Addis Ababa University

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Magnitude and determinants of primary cesarean section among women who give birth at 37 & above weeks of gestational age in three teaching hospitals of Addis Ababa University in Addis Ababa, Ethiopia: Cross Sectional Study

RESEARCH RESULT

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Research Report Attesting Page

Student Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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Supervisors' Declaration

I have undersigned and certify that I have read and hereby recommend for acceptance to Addis Ababa University dissertation entitled "Magnitude and determinants of primary cesarean section among women who give birth at 37 & above weeks of gestational age in three teaching hospitals of Addis Ababa University in Addis Ababa, Ethiopia"

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Abbreviations and Acronym

ACOG	American College of Obstetricians & Gynecology
AREDF	Absent/Reversed End Diastolic Flow
AREDV	Absent/Reversed End Diastolic Volume
CD	Cesarean Delivery
CS	Cesarean Section
FHR	Fetal Heart Rate
GDM	Gestational Diabetes Mellitus
GMH	Gandhi Memorial Hospital
IUGR	Intrauterine Growth Retardation
MCA	Middle Cerebral Artery
MOHE	Ministry of Health of Ethiopia
NICU	Neonatal Intensive Care Unit
NICHD	National Institute Child Health and Human Development
NNM	Neonatal Near Miss
PPH	Postpartum Hemorrhage
SGA	Small for Gestational Age
SMFM	Society of Maternal-Fetal Medicine
SMO	Severe adverse Maternal Outcome
SNO	Severe adverse Neonatal Outcome
TASH	Tikur Anbesa Specialized Hospital
VD	Vaginal Delivery
ZMH	Zewuditu Memorial Hospital

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Abstract

Background: The use of cesarean section has expanded to low-, middle-, and high-income nations along with notable advancements in clinical obstetric care and better surgical procedure safety. According to Ethiopia Demographic and Health Surveys (DHS), 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 areas. Studies done in Addis Ababa public hospitals showed that the rate of cesarean section ranges between 21% and 38%. The rate of primary cesarean sections, however, has never been researched and no data is available. To lower this concerning 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 for Maternal-Fetal Medicine in their obstetric care consensus recommendation.

Objectives: To assess the magnitude and determinants of primary cesarean section among women who gave birth at term in three teaching hospitals of Addis Ababa University in Addis Ababa, Ethiopia.

Methods: A hospital-based cross-sectional study was conducted from January 01 to April 30, 2024. Systematic random sampling was used to select 422 participants. The structured, pretested, and anonymous questionnaire was used, and data were entered into Epi-Data version 3.1 and will be exported analysis to SPSS version 23. Descriptive statistics were performed, and then used tables and figures to present the findings. A P-value of <0.05 will be considered statistical significance.

Result: Four hundred twenty-two women's medical charts were included in this study, making 100% response rate. Our research finding indicates that 25.83% of women underwent a primary cesarean section. The most frequent indications for primary cesarean section were fetal distress (55%), mal-presentation (19.3%), failed induction (11.9%), and CPD (11%). Our research findings indicate that parity, gestational diabetic mellitus, chronic medical disease, fetal presentation, fetal membranes status and liquor status were variable statistically significantly associated with Primary CS with p-value <0.05.

Conclusion: The magnitude of primary cesarean section in this study was high. Our study emphasizes the need for careful monitoring and management of women with gestational diabetic mellitus, chronic medical conditions during pregnancy, and the importance of monitoring the status of the fetal membranes during labor. The results indicate that most neonates had favorable outcomes. Further research could explore interventions that address factors, potentially reducing the overall rates of cesarean deliveries while ensuring safety for both mothers and infants.

1. Introduction

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 cesarean section rate is significantly high, at 40 percent, 40.5 percent, 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 for Maternal-Fetal Medicine in their obstetric care consensus recommendation.

Statement of Problem

The optimal caesarean 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 have been shown to be 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 strategy 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, amnioinfusion for severe variable deceleration, promoting non-pharmacological pain relief options, and allowing labor to last longer if maternal and fetal conditions permit (1)(8).
Some of ACOG/SMFM obstetric care recommendations on safe reduction of primary cesarean section practice are not adopted by our national obstetric care guideline. There is a startling difference in the decision-making process, for instance, at the first stage of labor abnormality management as well as in the timing and length of elective induction which currently performed at 42 weeks of gestation and for a period of 12 hours. In addition, amnioinfusion 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.

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. There are several factors that can affect cesarean delivery rates, and each institution will have those that are simpler to change (1)(2)(6)(7).

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 its 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. Literature Review

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 caesareans has expanded in low, middle, and high-income nations along with notable advancements in clinical obstetric care and better surgical procedure safety (5). In 154 countries between 1990 and 2018, the World Health Organization (WHO) conducted research that found that the use of cesarean sections is increasing globally and now accounts for more than one in five (21%) of all childbirths, with average rates ranging from 5 percent in sub-Saharan Africa to 42.8 percent in Latin America and the Caribbean. This number is anticipated to increase over the following 10 years, with cesarean sections anticipated to make up nearly a third (29%) of all deliveries by 2030 (2).

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 areas, according to Ethiopia Demographic and Health Surveys (DHS) carried out in 2000, 2005, 2011, and 2016. In 2016, Addis Ababa had the highest rate of cesarean sections (21.4%) and the biggest growth since 2000 (8). In 2017, a hospital-based cross-sectional study involving 298 women in Addis Ababa hospitals, Ethiopia, found that 38.3 percent of women underwent cesarean sections. Previous cesarean, NRFHR, and post-term pregnancy are the most frequent causes (6). According to a facility-based prospective observation study done at Tikur Anbesa Specialized Hospital, the cesarean section rate was 43% which is high (7).

The cesarean section rate is significantly high, at 40 percent, 40.5 percent, and 35.7 percent, respectively, according to the 2022–23 annual perinatal mortality audit report of the three teaching hospitals in Addis Abeba, Ethiopia—Tikur Anbesa Hospital, Gandhi Memorial Hospital, and Zewuditu Memorial Hospital—where our study is being conducted. 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 for Maternal-Fetal Medicine in their obstetric care consensus recommendation.

Balancing Risks and Benefits

Regardless of the method of delivery, childbirth by its very nature entails potential risks for the mother and her child (1). The WHO states that a rate of between 10% and 15% is optimum for cesarean sections (WHO statements on cesarean section rate) (3). A normal physiological process is vaginal birth. However, in some cases, a cesarean section (CS) may be necessary to preserve the health of the mother and the unborn child. Underutilization of CS under these conditions raises maternal and neonatal mortality and morbidity. In contrast, excessive use of CS—that is, using it when there is no medical need for it—has not demonstrated any positive effects and may even be harmful, wasting both time and money. Consequently, maximizing the use of CS is a challenge for public health and a global problem (2)

Despite some research suggesting that increasing rates may hurt mother and child health, there is little evidence to support the benefits of cesarean birth for women or newborns who do not need it. These hazards need to be carefully considered in environments lacking the

resources and competence to carry out surgery safely or to manage surgical complications since they are higher in women who have less access to comprehensive obstetric care (5).

It is anticipated that a decreased CD rate will lessen some of the worst side effects of repeat CD, including peritoneal adhesions, uterine rupture, and sticky placental abnormalities. The latter two issues could increase the requirement for a hysterectomy and increase the risk of maternal death in subsequent pregnancies. In comparison to VD, the probability of severe unfavorable maternal outcomes (SMO) was considerably higher with primary and repeat CD. Women with primary CD also had considerably higher risks of both severe unfavorable neonatal outcomes (SNO) and neonatal near misses (NNM). The likelihood of NNM and SNO for subsequent CD increased significantly (9). Non-indicated deliveries before 39 weeks of gestation have long been discouraged. Because elective deliveries at fewer than 39 0/7 weeks of gestation may result in newborn problems, which have been well characterized. Based on these, it is advised to deliver at 39 weeks of gestation and above (10).

Indications

Maternal-Fetal Indications

Prolonged Second Stage Labor

The second stage of labor begins once the cervix is fully dilatational, and it ends with the delivery of the baby. A protracted second stage of labor is associated with increased perinatal mortality. The factors influencing the length of the second stage are not well understood. Parity, delayed pushing, the use of epidural analgesia, maternal body mass index, birth weight, occiput posterior position, and fetal station at complete dilatation have all been shown to affect the duration of the second stage of labor (1)(11)(12). There isn't a set absolute maximum amount of time in the second stage of labor beyond which all women should have an operation (19). The second stage's optimal duration must consider a variety of short- and long-term maternal and newborn outcomes, which makes it difficult to define (1).

To determine what should constitute a "normal" duration of the second stage, numerous researchers have looked at the association between the length of the second stage of labor and unfavorable mother and newborn outcomes. Evidence of a strong correlation between a prolonged second stage and operative delivery and maternal outcomes like postpartum hemorrhage, infection, and severe obstetric lacerations was found in a systematic review on the prolonged second stage of labor and the risk of adverse maternal and perinatal outcomes. Negative neonatal outcomes are not linked to a protracted second stage, though (13).

This means that the duration of the second stage of labor, which could continue up to 5 hours in some circumstances, was not linked to poor newborn outcomes. This was discovered in a secondary analysis of multicenter randomized research that involved 4126 nulliparous women and fetal pulse oximetry. One of the only specific adverse neonatal outcomes that was significantly correlated with the length of the second stage was admission to a newborn critical care unit. Chorioamnionitis (overall rate, 3.9 percent), third- or fourth-degree perineal lacerations (overall rate, 8.7 percent), and uterine atony were adverse maternal outcomes that were substantially correlated with the length of the second stage of labor (overall rate, 3.9 percent). The odds ratios for each hour that the second stage of labor continued varied from 1.3 to 1.8. The study also revealed that spontaneous vaginal delivery rates decreased from

85% when the second stage lasted under an hour to just 9% when it lasted over five hours (14).

Another retrospective cohort study revealed that multiparous women who had a second stage of at least three hours were more likely to experience surgical births, peripartum morbidity, and unfavorable neonatal outcomes (15).

Study results showed that a second stage of labor lasting longer than 4 hours in nulliparous women increased the risk of a low 5 min Apgar score of 7, admission to the Neonatal Intensive Care Unit, neonatal sepsis, and neonatal intubation. This study evaluated the relationship between prolonged second stage of labor and the risk of adverse neonatal outcomes using a systematic review and meta-analysis study, done on 268,624 women. The likelihood of a 5-minute Apgar score below 7, admission to a newborn intensive care unit, meconium staining, and composite neonatal morbidity rose in multiparous women when the second stage of labor lasted longer than 3 hours. The risk of any of the other factors examined, such as umbilical artery pH 7, birth depression, infant death, meconium aspiration, or shoulder dystocia, was not increased by a prolonged second stage of labor (16).

Negative maternal outcomes, such as greater rates of puerperal infection, third- and fourth-degree perineal lacerations, and postpartum hemorrhage, are linked to a prolonged second stage of labor (14)(15). Furthermore, the possibility of a spontaneous vaginal birth gradually declines during the second stage's hours. Only 1 in 4 nulliparous women (17) and 1 in 3 multiparous women give birth naturally after a 3-hour second stage of labor, according to research, whereas up to 30 to 50 percent may need an operation to give birth vaginally in the current second stage of labor threshold environment (15)(16). If maternal and fetal conditions permit, allow for at least 2 hours and 3 hours of pushing in multiparous and nulliparous women, respectively, before diagnosing second-stage labor arrest. If progress is being documented, longer durations might be appropriate for women who utilize epidural analgesia or have fetal malposition (1)(18).

Management Options

Two more procedures could lower the number of cesarean deliveries in the second stage in addition to better expectant management of the second stage: Operative vaginal delivery and manual fetal occiput rotation for malposition are the first two options (1).

Failed Induction

Elective induction of labor is defined as induction in the absence of any medical indication (19). To reduce the dangers to the health of the mother and the fetus, it is essential to determine the best time to induce labor. When the risks of an early delivery outweigh the dangers to the health of the mother or the fetus, induction of labor may be considered. The precise calculation of these hazards is challenging, though. Numerous variables need to be considered, including gestational age, condition severity, likelihood of approaching difficulties for either the mother or the fetus, and cervical exam (20).

Use of cervical ripening agents and duration of labor induction:

Variations in labor induction management, particularly the use of cervical ripening agents for the unfavorable cervix and the lack of a consensus definition of what constitutes a prolonged

duration of the latent phase, are likely to have an impact on cesarean delivery rates once the decision to proceed with a labor induction has been made (a failed induction) (1).

An increased risk of cesarean delivery is associated with medical and elective induction of labor in nulliparous women at term with a single fetus in cephalic presentation, compared to spontaneous onset of labor, according to a prospective cohort study done on 1,389 nulliparous women. This risk is primarily related to an unfavorable Bishop score at admission (21). Birth weight and dilatation may be indicators of labor induction success. Additionally, inducing labor when the cervix is 3 cm or smaller in size may lead to a higher chance of cesarean birth (22). Another study done in Ethiopia also concluded that the Bishop's score after cervical ripening significantly predicted success of induction and induction is eight times more likely to succeed if the bishop's score is Favorable (23). Cervical ripening is facilitated by the sequential or combined use of more than one cervical ripening technique, such as misoprostol and a Foley bulb (36). When a woman's cervix is not favorable and labor is induced, cervical ripening techniques should be performed (1)(21).

The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine have agreed that after membrane rupture, oxytocin must be delivered for at least 12 to 18 hours before induction is deemed unsuccessful. This will lessen the number of cesarean deliveries due to unsuccessful labor induction during the latent phase (1).

Maternal Indications

Medical Conditions (Hypertensive Disorder of Pregnancy, Diabetes, HIV)

Because of the unpleasant labor and delivery process and the resulting rise in obstetric interventions, particularly cesarean sections, gestational diabetes is linked to several severe pregnancy outcomes. In these high-risk populations, primary CS is quite prevalent, which could speed up the rate of recurring CS. Obstructed labor and shoulder dystocia, the two symptoms of CS that are most frequently present, are linked to diabetes mellitus. The likelihood of having a cesarean section rises with pregnancy-induced hypertension. This could be because severe pre-eclampsia and/or eclampsia that is intended to avoid perinatal morbidity and mortality shortens the labor phase and delivery (24)(25).

Fetal Indications

Non-reassuring FHRP

An irregular or ambiguous fetal heart rate tracing is the second most frequent cause of primary cesarean delivery. A standardized method is a logical prospective aim for interventions to safely lower the cesarean delivery rate given the known variance in the interpretation and management of fetal heart rate tracings (1). The NICHD states that the classification of FHR patterns is based on the baseline rate (normal, tachycardia, and bradycardia), the type of decelerations (early, late, variable, and extended), and the amount of variability (undetectable, minimal, moderate, and marked) (17).

The baseline FHR is calculated using an approximation of the mean FHR throughout a 10-minute window, rounded to 5 bpm increments and eliminating accelerations, decelerations, and periods of noticeable FHR variability (25 bpm). Any 10-minute window must contain at

least 2 minutes of distinct baseline segments (not necessarily continuous), the baseline for that time frame is unknown. In certain circumstances, it could be required to use the prior 10-minute window to establish the baseline. When the baseline FHR is 110 bpm, the abnormal baseline is referred to as bradycardia; when it is 160 bpm, it is referred to as tachycardia (26). In a 10-minute time frame, baseline FHR variability is calculated, ignoring accelerations and decelerations. Baseline FHR variability is characterized as uneven in amplitude and frequency baseline FHR fluctuations. The peak-to-trough amplitude in bpm is used to graphically quantify the fluctuations. This is how variability is categorized: FHR variability not present: undetectable amplitude range. A minimum FHR fluctuation of 5 bpm and an amplitude range > undetectable. FHR variability is moderate, with an amplitude range of 6 to 25 bpm. FHR variability with a marked amplitude range of 25 bpm (26)(27).

Acceleration is a rapid increase in FHR that is immediately visible. An increase that occurs within 30 seconds of the acceleration's start and its peak is referred to as an abrupt rise. An acceleration must have a peak heart rate of 15 bpm and last for 15 seconds before returning to normal. A lengthy acceleration lasts for two minutes but lasts for ten. Finally, a baseline change is defined as an acceleration lasting 10 minutes. Accelerations are characterized as having a peak heart rate of 10 bpm and a duration of 10 seconds before 32 weeks of pregnancy (26).

Depending on certain qualities, deceleration can be classed as late, early, or variable. Other features may be present along with variable deceleration. A slow return of the FHR following the contraction, biphasic decelerations, tachycardia following varied decelerations, accelerations before to and/or following, commonly referred to as "shoulders" or "overshoots," and changes in the FHR during the deceleration's trough are a few instances. When there is a visually discernible fall in FHR from a baseline of 15 bpm lasting not just 2 minutes but 10 minutes, there is a persistent deceleration. A baseline change is a slowdown that lasts 10 minutes. If more than 50% of uterine contractions occur during any 20 minutes, a deceleration is deemed recurring. A sinusoidal fetal heart rate rhythm is specifically described as a form of heart rate pattern that has a visibly discernible, smooth, sine wave-like undulating pattern in FHR baseline with a cycle frequency of 3-5/min and lasts for 20 minutes (26). According to Kubli et al., severe variable decelerations are those that last longer than 60 seconds and less than 70 beats per minute, or longer than two minutes and less than 80 beats per minute. Moderate variable decelerations last 30 to 60 seconds, are less than 70 beats per minute, or last longer than 60 seconds and are less than 80 beats per minute. Mild deceleration characterizes all other variations. Whether the FHR must be lower than the minimum stated FHR for the entire given time is an unanswered aspect of this quantification (27). According to NICHD criteria, late deceleration is classified as severe if they are more than 45 beats/min below baseline, moderate if they are more than 15 beats/min below baseline, and mild if they are less than 15 beats/min below baseline (26). Prolonged deceleration, as defined by NICHD guidelines, requires the FHR to be depressed for ’2 minutes. Severe was defined as < 70 beats/min, moderate as between 70 and 80 beats/min, and mild as not < 80 beats/min. These are criteria that are like those used for quantitating bradycardia (26).

In general, it was agreed that the normal pattern—defined as a normal baseline rate, normal [moderate] FHR variability [FHRV], the presence of accelerations, and the lack of decelerations—confers a very good predictability of a healthily oxygenated fetus when it is

obtained. Therefore, no action is needed to change this trend. There was agreement that the pattern of recurrent late or variable decelerations or significant bradycardia, with absent FHRV, is predictive of current or impending fetal asphyxia so severe that the fetus is at risk of neurologic or other fetal damage or death. This is on the other end of the spectrum from normality. The consequence is that, unless acidemia can be quickly ruled out, the fetus should be delivered as soon as feasible (26)(28). Disturbances in acid-base balance are associated with specific FHR deceleration patterns. This is particularly true of significant fluctuating deceleration and late deceleration. A small shift to the acid side is likewise related to moderate variable deceleration (29).

Based on a review of the literature, the following conclusions regarding the relationship between fetal acidemia and electronic fetal heart rate patterns were drawn: (1) The presence of spontaneous or provoked FHR accelerations accurately predicts the absence of fetal metabolic acidemia. Nevertheless, fetal acidemia cannot be accurately predicted by the absence of accelerations. There are several ways to trigger fetal heart rate acceleration (vibroacoustic, transabdominal halogen light, and direct fetal scalp stimulation) (30)(31). (2) The absence of pH 7.15 or an Apgar score of 7 at 5 minutes is highly (98 percent) correlated with the presence of moderate FHRV, even in the context of decelerations (31). (3) There is a 23 percent correlation between pH 7.15 or an Apgar score of less than 7 at 5 minutes and minimal or less FHRV with decelerations. However, fetal hypoxemia or metabolic acidemia cannot be accurately predicted by low or absent FHR variability alone. It's unclear what significant FHR variability—previously known as saltatory variability—means (31). (4) The probability of acidemia rises with the[1] magnitude of decelerations, particularly late decelerations, and is especially high in patterns with decreased FHRV and even higher in patterns with nonexistent variability. The risk categories are based on the frequency of decelerations, defined as > 50% of contractions in any 20 minutes (31).

Management Options

A three-tier system for classifying FHR patterns is suggested after carefully examining the alternatives. Fetal acid-base status at the time of observation is substantially predicted by Category I FHR tracings, which are normal and normal. There is no specific activity necessary; it can be followed routinely. The outcome of Category II FHR tracings is uncertain. Even though Category II FHR tracings do not indicate an aberrant fetal acid-base balance, there is currently insufficient data to designate them as Category I or Category III. Considering all relevant clinical circumstances, evaluation, ongoing observation, and reevaluation is necessary. The fetal acid-base status that is abnormal at the time of observation is indicated by category III FHR tracings, which are abnormal. Category III FHR tracings need to be examined as a result. Interventions to swiftly correct the irregular FHR pattern may include but are not limited to, giving the mother oxygen, changing the mother's posture, stopping labor stimulation, and treating maternal hypotension, depending on the clinical condition (26).

Amnioinfusion during the beginning of labor has been shown in one randomized controlled trial research on 75 women to significantly relieve variable decelerations and reduce the need for cesarean sections due to fetal distress. The amnioinfusion-treated nulliparous women experienced a significant decrease in neonatal acidemia. The length of the mother's postpartum hospital stay was greatly cut. There were no negative effects on the mother or the newborn (1)(32).

Repetitive variable fetal heart rate decelerations treated with amnioinfusion have been shown to safely lower cesarean delivery rates (32). When aberrant or uncertain (before, non-reassuring) fetal cardiac rhythms (e.g., low variability) are present, scalp stimulation can be employed as a safe alternative to cesarean delivery to determine the fetal acid-base status (1)(26).

Malpresentation

Breech presentation is thought to complicate 3.8 percent of pregnancies at or after 37 weeks, and more than 85 percent of pregnant women with persistent breech presentations deliver through cesarean surgery (1). ECV had no impact on the outcomes of term breech pregnancies about gestation at birth, birth weight, arterial cord pH, or blood loss at delivery. However, it might increase meconium's frequency. It is unclear whether this is a direct result of the surgery or a side effect of labor (33). A high rate of ECV failure and a low rate of spontaneous vaginal delivery were observed in women who had a persistent breech presentation, which is defined as a persistent breech presentation during all ultrasound exams conducted between the anatomy scan at mid-pregnancy and the gestational week when ECV was attempted (34)(54). Independent risk variables for success included multiple parity, transverse lying, unengaged breech presentation, low body mass index, soft uterus, and palpable fetal head. With no increase in maternal or newborn morbidity, routine use of ECV allowed for a decrease in the rate of cesarean deliveries for breech presentation. Following a successful ECV, operational delivery rates were comparable to those of the general populace. Despite having a generally low success rate, routine ECV use can lead to lower cesarean delivery rates and comparable perinatal outcomes (55). 46 percent of ECV attempts were made, which is underused, according to ACOG research. Beginning at 36 0/7 weeks of pregnancy, the fetal presentation should be evaluated and documented to enable the offering of an external cephalic version (1)(55).

Macrosomia

To prevent potential birth damage, suspected fetal macrosomia cesarean deliveries should be kept to estimated fetal weights of at least 5000 g (about 11.02 lb.) in women without diabetes and 4500 g (about 9.92 lb.) in those with diabetes. Birth weights of more than 5000 grams (about 11.02 lb.) are uncommon, and patients should be informed that estimates of fetal weight, particularly those made late in pregnancy, are subject to error (1).

3. Objectives

General Objective

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

Specific Objective

- To determine the magnitude of primary cesarean section
- To assess determinants of primary cesarean section
- To assess physician's decision making on indications of cesarean section
- To assess immediate postoperative maternal and perinatal outcome

4. Materials and Methods

Study Area

Addis Ababa is located at a height of 2,400 meters above sea level, almost in the heart of Ethiopia (44). 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 (45). 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 (45). 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 Anbessa Specialized Hospital (TASH) was established. 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 residents make up components of hospital's staff.

Study Period and Design

The study was conducted between January 2024 and April 2024 on all patients who undergo primary cesarean section at 37 and above weeks of gestational age at TASH, GMH, and ZMH. Institution-based cross-sectional study design was used.

Population

Source Population

All women who gave birth at TASH, GMH, and ZMH.

Study Population

All women who undergo primary cesarean section at 37 and above weeks of gestational age at TASH, GMH, and ZMH in the above-stated study period.

Sampling Technique and Sample Size Determination

Sample Population

All patients who fulfilled the inclusion criteria in the specified period were the sample population.

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.

Sample Size

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

The formula for calculating the sample size (n) is $n = [(Z_{a/2})^2 P(1-P)] \div d^2$, $n = [1.96^2 \times 0.5 \times 0.5] \div (0.05)^2$, 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

Eligibility Criteria

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.

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)
- Type of labor
- Obstetrical procedures (induction, argumentation, and instrumentation)
- Type of cesarean section
- The outcome of the neonate & the mother

Dependent Variable

- **Primary outcome**: - determinants of primary cesarean section.
- **Secondary outcome**: - identified potential to safe reduction strategies.

Data Collection and Procedures

Procedure

The structured, pretested, and anonymous questionnaire was prepared in English and was include 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.

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 was used. Statistical significance was determined by the P-value threshold of 0.05.

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 intraoperatively and postoperatively. This study was accepted if the documentation error is < 5% and the coefficient of reliability (R) is > 0.95.

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 was distributed to Addis Ababa University, TASH, GMH, ZMH, MOH, and for publication.

Operational Definitions

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

Ethical Consideration

Before collecting data from Addis Abeba University's College of Health Science for this study, DRPC approval was necessary. The objectives of the investigation was 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

Socio-Demographic Characteristics

Four hundred twenty-two mothers were included in this study. The age of the majority women 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 caesarean section done in the three hospitals during the study period was 169 (40.05%). Among cesarean deliveries, primary CS was 109 (64.5%). The prevalence of primary cesarean section performed among women who give birth after 37 weeks of gestation was 109 (25.83%) (Fig. 1).

Figure 1: Prevalence of primary cesarean section performed among women who give birth after 37 weeks of gestation at three teaching hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422).

Three hundred ninety-seven (94.5%) of women were from Addis. Two hundred fifty-one (59.8%) of women were had at least one ANC contact at our hospitals and one hundred sixty-nine (40.2%) were referred from other health facilities (Table 1).

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).

Characteristics	Categories	Primary CS			Percentage
		Yes	No	Total	
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
Total		109	313	422	100.0

Obstetrical, Gynecological and Medical Characteristics

The gestational age ranged between 37 weeks (259 days) and 43+2 weeks (303days) 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 2). Among those delivered by cesarean section, 89 (81.7%) were done on emergency base 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 were primary CS.

Characteristics	Categories	Primary Cesarean Section			
		Yes	No	Total	Percentage
Admission status (n=422)	Spontaneous labor	64	221	285	67.5
	For priming & induction	25	92	117	27.7
	For 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)	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
	No History	66	266	330	78.2
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 during admission for priming & induction	Unfavorable	24	80	104	88.9
	Favorable	1	12	13	11.1
	Total	25	92	117	100.0
Cervix primed	Yes	19	88	107	91.5
	No	6	4	10	8.5
	Total	25	92	117	100.0
Priming methods	Foley catheter	18	68	86	80.4
	Misoprostol	1	20	21	19.6
	Total	19	88	107	100.0
Labor augmented	Yes	7	12	19	6.7
	No	57	207	264	93.3
	Total	64	219	283	100.0
Oxytocin Used	Yes	32	99	131	32.6
	No	57	214	271	67.4
	Total	89	313	402	100.0
Fetal membrane status on arrival or admission	Intact	36	173	209	52.0
	Ruptured	53	140	193	48.0
	Total	89	311	402	100.0
Liquor Status	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
	Total	89	311	402	100.0

Figure 2: Mode of delivery among women who gave birth after 37 weeks of gestation at three teaching hospitals in Addis Ababa University, Ethiopia, January 01 - April 30, 2024 (n=422).

The majority 235 (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 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: - 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).

Fetal Characteristics

Of total, 410 (97.2%) were singleton and 12 (2.8%) were twin pregnancy. The majority 395(93.6%) 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 were low birth weight (Table 3).

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).

Characteristics	**Categories**	**Primary Cesarean Section**		**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	395	93.6
Breech presentation		15	4	19	4.5
Transverse lie		4	0	4	0.9
Birth weight of the newborn (n=434)	4000gram and above	14	19	33	7.6
Between 2500gram & 4000gram		86	264	350	80.6

	Below 2500gram	**13**	**34**	**51**	**11.8**

Indications of Primary Cesarean Section

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: - 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).

Variables	**Frequency**	**Percent**
Fetal distress	60	55.0
Malpresentation (breech or transverse)	21	19.3
Failed Induction	13	11.9
CPD	12	11.0
Twin Pregnancy with IUGR at term	2	1.8
Others	1	0.9
Total	109	100.0

Determinants of Primary Caesarean Section

Each independent variable was computed in 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 (Table 5). However, on multivariable logistic regression analysis nulliparity, gestational diabetic mellitus, chronic medical disease, fetal presentation, fetal membrane and liquor status were variables significantly associated with primary cesarean section with p-value <0.05 as clearly depicted on table below (Table 5).

This study reveals several significant factors associated with the risk of having primary cesarean section. Notably, nulliparous women had 13.83 times (AOR= 13.83; 95% CI: 6.25, 30.60) more likely 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 undergo primary CS than women who had cephalic presentation. Similarly, women who had history of gestational diabetes mellitus and chronic medical disease like pregestational diabetes, cardiac disease and chronic hypertension had 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 membrane and clear amniotic fluid had 77% and 40% less likely to undergo primary CS than women with ruptured amniotic membrane and meconium-stained amniotic fluid respectively. Women who had favorable cervix had 50% less likely to undergo CS (Table 5).

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

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
Amniotic 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 $p < 0.05$.

Decision Making Process

The commonest type of fetal distress primary CS was persistent fetal tachycardia and fetal bradycardia. Maternal position change, IV fluid and artificial rupture of membrane was done for about 54.5% of women with NRFHRP before CS was decided. However, for 15.2% of women with NRFHRP nothing 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 second stage of labor due to malposition of 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).

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).

Variables	Categories	Frequency	Percent
Type of NRFHRP	Persistent Fetal Tachycardia	17	51.5
	Fetal Bradycardia	14	42.4
	Recurrent Variable Deceleration	2	6.1
	Total	33	100.0
What was done for NRFHRP	Maternal Position Changed to 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
	Total	33	100.0
If Failed Induction, was cervix primed?	Yes	9	69.2
	No	4	30.8
	Total	13	100.0
Cause CPD	Fetal Malposition	7	58.3
	Fetal macrosomia	4	33.3
	Contracted Pelvis	1	8.4
	Total	12	100.0
ECV attempted for breech or transverse	Yes	7	30.4
	No	16	69.6
	Total	18	100.0
If ECV attempted, was it successful?	Yes	0	0.0
	No	7	100.0
	Total	7	100.0

Maternal and Perinatal Outcome

Of the total neonate, 409 (96.9%) neonates had APGARE > 7. But 13 (3.1%) of the neonate born with low Apgar score at the fifth minute. 2 (1.8%) neonates delivered with cesarean section had low Apgar score. NICU admission was decided for 32 (7.6%) of neonate. 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 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 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 for 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 membrane 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.

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).

Characteristics	**Categories**	**Primary Cesarean Section**			**Percentage**
		Yes	**No**	**Total**	
First minute APGAR score	Reassuring (7-10)	104	295	399	94.5
Low APGAR Score (below 7)		5	18	23	5.5
Fifth minute APGAR score	Reassuring (7-10)	107	302	409	96.9
Low APGAR Score (below 7)		2	11	13	3.1
Neonatal NICU admission	Yes	8	24	32	7.6
No		101	289	390	92.4
Causes of NICU admission	Respiratory Distress Syndrome	5	12	17	4.0
PNA		1	4	5	1.2
EONS		3	5	8	21.9
Maternal complication	Yes	3	4	7	1.7
No		106	309	415	98.3
Causes of maternal complications	PPH	1	4	5	1.2
Febrile morbidity		2	0	2	0.5

6. 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 study done in Shire, northern Ethiopia on the proportion of women who undergone primary cesarean section which was 20.2% (12). 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% (71).

According to our findings, the most frequent indications for primary cesarean section were NRFHP (31.2%), Grade 3 Meconium-Stained Amniotic Fluid at LFSOL (23.9), 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 Shire, northern Ethiopia, the most frequent indications for primary cesarean section were NRFHP (32.1%), CPD (18.5%), and abnormal presentation (12. 3%) (12), 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%) (63). These slight differences reflect variations in healthcare practices, patient demographics, and cultural attitudes towards 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 14.3 times more likely to have a primary cesarean section compared to multiparous women. Our finding also supported by research done in our country report that multiparous women cesarean section rate decreased by 39%than that of nulliparous (70). 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 14.3 AOR found in our research. This may be due to; 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 labors 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.

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).

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

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 were 10 times increase the odds of having cesarean section (62). 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 (63, 64). 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 breech presentation were 19 (4.5%). Of which cesarean sections were done for 15 (78.9%). Of these 4 were attempted ECV, but all of them failed. Based on our findings the ECV rate and its success shows 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 [63]. 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 prior to 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 [61][64]. 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[63]. 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 highest risk allows for counseling and planning to optimize outcomes.

Additionally, Women with a history of chronic medical disease like pregestational diabetes, cardiac disease and chronic hypertension had 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 63% and 94%, respectively [61, 64]. 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, 409 (96.9%) neonates had APGAR > 7. But 13 (3.1%) of the neonate born with low Apgar score at the fifth minute. 2 (1.8%) neonates delivered

with cesarean section had low Apgar score. NICU admission was decided for 32 (7.6%) of neonate. 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 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 fetal lung immaturity, fetal asphyxia after the delivery of 41 weeks of gestation and the presence of obstetric complications like pregnancy induced hypertension and GDM. It is supported by different literatures (34, 40, 45, and 46).

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 for 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 membrane 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.

7. 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 (3.1%) of the neonate born with low Apgar score at the fifth minute. NICU admission was decided for 32 (7.6%) of neonate. 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.

8. Limitations of the Study

For some of the outcome the sample size was small.

9. Recommendation

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

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Annexes

Annex 1: Assurance of Principal Investigators

My name is Dawit Mekonnen. I am the principal investigator. I put my signature below to confirm that I take over the responsibility for the scientific, ethical and technical conduct of the research project and for provision of progress reports for all stakeholders of the research project.

Signature: _____ Date: _____

Contact Address of PIs:
Phone number: +251911601860
Email: gmekonnen83@gmail.com
TASH, ADDIS ABABA, ETHIOPIA

Annex 2: Information and Consent Sheet

Information Sheet

Dear participant,
The purpose of this study is to assess the magnitude and determinants of primary caesarean section. Since the findings of this study are very important in determining the magnitude and future decisions in safe reduction strategies of primary caesarean section. I kindly request your genuine participation. You have full right to participate throughout, or to discontinue at any time, or never participate in the study. The information you give will be used only for the purpose of this study confidentially.

Thank you for your valuable time.

Consent form

I, the undersigned, have heard the information in the information sheet and understood the purpose and significance of the study. I agree to participate in the research voluntarily with the hope of contributing to the effort to assess the magnitude and determinants of primary caesarean section.
Signature _____ date _____

Annex 3: Questionnaire

English Version

Date of interview _____
Interviewer name _____
MRN: _____

Date of C-section: _____ Time: _____ AM / PM

Socio-demographic characteristics
101. Age: _____ year

102. Residence

A. Addis Ababa
B. Out of Addis Ababa

103. Place of ANC follow up

A. At our hospital (at least with one contact)
B. Referral

Obstetrical factors, gynecological factors and chronic medical illnesses

103. Mode of delivery

A. Vaginal

B. Cesarean delivery

C. OVD

D. ABD

104. If mode of delivery is cesarean, what type?

A. Primary

B. Secondary

105. When was the primary CS done?

A. As emergency

B. As elective

106. Gravida _____ Para _____A/E/M

107. Gestational Age: ____ week's _____/7 days

108. Which bad obstetrical and gynecological factors does she have?

A. Pregnancy Induced Hypertension (current)
B. History of stillbirth
C. Early neonatal death (END)
D. History of infertility
E. History of fistula repair
F. Other, specify _____

109. Which chronic medical illness and/or pregnancy complications does she have?

A. Diabetes Mellitus
B. Chronic HTN
C. Cardiac disease
D. Other, specify _____

Baseline Clinical Information

110. Admission: Date: _____ Time: _____ AM/PM

111. Patient admission status:

A. Admitted to maternity ward for elective CS
B. Admitted in active labor/latent labor with risk factor
C. Not in labor, admitted for priming and induction

112. Fetal membrane status on admission:

A. Intact
B. Ruptured

113. If she is not in labor,

A. Scheduled induction or
B. Spontaneous rupture of membranes

114. Is she primed?

A. Yes

B. NO

115. Cervical Ripening Methods (check all that apply):

A. Misoprostol
B. PG Gel/Ring
C. Foley Balloon
D. Cook (double) Balloon

116. Oxytocin (check one):

A. None utilized
B. Induction

117. Cervical examinations (please enter as much information as was documented):

Event	Dilation (cm)	Effacement (%)	Station	Cervix Position	Cervix Consistency	Bishop Score*
Arrival/first admission						
Last exam (before delivery)						

*Leave blank and will be calculated for you

In the next section please use the primary indication for this cesarean section and answer the appropriate questions:

118. Non-reassuring FHR Pattern (Fetal Distress)

A. Antepartum testing results which precluded trial of labor

B. Category III FHR tracing (specify_____)
C. Category II FHR tracing (specify_____)
D. Other: _____

119. If the indication is category II FHR tracing, what was done before CS decided?

A. Intranasal oxygen given
B. Position changed to lateral side
C. IV fluid given
D. All the above given
E. Nothing done

120. If the indication is recurrent variable deceleration, is amnioinfusion done?

A. Yes
B. No

121. **Failed Induction** (must have both criteria if cervix unfavorable, Bishop score ≤ 8 for nulliparous and < 6 for multiparous)

A. Cervical Ripening used for those starting with Bishop scores as noted above, AND
B. Unable to generate regular contractions (every 3 minutes) and cervical change after oxytocin administered for at least 12-18 hours after membrane rupture. **Note**: at least 24-hours of oxytocin administration after membrane rupture is preferable if maternal and fetal statuses permit

122. **Latent Phase Arrest** (at less than 6 cm)

A. Moderate or strong contractions palpated for ≥ 12 hours OR,
B. IUPC ≥ 200 MVU for ≥ 12 hours

123. **Labor dystocia (greater than or equal to 6 cm Dilation) – Active Phase Arrest** (must fulfill one of the two criteria).

- Membranes ruptured (if possible) then:
    A. Adequate uterine contractions (e.g., ≥ 200 MVU for ≥ 4 hours) without improvement in dilation, effacement, station or position OR,
    B. Inadequate uterine contractions (e.g., < 200 MVU) for ≥ 6 hours of oxytocin administration without improvement in dilation, effacement, station or position)

If the indication is labor dystocia at AFSOL, Answer the following question (121-124).

124. Does the amniotic membrane rupture?

A. Yes
B. No

125. Is uterine contraction adequate?

A. Yes
B. No

126. If the above question is YES, is labor augmented?

A. Yes
B. No

127. **Labor dystocia in the Second Stage** (10 cm reached) (must fulfill any one of four criteria)

A. Nullipara with epidural in the second stage > 4 hours inclusive of laboring down (if applicable) OR,
B. Nullipara without epidural in the second stage > 3 hours inclusive of laboring down (if applicable) OR,

C. Multipara with epidural in the second stage > 3 hours inclusive of laboring down (if applicable) OR,
D. Multipara without epidural in the second stage > 2 hours inclusive of laboring down (if applicable)

128. For Q125, what is the cause?

A. Inadequate uterine contraction
B. Fetal macrosomia
C. Fetal malposition
D. Contracted pelvis

129. If Q126 answer is inadequate uterine contraction, is labor augmented?

A. Yes
B. No

130. Is the occiput manually rotated if the response is malposition?

A. Yes
B. No

131. If the station is $\geq$ +2, is operative vaginal delivery tried?

A. Yes
B. No

132. **Primary Cesarean for Breech or Transverse**:

A. Breech diagnosed in antepartum period and did not undergo attempted breech version
B. Breech diagnosed in antepartum period and had failed breech version
C. Breech diagnosed after labor began or membranes ruptured

133. If none of the above indications were the reason, please write in the diagnosis here with brief explanation:

_____

Immediate postop maternal and perinatal outcomes

134. Fill below for neonatal outcome

A. 1st and 5th Apgar score is _____ and _____ respectively.
B. EFW and Birth weight is _____ and _____ respectively.
C. Is the neonate referred to NICU? A. Yes B. No
D. If yes, what is the cause? specify _____

135. Does the mother have immediate post op complication? A. Yes B. No

136. If yes, specify _____