine

fetal death (IUFD), lethal congenital anomalies, unknown gestational age (e.g., unknown Last Menstrual Period [LMP] and no first-trimester or early second-trimester ultrasound documentation), and women who were too critically ill or mentally unstable to participate in the interview portion of the data collection were excluded to ensure a targeted analysis of PPROM's burden and risk factors in this specific population.

Interview: A pretested, structured questionnaire was administered by trained data collectors to gather information on socio-demographic characteristics, obstetric and gynecological history, medical history, current pregnancy status, and behavioral factors (smoking).

Medical Record Review: The participant's medical records (antenatal care cards, admission notes, and laboratory results) were reviewed to abstract clinical data, including gestational age, multiple gestational status, documented infections, hemoglobin level, and confirmation of PPROM.

Measurement of Key Variables:

Nutritional Status (MUAC): Maternal Mid-Upper Arm Circumference (MUAC) was measured on the participant's left arm at the midpoint between the acromion (shoulder) and olecranon (elbow) processes. A standard, non-stretchable MUAC tape was used, and the measurement was recorded to the nearest 0.1 cm. Low MUAC is defined as <23 cm.

Anemia: The presence of anemia was ascertained by reviewing the participant's medical record. A participant was classified as having anemia (Yes/No) if there is a documented hemoglobin level of < 11 g/dL, in accordance with World Health Organization (WHO) guidelines, or a clinical diagnosis of anemia recorded during the current pregnancy.

Urinary Tract Infection (UTI): A diagnosis of UTI was considered present if it was documented in the medical record, based on clinical symptoms and/or laboratory confirmation (urinalysis) during the current pregnancy.

PPROM Diagnosis: A case of PPROM was confirmed based on the documented clinical diagnosis in the patient's chart, confirmed by sterile speculum examination.

Data Collection Assurance:

To ensure the collection of high-quality data, several measures were implemented. The data collection instrument, a structured questionnaire adapted from existing literature, was translated from English to the local language (e.g., Amharic) and back to English to ensure consistency. The questionnaire was pretested on 5% of the sample size (approximately 10 women) at the high risk, labor, and delivery ward to check for clarity, flow, and appropriateness, and any necessary modifications were made. Data was collected by residents in obstetrics and gynecology using printed structured questionnaires. All data collectors received a comprehensive two-day training on the study objectives, data collection instruments, ethical considerations, interviewing techniques, and procedures for abstracting data from medical records. The principal investigator conducted daily supervision during the data collection period. Completed questionnaires were checked for completeness and consistency on a daily basis. Regular meetings were held with the data collectors to discuss any challenges encountered and ensure standardized data collection practices were maintained throughout the study.

3.9. Data Analysis

Collected data was entered into EpiData version 3.1 and exported into SPSS version 25 for analysis. Both descriptive and analytical statistics were used. Descriptive statistics like mean, frequency, and percentage described the characteristics of participants using graphs, tables, and text. Both bivariable and multivariable logistic regression analyses were carried out to identify factors associated with PPROM. In the bivariable analysis, variables with a p-value less than or equal to 0.25 were entered into a multivariable logistic regression model to control for potential confounding variables. A statistically significant association was claimed based on the Adjusted Odds Ratio (AOR) with its 95% CI and a P-value <0.05.

3.10. Ethical Considerations

The study was reviewed and approved by the Institutional Health Research Ethics Review Committee of Wolkite University Comprehensive Specialized Hospital. A permission letter was obtained from Wolkite University. Written and verbal informed consent was taken from all respondents. The confidentiality of the information collected from each participant was strictly maintained by using codes instead of names. Participants were informed that their participation is voluntary and that they have the right to withdraw at any time.

3.11. Dissemination of Results

First, the study findings will be presented and defended to the academic community of Wolkite University. Second, a final report will be submitted to the Wolkite University College of Health and Medical Sciences and WKUCSH. Finally, the findings will be submitted for publication in a peer-reviewed scientific journal to contribute to the broader scientific evidence.

CHAPTER 4. RESULTS

4.1. Socio-Demographic Characteristics

A total of 199 preterm pregnant women were enrolled in the study with a 100% response rate. Of these, 156 (78.4%) were in the 18-35 age group, with the mean age of participants being 28.8 ±0.46, ranging from 18 to 42 years. The majority of the study participants were married 178 (89.4%), housewives 66 (33.2%), and half of them were urban residents 105 (52.8%). Concerning the maternal level of education status of the respondents, 18.6% of the mothers had attended a primary level of education, 26.1% of the study participants had attended a secondary level of education, and 33.3% of the study participants were housewives (Table 2).

Table 2. Socio-demographic characteristic of pregnant women (GA≥ 28) admitted to Wolkite University Comprehensive Specialized Hospital, Wolkite, Central Ethiopia, (n=199).

Variable	Categories	Frequency	Percent (%)
AGE	< 18 year	5	2.5
	18-35 year	156	78.4
	>35 year	38	19.1
Residence of study participants	Urban	105	52.8
	Rural	94	47.2
Occupation	House wife	66	33.2
	Farmer	48	24.1
	Government	21	10.6
	Merchant	29	14.6
	Student	8	4
	Others	4	2
Marital status	Married	178	89.4
	Single	11	5.5
	Divorced	9	4.5
	Widowed	1	0.5
Women's educational status	No formal education	36	18.1
	Read/Write	30	15.1
	Primary	37	18.6
	Secondary	52	26.1
	Collage and above	44	22.1
Monthly income	2501-3500	14	7
	>3500	185	93

4.2. Health Service Related Factors

Regarding health care service utilization, the vast majority of the 199 study participants (n = 195, 98%) received antenatal care (ANC) during the current pregnancy. Among those who utilized ANC services, 189 mothers (96%) had more than two contacts, while six mothers (3%) had two contacts. Only four mothers (2%) had no ANC contact (Table 3).

4.3. Medical Related Factors

Assessment of medical profiles of the study participants revealed that nearly one-tenth (n=19, 9.5%) were diagnosed with a urinary tract infection. Regarding nutritional status, approximately one-third of women (n=64, 32.2%) had a MUAC of less than 23 cm, while 27 mothers (13.6%) had anemia (Hgb < 11g/dl), and 15 participants (7.5%) had a chronic illness (Table 3).

Table 3. Health service and medical related factors of study participants (n=199).

Variables	Categories	Frequency	Percent (%)
UTI diagnosed	Yes	19	9.5
	No	180	90.5
Chronic illness	Yes	15	7.5
	NO	184	92.5
Anemia	Yes	27	13.6
	No	172	86.4
ANC attendance	Yes	195	98
	No	4	2
Number of ANC visit	No visit	4	2
	Two visit	6	3
	>2 visit	189	95
MUAC	MUAC < 23cm	64	32.2
	MUAC greater or equal to 23	135	67.8

4.4. Maternal and Obstetric Profile of Study Participants

The study revealed that nearly two-thirds (n=126, 63.3%) of study participants were multipara, while 23 women (11.6%) were Primigravida. Analysis of gestational age at the time of admission showed that 83 participants (41.7%) were preterm (GA between 28 and 37), while the majority (n=116, 58.3%) were at term. With regards to previous obstetric complications, a history of PPROM in a previous pregnancy was reported by

10 participants (5%), and 20 mothers (10.1%) of the study participants had a history of abortion (Table 4).

Table 4. Maternal and Obstetric profile of study participants (n=199).

Variables	Categories	Frequency	Percent (%)
Gravidity	I	23	11.6
	II-IV	123	61.8
	≥IV	53	26.6
Parity	Nulliparous	28	14.1
	Primpara	45	22.6
	Multipara	126	63.3
Hx of abortion	Yes	20	10.1
	No	179	89.9
GA in wks	Preterm (28-37) wks	83	41.7
	≥37 wks	116	58.3
PPROM cases (GA) (n = 23)	Very preterm (28 - 31+6 weeks)	2	1.0%
	Moderate preterm (32 - 33+6 weeks)	5	2.5%
	Late preterm (34 - 34+6 weeks)	16	8.1%
Vaginal bleeding	Yes	10	5
	No	189	95
Current outcome of PPROM	Yes	23	11.6
	No	176	88.4

4.5. Prevalence of PPROM

Among 199 mothers enrolled in this study, 23 had preterm premature rupture of membranes (PPROM), which represents a prevalence of 11.6% (95% CI: 7.1, 16.1), and the remaining 176 participants (88.4%) had no preterm premature rupture of membranes.

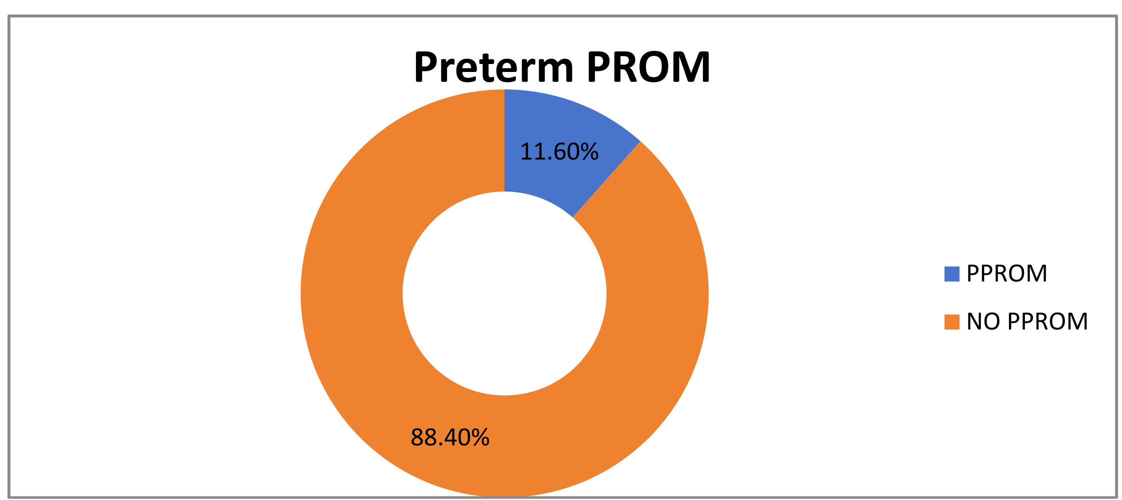

Figure 2. The prevalence of preterm premature rupture of membrane at Wolkite University Comprehensive Specialized Hospital (N=199).

4.6. Factors Associated with Preterm Premature Rupture of Membrane

In the bivariable logistic regression analysis, variables including residence, Antenatal care attendance, history of abortion, previous history of PPROM, anemia, history of vaginal bleeding in current pregnancy, urinary tract infection, history of chronic illness, and gravidity were selected as candidate variables at p-value <0.25 for multivariable logistic regression. Multicollinearity was checked using the variable inflation factor with results between 1.07 and 1.36. The Hosmer-Lemeshow goodness of fit test was checked for model fitness, with the p-value indicated being 0.22. The result in the multivariable logistic regression analysis showed that a history of abortion, pregnant women with urinary tract infection, and pregnant women with a history of vaginal bleeding in the current pregnancy had a statistically significant association with the preterm premature rupture of membranes.

According to our study results, pregnant women with a previous history of abortion were 5.7 times more likely predisposed to PPROM as compared with women who did not experience abortions [AOR=5.7, 95% CI: (1.725, 18.921)]. Pregnant women who had urinary tract infections were more than four times likely to develop PPROM in contrast to those who did not [AOR=4.3, 95% CI: (1.074 to 17.4)]. Pregnant women who had a history of antepartum vaginal bleeding were 18 times more likely to develop PPROM compared to those who did not experience vaginal bleeding [AOR=18.07, 95% CI: (3.7 to 87)], and pregnant women living in rural areas were

3.54 times more likely to develop PPROM compared to urban residents [AOR=3.54, 95% CI (1.18 to 10.61)].

Table 5. Bivariable and multivariate analysis of factors associated with preterm premature rupture of membrane among pregnant women admitted to Wolkite University Comprehensive Specialized Hospital.

Variable	Category	PPROM Yes	PPROM No	COR (95% CI)	AOR (95% CI)	P-value
Residence	Urban	8	97	1	1	
	Rural	15	79	2.302 (0.929, 5.708)	3.54 (1.181, 10.614)	0.024 *
Previous history of PPROM	Yes	2	8	2.00 (0.398, 10.051)	1.374 (0.218, 8.677)	0.735
	No	21	168	1	1	
History of Vaginal bleeding	Yes	5	5	9.5 (2.509, 35.968)	18.07 (3.7, 87)	0.000 *
	No	18	171	1	1	
UTI diagnosed	Yes	4	15	2.260 (0.680, 7.510)	4.3 (1.074, 17.4)	0.039 *
	No	19	161	1	1	
History of abortion	Yes	6	14	4.084 (1.388, 12.015)	5.7 (1.725, 18.921)	0.004 *
	No	17	162	1	1	
Chronic illness	Yes	2	13	1.194 (0.252, 5.663)	1.110 (0.200, 6.166)	0.905
	No	21	163	1	1	
Anemia	Yes	6	21	2.605 (0.924, 7.343)	1.928 (0.557, 6.668)	0.300
	No	17	155	1	1	
ANC attend	Yes	1	173	1	1	
	No	22	3	2.621 (0.261, 26.308)	4.86 (0.432, 54.6)	0.201
Gravidity	Null gravida	5	18	1	1	
	Primigravida	15	108	4.6 (1.003, 21.387)	5.687 (0.942, 34.322)	0.058
	Multigravida	3	50	2.315 (0.641, 8.360)	2.541 (0.602, 10.731)	0.205

*(Note: * indicates statistical significance at P < 0.05)*

CHAPTER 5. DISCUSSION

The findings of this study reveal that PPROM is a significant obstetric complication at WKUCSH with a prevalence of 11.6% (95% CI: 7.1, 16.1). This means more than one in every ten women admitted to our hospital experiences an early break up of their water before they reach term. Our finding is nearly comparable with the finding from public hospitals in West Guji Zone (Abebe Diriba et al., 2022a). In our study, the prevalence of PPROM was higher than the global prevalence of 1% to 3% and other studies in Rio Grande, Brazil (3.1%) (Hackenhaar et al., 2014), in India (2.01% - 4.9%) (Mohan et al., 2017; Pisoh et al., 2021), and in Nigeria (3.3%) (2019). This might be due to the differences in the study population; in this study, data was collected from a selected high-risk population, which may increase the magnitude of PPROM. On the other hand, this finding is lower than study findings from Oromia Region, Ethiopia (13.3%) (Beyene et al., 2023), South Ethiopia (14.3%) (Tsegaye et al., 2023a), Uganda (13.8%) (Byonanuwe et al., 2020), and Debre Tabor General Hospital (13.7%) (Addisu et al., 2020a). The difference could be attributed to the time gap between the studies and socio-demographic distribution.

We found that PPROM was associated with UTI, which is consistent with previous reports from Debre Tabor, Ethiopia (Addisu et al., 2020a), Southern Ethiopia (Argaw et al., 2021), a systematic review study of Ethiopia (Geremew et al., 2024), and Northeastern India (Pisoh et al., 2021). This might be linked with elevations in inflammatory mediators such as prostaglandins, cytokines, and proteinases in the local tissue, which play a causative role in the disruption of fetal membrane integrity, triggering uterine contractility as part of the physiologic defense mechanism.

Similarly, women with vaginal bleeding were more likely to develop PPROM compared to their counterparts. This finding was consistent with the study conducted at Hiwot Fana Comprehensive Specialized University Hospital, Eastern Ethiopia (Wolde et al., 2024), Debre Tabor General Hospital (Addisu et al., 2020a), Southern Ethiopia (Argaw et al., 2021), and a systematic review study of Ethiopia (Geremew et al., 2024). This might be related to thrombin release from the decidual cells as a result of decidual hemorrhage, which might result in tissue necrosis and degradation of the extracellular matrix.

We also found that a history of abortion was significantly associated with PPROM. The likelihood of having PPROM among mothers who have a history of abortion was six times higher compared with those who did not have a history of abortion. Our study was supported by previous reports, including a systematic review study of Ethiopia (Geremew et al., 2024), Southern Ethiopia (Argaw et al., 2021), and West Guji Zone (Abebe Diriba et al., 2022b). The relationship may be explained by iatrogenic mechanical trauma sustained during prior surgical evacuation procedures, such as dilatation and curettage (D&C), which can lead to cervical insufficiency or structural weakening of the uterine wall. Additionally, prior procedures may introduce pathogens that persist as latent upper genital tract infections, which later progress into intra-amniotic triggers for PPROM during subsequent gestations.

This study also established a strong link between geographic location and obstetric emergencies, revealing that rural residence is a significant predictor of PPROM. Mothers residing in rural areas were 3.5 times more likely to experience PPROM compared to urban residents. This finding is highly consistent with a national systematic review conducted in Ethiopia by Tiruye et al. (2021) and a similar study in Southern Ethiopia (Argaw et al., 2021). The elevated risk among rural mothers can be explained by a cascade of socioeconomic and healthcare access barriers. Women in rural settings often experience delayed healthcare-seeking behavior, endure heavy physical workloads throughout their third trimester, and face higher exposure to untreated urogenital infections due to poor water, sanitation, and hygiene (WASH) infrastructures. Consequently, minor infections or obstetric warning signs that could be managed early in urban settings are often missed, culminating in membrane rupture.

Overall, the findings of this study indicate that PPROM remains a considerable obstetric problem in the study setting, with a prevalence that is higher than global estimates but comparable to reports from similar high-risk and resource-limited settings. The consistent associations observed with urinary tract infection, history of abortion, and antepartum vaginal bleeding across regional and international studies strengthen the evidence that infectious, structural, and inflammatory pathways play an important role in the pathogenesis of PPROM. The similarities between this study and findings from other Ethiopian regions and low- and middle-income countries suggest

that these risk factors are contextually relevant and potentially modifiable through improved antenatal screening and timely clinical management. These results provide important local evidence to inform clinical practice and reinforce the need for focused preventive strategies targeting women at increased risk of PPROM.

Limitation of the study: The results must be interpreted with some limitations. Because this was a hospital-based study focusing on a high-risk population, the prevalence may be higher than what would be found in a community-wide survey. Additionally, the cross-sectional design prevents the establishment of a definitive temporal or causal relationship between the risk factors and PPROM. Finally, while efforts were made to minimize bias, the study remains susceptible to recall bias regarding past obstetric events and unmeasured behavioral confounders, such as specific substance use.

CHAPTER 6. CONCLUSIONS

The findings of this study demonstrate that preterm premature rupture of membranes was a significant obstetric challenge at Wolkite University Comprehensive Specialized Hospital, with a prevalence of 11.6% (95% CI: 7.1, 16.1). While this rate is nearly four times higher than the 3% global average, it aligns with the burden seen in other Ethiopian tertiary referral centers, such as Debre Tabor (13.7%). Factors like antepartum vaginal bleeding, a history of abortion, urinary tract infections, and rural residence were significantly associated with preterm premature rupture of membranes.

CHAPTER 7. RECOMMENDATIONS

Based on the finding that Vaginal bleeding in the current pregnancy was the strongest independent risk factor for PPROM (AOR 18.07). Clinicians must treat antepartum hemorrhage (APH) as a severe, immediate warning sign for PPROM. Mothers presenting with bleeding require immediate evaluation, admission, and strict follow-up for fetal and maternal well-being. Hospital management should proactively optimize NICU capacity and ensure consistent pharmacy stock for prophylactic antibiotics and antenatal corticosteroids, as approximately one in ten admissions to the high-risk ward experiences PPROM.

For Antenatal Screening and Infection Control (UTI):
In light of the finding that urinary tract infections increase the odds of PPROM more than fourfold (AOR 4.3), it is strongly recommended that WKUCSH transition from symptomatic-only evaluation to routine laboratory-based screening for asymptomatic bacteriuria. Rather than relying solely on basic urinalysis or empiric treatment, the hospital should integrate urine culture and antimicrobial susceptibility testing into standard ANC screening—at least during the initial visit—and for any mother presenting with high-risk obstetric signs. Strengthening early, culture-directed management of UTIs is a highly effective, modifiable strategy to combat antibiotic resistance and reduce the incidence of PPROM.

For Risk-Stratification and Counseling (History of Abortion):
A history of abortion was found to be a significant independent predictor of PPROM (AOR 5.7). It is recommended that women with this background risk be flagged early in their antenatal care. They should receive intensified counseling on the danger signs of PPROM and undergo closer clinical surveillance (such as cervical length monitoring) during routine ANC to detect early signs of cervical incompetence or ascending infections.

For Health System and Community Interventions (Rural Residence):
Finally, rural mothers had a 3.5-fold increased risk of PPROM compared to urban residents. Health centers and Health Extension Workers must actively educate rural women on the danger signs of PPROM, UTI, and vaginal bleeding to facilitate early referrals. To mitigate the risks associated with transportation delays and delayed

healthcare-seeking behaviors among these highly vulnerable mothers, the hospital and regional health bureau should strongly encourage and facilitate the use of Maternity Waiting Homes during the third trimester.

For Future Research:

Because the current study utilized a hospital-based, cross-sectional design—which limits the ability to establish definitive temporal or causal relationships between the identified risk factors and PPROM—it is highly recommended that future researchers conduct prospective longitudinal (cohort) studies. A community-based longitudinal study would help validate these findings, minimize recall bias regarding past obstetric events, and explore unmeasured behavioral confounders to better understand the true causal pathways of PPROM in this population.

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CHAPTER 9. APPENDIX

APPENDIX A: QUESTIONNAIRES

Questionnaire for the Study on Prevalence of PPROM and Associated Factors
Wolkite University Comprehensive Specialized Hospital

Participant Identification Number: _______________
Date of Interview (DD/MM/YYYY): //______
Data Collector's Name: _________________________ Signature: _______________

Part I: Informed Consent Form

Hello, my name is ________________ and I am a data collector for a research study being conducted by Dr. Kefele Desta from Wolkite University. We are conducting a study to understand the prevalence and factors associated with the early breaking of the water bag (preterm premature rupture of membranes) among pregnant women admitted to this hospital. You have been selected to participate in this study. If you agree, I will ask you some questions about your health, pregnancy history, and lifestyle. The interview will take about 15-20 minutes. Your participation is completely voluntary. All the information you provide will be kept strictly confidential.

Do you have any questions for me? May I proceed with the interview?

1. Yes (Proceed to questionnaire)
2. No (Thank the participant and end the interview)

Participant's agreement signature/thumbprint (if they agree): ______________

Questionnaire (English)

No.	Question	Response Options
Part II: Socio-Demographic Information		
201	How old are you? (in completed years)	______ (Years)
202	Where is your current residence?	1. Urban 2. Rural
203	What is your marital status?	1. Married 2. Single 3. Divorced 4. Widowed
204	What is your highest level of education?	1. Cannot read and write 2. Can read and write 3. Primary School (1-8) 4. Secondary School (9-12) 5. College/University
205	What is your current occupation?	1. Housewife 2. Farmer 3. Government employee 4. Private employee 5. Merchant/Trader 6. Student 7. Other (specify): ______
206	What is your estimated average monthly family income (in ETB)?	__________ ETB
Part III: Obstetric and Gynecological History		
301	Including this one, how many times have you been pregnant? (Gravida)	______
302	How many live births have you had? (Parity)	______
303	Have you ever had a pregnancy that ended in an abortion or miscarriage?	1. Yes 2. No
304	In any of your previous pregnancies, were you told that your water broke early?	1. Yes 2. No
305	During this current pregnancy, have you had any vaginal bleeding?	1. Yes 2. No
Part IV: Medical and Behavioral History		
401	Did you have Antenatal Care (ANC) follow-up for this pregnancy?	1. Yes 2. No (If No, skip to 403)
402	If yes, how many ANC visits did you have?	______ (Number of visits)
403	Do you smoke cigarettes?	1. Yes 2. No
404	Have you been diagnosed with any chronic illness like hypertension, diabetes, or HIV?	1. Yes 2. No
Part V: Data from Medical Records and Measurements (For Data Collector Use Only)		
501	Gestational Age at admission (in weeks + days)	___ weeks + ___ days
502	Is this a multiple gestation (twins, triplets)?	1. Yes 2. No

503	Is anemia diagnosed (<11 g/dL)?	1. Yes 2. No
504	Is there a documented diagnosis of Urinary Tract Infection (UTI)?	1. Yes 2. No
505	Mid-Upper Arm Circumference (MUAC) measurement	_____ cm
506	Final Diagnosis: Is PPROM confirmed?	1. Yes (PPROM Case) 2. No (Not a PPROM Case)

Thank you very much for your time and participation!