

**DETERMINANTS OF PUERPERAL SEPSIS AMONG POST PARTUM  
WOMEN WHO WERE ADMITTED TO HARAR TOWN PUBLIC  
HOSPITALS, EASTERN ETHIOPIA: - A CASE CONTROL STUDY**

**MSc THESIS**

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**Determinants of Puerperal sepsis among Postpartum Women Who Were  
Admitted to Harar Town Public Hospitals, Eastern Ethiopia: - A Case-Control  
Study**

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Nursing**

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**Harar, Ethiopia**

## APPROVAL SHEET

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I hereby certify that I have read and evaluated this Thesis entitled “**Determinants of Puerperal sepsis among Postpartum Women who were admitted to Harar Town Public Hospitals, Eastern Ethiopia.**” A Case-control study” Prepared under my guidance by **Tarikwa Habetamu**. I recommend that it can be submitted as fulfilling the Thesis requirement.

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## **BIOGRAPHICAL SKETCH**

I was born in 1994 in Haramaya, Eastern Ethiopia. I completed my primary and secondary school in Bate Primary School and Haramaya Secondary school. I graduated Diploma in Midwifery from Adama university Assella health Science College in 2011. And I graduated BSc Degree in Midwifery from Harar Health Science College in 2017. I have been employed and serving at Hiwot Fana Specialized University Hospital until I joined the school of postgraduate studies in Maternity and neonatal nursing in 2021 G.C.

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# TABLE OF CONTENTS

<b>APPROVAL SHEET</b>	<b>i</b>
<b>STATEMENT OF THE AUTHOR</b>	<b>ii</b>
<b>BIOGRAPHICAL SKETCH</b>	<b>iii</b>
<b>ACKNOWLEDGMENTS</b>	<b>iv</b>
<b>TABLE OF CONTENTS</b>	<b>v</b>
<b>LIST OF TABLES</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>ACRONOMS AND ABBRIVATIONS</b>	<b>x</b>
<b>ABSTRACT</b>	<b>xi</b>
<b>1. INTRODACTION</b>	<b>1</b>
1.1. Background	1
1.2. Statement of the problem	3
1.3. Significance of the Study	5
1.4. Objective	6
<b>2. LITERATURE REVIEW</b>	<b>7</b>
2.1. Determinants of Puerperal Sepsis	7
2.1.1 socio-demographic factors	7
2.1.2. Obstetric Related Factors	8
2.1.3. Maternal Medical Disease Related Factors	9
2.1.4. Health Care System Related Factors	10
2.2. Conceptual framework	11
<b>3. METHODS AND MATERIALS</b>	<b>12</b>

3.1. Study Area/Setting and Study Period	12
3.2 Study Design	12
3.3. Population	12
3.3.1. Source population	12
3.3.2. Study Population	12
3.4. Inclusion and Exclusion Criteria	13
3.4.1. Inclusion Criteria	13
3.4.2 Exclusion Criteria	13
3.5. Sample Size Determination	14
3.6. Sampling Procedure and Sampling Technique	15
3.7. Data Collection Methods	17
3.7.1. Data Collection tool	17
3.7.2. Data collectors	17
3.7.3. Procedure of data collection	17
3.8. Study variables	17
3.8.1. Dependent Variable	17
3.8.2 Independent Variables	17
3.9. Operational Definitions	18
3.10. Data Quality Assurance	18
3.11. Data Processing and Analysis	18
3.12. Ethical Consideration	19
3.13. Dissemination of the Results	19
<b>4. RESULTS</b>	<b>20</b>
4.1 Socio-demographic characteristics	20



4.2 Obstetrical Characteristics	21
4.3 Maternal medical health related history	23
4.4 Health care system related factors	24
4.4 Determinants of puerperal sepsis	26
<b>5. DISCUSSION</b>	<b>29</b>
<b>6. STRENGTH AND LIMITATION OF THE STUDY</b>	<b>31</b>
6.1 Strengths	31
6.2 Limitations	31
<b>7 CONCLUSION AND RECOMENDATIONS</b>	<b>32</b>
7.1 Conclusion	32
7.2 Recommendations	32
<b>8. REFERENCE</b>	<b>33</b>
<b>9. ANNEXES</b>	<b>36</b>
9.1 Information Sheet and Voluntary Consent Form for Head of Hospitals	36
9.2 English version checklist	38
9.3 Curriculum vitae (CV)	46

## LIST OF TABLES

Figure 1: Conceptual framework showing determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022.	11
Table 1: Sample size calculation for determinants of puerperal sepsis among postpartum women who were admitted to Harar town public Hospitals, Eastern Ethiopia.	14
Figure 2: Schematic presentation of the sampling procedure and sampling technique for the determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022.	16
Table 2: Socio demographic characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).	20
Table 3: Obstetrics characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).	22
Table 4: Maternal chronic medical health related history characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).	23
Table 5: Health care system related characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).	24
Table 6: Diagnosis, Treatment, and Prognosis of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).	25
Table 7: Multivariable analysis on determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n=423).	27

## **LIST OF FIGURES**

Figure 1: Conceptual framework showing determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022. 11

Figure 2: Schematic presentation of the sampling procedure and sampling technique for the determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022. 16

## ACRONOMS AND ABBRIVATIONS

ANC	Ante Natal Care
AOR	Adjusted Odd Ratios
CI	Confidence Interval
EFMOH	Ethiopian Federal Ministry of Health
GA	Gestational Age
Hgb	Hemoglobin
HIV	Human Immune Deficiency Virus
HFSUH	Hiwot Fana Specialized University Hospital
HMIS	Health Management Information System
IHREC	Institutional Health Research Ethical Committee
JH	Jugol Hospital
PPH	Postpartum Hemorrhage
PROM	Premature Rupture of Membrane
PS	Puerperal Sepsis
SPSS	Statistical Software for Social Sciences
UTI	Urinary Tract Infection
VE	Vaginal Examination
WHO	World Health Organization

## ABSTRACT

**Background:** Puerperal sepsis is a major public health concern as it contributes high number of maternal mortality. It is characterized commonly with fever and other symptoms like pelvic pain, foul smelling vaginal discharge and delayed reduction of the uterine size. As puerperal sepsis is among the top leading causes of maternal morbidity and mortality in Ethiopia, addressing the determinants of puerperal sepsis will have an important contribution to minimize maternal mortality and morbidity. However there is limited information about the determinants of puerperal sepsis in the study area.

**Objective:** This study aimed to identify the determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from June 15 to July 15, 2022

**Method:** A hospital-based retrospective unmatched case-control study design was conducted on 423(106cases and 317 controls) study subjects. The subjects were selected from medical registration numbers by simple random sampling method. The data was extracted by using a structured questioner adapted from different literatures. Data was cleaned manually, coded, and entered into Epi-Data version 3.1 and analyzed by SPSS version 25 statistical software. Bivariable and multivariable logistic regression analyses was employed to identify the determinants of puerperal sepsis. Variables with p-value less than 0.25 in bivariable analysis, was considered for multivariable analysis. Then adjusted odds ratio with a 95% confidence interval was carried out to estimate the direction and strength of the association. Statistical significance was declared at a p-value of less than 0.05.

**RESULTIS:** Determinants of puerperal sepsis were found to be cesarean section delivery [AOR=2.32 95% CI (1.24, 4.33)], rupture of membrane more than 24 hours [AOR=4.34, 95% CI (1.93, 9.76)], duration of labor >24 hours [AOR=2.91, 95% CI (1.11, 7.62)], experiencing more than 4 number of vaginal examinations [AOR=3.02, 95 % CI (1.32, 6.92)], and being referred from other health institutions [AOR=2.48, 95 % CI (1.42, 4.36)].

**Conclusion:** mode of delivery, duration of labor, number of vaginal examination, ruptured of membrane and referral system were determinants of puerperal sepsis. Strengthen aseptic techniques during labor and delivery and organizing effective referral system through collaborating with different stakeholders.

**Keyword:** puerperal sepsis, determinants, Harar Town, Eastern Ethiopia.

# 1. INTRODACTION

## 1.1. Background

Puerperal sepsis is an infection of the genital tract occurring at any time between the rupture of membranes or labor and the 42<sup>nd</sup> day postpartum, in which two or more of the following are present: pelvic pain, fever that is oral temperature 38.5 °C or higher on any occasion, abnormal vaginal discharge example presence of pus, abnormal smell or foul odor of discharge, delay in the rate of reduction of the size of the uterus (less than 2 cm per day during the first 8 days) (WHO, 2020).

Puerperal sepsis mainly occurs after discharge in the first 24 hours of parturition when Streptococci colonize the genital tract or acquired nosocomial invade the endometrium, adjacent structures, lymphatic and blood stream (Gourlay *et al.*, 2001 ;Demisse *et al.*, 2019). It is a largely preventable condition with standard practice of good antenatal care, aseptic delivery practices and proper postpartum care (Pradhan *et al.*, 2015).

The most common known risk factors of puerperal sepsis are, community related factors, Maternal Comorbid Condition and delivery under unhygienic conditions and delivery by an untrained birth attendant significantly increase patient risk. Similarly other risky delivery conditions including prolonged rupture of membranes, prolonged labor, multiple vaginal exams, cesarean delivery, and postpartum hemorrhage(WHO, 2016).

The prevention of puerperal sepsis is very important to reduce the problem, this could be by educating providers on maternal nutrition to maintain healthy pregnancies, giving training for traditional birth attendants (TBAs, to promote healthcare hand washing practices, screening for sexually transmissible infections. and treat them when diagnosed). Preparing of clean delivery kits with bags containing sterile draping and packaged sterile instruments can reduce risks. And in the setting of preterm rupture of membranes, prophylactic antibiotics reduce sepsis by 52–90% (WHO, 2016). Additionally, careful attention to antiseptic procedures during delivery, consumption of adequate nutritive diet/supplements, especially those rich in protein and vitamins during pregnancy, use of therapeutic antibiotics in cases of prolonged rupture of membrane or obstructed/prolonged labor, proper use of partograph, use of prophylactic antibiotics prior to

caesarean section and efficient referral system are effective preventive measures (Shamshad *et al.*, 2010 ;Momoh *et al.*, 2010).

Management of puerperal sepsis involves a multi-disciplinary collaboration. Medical, surgical, and nursing unit collaboration was discovered as an essential means for puerperal sepsis management. Generally, its management implies on making timely diagnosis, treating with appropriate antibiotics, and preventing further complications (Momoh *et al.*, 2010).

## 1.2. Statement of the problem

Globally, about 295,000 women die during pregnancy, childbirth or postpartum period in 2017. From those deaths 86% of them occurred in developing countries, and the majority of them were in sub-saran Africa(200000) and southern Asia(57000)(WHO, 2019). Maternal morbidity and mortality rate in Ethiopia are among the highest in the world. According to WHO report, an estimated 14,000 of maternal deaths occurred in Ethiopia in 2017 (WHO, 2019).

Puerperal sepsis is the major cause of maternal morbidity and mortality. It is one of the five common causes of maternal mortality worldwide (WHO, 2019).Globally,75000 maternal death occurs per year due to puerperal sepsis; among this 11.6% in Asia, 9.7% in Africa, 7.7% in south America, and 7.7 in Caribbean country(Kehoe *et al.*, 2010 ;Van Dillen *et al.*, 2010).

Studies in India, Pakistan, Bangladesh showed puerperal sepsis contributes 6.27, 13-16, and 17-20.3 per 100 live birth maternal mortalities respectively (Taskin *et al.*, 2016 ;Shamshad *et al.*, 2010 ;Pradhan *et al.*, 2015). Whereas studies in Uganda reported that puerperal sepsis is a leading causes of maternal mortality which accounted for 30.9 % of maternal mortality (Ngonzi *et al.*, 2016). On the other hand, puerperal sepsis accounts 15 % of all maternal deaths in Kenya (Chepchirchir *et al.*, 2017).

In Ethiopia, puerperal sepsis is the fourth leading causes of maternal morbidity and mortality next to hemorrhage, obstructed labor and hypertensive disorders with pooled prevalence of 14.81percentage(Melkie and Dagne, 2021 ;Mekonnen and Gebremariam, 2018)

Incidence of puerperal sepsis varies with reports between 2–10 % (Organization, 2016) and varies by risk factors which includes home delivery, cesarean section, parity, prolonged period of delivery after rupture of the amniotic membrane, frequent vaginal examinations, prolonged labor, socioeconomic condition, diabetes mellitus and anemia (Organization, 2016 ;Demisse *et al.*, 2019 ;Kajeguka *et al.*, 2020 ;Admas *et al.*, 2020).

According to multiple research reports anemia and diabetes mellitus were factors significantly associated with Puerperal sepsis. Similarly obstetrics related factors i.e. number of vaginal examination, mode of delivery, and parity were influencing the occurrence of Puerperal sepsis (Atlaw *et al.*, 2019 ;Admas *et al.*, 2020).



Despite modern medicine is becoming advanced and multi anti-microbial agents are produced, puerperal sepsis is public health problem which is contributing to maternal morbidity and mortality worldwide, especially in developing countries which consists of 10-15% of total maternal mortality rate (Chepchirchir *et al.*, 2017 ;Ononuju *et al.*, 2015).The severity of puerperal sepsis, from causing maternal death lead to long-term complications such as chronic pelvic pain, fallopian tube obstruction, and infertility are the most common maternal morbidities (WHO, 2015). Majority of predisposing factors of puerperal sepsis are preventable. Optimal antiseptic measures and careful monitoring are needed throughout the process of labor.

Ethiopia has agreed to implement the sustainable development goals (SDGs) to decrease maternal mortality to < 70/100,000 live births through 2030 G.C. The strategies for reducing maternal morbidity and mortality in relation to sepsis include having every birth attended by a skilled birth attendant, having access to comprehensive emergency obstetric care, using standard infection prevention techniques in the health facility, and having an effective referral system (Melkie and Dagne, 2021).

So, addressing the determinants of puerperal sepsis have an important contribution to minimize maternal mortality and morbidity. Moreover, some variables like preterm birth and induced labor were not included in the studies done in Ethiopia which were found to be determinants of puerperal sepsis in other countries (Acosta *et al.*, 2012). Despite that up to my knowledge, limited studies were done in, Ethiopia. And there is no study done in Harari region therefore, this unmatched case-control study aims to identify the determinants of puerperal sepsis among post-partum women who were admitted to Harar town public hospitals, eastern Ethiopia.

### **1.3. Significance of the Study**

This study provides information about puerperal sepsis on public hospitals at Harar town. The findings of this study will give paramount important for Hiwot Fana Specialized University Hospital and Jugol hospital, stakeholders from government and nongovernmental organizations (NGOs) and policy makers to plan intervention programs. Which are important to know areas of interventions that help to improve maternal health. It also provides reliable evidence for health care providers, to develop preventive and educational programs for the reduction of maternal mortality and morbidity due to puerperal sepsis. In addition, the findings will help policy makers, planners and other concerning organizations working in the area of maternal health to plan various intervention programs based on the identified factors in the institutions. Moreover, it can be used as a baseline and reference for future studies.

#### **1.4. Objective**

To identify the determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia from January 1, 2020 to December 31, 2021, the study was conduct from June 15 to July 15, 2022.

## 2. LITERATURE REVIEW

### 2.1. Determinants of Puerperal Sepsis

Evidence from different literatures showed that maternal age, residence, home delivery, number of antenatal cares follow up, prolonged period of delivery after rupture of the amniotic membrane, frequent per-vaginal examinations and prolonged labor were factors that determine puerperal sepsis (Demisse *et al.*, 2019 ;Ngonzi *et al.*, 2016 ;Taskin *et al.*, 2016).

#### 2.1.1 socio-demographic factors

A case-control study conducted to asses socio-demographic factors and puerperal sepsis from April 2011 to December 2011 at two tertiary level hospitals in Bangladesh showed a significant association between puerperal sepsis and younger maternal age. The study revealed that maternal age less than 25 years had strong association with puerperal sepsis than mothers age greater than 25 (AOR = 5.22; 95% CI: 2.25-12.08; p= <0.001) (Taskin *et al.*, 2016). In addition studies done in Pakistan and Nepal also showed that puerperal sepsis was seen common among young patients of 15–25 and between 20-29 years age respectively (Shamshad *et al.*, 2010 ;Pradhan *et al.*, 2015). A case control study done in West Shoa Zone Oromia Regional State, Ethiopia showed that women who live in rural areas were 2.5 times more likely to develop puerperal sepsis compared to those living in the urban area (AOR [95%CI = 2.5(1.029–6.054) (Demisse *et al.*, 2019).

Educational level of mothers was also associated with the puerperal sepsis. A study done in West Shoa Zone Oromia Regional State, Ethiopia showed that mothers who have no formal education were 6.8 times and those learned up to primary level of education were 6.7 times more likely to develop puerperal sepsis compared to those who joined college and above (Demisse *et al.*, 2019). Similar study done in Pakistan showed that puerperal sepsis was common among uneducated patients 72 (78.20%) (Shamshad *et al.*, 2010).

A ten year review at UsmanuDanfodiyo University Teaching Hospital, Sokoto, Nigeria, showed that majority (97.8%) of the patients were unemployed (Sulaiman *et al.*, 2018). In contrast to this a study done in Bangladesh showed no association between maternal occupation and development of puerperal sepsis (Taskin *et al.*, 2016).

### 2.1.2. Obstetric Related Factors

A cross sectional study was conducted in University of Gondar referral hospital Ethiopia low parity (primiparous and multipara) was significantly associated with puerperal sepsis. In this study mothers having less than five children were 4 times more likely to develop puerperal sepsis when compared to those having more than or equal to five children (grand multipara) (AOR [95%CI]= 3.92 (1.10-13.92) (Atlaw *et al.*, 2019).

In contrary to this a cross sectional study was conducted in Bahirdar north west Ethiopia Women that had multiparous parity were four times more likely to develop puerperal sepsis compared to primiparous women (AOR [95%CI] = 4.045 (1.479-11.061) (Admas *et al.*, 2020). Similar finding was reported from Pakistan that high prevalence of puerperal sepsis was observed among women of multiparous parity (Khaskheli *et al.*, 2013a). So from the above studies we can understand that the level of parity in relation to puerperal sepsis is varies in different studies.

A cross sectional study conducted in Gondar shows that those who gave birth by cesarean section was 2% times less likely to develop puerperal sepsis when compared to those who gave birth through spontaneous vaginal delivery (AOR [95%CI] 0.98(0.18-0.82) (Atlaw *et al.*, 2019).

However, some studies were inconsistent with this study. A case control study conducted in West Shoa Zone Oromia Regional State mothers who delivered by caesarean section were 3.9 times more likely to develop puerperal sepsis when compared to those delivered by spontaneous vaginal delivery (AOR [95%CI] = 3.85 ([1.425–10.413]) (Demisse *et al.*, 2019). A study done in West Shoa Zone Oromia Regional State, Ethiopia showed that mothers who were in labor for greater than or equal to 25 hours were 4.7 times more likely to develop puerperal sepsis compared with those greater than 12 hours duration on labor (Demisse *et al.*, 2019). Studies done in Pakistan and Nigeria also showed that puerperal sepsis was reported 58.60% and 17.6 % of mother who had prolonged labor respectively (Shamshad *et al.*, 2010 ;Ononuju *et al.*, 2015).

Study done in Oromia, Ethiopia showed that participants whose amniotic membrane ruptured 24 hours before delivery were 3.7 times more likely to develop puerperal sepsis compared to those less than 24 hours duration (AOR [95%CI] = 3.73 ([1.37–10.2]) (Demisse *et al.*, 2019). Another study done in Pakistan showed that 68 (73.8%) Participants with prolonged rupture of membranes from 48–72 hours were developed puerperal sepsis (Shamshad *et al.*, 2010). Similar study in Patan

Hospital, Lalitpur also showed that from 122 cases of puerperal pyrexia majority of these women (58.2%) had rupture of membrane at the time of labor (Pradhan *et al.*, 2015). A number of ANC follow up is significantly associated with puerperal sepsis. Those mothers who had ANC follow up one to two times be 4.2times more likely to develop puerperal sepsis when compared to those who had three to four times (Demisse *et al.*, 2019).

Place of delivery is also significant determinant of puerperal sepsis. A study done at University of Maiduguri Teaching Hospital, Maiduguri, North-eastern Nigeria shows that mothers who gave birth at home were 56.6 more likely to develop puerperal sepsis than mothers who gave birth in health institution (Ononuju *et al.*, 2015). And study done in Pakistan showed that 68 (73.9%) participants who developed puerperal sepsis were gave birth at home (Shamshad *et al.*, 2010).and similar study done in Bahirdar north west Ethiopic place of delivery had significant association with puerperal sepsis (Admas *et al.*, 2020).

Studies indicates that frequent vaginal examination as significant determinant of puerperal. A Case-control study done in Oromia, Ethiopia showed that mothers who undergo five or more vaginal examination during delivery were 4 times more likely to develop puerperal sepsis (AOR [95%CI] = 4.00([1.330–12.029]) (Demisse *et al.*, 2019). Similarly, A study in Nigeria also showed that mothers who undergo five or more vaginal examination during delivery were 5 times more likely to develop puerperal sepsis 17.3% (Ononuju *et al.*, 2015).

Study conducted by Acosta *et al* had identified that induced of labor had statistical association with puerperal sepsis. It showed that women with induced labor were 3.92 times more likely to develop severe puerperal sepsis than women whose labor were spontaneous in its onset( AOR [95%CI] = 3.92([1.02–15.35]) (Acosta *et al.*, 2012). Other obstetrical factors like women who had preterm birth were 2.5 times more likely to develop puerperal sepsis than term labor (AOR [95%CI] = 2.46([1.11–5.47]) (Acosta *et al.*, 2012).

### **2.1.3. Maternal Medical Disease Related Factors**

Studies which were conducted in different part of the world indicate puerperal sepsis is common among anemic mothers. A Scottish population based study showed that mothers who were anemic had 3.44 times more likely to develop puerperal sepsis (AOR [95%CI ] 3.44(1.93-6.13)(Acosta *et*

*al.*, 2012). In addition a study at the Hospital in Nigeria showed that anemia were found in 69.2% of cases of puerperal sepsis (Ononuju *et al.*, 2015).

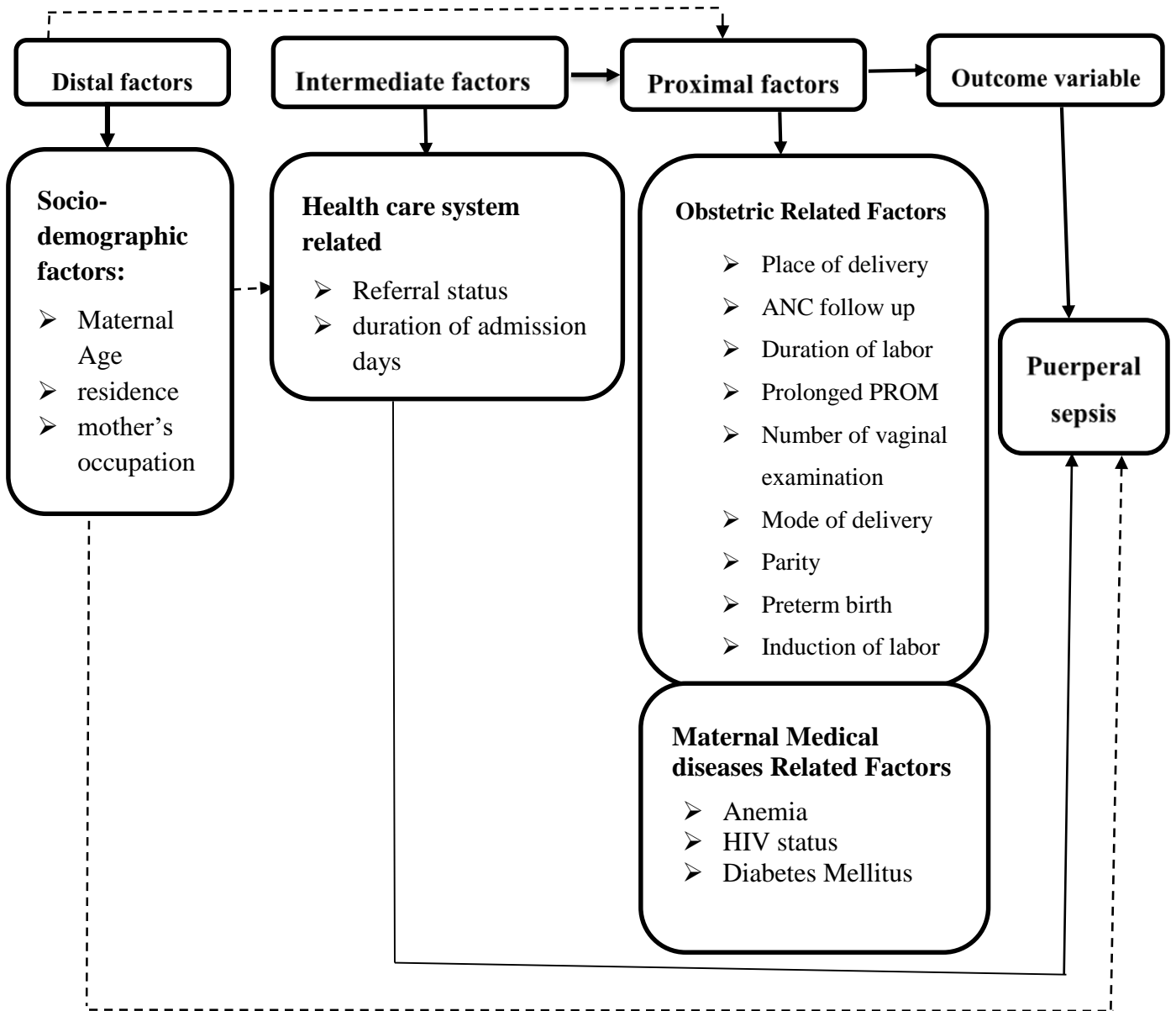
A study conducted in Obstetrics and Gynecology Unit of Ayub Teaching Hospital, Abbottabad, Pakistan over a period of three years from 1<sup>st</sup> Jan 2005 to 31<sup>st</sup> Dec 2007, showed that from 122 women with puerperal sepsis 47.5%, 20.5% and 8.2% had a history of urinary tract infection, wound infection and retained product of conception respectively (Pradhan *et al.*, 2015).

A study done in Nigeria also showed that anemia, positive human immunodeficiency status, retained placenta and diabetes mellitus were risk factors associated with puerperal sepsis (Ononuju *et al.*, 2015). And A study conducted in Bahirdar north west Ethiopia showed that mothers who were diabetes mellitus had 3.47 times more likely to develop puerperal sepsis (AOR [95%CI] 3.47(0.7733-16.433) (Admas *et al.*, 2020).

#### **2.1.4. Health Care System Related Factors**

Maternal referral status was found to be a determinant of puerperal sepsis. Mothers who were referred from other health institutions were 2.5.times more likely to develop puerperal sepsis (AOR [95%CI] = 2.5([1.09–5.9]) (Demisse *et al.*, 2019). This result was supported by a study done in Jamshoro/Hyderabad, Sindh Pakistan which showed that from 129 (3.89%) women who had puerperal sepsis, 95(73.64%) were referred cases (Khaskheli *et al.*, 2013a).

## 2.2. Conceptual framework



**Figure 1:** Conceptual framework showing determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022.

**Source:** Developed from different literatures (Taskin *et al.*, 2016 ;Acosta *et al.*, 2012 ;Admas *et al.*, 2020 ;Demisse *et al.*, 2019 ;Atlaw *et al.*, 2019)



## **3. METHODS AND MATERIALS**

### **3.1. Study Area/Setting and Study Period**

The study was conducted in Public Hospitals at Harari Regional State, Eastern Ethiopia.

Harar is the capital city of Harari Regional State, which is located 526 km away from capital city of Ethiopia, Addis Ababa. The town has six hospitals (two public hospitals, one federal police hospital, one military hospital and two private hospitals), eight health centers, 27 health posts, and Family Guidance Association of Ethiopia model clinic. The two public hospitals in Harar, namely Hiwot Fana Specialized University Hospital (HFSUH) and Jugol General Hospital (JGH), provides multidimensional aspect of care to patients who need highly qualified/specialized health care services and each hospitals deliver the service to more than 5 million population in the catchment area. HFSUH has a total of about 201 beds and 12 case teams. It is affiliated with College of Health and Medical Sciences of Haramaya University. JGH of the Harari Regional State has 95 beds and 10 case teams. Both hospitals have medical, surgical, gynecology and pediatrics wards. This study was conducted in Hiwot Fana Specialized Hospital (HFSH) and Jugol Hospital (JH) from June 15, to July15, 2022.

### **3.2 Study Design**

Facility based retrospective unmatched case-control study was employed

### **3.3. Population**

#### **3.3.1. Source population**

Postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia

#### **3.3.2. Study Population**

**Cases:** Postpartum women who have puerperal sepsis and who were admitted to postnatal or gynecology wards within 42 days of delivery at Public Hospitals in Harar town, eastern Ethiopia from January 1, 2020 to December 31, 2021.

**Controls:** Postpartum women who have no puerperal sepsis and who were admitted to postnatal or gynecology wards within 42 days of delivery at Public Hospitals in Harar town, eastern Ethiopia from January 1, 2020 to December 31, 2021.

### **3.4. Inclusion and Exclusion Criteria**

#### **3.4.1. Inclusion Criteria**

**Inclusion cases (Puerperal Sepsis):** All Medical records of postpartum women who were admitted to the postnatal or gynecology ward in Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021. And fulfilled the WHO diagnostic criteria of puerperal sepsis were included.

**Inclusion of controls:** All Medical records of postpartum women who were admitted to the postnatal or gynecology ward in Harar town public hospitals, Eastern Ethiopia from January 1, 2020 to December 31, 2021 and had no puerperal sepsis diagnosis were included.

#### **3.4.2 Exclusion Criteria**

Postpartum women whose medical records missed important variables were excluded.

### 3.5. Sample Size Determination

A double population proportion formula was used to determine the sample size for the determinants of puerperal sepsis. The sample size is calculated based on the determinants obtained from different studies by using Epi info 7 software Stat Cal with the following assumptions: 95% confidence level, Power 80% and the ratio of cases to controls is equivalent to 1:3 and consideration of 10% non-response rate (Table 1).

**Table 1:** Sample size calculation for determinants of puerperal sepsis among postpartum women who were admitted to Harar town public Hospitals, Eastern Ethiopia.

Factor	% of controls with exposed	% of cases with exposure	cases	controls	Sample size	Final sample size with 10% non-response rate	CI	Reference
Rural Residence	28.6	70.1	17	51	68	75	95%	(Demisse <i>et al.</i> , 2019)
vaginal exam $\geq$ 5x	16.4	35.8	57	170	227	250	95%	
HIV positive sero status	34.5	15.6	58	174	232	255	95%	(Ngonzi <i>et al.</i> , 2016)
Cesarean section delivery	20.7	35.8	98	292	390	429	95%	(Demisse <i>et al.</i> , 2019)

Therefore, the largest sample size is found to be 390 and by adding 10% of non-response rate, the final sample size was 429 (107case and 321control).

### 3.6. Sampling Procedure and Sampling Technique

According to the Hiwot Fana specialized university hospital and Jugol hospital two years Health Management Information System (HMIS) reports, (from January 1, 2020 to December 31, 2021) the estimated number of postpartum women was 9087 and 4298 respectively. Out of them 92 and 54 were puerperal sepsis in HFSUH and JH respectively. All selected unique medical registration numbers (MRN) of postpartum women from January 1, 2020 to December 31, 2021 were recorded. The MRN was identified from the admission registration logbook. Then, the study subjects/cases and controls were identified from MRN and they were taken by simple random sampling technique from each selected hospital. The sample size was proportionally allocated for both hospitals by using the following formula:

$n = \frac{nf \times ni}{N}$  Where:

N

nf = sample size

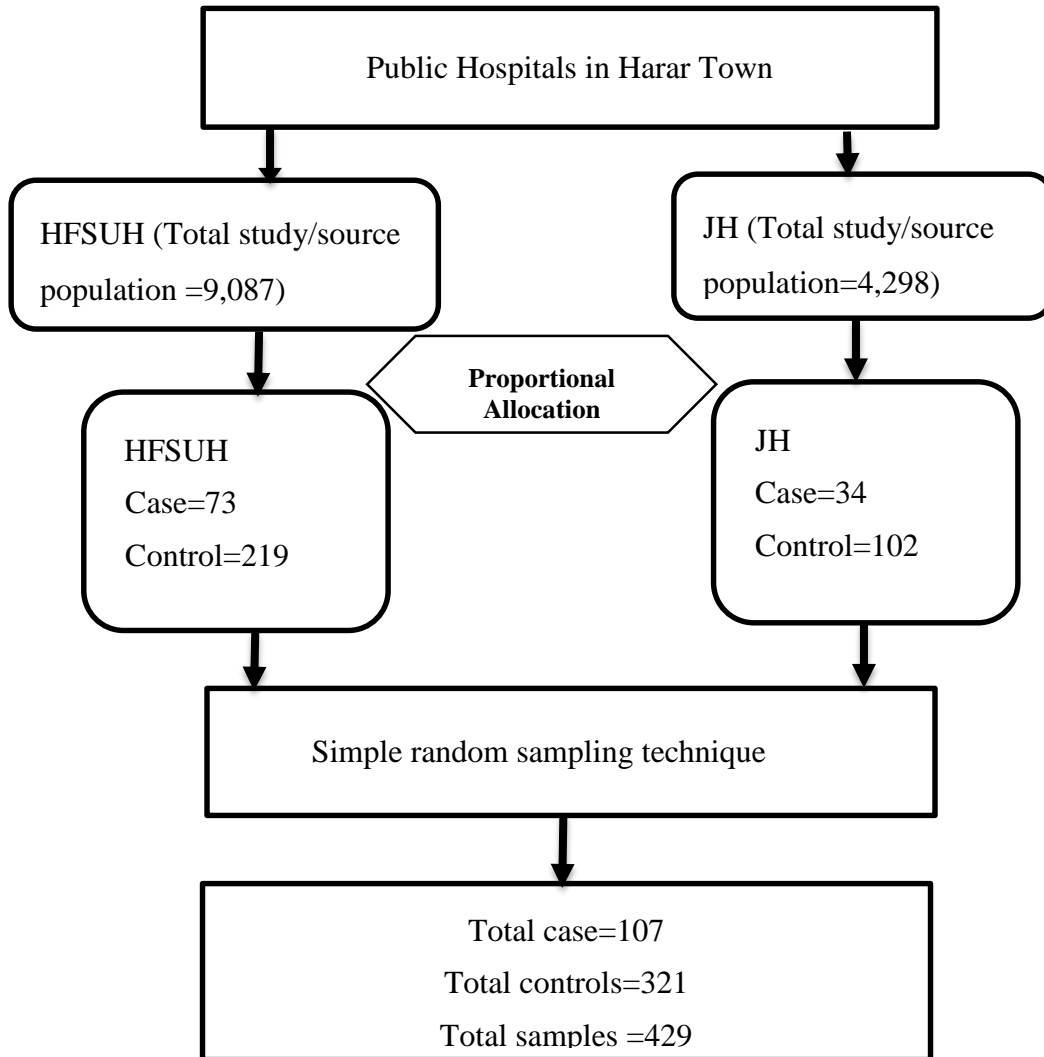
ni = number of postpartum women in two year in each hospital

N = Total number of postpartum in women two year in both hospital (HFSUH+JH)

$n_{Hca} (HFSUH) = \frac{107 \times 9087}{13385} = 73$  cases,  $n_{Hco} (HFSUH) = 219$  controls

$n_{JHca} (JH) = \frac{107 \times 4298}{13385} = 34$  cases,  $n_{JHco} = 102$  controls

Proportional allocation to sample size was used for each hospital as seen below in the diagram



**Figure 2:** Schematic presentation of the sampling procedure and sampling technique for the determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, Eastern Ethiopia, 2022.

## **3.7. Data Collection Methods**

### **3.7.1. Data Collection tool**

The data were extracted using pretested and structured checklist. The checklist was adapted from different previous literatures, (Atlaw *et al.*, 2019 ;Admas *et al.*, 2020 ;Demisse *et al.*, 2019 ;Taskin *et al.*, 2016). It contains socio-demographic factors, obstetric related factors, maternal medical disease related and health care system related factors.

### **3.7.2. Data collectors**

Twelve BSc midwives were recruited from Harar town for data collection. Two BSc and two MSc midwives were also recruited for supervision of data collectors and the supervisors checked the collected data daily for completeness. The supervisors and data collectors were trained on the aim and relevance of the study. In addition, clearly stated diagnostic criteria of puerperal sepsis was explained to the data collectors to decrease interpersonal variations.

### **3.7.3. Procedure of data collection**

The actual data extraction was take place in Hiwot Fana Specialized University Hospital and Jugol Hospital. Records was retrieved using medical record numbers found from the postnatal or gynecology ward log Books. Then patient's card was collected from the archive room of the hospital. All maternal records found from logbooks and cards was reviewed to obtain any information pertinent to the postpartum mother; including maternal medical conditions, maternal obstetrics condition and reports and other cases, which need a diagnosis for confirmation.

## **3.8. Study variables**

### **3.8.1. Dependent Variable**

Puerperal sepsis

### **3.8.2 Independent Variables**

**Socio-demographic characteristics:** Age, residence, mother's occupation.

**Obstetrical related factors:** Place of delivery, ANC follow up, APH, PIH, onset of labor, PPH, Anemia, duration of labor, obstructed lobar, prolonged PROM, preterm birth, induced labor, number of vaginal examinations, mode of delivery, fetal outcome parity.

**Maternal medical disease related factors:** hypertension, anemia, Diabetes mellitus, HIV, UTI.

**Health care system related factors:** Referral status and duration of admission days.

### **3.9. Operational Definitions**

**Puerperal sepsis** is defined as infection of the genital tract occurring at any time between the rupture of membranes or initiation of labor and 42 day postpartum in which 2 or more of the following were present: pelvic pains, fever (that is oral temperature 38,5°C or higher on any occasion, abnormal vaginal discharge (example presence of pus), abnormal smell or foul odor of discharge, delay in the rate of reduction of the size of the uterus (less than 2 cm per day during the first 8 days) (WHO, 2020). For this study we collected the Puerperal sepsis diagnosed by physicians from medical record.

**Anemia:** a condition where the hemoglobin level in the body of pregnant mother is less than 11g/dl which depicts decreased oxygen carrying capacity of the body (Lebso *et al.*, 2017). For this study we collected the maternal Anemia diagnosed by physicians from medical record.

**Prolonged PROM:** rupture of amniotic membrane for greater than 18 hours (Simhan and Canavan, 2005). For this study we collected the Prolonged PROM diagnosed by physicians from medical record.

### **3.10. Data Quality Assurance**

Before the actual data collection, One-day training was given to data collectors and supervisors. The questionnaire and data abstraction checklist were pretested on 5% of the sample size in Dil Chora referral hospital. Every questionnaire was checked for an error after data has been collected. Correction and modifications were made to the tool based on the result of the pretest. Collected data was checked for accuracy and completeness daily.

### **3.11. Data Processing and Analysis**

Data were manually checked, coded, and entered into Epi-data 3.1 and analyzed using SPSS 25. Any errors identified at this time were corrected after referring to the original data using the coded data. Descriptive statistic variables were done by cross-tabulation. Based on the nature of variables, frequency distribution and summary statistics were computed for case and control

groups. Bivariable and multivariable logistic regression analyses were performed. A variable with a p-value less than 0.25 in the bivariable analysis was recruited for multivariable logistic regression analysis. The assumptions for logistic regression such as; multicollinearity were checked by using variance inflation factor (VIF). Hosmer-Lemeshow's test was used to check model fitness. An adjusted odds ratio (AOR) along with a 95% confidence interval at a p-value less than 0.05 was used to identify determinants of puerperal sepsis.

### **3.12. Ethical Consideration**

The study was approved by Haramaya University (HU), College of Medicine and Health sciences Institutional Health Research Ethics Review Committee (IHRERC). An official supportive letter was obtained from Haramaya University to Hiwot Fana Specialized university Hospital and Jugol Hospital. An informed, voluntary, written and signed consent was obtained from each head of the health facility after clearly informing them about the purpose, procedure risk and benefit of the study.

### **3.13. Dissemination of the Results**

First, the finding of this study will be presented to Haramaya University Collage of Health medical Science School of Nursing and Midwifery Department. Then the finding will be shared/submitted to Haramaya, university, Harar health bureaus and the concerned hospitals. Besides, attempts will be made to present the study on scientific conferences and published it on scientific journals.



## 4. RESULTS

### 4.1 Socio-demographic characteristics

Out of 429 post-partum women, 6 of them were referred to other health facilities therefore the final analysis was done on 423 women`s data (106 cases and 317 controls) making the response rate 98.6%.

The age of women ranged from 16 to 44 with the mean age of 25 (SD±6) for cases and controls 26 (SD ±5) years, respectively. 64 (60.4%) of cases lived in the rural areas whereas 185(58.4%) of controls were from urban areas. Regarding maternal occupation, 76 (71.7%) of cases and 211 (66.6%) of controls were housewife (Table 2).

**Table 2:** Socio demographic characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).

Variable	Cases (%)	Controls (%)	Total (%)
<b>Age of mother</b>			
<=24	47 (44.3%)	159 (50.2%)	206(48.7%)
25-34	48 (45.3%)	117 (36.9%)	165 (39.0%)
>=35	11 (10.4%)	41 (12.9%)	52 (12.3%)
<b>Residence</b>			
Urban	42 (39.6%)	185 (58.4%)	227 (53.7%)
Rural	64(60.4%)	132(41.6%)	196(46.3%)
<b>Maternal occupation</b>			
Government employee	4(3.8%)	37(11.7%)	41(9.7%)
Farmer	12(11.3%)	36(11.4%)	48(11.3%)
Merchant	11(10.4%)	29(9.1%)	40(9.5%)
Housewife	76(71.7%)	211(66.6%)	287(67.8%)
Other	3(2.8%)	4(1.3%)	7(1.7%)

Other; students

## 4.2 Obstetrical Characteristics

From the total 39 (36.8%) of the cases and 110 (34.7%) of the controls were primiparous. And 69 (65.1%) of cases, 241 (76%) of controls had ANC follow up. From those 7(10.1%) of cases, 3 (1.2%) of controls had one visit, 26 (37.7%) of cases, 35(14.5%) of controls had two visits, 24 (34.8%) of cases and 60 (24.9%) of controls had three visits, 12 (17.4%) of cases and 143 (59.3%) of controls had four and above ANC visits. Obstetric complications happened during the current pregnancy. These were, APH 6.6% of cases and 7.6% of controls. Preterm birth 7.5% of the cases and 2.5% of the controls. PIH 9.4 % of the cases and 3.8% of the controls. A total of 91 (85.8%) cases and 313 (98.7%) controls gave birth at health institution. A total of 85.8 of cases and 91.5% of controls had spontaneous onset of labor. The placenta of 69.8% of cases and 95% of controls were delivered by control cord tractions (Table 3).

**Table 3:** Obstetrics characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).

<b>variable</b>	<b>Cases (%)</b>	<b>Controls (%)</b>	<b>Total (%)</b>
<b>Parity</b>			
Primiparous	39 (36.8%)	110 (34.7%)	149 (35.2%)
Multiparous	38 (35.8%)	166 (52.4%)	204 (48.2%)
Grand multiparas	29 (27.4%)	41 (12.9%)	70 (16.5%)
<b>ANC</b>			
Yes	69(65.1%)	241(76%)	310 (73.3%)
No	37(34.9%)	76(24%)	113 (26.7%)
<b>APH</b>			
Yes	7(6.6%)	24(7.6%)	31(7.3%)
NO	99(93.4%)	293(92.4%)	392(92.7%)
<b>PIH</b>			
Yes	10(9.4%)	12(3.8%)	22(5.2%)
No	96(90.6%)	305(96.2%)	401(94.8%)
<b>GDM</b>			
Yes	1(0.9%)	4(1.3%)	5(1.2%)
No	105(99.1%)	313(98.7%)	418(98.8%)
<b>Type of pregnancy</b>			
Single	103 (97.2%)	305 (96.2%)	408 (96.5%)
Multiple	3 (2.8%)	12 (3.8%)	15 (3.5%)
<b>Preterm labor</b>			
Yes	8(7.5%)	8(2.5%)	16(3.8%)
No	98(92.5%)	309(97.5%)	407(96.2%)
<b>Obstructed Labor</b>			
Yes	7 (6.6%)	6 (1.9%)	13 (3.1%)
NO	99 (93.4%)	311 (98.1%)	410 (96.9%)
<b>Place of delivery</b>			
At Home	15 (14.2%)	4 (1.3%)	19 (4.5%)
At health institution	91 (85.8%)	313 (98.7%)	404 (95.5%)
<b>Onset of labor</b>			
Spontaneous	91(85.8%)	290(91.5%)	381(90.1%)
Induced	11(10.4%)	17(5.4%)	28(6.6%)
Elective C/s	4(3.8%)	10(3.2%)	14(3.3%)
<b>Duration of labor</b>			
<12hrs	47 (44.3%)	216 (68.1%)	263 (62.2%)
12-24hrs	35 (33%)	83 (26.2%)	118 (27.9%)
>24hrs	24 (22.6%)	18 (5.7%)	42 (9.9%)
<b>Duration of PROM</b>			
<=24hrs	88 (83%)	294 (92.7%)	382 (90.3%)
>=25hrs	18 (17%)	23 (7.3%)	41 (9.7%)
<b>PV frequency</b>			
<=4	75(70.8%)	297(93.7%)	372(87.9%)
>4	31 (29.2%)	20(6.3%)	51 (12.1%)
<b>Mode of delivery</b>			
SVD	45 (42.5%)	212 (66.9%)	257 (60.8%)
C/S	45 (42.5%)	70 (22.1%)	115 (27.2%)
Instrument delivery	16 (15.1%)	35 (11%)	51 (12.1%)
<b>Mode of placenta delivery</b>			
spontaneous	15 (14.2%)	4 (1.3%)	19 (4.5%)
Control cord traction	74 (69.8%)	301 (95%)	375 (88.7%)
Manual removal	17 (16%)	12 (3.8%)	29 (6.9%)
<b>Has episiotomy</b>			

Yes	33 (31.1%)	71 (22.4%)	104 (24.6%)
No	73 (68.9%)	246 (77.6%)	319 (75.4%)
<b>Has perinatal tear</b>			
Yes	12 (11.3%)	20 (6.3%)	32(7.6%)
No	94 (88.7%)	297(93.7%)	391 (92.4%)
<b>PPH</b>			
Yes	13 (12.3%)	16(5%)	29 (6.9%)
No	93 (87.7%)	301(95%)	394 (93.1%)
<b>Anemia during in L&amp;D</b>			
Yes	34(32.1%)	41 (12.9%)	75(17.7%)
No	72(67.9%)	276(87.1%)	348 (82.3%)
<b>Fetal out come</b>			
live birth	91 (85.8%)	293(92.4%)	384 (90.8%)
still birth	6 (5.7%)	9 (2.8%)	15 (3.5%)
IUFD	9 (8.5%)	15 (4.7%)	24 (5.7%)

(PV; vaginal examination; L and D, lobar and delivery; SVD, spontaneous vaginal delivery; C/S, cesarean section delivery; IUFD, intrauterine fetal death)

### 4.3 Maternal medical health related history

From the total subjects, 12 (11.3%) of cases and 19(6%) of controls had history of medical health problems, with chronic hypertensive 3(2.8%) of cases, 3 (0.9%) of controls, Anemia 7(6.6%) of cases, 11(3.5%) of controls, Diabetes mellitus 1 (0.9%) of cases, 2 (0.6%) of controls (Table 4)

**Table 4:** Maternal chronic medical health related history characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).

Variable	Cases (%)	Controls (%)	Total (%)
<b>Medical Hx</b>			
Yes	12(11.3%)	19(6%)	31(7.3%)
No	94(88.7%)	298(94%)	392(92.7%)
<b>Chronic hypertensive</b>			
Yes	3(2.8%)	3(0.9%)	6(1.4%)
No	103(97.2%)	314(99.1%)	417(98.6%)
<b>Anemia</b>			
Yes	7(6.6%)	11(3.5%)	18(4.3%)
No	99(93.4%)	306(96.5%)	405(95.7%)
<b>Diabetes mellitus</b>			
Yes	1(0.9%)	2(0.6%)	3(0.7%)
No	105(99.1%)	315(99.4%)	420(99.3%)
<b>HIV</b>			
Yes	1(0.9%)	3(0.9%)	4(0.9%)
No	105(99.1%)	314(99.1%)	419(99.1%)

#### 4.4 Health care system related factors

Of the overall subjects, 61 (57.5%) of cases, 76 (24%) of controls were referred from other health institutions. From those majority were from health centers 48 (78.8%) of cases and 53 (69.7%) of controls (Table 5).

**Table 5:** Health care system related characteristics among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).

<b>variable</b>	<b>Cases (%)</b>	<b>Controls (%)</b>	<b>Total (%)</b>
Referred			
Yes	61 (57.5%)	76 (24%)	137 (32.4%)
No	45 (42.5%)	241 (76%)	286 (67.6%)
If yes from which facility			
Hospital	11 (18%)	12 (15.8%)	23(16.8%)
Health center	48 (78.7%)	53 (69.7%)	101 (73.7%)
Private health facility	2 (3.3%)	11(14.5%)	13 (9.5%)
duration of admission			
<=3	84 (79.2%)	275 (86.8%)	359 (84.9%)
>3	22 (20.8%)	42 (13.2%)	64 (15.1%)

**Table 6:** Diagnosis, Treatment, and Prognosis of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n= 423).

Variable	Category	Cases (%)
<b>Diagnosis</b>		
Fever	yes	103 (97.2%)
	No	3 (2.8%)
Chills and general malaise	Yes	31 (29.2%)
	NO	75 (70.8%)
Lower abdominal pain	Yes	66 (62.3%)
	No	40 (37.7%)
Tender uterus	Yes	3 (2.8%)
	No	103 (97.2%)
Sub involution of uterus	Yes	9 (8.5%)
	No	97 (91.5%)
Purulent, foul-smelling lochia	Yes	94 (88.7%)
	No	12 (11.3%)
<b>Intervention done to manage puerperal sepsis</b>		
Intravenous fluids	Yes	89 (84%)
	No	17 (16%)
Oxygen	Yes	5 (4.7%)
	No	101 (95.3)
<b>Medication used for treatment</b>		
Antibiotics	Yes	106 (100%)
	No	0
Blood transfused	Yes	10 (9.4%)
	No	96 (90.6%)
Feso4	Yes	10 (9.4%)
	No	96 (90.6%)
<b>Treatment outcome</b>	Improved without Complication	93 (87.7%)
	Improved with Complication	13 (12.3%)
	Died	0

#### **4.4 Determinants of puerperal sepsis**

Variables that had a p-value<0.25 on bi-variable analysis were residence, parity, antenatal care visit (ANC), pregnancy-induced hypertension (PIH), preterm Labor, obstructed Labor, mode of delivery, postpartum hemorrhage(PPH), duration of labor, duration of ruptured of membrane (PROM), number of vaginal examination during delivery(PV), anemia during labor and delivery, referred from other health institution. After checking for multi collinearity, in the multivariable logistic regression, only mode of delivery, duration of labor, no of vaginal examination during delivery (PV), duration of ruptured of membrane (PROM) and referral system were statistically significant with puerperal sepsis.

The odds of puerperal sepsis were 2.3 [AOR=2.32 95% CI (1.24, 4.33)] times higher among women who gave birth through C/S than those who gave birth by SVD. Furthermore, the odds of puerperal sepsis among women who had ruptured membrane for more than 24 hours were 4.3[AOR=4.34, 95% CI (1.93, 9.76)] times higher than their counterparts. Moreover, the odds of having puerperal sepsis among women who had duration of labor >24 hours were 3 [AOR=2.91, 95% CI (1.11, 7.62)] times higher when compared to those who had duration of labor <12 hours. . Furthermore, women who had more than 4 number of vaginal examinations during labor were 3 [AOR=3.02, 95 % CI (1.32, 6.92)] times more likely to have puerperal sepsis than those with 4 or less number of vaginal examinations. In addition, women who had referred from other health institutions were 2.5 [AOR=2.48, 95 % CI (1.42, 4.36)] times more likely to have puerperal sepsis compared to non-referred women.

**Table 7:** Multivariable analysis on determinants of puerperal sepsis among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia from January 1, 2020 to December 31, 2021, 2022 (n=423).

Variables	Study subjects		COR (95% CI)	AOR(95%CI)
	Cases %	Controls %		
<b>Address</b>				
Urban	42 (39.6 %)	185 (58.4 %)	1	1
Rural	64 (60.4 %)	132 (41.6 %)	2.14 (1.36 , 3.34 )	1.40 (0.80, 2.46)
<b>Parity</b>				
Primiparous	39 (36.8%)	110 (34.7%)	1	1
Multiparous	38 (35.8%)	166 (52.4%)	0.65 (0.39, 1.07)	0.89 (0.47, 1.68)
Grand multiparas	29 (27.4%)	41 (58.6%)	1.99 (1.09, 3.63)	2.05 (0.96, 4.37)
<b>ANC visit</b>				
Yes	69 (65.1%)	241 (76%)	1	1
No	37 (34.9%)	76 (24%)	1.70 (1.06, 2.73)	1.59 (0.88, 2.89)
<b>PIH</b>				
Yes	10 (9.4%)	12 (3.8%)	2.65 (1.11, 6.32)	2.78 (0.94, 8.20)
No	96 (90.6%)	305 (96.2%)	1	1
<b>Preterm labor</b>				
Yes	8 (7.5%)	8 (2.5%)	3.15 (1.15, 8.62)	2.97 (0.89, 9.81)
No	98 (92.5%)	309 (97.5%)	1	1
<b>Obstructed labor</b>				
Yes	7 (6.6%)	6 (1.9%)	3.66 (1.20, 11.16)	1.43 (0.39, 5.25)
No	99 (93.4%)	311 (98.1%)	1	1
<b>Mode of delivery</b>				
SVD	45 (42.5%)	212 (66.9%)	1	1
C/S	45 (42.5%)	70 (22.1%)	3.03(1.85, 4.96)	<b>2.32 (1.24, 4.33)***</b>
Instrument delivery	16 (15.1%)	35 (11%)	2.15 (1.09, 4.22)	1.90 (0.84, 4.29)
<b>PPH</b>				
Yes	13 (12.3%)	16 (5%)	2.63 (1.22, 5.67)	1.67 (0.64, 4.37)
No	93 (87.7%)	301 (95%)	1	1
<b>Duration of labor</b>				
<12hrs	47(44.3%)	216(68.1%)	1	1
12-24hrs	35(33%)	83(26.2%)	1.94 (1.17, 3.21)	1.44 (0.77, 2.72)
>24hrs	24(22.6%)	18(5.7%)	6.13 (3.08, 12.19)	<b>2.91(1.11, 7.62)***</b>
<b>Duration of rupture of the membrane</b>				
<=24	88 (83%)	294 (92.7%)	1	1
>=25	18 (17%)	23 (7.3%)	2.61 (1.35, 5.06)	<b>4.34 (1.93, 9.76)***</b>
<b>PV frequency</b>				
<=4	75(70.8%)	297(93.7%)	1	1
>4	31(29.2%)	20(6.3%)	6.14 (3.31, 11.37)	<b>3.02 (1.32, 6.93)***</b>
<b>Anemia diagnosed in L&amp;D</b>				
Yes	34 (32.1%)	41 (12.9%)	3.18 (1.88, 5.36)	1.42(0.74, 2.72)
No	72 (67.9%)	276 (87.1%)	1	1
<b>Referred</b>				



Yes	61 (57.5%)	76 (24%)	4.29 (2.70 ,6.83)	<b>2.48 (1.42, 4.36)***</b>
No	45 (42.5%)	241 (76%)	1	1

Significant at \*\*\*p<0.05 (PV frequency; Number of vaginal examinations during labor and delivery; PPH, Postpartum hemorrhage; PIH, pregnancy-induced hypertension; L and D, lobar and delivery; SVD, Spontaneous vaginal delivery; C/S, Cesarean section delivery; COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval).

## 5. DISCUSSION

This study was conducted to identify the determinants of puerperal sepsis in Harar town public hospitals, eastern Ethiopia, in order to reduce puerperal sepsis complications and deaths. The study showed that mode of delivery, duration of labor, duration of ruptured of membrane, number of vaginal examination during delivery, referred from other health institution were determinants of puerperal sepsis

Women who gave birth through cesarean section were more likely to have a puerperal sepsis than those delivered by spontaneous vaginal delivery. This is consistent with the study done in West Shoa Zone Oromia Ethiopia (Demisse *et al.*, 2019). The possible justification is more tissue trauma and manipulation will occurs in cesarean section/laparotomy than in spontaneous vaginal delivery (Pradhan *et al.*, 2015).

In addition, this study indicated women who had duration of labor greater than 24 hours were more likely to have a puerperal sepsis than those with less than <12hrs duration of labor. This was consistent with studies done in Pakistan, Nigeria, West Shoa Zone Oromia Ethiopia (Shamshad *et al.*, 2010 ;Ononuju *et al.*, 2015 ;Demisse *et al.*, 2019). This is because a prolonged labor attracts several vaginal examinations and this directly leads to prolonged state of an open cervix, often with ruptured membranes impairing natural mechanical barrier and allows infections to ascend from the vagina (Pradhan *et al.*, 2015). On the other hand, it could be because prolonged labor results in adverse maternal outcomes such as postpartum hemorrhage which increases the risk of puerperal sepsis as its management results in frequent uterine manipulation (Song *et al.*, 2020).

On the other hand, the finding from the current study showed women who had premature rupture of the membrane for greater than 24 hours were more likely to have a puerperal sepsis. This was in line with studies conducted in Pakistan (Shamshad *et al.*, 2010) and Kenya, West Shoa Zone Oromia Ethiopia (Chepchirchir *et al.*, 2017 ;Demisse *et al.*, 2019). This is because a prolonged ruptured membrane impairs natural barriers and allows ascending of infection from the vagina (Ononuju *et al.*, 2015). On the other hand, this could be due to delayed use of prophylactic antibiotics (Boushra and Rahman, 2020). Additionally, prolonged premature rupture of membrane leads to induction of labor which is another factor that increases the risk of puerperal sepsis (Acosta *et al.*, 2012).

Furthermore, women who had more than 4 number of vaginal examinations during labor were more likely to have a puerperal sepsis. This was consistent with studies done in Egypt, West Shoa Zone Oromia Ethiopia (El-Mahally *et al.*, 2004 ;Demisse *et al.*, 2019). This is because frequent vaginal examination and manipulation of genital tracts will facilitate ascension of microorganisms from lower genital tract and thereby increase in probability to develop puerperal sepsis (Demisse *et al.*, 2019).

Women who were referred from other health institutions were also more likely to have a puerperal sepsis. This study was consistent with studies done in Pakistan, Uganda, and West Shoa Zone Oromia Ethiopia (Khaskheli *et al.*, 2013b ;Ngonzi *et al.*, 2016 ;Demisse *et al.*, 2019). This could be due to prolonged time required to arrive the hospital and probable unclean vaginal examination on the way to hospital contribute in development of puerperal sepsis (Demisse *et al.*, 2019).

## **6. STRENGTH AND LIMITATION OF THE STUDY**

### **6.1 Strengths**

The strength of this study was both controls and cases were selected from the same hospitals to reduce selection bias. The study tries to assess additional important factors of puerperal sepsis especially obstetrical factors in which that were not addressed by previous similar studies.

### **6.2 Limitations**

The study was conducted only at public hospitals so, those who went to private facilities were missed. Additionally as the study was facility-based, it may not be good as a population-based study to generalize to the general population.

## **7 CONCLUSION AND RECOMENDATIONS**

### **7.1 Conclusion**

The study revealed that different determinants such as mode of delivery, duration of labor, duration of rupture of the membrane, number of vaginal examinations and referral status were found to be significant determinants of puerperal sepsis.

### **7.2 Recommendations**

**To the public hospitals:** Should work to create an effective referral system in collaboration with the concerned stakeholder

#### **To the health care providers**

Healthcare providers have to:

- ✓ Avoid unnecessary vaginal examinations
- ✓ Take on time measurement and prevent prolonged labor
- ✓ Give appropriate antibiotics and strengthen prenatal counseling to seek early healthcare service in case of premature rupture of membrane

#### **To future researchers:**

- ✓ It would be better to include private hospitals

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## 9. ANNEXES

### 9.1 Information Sheet and Voluntary Consent Form for Head of Hospitals

My name is Tarikwa Habetamu I am studying for my Master's degree at Haramaya University, College of Health and Medical Sciences. I kindly request you to lend me your attention to explain to you about the study and your institution being selected as the study participant

**The study title:** Determinants of puerperal sepsis and its associated factors among postpartum women who were admitted to Harar town public hospitals, eastern Ethiopia

**Purpose/aim of the study:** This study will provide up-to-date information about determinants of puerperal sepsis in Harar town hospitals, which are important to know areas of interventions that help to improve maternal health. It is also important for participating hospitals to allocate resources for maternal health. This study also will provide reliable evidence for Harar health bureau to develop preventive and educational programs according to the national health policy based the study finding to achieve reduction of maternal mortality and morbidity. In addition, this study will provide evidence for health care providers to bring quality maternal health care as well as to solve the problem in scientific way. Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of a Master's Program in Maternity and Neonatal nursing for the principal investigator.

**Procedure and duration:** Data was collected from medical records of postpartum women in this hospital from January 1, 2020 to December 31, 2021 using a checklist that is helpful for the study. The data collection on each medical record of postpartum women was take about 30 minutes

**Risks and benefits:** The risk of participating in this study is very minimal, but only taking medical records of postpartum women for extraction of data. There would not be any direct payment for participating in this study. But the findings from this research may reveal important information for the local health planners.

**Confidentiality:** The information collected from the chart was kept confidential. There was no information that was identify the records in particular and all the findings of the study was general for the study community and not reflect anything particular of individual persons. The checklist was use codes for identification purpose and no name or other personal identifiers are collected.

**Rights:** This study will be done if you are voluntary on the behalf of the hospital. You have the right to allow (not) this study in your hospital. You have the right to stop the study if you observe any misconduct during data collection.

**Contact address:** If there are any questions or enquires any time about the study or the procedures, please contact: Contact address of the Principal Investigator:

- Name: Tarikwa Habetamu
- Phone number: 0939745931
- Email address: [Tarikwahabetamu5@gmail.com](mailto:Tarikwahabetamu5@gmail.com)
- Contact address of the responsible Institutional Health Research Ethics Review Committee (IHRERC) Haramaya University Office phone: 0254662011
- P.O. Box: 235, Harar, Ethiopia

**Declaration of informed voluntary consent**

I have read the participant information sheet. I have clearly understood the purpose, procedures, risks and benefits, issues of confidentiality, rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that all needed data are extracted from each hospital records. I am also informed that the hospital has the right to stop this study from being conducted if any misdeeds and unethical procedures are observed during the data collection process in the hospital. Therefore, I declare my voluntary consent on behalf of \_\_\_\_\_hospital management to allow this study to be conducted in the Hospital with my initials (signature).

Name and Signature of Head of the Hospital: \_\_\_\_\_ Date\_\_\_\_\_

Name and Signature of Data Collector: \_\_\_\_\_ Date\_\_\_\_\_

## 9.2 English version checklist

This was a data collection format checklist to identify the determinants of puerperal sepsis among postpartum women who were admitted to Harar public Hospital, Eastern Ethiopia.

Name of Data collector \_\_\_\_\_ Date \_\_\_\_\_

### Data Collector agreement

“I certify that I have filled the checklist in accordance with the training that is given to me and instructions stated in it. I have confirmed that the information **“it’s correct.”**”

Signature \_\_\_\_\_ Date \_\_\_\_\_

Name of hospital \_\_\_\_\_

Code no \_\_\_\_\_

Checked by supervisor for completeness: -

Supervisors Name \_\_\_\_\_ signature \_\_\_\_\_

Check list ID no. \_\_\_\_\_

Instruction

checklist ID no. \_\_\_\_\_

1. Fill the space provided by reviewing the medical record
2. Choose from given alternative

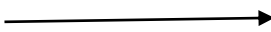
**English Version checklist**

<b>Part 1: Socio-Demographic Characteristics of the mother</b>			
NO	Questions	Answers/ choices for response	Skip
101	Age of the mother in years	years	
102	Marital status	<ol style="list-style-type: none"><li>1. Single</li><li>2. Married</li><li>3. Divorced</li><li>4. Windowed</li><li>5. Cohabited</li></ol>	
103	Residence	<ol style="list-style-type: none"><li>1. Urban</li><li>2. Rural</li></ol>	
104	Maternal Occupation	<ol style="list-style-type: none"><li>1. Government employee</li><li>2. Farmer</li><li>3. Merchant</li><li>4. Handcraft makers</li><li>5. Housewife</li><li>6. Daily laborer</li></ol>	
105	Maternal Educational background	<ol style="list-style-type: none"><li>1. Cannot Read and write</li><li>2. Read and write</li><li>3. 1-8Grade</li><li>4. 9-12 grade</li></ol>	

		5. Diploma and above	
106	Ethnicity	1. Oromo 2. Hadere 3. Amhara 4. Others(specify)_____	
<b>Part 2: Maternal and Obstetrics Factors</b>			
201	No of pregnancy (gravidity)	_____	
202	No of live birth (parity)	_____	
203	Has ANC follow-up	1.yes 2.No	
204	No of visit	1. One 2. Two 3. Three 4. Four and Above	
205	Presence of Complication during pregnancy	1. Yes 2.No 3. not recorded	If no skip Q.212
	<b>Types of complication</b>		

206	APH	1. Yes 2. No	
207	Pregnancy-induced hypertension	1.Yes 2.No	
208	Gestational diabetes mellitus	1.Yes 2.No	
209	Premature rupture of membrane	1.Yes 2.No	
210	Preterm labor	1.Yes 2.No	
211	Others Medical and surgical problem(specify)	_____	
212	Type of pregnancy	1. Single 2. Multiple	
213	Place of delivery	1.At Home 2.In route 3.At health post 4. At Health center 5.At private clinic 6.Other(specify)_____	

214	Onset of labor	1.Spontaneous 2. Induced 3.C/S before the onset(Elective C/S)	
215	Time of delivery	1. Day2. Night	
216	Did she have prolonged duration Labor	1.Yes 2.No	If No skip Q.218
217	What was the Duration of labor in hours?	_____hrs.	
218	How long did the rapture of the membrane take?	_____hrs.	
219	Gestational age at the time of birth	_____wks.	
220	Number of vaginal examination during delivery	_____	

221	Complications during labor?	1.Yes 2. No 	If No Skip Q.226
	<b>Type of Complication</b>		
222	Obstructed labor	1.Yes 2.No	
223	Prolonged Labor	1. Yes 2. No	

224	APH	1.Yes 2.NO	
225	Eclampsia	1.Yes 2.No	
226	Other specify	_____	
227	Mode of delivery	1. SVD 2. C/S 3. Vacuum 4. Forceps 5. Other specify_____	
228	Mode of placenta delivery	1.spontaneous 2.control cord traction 3.manual removal 4.other (specific)_____	
229	Have episiotomy	1.Yes 2.N O	
230	Have perinatal tear during Delivery	1.Yes 2.No	
231	PPH	1.Yes 2.No	
232	Have diagnosis about anemia during labor and delivery?	1.Yes 2No	
233	If yes what was the level of hemoglobin level	-----	
234	What was fetal out come at birth?	1.live birth 2.still birth 3.IUFD 4.Other(specific)_____	



<b>Part 3: Maternal health related factors</b>			
301	Have medical health problem complication	1.Yes 2.No	
302	chronic hypertensive	1.Yes 2.No	
303	Anemia	1.Yes 2.No	
304	Diabetes mellitus	1.Yes 2.No	
305	Cardiac diseases	1.Yes 2.No	
306	UTI	1.Yes 2.No	
307	HIV	1.Reactive 2.Nonreactive	
308	Other medical and surgical problems	_____	
<b>Part 4: health care system related factors</b>			
401	The mother referred from other health institutes?	1.Yes 2.No	
402	If yes for Q 501 specify facility type?	1.Hospital 2.health center 3.preavit health facility 4.others_____	
403	Did the mother readmitted after discharge on the last delivery	1.Yes 2.No	

404	Duration of admission	_____	
<b>Part 5: Diagnosis, Treatment, and prognosis of puerperal sepsis</b>			
501	Does the mother diagnosed to have puerperal sepsis	1.Yes 2.No	If yes go to Q.505 and Q.506
502	If yes for question No 504 which of the following classify the mother to have puerperal sepsis?	1. Fever (temperature of 38 °C or more), 2. Chills and general malaise, 3. Lower abdominal pain, 4. Tender uterus, 5. Sub involution of the uterus (less than 2 cm per day during the first eight days) 6.Purulent, foul-smelling lochia	
503	What intervention was done to manage puerperal sepsis?	1.Antibiotics 2. Intravenous fluids 3.Oxygen 4.Others (Specify) _____	
504	What medications was used for treatment?	_____	
505	Treatment outcome	1. Improved without complication 2. Complicated 3. Died	

## 9.3 Curriculum vitae (CV)

### 1. Personal Information

- ❖ Name: Tarikwa Habetamu
- ❖ Mobile phone-----+251939745931
- ❖ Email----- [tarikwahabetamu5@gmail.com](mailto:tarikwahabetamu5@gmail.com)
- ❖ Sex: Female.
- ❖ Date of birth: May 28/1994 G.C
- ❖ Nationality: Ethiopian
- ❖ Marital Status: Single
- ❖ Address: Harar, Ethiopia.

### 2. Language skills

Langue	Speaking	Reading	Writing
Oromifa	Excellent	Excellent	Excellent
Amharic	Excellent	Excellent	Excellent
English	Excellent	Excellent	Excellent

### 3. Educational background

- ❖ Primary school(1-8): - Bate elementary school eastern Hararge
- ❖ Secondary school(9-10): -Haramaya secondary School eastern Hararge,
- ❖ College/University
  - Diploma: from Adama university Assella health science college with (2000-2003)
  - BSc Degree: from Harar Health science college eastern Harare (2006-2009)
- ❖ Qualification: BSc Midwifery, CGPA =3.3

### 4. Work experience

- ❖ I have about 7years' experience at Hiwot Fana specialized university hospital obstetric ward.

## **Hobbies**

- ✓ Reading books
- ✓ Watching television

## **Training**

- BEMOC
- HIV counseling and testing.
- Long-term Family planning, Postpartum Family planning
- Comprehensive and integrated HIV/AIDS care for chronic and new HIV patients.

## **5. Reference**

- Sr. Seble Mengistu -0910072855 (Head of obstetric ward at Hiwot Fana specialized university Hospital).
- Dr. Tadesse Gure -0913868714 (MD, Assistant professor of OBGYN at Hiwot Fana specialized university Hospital).