



WALLAGA UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
SCHOOL OF MEDICINE
DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

**PREVALENCE OF CESAREAN SECTION COMPLICATIONS
AND ASSOCIATED FACTORS AMONG WOMEN WHO
UNDERWENT CESAREAN SECTION AT WALLAGA
UNIVERSITY COMPREHENSIVE SPECIALIZED
HOSPITAL, NEKEMTE TOWN, WESTERN ETHIOPIA**

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MAY, 2026

NEKEMTE, ETHIOPIA

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**A THESIS SUBMITTED TO INSTITUTE OF HEALTH SCIENCE,
SCHOOL OF MEDICINE, DEPARTMENT OF OBSTETRICS AND
GYNECOLOGY IN PARTIAL FULFILLMENT FOR REQUIREMENTS
OF SPECIALTY CERTIFICATE IN OBSTETRICS AND
GYNECOLOGY**

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MAY, 2026

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APPROVAL SHEET FOR SUBMITTING THE THESIS

As members of the examining the Thesis defense, we certify that we have read and evaluated the Final thesis performed by: **Dr. Sihingitan Asefa Hayle** under the title **“Prevalence and associated factors of Complications of Cesarean Section Among Women who underwent Cesarean Section at Wallaga University Comprehensive Specialized Hospital, Wallaga, West Ethiopia (July 1,2025 – January 31, 2026 GC)”**

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ACRONYMS AND ABBREVIATIONS

ACOG	American College of Obstetricians and Gynecologists
ANC	Antenatal Care
AOR	Adjusted Odds Ratio
APH	Antepartum Hemorrhage
CI	Confidence Interval
COR	Crude Odds Ratio
CPD	Cephalopelvic Disproportion
CS	Cesarean Section
DM	Diabetes Mellitus
DVT	Deep Venous Thrombosis
EDHS	Ethiopian Demographic Health Survey
PPH	Postpartum Hemorrhage
PROM	Premature Rupture of Membranes
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SPSS	Statistical Package for Social Sciences
VS	Versus
WHO	World Health Organization
WUCSH	Wallaga University Comprehensive Specialized Hospital

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ABSTRACT

Background:

Cesarean section (CS) is one of the most commonly performed major surgical procedures worldwide and is associated with significant maternal morbidity. Understanding the magnitude and determinants of cesarean section–related complications is essential for improving the quality of obstetric care, particularly in low-resource settings. However, evidence regarding CS complications at Wallaga University Comprehensive Specialized Hospital is limited.

Objective:

To assess the prevalence of cesarean section complications and identify associated factors among mothers who delivered by Cesarean section at Wallaga University Comprehensive Specialized hospital from July 1, 2025, to January 31, 2026.

Methods:

A hospital-based cross-sectional study was conducted among 341 mothers who underwent cesarean section at Wallaga University Comprehensive Specialized Hospital. Data were collected using a structured and pretested questionnaire through face-to-face interviews and medical record review. Bivariate logistic regression analysis was performed to identify candidate variables ($p < 0.25$), followed by multivariable logistic regression using the Enter method to determine independent predictors. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated, and statistical significance was declared at $p < 0.05$.

Results:

The overall prevalence of cesarean section complications was 12.9% (95% CI, 9.4%–16.5%). The most common complications were hemorrhagic complications (10.6%), intraoperative complications (9.7%), and wound-related complications (2.1%). Emergency cesarean section (AOR = 5.59, 95% CI: 1.40–22.25), use of general anesthesia (AOR = 5.96, 95% CI: 1.28–27.73), presence of obstetric complications (AOR = 2.48, 95% CI: 1.19–5.17), and prolonged duration of surgery (AOR = 2.80, 95% CI: 1.48–5.31) were significantly associated with increased odds of complications. Conversely, higher number of antenatal

care (ANC) visits was associated with a reduced risk of complications (AOR = 0.51, 95% CI: 0.30–0.88).

Conclusion:

The prevalence of cesarean section complications was relatively high. Emergency cesarean delivery, use of general anesthesia, presence of obstetric complications, prolonged surgical duration, and fewer ANC visits were identified as significant predictors. Strengthening antenatal care services to ensure adequate follow-up, optimizing emergency cesarean section management, and improving perioperative care are recommended to reduce postoperative complications.

Keywords: Cesarean section, post-operative complications, associated factors, antenatal care, Wallaga, Ethiopia

1: INTRODUCTION

1.1. Background

A Cesarean section (CS) is a widely performed major surgery in the operating room. It involves the delivery of the fetus, membranes, and placenta from the uterus through an abdominal incision, typically after fetal viability or after 28 completed weeks of pregnancy (1) In Africa, cesarean sections accounted for 8.8% of all births. In Ethiopia, the overall pooled prevalence of cesarean section was 29.5 % (2,3)

A Cesarean section is carried out for reasons related to both the mother and the fetus, as well as specific maternal and fetal conditions. In Ethiopia, the most common reasons for performing a Cesarean section include non-reassuring fetal heart rate patterns (NRFHRP), abnormal presentation or position of the fetus, cephalo-pelvic disproportion (CPD), obstructed labor, multiple pregnancies, previous Cesarean sections, failed inductions, and antepartum hemorrhage (2,4).

Different studies report showed increased maternal morbidity rate in cesarean sections as compared to vaginal deliveries (5). These high morbidities are associated with some determinants like duration of labor, lack of ANC, type of Cesarean delivery and type of anesthesia (6). The common neonatal complications following Caesarean section included low APGAR score, perinatal asphyxia, neonatal sepsis, meconium aspiration syndrome, early neonatal death, stillbirth, and prematurity whereas febrile morbidity, surgical site infection, maternal mortality, severe anemia, and postpartum hemorrhage were the most common maternal complications following Caesarean section (7,8). In a 10-year study conducted in Western countries examining the intraoperative and postoperative complications of Cesarean sections, the overall rate of maternal intraoperative complications was 14.8%, while the postoperative morbidity rate was 35.7% (9). A study conducted in Ethiopia revealed that the overall maternal complications of cesarean deliveries were 38.2% (10). Additionally, research from Oromia Region, specifically at Bedelle and Mettu-Kharl Hospitals in South West Ethiopia, reported a maternal morbidity rate of 20.5% for cesarean sections (11). Cesarean section (CS) raises the risk of maternal morbidity, which includes complications such as hemorrhage, issues with anesthesia, obstetric shock, cardiac arrest, acute renal

failure, venous thromboembolism, infections at the surgical site, puerperal sepsis, hematoma, and even maternal death(12,13).

In developing countries, the most frequent complications of cesarean sections include febrile morbidity, puerperal sepsis, postpartum hemorrhage, surgical site infections, maternal death, and severe anemia (14, 15). Although the factors contributing to adverse complications from cesarean sections (CS) are not fully understood, several documented risk factors include prolonged labor, premature rupture of membranes (PROM), chorioamnionitis, placental abruption, preeclampsia, eclampsia, and the surgeon's experience. Other contributing factors are the competence of the healthcare facility, the surgical technique used, and the type of anesthesia administered. Maternal factors, such as age, residency, obesity, and diabetes mellitus (DM), also play a role in post-CS complications (8,15,16).

While not all complications are preventable, most can be minimized by addressing modifiable risk factors and ensuring better readiness and preparation. This approach leads to improved patient outcomes and satisfaction, as it allows healthcare providers to implement preventive measures for common complications and avoid modifiable risks. The findings can also assist policymakers, program planners, and maternal health service providers in developing targeted interventions to enhance maternal health and outcomes(2,4).

1.2. Statement of the Problem

The World Health Organization (WHO) recommends a cesarean section incidence rate between 10% and 15%, but this rate has been steadily increasing over time. In Ethiopia, the pooled prevalence of cesarean sections is 29.5 %(2, 3).

The cesarean section rate varies significantly across countries, ranging from 3.0% of births in West Africa to 42.9% of births in South America. In terms of development, the rate was 6% in the least developed regions, while it reached 27.2% in more developed regions(3). Cesarean delivery (CD) is a common procedure in many hospitals, but it carries the risk of adverse outcomes, and complications after the procedure are not uncommon. In a Western study conducted over a 10-year period, examining both intraoperative and postoperative

complications of cesarean sections, the overall maternal intraoperative complication rate was 14.8%, while the postoperative morbidity rate was 35.7 %(9).

A study conducted in Ethiopia revealed that the overall maternal complications associated with cesarean section were 38.2 %(10). Another study at Jimma Hospital reported a maternal morbidity rate of 20% for cesarean sections (14). In higher-income countries, the most common adverse maternal complications following cesarean section include febrile morbidity, puerperal sepsis, postpartum hemorrhage, surgical site infections, maternal mortality, and severe anemia. The rising rate and number of cesarean sections are linked to increased maternal risks, such as peripheral organ damage, bleeding, the need for intensive care, prolonged surgery time, hysterectomy, and even maternal death (8,16).

Most documented complication rates and their associated factors come from high-income countries, while data from low- and middle-income countries remains scarce. Similarly, research in Ethiopia is limited. Identifying the prevalence and the factors contributing to these complications in this context was crucial for improving maternal health outcomes(16). However, setup-based information in the study area was limited. There was no similar study done in the selected area prior to this investigation.

Although the factors contributing to adverse complications were not fully understood, several elements were considered to play a role. These included the timing of the birth, obstetric complications such as PROM, chorioamnionitis, placental abruption, preeclampsia, and eclampsia. Additionally, the surgeon's experience, the competence of the healthcare facility, the surgical technique, and the type and risk associated with anesthesia were important factors. Maternal factors such as age, residency, and comorbid conditions like obesity and diabetes mellitus (DM) could also contribute to complications (15, 16).

Complications following cesarean sections were among the most frequent concerns raised by patients at the postnatal clinic. In our setting, the extent of these complications was not well documented, and the factors contributing to them had not been studied.

The extent to which predisposing factors were associated with complications was also unclear, which contributed to poor outcomes following cesarean Section (CS). In addition to

assessing the magnitude of the problem, further research was needed to identify the potential factors associated with these complications.

This study assessed both the complications and the determinants. Gaining a better understanding of these complications and their underlying causes will help improve patient outcomes and satisfaction.

1.3. Significance of the Study

This study provided valuable insights into the prevalence and determinants of complications following cesarean section, contributing to improved maternal healthcare. The findings directly benefited women undergoing cesarean section by identifying risk factors and informing better clinical management, ultimately reducing postoperative complications. Healthcare providers, including obstetricians, midwives, nurses, and anesthetists, gained evidence-based knowledge to enhance patient care. Additionally, hospital administrators and policymakers can use the study's findings to refine protocols, allocate resources effectively, and improve surgical and postnatal care services.

Beyond direct beneficiaries, the study had a broader impact on maternal healthcare. Future mothers will benefit from improved medical practices, leading to safer cesarean deliveries. Health institutions and training programs can incorporate the findings into medical education, strengthening the knowledge base of upcoming healthcare professionals. The community as a whole will gain from better maternal health outcomes, reduced healthcare costs, and increased confidence in the healthcare system. Furthermore, researchers and academics can use the study as a reference for future investigations on cesarean section complications and maternal health.

Ultimately, this study played a crucial role in identifying gaps in clinical care, leading to evidence-based interventions that enhance maternal health outcomes at Wallaga University Comprehensive Specialized Hospital and beyond.

2: LITERATURE REVIEW

2.1. Complications of Cesarean Section

Cesarean section exposes both mothers and their babies to potential short- and long-term health risks. It is associated with both intraoperative and postoperative complications, the incidence of which can vary depending on several factors.

A study was conducted to evaluate intra-operative surgical complications and postoperative maternal morbidity rates following cesarean section over a 10-year period. A total of 2,647 women were included in the retrospective analysis. The overall maternal intra-operative complication rate was 14.8%, with the most common complications being uterine corpus lacerations (10.1%) and blood loss of 1000 ml or more (7.3%). The overall maternal postoperative morbidity rate was 35.7%, with fever (24.6%), blood loss between 1000 and 1500 ml (4%), hematoma (3.5%), and urinary tract infections (3.0%) being the most frequent complications(9,17).

A study conducted in Denmark on intraoperative surgical complications during cesarean section evaluated 929 women who underwent CS. The overall intraoperative complication rate was 12.1%. Complications were more common in emergency cesarean sections, with a rate of 14.5%, compared to 6.8% in the elective cesarean section group. Similarly, one study in India reveals intraoperative complications rate following repeat CS was 43% (18,19).

A cross-sectional study conducted in Thailand in 2020, titled "Risk of Severe Adverse Maternal and Neonatal Outcomes in Deliveries with Repeated and Primary Cesarean Deliveries versus Vaginal Deliveries," found that both primary and repeated cesarean deliveries significantly increased the risk of severe adverse maternal outcomes compared to vaginal delivery. The study also revealed that cesarean deliveries notably elevated the risks of neonatal near-miss events and severe adverse neonatal outcomes (20).

A five-year retrospective study conducted in Egypt on the incidence, risk factors, and management of post-cesarean section surgical site infection (SSI) found that the incidence of SSI after cesarean delivery was 5.34%. The study identified several common risk factors for SSI, including chorioamnionitis, PROM, blood loss greater than 1000 ml, emergency

cesarean section, surgery duration longer than 1 hour, lack of antenatal care, labor duration of 24 hours or more, diabetes mellitus, obesity, high parity, hypertension, and a gestational age of less than 37 weeks. The mortality rate due to SSI was 1.33% (21).

In Ethiopia, a study conducted in the Tigray region in 2019 focused on post-cesarean section maternal health outcomes and their determinants. The study included 357 mothers who underwent cesarean section in six public general hospitals, revealing an overall proportion of adverse maternal outcomes of 19.3%. Additionally, a cross-sectional study at Ayder Specialized Comprehensive Hospital in Mekelle, Tigray, was conducted in 2017 on 338 cesarean cases, investigating maternal and fetal outcomes as well as factors associated with unfavorable outcomes. The unfavorable maternal outcomes included adhesions (8.3%), excessive blood loss and blood transfusion (5.6%), cesarean hysterectomy (3%), re-laparotomy (1.5%), wound infection, and wound dehiscence (6.8%). Unfavorable fetal outcomes included stillbirth (2.6%), early neonatal death (2.4%), and low birth weight (17.2%) (10,22).

In a prospective study conducted at Jimma Hospital in south-western Ethiopia, which analyzed cesarean deliveries among 100 mothers, the overall morbidity rate was found to be 20%, with no maternal mortality recorded. The main causes of morbidity included wound infection (27.1%), sepsis (21.4%), endometritis (33.3%), hemorrhage (8%), and wound dehiscence (10%) (14).

A retrospective cohort study conducted at Arba-Minich General Hospital on the magnitude of maternal complications and associated obstetric factors among women who delivered by cesarean section included 488 women over the course of a year. The study found that 119 mothers (28.6%) experienced intra-operative surgical complications. The seven most common intra-operative complications were managed through procedures such as repair (33 women, 7.9%), cesarean hysterectomy (13 women, 3.1%), uterine artery ligation (12 women, 2.9%), and B-Lynch compression suture (9 women, 2.2%). The overall post-operative maternal complication rate was 23.6% (98 women). Tragically, two mothers died either during or immediately after the operation. Major postoperative complications included surgical wound infections in 50 women (12%), febrile morbidity in 19 women (4.6%),

postpartum hemorrhage (PPH) in 9 women (2.2%), deep vein thrombosis (DVT) in 2 women (0.5%), and urinary tract infections (UTI) in 1 woman (0.2%) (23).

In another study conducted in the Oromia Region, South West Ethiopia, which examined the indications, outcomes, and risk factors of cesarean delivery among pregnant women utilizing delivery services at selected public health institutions, 20.5% of women who underwent cesarean section developed maternal complications. The most common complications included wound infection (50%), respiratory tract infections (31.3%), postoperative fever (12.5%), and other complications (6.3%)(11).

A study conducted at Attat Hospital in the Gurage Zone, SNNPR, Ethiopia, from 2011 to 2013 examined the prevalence and outcomes of cesarean section. Out of 5,611 deliveries at the hospital, 1,547 were cesarean sections, resulting in an incidence rate of 27.6%. The most common postoperative maternal complications were respiratory tract infections (2.5%) and postoperative fever (2.1%)(24).

2.2. Associated Factors for Complications of Cesarean Section

Complications following cesarean section are influenced by multiple interrelated factors, including socio-demographic characteristics, obstetric conditions, obstetric complications, facility-related aspects, operative factors, and maternal comorbidities.

2.2.1 Socio-demographic factors

Maternal socio-demographic characteristics such as age and residence have been shown to influence the risk of cesarean section complications. A study conducted in Washington reported that maternal age greater than 35 years was associated with an increased risk of adverse outcomes following cesarean section (29). In addition, women residing in rural areas were found to have higher rates of unfavorable outcomes, possibly due to delayed access to care and late presentation to health facilities (23).

2.2.2. Obstetric factors

Obstetric characteristics such as parity, gestational age, previous cesarean section, and stage of labor play a significant role in determining maternal outcomes. Cesarean sections

performed during the second stage of labor were associated with higher risks of complications, including uterine incision extension compared to those performed during the first stage (33,34). Furthermore, cesarean deliveries performed at earlier gestational ages (<34 weeks) were linked to increased intraoperative and postoperative complications such as hemorrhage and the need for blood transfusion (35).

2.2.3. Obstetric complication–related factors

The presence of obstetric complications significantly increases the likelihood of adverse maternal outcomes. Conditions such as prolonged labor, premature rupture of membranes (PROM), chorioamnionitis, antepartum hemorrhage (APH), hypertensive disorders of pregnancy, malpresentation, macrosomia, and multiple pregnancies have been identified as important contributors to complications (25). These complications often necessitate emergency cesarean section, which is associated with a higher risk of morbidity (24).

2.2.4. Facility-related factors

Facility and healthcare system factors, including referral status and antenatal care (ANC) utilization, are important determinants of cesarean section outcomes. A study conducted at Ayder Specialized Comprehensive Hospital found that mothers who did not attend ANC were 9.6 times more likely to experience unfavorable maternal outcomes compared to those who had regular ANC follow-up (10). Referral from other health facilities, often associated with delayed management and complicated labor, was also identified as a significant factor affecting outcomes (10, 23).

2.2.5. Operation-related factors

Operative characteristics are key predictors of complications following cesarean section. Emergency cesarean section has been consistently associated with a higher risk of complications compared to elective procedures (11,24). The type of anesthesia used also influences outcomes; studies have shown that general anesthesia is associated with higher complication rates compared to spinal anesthesia (32). In addition, prolonged duration of surgery, type of incision, and intraoperative factors such as excessive blood loss contribute significantly to adverse outcomes (23).

2.2.6. Comorbidity-related factors

Maternal comorbidities such as obesity, diabetes mellitus, and hypertension are important predictors of cesarean section complications. A study conducted in Australia reported that obesity (BMI ≥ 30 kg/m²) significantly increased the risk of surgical site infections, with even higher risk observed among women with BMI greater than 40 kg/m² (36). Similarly, other medical conditions such as cardiac and renal diseases have been associated with increased maternal morbidity following cesarean delivery (25).

2.3. Conceptual Framework

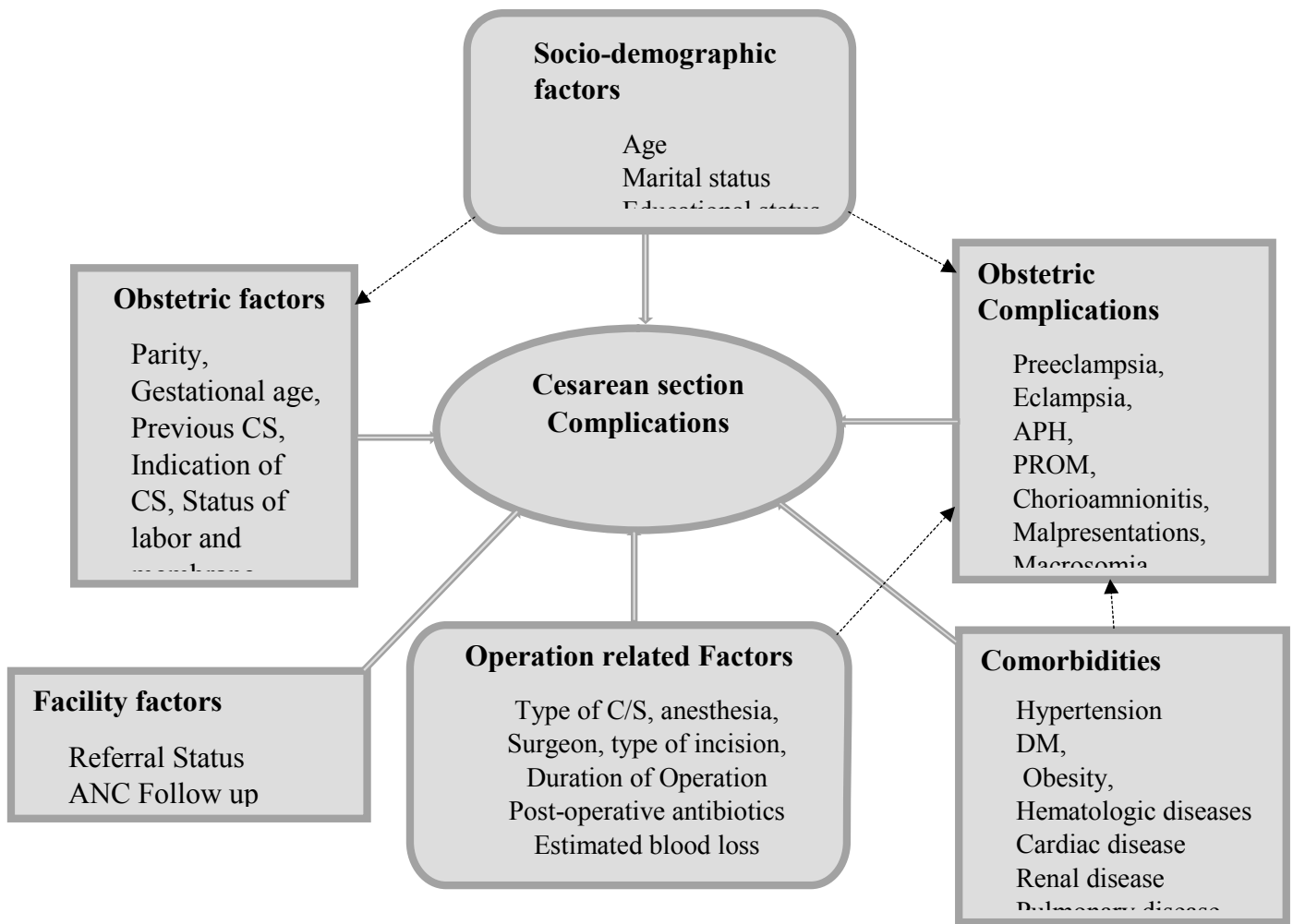


Figure 1: Conceptual Framework showing determinants of cesarean section complications at Wollaga University comprehensive specialized hospital (.4, 10, 11, 13.37, 42)

3: OBJECTIVES

3.1. General Objective

To assess the prevalence and factors associated with complications from cesarean section among women who underwent cesarean section at Wallaga University Comprehensive Specialized Hospital (WUCSH), West Ethiopia, from July 1, 2025, to January 31, 2026.

3.2. Specific Objectives

1. To assess the prevalence of complications of cesarean section among women who underwent cesarean section at WUCSH, West Ethiopia, from July 1, 2025, to January 31, 2026.
2. To identify the associated factors with complications of cesarean section among women who underwent cesarean section at WUCSH, West Ethiopia, from July 1, 2025, to January 31, 2026.

4.METHODS

4.1. Study Area and Period

The study was conducted from July 1, 2025, to January 31, 2026, at Wallaga University Comprehensive Specialized Hospital (WUCSH), which is located in Nekemte city, Wallaga, West Ethiopia. Nekemte city is found 328 km to the west of Addis Ababa (the capital city of Ethiopia). It has a latitude and longitude of 9°5'N 36°33'E with an elevation of 2,088 meters (6,850 ft) above sea level. Based on the 2019 Central Statistical Agency of Ethiopia, Nekemte had a total population of 156,004. Of those, 78,820 were men and 77,184 were women.

The Wallaga University Comprehensive Specialized Hospital (WUCSH) is a teaching hospital used as the referral center for a catchment population. It provides both specialty and subspecialty services, including Obstetrics and Gynecology units in its inpatient and outpatient clinics. According to the hospital's data registry, more than 3,000 women have delivery services annually. In addition to comprehensive health care services, the hospital provides teaching services to undergraduates and postgraduates. In terms of human resources and facility capacity to perform cesarean sections, the hospital had 4 functional operating room tables, isolated recovery room for post anesthesia care, 7 Obstetricians and Gynecologists, and 20 Residents. There were also 10 Anesthetists (5 masters and 5 BSc anesthetists) and 1 Anesthesiologist. Pre-operative and postoperative cares were provided by Obstetrics and Gynecology department teams, including Midwives, Medical Interns, Residents, and seniors.

4.2. Study Design

A hospital-based cross-sectional study was conducted.

4.3. Population

4.3.1. Source Population

The source population for this study was all women who underwent cesarean section at WUCSH, from July 1, 2025, to January 31, 2026.

4.3.2. Study Population

The study population was all selected women who underwent cesarean section during the study period selected by systematic random sampling technique among the source population.

4.3.3. Study Unit

The study unit was an individual woman who underwent cesarean section and was followed for complications of cesarean deliveries for 3 days during the study period (July 1, 2025, to January 31, 2026).

4.4. Eligibility Criteria

4.4.1. Inclusion Criteria

- Women who were 18 years or older
- Women who were within 3 days of post-cesarean delivery at the time of data collection
- Women with complete medical record data
- Women who provided informed consent to participate

4.4.2. Exclusion Criteria

- Women who declined consent
- Women who were transferred to another facility immediately after delivery and could not be followed up postoperatively
- Women with pre-existing severe medical or surgical conditions unrelated to CD that could confuse study results
- Critically ill women from whom consent could not be obtained

4.5. Sample Size Determination and Sampling Techniques

4.5.1. Sample Size Determination

Sample size was calculated using the single population proportion formula with the assumption of 95% confidence interval and 5% margin of error.

Different institutional-based studies reported different prevalence of outcome (complications of CS and associated factors) on similar study and similar institutional level. Owing to socio-demographic similarities, a study done at Jimma was chosen; it reported prevalence of complications associated with cesarean section as 28%.

$$n = (Z\alpha/2)^2 p (1 - p)/d^2$$

Where:

n = Sample size

$Z\alpha/2 = 1.96$

d = Margin of error (expressed in decimal) = 0.05

p = Percentage from assumption of 28% = 0.28

$$n = (1.96)^2 \times 0.28 \times 0.72 / (0.05)^2 = 310$$

Adding 10% non-response rate, the total sample size was 341.

The total sample size for this study was 341.

4.5.2. Sampling Techniques

Systematic random sampling was used after arranging the study units according to the date of operation on the cesarean delivery registration book at WUCSH.

The annual number of cesarean deliveries over the last 12 months was 1,200, showing a monthly average of 100 CS. So, study population size (N) was calculated from the historical data as the estimated total number of cesarean deliveries during the data collection period (7 months):

Study period = 7 months

Monthly average CS = 100

N = monthly rate (100) × months of study period (7) = 700

n = sample size = 341

$K = N/n = 700/341 \approx 2.05$, rounded to 2

The first case was selected using the lottery method from the first two cesarean cases in the register. After the first selection, every second case in the registration book was included until the required sample size was reached.

4.5.3. Flow Diagram of the study Participants

A total of 700 women underwent cesarean section during the study period. After systematic random sampling (every 2nd case), 350 women were selected. Of these, 341 (97.4%) provided informed consent and were included in the final analysis, yielding a 100% response rate among consented participants (Figure 2)

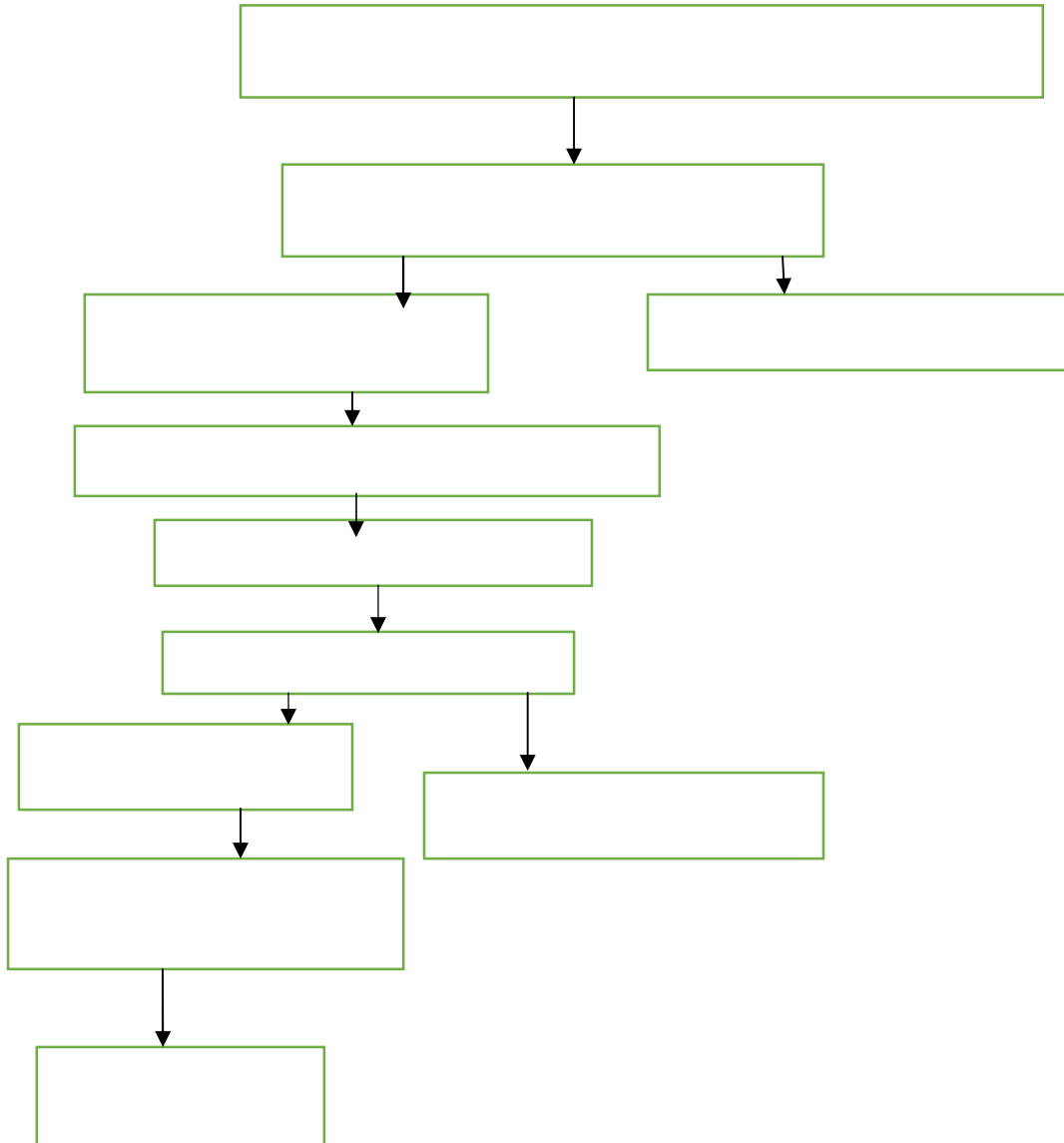


Figure 2: Flow diagram of study participants included in the study at Wallaga University Comprehensive Specialized Hospital, 2025–2026

4.6. Variables of Study

4.6.1. Dependent Variable

Complications of Cesarean Section

4.6.2. Independent Variables

- Sociodemographic factors
 - ✓ Age
 - ✓ Marital Status
 - ✓ Residence
 - ✓ Education
 - ✓ Occupation
- Obstetric factors
 - ✓ Parity/gravidity
 - ✓ Gestational age
 - ✓ Number of gestations
 - ✓ Previous C/S scar
 - ✓ Indication of caesarean section
 - ✓ Type of caesarean section
 - ✓ Status of labor and membrane
- Obstetric complications
 - ✓ Pre- eclampsia /eclampsia
 - ✓ APH
 - ✓ PROM
 - ✓ Chorioamnionitis
 - ✓ Malpresentation
 - ✓ Other complications (cord prolapse, obstructed labor, fetal macrosomia, FGR)
- Surgical factors
 - ✓ Type of anaesthesia
 - ✓ Surgeon (Seniors and Residents)
 - ✓ Duration of surgery

- ✓ Amount of estimated blood loss
- Facility's factors
 - ✓ Referral status
 - ✓ Place of ANC follow up
- Comorbidities
 - ✓ Hypertension and cardio pulmonary diseases
 - ✓ DM & Obesity
 - ✓ Renal diseases
 - ✓ Hematologic disorders

4.7. Operational Definition

Maternal complications: Any adverse maternal health condition occurring intraoperatively or within 3 days after cesarean section, attributable to the procedure(17,19).

Intra-operative complications: Issues that occurred during the surgery itself, including incision extension, hemorrhage (>1000 ml), injury to adjacent organs, and cesarean hysterectomy (18).

Postoperative complications: Any issues that occurred within 3 days following a cesarean section, including, wound dehiscence, hematoma, postpartum hemorrhage, and anemia requiring blood transfusion (8).

Obstetric complications: Issues that arose during the current pregnancy, such as antepartum hemorrhage (APH), premature rupture of membranes (PROM), chorioamnionitis, macrosomia, multiple pregnancies, pregnancy-induced hypertension (PIH), cephalopelvic disproportion (CPD), obstructed labor, and malpresentation (15).

Postpartum hemorrhage (PPH): Estimated blood loss of more than 1,000 ml following a cesarean section or any blood loss sufficient to compromise hemodynamic stability(20).

Hemorrhagic complication: Refers to excessive bleeding occurring during or after cesarean section, defined as estimated blood loss ≥ 1000 mL, or a decrease in hemoglobin ≥ 2 g/dL, or

requirement of blood transfusion, or presence of clinical signs of hemorrhage requiring intervention (20)

Duration of surgery: defined as longer if it took 60 minutes or more; short for those took 30 minutes or less (21)

Cesarean section complication: At least one of the above complications was happened intraoperatively or within 3 days after cesarean section, attributable to the procedure (9).

Excessive hemorrhage: defined as estimated blood loss ≥ 1000 mL (21)

Early ambulation: starting mobilization within 6 -12 hours of performed cesarean section (3)

4.8. Data Collection Tool and Procedures

Data collection tool was developed by revising different literatures. Data were collected using a pretested structured questionnaire designed in English and translated to Afan Oromo and then translated back to English by language expert. The questionnaire included items designed to capture the key independent variables of the study, such as sociodemographic characteristics, obstetric and clinical variables, and surgical-related variables.

Data collection was carried out by 4 midwives and 4 Obstetrics and Gynecology residents prospectively by interviewing patients and reviewing patients' charts. Data collectors were supervised by a senior resident. For this, 1-day training was given to collectors on the objective of the research and how to carry out the data collection.

4.9. Data Processing and Analysis

All collected data were checked for completeness and consistency each day after data collection. The data were then coded using a prearranged coding system to ensure uniformity and ease of entry. Coded data were entered into Epi Data version 4.6 software. After entry, the data were exported to SPSS version 26.00 for cleaning and analysis.

Data cleaning included checking for missing values, outliers, and inconsistencies. Any incomplete or inconsistent data were addressed through rechecking the source or excluding the affected cases if necessary.

Descriptive analysis was computed to summarize the characteristics of the study participants using frequencies and percentages as appropriate depending on the nature of the variables.

Bivariate analysis was conducted to assess the relationship between various factors and the outcome variable. Variables that showed significance in the bivariate analysis ($P\text{-value} < 0.25$) were included in the multivariable logistic regression analysis. In the multivariable analysis, variables with a $p\text{-value} < 0.05$ were considered statistically significant associations. The goodness of fit of the logistic regression model was tested using the Hosmer-Lemeshow test.

The strength of the association between dependent and independent variables was evaluated using the adjusted odds ratio (AOR) with a 95% confidence interval (CI). The results were presented using tables, graphs, and figures where appropriate to facilitate understanding and interpretation.

4.10. Data Quality Control

Data collectors and supervisors underwent one day of training on data collection procedures. Before the data collection began, the tool was tested to ensure the questionnaire was consistent and to assess the performance of the data collectors. A pre-test was conducted on 5% (17 women) of the cases with CS at Nekemte Comprehensive Specialized Hospital, after which any necessary adjustments were made. The final version of the data collection tool was then used for training the data collectors. Supervisors checked the data collection process and completeness.

During data collection, a senior resident supervised and checked the data collection daily to monitor completeness, consistency, and accuracy. During data entry, data cleaning, double entry, back check, and secure storage for completed questionnaires were performed.

4.11. Ethical Consideration

Ethical clearance was obtained from the Ethical Review Committee of the Institute of Health Science of Wallaga University. Throughout the process, the confidentiality of all data was maintained during its storage and management.

Written informed consent was obtained from all participants after explaining the purpose, procedures, risks, and benefits of the study. Participants were informed of their right to withdraw at any time without affecting their care. Confidentiality was maintained by using unique codes instead of names.

4.12. Plan for Dissemination of Findings

A copy of the thesis was provided to Wallaga University, and the final report was submitted to WUCSH, with an additional copy shared with the Obstetrics and Gynecology department and Wallaga University. The findings will also be presented at professional conferences at the local or national level and will be published in local or national journals.

5: RESULTS

5.1. Sociodemographic Characteristics of the study Participants

A total of 341 women participated in the study, yielding a response rate of 100%. The mean age of participants was 24.4 years (SD = 4.3), ranging from 18 to 39 years. The majority of participants were in the 20-24 years age group (41.9%), followed by 25-29 years (37.2%). Over half of the participants resided in rural areas (51.0%), and the vast majority were married (97.7%). Regarding education, 35.2% had completed college or above, while 9.1% had no formal education. Housewives constituted the largest occupational group (57.5%).

Table 1: Distribution of Sociodemographic Characteristics of study Participants at WUCSH, 2026 (N=341)

Characteristic	Category	Frequency (n)	Percent (%)
Age groups (years)	15-19	26	7.6
	20-24	143	41.9
	25-29	127	37.2
	30-34	32	9.4
	>35	13	3.8
Residence	Urban	167	49.0
	Rural	174	51.0
Marital Status	Married	333	97.7
	Unmarried	2	0.6
	Divorced	5	1.5
	Widowed	1	0.3
Education	No formal	31	9.1
	Primary school	74	21.7
	Secondary school	116	34.0
	College and above	120	35.2
Occupation	Housewife	196	57.5
	Employee	107	31.4
	Daily laborer	25	7.3
	Other*	13	3.8

*Other include: Merchants, Farmers, Artisans, self-employed

5.2. Obstetric Characteristics of the Study Participants

The majority of participants had 1-4 parity (93.0%), and 75.1% had no previous CS scar. ANC attendance was high, with 98.2% attending at least one ANC visit, and 67.2% having more than four contacts. Emergency CS accounted for 76.8% of procedures, and spinal anesthesia was used in 93.5% of cases. The Joel-Cohen skin incision was the most commonly used technique (64.5%). Regarding intraoperative parameters, 50.7% had surgery duration <30 minutes, and 49.6% had estimated blood loss between 500-1000 ml. Early mobilization within 12 hours was achieved in 97.7% of mothers.

Table 2: Distribution of Obstetric Characteristics of the study participants at WUCSH,2026. (N=341)

Characteristic	Category	Frequency (n)	Percent (%)
Parity	1-4	317	93.0
	>5	24	7.0
Previous CS Scar	0	256	75.1
	1	66	19.4
	2	18	5.3
	3	1	0.3
Indication for CS	NRFHRP	101	29.6
	CPD	42	12.3
	Previous CS Scar	73	21.4
	Obstructed Labor	15	4.4
	G-III MSAF in LFSOL	45	13.2
	Twin Pregnancy	19	5.6
	Malpresentation	20	5.9
	Cord Prolapse	10	2.9
	Other*	16	4.7
ANC Attendance	No	6	1.8
	Yes	335	98.2
ANC Contacts	1-2	24	7.2
	3-4	86	25.7

	>4	225	67.2
Type of CS	Elective	79	23.2
	Emergency	262	76.8
Type of Anesthesia	Spinal	319	93.5
	General	22	6.5
Type of Skin Incision	Pfannenstiel	106	31.1
	Joel-Cohen	220	64.5
	Midline	15	4.4
Estimated Blood	<500 ml	163	47.8
Loss	500-1000 ml	169	49.6
	>1000 ml	9	2.6
Surgery Duration	<30 min	173	50.7
	31-45 min	159	46.6
	46-60 min	7	2.1
	>60 min	2	0.6
Early Ambulation	No	8	2.3
	Yes	333	97.7

*Others: Placental abnormalities (placenta previa, abruptio placentae), oligohydramnios, polyhydramnios, and combinations of indications

5.3. Prevalence and Types of Cesarean section Complications

The overall prevalence of complications following cesarean section was **12.9%** (95% CI: 9.4%- 16.5%). This finding is comparable to studies conducted in Ethiopia and other low- and middle-income countries.

Among those with complications, the most common were hemorrhagic complications (10.6%), followed by intraoperative complications (9.7%) and complications within 3 days (10.9%). Wound-related complications occurred in 2.1% of all mothers.

Table 3: Distribution of Complications of Cesarean sections in WUCSH, 2026

Type of Complication		Frequency (n)	Percent of Total (N=341)	Percent Among Those with Complications (n=44)
Any Complication		44	12.9	100.0
Surgical wound complication Hemorrhagic Complications	Wound dehiscence	2	0.6	4.7
	Hematoma formation	5	1.5	11.6
	Postpartum hemorrhage (PPH)	26	7.6	59.1
	Anemia requiring blood transfusion	10	2.9	22.7
	Incision extension	12	3.5	27.3
Intraoperative Complications	Excessive hemorrhage	16	4.7	36.4
	Organ injuries	1	0.3	2.3
	Hysterectomy	4	1.2	9.1
Complications within 3 days		37	10.9	84.1

Note: Some women had multiple complications; therefore, the sum of individual complications exceeds the total number of women with complications.

5.4. Factors Associated with Cesarean section Complications

In this study, both bivariate and multivariable logistic regression analyses were performed to identify factors associated with cesarean section complications. Initially, bivariate analyses were conducted to assess the crude associated between each independent variable and CS complications. Variables with p-value less than 0.25 in the bivariate analysis were considered as candidate for the multivariable logistic regression model. Accordingly, a total of 11 variables were included in the final multivariable analysis using the Enter (Direct) method to control for potential confounding effects. The results of both analyses are presented together below in table 5.4, showing COR, AOR with 95% confidence interval (CI). In the multivariable analysis regression, variables with p-value less than 0.05 were considered as statistically significant independent predictors of CS complications. The model fitness was checked using the Hosmer-Lemeshow goodness-of-fit test, which indicated a good fit of the model.

Table 4: Bivariate and Multivariable Analysis of Factors Associated with CS Complications at WUCSH, 2026 (N=341)

Variable	Category	CS Complications		COR (95% CI)	P-value	AOR (95% CI)	P-value
		No (%)	Yes (%)				
Parities	1- 4	280 (88.3)	37 (11.7)	0.321(.125 -.825)	.018	0.873 (0.225-3.387)	0.844
	>5	17 (70.8)	7 (29.2)	1(Reference)		1(Reference)	
Residence	Urban	149 (89.2)	18 (10.8)	1 (Reference)		1 (Reference)	
	Rural	148 (85.1)	26 (14.9)	1.45(0.765-2.765)	0.213	0.736 (0.329-1.647)	0.456
One of obstetric complication	No	174 (90.6)	18 (9.4)	1 (Reference)		1(Reference)	
	Yes	123 (82.6)	26 (17.4)	4.0 (0.25-0.76)	.094	2.48 (1.19-5.17)	0.015
Type of CS	Elective	78 (96.3)	3 (3.7)	1 (Reference)		1 (Reference)	
	Emergency	219(84.2)	41 (15.8)	2.043 (1.074-3.88)	0.012	5.59 (1.40-22.25)	0.015
Type of anesthesia	Spinal	290 (91.2)	28 (8.8)	1(Reference)		1 (Reference)	
	General	7 (31.8)	15 (68.2)	0.213 (0.064-0.708)	0.018	5.96 (1.28-27.73)	0.023
Type of skin incision	Midline	10 (66.7)	5 (33.3)	1 (Reference)		1 (Reference)	
	Pfannenstiel	96 (90.6)	10 (9.4)	0.206 (0.056-0.762)	0.014	0.963 (0.116-8.025)	0.973
	Joel-Cohen	191(86.8)	29 (13.2)	0.208 (0.059-0.731)	0.041	1.27 (0.62-2.62)	0.520
Pre-existing medical condition	No	283 (87.9)	39 (12.1)	1 (Reference)		1 (Reference)	
	Yes	14 (73.7)	5 (26.3)	0.36	0.082	1.28 (0.32-5.05)	0.727
Number of ANC contacts	1 - 2	16 (66.7)	8 (33.3)	5.125 (1.954-13.447)	0.001	5.1 (1.42- 5.18)	0.016
	3 - 4	70 (81.4)	16 (18.6)	2.343 (1.150-4.770)	0.019	2.343 (1.150-4.770)	0.019

	Above 4	205 (91.1)	20 (8.9)	1 (Reference)		1 (Reference)	
Prolonged rupture of membrane	No	252 (88.4)	33 (11.6)	1 (Reference)		1 (Reference)	
	Yes	45 (80.4)	11 (19.6)	1.867 (0.879-3.966)	0.104	1.24 (0.52-2.92)	0.628
Age (recoded)	15- 19	23 (88.5)	3 (11.5)	0.293 (0.054 -1.580)	0.154	1.38e7 (0.00 - .)	0.999
	20-24	127(88.8)	16 (11.2)	0.293 (0.054-1.580)	0.055	2.43e7 (0.00 - .)	0.999
	25-29	115(90.6)	12 (9.4)	0.283 (0.078-1.027)	0.031	8.53e7(0.00 - .)	0.999
	30-34	23 (71.9)	9 (28.1)	0.235 (0.063-0.878)	0.859	0.33 (0.00 - .)	1.000
	>35	9 (69.2)	4 (30.8)	1 (Reference)		1 (Reference)	
Surgery duration (recoded)	<30 min	156 (90.2)	17 (9.8)	0.48 (0.24-0.75)	0.12	0.28 (0.14-0.85)	0.002
	31- 45 min	137 (86.2)	22 (13.8)	0.65(0.12 – 4.10)	0.18	0.95(0.03 – 5.50)	0.430
	46 -60 min	3 (42.9)	4 (57.1)	1.14 (0.05 – 5.41)	0.23	1.49 (0.03 – 8.43)	0.402
	>60 min	1 (50)	1(50)	1 (Reference)		1 (Reference)	

Table 5: Model Fit Statistics for indices of Multivariable Regression at WUCSH, 2016

Measure	Value	Interpretation
Sample size analyzed	335 (98.2% of total)	Excellent
-2 Log Likelihood	211.809	Lower is better
Cox & Snell R ²	0.135	13.5% variance explained
Nagelkerke R ²	0.251	25.1% variance explained
Hosmer-Lemeshow Test	$\chi^2 = 7.952$, df = 8, p = 0.438	Good fit
Overall classification accuracy	88.4%	Good
Sensitivity	15.9%	Low
Specificity	99.3%	Excellent

6: DISCUSSION

This study found that 12.9% of mothers who underwent cesarean section (CS) at WUCSH developed postoperative complications. This prevalence is comparable with findings from other Ethiopian studies, including Addis Ababa (11.4%) (12), Jimma (13.2%) (11), and Bahir Dar (13.1%)(37), as well as reports from sub-Saharan African countries such as Nigeria (14.2%)(38), Tanzania (11.8%)(39), and the Democratic Republic of Congo (14.2%) (17). However, it is higher than findings from Debre Birhan (8.5%)(6) and Tigray (9.7%)(10), and lower than reports of a study from Jordan (16.2%) (7). These variations may be explained by differences in study settings, case mix, patient characteristics, definitions of complications, and data collection methods (1,6).

Hemorrhagic complications were the most common in this study (10.6%), which is consistent with global evidence identifying postpartum hemorrhage as a leading cause of maternal morbidity following CS (20). Intraoperative complications were also frequent (9.7%), highlighting the technical challenges associated with cesarean delivery, particularly in emergency situations (18,19). In contrast, wound-related complications were relatively low (2.1%) compared to some studies (21, 22), possibly due to the high utilization of prophylactic antibiotics and early mobilization observed in this setting (36).

Emergency cesarean section was the strongest independent predictor of postoperative complications, with more than fivefold increased odds compared to elective procedures (AOR = 5.59, 95% CI: 1.40-22.25, $p = 0.015$). This finding is consistent with studies from Nepal (25) and India, where complications such as blood transfusion, febrile morbidity, urinary tract infections, and wound infections were significantly more common in emergency CS (26–28). The increased risk associated with emergency CS can be attributed to multiple factors, including suboptimal preoperative preparation, ongoing labor, and more complex obstetric conditions such as fetal distress, obstructed labor, or placental abruption (10,23,25,27,28). Furthermore, the urgency of these procedures may limit the timely application of preventive measures, including antibiotic prophylaxis and optimal surgical planning (21,36).

Type of anesthesia was also significantly associated with postoperative complications, with general anesthesia linked to higher odds compared to spinal anesthesia (AOR = 5.96; 95% CI: 1.28–27.73; $p = 0.023$). However, this finding should be interpreted cautiously due to the small number of cases managed under general anesthesia, which may affect the precision of the estimate. Nevertheless, this result is consistent with published literature, including a randomized trial by Saygı et al. (2015), which reported better maternal outcomes with spinal anesthesia (32).

The presence of obstetric complications, including PROM, preeclampsia, and antepartum hemorrhage, increased the likelihood of postoperative complications by 2.5-fold (AOR = 2.48, 95% CI: 1.19-5.17, $p = 0.015$). This finding is consistent with studies from Egypt (21) and Ethiopia (23), which identified conditions such as chorioamnionitis, PROM, and preeclampsia as significant risk factors for post-CS complications. These conditions may increase the risk of adverse outcomes through mechanisms such as infection, hemorrhage, and increased surgical complexity.

Duration of surgery was another important factor, with longer procedures associated with nearly threefold increased odds of complications (AOR = 2.80, 95% CI: 1.48-5.31, $p = 0.002$). This finding is consistent with Gomaa et al. (2021), who reported that surgeries exceeding one hour were associated with increased risk of surgical site infections (21). Prolonged operative time may reflect surgical difficulty due to adhesions from previous surgeries, maternal obesity, intraoperative complications, or operator experience. The relationship may also be bidirectional, as complications can prolong surgery, while extended operative time increases the risk of infection and other adverse outcomes (18,21).

Antenatal care (ANC) attendance emerged as the most significant modifiable predictor of postoperative complications. Women with one to two ANC visits had a fivefold increased risk, while those with three to four visits had a twofold increased risk compared to women with more than four visits, demonstrating a clear dose–response relationship. This finding is consistent with WHO recommendations and existing literature emphasizing the importance of adequate ANC attendance for optimal maternal outcomes (41). Similar findings have been

reported in Ethiopia (12) and Jordan (7), as well as in a systematic review demonstrating reduced maternal morbidity among women attending at least four ANC visits (42).

This protective effect may be explained through early detection and management of risk factors such as anemia, hypertensive disorders, and infections (35,36), provision of health education (41), improvement of maternal nutritional status (31), enhanced birth preparedness (2), and continuity of care (43). Although a large proportion of women in this study attended more than four ANC visits, the finding that even three to four visits were associated with higher risk compared to more than four visits suggests that the minimum recommended number of visits may be insufficient in settings with high CS rates (43).

Several variables that were significant in bivariate analysis did not retain significance after adjustment, suggesting mediation effects. The association between maternal education and postoperative complications is likely mediated through health-seeking behavior, particularly ANC utilization, as reported in previous studies (2,37). Similarly, the apparent effect of parity may be influenced by previous cesarean section history, as higher parity women are more likely to undergo elective repeat CS, which carries lower risk (2,10,19). The type of skin incision also lost significance after adjustment, indicating that incision choice may reflect underlying case complexity rather than an independent effect (4,18,24).

The final regression model demonstrated good fit (Hosmer-Lemeshow $p = 0.438$) and explained approximately 25.1% of the variability in postoperative complications (Nagelkerke $R^2 = 0.251$). While this indicates acceptable model performance, a substantial proportion of variance remains unexplained, suggesting that additional factors such as facility infrastructure, intraoperative practices, and provider experience may also contribute to outcomes (10,17). The model showed high specificity but low sensitivity, indicating that it is more effective at identifying women who are unlikely to develop complications than those at risk. This pattern is consistent with other prediction models for multifactorial obstetric outcomes (9,16).

The findings of this study have important clinical and public health implications. Identification of key risk factors allows for improved risk stratification and targeted perioperative care. Women undergoing emergency CS, those with obstetric complications,

prolonged surgical duration, or inadequate ANC attendance should be considered high-risk and managed accordingly. This includes preoperative optimization such as correction of anemia, ensuring blood availability, and administration of prophylactic antibiotics, even in emergency settings where feasible (21,36). In addition, involvement of experienced surgeons in complex cases and enhanced postoperative monitoring during the first 48–72 hours are essential to reduce adverse outcomes (8,15).

From a surgical perspective, reducing unnecessary emergency cesarean sections through improved labor management and timely decision-making is critical (25,26). Monitoring operative duration and implementing appropriate infection prevention measures, particularly in prolonged procedures, may further reduce complications (21). While midline incisions may be necessary in complex cases, transverse incisions such as Pfannenstiel or Joel-Cohen remain preferable for most patients due to better wound healing outcomes (4, 24).

At the health system level, regular audits of cesarean section outcomes, including complication rates and associated factors, are essential for quality improvement (2,4). The development and implementation of standardized protocols, such as emergency CS checklists and risk-based care pathways, can enhance consistency and safety. Continuous training of healthcare providers in surgical techniques, emergency obstetric management, and infection prevention is also crucial (4,23).

From a public health perspective, strengthening antenatal care services is a key priority. The strong protective effect of ANC attendance supports efforts to expand coverage, improve quality, and ensure comprehensive risk assessment and counseling during each visit (2,41,42). The finding that more than four visits confer additional benefit suggests that increasing the number of recommended contacts may be advantageous in high-risk settings (42). Furthermore, reducing unnecessary cesarean sections through adherence to evidence-based guidelines and improved labor management practices should be emphasized (3,4,23). Establishing effective monitoring systems linking ANC services with delivery outcomes will also support data-driven decision-making and resource allocation (43). Community-based interventions aimed at improving awareness, addressing barriers to care, and promoting timely health-seeking behavior are equally important ((42).

Strengths and Limitations of the Study

This study has several strengths, including a 100% response rate, comprehensive data collection combining interviews and medical record review, an adequate sample size, and robust statistical analysis. However, some limitations should be acknowledged. The cross-sectional design limits causal inference, and the single-center setting may affect generalizability. The relatively small number of complication events restricted the number of variables included in the multivariable model. In addition, the short follow-up period may have resulted in underestimation of complications occurring after discharge, and the small number of cases managed under general anesthesia limits the precision of related findings.

7: CONCLUSION AND RECOMMENDATIONS

7.1. Conclusion

The prevalence of complications following cesarean section at Wallaga University Comprehensive Specialized Hospital was 12.9%. Multivariable analysis identified emergency CS, **presence of obstetric complications, longer surgery duration, general anesthesia and fewer ANC contacts** as independent risk factors. The model demonstrated good fit (Hosmer-Lemeshow $p = 0.438$) and explained 25.1% of the variance in CS complications.

7.2. Recommendations

For Healthcare Providers:

1. **Optimize emergency CS protocols:** When time permits, ensure preoperative optimization (antibiotic prophylaxis, hydration, cross-matching) even in emergency settings.
2. **Strengthen ANC services:** Encourage at least four ANC visits per pregnancy, emphasizing early detection and management of risk factors.
3. **Enhance postoperative monitoring:** Provide enhanced monitoring for women with obstetric complications, prolonged surgery, or emergency CS.
4. **Document indications clearly:** Ensure clear documentation of CS indications to facilitate risk stratification and quality improvement.

For WUCSH:

1. **Establish quality improvement programs:** Conduct regular audits of CS outcomes, complication rates, and surgery duration.
2. **Implement risk-stratified care protocols:** Develop protocols where high-risk women (emergency CS, obstetric complications, prolonged surgery) receive enhanced perioperative care.
3. **Provide staff training:** Conduct regular training on surgical techniques, and management of obstetric emergencies.

For Zonal Health Department

1. **Strengthen antenatal care (ANC) services**
 - Promote **early initiation and completion of ≥ 4 ANC visits**, with emphasis on increasing contacts beyond the minimum
 - Improve quality of ANC through comprehensive risk screening and counseling
2. **Improve referral systems**
 - Ensure timely referral of high-risk pregnancies to higher-level facilities like WUCSH
 - Strengthen communication and transport systems between facilities
3. **Enhance community awareness programs:** Promote maternal health education focusing on: Importance of ANC attendance, early care-seeking behavior and birth preparedness and complication readiness

For Policy Makers:

1. **Promote ANC utilization:** Strengthen community-based programs to increase ANC attendance and early initiation of care.
2. **Standardize CS guidelines:** Implement and monitor adherence to evidence-based guidelines for CS indications and perioperative care.
3. **Monitor CS rates and outcomes:** Establish systems to monitor CS rates and outcomes at facility and population levels.

7.3. Suggestions for Future Research

1. **Multicenter prospective studies:** Include multiple facilities to improve generalizability and increase power for subgroup analyses.
2. **Adequately powered anesthesia studies:** Future studies should aim for balanced groups to properly evaluate anesthesia-related risks.
3. **Long-term follow-up:** Extend follow-up to 30 days post-discharge to capture late complications (e.g., deep surgical site infections, incisional hernias).

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ANNEXES

Questionnaires for the study of Prevalence and Determinants of Complications of Cesarean Section among Women Delivered by CS at WUCSH from July 1, 2025, to January 30, 2026.

ANNEX 1

Participant information sheet

Project title _____

Investigator _____

Introduction

Hello, I am Sihingitan Asefa Hayle from Wallaga University, institute of health sciences. I am here today to collect data on “Prevalence and Determinants of Complications of Cesarean Section among Women Delivered by CS at WUCSH.” The objective of this study is to assess Prevalence and Determinants of Complications of Cesarean Section among Women Delivered by CS at WUCSH from July 1, 2025, to January 30, 2026. I kindly request you to take part in this study. Your co-operation and willingness are greatly helpful in identifying information related to practice of informed consent process and factors affecting it. It needs about 20 minutes for the interview. There is no direct benefit and possible risk associated with participating in this study except the time spent for responding to the questionnaire. The information you provide will be kept strictly confidential. Your participation is voluntarily and you are not obliged to answer any question that you do not want to answer. If you feel discomfort with the question, it is your right to drop it at any time you want.

Purpose

The overall purpose of this study is to assess Prevalence and Determinants of Complications of Cesarean Section among Women Delivered by CS at WUCSH from July 1, 2025, to January 30, 2026.

Final result will be submitted to department of obstetrics and gynaecology and regional health bureau to fill on the gap identified, and address on associated factors to improve maternal outcome.

Procedure and participation

After explanation on procedure and step of study and got it understand importance of study and gave informed consent to voluntary participant on study, data collector will provide you with structured prepared questions with interview-based data collection.

Confidentiality

We strongly assure you that your name and other identifiers will not be disclosed to anyone outside of the study.

Rights, Risk and Benefits of the Study

Your participation in this study is fully voluntarily. You have the right not participate in this study, with draw from study and differ answering of question which you uncomfortable. Whether participate or not in this study will not affect your treatment and care through your stay. There will not be direct benefit from participating on this study but is your participation is paramount significant to investigate process of informed consent and to address gap on future health care practice.

Inducement and incentive

There will not be any kind of incentive for participating in this study. The benefit is not in kind rather improving or addressing gaps from study in future health care service.

Results dissemination

The finding of study will disseminate with publication and conference presentation.

Person to contact

If you have questions regarding this study or would like to be informed of the results after its completion, please feel free to contact the research team leader with the following address: Institute of Health Sciences, Wallaga University.

Investigator: Sihingitan Asefa Hayle

Email: Singtonasefa904@gmail.com

ANNEX 2

Informed Consent

I have understood on purpose of study on Prevalence of Cesarean Section Complications and Associated factors among Mothers who underwent Cesarean Section at WUCSH. I have read the above information's or explained to me and answered my questions well and informed on my right and volunteer participation on study which will not affect current or future my medical care whether participate or not.

1. Yes, of course ☐

2. No. ☐

MRN of Informant_____ Signature_____ Address_____ Date_____

Name of Data Collector_____ Signature _____ Address_____ Date_____

Assurance of Principal Investigator

I, understood, agree to accept all responsibilities for the scientific and ethical conduct of the research project and for the provision of required progress reports as per the terms and conditions of the requirements of the department. I will provide timely progress report to my advisors and seek the necessary advice and approval from my advisors in the course of the research.

Name trainee: Sihingitan Asefa (MD, OBGYN Year IV Resident)

Signature: _____

Date: _____

Structured Interview Questionnaire

Part 1: Socio-Demographic characteristics/information

1. Maternal age: _____
2. Residence: A. Urban B. Rural
3. Marital status: A. Married B. Single C. Divorced D. Widowed
4. Educational level: A. No formal education B. Primary school B. Secondary school
D. College and above
5. Occupation: A. Housewife B. Employee C. Daily laborer D. Others
(specify)_____

Part 2: Obstetric and Surgical history

1. Parity: _____
2. Number of previous Cesarean section: _____
3. Indication of current cesarean section: A. Fetal distress B. CPD C. Previous CS
scar D. Obstructed labor E. Others(specify) _____
4. Any obstetric complication? A. yes B. No
5. If the above is 'yes', which of the following? A. PROM B. PE C. Eclampsia D.
APH E. IAI F. Macrosomia G. Others (specify) _____
6. Type Cesarean section: A. Elective B. Emergency
7. Type of Anesthesia: A. Spinal B. General
8. Duration of surgery in minutes: _____
9. Type of skin incision: _____
10. Blood loss during surgery (estimated amount in ml): _____
11. Pre-operative antibiotic prophylaxis received: A. yes B. No
12. If any of intra operative complications encountered? A. Incision extension B.
Hemorrhage C. Organ injuries D. Hysterectomy E. Others(specify)_____

Part 3. Post-operative complications (if no complication, skip each question below)

1. Did the patient develop any complication within 3 days? A. Yes B. No
2. Wound related? A. wound infection B. wound dehiscence C. Hematoma formation
3. Infectious complications: A. Endometritis B. UTI C. Sepsis D. Others (specify)_____
4. Hemorrhagic complication? A. PPH B. Anemia requiring blood transfusion
5. Thromboembolic complications? A. DVT B. P. Embolism

Part 4: Determinants of complications

1. Did the patient has pre-existing medical conditions? A. yes B. No
2. If number 1 is 'yes' A. Hypertension B. DM C. Anemia D. others(specify)_____
3. Was ANC attended? A. yes B. No
4. If number 3 is "yes", how many contacts? A. 1-2 B. 3-4 C. > 4
5. Duration of hospital stay after CS in days: A. <3 B. 3-5 C. >5
6. Was the patient mobilized early (with in 12hrs of CS)? A. Yes B. No
7. Was there history of prolonged rupture of membrane? A. Yes B. No
8. Was there labor dystocia? A. yes B. No
9. If the above is 'yes' at which stage of labor? A. LFSOL B. AFSOL C. SSOL
10. Any Intra-operative complication in countered? A. yes B. No
11. Who did the operation? A. Senior B. Resident

Hayyama Odeeffannoo Kennuu

Kaayyoon qorannoo “Hanga miidhaa Karaa garaa baqaqsuun daa’ima deessisuun madatuu fi Haalota miidhaa kana fiduu keessatti shoora qaban beekuuf haaadholii Karaa garaa baqaqsuun daa’ima deessisuun WUCSH tti isaaniif godhame” irratti godhamu kun naaf ibsamee haala gaariin hubadheera. Irratti hirmaachuu fi dhiisuun mirga kiyyaa akka ta’e sirriitti nan beeka. Hirmaachuu fi hirmaachuu dhiisuun kiyyaa haala fayyaa fi yaala naaf godhamu kan ammas ta’e kan gara fuulduraa irratti dhiibbaa homaa akka hin qabne hubadheera. Fedhaa kootinis qorannoo kana irratti akkan hirmaadhu murteesseera.

MRN Hirmaataa _____ Mallattoo: _____ Teessoo: _____
Guyyaa: _____

Maqaa Walitti Qabaa Odeeffannoo: _____ Mallattoo: _____ Teessoo: _____
Guyyaa: _____

Kutaa Gaaffilee Afaan Oromoo

Kutaa 1: Amaloota Hawaas-Dinagdee

1. Umurii haadhaa _____
2. Bakka Jireenyaa: A. Magaalaa B. Baadiyyaa
3. Haala Gaa’elaa: A. Heerumte B. Hin heerumne C. Ni Hiiakte
4. Sadarkaa barnootaa _____
5. Dalagaa _____

Kutaa 2: Odeeffannoo haala ulfaa, da’umsaa fi yaala baqaqsuu qaamaa

1. Baay’ina da’umsa turee _____
2. Baay’ina da’umsa karaa garaa baqaqsuun godhame ture _____
3. Sababa da’umsi karaa garaa baqaqsuun godhameef _____
4. Rakkoon da’umsaan walqabatu mudateera? A. Eeyyee B. Lakki
5. Yoo jiraate, maal ture: _____
6. Gosa yaala karaa garaa baqaqsanii deessisuun? A. Itti qopha’ame B. Atattama
7. Gosa dawaa adoochaa? A. Dugda irra kennamu B. Gutuma raffisuu
8. Yeroo itti fudhate karaa garaa baqaqsuun deessisuuf: _____

9. Gosa gogaa garaa baqaqsuu: _____
10. Tilmaama amma dhiiga Yeroo yaalaa dhangala'e _____
11. Yaala baqaqsuun dura dawaan farra bakteriiyaa kennameraa? A. Eeyyee B. Lakki
12. Rakkoon Yeroo garaa baqaqsanii deessisuu mudate _____

Kutaa 3: Rakkoo yaala baqaqsuun booda mudatan

1. Yaalamtuun Guyyaa 3 duraa keessatti rakkoo godhattettii? A. Eeyyee B. Lakki
2. Madaa waliin wal qabatee? _____
3. Rakkoo infeksinii? _____
4. Rakkoo dhiiguu? _____
5. Rakkoo itituu dhiiga ujuummoo dhiigaa? _____

Kutaa 4: waantota rakkoo uumuu keessatti shoora qaban

1. Dhibeen buleessi jiraa? A. Eeyyee B. Lakki
2. Yoo jiraate, maal ture? _____
3. Hordoffiin ulfaa godhameeraa? A. Eeyyee B. Lakki
4. Yoo jiraate, Yeroo meeqa? _____ -
5. Da'umsaa booda guyyaa meeqa hospitaala turte? _____
6. Yaada booda saatii 12 keessatti siree irraa buutee sosocha'uu eegalteettii? A. Eeyyee B. Lakki
7. Bishaan gubbee dhangala'ee saatii meeqa ture? _____
8. Miixuu irratti rakkoon turee? A. Eeyyee B. Lakki
9. Kan armaan olii yoo jiraate maal ture? _____
10. Rakkoon yeroo yaala baqaqsuu tureeraa? A. Eeyyee B. Lakki
11. Yaala baqaqsuu godhame eenyutu hojjete? A. Siinerii B. Rezidentii