ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES DEPARTMENT OF ANESTHESIA

FACTORS ASSOCIATED WITH OBSTETRICS MORTALITY IN INTENSIVE CARE UNIT OF ADDIS ABABA PUBLIC HOSPITAL IN, 2020/21. (A HOSPITAL BASED CASE CONTROL STUDY)

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Abstract

Background: Obstetrics mortality in intensive care unit (ICU) is high in low income countries like Ethiopia. The indications of admission are Preeclampsia/ Eclampsia, postpartum hemorrhage, and puerperal sepsis but, patient outcomes subsequent to intensive care unit admission are lacking.

Objectives: To assess factors associated with obstetrics mortality in ICUs' of Addis Ababa Public hospitals, Ethiopia from October 2020 – May 2021.

Methods: A hospital based unmatched case control study was conducted on obstetrics patients admitted to Addis Ababa Public hospital's intensive care unit from October 2018 to November 2020. Data from 75 cases (died) and 150 controls (survived) were collected using simple random sampling technique. Multivariable logistic regression analysis was done; Odds Ratio and Confidence Interval (OR and 95% CI) were computed using SPSS version 26. P value < 0.05 was taken as statistically significant.

Result: Obstetrics mortality in intensive care unit was high and accounts 27% from the total ICU admission. Severe pre-eclampsia AOR: 6.33; 95% CI: 2.25-17.79, peurpral sepsis AOR: 4.51; 95% CI: 1.68-12.15, age greater than or equal to (≥ 35) AOR: 4.09; 95% CI: 1.42-11.77, absence of antenatal care: AOR: 3.74; 95% CI: 1.03-13.5, maternal coexisting diseases AOR: 5.2; 95% CI: 2.22-12.16, and severe GCS at admission AOR: 3.78; 95% CI: 1.21-11.79 were significantly associated with obstetrics mortality in Addis Ababa Public Hospitals intensive care unit.

Conclusion and Recommendation: Advanced maternal age (≥35 years), loss of antenatal care, peurpral sepsis, severe pre-eclampsia, pre-existing medical comorbidities and severe Glasgo coma scale (GCS) during ICU admission were the most significant factors associated with obstetrics mortality in intensive care unit. It is recommended that all pregnant women should have antenatal care so that preeclampsia and maternal comorbidies will be early diagnosed and treated.

Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented, in this or any other university and that all sources of materials used for the thesis proposal have been fully acknowledged.

Name_____ Signature _____Date _____

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Adviser (II)

Name_____ Signature _____Date _____

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Abbreviations and Acronyms

ANC……Antenatal Care

AOR……Adjusted Odd Ratio

COR……Crude Odd Ratio

C/S……Cesarean Section

EDHS…….Ethiopian Demographic Health Survey

GCS……Glasgo coma scale

HR……Hazard Ratio

MMR……Maternal Mortality Rate

OR……Odds ratio

SBP…… …. Systolic Blood pressure

TASH……Tikur Anbessa Specialized Hospital

WHO……World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1 Back ground

An intensive care unit (ICU) is a structured system for providing care to critically ill patients that includes intensive and specialized medical care, increased monitoring capacity, and multiple modalities of physiologic organ support to help patients maintain their lives during a period of life-threatening organ system insufficiency (1).

According to data from 171 countries, 303,000 (80%CI: 291 000–349 000) mothers were died globally in 2015. Starting from the 1990, the annual maternal mortality rate reduction was higher in eastern Asia 5% (4·0–6·0) than the Caribbean 1·8%. The maternal mortality rate (MMR) was 12 (80% CI: 11–14) deaths per 100,000 live births for developed countries while it was 546 (511–652) for sub-Saharan Africa (SSA) in 2015(2).

Between 2000 and 2017, a report by the WHO, United Nations Children's Fund (UNICEF), World Bank Group, and the United Nations Population Division revealed that the maternal mortality ratio dropped by about 38% worldwide(3). But this is not uniform worldwide and in Sub-Saharan Africa it is still unacceptably high. The inequalities of maternal deaths in some areas of the world reflect a difference in access to quality health services and highlight the gap between rich and poor(4).

By 2030, Africa will not achieve the Sustainable Development Goal (SDG) of 70 per 100,000 live births; instead, the MMR will be around 347 per 100,000 live births. As a result, in order to fulfill the 2030 Sustainable Development Goals, Africa and its partners will need to implement accelerated efforts to reduce the MMR by nearly 13% per year from its 2015 level(5).

In 2017, the MMR in low-income nations was 462 per 100,000 live births, compared to 11 per 100,000 in high-income countries. The Sustainable Development Goals (SDG) aimed for a global MMR of less than 70 per 100,000 births by 2030, with no nation having a rate more than twice that of the global average. In 2017, Ethiopia's MMR was 401 per 100,000 live births(6).

1.2 Statement of the problem

Obstetric intensive-care unit mortality is high, ranging from 0% to 4.9 percent of admissions in high-income nations to 2% to 43.6 percent in low and middle-income countries (6). Even if ICU mortality of obstetrics patients was high there was evidence that appropriate use of high quality ICU will decrease maternal mortality(7).

Data from the 2019 atlas of African health statistics showed that the MMR of Africa was 542 per 100,000 live births in 2015. This death was reported to be 34 times higher than the Europe's MMR and suggested to be unacceptably high(5).

Millennium Development Goal 5 (MDG5) by world health organization (WHO) planned to reduce MMR by 75% between 1990 and 2015. But the global MMR was only reduced from 385 deaths per 100,000 live births in 1990, to 216 in 2015. The amount of reduction was only about 43·9% and the planned one does not reached yet(2).

According to the study done in three Addis Ababa public hospitals, Ethiopia between January 2015 and December 2017 maternal mortality ratio was 156/100000. Preeclampsia/Eclampsia, postpartum hemorrhage and puerperal sepsis all contribute considerably to direct maternal deaths, with ICU mortality accounting for 27.4% of total hospital deaths(8).

There was no difference in the admission criteria to ICU in developing compared to developed countries, except for the significantly higher maternal mortality rate in developing countries. Studies reporting patient outcomes subsequent to ICU admission are lacking(9). Similarly obstetrics mortality in intensive care unit and cause of death was under reported in Ethiopia(8). So the aim of this study was to identify factors affecting obstetrics mortality in the intensive-care unit.

1.3. Significance of the study

Obstetric admissions to an intensive-care unit indicate morbidity and mortality which is very important indicators of the quality of health care services in one country. Identifying factors associated with obstetrics mortality in the intensive-care unit will enable the Ethiopian government to give attention towards critical care of pregnant mothers. As maternal death often occurs in the ICU, early warning tools may help in identifying critical obstetrics mothers, so that specific treatment would be given accordingly to decrease mortality.

This research will help health institutions, policymakers, and other stakeholders offer important maternal care by identifying interventions that are most likely to reduce mother fatalities and improve maternal health across the country. Specifically the results from this study were beneficial for healthcare providers and hospitals management to allocate resources in order to reduce maternal mortality in the intensive-care unit.

Overall, there was a scarcity of published data on factors affecting obstetrics intensive care unit mortality both globally and nationally, including Ethiopia. So that, this research will allow for the collection of trustworthy data that can forecast a problem and provide guidance for better management strategies to reduce maternal ICU mortality.

CHAPTER TWO: LITERATURE REVIEW

A systemic analysis by WHO in 2014 revealed that hemorrhage (27.1%; 95% CI 19.9–36.2), hypertensive disorders (14%; 95% CI: 11.1–17.4)), and sepsis (10.7%; 95% CI: 5.9–18.6) were the major cause of maternal deaths worldwide. Finding by WHO further stated that abortion (7.9% ;95% CI: 4.7–13.2), and embolism (3.2% ;95% CI: 1.8–5.5) were also contributed to maternal deaths(10).

A case control study by Knight in United kingdom in 2017 found that smoking during pregnancy (AOR: 2.06; 95% CI: 1.13–3.75), absence of ANC follow up (AOR; 23.62; 95% CI: 8.79–63.45), co-existing medical disease (AOR: 5.92; 95% CI: 3.56–9.86), pervious history pregnancy complications and advanced maternal age (AOR; 1.12; 95% CI: 1.02–1.22 were significantly associated with obstetric mortality(11).

A cohort study by Pasha and his colleagues in 6 countries on 158,205 women from middle and low income countries identified hemorrhage (38.6%), pregnancy- related infection (26.4%) and pre- eclampsia/eclampsia (18.2%) as determinants of obstetrics mortality in 2018(12).

A case control study by Diana in Indonesia on 48 pregnant mother in 2020 obtained that low nutritional status, anemia, advanced age, mode of delivery, late referral and postpartum complications were the risk factors for mortality(13).

According to the study done in France on 11 European countries by Wildman, the most prevalent causes of death were hypertensive diseases of pregnancy (16.9%), hemorrhage (23.6%), thromboembolism (18.1%), and infection (10.6%), which together accounted for 65% of the maternal deaths. Maternal age greater than 35 years are higher mortality when compared to maternal age less than 35 (67.5% vs 32.5%)(14).

A case control study in Brazil by Pereira et al in 2016 on 73 cases and 9,221 controls found that cesarean delivery (AOR: 2.87; 95% CI; 1.63– 5.06) than vaginal delivery and postpartum hemorrhage (AOR: 3.0; 95% CI: 1.4–6.6) were associated with maternal mortality. Their result further stated that complications of anesthesia and thromboembolism were also leaded to maternal mortality(15).

Studies showed that obstetric patients developing gastro-intestinal complications in ICU (AOR 4.87; 95%CI: 1.65-14.36)(16), diagnosing with anesthesia related complications(17), cardiac arrest (63.2%(18), and having high Sequential Organ Failure Assessment (SOFA) score at admission ($p < 0.001$) were significantly died in ICU. Obstetric patients who had Acute Physiology And Chronic Health Evaluation II (APACHE II) and Simplified Acute Physiology Score II (SAPS II) scores in ICU were survived(19).

Diallo and his colleagues conducted a case control study in Guinea to identify predictors' of maternal mortality in 2020. Their result indicated that referral mother (AOR: 24.60; 95%CI: 11.32-53.46), induced labor (AOR: 4.26; 95%CI: 2.51-7.91), no use of partogram (AOR: 3.70;95%CI: 1.31-5.20), duration of labor ≥24 hours (AOR :2.87; 95%CI: 1.35-5.29), and pervious history of CS (AOR 2.54; 95%CI: 1.12-6.19) were the predictors of obstetric mortality(20).

According to the study done by Paternina-Caicedo et al(2017) in Colombia abnormal systolic blood pressure(OR 3.89), heart rate(OR 3.29), temperature(OR 3.53), FiO2(OR 7.15), and an abnormal GCS score(OR 11.3) were all significantly associated with maternal ICU mortality but abnormal values of diastolic blood pressure(OR 0.63) or respiratory rate were not. Importantly, the variable with the highest association with maternal death was a GCS score less than 14 (abnormal level of consciousness)with an AOR of 12.35 (95% CI, 5.26 - 29.02)(21).

A study done in Intensive Care Unit (ICU) medical college with tertiary hospital facility in Mumbai India by Bendre (2015) showed that most of the obstetrics deaths were due to multiorgan dysfunction (6.6%) and Disseminated Intravascular Coagulation (DIC)(6.6%). Most common interventions done in ICU were blood and blood product transfusions (55.5%) and central venous pressure line (35.5%)(22).

A study done in Wenzhou Medical University China by Pan etl in 2017 showed that total bilirubin, OR 3.125 (95% CI: 1.013-9.644, Prothrombin time(PT), OR 6.409 (95% CI: 1.855-22.140, p=0.003); p=0.037); and APACHE score, OR 4.750 (95% CI: 1.488-15.167, p=0.009) were independent risk factors associated with maternal mortality(23).

A study done in intensive care unit (ICU) of the University of Ilorin Teaching Hospital, Ilorin, Nigeria found that woman's age (regression coefficient(β) -0.004, hazard ratio 0.996), Glasgow Coma Scale (GCS) score (β -0.143, HR 0.867), oxygen saturation (β -0.011, HR 0.989), and, systolic blood pressure at admission (β -0.030, HR 0.970) were statistically significant factors associated with maternal ICU death(24).

A case control study by Egbe in Cameroon on determinants maternal mortality in 2017 showed that severe malaria (5.6%), HIV/AIDS (5.6%), lack of ANC follow up (RR:1.87; 95% CI: 1.33-2.63), pre-existing co-morbidities (RR:1.45; 95% CI: 1.03-2.03), place of delivery(RR: 2.44;95% CI: 1.79-3.32), healthcare provider qualification(RR: 2.87; 95% CI: 2.17-3.79) and delays in arrival at health facilities (RR:1.420; 95% CI: 1.01-2.0) were significantly associated with obstetric deaths(25).

A study by Okafor et al in SSA identified that organ dysfunction on admission; massive hemorrhage, amniotic fluid embolism, chorioamniotis, and late presentation were the most factors associated with obstetric mortality in ICU. Their study further stated that many mothers were died due to lack of blood products and inadequate prenatal care at health facilities(26).

A case control study done by Besaina (2018) in Madagascar to determine the associated factors to maternal death in postpartum hemorrhage showed that multiparity (p:2.2 OR:0.01), absence of prenatal care (p:0.01 OR:2.2), cesarean section (p:0.00 OR:5.5); uterine atony (p=0.03, OR 2.1); the state of shock (p=0.00 OR:57.8), the need for blood transfusion (p=0.00 OR: 3, 7), use of catecholamines (p=0.00, OR:17.5); delayed management (p=0.01, OR:2.2), and hemostasis hysterectomy (p=0.00 OR: 8.67) were the the most common(27).

According to study done in Jimma University by Legesse et al maternal mortality ratio was 350/100,000 in 2014. The leading cause of maternal death was hemorrhage (54%) (β=0.477, 95% confidence interval (CI: 0.307, 0.647), followed by pregnancy-induced hypertension (20%) (β=0.232, 95% CI: 0.046, 0.419), and anemia (12%) (β=0.110, 95% CI: 0.017, 0.204)(28).

A case control study on 595 obstetric patients at Mizan-Tepi University, Ethiopia by Tegene Legese et al in 2016 identified lack of ANC follow up (AOR:2.4; 95CI:1.19- 4.83), labor duration >24hrs(AOR: 4.0 ;95% CI:1.86-8.74), presence of obstetric complications(AOR:7.2; 95% CI:3.08-16.72), uterine rupture (AOR:11.4; 95%CI:4.27-30.41), abortion (AOR:33.5; 95% CI:4.98-224.98), abnormal puerperium (AOR:10.9 ;95%CI:1.96-59.97), and destructive delivery (AOR:10.9; 95%CI:2.13,56.2) to be associated with obstetric(2).

Even though, factors affecting ICU outcome was multifactorial study found that effective use of intensive care unit for obstetrics patients in severe clinical condition would decrease mortality(7). Generally, obstetric hemorrhage and hypertensive disorders of pregnancy were the most identified risk factors associated with maternal mortality, but there is less literature in case of obstetrics ICU mortality in our literature reviewing.

Conceptual Frame work

We develop a conceptual frame work by using variables associated with obstetrics mortality from previous studies in the literature reviews and finally death or survival is reached in the frame work.

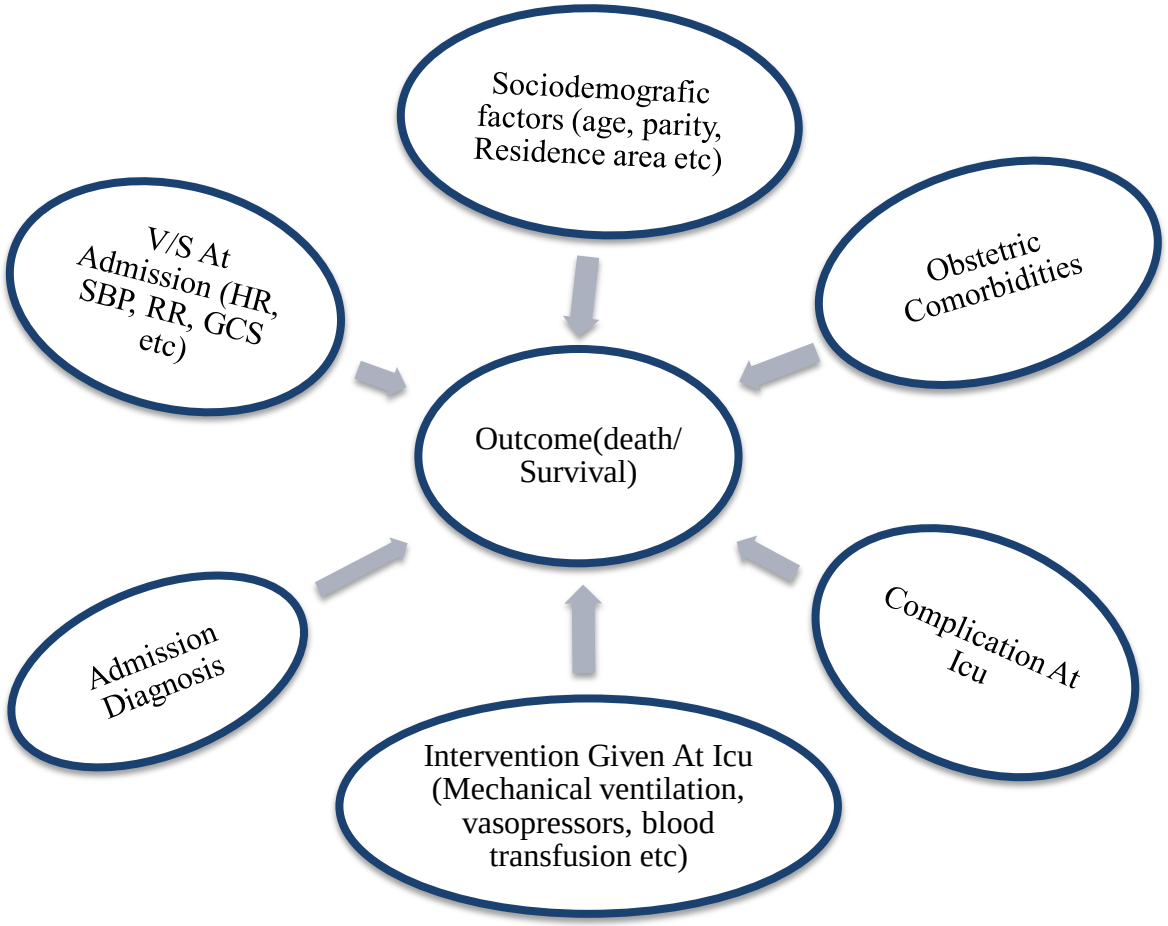

Figure 1: **Conceptual frame work of factors associated with obstetrics mortality in the intensive-care unit of Addis Ababa Public hospitals in 2021.**

CHAPTER THREE: OBJECTIVES

3.1 General objective

- ✓ To assess factors associated with obstetrics mortality in intensive care unit of Addis Ababa Public Hospitals, Ethiopia in, 2020/21.

3.2 Specific objectives

- ✓ To identify factors associated with obstetrics mortality in intensive care unit of Addis Ababa Public Hospitals, Ethiopia.
- ✓ To determine the magnitude of maternal mortality in intensive care unit of Addis Ababa Public Hospitals, Ethiopia

CHAPTER FOUR: METHODS AND MATERIAL

4.1 Study Area and period

This study was conducted at three public hospitals of Addis Ababa from October, 2020 to June, 2021. Addis Ababa is the capital city of Ethiopia and had 13 Public hospitals and 34 private hospitals in 2020. According to 2017 estimations Addis Ababa has a population of 6.6 million people. The study was conducted at Tikur Anbessa specialized hospital, Yekatit 12 Hospital Medical College and Ghandi memorial referral hospitals. The hospitals provide health care services not only for Addis Ababa residents but also serve as referral facilities for the nation.

Tikur Anbessa specialized hospital is the largest specialized hospital in Ethiopia, provides a tertiary level referral treatment, with over 700 beds and serves as the training center for undergraduates and postgraduate medical students, anesthetists, dentists, nurses, midwives, pharmacists, medical laboratory technologists, radiology technologists, and others who shoulder the health problems of the community and the country at large. The medical ICU has eight beds and serves critically ill patients from different departments of the hospital. Yekatit 12 Hospital Medical College (Y12HMC) is serving more than a million people in the catchment area. The hospital has 9 departments and 6 units and has 265 beds. It has 6 adult ICU bed. Gandhi Memorial Hospital is a referral maternity hospital and is a catchment hospital for 40 health centres and other health facilities. It provides comprehensive emergency obstetric care (CEmOC) and attends to more than 17,000 deliveries per year. Gandhi Hospital is the only hospital that has opened the first Maternal Intensive Care Unit (MICU) in the country yet.

4.2 Study design

An unmatched case control study was conducted to identify factors associated with obstetrics mortality in the intensive-care unit. Cases were defined as obstetric death after admitted to the intensive-care unit (ICU). Cases were confirmed for whose death certificates were accessed. Controls were obstetric who was admitted to the three ICUs, survived and got discharged from the intensive-care unit. The ratio of cases to control was one to two (One case: 2 controls) for one obstetrics ICU death two survived obstetrics was taken as control.

4.3 Population

4.3.1 Source population

The source populations were all obstetrics patients admitted to the three selected hospitals in Addis Ababa.

4.3.2 Study population

The study populations were all obstetric patients who admitted to the three selected hospital's intensive care unit.

4. 4 Eligibility Criteria

4.4.1 Inclusion criteria

All obstetrics mothers who were admitted to the three hospital's ICU between those specified period, and after 28 weeks of gestation or within 42 days post-partum due to obstetric or co morbid conditions and who were survived or died.

4.4.2 Exclusion criteria

- ✓ Pregnant mother admitted for any accident(road traffic accident, personal fighting,etc)
- ✓ Pregnant women admitted for treatment of poisoning
- ✓ Non obstetrics emergency surgery
- ✓ Obstetrics mothers referred to other hospitals for further investigation or for treatment

4.5 Variables

4.5.1 Dependent variable

Obstetrics ICU care outcome: Survival or death

4.5.2 Independent variable

- Obstetrics sociodemographic factors (age, parity, residence area)
- Maternal co-existing medical disease
- ANC follow up
- Mode of Delivery(SVD or C/S)
- V/T at admission (GCS,SBP,HR,RR and Oxygen Saturation)
- Admission diagnosis(PIH ,Obstetric hemorrhage, Sepsis and Other)
- Complications in ICU
- Treatment provided in ICU
    - ✓ Magnesium sulphate, Vasopressor, Blood transfusion and other
- Duration of ICU stay

4.6 Sample size and sampling technique

4.6.1 Sample size determination

Sample size was calculated from a previous case control study done in Nigeria using unmatched case control study formula. We calculated sample size by inserting different predictors of obstetrics mortality variables from pervious study both into Open Epi software and formula. Both calculations provided the same results to us. Postpartum hemorrhage gave the largest sample size and was used in the formula(24).

α = the probability of type I error (significance level)

β = the probability of type II error (1 - power of the test)

$Z\alpha_{/2}$ = 1.96 for p = 0.05 (95% confidence interval)

Power = 80%, $\boldsymbol{Z_\beta}$ = 0.84 for 20% beta error

$\boldsymbol{p_1}$= proportion of cases with exposure and q1 = 1-p1

$\boldsymbol{p_2}$= proportion of controls with exposure and q2 = 1-p2,

$\boldsymbol{p_1}$ = 48% and $\boldsymbol{p_2}$ = 28% (from previous study)

r = the ratio of case to control (1case/2 controls) = 2

$\boldsymbol{n_1}_{\text{Fleiss}}$ = required sample size for cases using Fleiss's formula

$\boldsymbol{n_1}_{\text{Fleiss-cc}}$ = required sample size for cases using Fleiss's formula with continuity correction

$\overline{\boldsymbol{p}} = \frac{\boldsymbol{p_1 + rp_2}}{\boldsymbol{r+1}}$ and $\overline{\boldsymbol{q}}$ = 1 - $\overline{\boldsymbol{p}}$

$\boldsymbol{n_1}$ = Number of cases,$\boldsymbol{n_2}$ = number of controls,$\boldsymbol{n_2 = 2n_1}$

The sample size formula *without* the correction factor by Fleiss is:

$$\boldsymbol{n_1} = \frac{\left[Z_{\alpha/2}\sqrt{(r+1)\overline{p}\overline{q}} + Z_\beta\sqrt{rp_1q_1 + p_2q_2}\right]^2}{r(p_1 - p_2)^2} = \frac{\left[1.96\sqrt{(2+1)(0.38)\ (0.62)} + 0.84\sqrt{2(0.48)(0.52) + (0.28)(0.72)}\right]^2}{2(0.48 - 0.28)^2} = 70$$

For the Fleiss method *with* the correction factor,

$$\boldsymbol{n_1 cc} = \frac{n_1}{4}\left[1 + \sqrt{1 + \frac{2(r+1)}{n_1 r|p_1 - p_2|}}\right]^2 = \frac{70}{4}\left[1 + \sqrt{1 + \frac{2(2+1)}{70(2)|0.48 - 0.28|}}\right]^2 = 75$$

$\boldsymbol{n_2 = 75 \times 2 = 150}$ Total sample size (75 cases + 150 controls) = 225

4.6.2 Sampling Technique

Out of twelve Addis Ababa governmental hospitals, five hospitals were selected by lottery method. Card numbers of obstetric cases fulfilling inclusion criteria were used from ICUs' registration book. Numbers of samples taken for cases were proportionally allocated to the three hospitals ICU then two controls was taken for each case from the same hospital in order to make cases and control homogenous. Simple random sampling technique was used. The card numbers were coded from first to the end in order. Then random numbers table was generated by a computer. From the generated random number, the first sample was marked by pencil anywhere in the table by looking away or closing eye. The subsequent sample was selected by going down the column and continuing on to the next column in the table until the calculated sample size is obtained for cases and controls.

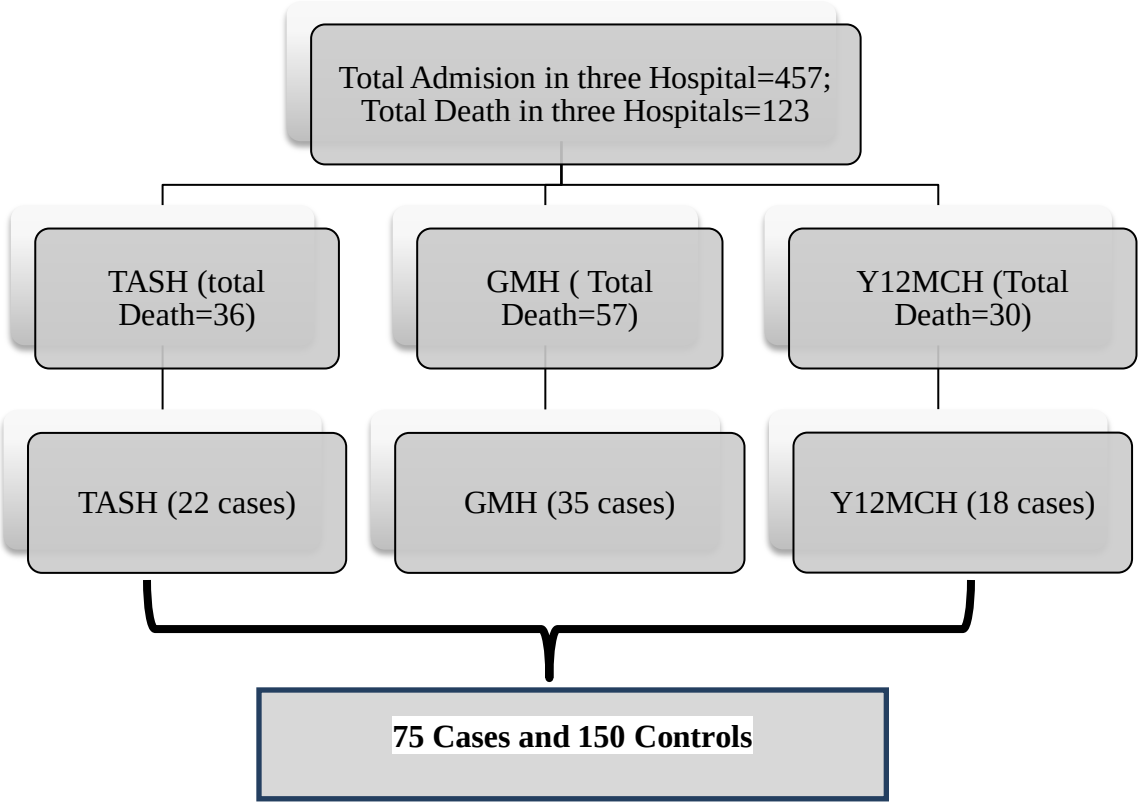

Figure 2: **Schematic Presentation of Proportional Allocation and Sampling Procedure**

4.7. Data collection technique and procedure

Data were collected from all eligible obstetrics' chart using structured questionnaire. All obstetrics' risk factors were collected from ICU registration logbook, delivery registration log book, maternal chart (card), Health Management Information System (HMIS), death reports, and referral papers. Maternal's charts were reviewed for maternal age, address, ANC, Parity, reason for admission to ICUs, diagnosis, vital sign, treatment provided in ICU, length of ICU stay, outcome and for other necessary data using structured questionnaire tool. The questioners are modified and prepared from the articles in the literature review, 2016 Ethiopia Demographic and Health Survey (EDHS), and world health organization (WHO) statistics. The questioners were filled by two bachelors of degree (BSC) intensive-care unit nurses.

4.8 Data Analyzing and processing

Data were checked manually for completeness and then coded and entered into Epi info version 7. Data were cleaned and analyzed with SPSS version 26. Student's t-test was used for comparison of sociodemographic variables like age and parity between cases and controls. Hosmer and Lemeshow goodness of fit test for logistic regression were used to test for the model fitness. Multicollinearity was checked by variance inflation factor (VIF). Both binary logistic regression analysis and multivariable logistic regression were performed and association between the outcome and independent variables was assessed. On bivariate logistic regression analysis, a variable with P-value less than 0.2 was considered as a candidate for multivariable logistic regression analysis. Multivariable logistic regression analysis was performed to control for confounders and the factors associated with obstetrics death in the ICUs were identified. Adjusted odds ratio (AOR) were determined and variables with p value <0.05 on multivariable logistic regression was declared statistically significant. Confidence intervals (CIs) were used for the odds ratios. Finally, the result was presented by using text, graph and tables.

4.9. Operational Definitions

Coexisting disease- Pregnancy unrelated chronic medical disease

Complications at ICU- A disease a patient did not have during ICU admission and acquired while in the ICU (acute kidney injury, infection in ICU, and pulmonary and cardiovascular complications such as aspiration pneumonia and etc)

Duration of ICU stays - is a period in days the patients stayed in ICU from admission to discharge

Non-survived- Patients who are not alive at the time of discharge or died in the ICU

Organ Failure at admission- Presence of specific organ failure at admission e.g Renal, Pulmonary, hepatic etc

Outcome- Indicate either patient survived or died at the time of ICU discharge.

Survived- Patients, who survived during ICU stay, including patients who improved and got discharged, transferred to the wards.

4.10. Data Quality Assurance

The questionnaire was prepared by English language. The questionnaire was pretested on 5% of the sample size before actual data collection in Zewditu memorial hospital which is one of the Addis Ababa public hospitals. Training and orientation about the objectives and relevance of the study on each item included in the study tools and the whole process of data collection was provided for data collectors and supervisor. During data collection, regular supervision and follow up was undertaken. Supervisors checked each questionnaire daily with further cross check by principal investigator for completeness and consistency of data was undertaken.

4.11. Ethical consideration

Ethical clearance was obtained from Addis Ababa University, College of Health Sciences Department of Anesthesia. The official letter of cooperation was taken from the Hospitals to the respective departments/case team. Written consent could not be obtained, because it was a retrospective study.

4.12. Dissemination plan

The copies of final results will be summited to AAU, College OF health Sciences and anesthesia department. The study result will be disseminated to studied hospital**s**. Possible efforts will be made to publish the results of the study to international Journal.

CHAPTER FIVE: RESULTS

5.1 Sociodemographic factors, co-existing medical disease, and delivery mode of obstetrics patients admitted to Addis Ababa Public Hospitals' intensive care unit

During October, 2018 to November, 2020, a total of 457 Obstetric patients were admitted to the three selected Addis Ababa Public hospital's intensive-care unit. From the total admission to the ICU, 123 were recorded as death, making Obstetrics intensive care unit mortality 27%. Total sample size was 225 from which 75 were cases and 150 were controls.

The mean obstetrics age among the cases was 29.51(± 6.31) and the mean among the controls was 28.99(± 5.24). The mean maternal parity was 3.01±2.12 and 2.65±1.72 for the cases and controls, respectively. The mean duration of ICU stay was 5.8±4.7 among the cases and 8.16±6.27 days among the controls.

Table 1: **Sociodemographic factors, co-existing medical disease, and delivery mode of obstetrics patients admitted to Addis Ababa Public Hospitals ICU from October, 2018 to November, 2020, (75 = Cases, 150 = Controls)**

Variables		Case(n = 75),%	Control(n=150),%	Total(n=225),%
Age category	<35	52(69.3%)	124(82.7%)	176(78.2%)
<35	≥35	23(30.7%)	26(17.3%)	49(21.8%)
Residence area	In A.A	54(72%)	114(76%)	168(74.7%)
	Out of A.A	21(28%)	36(24.09%)	57(25.3%)
ANC Follow up	No	11(14.7%)	9(6%)	20(8.9%)
	Interrupted	12(16%)	13(8.7%)	25(11.1%
	Yes	52(69.3	128(85.3%)	180(80%)
Coexisting medical disease	Yes	29(38.7%)	23(15.3%)	52(23.1)
	No	46(61.3%)	127(84.7%)	173(76.9%)
Delivery Mode	C/S	32(42.7%)	49(32.7%)	81(36%)
	SVD	43(57.3%)	101(67.3%)	144(64%)

5.2 Admission Diagnosis among Obstetrics Patients Admitted to Addis Ababa Public Hospitals Intensive Care Unit

Complications of Anesthesia among the admitted obstetrics cases were 4(5.3%) and 9(6%) among the controls. These complications of anesthesia were total spinal anesthesia 2(2.65%), cardiac arrest 1(1.33%), and delayed awakening from anesthesia 1(1.33%) in obstetrics cases. In obstetrics controls total spinal anesthesia 4(2.67%), and delayed awakening from anesthesia 5(3.33%) were found as anesthesia complications that resulted in ICU admission. Bronchial asthma, epilepsy, and amniotic fluid embolism were reported as the other indication and overall account 3.1% of ICU admission (figure 3 below).

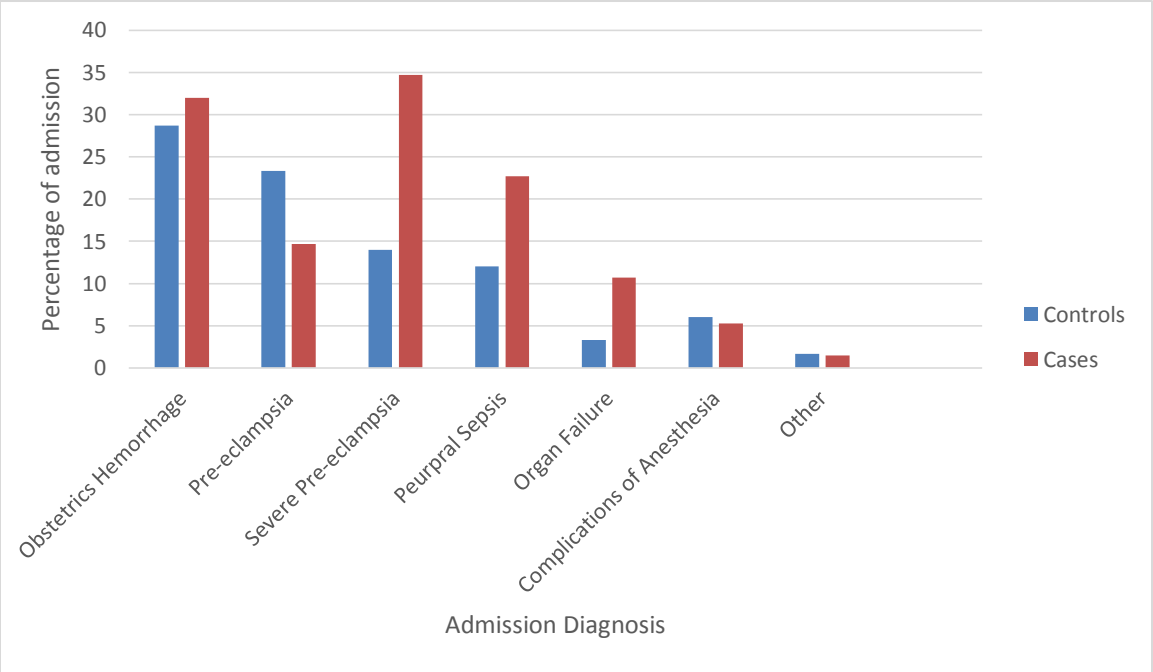

Figure 3: **Admission Diagnosis of Obstetrics Patients Admitted to Addis Ababa Public Hospitals Intensive Care Unit**

Table 2: **Bivariate associations of factors associated with obstetrics patients mortality that were admitted to Addis Ababa Public hospitals intensive care unit**

Variables		Case n (%)	Control n (%)	COR(95%CI)	P Value
Age category	<35	52(69.3%)	124(82.7%)	1	
	≥35	23(30.7%)	26(17.3%)	2.11(1.1-4.03)	0.024*
Parity		3.01±2.12	2.65±1.72	1.11(0.96-1.28)	0.17
ANC Follow up	No	11(14.7%)	9(6%)	3(1.18-7.69)	0.02*
	Yes	52(69.3	128(85.3%)	1	
Comorbidity	Yes	29(38.7%)	23(15.3	3.48(1.83-6.62)	<0.001*
	No	46(61.3%)	127(84.7%)	1	
Delivery Mode	C/S	32(42.7%)	49(32.7%)	1.53(0.87-2.72)	0.14
	SVD	43(57.3%)	101(67.3%)	1	
Obstetrics Haemorrhage	Yes	24(32%)	43(28.7%)	1.17(0.64-2.14)	0.61
	No	51(68%)	107(71.3%)	1	
Peurpral Sepsis	Yes	17(22.7%)	18(12%)	2.15(1.04-4.47)	0.04*
	No	58(77.3%)	132(88%)	1	
Pre-eclampsia	Yes	11(14.7%)	35(23.3%)	0.56(0.27-1.19)	0.13
	No	64(85.3%)	115(76.7%)	1	
Severe Pre-eclampsia	Yes	26(34.7%)	21(14%)	3.26(1.7-6.32)	0.001*
	No	49(65.3%)	129(86%)	1	
Organ Failure	No	67(89.3%)	145(96.7%)	1	
	Yes	8(10.7%)	5(3.3%)	3.46(1.1-10.98)	0.04*
GCS	≥13	28(37.3%)	103(68.7%)	1	
	9-12	29(38.7%)	35(23.3%)	3.1(1.6-5.81)	0.001*
	<9	18(24%)	12(8%)	5.5(2.3-12.8)	0.001*
SBP	90-140	33(44%)	77(51.3%)	1	

	<90	26(34.7%)	41(27.3%)	1.5(0.78-2.8)	0.23
	>140	16(21.3%)	32(21.3%)	1.2(0.57-2.4)	0.68
Heart Rate	Normal	37(49.3%)	80(53.3%)	1	
	Tachycardi	38(50.7%)	70(46.7%)	1.2(0.67-2.1)	0.57
Respiratory Rate	Normal	27(36%)	66(44%)	1	
	Tachypnea	48(64%)	84(56%)	1.4(0.8-2.47)	0.25
Oxygen Saturation	Normal	32(42.7%)	86(57.3%)	1	
	Hypoxia	43(57.3%)	64(42.7%)	1.8(1.03-3.2)	0.04*
Mechanical Ventilation	Yes	50(66.7%)	71(47.3%)	2.22(1.25-3.96)	0.007*
	No	25(33.3%)	79(52.7%)	1	
Vasopressors and Inotropes	Yes	48(64%)	74(49.3%)	1.83(1.03-3.23)	0.04*
	No	27(36%)	76(50.7%)	1	
ICU Complications	Yes	18(24%)	11(7.3%)	4(1.77-8.98)	0.001*
	No	57(76%)	139(92.7%)	1	

Where: 1=reference group, COR=crude odd ratio, CI= confidence interval,* P Value < 0.05

5.3 Multivariable analysis of factors associated with obstetrics mortality in Addis Ababa Public Hospitals' ICU

Multivariable unconditional logistic regression analysis show that, six(6) risk factors were identified to be significantly associated with obstetrics ICU mortality in Addis Ababa Public Hospitals. These risk factors were age greater than or equal to (≥ 35), absence of ANC follow up, maternal coexisting diseases, severe pre-eclampsia, peurpral sepsis and severe GCS during admission.

Our study found that obstetrics age (≥35) years old were 4 times more likely to die compared to obstetrics age (<35) (AOR: 4.09; 95% CI: 1.42-11.77). Obstetrics patients who did not attend ANC were 3 times more likely to die relative to those who had attended ANC (AOR: 3.74; 95% CI: 1.03-13.5). Obstetrics mothers who had coexisting medical diseases were 5 times more likely to die compared to those who had not (AOR: 5.2; 95% CI: 2.22-12.16).

Obstetrics patients admitted with severe pre-eclampsia were 6 (AOR: 6.33; 95% CI: 2.25-17.79) times more likely to die compared to those who had no severe pre-eclampsia. Obstetrics patients admitted with peurpral sepsis were 4 (AOR: 4.51; 95% CI: 1.68-12.15) times more likely to die compared to those who had no peurpral sepsis. Obstetrics patients with severe GCS (<9) at admission were 3 (AOR: 3.78; 95% CI: 1.21-11.79) more likely to die relative to mild GCS.

Table 3: **Multivariable analysis of factors associated with obstetrics mortality in Addis Ababa Public Hospitals' ICU**

Variable	Category	COR(with 95% CI)	AOR (with 95% CI)	P Value
Age Interval	≥35	2.11(1.1-4.03)	4.09(1.42-11.77)	**0.009**
	<35	1	1	
Parity		1.11(0.96-1.28)	0.98(0.8-1.21)	0.855
ANC follow up	Yes	1	1	
	No	3(1.18-7.69)	3.74(1.03-13.5)	**0.044**
Coexisting Diseases	Yes	3.48(1.83-6.62)	5.2(2.22-12.16)	**P<0.001**
	No	1	1	
Mode of Delivery	C/S	1.53(0.87-2.72)	1.75(0.85-3.58)	0.127
	SVD	1	1	
Pre-eclampsia	Yes	0.56(0.27-1.19)	1.94(0.68-5.55)	0.214
	No	1	1	
Severe Pre-eclampsia	Yes	3.26(1.68-6.32)	6.33(2.25-17.79)	**P<0.001**
	No	1	1	
Peurpral Sepsis	Yes	2.15(1.04-4.47)	4.51(1.68-12.15)	**0.003**
	No	1	1	
Organ Failure	Yes	3.46(1.110.98)	1.75(0.36-8.53)	0.486
	No	1	1	
GCS	Severe	5.5(2.38-12.8)	3.78(1.21-11.79)	**0.022**
	Moderate	3.05(1.6-5.81)	1.99(0.83-4.8)	0.124
	Mild	1	1	
Oxygen Saturation	Hypoxia	1.81(1.03-3.16)	0.9(0.41-2.01)	0.805
	Normal	1	1	
Mechanical Ventilation	Yes	2.22(1.25-3.96)	1.4(0.61-3.18)	0.43
	No	1	1	
Vasopressor	Yes	1.83(1.03-3.23)	1.19(0.53-2.67)	0.667
	No	1	1	
ICU Complications	Yes	4(1.77-8.98)	2.51(0.88-7.12)	0.084
	No	1	1	

1=reference group, COR=crude odd ratio, AOR= adjusted odd ratio CI= confidence interval

CHAPTER SIX: DISCUSSION

Causes of obstetrics patients' mortality in intensive care unit are multifactorial. In this study advanced maternal age, loss of antenatal care, peurpral sepsis, severe pre-eclampsia, pre-existing medical comorbidities, and severe GCS during ICU admission were significantly associated with obstetrics mother's intensive care unit mortality. During this study period the overall obstetrics mortality in intensive care unit was 27%, which is comparable to the study done in Nigerian tertiary hospital ICU (31.09%)(29) and the result was in agreement with the reports from developing countries(5). Even so maternal death is rare event; the results from this two studies show that it was huge. The reason may be due to both studies were on a more critical obstetrics patients admitted to ICU and mortality in ICU rather than hospital patients and hospital mortality, in addition both study area are in 3rd world countries in which MMR is high.

This study found that obstetrics age (≥35) years are 4 times higher mortality when compared to maternal age less than 35 years. It was consistent with the study done in France on 11 European countries by Wildman(14), and a case control study done by Diana in Indonesia(13). In one study increasing parity was significantly associated with maternal mortality in ICU (59.5%)(30). However, in this study maternal mortality at ICU was not affected by parity. A possible justification may be a pregnant woman is usually young and less likely to suffer from chronic medical comorbidities, so that maternal age would be a confounding factor.

Obstetrics mothers who did not follow ANC during their pregnancy were 3 times more likely to die when compared to those who had ANC follow up. This finding is consistent with a case control study done on obstetric patients at Mizan-Tepi University, Ethiopia by Tegene Legese et al in 2016(31), another case control study by Knight in United kingdom in 2017(11) and other studies reported by different authors(25,27). So adequate ANC during pregnancy can reduce maternal mortality by early actions that can ensure a safe and uncomplicated delivery and this idea was supported by Katia M. S. Figueiredo et al (32).

This study result showed that obstetrics coexisting medical diseases were significantly associated with obstetrics mortality and it is consistent with a study done in United kingdom (AOR: 5.92; 95% CI: 3.56–9.86),(11) and also comparable to a case control study done in Malaysia(33).

Obstetrics patients admitted with peurpral sepsis were 4 times more likely to die compared to those who had no peurpral sepsis. In line with this, a study done in Brazil found that infection was responsible for nearly half (46.4%) of maternal deaths(34). The reason behind might be substandard set up, unavailability of highly broad spectrum antibiotics, delayed management, and poor maternal care. In addition to this being pregnant can increase a risk of infection due to immunosuppression, cesarean delivery, and retained placental tissue(35).

According to the study done by Global Network Maternal Newborn Health Registry from six low- and middle-income countries obstetric haemorrhage, pregnancy-related infection and pre-eclampsia/eclampsia were related with obstetrics causes of death(12). But, in this study obstetric haemorrhage was not significantly associated with obstetrics death, and these variations may probably be due to availability of blood and blood products in our study area. The study done in ICU of Sub Saharan Africa reported that limited supply of blood products and inadequate prenatal care were resulted in high maternal mortality(26). As presented in the result section, obstetrics patients admitted with severe pre-eclampsia were 6 times more likely to die compared to those who had no severe pre-eclampsia; this is due to the fact that severe pre-eclampsia may be complicated with pulmonary edema, loss of consciousness and pulmonary aspiration as well as acute kidney injury which needs hemodialysis and if not would result in death.

A cohort study carried out in the Medical Intensive Care Unit (MICU) of a tertiary care teaching hospital in India, showed that patients with GCS of ≤10 at the time of admission had significantly high mortality (85.3%) as compared with patients with GCS of more than 10 (9.1%)(30). The result was comparable to this study that severe GCS (<9) during admission was significantly associated with obstetrics mortality (OR 3.78) in Addis Ababa Public hospitals intensive care unit. The study done by Paternina-Caicedo et al(2017) in Colombia abnormal systolic blood pressure(OR 3.89), heart rate (OR 3.29), and temperature (OR 3.53) during intensive care unit admission were all significantly associated with maternal ICU mortality(21). In contrast, this study found that patients' vital sign during ICU admission were not associated with obstetrics mortality in intensive care unit. The reason may be due to variations in vital sign during pregnancy shows a disease process or due to physiologic changes of pregnancy and the later one does not affect the outcome.

Study done in Nigeria found that presence of organ failure during ICU admission was one of the factors associated with maternal death(24). However, result from this study does not show presence of organ failure during ICU admission as an attributable to obstetrics ICU mortality. The reason may be due to, inability to early diagnose organ failure before ICU admission, in our setup.

6.1 Strengths and Limitations of the Study

6.1.1 Strengths

This is the first case control study done on factors associated with obstetrics mortality in intensive care unit of Addis Ababa public hospitals, Ethiopia. As much as possible we try to make cases and controls homogenous by taking cases and controls from the same hospitals which are admitted nearest in terms of time. We conducted our research in a multi-center setting to ensure that our findings could be verified and that we had a sufficient sample size.

6.1.2 Limitations

Because the number of obstetrics patients admitted to the intensive care unit was small and matching was problematic, we did not use a matched case control study. As this study was limited to the intensive care unit, it does not reflect hospital mortality because there is a delivery room and in an emergency death of obstetrics patients. Only a few studies on parameters linked to obstetrics mothers critical care unit mortality had been reported.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

In conclusion, advanced maternal age, loss of antenatal care, peurpral sepsis, severe pre-eclampsia, pre-existing medical comorbidities, and severe GCS during ICU admission were the most significant factors associated with obstetrics mother's intensive care unit mortality. Despite the fact that this was not a country-based study, it did identify factors linked to obstetric mortality in the intensive care unit.

7.2. Recommendations

The following recommendations are forwarded based on the finding of this study

For stakeholders

- ✓ All mothers should get adequate antenatal care during pregnancy and this will help to early identifying any obstetrics complications and will get treated to reduce maternal mortality
- ✓ Pre pregnancy assessment should be under taken in order to early diagnose a preexisting medical comorbidities that would affect maternal outcome so that they can early treated or avoid pregnancy at all.

For Health Professionals

- ✓ Obstetrics patients diagnosed with peurpral sepsis and those with severe GCS should treated promptly as it was strongly associated with mortality.

For Researcher

It is better if further study with cohort study is conducted to determine whether this findings can be reproduced.

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Questionnaire

Addis Ababa University College of Health science department of Anesthesia

Data collection tools to assess factors associated with Obstetrics Mortality in Intensive Care Unit of Black Lion Hospital, Ghandi memorial Hospital and Yekatit 12 medical college Hospital in Addis Ababa Ethiopia, 2020/21.

My name is----------. I am one of the members of the research team in Addis Ababa University department of Anesthesia. The purpose of this questionnaire is to gather information on factors associated with Obstetrics Mortality in Intensive Care Unit. All information obtained will be kept confidential and we will not include a patients name or exact address. The study result will help to determine factors affecting obstetrics ICU Mortality in Addis Ababa Public Hospitals.

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Advisors name 1. Eyayelem Melesse (Assistant Professors in Anesthesia)

2. Sulieman Jemal (BSC, MSC, Lecturer of Anesthesia)

Name of sponsor – Addis Ababa University

Medical Registration N0:_____

Table 1.Maternal Sociodemographic factors and past medical history

Code no		
101	Age	

102	Parity and Gravida	A.Para----- B.Gravida------
103	Residence area	a. In AA b. Out of AA
104	ANC follow up	a. Yes b. yes but , interrupted c. no
105	Maternal Coexisting disease	a.yes b.no

Table 2. Determinants of obstetric mortality in ICUS' of selected Public Hospitals of Addis Ababa, Ethiopia.

106	Mode of delivery	a. SVD b. C/S
107	Admission diagnosis(multiple answers are possible)	a.Obstetricshaemmorhage b.Preeclampsia c. severe preeclampsia d..Peurpral Sepsis e. Organ failure f. anesthesia complications g.other
108	Patient Status During admission	A.GCS……. B.BP……. C.HR…… D.RR…… E. temprutre….. E.Oxygen Saturation……
109	Treatment given at ICU(Multiple answers can be possible)	A.Mechanical Ventilation B..Vasoprressor C. Anticougulant (Heparin or warfarin) D.Antihypertensive

		E.Magnsiumsulphate F.Blood Transfusions
110	Had the patient complications in ICU	a. Yes b. No
111	If your answer for questions no 113 is yes, what was the complication?	a. Pulmonary complications b. cardiovascular complication c. infections d. AKI e.DIC e.other(specify)…….
112	Durations of ICU Stay (in days)	……..
113	Outcome after ICU Care	a. Death b. Survived

Name of data collector signature Date----------

_____ _____

Name of supervisor(s) signature

_____ _____

Information sheet

This information sheet is prepared with the aim of explaining the research project.

Title: Factors Associated with Obstetrics Mortality in Intensive Care Unit of Addis Ababa Public Hospitals (A case control Study)

Name of Principal Investigator: Asaminew Tasew (BSC)

Name of advisors: 1.Eyayelem Melesse (Assistant Professor in anesthesia)

2. Suliman Jemal (BSC, MSC in Anesthesia)

Name of the Organization: Addis Ababa University, College of Medicine and Health Sciences, Department of Anesthesia

Name of the Sponsor: Addis Ababa University

Purpose of the Research Project

To assess factors associated with Obstetrics Mortality in Intensive Care Unit of Black Lion Hospital, Ghandi memorial Hospital and Yekatit 12 medical college Hospital

Incentive

There is no incentive or payment to be gained by taking part in this project. The information collected from this research project will be kept confidential and only accessed the researcher and research assistant only. This research project will be reviewed and approved by ethical committee of Addis Ababa University College of Health science.

Confidentiality

Except the principal investigator, no one will have access to the collected data, name or anything taken from your chart. The data will be kept coded and locked with no labeling specifying anyone participating in the research.

Whom to contact

This research project was received and approved by Ethical Committee of Addis Ababa University CHS, Department of Anesthesia.

If any question, contact any of the following individuals and may ask at any time wanted:

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Data safety assuring sheet

s.no	Tools Checked	yes	No	Data entry
1	Are the inclusion and exclusion criteria done appropriately	yes		

Data Accuracy check sheet

S.no	Tools	Yes	No
1	Are all questions on socio-demographic data filled appropriately	yes	
2	Are all data on admission diagnosis filled appropriately	yes	
3	Are all data during ICU treatment filled appropriately	yes	