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Advances in
Women and Children Health Research

Research Article

# Magnitude and Determinants of Primary Cesarean Section Among Women Who Give Birth at 37 Weeks & Above of Gestational Age in Addis Ababa, Ethiopia: Multicenter Cross-Sectional Study

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**Received:** 2025 Oct 31 **Accepted:** 2025 Nov 20 **Published:** 2025 Nov 29

## Abstract

***Background:*** *The rate of cesarean sections (CS) has increased worldwide, including in low-, middle-, and high-income countries, driven by advances in obstetric care and safer surgical procedures. In Ethiopia, the national CS rate rose from 0.7% in 2000 to 1.9% in 2016, with increases reported in seven out of eleven administrative regions. Studies from public hospitals in Addis Ababa show CS rates ranging from 21% to 38%. (4,6). Despite this rise, no data exists on the prevalence of primary cesarean sections—those performed on women giving birth for the first time or who have never had a CS before. Reducing primary CS rates is crucial, as recommended by the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine, which advocate for strategies that ensure safe delivery practices.*

***Objectives:*** *To assess the magnitude and factors associated with primary cesarean sections among women who gave birth at 37 weeks or later in three teaching hospitals of Addis Ababa University, Ethiopia.*

***Methods:*** *A hospital-based cross-sectional study was conducted from January to April 2024. Systematic random sampling selected 422 participants, and data were analyzed using SPSS version 23.*

***Results:*** *Among 422 mothers, 25.83% underwent primary CS. The most common reasons were fetal distress (55%), mal-presentation (19.3%), failed induction (11.9%), and cephalopelvic disproportion (11%). Factors significantly associated with primary CS included parity, gestational diabetes, chronic medical conditions, fetal presentation, membrane status, and amniotic fluid status ($p < 0.05$).*

***Conclusion:*** *High primary CS prevalence highlights the need for improved management of chronic conditions and labor monitoring to reduce unnecessary procedures while ensuring maternal and neonatal safety.*

**Keywords:** Primary Cesarean Section, Determinants, Magnituden

## Plain Language Summary

Cesarean section (CS) is a surgical procedure used to deliver a baby when a vaginal birth is not possible or safe. In recent years, the number of cesarean sections has increased worldwide, including in Ethiopia. Although cesarean sections can save lives, they also carry risks for both mothers and babies. Therefore, it is important to understand the factors that lead to primary cesarean sections, which are cesarean deliveries performed on women giving birth for the first time or who have never had a cesarean before. In our study, we looked at the number and reasons for primary cesarean sections among women who gave birth at 37 weeks or later in three teaching hospitals in Addis Ababa, Ethiopia. We collected information from 422 mothers who gave birth between January and April 2024. We found that about 26% of the women had a primary cesarean section. The most common reasons for performing the surgery were signs of fetal distress (55%), babies not being in the right position for birth (19.3%), failed attempts to start labor (11.9%), and the baby not fitting through the mother's pelvis (11%). We also identified several factors that made a primary cesarean section more likely, including having diabetes during pregnancy, other chronic medical conditions, the baby's position in the womb, the condition of the fetal membranes, and the amount of amniotic fluid. Our study highlights the importance of closely monitoring pregnant women with chronic illnesses and those with pregnancy-related diabetes. Proper management of these conditions could help reduce the number of primary cesarean sections. Additionally, careful attention to the baby's position and the status of the membranes during labor may help improve outcomes. Overall, most newborns in our study had good health outcomes despite the surgery. Future studies should focus on developing strategies to reduce unnecessary cesarean sections while maintaining safety for both mothers and babies.


## 1. Introduction

### 1.1. Background

When certain difficulties occur during pregnancy or labor, a surgical operation called a cesarean section may be necessary to preserve the lives of both mothers and babies [1]. The use of cesarean section has expanded in low-, middle-, and high-income nations along with notable advancements in clinical obstetric care and better surgical procedure safety [2]. The WHO states that a rate between 10% and 15% is optimum for cesarean sections [3]. Some research suggests that increasing rates may hurt mother and child health. On the contrary, there is little evidence to support the benefits of cesarean birth for women or newborns who do not need it (2)(3). With average rates of 8.2 percent, 24.2 percent, and 27.2 percent in the least developed, less developed, and more developed regions, respectively, more than one in five newborns (21%) globally are now delivered via cesarean section. These rates range from 5 percent in sub-Saharan Africa to 42.8 percent in Latin America and the Caribbean [2]. Ethiopia is among the five countries with the lowest rates of CS in the world (1.9%) [2,4].

In 154 countries, cesarean section rates increased globally between 1990 and 2018, with an average increase of 19%. The growth was lowest in the least developed countries (8.6%) and biggest in less developed countries (22.9%). Eastern Asia, Western Asia, and Northern Africa saw the biggest increases (44.9, 34.7, and 31.5 percent, respectively), whereas sub-Saharan Africa and Northern America saw the smallest increases (3.6 and 9.5 percent, respectively) [2]. By 2030, 29 percent of deliveries worldwide are expected to be performed via cesarean section. Nearly 80% of these CS will take place in less developing nations, 9.4% in the least developed nations, and 11.7% in more developed nations (2). Over the next ten years, where both unmet demand and over usage are anticipated to coexist [2,5]. Both historical patterns and future predictions point to a "two-speed growth" in Africa, resulting in two distinct emergencies that will present a challenging situation with morbidity and mortality linked to unmet needs, unsafe CS provision, and concurrent overuse of the surgical procedure that depletes resources and increases avoidable morbidity and mortality [2,3]. The fundamental causes of this trend need to be examined and may be complicated given the challenge's many facets. To comprehend how societal, public health policy and therapeutic advancements may have contributed to the increase, more research is required. Several strategies are needed to reduce the cesarean delivery rate [2,5]. It's crucial to develop a plan to lower the rate of primary cesarean sections, which will in turn lower the rate of repeat cesarean deliveries. Although national and local organizations can set the agenda, practices, hospitals, health care systems, and, of course, patients can emphasize the safe prevention of primary cesarean birth [1,5].

The national population-based cesarean section rate climbed from 0.7 percent in 2000 to 1.9 percent in 2016, with rises throughout seven of the country's eleven administrative districts, according to Ethiopia Demographic and Health Surveys (DHS) carried out in 2000, 2005, 2011, and 2016. In Addis Ababa, the rate of cesarean deliveries hit a record high in 2016 (21.4%) and rose by the most since 2000 (4). A hospital-based cross-sectional survey of 298 women in 2017 indicated that 38.3 percent of women in Addis Ababa hospitals underwent cesarean sections, a number that is rising quickly [6]. The cesarean section rate was 43 percent according to hospital-based prospective observation research conducted at Tikur Anbesa Specialized Hospital, which is similarly comparable to both Zewditu and Gandhi Memorial Hospitals [7].

The rate of cesarean sections is notably elevated, with percentages of 40, 40.5, and 35.7 percent, respectively, according to the 2022–23 annual perinatal mortality audit report of the three teaching hospitals in Addis Ababa, Ethiopia—Tikur Anbesa Hospital, Gandhi Memorial Hospital, and Zewuditu Memorial Hospital. The rate of primary cesarean sections, however, has never been researched and no data is available. To lower this alarmingly high cesarean section rate, it is crucial to look at decision-making processes and put in place a safe prevention strategy for primary cesarean section practice, as advised by the American College of Obstetricians and Gynecologists and the Society



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for Maternal-Fetal Medicine in their obstetric care consensus recommendation.

### 1.2. Statement of Problem

The optimal cesarean section rate has been deemed to be between 10% and 15% by the global healthcare community since 1985. Since that time, both industrialized and developing nations have seen an increase in the frequency of cesarean sections. Cesarean section rates increased globally between 1990 and 2018, with an average increase of 19% [2]. Even though Ethiopia had a low population-based cesarean section rate (1.9%), Addis Ababa saw a record-high rate (21.4 percent) [4]. In addition, Tikur Anbesa Specialized Hospital had a high rate of cesarean sections performed on hospital patients (43 percent) [7]. Morbidity and mortality are linked to the overuse of the surgical technique that exhausts resources and raises needless morbidity and mortality [2,3]. Evidence-based strategies should be researched to assist clinicians and institutions in selecting prenatal and intrapartum techniques that are successful in lowering cesarean deliveries. To lower the rate of cesarean deliveries, it is necessary to investigate the root causes of this trend and implement several solutions [2,5]. Therefore, it's imperative to create a strategy to reduce the frequency of primary cesarean sections, which will reduce the frequency of repeat cesarean deliveries [1,5]. However, there is no available information about the prevalence of primary cesarean sections or the causes of them in Ethiopia or at our facilities (Tikur Anbesa Hospital, Gandhi Memorial Hospital, and Zewuditu Memorial Hospital). It is crucial to look at decision-making processes and put in place a safe prevention strategy for primary cesarean section practice. The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine developed recommendations on safe prevention strategies for primary cesarean section practice as part of their obstetric care consensus. These include performing an ECV at 37 weeks gestation, not using active phase progress standards until 6 cm of cervical dilatation is reached, performing an elective induction at 41 weeks gestation and extending the time before declaring the induction failure by 18 to 24 hours, offering continuous labor support, using intermittent fetal monitoring techniques, Amnion fusion for severe variable deceleration, promoting non-pharmacological pain relief options, and allowing labor to last longer if maternal and fetal conditions permit [1,8].

Our national obstetric care guideline does not follow all of the ACOG/SMFM recommendations for safe decrease of primary cesarean section practice. The time and duration of the elective induction procedure, which is currently carried out at 42 weeks of gestation and lasts for 12 hours, as well as the decision-making process at the initial stage of labor abnormality management differ dramatically. In addition, amnion fusion was impractical in our hospitals in situations involving severe recurrent variable deceleration. This increases the rate of cesarean sections and raises healthcare costs. Therefore, it is crucial to have policies that are supported by data if we are to lower this rapidly rising cesarean delivery rate. Our study aims to assess the magnitude and determinant factors of primary cesarean section to generate evidence on safe reduction strategies.

### 1.3. Significance of Study

One of the main causes of primary cesarean section for low-risk pregnancies is elective induction of labor and failing to perform a trial of labor after a previous cesarean birth. Additional elements such as shifting thresholds for various indications, changing maternal demographics, provider and patient preferences, the medicolegal environment, and financial incentives could also be influencing the rise in cesarean deliveries. Several factors can affect cesarean delivery rates, and each institution will have those that are simpler to change [1-8]. It's also critical to apply evidence-based system-level strategies, such as audit and feedback, quality improvement methodologies, and a variety of implementation strategies for specific clinical interventions [1-9]. The fundamental issue facing resource-constrained countries, particularly in Africa (including our country), is the lack of evidence-based system-level methods, such as audit and feedback, quality improvement methodologies, and other safe reduction strategies of primary cesarean delivery [6,7]. This increases the rate of cesarean sections and raises healthcare costs. Therefore, it is crucial to have policies that are supported by data if we are to lower this rapidly rising cesarean delivery rate. The purpose of this study is to investigate the primary cesarean section determinant factors and their magnitude. To update the national obstetric care guideline and implement audit and feedback systems, this study will make recommendations to the Ethiopian Ministry of Health and our hospitals. It will also serve as a resource for subsequent research.

## 2. Objectives

To assess the magnitude and determinants of primary cesarean section among women who give birth at 37 weeks or older in three teaching hospitals of the Addis Ababa University to generate evidence on applying safe reduction strategies in Addis Ababa, Ethiopia.

## 3. Materials and Methods

### 3.1. Study Area

Addis Ababa is located at a height of 2,400 meters above sea level, almost in the heart of Ethiopia [1-17]. It has an estimated 526.99 square kilometers of built-up area and a projected population density of 5,535.8 inhabitants per square kilometer. According to figures from Ethiopia's Central Statistical Agency (CSA) for 2012 (EFY), an estimated 3,686,068 people are living in the Addis Ababa Region, 1,389,817 of whom are men and 1,527,478 of whom are women [4]. Addis Ababa has 13 government hospitals and 98 health centers, according to the 2012 (EFY) Health and Health Related Indicators issued by the Ministry of Health [4]. Our study is being undertaken at Tikur Anbesa Hospital, Gandhi Memorial Hospital, and Zewuditu Memorial Hospital, three teaching hospitals in Addis Ababa, Ethiopia. According to the 2022–23 annual perinatal death audit report of these hospitals, there were 16,173 deliveries overall. 6,554 (40.5%) of these births were through cesarean section. In 1972, the Tikur Anbesa Specialized Hospital (TASH) was established.


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The Federal Ministry of Health entrusted TASH, the largest referral hospital in the nation with 700 beds, to the school in 1998, and it has since evolved into a university teaching hospital. Gandhi and Zewuditu Memorial Hospital, among 13 public hospitals, were chosen owing to its high yearly delivery rate and availability of antepartum, intrapartum, and postpartum care, including cesarean delivery. Along with professional specialists, general practitioners, and midwives from the Ministry of Health, AAU university students, consultants, and resident's makeup components of the hospital's staff.

### 3.2. Study Period and Design
The study was conducted between January 2024 and April 2024 on all patients who underwent primary cesarean section at 37 weeks or older at TASH, GMH, and ZMH. Institution-based cross-sectional study design was used.

### 3.3. Population
### 3.4. Source Population
All women who gave birth at TASH, GMH, and ZMH.

### 3.5. Study Population
All women who undergo primary cesarean section at 37 weeks or older at TASH, GMH, and ZMH in the above-stated study period. Sampling Technique and Sample Size Determination

### 3.6. Sample Population
All patients who fulfilled the inclusion criteria in the specified period were the sample population.

### 3.7. Sampling Procedure
We used a sequential sampling technique for all consecutive patients who gave birth and shall be included up to the end of the study period until we reach the calculated sample size.

### 3.8. Sample Size
The sample size was calculated using the single population proportion formula. Considering a z value of 1.96 for a 95% confidence interval, 50% prevalence of cesarean section, and 5% margin of error, gives an initial sample size of 422 (including a 10% nonresponse rate).

The formula for calculating the sample size (n) is n = [(Za/2)2 P(1-P)] ÷ d2, n = [1.962 x 0.5 x 0.5] ÷ (0.05)2, n = 384 (including 10% nonresponse rate n=422) n = sample size
Z = 95% confident interval corresponds to 1.96
P = magnitude of primary cesarean section = 50% = 0.5
d = margin of error = 5% = 0.05

## 4. Eligibility Criteria
### 4.1. Inclusion Criteria
All women who give birth at term with a complete available date or variable of interest within the study period women providing written informed consent

### 4.2. Exclusion Criteria
Women with previous uterine scar GA less than 37 weeks Study Variables Independent Variable Socio-demographic characteristics (age, residence, referral) Current obstetrical factors (parity, gestational age, fetal condition, and PIH) Bad obstetrical and gynecological factors (history of stillbirth, early neonatal death (END), history of infertility, and history of fistula repair) Chronic medical illness (DM, HTN, and cardiac disease) Fetal characteristics (presentation, number, lie, and birth weight) Obstetrical procedures (induction, argumentation, and instrumentation)

### 4.3. Type of Cesarean Section
The outcome of the neonate & the mother

### 4.4. Dependent Variable
• Primary outcome: - determinants of primary cesarean section.
• Secondary outcome: - identified potential for safe reduction strategies.

### 4.4. Data Collection and Procedures
### 4.4.1. Procedure
The structured, pretested, and anonymous questionnaire was prepared in English and included socio-demographic characteristics, fetal characteristics, and obstetrical procedures. Similarly, bad obstetrical and gynecological factors, chronic medical illness, and current obstetrical factors were considered through the questionnaire. Moreover, the type of CS (Emergency and elective) was included in the checklist. Data was collected by 3 residents and 3 nurses.

### 4.5. Data Processing and Analysis
Data was coded, input, and exported to SPSS version 23 for cleaning and analysis after being entered and coded in SPSS version 26. We performed descriptive statistics and then used tables and figures to present the findings. Several checks for the fundamental assumptions underlying dependability and linear regression will be considered before analysis. Cronbach's Alpha result was computed to determine whether the current data are reliable. Whenever necessary, the mean and median values for continuous and discrete variables were determined. To characterize pertinent variables relating to the result variables, frequency and cross-tabulation were used. Statistical significance was determined by the P-value threshold of 0.05.

### 4.6. Data Quality Assurance
The principal investigator trained the data collectors for one day at each labor ward unit, supervising the completeness of the daily collected data. Before data collection started, the data documentation error was evaluated by randomly selecting 30 surgical patients and the principal investigator checked for proper documentation by cross-checking with the collected data by data collectors both intra-operatively and post-operatively. This study was accepted if the documentation error is < 5% and the coefficient of reliability (R) is > 0.95.

### 4.7. Dissemination of the Result
After being completed, the research paper was submitted to

Addis Ababa University College of Health Science Department of Obstetrics and Gynecology. The findings of this study were distributed to Addis Ababa University, TASH, GMH, ZMH, MOH, and for publication.

### 4.8. Operational Definitions

Immediate postop maternal/neonatal outcome is the time just after childbirth to the first 24 hours.

### 4.9. Ethical Consideration

Before collecting data from Addis Ababa University's College of Health Science for this study, DRPC approval was necessary. The objectives of the investigation were disclosed to study participants, and their decision to decline will be respected. Only with the express/written consent of each participant will data be gathered. The identities of participants will remain private. The questionnaire won't include the participant's name or address. The data was only used for the study's intended purpose.

## 5. Results

### 5.1. Socio-Demographic Characteristics

Four hundred twenty-two mothers were included in this study. The age of the majority of women was 20 - 30 years with a mean age of 27.0 years (SD ± 4.7). The total deliveries during the study period were 422 and all cesarean section done in the three hospitals during the study period was 169 (40.05%). Among cesarean deliveries, primary CS was 109 (64.5%). Three hundred ninety-nine (94.5%) of women were from Addis. Two hundred fifty-three (60.0%) of women had at least one ANC contact at our hospitals and one hundred sixty-nine (40.0%) were referred from other health facilities (Table 1).

| Characteristics | Categories | Primary CS | | Total | Percentage |
|---|---|---|---|---|---|
| | | Yes | No | | |
| **Age (Year)** | <20 | 7 | 28 | 35 | 8.3 |
| | 20-24 | 29 | 65 | 94 | 22.3 |
| | 25-30 | 53 | 139 | 192 | 45.5 |
| | 31-34 | 14 | 56 | 70 | 16.6 |
| | >34 | 6 | 25 | 31 | 7.3 |
| **Residence** | Addis Ababa | 103 | 296 | 399 | 94.5 |
| | Out of Addis Ababa | 6 | 17 | 23 | 5.5 |
| **ANC follow up** | At our hospital | 63 | 190 | 253 | 60.0 |
| | Referral | 46 | 123 | 169 | 40.0 |

**Table 1: Socio-Demographic Characteristics of Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422)**

### 5.2. Obstetrical, Gynecological and Medical Characteristics

The gestational age ranged between 37 weeks (259 days) and 43+2 weeks (303 days) with a mean and SD of 39+6 weeks (279 days) ± 11 days. Three hundred (71.1%) were vaginal deliveries while, one hundred-nine (26%), were cesarean (fig 1). Among those delivered by cesarean section, 89 (81.7%) were done on an emergency basis and the rest 20 (17.3%) were done as elective. The overall cesarean section during the study period was 169. Of which we were excluded 60 repeat cesarean section and 109 (25.83%) were primary CS.

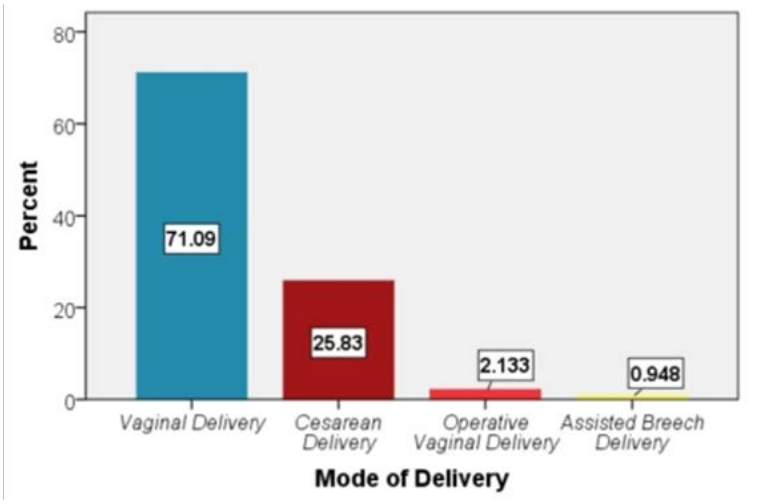


**Figure 1: Mode of Delivery Among Women Who Gave Birth After 37 Weks of Gestation at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422)**


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The majority 237 (56%) of all study participants were multipara. About 2/3rd 285 (67.5%) of study participants had spontaneous labor, for 117 (27.7%) of women labor was induced and the rest 20 (4.7%) were admitted for elective cesarean section. Of those whose labor was stated spontaneously, 19 (6.7%) were augmented. For those of whom labor was induced, 109 (93.2%) had unfavorable cervix and were primed with misoprostol 23 (21.1%) and Foley catheter (86, 78.9%), and the rest (8, 6.8%) were directly induced with oxytocin or misoprostol. Twenty-seven (6.4%) of the participants had a history of chronic medical illness. Such as chronic hypertension (12, 44.4%), cardiac disease (10, 37.0%), and pre-gestational diabetes mellitus (5, 18.5%) (Table 2).

| Characteristics | Categories | Primary CS | | Total | Percentage |
|---|---|---|---|---|---|
| | | Yes | No | | |
| **Admission status (n=422)** | Spontaneous labor | 64 | 221 | 285 | 67.5 |
| | Priming & induction | 25 | 92 | 117 | 27.7 |
| | Elective CS | 20 | - | 20 | 4.8 |
| **Parity (n=422)** | Multipara | 30 | 207 | 237 | 56.2 |
| | Nulliparous | 79 | 106 | 185 | 43.8 |
| **Gestational age (n=422)** | Early term | 23 | 79 | 102 | 24.2 |
| | Full term | 41 | 121 | 162 | 38.4 |
| | Late-term | 27 | 73 | 100 | 23.7 |
| | Post-term | 13 | 30 | 43 | 10.2 |
| | Unknown GA | 5 | 10 | 15 | 3.6 |
| **Obstetrics and gynecological conditions (n=422)** | No History | 66 | 266 | 330 | 78.2 |
| | Pregnancy-induced hypertension | 21 | 31 | 52 | 12.3 |
| | GDM | 16 | 8 | 24 | 5.7 |
| | History of Stillbirth | 3 | 2 | 5 | 1.2 |
| | Early Neonatal Death | 2 | 2 | 4 | 0.9 |
| | Other | 1 | 4 | 5 | 1.2 |
| **Chronic medical illness (n=422)** | Chronic hypertension | 6 | 6 | 12 | 2.8 |
| | Cardiac disease | 2 | 8 | 10 | 2.4 |
| | Diabetes mellitus | 4 | 1 | 5 | 1.2 |
| | No history | 97 | 298 | 395 | 93.6 |
| **Bishop score (n=117)** | Unfavorable | 24 | 80 | 104 | 88.9 |
| | Favorable | 1 | 12 | 13 | 11.1 |
| **Cervix primed (n=117)** | Yes | 19 | 88 | 107 | 91.5 |
| | No | 6 | 4 | 10 | 8.5 |
| **Priming methods (n=107)** | Foley catheter | 18 | 68 | 86 | 80.4 |
| | Misoprostol | 1 | 20 | 21 | 19.6 |
| **Labor augmented (n=285)** | Yes | 7 | 12 | 19 | 6.7 |
| | No | 57 | 207 | 266 | 93.3 |
| **Oxytocin used (n=402)** | Yes | 32 | 99 | 131 | 32.6 |
| | No | 57 | 214 | 271 | 67.4 |
| **Fetal membrane status (n=402)** | Intact | 36 | 173 | 209 | 52.0 |
| | Ruptured | 53 | 140 | 193 | 48.0 |
| **Liquor Status (n=402)** | Clear | 43 | 284 | 327 | 81.3 |
| | Meconium Stained | 41 | 19 | 60 | 14.9 |
| | Bloody | 3 | 2 | 5 | 1.2 |
| | Not Documented | 2 | 8 | 10 | 2.5 |

**Table 2: Obstetrics and Gynecologic Conditions of Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422)**

### 5.3. Fetal Characteristics

Of the total, 410 (97.2%) were singleton and 12 (2.8%) were twin pregnancy. The majority 399 (94.5%) had cephalic presentation, 19 (4.5%) were breech presentation and the rest 4 (0.9%) transverse lie. Close to one in eleven of the fetuses, 33 (7.8%) were macrosmic and 44 (10.4%) neonates had low birth weight (Table 3).

| Characteristics | Categories | Primary CS | | Total | Percentage |
|---|---|---|---|---|---|
| | | Yes | No | | |
| **Fetus number (n=422)** | Single | 105 | 305 | 410 | 97.2 |
| | Twin | 4 | 8 | 12 | 2.8 |
| **Fetal presentation and lie (n=422)** | Cephalic | 90 | 305 | 399 | 94.5 |
| | Breech | 15 | 4 | 19 | 4.5 |
| | Transverse | 4 | 0 | 4 | 0.9 |
| **Birth weight of the newborn (n=434)** | >4000gram | 14 | 19 | 33 | 7.6 |
| | B/n 2500gram & 4000gram | 86 | 264 | 350 | 80.6 |
| | <2500gram | 13 | 34 | 51 | 11.8 |

**Table 3: Fetal Characteristics of Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422**

### 5.4. Indications of Primary Cesarean Section

The prevalence of primary cesarean section performed among women who give birth at 37 weeks or older gestational age was 25.83% (109) with 95% CI [0.216, 0.3] (Fig. 2).

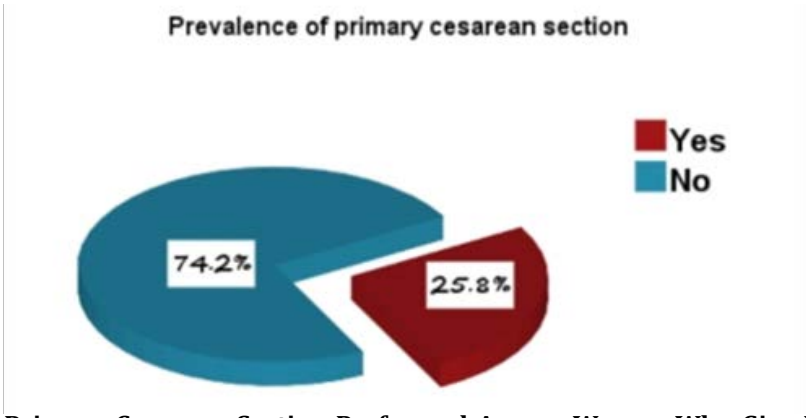


**Figure 2: Prevalence of Primary Cesarean Section Performed Among Women Who Give Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422**

The most frequent indications for primary cesarean section were fetal distress (55%), malpresentation (19.3%), failed induction (11.9%), and CPD (11%). The least frequent indications were severe IUGR and other accounts (2.7%) (Table 4).

| Variables | Frequency | Percent |
|---|---|---|
| **NRFHRP** | 60 | 55.0 |
| **Malpresentation** | 21 | 19.3 |
| **Failed Induction** | 13 | 11.9 |
| **CPD** | 12 | 11.0 |
| **Twin Pregnancy with IUGR at term** | 2 | 1.8 |
| **Other** | 1 | 0.9 |
| **Total** | 109 | 100.0 |

**Table 4: Indication of Primary Cesarean Section of Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=109)**

### 5.5. Determinants of Primary Caesarean Section

Each independent variable was computed in the bivariate logistic regression model, those variables whose p-value <0.25 were nulliparity, gestational hypertension, gestational diabetic mellitus, chronic medical disease, bishop score, cervix priming, fetal membrane status, liquor status, labor augmentation and the presentation of fetus which were associated with cesarean section. However, on multivariable logistic regression analysis nulliparity, gestational diabetic mellitus, chronic medical disease, fetal presentation, bishop score, fetal membrane and liquor status were variables significantly associated with a primary cesarean section with p-value <0.05 as depicted in the table below (Table 5).

This study reveals several significant factors associated with the risk of having a primary cesarean section. Notably, nulliparous women were 13.83 times (AOR= 13.83; 95% CI: 6.25, 30.60) more likely to undergo primary CS than multipara women. Additionally, women who had mal-presentation presentation (breech or transverse) had 43.02 times (AOR= 43.02; 95% CI: 7.48, 247.36) more likely to undergo primary CS than women who had a cephalic presentation. Similarly, women who had a history of gestational diabetes mellitus and chronic medical diseases like pregestational diabetes, cardiac disease, and chronic hypertension were 6.12 times and 5.11 times more likely to undergo primary CS than women who didn't have the disease respectively. However, women who presented with intact membranes and clear amniotic fluid were 67% and 94% less likely to undergo primary CS than women with ruptured amniotic membranes and meconium-stained amniotic fluid respectively. Women who had favorable cervix were 95% less likely to undergo CS (Table 5).

| *Variables* | Categories | Primary CS | | COR (95% CI) | P-Value | AOR (95% CI) |
|---|---|---|---|---|---|---|
| | | Yes | No | | | |
| *Parity* | Multipara | 30 | 207 | 1 | | 1 |
| | Nulliparous | 79 | 106 | 5.14(3.18,8.32) | 0.000 | 13.83(6.25,30.60) * |
| *PIH* | Yes | 21 | 31 | 2.17(1.19,3.97) | 0.267 | 1.72(0.66,4.44) |
| | No | 88 | 282 | 1 | | 1 |
| *GDM* | Yes | 16 | 8 | 6.56(2.72,15.81) | 0.011 | 6.12(1.51,24.70) * |
| | No | 93 | 305 | 1 | | 1 |
| *Chronic Medical Disease* | Yes | 12 | 15 | 2.46(1.11,5.43) | 0.010 | 5.11(1.48,17.70) * |
| | No | 97 | 298 | 1 | | 1 |
| *Bishop Score* | Favorable | 1 | 12 | 0.28(0.03,2.25) | 0.032 | 0.05(0.003,0.762) * |
| | Unfavorable | 24 | 80 | 1 | | 1 |
| *Cervix Primed* | Yes | 19 | 88 | 1 | | 1 |
| | No | 6 | 4 | 1.78(1.02,3.10) | 0.427 | 2.16(0.32,14.41) |
| *Labor Augmented* | Yes | 7 | 12 | 2.12(0.80,5.62) | 0.348 | 2.14(0.44,10.51) |
| | No | 57 | 207 | 1 | | 1 |
| *Fetal Membrane Status* | Intact | 36 | 173 | 0.55(0.34,0.89) | 0.005 | 0.33(0.15,0.72) * |
| | Ruptured | 53 | 140 | 1 | | 1 |
| *Liquor Status* | Clear | 43 | 284 | 0.07(0.04,0.13) | 0.000 | 0.06(0.02,0.13) * |
| | Meconium Stained | 41 | 19 | 1 | | 1 |
| *Fetal Presentation* | Cephalic | 90 | 308 | 1 | | 1 |
| | Malpresentation | 19 | 3 | 16.3(5.41,49.16) | 0.000 | 43.02(7.48,247.36) * |
| *Note: COR - Crude Odds Ratio, AOR - Adjusted Odds Ratio, * Statistically Significant at p < 0.05.* | | | | | | |

**Table 5: Bivariate and Multivariate Analysis of Factors Associated with Primary Cesarean Section**

### 5.6. Physician's Decision on Indications

The commonest type of fetal distress primary CS was persistent fetal tachycardia and fetal bradycardia. Maternal position change, IV fluid, and artificial rupture of the membrane were done for about 54.5% of women with NRFHRP before CS was decided. However, for 15.2% of women with NRFHRP, nothing was done. 30.8% of women who were admitted for priming and induction were not primed. Most of the labor dystocia 7(58.3%) of labor dystocia occurred at the second stage of labor due to the malposition of the fetal head. But manual rotation of the occiput is not done at all. For 22.2% of women with mal-presentation, ECV was tried and all of them failed (table 6).


**Citation:** Denberu, Y. D., Alemu, D. M., Yigeremu, M., Desalegn, D., Tizazu, H. M., et al. (2025). Magnitude and Determinants of Primary Cesarean Section Among Women Who Give Birth at 37 Weeks & Above of Gestational Age in Addis Ababa, Ethiopia: Multicenter Cross-Sectional Study. *Adv Women Children Health Res, 1*(1). 1-13.

| Variables | Categories | Frequency | Percent |
|---|---|---|---|
| **Type of NRFHRP (n=60)** | Meconium stained amniotic fluid | 27 | 45.0 |
| | Persistent fetal tachycardia | 17 | 28.3 |
| | Fetal bradycardia | 14 | 23.3 |
| | Recurrent variable deceleration | 2 | 3.4 |
| **What was done for NRFHRP (n=33)** | Maternal position changed to the lateral side | 1 | 3.0 |
| | IV fluid was given | 2 | 6.1 |
| | ARM was done | 7 | 21.2 |
| | All of the above was given | 18 | 54.5 |
| | Nothing was done | 5 | 15.2 |
| **If failed induction, was the cervix primed? (n=13)** | Yes | 9 | 69.2 |
| | No | 4 | 30.8 |
| **Cause CPD (n=12)** | Fetal malposition | 7 | 58.3 |
| | Fetal macrosomia | 4 | 33.3 |
| | Contracted pelvis | 1 | 8.4 |
| **ECV attempted for breech or transverse (n=23)** | Yes | 7 | 30.4 |
| | No | 16 | 69.6 |
| | Total | 23 | 100.0 |

**Table 6: Indication and Decision-Making Process of Primary Cesarean Section of Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=109)**

## 6. Maternal and Perinatal Outcome

Of the total neonate, 421 (97%) neonates had APGARE > 7. However, 13 (3%) of the neonates were born with low Apgar scores at the fifth minute. 2 (1.8%) neonates delivered with cesarean section had low Apgar scores. NICU admission was decided for 32 (7.4%) of neonates. 8 (1.9%) neonates delivered with cesarean section were admitted to NICU. The commonest cause of admission was respiratory distress syndrome which was 17 (3.9%) (Table 7). Of these, 12 were delivered vaginally and the rest 5 were by cesarean section. 9 and 4 were delivered at early and late gestational age, and the rest 4 were at full term. 7 were having obstetrics complications like pregnancy-induced hypertension (5) and GDM (2), and of a total 10 were delivered from Nullipara women and 8 were from multipara mothers.

Maternal immediate postpartum and post-operation complications were observed for 7 (1.7%) of mothers who developed immediate post-partum and post-op complications like PPH and febrile morbidity. 5 (1.2%) women developed PPH. Of these 4 were delivered vaginally, which were admitted for priming and induction, and one was by emergency cesarean delivery (Table 7). This may show that the use of oxytocin may contribute to the development of PPH. Our study shows that 2 (0.47%) women developed febrile morbidity. All of them were delivered by emergency cesarean section and admitted with ruptured membranes with one having clear amniotic fluid and the other meconium-stained amniotic fluid. One woman who was delivered by cesarean section for obstructed labor developed both PPH and febrile morbidity.

| Characteristics | Categories | Primary CS | | Total | Percentage |
|---|---|---|---|---|---|
| | | Yes | No | | |
| **First-minute APGAR score** | Reassuring (7-10) | 104 | 307 | 411 | 94.7 |
| | Low APGAR Score (<7) | 5 | 18 | 23 | 5.3 |
| **Fifth-minute APGAR score** | Reassuring (7-10) | 107 | 314 | 421 | 97.0 |
| | Low APGAR Score (<7) | 2 | 11 | 13 | 3.0 |
| **Neonatal NICU admission (n=434)** | Yes | 8 | 24 | 32 | 7.4 |
| | No | 101 | 301 | 402 | 92.6 |
| **Causes of NICU admission (n=434)** | Respiratory Distress Syndrome | 5 | 12 | 17 | 3.9 |
| | PNA | 2 | 4 | 6 | 1.4 |
| | EONS | 3 | 6 | 9 | 2.1 |

| | | | | | |
|---|---|---|---|---|---|
| **Maternal complication** | Yes | 3 | 4 | 7 | 1.7 |
| | No | 106 | 309 | 415 | 98.3 |
| **Causes of maternal complication** | PPH | 1 | 4 | 5 | 1.2 |
| | Febrile morbidity | 2 | 0 | 2 | 0.5 |

**Table 7: Immediate Post-Partum and Post-Operative Conditions of Neonates and Mothers Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422)**

## 7. Discussion

Our research finding indicates that 25.83% of the deliveries were a primary cesarean section. This statistic is significant as it provides insight into the prevalence of primary cesarean deliveries in the population. This rate can be compared to national and global averages, which vary widely based on geographic, socioeconomic, and healthcare system factors. For instance, the World Health Organization recommends that cesarean section rates should not exceed 10-15% in a population (3). Our finding is slightly higher than the study done in Shire, northern Ethiopia on the proportion of women who undergone primary cesarean section which was 20.2% (38). This difference may be due to differences in study populations. However, it is consistent with the study done in Pakistan at Jinnah Medical College Hospital Karachi, which was 26.06% (39).

According to our findings, the most frequent indications for primary cesarean section were NRFHP (55%), Malpresentation (19.3%), failed induction (11.9%), and CPD (11%). These findings are consistent with the most common indications reported in the literature. For example, in the Shire, northern Ethiopia, the most frequent indications for primary cesarean section were NRFHP (32.1%), CPD (18.5%), and abnormal presentation (12. 3%) (38), and in the U.S., primary cesarean rate was 30.8% for primiparous women and 11.5% for multiparous women and the leading indications are failure to progress in labor (35.4%), non-reassuring fetal heart rate (27.3%), and fetal malpresentation (18.5%) (40). These slight differences reflect variations in healthcare practices, patient demographics, and cultural attitudes toward childbirth in each region.

Our research findings indicate a significant association between Nulliparity and the likelihood of undergoing a primary cesarean section. Specifically, nulliparous women are 13.8 times more likely to have a primary cesarean section compared to multiparous women. Our finding is also supported by research done in our country reporting that multiparous women's cesarean section rate decreased by 39% than that of nulliparous (6). Like our findings, studies in Africa often report that nulliparous women have higher rates of cesarean sections. For example, a study in Nigeria found that nulliparous women were significantly more likely to undergo cesarean delivery due to factors such as increased fetal distress and prolonged labor. The Adjusted Odds Ratios in African studies can vary. Some studies report AORs ranging from 2 to 10 for nulliparous women compared to multiparous women, indicating that while there is a significant association, it may not be as pronounced as the 13.8 AOR found in our research. This may be due to the nulliparous women may experience different labor dynamics compared to multiparous women. According to our study of failed induction, CPD and fetal distress were higher in nulliparous than multipara (Table 8). They might have longer labor or face more complications, leading to a higher likelihood of cesarean delivery. Nulliparous women may have different health profiles that contribute to this increased risk.

| Variables | Parity | | Frequency | Percentage |
|---|---|---|---|---|
| | Multipara | Nullipara | | |
| Fetal distress | 10 | 50 | 60 | 55.0 |
| Malpresentation | 12 | 9 | 21 | 19.3 |
| Failed Induction | 0 | 13 | 13 | 11.9 |
| CPD | 5 | 7 | 12 | 11.0 |
| Twin Pregnancy with IUGR at term | 2 | 0 | 2 | 1.8 |
| Others | 1 | 0 | 1 | 0.9 |
| Total | 30 | 79 | 109 | 100.0 |

**Table 8: Comparison of Parity by Indication of Primary Cesarean Section of Mothers by Parity Who Gave Birth at Three Teaching Hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=109)**

Our research indicates that women with malpresentation (breech or transverse lie) had a significantly higher likelihood of undergoing primary cesarean section compared to those with cephalic presentation. Specifically: Women with malpresentation were 43.02 times more likely to have a primary CS (AOR = 43.02, 95% CI: 7.48, 247.36). A similar study in in two hospitals southwestern Ethiopia on determinants of unjustified cesarean section showed that women who had mal-presentation had 10 times increase the odds of having a cesarean section (41). These results align with the understanding that malpresentation is a major contributor to abnormal labor and delivery. When the fetus is not in the optimal vertex presentation, it is less likely to descend and rotate properly through the maternal pelvis, often necessitating cesarean section (41)(42). The higher odds ratios found in our study compared to the Ethiopian study could be due to differences in study populations, definitions of malpresentation, or other confounding factors. However, both demonstrate the strong association between malpresentation and primary CS.

In our study mal-presentations (breech and transverse) were 23 (5.45%). Of which cesarean sections were done for 15 (78.9%). Of these 7 were attempted ECV, but all of them failed. Based on our findings the ECV rate and its success are low, and it may be due to being done by less experienced residents. Malpresentation increases risks of perinatal morbidity and mortality, especially with vaginal delivery (39). Our research provides further evidence that malpresentation, especially breech and transverse lie, is a major risk factor for primary cesarean section. This highlights the importance of antenatal identification of malpresentation and consideration of interventions like ECV to optimize fetal position before labor. In general, our research results provide valuable insights into the factors influencing the decision to perform primary cesarean sections. These findings can inform clinical practices and guidelines, aiming to optimize maternal and fetal outcomes. Further research could explore interventions that address these factors, potentially reducing the overall rates of cesarean deliveries while ensuring safety for both mothers and infants.

Our research indicates that women with a history of gestational diabetes mellitus (GDM) are significantly more likely to undergo primary cesarean sections (CS), with a risk increase of 6.96 times compared to those without GDM. This aligns with findings from a study in Addis Ababa, where 57.8% of diabetic mothers had cesarean deliveries (39). There are several key reasons for the higher cesarean delivery (CD) rates in women with gestational diabetes mellitus (GDM): Increased risk of fetal macrosomia, Obesity (increases the odds of CD in women with GDM by 2.25 times), Nulliparity with GDM have a 4.6 times greater chance of undergoing CD compared to multiparous women and Pregnancy complications like pregnancy-induced hypertension, fetal distress, and cervical factors unfavorable for induction can necessitate a CD in women with GDM (40). So, the combination of fetal, maternal, and obstetric factors in GDM pregnancies contributes to the elevated CD rates observed in this population. Identifying women at the highest risk allows for counseling and planning to optimize outcomes.

Additionally, Women with a history of chronic medical diseases like pregestational diabetes, cardiac disease, and chronic hypertension were 5.11 times more likely to undergo primary CS than women who didn't have the disease. This significant association suggests that chronic medical conditions may complicate pregnancies. It highlights the need for careful monitoring and management of women with chronic medical conditions during pregnancy. Tailored prenatal care could potentially mitigate risks and improve outcomes. The presence of intact fetal membranes and clear amniotic fluid were associated with reduced odds of CS, decreasing by 67% and 94%, respectively [18,19]. Of the total meconium-stained amniotic fluid, 9 (15%) and 8 (13%) had pregnancy-induced hypertension and GDM respectively. This result may indicate that intact membranes are associated with a more favorable labor progression, potentially reducing the need for surgical intervention. It emphasizes the importance of monitoring the status of the amniotic membranes during labor and considering interventions that could prolong membrane integrity, where safe and appropriate. The presence of meconium-stained fluid often raises concerns about fetal distress, which can lead to an increased likelihood of cesarean delivery. This significant association suggests that obstetric conditions like pregnancy-induced hypertension and GDM may complicate pregnancies. It highlights the need for careful monitoring and management of women with obstetric conditions, like pregnancy-induced hypertension and GDM, during pregnancy. Tailored prenatal care could potentially mitigate risks and improve outcomes. This finding underscores the importance of assessing amniotic fluid characteristics during labor. It suggests that strategies aimed at reducing the incidence of meconium-stained amniotic fluid could be beneficial in lowering CS rates.

Of the total neonates, 421 (97%) neonates had 5$^{th}$ minute Apgar score > 7. However, 13 (3%) of the neonates were born with low Apgar scores at the fifth minute. 2 (1.8%) neonates delivered with cesarean section had low Apgar scores. NICU admission was decided for 32 (7.4%) of neonates. 8 (1.9%) neonates delivered with cesarean section were admitted to NICU. The commonest cause of admission was respiratory distress syndrome which was 17 (4.0%) (Table 7). Of these, 12 were delivered vaginally and the rest 5 were by cesarean section. 9 and 4 were delivered at early and late gestational age, and the rest 4 were at full term. 7 were having obstetrics complications like pregnancy-induced hypertension (5) and GDM (2), and of a total 10 were delivered from Nullipara women and 8 were from multipara mothers. The results indicate that most neonates had favorable outcomes. However, the high incidence of respiratory distress syndrome among admitted neonates suggests the need for improved management strategies and early intervention to prevent or mitigate this complication. According to our study, it may be due to early-term delivery contributing to fetal lung immaturity, fetal asphyxia after the delivery of 41 weeks of gestation, and the presence of obstetric complications like



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pregnancy-induced hypertension and GDM. It is supported by different literature [16,18].

Our study shows that 5 (1.2%) women developed PPH. Of these 4 were delivered vaginally, which were admitted for priming and induction, and one was by emergency cesarean delivery. This may show that the use of oxytocin may contribute to the development of PPH. Our study shows that 2 (0.47%) women developed febrile morbidity. All of them were delivered by emergency cesarean section and admitted with ruptured membranes with one having clear amniotic fluid and the other meconium-stained amniotic fluid. It may be due to a ruptured membrane and emergency cesarean section. Regarding maternal outcomes, the low rate of immediate postoperative complications is reassuring. However, continued monitoring and prompt management of PPH and postoperative fever are essential to ensure the well-being of mothers. These findings contribute to the understanding of neonatal and maternal outcomes in the studied population. The data can inform clinical decision-making, guide resource allocation, and help develop targeted interventions to further improve perinatal outcomes [1-19].

## 8. Conclusion

The magnitude of primary cesarean section in this study was high. The most common indications were fetal distress, malpresentation, failed induction, and CPD. Nulliparity, gestational diabetic mellitus, chronic medical disease, fetal malpresentation, fetal membrane status, and liquor status were factors significantly associated with primary CS. 5 (1.2%) and 2 (0.47%) women developed PPH and febrile morbidity respectively. And 13 (3%) of the neonates were born with low Apgar scores at the fifth minute. NICU admission was decided for 32 (7.4%) of neonates. The results indicate that most neonates had favorable outcomes, with only a small percentage experiencing low Apgar scores or requiring NICU admission. However, the high incidence of respiratory distress syndrome among admitted neonates suggests the need for improved management strategies and early intervention to prevent or mitigate this complication. It needs further research.

## Limitations of the Study

For some of the outcomes, the sample size was small.

## Recommendation

Our research results provide valuable insights into the factors influencing the decision to perform primary cesarean sections. Further study with a larger sample size and methodology is advised.

## Declaration of Competing Interest

I declare that there are no competing financial and non-financial interests that could influence the content of this manuscript.

## Disclosure Statement

We, the first and last authors, affirm that this thesis was prepared independently without any external funding or financial support. All views and interpretations presented are solely those of the authors.

## Funding Statement

The author(s) received no financial support for the authorship and/or publication of this article.

## Acknowledgment

First and foremost, I thank Almighty GOD for His blessings throughout my life and during the course of this research work. I would like to express my deepest gratitude to my advisors, Dr. Mahlet and Dr. Dawit, and other authors for their invaluable guidance, support, and encouragement throughout the development and completion of this research. Their expertise and mentorship played a crucial role in shaping the quality and depth of this study. I also extend my heartfelt appreciation to Addis Ababa University College of Health Sciences for providing me with this opportunity and the support necessary to conduct this research. As the principal investigator. Dr. Yidersal Demsie Denberu, took an active and leading role in every aspect of this research, from conceptualization and study design to data collection, analysis, and manuscript preparation. My dedication to exploring and addressing the magnitude and determinants of primary cesarean sections in Addis Ababa was pivotal to the successful completion of this study. Finally, I am immensely grateful to my friends, family, and colleagues for their unwavering support and motivation throughout this journey. Their encouragement gave me the strength to persevere, and I truly value their presence in my life.

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