

**PREVALENCE AND ASSOCIATED FACTORS OF POSTPARTUM HEMORRHAGE
IN MOTHERS WHO DELIVERED BYCESAREAN SECTIONAT SELECTED
HOSPITALS IN JIMMA ZONE,OROMIA REGION, SOUTHWESTERN ETHIOPIA.**



BY: ANDEBET ASMARE (MD, OBGYN FINAL YEAR RESIDENT)

**A PROPOSAL TO BE SUBMITTED TO, JIMMA UNIVERSITYINSTITUTE OF HEALTH,
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PREVALENCE AND ASSOCIATED FACTORS OF POSTPARTUM HEMORRHAGE IN
MOTHERS WHO DELIVERED BYCESAREAN SECTION AT SELECTED HOSPITALS IN
JIMMA ZONE, OROMIA REGION, SOUTH WESTERN ETHIOPIA.

ADVISORS:

1. TEKLE WAKJIRA (MD, ASSISTANT PROF. OF OBSTETRICS & GYNECOLOGY,
UROGYNECOLOGIST)
2. AFEWERKTADELE (MPH, PhD fellow)

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ABSTRACT

Background: Postpartum hemorrhage (PPH) is the leading direct cause of maternal mortality worldwide, responsible for more than a quarter of all maternal deaths. A third (32%) of all deaths following cesarean section is attributed to postpartum hemorrhage. Despite variations across studies and regions, excessive hemorrhage associated with cesarean section, occurs in more than 3-10% of cesarean sections. Only about one-third of PPH cases have identifiable risk factors suggesting that essentially every woman might be at risk. Overuse of CS worldwide and substandard care provision in low resource settings has, in turn, exacerbated incidence of post-operative complications such as bleeding, placental invasion anomalies, intra-abdominal adhesions. Importantly, 54-93% of maternal deaths from obstetric hemorrhage may be preventable.

Objective: To determine magnitude, identify associated factors and assess maternal outcomes of postpartum hemorrhage.

Methods: Facility-based cross-sectional study design was conducted at five purposefully selected hospitals in Jimma zone from December 09, 2020 to September 31, 2021: one referral and teaching hospital, three general hospitals and one primary hospital. Because there was no similar study done specifically on this topic, sample size was determined using epi Info version 7.1.1 with the following assumptions; Confidence level 95%, Margin of error 5%, and 50% proportion of mothers developing PPH at cesarean delivery was used. $n=384$. After adding 10% nonresponse rate the final sample size was $n=422$. Data was collected using a pretested structured questionnaire by clerking the patient and reviewing the patient's chart and asking the operating physician and IESO surgeon about vague documentations that will be filled by trained OR nurse. Data was coded and entered using Epi-data version 4.6 and analysis was carried out using SPSS 26.0 version computer software.

Results: The overall prevalence of PPH in mothers who delivered by cesarean section in this study was 18.2%. In the multivariable model, Hosmer–Lemeshow test, $P = 0.6$, mothers presented with APH [AOR=4.9; 95% CI(1.1, 21.8)], advanced stage of labor at decision [AOR=4.8; 95% CI(1.3, 17.8)] and difficulty in extracting fetal presenting part intra operatively [AOR= 22.8; 95% CI(8.19, 63.9)] were significant predictors of PPH during cesarean delivery. Uterine atony and uterine trauma/extension were the commonest causes of PPH during surgery in 42.9% and 35.1% of the deliveries respectively. Anemia, sepsis and shock secondary to bleeding were the most commonly identified morbidities that follow cesarean delivery.

Conclusion: The study shows postpartum hemorrhage in mothers who delivered by cesarean delivery is a quite common problem in the study area. Majority of the causes of PPH were avoidable with meticulous surgical technique and early recognition of risk factors and preparation to manage timely.

Recommendation: Knowledge and clinical skills in early decision making, surgical hemostasis techniques and stepwise medical and surgical management of PPH must be practiced especially in primary and general hospital setups. In addition, further large scale studies should be done both nationally and in Jimma zone to strengthen this study and design strategies.

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LIST OF ABBREVIATIONS

ACOG - American College of Obstetricians and Gynecologists

AMTSL – Active Management of Third stage of Labor

ANC – Antenatal care

APH –Antepartum Hemorrhage

ARDS – Acute Respiratory Distress Syndrome

ARI –Acute Kidney Injury

BEmOC–Basic Emergency Obstetric Care

BDACS-Bleeding During and After CS

BMI – Body Mass Index

CEmOC – ComprehensiveEmergency Obstetric Care

C/S orCD – Cesarean Section /cesarean delivery

CPD – Cephalo Pelvic Disproportion

DIC – Disseminated Intravascular Coagulation

EDHS - Ethiopian Demographic Health Survey

ETB – Ethiopian Birr

FHB – Fetal Heart Beat

HCT – Hematocrit

HgB - Hemoglobin

HTN – Hypertension

IESO – Integrated Emergency Surgical Officer

JMC – JimmaMedical Center

MMR – Maternal Mortality Rate

MAP – Morbidly Adherent Placenta

NCCEMD - National Committee for Confidential Enquiries into Maternal Deaths

PPH – PostpartumHemorrhage

SBA – Skilled Birth Attendant

SPSS- StatisticalPackage for Social Sciences

WHO – World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 BACK GROUND

The prevalence of cesarean section is rapidly growing in continuous way in both developed and developing countries without concomitant decrease in maternal morbidity and mortality rates. The risk of maternal mortality associated with Cesarean Section (CS) compared with Vaginal Delivery (VD) after exclusion of pre-existing morbidity was 4- 5 fold. (1) Maternal deaths following cesarean sections in low and middle income countries are 50-100 times higher than in high income countries. A third (32%) of all deaths following cesarean section is attributed to postpartum hemorrhage. (2)

Postpartum hemorrhage (PPH) is defined as blood loss ≥ 500 mL within 24 hours of vaginal birth and ≥ 1000 mL following a cesarean birth or any amount of vaginal bleeding following delivery that causes vital sign derangement or loss of 10% hemoglobin from the baseline. (3) Though, many professional societies have developed definitions with more clinical significance, there is no clear expert consensus yet. Postpartum morbidity is unusual with blood loss 500-999ml. Thus, American College of Obstetricians and Gynecologists (ACOG) updated their definition of postpartum hemorrhage in 2017 to be “blood loss greater than or equal to 1000 ml or blood loss accompanied by signs or symptoms of hypovolemia within 24 hours after birth regardless of the mode of delivery”. (4) The incidence of postpartum hemorrhage varies widely, depending upon the criteria used to diagnose the disorder.

Many studies have assessed the prevalence of postpartum hemorrhage, but the results are relatively different across studies and regions. Despite these variations, the global prevalence of postpartum hemorrhage is 6 %, which equates to nearly 14 million women annually. (5) Hemorrhage is the most common maternal morbidity after cesarean section worldwide accounting for 8.6%-13 %. (1) Where a definition of 1000 mL blood loss or hemodynamic instability requiring transfusion is used, a primary postpartum hemorrhage rate of 4.84% has been found at elective cesarean and 6.75% at emergency cesarean deliveries. (6) One systematic review in Ethiopia (Gedefaw et al. 2020, showed postpartum hemorrhage was the second most common maternal morbidity following CS next to post op febrile morbidity. (7)

The ability to predict postpartum hemorrhage from antepartum and intra partum risk factors is very low. Only about one-third of PPH cases have identifiable risk factors suggesting that essentially every woman might be at risk. (8)(9) Risk factors specifically associated with caesarean section include general anaesthesia as opposed to regional anaesthesia, pre-eclampsia, chorioamnionitis, prolonged labour, macrosomia, increased Body Mass Index (BMI), previous uterine scar, placenta praevia and placental abruption. The causes of excessive bleeding

at CD are uterine atony (commonly after prolonged labour), uterine trauma (excessive bleeding from uterine incision or additional tears laterally into the broad ligament or vertically down the lower segment) and placental site bleeding (associated with placenta praevia, previous cesarean delivery and/or morbidly adherent placenta).The importance of identifying risk factors early in pregnancy is that it allows women to be managed and delivered at the appropriate level of care.(10)

Importantly, 54-93% of maternal deaths from obstetric hemorrhage may be avoidable.(11)The most effective preventive measure is Active Management of Third Stage of Labor (AMTSL), which has been shown to reduce postpartum hemorrhage by 60% of cases, a significant reduction in postpartum anemia and the need for transfusion.(12)Uterotonics should be the first line treatment for postpartum hemorrhage caused by uterine atony. Surgical options included frequent use of uterine and hypogastric vessel ligation, B-Lynch compression sutures and hysterectomy, both at caesarean section and at second-look emergency laparotomy(10).It is recommended that conservative methods of treatment should be attempted before the radical decision for hemostatic hysterectomy, as a large number of cases (42-45%) can be resolved conservatively. (13)

Postpartum hemorrhage associated with caesarean section is a major cause of maternal morbidity globally and of maternal mortality in low- and middle-income countries.Shock, massive blood transfusion and intensive care unit admission, urological injury and the need for relook laparotomy, loss of uterus and puerperal infections are grave maternal morbidities that follow massive bleeding at caesarean section.(14)

1.2 STATEMENT OF THE PROBLEM

Though, World Health Organization (WHO) suggesting that cesarean delivery rate should not exceed 15%, recent multi-country cross-sectional study showed the 50th percentile for CS rate was 30% worldwide.(15) This explosion in CS worldwide has, in turn, exacerbated incidence of post-operative complications such as bleeding, placental invasion anomalies, intra-abdominal adhesions.(16) Globally, there are insufficient data on maternal deaths related to BDACS, especially in terms of clinical and surgical detail.

In low resource settings, while many women in need of cesarean sections still do not have access to CS, those who get the access undergo the procedure unnecessarily, for reasons which are not medically justified.(2) An increasing rate of cesarean delivery is thought to be the main cause of the rising numbers of deaths due to cesarean-related hemorrhage in South Africa.(17) There is also concern about a lack of surgical skills to manage women with severe bleeding during and after cesarean (10) One study in South Africa mentioned a shortage of skilled and specialist staff was one of the contributors for more than 60% of avoidable maternal deaths associated with bleeding during cesarean section. so, we can conclude that lack of good surgical skill and failure to follow standard surgical algorithms increases maternal morbidities and mortalities.(18)

The overall prevalence of Caesarean section in Ethiopia was 29.55 %.(7) The government policy in Ethiopia and South Africa encourages a medical officer who has completed the two-year internship can perform a caesarean section to improve access to caesarean section. However, even with these deficiencies corrected and with increased access, the ability to manage complications from caesarean section related hemorrhage remains a challenge. (18)

Ethiopia has made significant progress in maternal health care services include the increases institutional births, carry out BEmOC and CEmOC and avail skilled birth attendants. Despite this, PPH continues to remain the leading cause of maternal mortality in Ethiopia. According to some studies on cesarean section morbidity and mortality in Ethiopia, health system factors such as late diagnosis of the problem, lack of drugs, supplies and blood, delay in referral, shortage of staffs, mismanagement and sub optimal care have been highlighted as possible contributors to maternal morbidities from bleeding during and after cesarean section.(19)

Though, different studies have identified hemorrhage as leading cause of maternal death in Ethiopia, there is no study done to assess the impact of hemorrhage associated with cesarean section in this country. The primary objective of this study is to assess the magnitude, identify associated with risk factors, the causes and extent of morbidity and mortality of PPH associated with cesarean section at selected hospitals in Jimma zone.

1.3 SIGNIFICANCE OF THE STUDY

In general, the rationale of this study is to show the magnitude and identify factors associated with PPH during cesarean section at selected hospitals Jimma zone public hospitals and come up with possible recommendations based on the findings. In addition, the study helps

- To design evidence based preventive strategies and interventions based on specific factors and causes of PPH identified during cesarean section at different levels of hospitals in Jimma zone.
- To provide background evidence about the degree of the problem and its complications for the first time both nationally and in Jimma zone.
- To be an input for further studies that explore more about the topic in the future.

CHAPTER TWO: LITERATURE REVIEW

Globally, about 295 000 women died during and following pregnancy and childbirth in 2017. Direct causes account for nearly 75% of maternal deaths. Obstetric haemorrhage, especially postpartum hemorrhage (PPH) remains the leading single direct cause of maternal mortality worldwide, responsible for more than a quarter of all maternal deaths.(5) According to the 2014 WHO global estimates of causes of maternal death, about 27.1% of women die of haemorrhage worldwide. More than two thirds were due to postpartum haemorrhage.(20)

Cesarean section is the most frequent abdominal surgery performed in adults with an estimate of 20 million CS deliveries occurs each year in the world. The frequency of varies from 2 to 51% in Africa. Although a CS is an a lifesaving procedure when used appropriately, it is not free of risk and is associated with short- and long term complications.(21) Currently, haemorrhage during and after cesarean become a major cause of maternal mortality and morbidity as the rate of cesarean section is rising due to unnecessary operations attributable to maternal request, non-evidence-based indications, increasing maternal age and a decline in vaginal birth after caesarean delivery and vaginal breech delivery, increasing rates of fetal macrosomia and an increase in the number of women with pre-existing medical disorders.(22)

The increased national caesarean section rate in South Africa is considered to be the main contributing factor to the increasing number of maternal deaths from BDACS. The perioperative complications independently associated with maternal mortality in Africa are obstetric haemorrhage and anaesthesia complications. African countries need to improve both access to caesarean delivery and the safety of this procedure.(10,23)

One study in the United States put the overall PPH rate after cesarean section is about 10 %. Nonselective cesareans (6.75%) have greater risk of PPH than after elective cesarean (4.84%). Risk factors for PPH after an elective operation included leiomyomata, blood disorders, placenta previa, antepartum bleeding, preterm birth, and general anesthesia. Nonelective cesarean PPH risk factors included blood disorders, retained placenta, antepartum transfusion, antepartum/intrapartum hemorrhage, placenta previa, general anesthesia, and macrosomia.(6)

Another study in the United States, between 1994 and 2006, the rate of atonic PPH increased by 160% among women undergoing cesarean section after induction of labor and 130% among women undergoing non-induced cesarean section. This increase may be explained by the increasing rates of cesarean sections and associated complications caused by general anesthesia, operative techniques or complications such as placental abruption leading to an emergency cesarean section, but also due to an extensive use of uterotonics to induce or augment labour(24).

Identifying the risk factors of PPH helps to develop predictive rules and implement these rules into clinical practice to optimize the patient outcome. For high-risk patients awaiting elective CD, arrangements could be made for delivery in an obstetric center with the necessary staff and resources for providing effective PPH management. This difference in surgical setting may explain the lower risk of PPH in women undergoing elective compared with women having emergency operations. But this can be challenging because key differences exist in patient, obstetric, and intrapartum characteristics for women who undergo prelabor CD versus CD after onset of labor or induction of labor.(25)

One medical birth registry-based case control study in Norway showed that the overall prevalence of extensive blood loss (> 1,000 ml) after CD was 2.8%. The prevalence of severe blood loss was consistently higher in emergency (3.2%) than planned CD (1.9%). This is because emergency CD carries more risk factors for moderate and severe blood loss like failed induction of labor, labor arrest, placental abruption, chorioamnionitis and HELLP syndrome and advanced labor in addition to shared common risk factors (twin pregnancy, placenta previa, transverse lie, general anesthesia, and high birthweight).(26)

General anesthesia may itself directly influence the likelihood of severe blood loss. Volatile agents have a concentration-dependent inhibitory effect in vitro on uterine smooth muscle contractility, thereby increasing the likelihood of uterine atony.(27) Volatile agents (halothane, sevoflurane) and induction agents (propofol) can also inhibit platelet function in a dose-dependent manner.(28) The odds of PPH in women who had CS with general anesthesia were 8.15 times higher than for those who had CS with epidural anesthesia, after adjustment was made for the maternal and fetal characteristics.(29)

The first step of PPH management is to recognize that PPH is not a diagnosis, but a clinical sign of an underlying condition that, by itself, requires diagnosis. Determining the cause of PPH timely and early initiation of treatment is critical, as almost 90 percent of deaths due to PPH occur within four hours of giving birth. As with vaginal delivery, uterine atony is the predominant underlying cause of haemorrhage at caesarean section.(30) It accounts for 60-80% of cases, followed by retained placenta and injury to uterus. At caesarean delivery, hemorrhage due to lateral extension of the uterine incision can result from spontaneous tearing of an edematous lower segment after prolonged labor, from an incision made too low or not sufficiently curved on the lower segment, or from delivery of the fetus through an incision that is too small.(31)

In a retrospective study done in Romania, there were reported hemorrhagic complications after caesarean section (6.368% of caesarean sections), representing 53.81% of all postpartum hemorrhage. In this study, primary uterine atony represented 60.35% of post-caesarean bleeding which was higher than after vaginal birth (29.7%). About 39.43% of this required surgical treatment for hemostasis and preservation of the uterus was

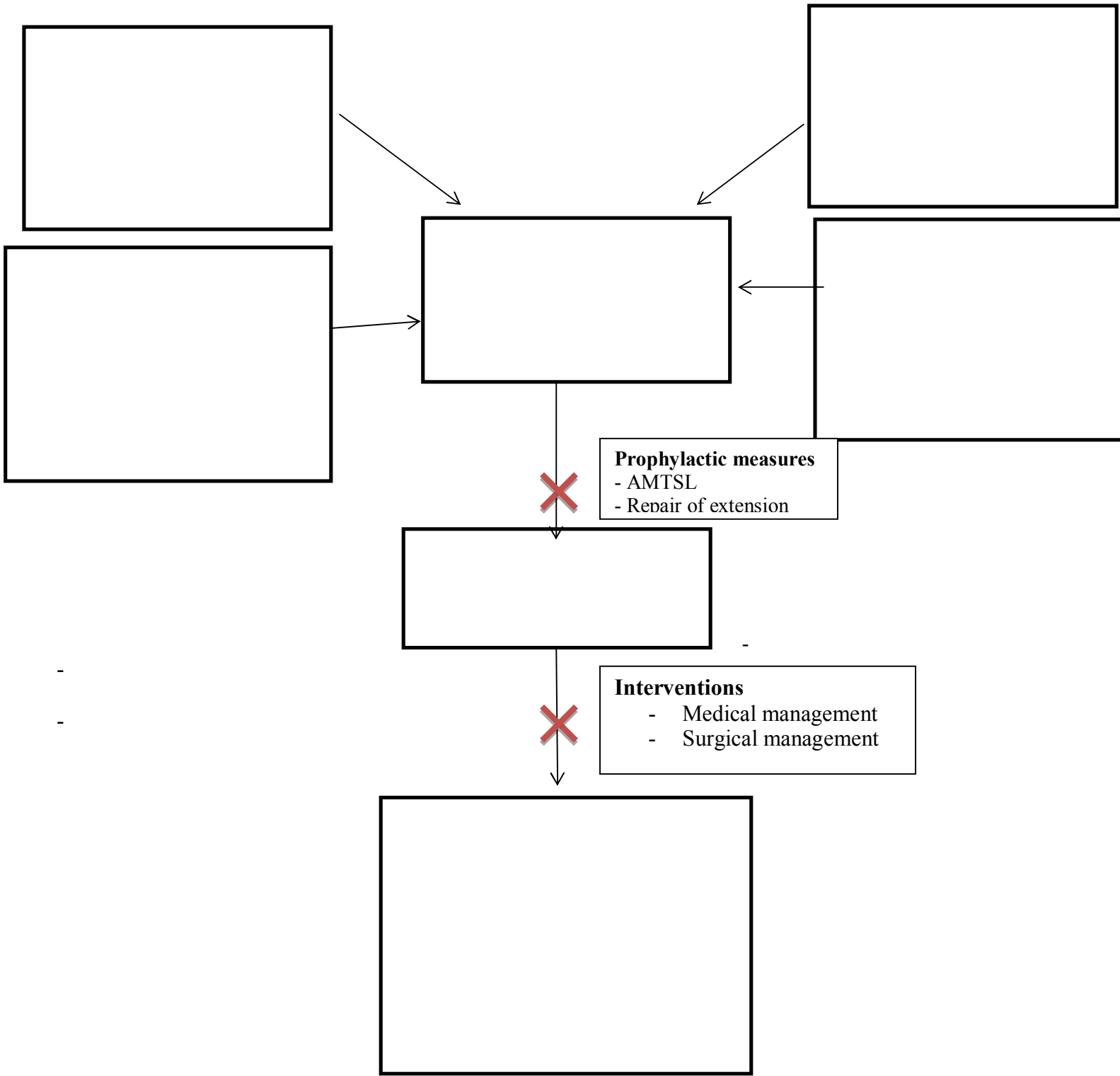
obtained in 42-45% of cases. Almost all (42%) of facilitated uterine conservation was achieved by uterine artery ligation. Therefore, it is recommended that conservative surgical methods of treatment should be attempted before the radical decision for hemostatic hysterectomy. The severity of intra-operative and postcesarean bleeding is due to its association to anesthetic risk, as well as to the associated pathology that indicated the caesarean section.(13).

One cross sectional study in South Africa shows maternal near-miss from BDACS is uncommon which is one in 216 caesarean sections, but severe enough to necessitate extensive life-saving interventions. In 76% of near-misses related to BDACS, the caesarean sections were noted by the surgeons as difficult, and early interventions were made intra-operatively. uterine atony is the most common cause of post-partum haemorrhage in this study, followed by placental site bleeding associated with placenta praevia/accrete.(14)

Unlike vaginal delivery, PPH after cesarean do not arise from an isolated event, but stem from multiple factors. The skill of the surgeon (operative time, type of incision), interventions to arrest intraoperative hemorrhage, the cause and site of the bleeding and type of anesthesia may affect the risk of bleeding in addition to the independent risk factor.(18)

The National Committee for Confidential Enquiries into Maternal Deaths (NCCEMD), which since 1998 has produced triennial reports of maternal deaths in South Africa, has identified the increasing rate of haemorrhage during and after caesarean section (CS) as a problem. In this report, severe bleeding during and/or after CS account for 28.7% of all haemorrhage-related maternal mortality in 2005 – 2007. In many cases, postoperative bleeding followed intra-operative problems with haemostasis, frequently due to an atonic uterus(41%) or uterine tears from a distended lower segment after difficult delivery of an impacted head(29%). In a few cases the bleeding originated from the placental bed, such as in placenta previa or previous CS, and in some surgery was difficult due to multiple adhesions. 59% of procedures were recorded as “difficult” by the operating surgeons. The report shows deaths were assessed as clearly avoidable in 85% of cases. Lack of and insufficient blood was a problem in 28%, and staff shortages, particularly for postoperative monitoring, were a factor in 15.5%. There was grossly substandard care in 60% of cases, including failure to secure haemostasis at the initial CS, non-use of potentially effective treatment such as parenteral ergometrine, uterine compression sutures and balloon tamponade, and delays in definitive management such as hysterectomy.(18) 27% of the cases had a hysterectomy, either at initial CS or at re-laparotomy. Of great concern is that 68% of the total group had no additional conservative surgical measures.(18)

2.1 CONCEPTUAL FRAME WORK



CHAPTER THREE: OBJECTIVES

3.1 GENERAL OBJECTIVE

- To determine the magnitude and associated factors of postpartum hemorrhage during cesarean delivery.

3.2 SPECIFIC OBJECTIVES

- To identify the causes and factors associated with postpartum hemorrhage during cesarean delivery.
- To assess the preventive and therapeutic measures taken for bleeding during and after cesarean delivery.
- To assess the maternal outcomes of postpartum hemorrhage during cesarean delivery.

CHAPTER FOUR: METHODOLOGY

4.1 STUDY SETTING AND PERIOD

An institution-based cross-sectional study was conducted at five purposefully selected hospitals in Jimma zone, Oromiya Regional State, Southwest Ethiopia, whose center is Jimma Town located 357 km from Addis Ababa.

The study was conducted from December 09, 2020 to September 30, 2021 at one referral and teaching hospital (Jimma University Medical center), two general hospitals (Agaro hospital and Shenan Gibe Hospital) and two primary hospitals (SekaChekorsa hospital and O/Nada Hospital).

Jimma University Medical Centre and Shenan Gibe hospital are located in Jimma town whereas, Seka hospital, Agaro hospital, and Omo nada hospital are located is 18 km, 45 km and 71 km respectively away from Jimma town. JUMC provide services for all clients from not only Jimma zone but also from nearby southern Ethiopia and Gambella region.

According to projection of 2007 population census, the zone has an estimated population of 3,261,371 in 2017. From these 49.9% were women and of these, 23.1% of women were women in the child bearing age (WCBA).

JMC Obstetrics and gynecology department has better resourced setting in terms of equipment and facilities that provide major surgeries including emergency and elective high risk pregnancies, urogynecology and gynecologic oncology surgeries. It has two functional operation tables for emergency and elective obstetric surgeries. JMC adult ICU has six beds and four machines with one machine secured for obstetrics and gynecology patients. Agaro hospital and SGH maternity and labor ward provide services to the level of emergency and elective caesarean deliveries including emergency hysterectomy. The services are delivered in two OR tables shared with surgery department. Agaro hospital had one ICU unit with one functional machine shared for all departments. Sekackekorsa and O/Nada hospitals provide emergency and caesarean deliveries with two OR tables shared with surgery department. SGH, sekachekorsa and O/Nada hospitals has no ICU service. JMC obstetrics and gynecology department staffed with 13 obstetrics and gynaecology specialists and sub specialists, 71 midwives and 53 residents of different years (levels) of study. At each General hospital there were 24-28 midwives and 2-3 Emergency surgical officers working at labour ward. There were 24-26 midwives and 1-2 Emergency surgical officers working at each of primarily hospitals.

4.2 STUDY DESIGN

A facilitybased cross-sectional study design wasconducted.

4.3 SOURCE POPULATION

All mothers who were undergone cesarean deliveryin selected public hospitals in Jimma zone during the study period.

4.4STUDY POPULATION

Systematically selected mothers whowere undergone cesarean delivery in selected public hospitals in Jimma zone

4.4.1 INCLUSION CRITERIA

All selected mothers who were undergone cesarean delivery at a given institution/hospitalin the given time periodexcluding those mothers referred from other health facility after surgery.

4.4.2 EXCLUSION CRITERIA

Those mothers treated for uterine rupture.

Mothers with PPH during cesarean section referred from other health facility after surgery.

4.5 SAMPLE SIZE AND SAMPLING METHOD

Because there was no similar study done specifically on this topic nationally, sample size was determined using epi Info version 7.1.1 with the following assumptions; Confidence level 95%, Margin of error 5%, and 50% proportion of mothers developing PPH at cesarean delivery was used. $n=384$.but, after adding 10% nonresponse rate the final sample size will be $n=422$.

Five hospitals with different levels were selected purposely. The total number of previous cesarean delivery performance in all selected hospitals was 2672 during the ten months period. The allocation of the study participants to each hospital was based on the previous 10 months deliveries (from previous hospital records).

From all hospitals, 422 participants were selected using a systematic sampling technique by taking the respondents every 6th interval using the total deliveries of all hospitals in ten months from hospital records (registration books)as a sampling frame.

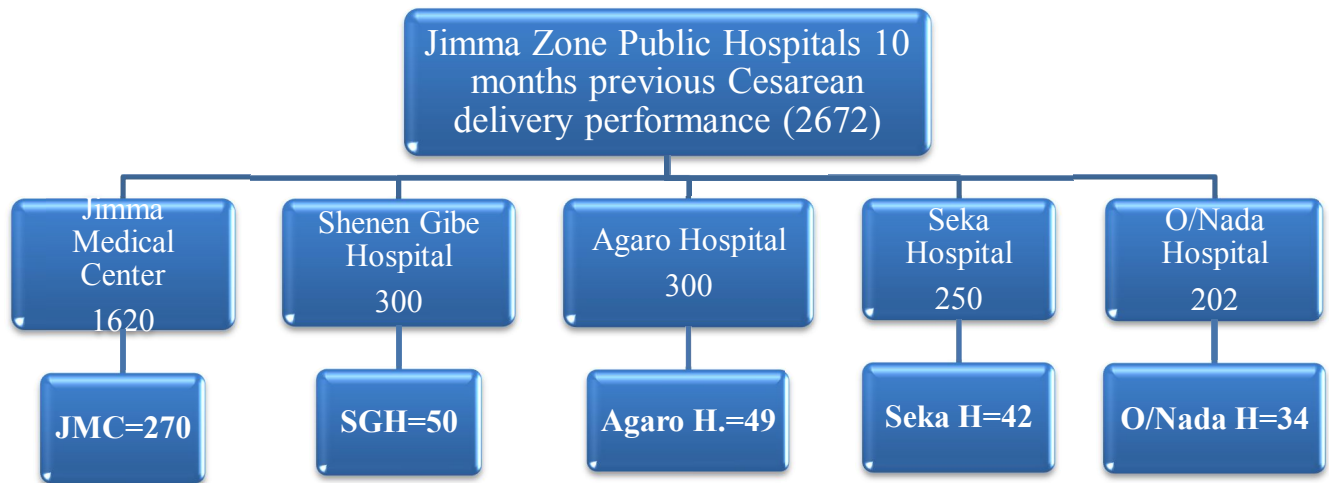


Figure 1: Cesarean delivery performance and distribution of sample sizes in selected Jimma zone public hospitals, 2020/2021

4.6 STUDY VARIABLES

4.6.1 INDEPENDENT VARIABLE

4.6.1.1 Sociodemographic variables

- Maternal age
- Marital status
- Residence
- Educational Status
- Occupation
- Monthly income

4.6.1.2 Obstetric variables

- Parity
- Gestational age
- ANC follow-up
- APH

- MultipleGestation
- HDP
- Pre partum anemia
- Previous history of PPH
- Previous CD

4.6.1.3 Intrapartum and intraoperative variables

- Onset of labor
- Intrapartum infection
- CD indication
- Birthweight
- Type of surgery
- Provider of surgery
- Type of anesthesia
- Cause of PPH
- Type of uterine incision
- Duration of surgery
- Blood transfusion

4.6.2 Dependent variable

- Postpartum hemorrhage

4.7 OPERATIONAL DEFINITION

PPH is defined as an excess of the normal bleeding estimated blood loss ≥ 1000 mL after cesarean delivery and ≥ 1500 mL after cesarean hysterectomy as estimated by the operating surgeon.

Or a drop in HCT by $> 10\%$ from the base line and derangement in hemodynamic status managed medically or surgically as PPH.

Severe PPH defined as an EBL ≥ 1500 mL after CD or red blood cell (RBC) transfusion during or within 48 hours after CD.

Aggressive fluid resuscitation- who receives bolus of fluid (≥ 3 L of crystalloids) within the first 30 minutes of identified bleeding.

Advanced stage of labor - mothers who are in the active first stage and second stage of labor.

Uterine trauma/extension- extensivetrauma or tear to the uterus, cervix or vagina other than the planned surgical incision

Difficulty extraction –extractionof fetal presenting partthatcause extensive trauma to the lower uterine segment, vagina,bladder, or fetal injurydue to either deeply impacted head,high station or malpresentationafter attempting standard maneuvers.

Induction- Artificial initiation of labor using uterotonics

4.8 DATA COLLECTION PROCEDURE

OR nurses were selected to collect data after getting proper training and orientation by principal investigator in how to record and fill data on written questionnaire. Data was collected using a pretested structured questionnaire by clerking the patient and reviewing the patient's chart and asking the operating physician and IESO surgeon about vague documentations and filled by properly trained OR nurse. The patient's chart was reviewed to retrieve important mothers' test results and missed information that could not be captured by the interview. The contents of the questionnaire include: Socio-demographic Characteristics, Obstetric events (antepartum, intraoperative and post-operative events)

4.9 DATA QUALITY ASSURANCE

The pretest was given 5% of samples in a study done on PPH at Bedele hospital and modifications made based on the patients' response. The data collection process and filled questionnaires was supervised and checked by a general practitioner (supervisor) for completeness. The English questionnaire was translated first to the local languages (Oroomifa and Amharic) and translated back into English language.

4.10 DATA ANALYSIS

Before entering a data, data cleaning was performed to check for accuracy, consistencies, and values. Data were coded and entered using Epi-data version 4.6 and exported to SPSS, version 26.0 software for analyses. Descriptive statistics such as proportions, percentages, ratios, frequency distributions and appropriate graphic presentation besides measures of central tendency were used for describing the data. The degree of association between independent, and dependent variables was assessed using odds ratio with 95% confidence interval. Variables with ($p < 0.05$) were analyzed by using multivariate logistic regression to control confounding effects. The P-value < 0.05 is considered as statistically significant. Potential candidate variables with VIF value up to 5 were taken for multivariate regression after checking for multi-collinearity between them.

4.11 ETHICAL CONSIDERATION AND DISSEMINATION

After permission is obtained from Jimma University Institute of health Ethical clearance board, formal letter was sent from Jimma University Medical Center and Jima zone health bureau to the respective medical directors of selected hospitals.

The result of the research will be presented and submitted to Jimma University, Department of Gynecology and Obstetrics. In addition, depending on the strength of the study findings, the outcome of the study will be disseminated to concerned body. Oral informed consents were obtained from respondents in order to perform data collection procedures. A questionnaire was anonymous which was kept the privacy and confidentiality of the participant.

CHAPTER FIVE: RESULTS

There were 2700 cesarean deliveries during the ten months of study period, from December 09, 2020 to September 30, 2021 at the selected public hospitals in Jimma zone. A total of 422 mothers were involved in this study making the response rate 100%. 1 in 5 mothers who underwent cesarean section developed PPH and 1 in 14 developed severe PPH that necessitates blood transfusion in this study.

5.1 Socio demographic characteristics

About 89.6% mothers were in the age group 20–34 years, with a mean age of 26.6 and a standard deviation of ± 4.7 years. The majority of mothers were married (420, 99.5%) and 218 (51.7%) of the mothers had at least completed primary school. 329 (78.0%) of mothers were housewives and 221 (52.4%) live in rural areas. More than half (254, 60.2%) of the mothers underwent cesarean delivery at a tertiary hospital.

Table 1: Socio-demographic characteristics of mothers who underwent cesarean delivery at selected Jimma zone public hospitals, Jimma, Southwest Ethiopia, 2021.

	Variables	Frequency(N=422)	Percent (100%)
Age group(in years)	<20	11	2.6
	20–34	378	89.6
	≥ 35	33	7.8
	Mean \pm S.D	26.6 \pm 4.7	
Marital status	Married	420	99.5
	Widowed	2	0.5
Educational Status	No formal education	204	48.3
	Completed 1–8	145	34.4
	High school and preparatory school completed	54	12.8
	Higher institution	19	4.5
Occupation	House wife	329	78.0
	Merchant	48	11.4
	Government employee	22	5.2
	Others	23	5.5
Residence	Urban	201	47.6
	Rural	221	52.4
Level of Hospital	Primary	76	18.0
	General	92	21.8
	Tertiary	254	60.2

5.2 Antepartum obstetrics characteristics

Regarding their parity, 297(70.4%) of mothers were multipara and 67(22.6%) of this were grand multipara. Majority 396 (93.8%) of mothers had a history of at least one ANC follow-up. Gestational age based on LNMP or early milestones was known in 265(62.7%) of the respondents. Of this, 33(7.8%) of them are preterm (<37weeks) and 28(6.6%) are post term (>=42weeks). The other 157(37.2%) of them has no known LNMP or early milestones. History of at least one previous cesarean section was reported by 102(24.2%) of the respondents but only 3(0.2%) of the mothers had three and above previous cesarean deliveries. 10(2.4%) of the respondents had encountered previous history of PPH. Pregnancy induced HTN is the leading complication encountered during the current pregnancy accounting 84(19.9%) of the respondents followed by antepartum hemorrhage in 76(18%) of the cases. AP and PP contributes 72(94.8 %) of APH. Only 26(34.2%) of APH cases develop PPH during cesarean delivery. The remaining 50(65.8%) of APH cases did not develop PPH intraoperative. Prepartum anemia was reported in 67(15.9%) of the respondents.

Table 2: Antepartum Obstetrics characteristics of mothers who underwent cesarean delivery at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

	Variables	Frequency (N=422)	Percent (100%)
parity	I	125	29.6
	II – IV	230	54.5
	>=V	67	15.9
Gestational Age(weeks)	<37	33	7.8
	37-42	204	48.3
	>=42	28	6.6
	Unknown(amenorrhea)	157	37.2
ANC follow up	Yes	396	93.8
	No	26	6.2
Place of ANC	Health center	208	49.3
	Hospital	164	38.9
	Private clinic	24	5.7
History of previous CD	Yes	102	24.2
	No	320	75.8
No of previous CDs	1	75	17.8
	2	24	5.7
	>=3	3	0.7
History of previous PPH	Yes	10	2.4
	No	412	97.6
Other previous uterine scar	Previous uterine repair	1	0.2
	Previous uterine curettage	5	1.2

No of Gestation	singleton	386	91.5	
	Multiple gestation	36	8.5	
Types of complication	Twin pregnancy	36	8.5	
	Fetal macrosomia	23	5.5	
	Diagnosed myoma	5	1.2	
	Pregnancy induced HTN	84	19.9	
	APH	yes	76	18.0
		No	346	82.0
	Type of APH	AP	38	9.0
		PP	34	8.1
others		4	0.9	
Pre-partum anemia	Yes	67	15.9	
	No	355	84.1	

5.3 Intra partum obstetrics characteristics

Majority 321 (76.1%) of the mothers had labor at the time of decision for cesarean delivery. During intra partum period, 257(60.9%) of the mothers had spontaneous onset of labor, whereas in the remaining 64(15.1%) of mothers labor started by induction. History of prolonged labor (>24hrs) is present in 34(8.1%) of mothers. The most common complication and indication for CD encountered during labor was labor abnormality due to CPD/OL in 140(33.2%) of the mothers followed by FHB abnormality in 82(19.4%) of the cases. Malpresentation and previous cesarean section are the next most common indications for CDs in 66(15.6%) and 62(14.7%) of mothers respectively. Chorioamnionitis complicates 38(11.8%) of laboring mothers. Failed induction or augmentation contributes for CD in 34(8.1%) the respondents.

23(5.5%) of mothers had birth outcome of fetal macrosomia, whereas majority 303(71.8%) of the birth outcome falls in the normal birth weight group.

Of the total study participants, 359(85.1%) of mothers underwent emergency cesarean delivery whereas the remaining 63(14.9%) of mothers underwent elective cesarean delivery. Among those mothers who developed PPH during surgery 72(93.5%) of the cases were in emergency operations whereas the remaining 5(6.5%) of cases were in elective surgeries.

Table 3: Intra partum obstetrics characteristics of mothers who underwent cesarean delivery at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

	Variables	Frequency(N=422)	Percent(100%)
Presence of labor	yes	321	76.1
	No	101	23.9
Type of intra partum complication	Prolonged Labor(>24hrs)	34	8.1
	Chorioamnionitis	38	9.0
	Labor abnormality	43	10.2
	Malpresentation	83	19.7
Onset of labor	Spontaneous	257	60.9
	labor induced/augmented	64	15.2
Stage of labor at decision	LFSOL	28	43.1
	AFSOL	22	33.8
	SSOL	15	23.1
Station at decision	Above ischial spine	38	58.5
	At ischial spine	13	20.0
	Below ischial spine	14	21.5
Indications of CD	FHB abnormality	82	19.4
	Malpresentation	66	15.6
	Failed induction/ Aug.	34	8.1
	APH	41	9.7
	Twin pregnancy	25	5.9
	Previuos CS scar	62	14.7
	Labor abnormality/OL/CPD	97	23.0
	Others	15	3.6
HCT at admission (%)	<21	–	–
	21-29	18	4.3
	30-32	49	11.6
	>=33	355	84.1
	Mean ± S.D	35.8 ± 3.5	
Birth weight(grams)	<2500	61	14.5
	2500-3999	303	71.8
	>=4000	23	5.5
Type of surgery	Emergency	359	85.1
	Elective	63	14.9

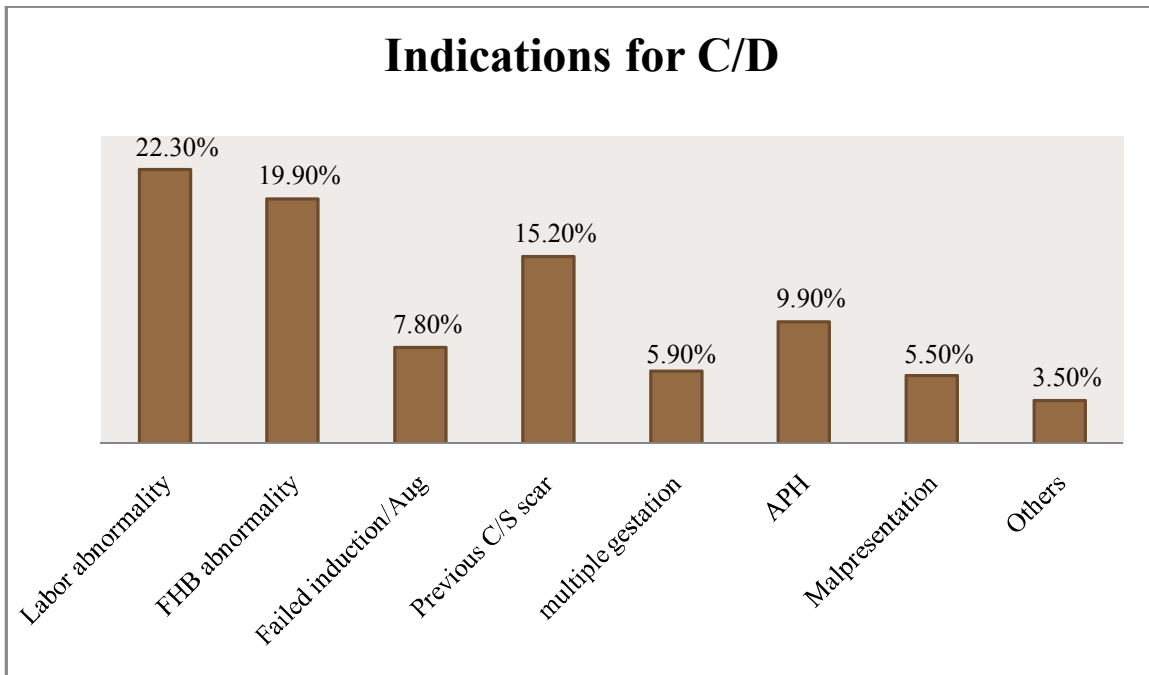


Figure 2: Distribution of indications of CD in mothers who underwent CD at selected Jimma zone public hospitals.

5.4 Intra operative characteristics

Majority 363(86.0%) of the mothers at all selected hospitals underwent cesarean delivery with spinal anesthesia, whereas in the remaining 59(14%) of mothers surgery was done with general anesthesia. Most of the cesarean deliveries with general anesthesia were performed in JMC in 26(6.2%) of mothers. Among all deliveries most 220(52.1%) of the surgeries were done by residents, followed by IESO surgeons in 159 (37.7) of mothers.

LUST is the most commonly performed type of uterine incision in all hospitals representing 415(98.3%) of the cases, followed by inverted T and classic incisions in 6(1.4%) and 1(0.2%) of the cases respectively. Majority 388(91.9%) of the surgeries took 25-60 minutes with a mean of 50.1 and SD of ± 31.0 minutes. 24(75%) of surgeries that lasts > 60 minutes were performed in general and primary hospitals. Among all mothers with previous uterine scar more than half 61(59.2%) of the current surgeries had adhesions.

Among all deliveries a difficulty in extracting the baby was encountered in 33(7.8%) of surgeries. Of this, 23(69.7%) of the cases are in primary and general hospitals. 23(69.7%) of the causes are malpresentation and deeply impacted head (station below 0). 26(79%) of difficult extractions occurred in those whose indication was labor abnormality(including CPD/OL) and malpresentation each representing 19(57.5%) and 7(21.2%) respectively. 27(81.8%) of the reported difficult extractions were associated with PPH and 7(27%) of them need blood transfusion and 3(11.5%) of them end up with hysterectomy.

A total of 77(18.2%) cases encountered PPH during and after cesarean delivery. Of this,27(6.4%) of the total PPH occurred in JMC. However, with regard to their delivery, JMC has the lowest contribution of PPH only in 10.7% of cesarean delivery of the same hospital. SGH and Sekachekorsahospital had the highest contribution of PPH in the same hospital accounting 34.8% and 33.3% of their total cesarean delivery respectively.

Uterine atony and uterine trauma/extension were the leading causes of PPH in all hospitals contributing 33(42.9%) and 27(35.1%) of the deliveries.Bleeding from PP/MAP is the third most common cause of PPH in 17(22.1%) of the deliveries. There were no reported cases of PPH associated with coagulopathy in all hospitals.

SekachekorsaandSGH hospitals had the highest number of uterine trauma/extension as a cause of PPH in their deliveries accounting for 46.2% and 43.8% of their cases respectively.Uterine atony was the most common cause of PPH among deliveries at JMC followed by bleeding from PP/MAP in 25.9% of the cases.

Table 4: Intra operative characteristics of mothers who underwent cesarean delivery at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

	Variables	JMC	SGH	Agaro	Seka	Nada	Total
Type of anesthesia	General	26(6.2%)	10(2.4%)	7(1.7%)	8(1.9%)	8(1.9%)	59(14.0%)
	Spinal	227(53.8%)	36(8.5%)	40(9.5%)	31(7.3%)	29(6.9%)	363(86.0%)
Surgical provider	Specialist	33(7.8%)	–	10(2.4%)	–	–	43(10.2%)
	Resident	220(52.1%)	–	–	–	–	220(52.1%)
	IESO surgeon	–	46(10.9%)	37(8.8%)	39(9.2%)	37(8.8%)	159(37.7%)
Type of uterine incision	classic	–	1(0.2%)	–	–	–	1(0.2%)
	LUST	253(60.0%)	44(10.4%)	45(10.7%)	37(8.8%)	36(8.5%)	415(98.3%)
	Inverted T	–	1(0.2%)	2(0.5%)	2(0.5%)	1(0.2%)	6(1.4%)
Duration of surgery(in minutes)	<25	1(0.2%)	–	–	–	1(0.2%)	2(0.5%)
	25-60	244(57.8%)	40(9.5%)	41(9.7%)	33(7.8%)	30(7.1%)	388(91.9%)
	>60	8(1.9%)	6(1.4%)	6(1.4%)	6(1.4%)	6(1.4%)	32(7.6%)
	Mean±S.D	50.1 ±31.0					
Adhesion	yes	35(8.3%)	8(1.9%)	5(1.2%)	5(1.2%)	8(1.9%)	61(14.5%)
	no	218(51.7%)	38(9.0%)	42(10.0%)	34(8.1%)	29(6.9%)	361(85.5%)
Difficulty in	yes	10(2.4%)	7(1.7%)	6(1.4%)	6(1.4%)	4(0.9%)	33(7.8%)
	no	243(57.6%)	39(9.2%)	41(9.7%)	33(7.8%)	33(7.8%)	389(92.2%)

extracting the baby							
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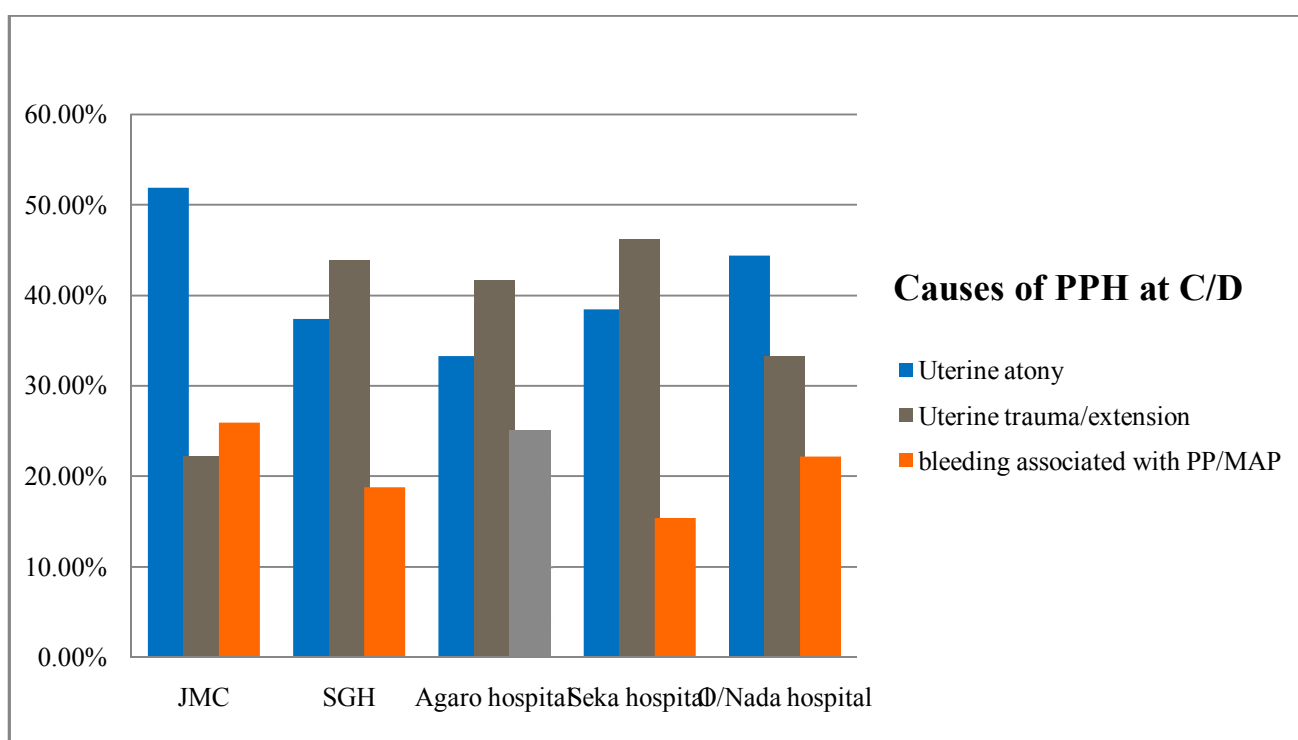


Figure 3: Distribution of causes of PPH during and after cesarean delivery in mothers who gave birth by cesarean section in selected Jmma zone public Hospitals

5.5 Interventions

All mothers who developed PPH during surgery require at least one method of medical intervention. Aggressive fluid resuscitation was the first line medical intervention provided for all PPH cases. 52 (67.5%) of mothers who developed PPH require at least one type of uterotonic agent. Blood transfusion with at least one unit was instituted for 28(36.4%) of PPH cases. Of this, 14(50%) of them received more than three units of

blood.6(7.8%) of the cases need inotropes as a medical management.45(58.4%) of the mothers who experienced PPH during surgery has received at least one type of surgical intervention. Repair of the extension is the most common surgical intervention performed to stop the bleeding accounting 27(35.1%) of PPH cases. Artery ligation and compression sutures were performed in 10(13%) and 8(10.5%) of mothers respectively.

Hysterectomy was performed in 12(15.6%)of the mothers. Of this, 4(5.2%) of the cases were relaparotomy for PPH after cesarean delivery.In another 4(5.2%) of cases, hysterectomy (cesarean) was done for bleeding related with PP/MAP.

Table 5:Distribution of mothers with PPH during and after cesarean delivery based upon type of interventions at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

Type of intervention for PPH		JMC	SGH	Agaro	Seka	O/Nada	Total
A need for medical management		27(35%)	16(20.8)	12(15.6)	13(16.9)	9(11.7)	77(100%)
Aggressive fluid resuscitation in 30 min		27(35%)	16(20.3%)	12(15.2%)	13(16.9%)	9(11.4%)	76(100%)
Uterotonics (Oxytocics, Misoprostol), Ergots		15(19.5%)	14(18.2%)	9(11.7%)	8(10.4%)	6(7.8%)	52(67.5%)
Inotropes		1(1.3%)	3(3.9%)	1(1.3%)	–	1(1.3%)	6(7.8%)
Blood products transfusion		9(11.7%)	8(10.4%)	5(6.5%)	3(3.9%)	3(3.9%)	28(36.4%)
No of units of blood products	<3	5(6.5%)	4(5.2%)	2(2.6%)	2(2.6%)	1(1.3%)	14(18.2%)
	>=3	4(5.2%)	4(5.2%)	3(3.9%)	1(1.3%)	2(2.6%)	14(18.2%)
A need for surgical management		12(15.6%)	11(14.3)	7(9.1%)	8(10.4%)	7(9.1%)	45(58.4%)
Repair of extension		6(7.8%)	8(10.4%)	5(6.5%)	5(6.5%)	3(3.9%)	27(35.1%)
Artery ligation		3(3.9%)	2(2.6%)	2(2.6%)	2(2.6%)	1(1.3%)	10(13.0%)
Uterine compression sutures		2(2.6%)	2(2.6%)	2(2.6%)	1(1.3%)	1(1.3%)	8(10.4%)
Hysterectomy		4(5.2%)	3(3.9%)	2(2.6%)	1(1.3%)	2(2.6%)	12(15.6%)
Relaparotomy		1(1.3%)	1(1.3%)	1(1.3%)	–	1(1.3%)	4(5.2%)
Management of MAP	Enbloc resection and repair	–	1(1.3%)	–	–	–	1(1.3%)

	Cesarean Hysterectomy	3(3.9%)	–	–	–	1(1.3%)	4(5.2%)
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5.6 Post-operative complications

Among all the respondents who underwent cesarean deliveries, 219(51.9%) of them had at least one of the listed morbidities. Anemia followed by sepsis were the most common morbidities identified after surgery accounting 157(37.2%) and 112(26.5%) of the cases. However, only 73(17.3%) of anemia and 36(8.5%) of sepsis cases were related with PPH. DIC complicates 18(4.3%) of the deliveries and 10(2.3%) of the cases were related with PPH. 6(1.4%) of the mothers admitted to ICU.3 (0.7%) were related with PPH. Maternal death complicates only one mother which was unrelated with PPH.

Table 6: Distribution of mothers with PPH during and after cesarean delivery based on the outcomes/complications at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

		JMC	SGH	Agaro	Seka	O/Nada	Total
Complications	count	124	26	24	22	23	219
	% within Hospital name	49.0%	56.5%	51.1%	56.4%	62.2%	51.9%
	% of Total	29.4%	6.2%	5.7%	5.2%	5.5%	51.9%
Vital sign deranged		24(5.5%)	16(3.8%)	12(2.8%)	13(3.1%)	10(2.4%)	75(17.8%)
Anemia		75(17.8%)	22(5.2%)	20(4.7%)	20(4.7%)	20(4.7%)	157(37.2%)
DIC		10(2.4%)	4(0.9%)	1(0.2%)	2(0.5%)	1(0.2%)	18(4.3%)
AKI		4(1.0%)	1(0.2%)	–	–	2(0.5%)	7(1.7%)
Sepsis		68(16.1%)	13(3.1%)	11(2.6%)	11(2.6%)	9(2.1%)	112(26.5%)
ICU admission		4(0.9%)	–	2(0.5%)	–	–	6(1.4%)
Viseral injury		–	–	–	–	1(0.2%)	1(0.2%)
Maternal death		1(0.2%)	–	–	–	–	1(0.2%)

5.7 Factors associated with PPH during cesarean section

APH, previous history of uterine curettage and type of surgery were antepartum obstetric variables which had statistically significant association with PPH during cesarean delivery with p value < 0.05. Prolonged labor, stage of labor at decision, station at decision, indication of CD and HCT at admission were intra-partum variables which had statistically significant association with PPH during cesarean delivery. In addition, level of hospital, type of anesthesia, provider of surgery, difficult extraction of the baby during cesarean section and length of surgery were intraoperative variables that had significant association with PPH. In multivariable logistic regression analysis, using Hosmer–Lemeshow test, P = 0.6

factors independently associated with PPH during cesarean section were APH [AOR=4.9;95% CI(1.1,21.8)], AFSOL at decision [AOR=4.8;95% CI(1.3,17.8) ;ref =LFSOL] and difficult extraction of the baby [AOR= 22.8;95% CI(8.19,63.9)]. Mothers who underwent cesarean delivery with GA were 80% more protective of developing PPH as compared SA. [AOR= 0.19; 95% CI (0.06, 0.6)].

Table 7: Association of maternal Obstetric characteristics and PPH during and after cesarean delivery among mothers who gave birth by cesarean delivery at selected Jimma zone public hospitals, Jimma ,Southwest Ethiopia, 2021.

	Variables	PPH		P value	COR(95% CI)	AOR(95% CI)
		Yes	No			
Residence	Urban	26	175	Ref	1	1
	Rural	51	170	0.180	0.5(0.30,0.83)	2.1(0.71,6.01)
APH		26	50	0.000	3.0(1.72,5.26)	4.9(1.1,21.8)**
Gestational Age(weeks)	<37	7	26	Ref	1	1
	37-42	32	172	0.284	1.1(0.44,2.76)	2.5(0.48,12.55)
	>=42	2	26	0.681	1.6(0.94,2.72)	1.8(0.12,26.14)
	Unknown(amenorrhea)	36	12	0.158	3.9(0.87,17.08)	3.2(0.64,15.50)
Previous history of uterine curettage		3	2	0.427	6.9(1.14,42.3)	2.9(0.21,41.51)
Prolonged labor(>24 hrs)		15	19	0.78	3.8(1.81,7.99)	1.2(0.27,5.65)
Stage of labor at decision	LFSOL	28	145	Ref	1	1
	AFSOL	22	89	0.033	2.1(1.44,6.62)	4.8(2.21,20.42) ***^
	SSOL	15	24	0.155	0.3(0.14,0.66)	0.2(0.02,1.82)
Station at decision	Above ischial spine	38	188	Ref	1	1
	At ischial spine	13	61	0.430	0.9(0.47,1.90)	2.1(0.32,14.15)
	Below ischial spine	14	9	0.580	0.1(.05,0.32)	2.3(0.12,43.71)
Indications of CD	FHB abnormality	11	73	Ref	1	1
	Malpresentation	8	57	0.788	0.5(0.14,2.20)	0.7(0.07,7.76)
	Failed induction/ Augmentation	3	30	0.979	0.5(0.13,1.94)	1.0(0.09,9.57)
	APH	18	24	0.970	0.8(0.15,4.09)	1.0(0.02,19.82)
	Twin pregnancy	2	23	0.270	0.1(0.03,0.38)	0.2(0.02,3.08)
	Previous CS scar	8	56	0.517	0.9(0.14,5.70)	4.7(0.04,494.3)
	Labor abnormality	25	69	0.340	0.5(0.13,2.16)	0.3(0.02,3.62)

	/OL/CPD					
	Others	2	13	0.935	0.1(0.03,0.38)	0.24(0.02,2.81)
HCT at admission (%)	21-29	7	11	0.25	0.3(0.11,.81)	0.1(0.02,0.78)
	30-32	13	36	0.499	0.5(0.26,1.06)	0.6(0.16,2.44)
	>=33	57	298	Ref	1	1
Type of surgery	Emergency	72	287	0.825	2.9(1.12,67.5)	1.12(0.26,5.36)
	Elective	5	58	Ref	1	1
Level of hospital	Primary	22	55	0.342	0.3(0.16,0.57)	0.6(0.23,1.6)
	General	28	64	0.11	0.3(0.15,0.50)	0.3(0.12,0.76)
	Tertiary	27	226	Ref	1	1
Type of anesthesia	General	33	32	0.005	0.12(0.1,0.24)	0.19(0.06,0.62)
	Spinal	44	313	Ref	1	1
Difficult extraction of baby		27	6	0.000	30.5(12.0,77.5)	22.8(8.19,63.9)* *^
Provider of surgery	Specialist	5	38	Ref	1	1
	Resident	23	198	0.000	0.391	3.5(0.20,61.46)
	IESO surgeon	49	109	0.812	1.1(0.41,3.17)	0.29(0.12,0.81)

**= p < 0.05

^ = using Forward LR

COR: Crude odd ratio

AOR: Adjusted odd ratio

CHAPTER SIX: DISCUSSION

The overall prevalence rate of postpartum hemorrhage during cesarean section in this study was 18.2%. This was higher than studies done in other areas like United States which was 11.5%, Norway that was 2.8 % and a retrospective study in Romania in 6.4 % of caesarean sections. This greater magnitude could be explained by a variation in definition and estimation of blood loss across countries and regions, differences in study design and ineffectiveness of the national strategies for maternal health care services in low resource settings. The other possible explanation could be this study was done in different levels of hospitals with different expertise in performing the surgery whereas the above mentioned studies were done in well-equipped tertiary set ups. For example, the figure of PPH in the tertiary hospital in same study showed 10.7% which was nearly similar to a prospective observational study done in France which was 11.6% using a definition of blood loss >1000ML and United states.(6,26,32)

The study showed that mothers who presented with antepartum hemorrhage were 5 times at high risk of developing postpartum hemorrhage during and after cesarean delivery than those who had no complaint of antepartum hemorrhage. This finding was almost found to be a universal fact that mothers who had abruptio placenta and placenta previa are at a greater risk of developing uterine atony and MAP complications respectively during intraoperative period. Similar findings were also reported from case control studies done in United States and Norway and Japan.(6,26,34)

In this study, 93.5% of PPH during cesarean section occurred in mothers who underwent emergency surgeries as compared to only 6.5% in elective surgeries but emergency CD was not a predictor of PPH. This could be explained with the study was not a case control comparing the two groups. Unlike this, case control studies done in United States, Norway and Denmark showed emergency cesarean delivery was a significant predictor PPH as compared to elective cesarean delivery.(6,34,35)

Among the intra partum factors, advanced stage of labor is the only factor that independently predicts the development of PPH. Mothers in the AFSOL at decision were about five times more likely to develop PPH during cesarean section than mothers who were in the latent phase of labor. This is because of extraction of the baby at advanced labor is technically more complicated due to deeply impacted position of the leading part of the fetus and the lower cervical segment is thinner and more fragile, which increase the risk for lacerations followed by bleeding. But in this study, AFSOL was solely a predictor of PPH because the numbers of cases in AFSOL outweigh those in SSOL. This report was in line with T. Kolås et al. in Norway, where cervical dilatation at 2-8 and 9-10 cm was 1.3 and 3.2 times respectively more likely to develop PPH during cesarean section than those whose cervical dilatation is < 2cm.(32)

General anesthesia may itself directly influence the likelihood of severe blood loss. Volatile agents such as halothane, sevoflurane have a concentration-dependent inhibitory effect on uterine smooth muscle contractility, thereby increasing the likelihood of uterine atony(27) Volatile agents and induction agents (such as propofol) can also inhibit platelet function

in a dose-dependent manner. (28). In our study, patients who undergone cesarean section with GA were 80 % less likely to develop PPH than those whose surgery was done with spinal/epidural anesthesia that contradicts the findings Taiwan with the odds of 8.15 times and Egypt with odds of 3.5 higher risk of PPH with GA than spinal/epidural anesthesia. This could be due to large number of mothers whose surgery done with spinal anesthesia than GA involved in the study.(not a case control study).(27–29,37)

Of the intraoperative factors, a difficulty in extracting the baby was the most predominant factor which strongly predicts the development of PPH during CS in this study. Surgeries done with difficult extraction were 22 times more likely to develop PPH than those surgeries done without a difficulty in extraction of the baby.79% of difficult extractions occurred in those women whose indication was labor abnormality(including CPD/OL) and malpresentation each representing 57.5% and 21.2%respectively. 69.7% of difficult extractions were reported in surgeries made by IESO surgeons whereas 27.3% and 3.0% of them were reported in surgeries made by residents and specialists respectively.The competency of surgeon has significant association with PPH but not a predictor of PPH this could be due to the effect of other confounding variables.81.8% of the reported difficult extractions were associated with PPH and 27% of them need blood transfusion and 11.5% of them end up with hysterectomy.In this study, it could be due to lack of clinical knowledge, poor techniques of extraction and experience and a rush in performing the procedure. This was an isolated finding in this study and it is not reportable in other studies.

Uterine atony was the most common causes of PPH during cesarean section in this study accounting for 42.9% deliveries .This is line with the study done in Romania and South Africa where atonic uterus was the main cause of bleeding in 60.35% and 41% of the cases respectively.Uterine trauma or extension is the second most common cause of PPH in this study representing 29% of the cases.77.7% of uterine trauma/extension as a cause of PPH was performed in primary and general hospitals. Sekachekorsa and SGH hospitals had the highest number of uterine trauma/extension as a cause of PPH in their deliveries accounting for 46.2% and 43.8% of their cases respectively. This contradicted the study of Romania where only 0.9% of cases of uterine trauma cases were associated with PPH. Even it was different from result of the tertiary hospital in this study where uterine atony and bleeding from PP/MAP were the leading causes of PPH.This could probably be explained because of most surgeries in this set ups were done by limited skilled professionals. (10,13,18)

In this study, almost all of the mothers who experienced PPH during CDs had received at least one type of medical management and about 58% of mothers received at least one type of surgical intervention for hemostasis in addition to medical management. This was higher than the figure mentioned in Romania in which only 39.4% of mothers require surgical management for hemostasis. But the type of intervention was different between the two studies. In our study repair of extension was the leading surgical intervention in 35%of the cases followed by hysterectomy and artery ligation in 15.6% and 10.4% of the cases. But in the study done in Romania, Uterine artery ligation was the most common surgical intervention in 38.7% of cases followed by hysterectomy in 16% of the cases. But the procedures were overlapping. This difference between the two studies was due to difference in the causes of PPH intra operatively.(13)

In this study 6(46.2%) of PPH due to uterine atony cases had hysterectomy which showed low rate of conservative medical and surgical managements as compared to WHO report and systematic review done in UK conservative management of uterine atony was successful in more than 90% of cases. This could be due to technical difficulty in performing conservative surgeries or difference in setups as de vascularization, balloontemponade and advanced procedures like hypogastric artery ligation were absent in this study. 4(33%) of hysterectomies in our studies were done after cesarean section was performed due to a failure of hemostasis. Of this, 3(25%) of them were done in primary and general hospitals. This can be due to gap in surgical technique to secure hemostasis and poor monitoring and early detection of signs of bleeding in immediate post op period in this set ups.(9)(13)

Finally, this study revealed that more than half of the surgeries were associated with at least one of the listed adverse outcomes. Of this, anemia, sepsis, shock secondary to bleeding and loss of uterus were the most commonly identified morbidities that follow cesarean delivery. This is similar with Karlstrom et al study where severe anemia, shock, febrile morbidity and long hospital stay are commonest maternal morbidities reported.(38)

Among this loss of uterus is the gravest complication that follows PPH in this study. 15.6 % of PPH cases in this report had hysterectomies which was higher than the figures mentioned by T. Bergholt et al in 3.9% and by Shellhaas et al which was 0.5%, but lower than study by Seligman et al. which was 18% in which the study involves only patients with severe PPH(blood loss>1500ML). 67% of hysterectomies were performed by primary and general hospitals. Abnormal placentation was the the commonest indications of peripartum hysterectomy in the above studies in 71% of Shellhaas et al study and 50% Seligman et al study which is different from our study where uterine atony (50%) was the commonest indication. This is mainly explained by the increasing rates of cesarean deliveries and more successful management of uterine atony with uterotonic agents, embolisation, and surgical procedures as the B Lynch technique in developed countries but there are still concerns in management of uterine atony despite similar rate of rise in cesarean sections in developing countries like in our setup.(39–41)

The strength of this study was involvement of different levels of institution may provide a balanced and alarming figure for the upcoming further studies and design interventions to mitigate avoidable causes of PPH during cesarean delivery.

The limitation of the present study was involvement small number of patients in the study which makes the comparison with the reference studies more difficult to conclude that the represented population has been studied sufficiently. In addition, there were no reference studies in this country specifically on PPH during cesarean section which may bias the study with regard to geographic distribution.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

CONCLUSION

Generally, overall prevalence of PPH during and after cesarean delivery in this set up is 18.2 % which is very alarming figure. Prolonged labor, station below the ischial spine at decision, labor abnormality as an indication for CS and emergency cesarean deliveries were risk factors associated with PPH during surgery. However APH, advanced stage of labor and difficulty in extracting the fetal presenting part were the most predictors of developing PPH during cesarean delivery. The two most common causes of PPH during cesarean delivery were uterine atony followed by uterine trauma/extension. So, this shows majority of the causes are avoidable through good surgical technique and early recognition of risk factors and preparation to manage conservatively.

The high figures of uterine extension/trauma as cause of PPH and high odds ratio of difficult extraction in primary and general hospitals indicate that lack of good surgical techniques were the main contributing factor for high incidence of PPH during cesarean section in this setups which was not a finding in other studies.

In this study, anemia, sepsis and risk of hysterectomy were most identified complications during and after cesarean delivery.

RECOMMENDATIONS

Knowledge and clinical skills in early decision making, surgical hemostasis techniques and stepwise medical and surgical management of PPH must be the area of focus in designing strategy especially in primary and general hospital setups.

Early recognition of strong risk factors like APH in our study and preparation and early referral of morbidly adherent placenta cases to the respective level of hospital must be a trend in all hospital setups.

Reducing cesarean delivery rates should be part of the national policy as most studies done in this country showed CD rates were far higher than the WHO recommendations.

Using this study as input for further large scale studies should be done both nationally and in Jimma zone

Strength of this study

Involvement of different levels of institution may provide a balanced figure for the upcoming further studies and design interventions

Limitations of the study

Involvement small number of patients in the study in primary and general hospitals makes difficult to conclude that the represented population has been studied sufficiently.

Lack of reference studies in this country specifically on PPH during cesarean section which may bias the study with regard to geographic distribution.

Inadequate budget allocation

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ANNEX 1: QUESTIONNAIRE

Individual consent form

Hello my name is----- I am currently members of data collector and part of this research work team at JMC .The research will assess the magnitude and risk factors of PPH during and after cesarean section in pregnant women having cesarean delivery at five selected hospitals in Jimma Zone, Oromia region, south western Ethiopia. Participants should be volunteer to participate in this study .The study doesn't cause any harm .Also I would like to assure about the confidentiality of your information .The information will be used only for this research and you have the right to reject ,to participate at any time during interview.

The information you give as is very important for successful completion of this study and for health policy makers as well.

Are you willing to participate in this study? Tick one

Agree-----don't agree----- thank you

If they didn't agree don't force people to participate in this study

Interviewers name-----date-----signature-----

Supervisor name-----date -----signature-----

Collected data (tick one): Complete----- Incomplete-----Other specify-----

Case code number ----- Name of Health facility -----

Card number -----

Part I: Socio-demographic characteristics

1. Age ----
2. Marital status a. Married b. Divorced c. Widowed
3. Educational Status a.No formal education b. Completed 1–8 c. High and preparatory completed d. Higher institution
4. Occupation a. House wife b. Merchant c. Government employee d. Others
5. Residence a) Urban b) Rural
6. Average monthly income in ETB a. <1000 b. 1000 –2000 c. 2001–3000 d. \geq 3000

Part II: Obstetric History

7. Parity-----
8. Gestational age (weeks) a. <37 b. 37-42 c. \geq 42 d. unknown
9. if unknown, mention month of amenorrhea.....
10. ANC (antenatal care)
 - a. yes b, no
 11. .if yes,i).where was the ANC follow up?
 - a.Health center b.hospital. c. health post
 - ii) Number of visits (contacts).....
12. History of previous C/S
 - a. yes b. no
13. If yes number of C/S.....
14. Do you have the following previous antepartum complications? (it is possible to mark more than one answer)
 - a. Myomectomy
 - b. PPH
 - c. still birth
 - d. uterine curettage
 - e. previous uterine repair

Part III: Ante partum Obstetric event

15. Does she have any of the following complications in the current pregnancy? (More than one answer is possible)

15a. Ante partum hemorrhage

i. If yes, which one?

a. Abruptio placenta b. Placenta Previa c. unknown

15b. Polyhydramnios

15c. diagnosed myoma

15d. Preeclampsia/eclampsia syndrome

16. Delivery characteristics

a. Singleton b. twins c. higher order

17. Hematocrit/Hemoglobin at admission-----

Part IV: Intra partum Obstetric event

18. Does she have any of the following labor complications? (More than one answer is possible)

a. Obstructed labor

b. Prolonged labor (>24 hrs)

c. Chorioamnionitis

19. Onset of labor.

a. Spontaneous b. induced

20. If spontaneous, is labor augmented

a. Yes b. no

21. Birth outcome

a. Live b. Still birth

22. Fetal weights (g)

a. <2500 b. 2500-3999 c. >=4000 d. Unknown

23. Indication of C/S (multiple answers possible)

- a. Labor abnormality
 - b. Malpresentation/malposition
 - i) if malpresentation which one?
 - a. breech b. transverse c. compound d. parietal bone e. face f. brow
 - c. FHB abnormality
 - d. failed induction
 - e. APH
 - f. multifetal gestation
 - g. previous C/S scar
 - h. OL/CPD
 - i. Others, Specify.....
24. Type of surgery
- a. emergency b. elective
25. Stage of labor at the time of decision,
- a. LFSOL .B AFSOL .c.SSOL
26. Position of the leading part (station)
- a. above the ischial spine b. at the ischial spine c. below the ischial spine
27. Is there a delay in management of this patient?
- a. yes b. no
28. If yes for the above question,
- i) What is the type of delay?
 - a. Delay 1 b. Delay 2. c. Delay 3. d. Delay 1&2 e. Delay 2&3 f. Delay 1,2&3
 - ii) What is the reason for each delay, specify.....
29. Level of hospital
- a. Primary hospital b. General hospital c. Private Hospital d. Tertiary Hospital

Part V: Intraoperative conditions

30. was there adhesion upon entering the abdomen?

a. Yes b. No

31. If yes for the above question,

i) How was entrance into uterus made? Specify.....

ii) What is the time between abdominal incision and uterine incision? (In minutes).....

32. Was the LUS well formed?

a. yes b. no

33. Was there a difficulty in extracting the baby?

a. yes b. no

34. If yes, what is the cause,

a. malpresentation b. too small incision c. big fetal head d. station too down (below 0) e. other specify.....

35. How was extraction effected?

a. pulling technique reverse breech extraction . Instrumental

36. Type of uterine incision

a. classic. b. LUST c. others, specify.....

37. If incision is other than LUSTC/S, what is the indication, Specify.....

38. Duration of surgery..... (In minutes/hours)

39. Type of anesthesia

a. General. b. Spinal

40. If general anesthesia, what is /are the drug/s.....

41. Provider of anesthesia

a. Anesthetist b. Resident c. Anesthesiologist

42. Provider of surgery

a. specialist b. resident c. IESO surgeon

43. Cause of PPH

a. uterine atony

b. uterine trauma/extension

c. bleeding associated with PP /MAP

44. If the cause of PPH is uterine trauma/Extension, What type?

a.lateral extension b. downward extension c. upward extension

45. Estimated blood loss (in ML)

46. Post-delivery Hct

Part VI: Management

I. Medical management

47. Maternal vital signs upon diagnosis of PPH

BP, PR..... RR.....O2 Sat.

48. Was the following medical management provided?(more than one answer is possible

a. Active management of the third stage of labor (AMTSL)?

b. Aggressive fluid for resuscitation in the first 30 minutes, if yes many bags of crystalloids?.....

c. uterotonics , if yes, which one?

i.Oxitocicsii.ergot alkaloids iii.PGs

49. Maternal vital signs after resuscitation

BP, PR..... RR.....O2 Sat.

50. Need for blood product transfusion

a. yes b. no

51. If yes, number of units and type of blood product

52. A need for inotropes?

a.yes b.no

53. Was the bleeding controlled?

a.yes b.no

II. Surgical management`

54. A need for surgical management

a. yes b.no

55. if yes, which one?(more than one answer is possible?)

i. Repair of extension

ii.Uterine compression suture, if yes which one?

a.B-lynch b.Hayman c. others,specify.....

iii.Artery ligation, if yes which one?

a.uterine artery b.internal iliac(Hypogastric) artery c. utero ovarian artery branches d. others.....

iv.Hysterectomy, If yes for the above question, what type?

a.TAHb.STAH.

56. Was there placenta previa intraoperatively? If yes,

i.Where is the bulk of placenta?

a. anterior b. posterior c.central

ii.If anterior how was the delivery made

a.cutting through the placenta b.cutting away from the placenta c.others, specify.....

iii.Was there bleeding from the placental bed?

a.yes b. no

iv) If yes, what was done to stop bleeding, specify.....

v) If not stopped, what was done? Specify.....

57. Was the placenta adherent?

a. yes b.no

58. If yes for the above question,

i) What type of adherence?

a. focal .b. complete

ii) How was it managed?

a.enbloc resection and repair. cesarean hysterectomy

Part VII: Postoperative Outcome

59. Maternal complication secondary to bleeding (multiple answers possible)

a. Shock (hypotension)

b. anemia

c. Acute Renal Failure (ARF)

d. Adult Respiratory Distress Syndrome (ARDS)

e. sepsis

f. DIC

g. cardiac arrest

h. Maternal death

i. ICU admission

j. organ injury (bowel, bladder, ureter, Fistula)

k. Others, specify----