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Determinants and outcomes of caesarean section in low-risk primigravida women at a tertiary hospital in Northern Tanzania

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Abstract

Background

Caesarean section (CS) rates are increasing globally, including among women without clear obstetric indications. Primigravida women are a key population for understanding factors contributing to primary caesarean delivery, as the initial mode of birth influences outcomes in subsequent pregnancies. In Tanzania, evidence on predictors and outcomes of CS among low-risk primigravida women, particularly in tertiary referral hospitals, remains limited. This study aimed to determine the prevalence, predictors, and maternal and neonatal outcomes of caesarean section among low-risk primigravida women delivering at Kilimanjaro Christian Medical Centre (KCMC).

Methods

A hospital-based prospective cohort study was conducted at KCMC from October 2024 to March 2025. A total of 180 low-risk primigravida women with singleton, term pregnancies in cephalic presentation were enrolled. Data were collected using structured electronic questionnaires and medical record reviews. Poisson regression with robust standard errors was used to estimate crude and adjusted risk ratios (RR and aRR) with 95% confidence intervals for predictors of caesarean section. Maternal and neonatal outcomes were compared by mode of delivery.

Results

The prevalence of caesarean section was 38.9% (70/180). After adjustment, induction of labour (aRR = 1.9; 95% CI: 1.3–2.7) and absence of a birth companion during labour (aRR = 3.1; 95% CI: 2.1–4.4) were independently associated with an increased risk of caesarean section. Maternal age, body mass index, number of antenatal care visits, gestational age at delivery, and estimated fetal weight were not independently associated with caesarean delivery.While overall adverse maternal outcomes were low, the most severe cases (hysterectomy, ICU admission, and death) occurred only after vaginal delivery. Neonatal outcomes differed; CS deliveries accounted for all NICU admissions, most neonatal deaths (75%), and a slight majority (55.6%) of low APGAR scores (≤ 7).

Conclusions

Caesarean section was common among low-risk primigravida women at this tertiary referral hospital. Intrapartum factors, particularly induction of labour and lack of continuous birth companionship, were significant predictors of caesarean delivery. Strengthening labour management practices and promoting birth companionship may help reduce unnecessary caesarean sections and improve maternal and neonatal outcomes.

Background

Caesarean section (CS) is defined as the delivery of a fetus and placenta through surgical incisions in the abdominal wall and uterus after fetal viability has been achieved. It is a common obstetric surgical procedure, indicated when vaginal delivery poses a significant risk to the mother, the fetus, or both (1). Initially, caesarean sections were primarily performed to save the baby rather than the mother. However, considerable improvements in surgical techniques, anesthesia, and antiseptics during the 19th century have made this procedure safer for both mother and child.

Globally, the rate of caesarean delivery has increased substantially over recent decades. Currently, approximately 21% of all births worldwide occur by caesarean section, and this proportion is projected to rise to nearly 29% by 2030(2). If current trends continue, 28.5% of women globally are expected to deliver by caesarean section by 2030. The 2007-08 WHO survey found global caesarean section rates were approximately 27%, which was significantly higher than the recommended 10–15% from 1985(3). Recent decades have seen a continued, significant rise in these rates, driven by diverse factors that vary across countries and cultures (3).

Primigravida women represent a distinct subgroup within the obstetric population, as they experience childbirth for the first time and lack prior obstetric history. This group is often perceived to be at increased risk of labor complications and contributes disproportionately to rising caesarean section rates(4). Importantly, the mode of delivery in the first pregnancy strongly influences subsequent obstetric outcomes, with a primary caesarean section increasing the likelihood of repeat caesarean deliveries and associated complications in future pregnancies. Understanding the determinants of caesarean delivery among low-risk primigravida women is therefore critical for improving maternal and neonatal outcomes and optimizing obstetric practice.

In Eastern Africa, the pooled CS prevalence is 24.0%, with country-specific rates varying from 11.9% in Uganda to 28.3% in Ethiopia(5). In Tanzania, caesarean delivery rates are notably higher, particularly among primigravida women. Recent studies have reported a caesarean delivery rate of 41.3% among primigravida women(6). Kilimanjaro region is the second region nationally with CS rate at 29.7%. This reflects an increasing trend. At Kilimanjaro Christian Medical Centre (KCMC), a major referral hospital, CS rates have historically ranged between 29.9% and 35.5%, with recent registry data indicating rates around 28.9% (7). Registry data from KCMC indicate consistently high caesarean rates in the obstetric population, reaching 28.9% by 2013. This reflects the hospital's tertiary referral role and provides context for studying caesarean practices in subgroups like low-risk primigravida(8).

Multiple maternal and obstetric factors have been identified as predictors of caesarean delivery among low-risk nulliparous women. Increasing maternal age has been associated with higher odds of caesarean delivery, with an estimated 4% increase in risk per additional year of age. Conversely, increasing maternal height has been shown to reduce the likelihood of caesarean delivery, while higher body mass index (BMI) increases the risk (9). Other factors associated with unplanned caesarean delivery include advanced maternal age (≥ 40 years), pregestational overweight or obesity, induction of

labor, delivery in private healthcare facilities, multiple gestation, and fetal malpresentation such as breech presentation(10) .

Although caesarean section can be life-saving when medically indicated, unnecessary procedures expose women and neonates to avoidable adverse outcomes. Reported maternal complications include anesthesia-related events, hemorrhage, infection, and thromboembolic disease. Approximately 27.5% of women undergoing caesarean section experience at least one procedure-related complication(11), and caesarean delivery carries a five- to tenfold higher risk of adverse outcomes compared with vaginal delivery(12). Evidence from a recent *Lancet* review indicates higher maternal mortality and severe maternal morbidity following caesarean delivery, including increased risks of uterine rupture, abnormal placentation, ectopic pregnancy, stillbirth, and preterm birth in subsequent pregnancies (9).

The increasing prevalence of caesarean delivery among primigravida women is therefore a major public health concern, particularly in low- and middle-income countries where healthcare resources are limited and surgical risks may be amplified. Despite the high and rising rates of caesarean section in Tanzania, there remains limited context-specific evidence focusing on predictors and outcomes of caesarean delivery among low-risk nulliparous women.

This study hypothesizes that caesarean section among low-risk nulliparous women is influenced by specific sociodemographic and obstetric factors and is associated with adverse maternal and neonatal outcomes compared with vaginal delivery. Factors such as maternal age, maternal height, antenatal care characteristics, and fetal birth weight are expected to play a critical role in determining the mode of delivery(13) Generating evidence on these predictors and outcomes is essential to inform clinical decision-making, support evidence-based guidelines, and contribute to strategies aimed at reducing unnecessary caesarean sections while ensuring safe and equitable maternity care.

Methodology

Study design and setting

This was a hospital-based prospective cohort study conducted over six months, from October 2024 to March 2025, at the Obstetrics and Gynecology Department of Kilimanjaro Christian Medical Center (KCMC), Northern Tanzania. KCMC is a tertiary referral and teaching hospital serving the northern zone of Tanzania, including Arusha, Kilimanjaro, Manyara, and Tanga regions. The department provides comprehensive obstetric services, including vaginal and caesarean deliveries, with an annual delivery volume of approximately 2,300–2,800 births, of which 1,200–1,500 are caesarean sections.

Study population

The study population comprised low-risk primigravida women who presented in labour and delivered at KCMC during the study period. Participants were followed from admission through delivery and up to one month postpartum.

Low-risk status was defined as a singleton pregnancy at term (≥37 weeks), cephalic presentation, and absence of known medical or obstetric complications prior to admission.

Eligibility criteria

Eligible participants were primigravida women aged 20–49 years with a singleton pregnancy in cephalic presentation at a gestational age of 37 weeks or more. The lower age limit of 20 years was selected to exclude teenage pregnancies, which are considered to be below 20 years in the Tanzanian context. Gestational age was determined using the last menstrual period and confirmed by fundal height measurement and/or first-trimester ultrasound when available.

Women were excluded if they had a history of uterine surgery such as myomectomy, multiple pregnancy, malpresentation, hypertensive disorders of pregnancy, gestational diabetes mellitus, or other pregnancy-related medical conditions requiring increased surveillance. Additional exclusion criteria included antepartum haemorrhage, active genital herpes infection diagnosed clinically by the attending obstetrician, chronic systemic medical disorders, and severe anaemia.

Sampling technique and sample size

A convenience sampling technique was used due to limited time for data collection to meet the required sample size. All eligible women who met the inclusion criteria and provided informed consent during the study period were consecutively enrolled.

The minimum required sample size was calculated using the single population proportion formula:

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

where n is the required sample size, Z is the Z-score for a 95% confidence level (1.96), p is the estimated prevalence of caesarean section among primigravida women, 12.6% (14), and d is the margin of error (5%). Based on this calculation, the minimum sample size was 169 participants.

Variables

The primary outcome variable was mode of delivery, categorized as vaginal or caesarean section. Maternal outcomes assessed included postpartum haemorrhage, admission to the intensive care unit, hysterectomy, and maternal death. Neonatal outcomes included an Apgar score of less than 7 at five minutes, neonatal unit admission, and neonatal death.

Independent variables included sociodemographic characteristics such as maternal age, place of residence, level of education, and marital status. Antenatal care–related variables comprised the number of antenatal clinic visits and maternal body mass index. Obstetric and intrapartum variables included history of infertility treatment, gestational age at delivery, onset of labour (spontaneous or induced), cervical dilatation at admission, use of oxytocin for labour augmentation, rupture of membranes, estimated fetal weight, and the presence or absence of a birth companion during labour.

Data collection procedures

Data were collected prospectively using a structured electronic checklist and an interviewer-administered questionnaire developed from relevant literature. Data collection tools were implemented using the KOBO data collection platform. The tools were pretested among 50 women at the same facility prior to the main study to assess clarity, reliability, and content validity; necessary modifications were made accordingly.

Trained midwives and research assistants, who were not involved in clinical decision-making, collected the data to minimize observer and recording bias. Primary data were obtained at admission for delivery after written informed consent was obtained. Anthropometric measurements were taken at admission. Information on maternal characteristics, labour progress, and delivery outcomes was verified using patient medical records and delivery registers to ensure accuracy.

Labour, delivery, and immediate postnatal events were observed and documented, including indications for caesarean section where applicable. Neonatal assessments included birth weight, Apgar score at five minutes, and admission to the neonatal unit. Participants who developed adverse maternal or neonatal outcomes were managed according to standard hospital protocols.

Documentation of intrapartum factors

Key intrapartum factors potentially influencing mode of delivery were systematically recorded. These included type and indication of labour induction, methods of induction, use of oxytocin for augmentation, cervical dilatation at admission, timing and type of membrane rupture, and the presence or absence of a labour companion. These variables were collected to allow detailed characterization of intrapartum care practices and analysis of their association with delivery outcomes.

Data management and statistical analysis

Data were exported from the KOBO platform into Microsoft Excel and subsequently analysed using appropriate statistical software. Data quality checks were performed regularly to ensure completeness and consistency.

Poisson regression with robust standard errors was used to estimate crude and adjusted risk ratios (RRs and aRRs) with 95% confidence intervals for factors associated with caesarean section. Variables were selected for multivariable analysis based on clinical relevance and evidence from existing literature. Statistical significance was set at a two-sided p-value of <0.05. Variables considered to be associated with both the exposure and the outcome were included in the multivariable Poisson regression model to estimate adjusted risk ratios, thereby minimizing confounding.

A complete-case analysis approach was applied, whereby participants with missing key exposure or outcome variables were excluded from regression analyses. The potential impact of missing data on study findings is acknowledged. (Figure 1).

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Kilimanjaro Christian Medical University College (KCMUCo) Research Ethics and Review Committee, Moshi, Tanzania (reference number: PG 56/2024).

Written informed consent to participate was obtained from all participants prior to enrolment after they were provided with detailed information about the study objectives, procedures, potential risks and benefits, and their right to withdraw at any time without consequences.

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and in compliance with national and institutional research ethics regulations..

Results

Follow-up rate and delivery profile

During the study period, a total of 977 deliveries were recorded at KCMC, of which 743 (76.1%) were multiparous and 234 (23.9%) were primigravida. Overall, 271 deliveries (27.7%) were conducted by emergency caesarean section (CS). Among these emergency CS deliveries, 70 were primigravida, representing 25.8% of all emergency caesarean sections (Figure 1).

Sociodemographic and obstetric characteristics of participants

A total of 180 low-risk primigravida women who delivered at KCMC between October 2024 and March 2025 were included in the analysis. 40.6% (n=73) of participants were aged 24 years or younger. Of these, 64.4% (n=47) delivered by spontaneous vaginal delivery (SVD), while 35.6% (n=26) delivered by caesarean section.

More than half of the women, 55.6% (n=100) had attained secondary-level education; among these, 61.0% (n=61) delivered vaginally and 39.0% (n=39) by caesarean section. Most participants were married or cohabiting 96.7% (n=174), with 62.1% (n=108) delivering by SVD and 37.9% (n=66) by CS. The majority of women resided in Moshi Municipal, 72.2%(n=130), among whom 59.2% (n=77)had vaginal deliveries and 40.8% (n=53) delivered by caesarean section (Table 1).

Clinical and obstetric characteristics

Clinical and obstetric characteristics varied by mode of delivery. Most women, 96.7%(n=174) had no history of fertility treatment, with 61.5% (n=107) delivering vaginally and 38.5% (n=67) by caesarean section. A small proportion 3.3% (n=6) reported prior infertility treatment, with equal distribution between SVD and CS.

Late antenatal booking beyond 12 weeks of gestation was observed in 58.3% (n=105) of participants; among these, 54.3% (n=57) delivered by SVD and 45.7% (n=48) by CS. The majority of women, 88.9%

(n=160) attended 4–8 antenatal care visits, of whom 61.3% (n=98) delivered vaginally and 38.7% (n=62) by CS.

At admission, 68.9% (n=124) of women were not in active labour (cervical dilation <4 cm). Spontaneous onset of labour occurred in 79.4% (n=143) of participants and was associated with a higher proportion of vaginal delivery 69.2% (n=99) compared with induced labour 29.7% (n=44). Two-thirds of women 66.7%(n=120) had a birth companion present, and among these, 78.3% (n=94) delivered vaginally.

Regarding neonatal birth weight, 78.9% (n=142) of infants weighed ≤3.5 kg, with 64.8% (n=92) delivered vaginally. Among neonates, 21.1% (n=38) weigh >3.5 kg, among these caesarean section was more common in 52.6% (n=20) (Table 2).

Prevalence of caesarean section

The prevalence of caesarean section among low-risk primigravida women delivering at KCMC between October 2024 and March 2025 was 38.9% (Figure 2).

Indications for caesarean section

Among the 70 low-risk primigravida women who underwent caesarean section, the most common indication was fetal distress (25.7%). This was followed by obstructed labour (22.9%) and non-reassuring fetal status (18.6%). Malposition accounted for 12.9% of cases, while dystocia contributed to 10.0%. Caesarean section on maternal request was uncommon (2.9%). Other indications (7.1%) included cord prolapse, failed induction of labour, and intrapartum haemorrhage (Figure 3).

Caesarean section performed on maternal request constituted the only elective procedures; all remaining caesarean deliveries were emergency interventions for obstetric or fetal indications.

Predictors of caesarean section

Poisson regression analysis was performed to identify predictors of caesarean section among the 180 low-risk primigravida women. In the unadjusted analysis, admission with cervical dilation <4 cm, induction of labour, absence of a birth companion, and fetal weight >3.5 kg were significantly associated with caesarean section.

After adjustment for potential confounders, induction of labour (aRR = 1.9; 95% CI: 1.3–2.7; p = 0.001) and absence of a birth companion (aRR = 3.1; 95% CI: 2.1–4.4; p < 0.001) remained independent predictors of caesarean section. Women with induced labour had almost twice the risk of caesarean section compared with those with spontaneous labour. Similarly, absence of a birth companion increased the risk of caesarean section more than threefold.

Maternal age, number of antenatal visits, gestational age at booking or delivery, body mass index, and fetal weight were not significantly associated with caesarean section in the adjusted model (Table 3).

Maternal outcomes

Among the 180 primigravida women who delivered between October 2024 and March 2025, maternal outcomes differed by mode of delivery. Postpartum haemorrhage occurred in 10 women, of whom 70% (n=7) had delivered vaginally. Sepsis was reported in seven women, slightly more frequently following vaginal delivery 57.1% (n=4) compared with caesarean section 42.9% (n=3). However, these numbers are too small to make a meaningful statistical comparison.

Notably, rare but severe outcomes such as postpartum hysterectomy, admission to the intensive care unit (ICU) and maternal death were observed from participants who delivered vaginally (Table 4).

Neonatal outcomes

Neonatal outcomes varied according to mode of delivery. All three neonatal intensive care unit admissions occurred among infants delivered by caesarean section 100% (n=3). Admissions to the neonatal ward were slightly more frequent following caesarean section 53.8% (n=14) than spontaneous vaginal delivery 46.2% (n=12).

Of the neonates who did not require admission, 64.9% (98) were delivered vaginally and 35.1% (n=53)by caesarean section. Neonatal death within 24 hours was rare (n = 4) but more common among caesarean deliveries 75% (n=3) than vaginal deliveries 25% (n=1).

Among neonates with APGAR scores ≤7, a higher proportion 55.6% (n=5) were delivered by caesarean section (Table 5).

Discussion

Overview of the Main Findings

This prospective cohort study among 180 low-risk primigravida women delivering at KCMC from October 2024 to March 2025 found a prevalence of caesarean section (CS) of 38.9%. After multivariable adjustment, induction of labor and absence of a birth companion were the only independent predictors of CS. Maternal age, BMI, gestational age, number of ANC visits, and fetal weight were not significantly associated with CS in the adjusted model.

Fetal distress, obstructed labor, and non-reassuring fetal status were the leading indications for CS. Regarding outcomes, severe maternal complications (hysterectomy, ICU admission, maternal death) were rare and occurred in the vaginal delivery group, while PPH and sepsis were seen in both groups. Neonatal admissions and early neonatal deaths within 24 hours were proportionally more frequent following CS than SVD, and low Apgar scores (≤7) were slightly more common among babies delivered by CS.

These findings highlight a substantial burden of CS among low-risk primigravida in a tertiary setting and identify modifiable intrapartum factors particularly induction of labor and lack of labor companionship that could be targeted to reduce unnecessary CS and improve outcomes.

5.1.1 Prevalence of Caesarean Section among Low-Risk Primigravida

The prevalence of CS in this study (38.9%) is markedly higher than the WHO's recommended optimal range of 10–15% and exceeds the pooled prevalence for Eastern Africa (24.0%) and reported rates from countries such as Uganda (11.9%) and Ethiopia (28.3%)(3,5). It is, however, broadly comparable to previous Tanzanian data in primigravida, where a CS rate of 41.3% was reported , and to the overall CS frequency at KCMC, reported at 29.9–35.5% (15).

The caesarean section rate of 38.9% among low-risk primigravida is higher than previously reported overall rates of approximately 28–29% at KCMC. Given that (16) included multiparous and high-risk women, this finding indicates that elevated caesarean section rates persist even among women without recognized obstetric risk, suggesting an important role of intrapartum care practices and clinical decision-making.

The prevalence observed in this study is consistent with global trends of rising caesarean section rates, with about 21% of births worldwide now occurring by CS and projections suggesting this may reach 29% by 2030 (17). This trend raises concerns that many caesarean sections are being carried out even when there is no strong medical indication. This is evident in large tertiary hospitals, where doctors may decide to perform a CS more quickly or more readily than necessary. Several factors can contribute to this lower threshold for intervention: fear of legal consequences if complications occur, a hospital culture that favors surgical delivery, and the availability of surgical staff and facilities that make CS easier to perform. Together, these influences may encourage a more intervention-driven approach to childbirth, even among women who could safely deliver vaginally.

The most frequent indications for CS were fetal distress, obstructed labor, and non-reassuring fetal status. These are consistent with previous literature identifying dystocia and fetal distress as dominant indications among primigravida (18)(19). However, these intrapartum indications can themselves be influenced by labor management practices (e.g., early admission, induction protocols, monitoring practices), suggesting potential upstream modifiable factors.

5.1.2 Predictors of Caesarean Section

5.1.2.1 Induction of Labor

Induction of labor (IOL) emerged as a strong independent predictor of CS. Women who underwent induction had almost twice the adjusted risk of CS (aRR = 1.9; 95% CI: 1.3–2.7) compared to those with spontaneous onset of labor. In crude analysis, the risk was even higher (RR = 2.3; 95% CI: 1.7–3.2).

This finding aligns with international and regional evidence. In Ireland, (20) similarly demonstrated that IOL significantly increased the likelihood of unplanned CS among nulliparous women, highlighting the heightened vulnerability of first-time mothers to intrapartum interventions. Comparable results were reported in Tanzania by (19) who found that primigravida undergoing IOL had a 26.75% risk of caesarean delivery, underscoring the challenges associated with labor induction in this population even within similar clinical settings and management protocols

5.1.2.2 Absence of a Birth Companion

The absence of a birth companion was the other independent predictor of CS in this study. Women without a companion were more than three times as likely to undergo CS (aRR = 3.1; 95% CI: 2.1–4.4) compared to those who labored with companion support.

This aligns closely with evidence that continuous labor support improves obstetric outcomes. (21) and other studies have demonstrated that labor companionship reduces the need for CS, shortens labor duration, reduces use of pharmacologic analgesia, and increases maternal satisfaction.

The magnitude of association in this study is notable and suggests that labor companionship is not merely a comfort measure but a powerful, low-cost intervention with potential to reduce unnecessary CS in low-risk primigravida.

5.1.2.3 Other Obstetric and Sociodemographic Factors

In contrast to findings from many global studies, several variables that are commonly associated with CS did not remain significant in the adjusted model. These include maternal age, BMI, number of ANC visits, gestational age at booking and at delivery, and fetal weight.

- Maternal age: Previous studies have shown that advanced maternal age (≥35 or ≥40 years) is associated with higher CS rates (20,22). In this study, the majority were relatively young (40.6% ≤24 years, only 3.3% ≥35 years), and the limited number of older mothers may have reduced statistical power to detect an age effect.
- BMI and maternal weight: Obesity has been linked to higher CS risk in several settings (22,23). In this cohort, 40% were obese and 40% overweight, yet BMI was not independently associated with CS. This may reflect the exclusion of women with major antenatal complications, as well as possible differences in clinical thresholds or management of obese women in this low-risk subset.
- Fetal weight: Although crude analysis showed an increased risk of CS for fetal weight >3.5 kg (RR = 1.5; p = 0.036), this association was attenuated and became non-significant in the adjusted model (aRR = 1.3; 95% CI: 0.9–1.8). This suggests that other labor-related variables, particularly induction and companionship, may mediate or confound the relationship between fetal size and CS.
- Cervical dilatation at admission: While admissions with less cervical dilatation are often associated with longer labors and higher intervention rates, the pattern in this dataset was complex and lost significance after adjustment (aRR = 0.055; CI = 0.3-1.1). It is possible that in a tertiary setting,

women admitted early in labor are more closely monitored and managed, offsetting the expected increased risk of CS.

Collectively, these results emphasize that, in a cohort of low-risk primigravid population, intrapartum care processes rather than baseline sociodemographic or antenatal factors may be the primary drivers of CS. This is an important shift from risk profiling based solely on maternal characteristics to a focus on the quality and organization of intrapartum care.

5.1.3 Maternal Outcomes

The study assessed key maternal outcomes including postpartum hemorrhage (PPH), sepsis, hysterectomy, ICU admission, and maternal death.

PPH occurred in 10 women (5.6%) of all the population, with a higher proportion following SVD (70%) than CS (30%). This contrasts with several studies where PPH risk is typically higher following CS, especially emergency CS (24,25). The difference in this study may be due to population of low risk primigravida hence fewer adverse outcomes.

Sepsis was observed in seven women (3.9%), with a slightly higher proportion among those with SVD (57.1%) than CS (42.9%). This is again somewhat unexpected, given that CS is usually associated with higher risk of postoperative infection, including wound and endometritis (25,26). This may be due to early diagnosis and antibiotic prophylaxis in the perioperative CS period, under-recognition of mild post-CS infections, or sepsis related to prolonged labor or premature rupture of membranes among vaginal deliveries.

Importantly, rare but severe outcomes such as hysterectomy, ICU admission, and maternal death occurred only among women who delivered vaginally (one case each). Given the very small numbers, no firm conclusion can be drawn about comparative safety of modes of delivery. These events may reflect specific obstetric emergencies (e.g., uterine rupture, unanticipated PPH) rather than mode of delivery per se.

Compared with previous regional data, where CS is associated with higher overall maternal morbidity, including hemorrhage, anesthesia-related complications, sepsis, and death(24,27,28), the findings from this study appear different. This discrepancy is likely due to the small number of participants, the short follow-up period of only one month, and the fact that the study focused exclusively on low-risk primigravida who are less likely to experience severe complications. These factors limit the ability to detect meaningful differences in maternal morbidity between delivery modes. This highlights the need for larger studies with longer follow-up to more accurately compare maternal outcomes across different risk groups.

Nonetheless, the presence of PPH and sepsis in both groups confirms that even low-risk primigravida are vulnerable to serious complications and require vigilant intrapartum and postpartum monitoring, regardless of delivery mode.

5.1.4 Neonatal Outcomes

Neonatal outcomes examined included NICU and neonatal ward admissions, early neonatal death within 24 hours, and 5th-minute APGAR scores. Overall, adverse neonatal outcomes were more frequent among babies delivered by CS.

All NICU admissions (three cases) occurred in the CS group, and more than half of pediatric ward admissions (53.8%) followed CS compared with 46.2% after SVD. This suggests that neonates delivered by CS, even in a low-risk primigravid cohort, may be more likely to require higher-level care. This is consistent with literature showing increased risk of neonatal respiratory morbidity, transient tachypnea, and need for NICU admission after CS, especially when performed before the onset of labor (29,30).

Early neonatal deaths within 24 hours were rare (4/180), but three of the four occurred after CS (75%). While numbers are too small for robust statistical inference, this pattern raises concern and aligns with multi-country data showing substantial neonatal mortality associated with CS in African settings (24). Potential contributors include Severity of underlying fetal compromise leading to emergency CS (e.g., severe fetal distress) or possible intraoperative complications.

Regarding APGAR scores, most babies (94.4%) had good 5th-minute scores (>7). Among the few with low APGAR scores (≤7), 55.6% were delivered by CS. This is in keeping with the notion that CS is often performed in response to intrapartum fetal compromise; thus, low APGAR scores may partly reflect the pre-existing indication for surgery rather than the procedure itself. However, it also mirrors Tanzanian data where birth asphyxia has been strongly associated with CS (28).

Taken together, these findings support the broader literature indicating that CS may be associated with increased neonatal respiratory and early morbidity, particularly when performed in emergency situations or without clear clinical optimization. This pattern reinforces the need for strengthening intrapartum and immediate postnatal practices. Specifically, it highlights the importance of rigorous fetal monitoring and timely decision-making, ensuring that CS is reserved for cases where clear benefit outweighs risk and strengthening neonatal resuscitation and early postnatal care, especially for infants born by CS.

Conclusion and Recommendations

The caesarean section (CS) rate among low-risk primigravida women at Kilimanjaro Christian Medical Centre was 38.9%, nearly four times higher than the World Health Organization–recommended upper limit, indicating substantial use of CS in women without clear obstetric risk. Induction of labor and absence of a birth companion were identified as key modifiable predictors of CS, whereas sociodemographic and antenatal characteristics were not independently associated with mode of delivery. Although severe maternal and neonatal complications were uncommon, adverse neonatal outcomes were more frequent following caesarean section than spontaneous vaginal delivery.

These findings highlight the need to optimize intrapartum care by rationalizing induction of labor through strict adherence to clinical indications and standardized protocols, and by strengthening labor companionship as part of routine maternity care. Health facilities should reinforce policies supporting birth companionship, integrate companions into care through staff training, and ensure supportive labor ward environments. Strengthened antenatal education on labor, delivery options, and the role of birth companions is also recommended. Regular audits of caesarean section indications and intrapartum decision-making should be implemented to reduce unnecessary procedures. Further multicenter and qualitative research is warranted to explore institutional practices, provider perspectives, and long-term maternal and neonatal outcomes.

Limitations of the study

This study has several limitations. Being conducted at a single tertiary referral hospital, the findings may not be generalizable to lower-level facilities or the wider Tanzanian population due to differences in case mix and clinical decision-making. Follow-up was short, limiting assessment of long-term maternal and neonatal outcomes associated with caesarean section. Although the sample size exceeded the minimum requirement, the low number of adverse events reduced the power to compare rare outcomes between delivery modes. Use of convenience sampling may have introduced selection bias, and residual confounding is possible, as some key intrapartum factors were not fully captured. Nevertheless, the findings provide relevant insights for tertiary facilities with similar clinical settings.

Declarations

Declaration on the use of AI

During the preparation of this work, the author(s) used ChatGPT in order to assist with grammar correction and language refinement. After using this tool, the author(s) carefully reviewed and edited the content as needed and take full responsibility for the content of the published article.

Author Contributions

Authors' contributions: Caroline Wanjara conceptualized and supervised the project, administered its execution, and wrote and reviewed/edited the manuscript. Patracia Swai, Subiraga Mwaihabi, Rachel Pesha, and Kelvin Musa conducted the investigation, with Patracia Swai also contributing to methodology, formal analysis, and original writing, Subiraga Mwaihabi to data curation and formal analysis, Rachel Pesha to resources and validation, and Kelvin Musa to data curation. Rafiki Mjema developed the methodology and software and performed validation. Glory Mangi contributed resources and visualization. Pendo Mlay provided supervision. Michael J. Wanjara contributed to conceptualization, methodology, and manuscript review/editing. Don Assey provided supervision and resources. Bariki Mchome handled project administration and validation. All authors read and approved the final manuscript.

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Consent for publication

Not applicable.

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not applicable.

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None

Data Availability

The datasets generated and analyzed during the current study are not publicly available due to patient privacy considerations but are available from the corresponding author (wanjaracaroline6@gmail.com) on reasonable request

https://www.healthline.com/health/pregnancy/history-cesarean-section

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Tables

Table 1: Social demographic information (N=180)

		Mode of delivery	
	n (%)	SVD n (%)	CS n (%)
Characteristics	**N=180**	**110 (61.1)**	**70 (38.9)**
Age			
≤24	**73 (40.6)**	**47 (64.4)**	**26 (35.6)**
25-29	66 (36.7)	40 (60.6)	26 (39.4)
30-34	35 (19.4)	20 (57.1)	15 (42.9)
≥35	6 (3.3)	3 (50)	3 (50)
Level of education			
No formal education	1 (0.6)		1 (100)
Primary	14 (7.8)	9 (64.3)	5 (35.7)
Secondary	**100 (55.6)**	**61 (61)**	**39 (39)**
Tertiary	65 (36.1)	40 (61.5)	25 (38.5)
Marital status			
Single	5 (2.8)	2 (40.0)	3 (60.0)
Married/ cohabiting	174 (96.7)	108 (62.07)	66 (37.93)
Divorced	1 (0.5)		1 (100)
Occupation			
Employed/ self employed	163 (90.6)	96 (58.9)	67 (41.1)
Student	4 (2.2)	4 (100)	
Unemployed	13 (7.22)	10 (76.9)	3 (23.1)
Place of residence			
Moshi municipal	130 (72.2)	77 (59.2)	53 (40.8)
Moshi district	31 (17.2)	18 (58.1)	13 (41.9)
Hai	8 (4.4)	7 (87.5)	1 (12.5)
Siha	5 (2.8)	3 (60)	2 (40)
Rombo	4 (2.2)	3 (75)	1 (25)
Mwanga	2 (1.1)	2 (100)	

Table 2: Clinical and obstetric information (N=180)

		Mode of delivery	
Characteristics	**n (%)**	**SVD n (%)**	**CS n (%)**
	N=180	**110 (61.1)**	**70 (38.9)**
History of fertility treatment			
No	174 (96.7)	107 (61.5)	67 (38.5)
Yes	6 (3.3)	3 (50)	3 (50)
Number of ANC visits			
<4	9 (5)	5 (55.6)	4 (44.4)
4-8	160 (88.9)	98 (61.3)	62 (38.7)
>8	11 (6.1)	7 (63.6)	4 (36.4)
Gestation age at booking			
<8 weeks	13 (7.2)	8 (61.5)	5 (38.5)
8-12 weeks	62 (34.4)	45 (72.6)	17 (27.4)
>12 weeks	105 (58.3)	57 (54.3)	48 (45.7)
Gestation age at delivery			
<40	163 (90.6)	102 (62.6)	61 (37.6)
≥40	17 (9.4)	8 (47.1)	9 (52.9)
BMI			
Normal (18-24.9)	36 (20)	23 (63.9)	13 (36.1)
Overweight (25.0-29.9)	72 (40)	44 (61.1)	28 (38.9)
Obesity (>=30)	72 (40)	43 (59.7)	29 (40.3)
Cervical dilation on admission			
<4	124 (68.9)	67 (54.)	57 (46)
4-7	43 (23.9)	34 (79.1)	9 (20.9)
>7	13 (7.2)	9 (69.2)	4 (30.8)
Type of labor onset			
Induced	37 (20.6)	11 (29.7)	26 (70.3)
Spontaneous	143 (79.4)	99 (69.2)	44 (30.8)
Time of membrane rapture			

Before labor onset	24 (13.3)	13 (54.2)	11 (45.8)
During labor	156 (86.7)	97 (62.2)	59 (37.8)
Type of membrane rapture			
Artificial rupture of membrane	106 (58.9)	58 (54.7)	48 (45.3)
Spontaneous	74 (41.1)	52 (70.3)	22 (29.7)
Presence of birth companion			
Present	120 (66.7)	94 (78.3)	26 (21.7)
Absent	60 (33.3)	16 (36.7)	44 (73.3)
Fetal weight (kg)			
≤3.5	142 (78.9)	92 (64.8)	50 (35.2)
>3.5	38 (21.1)	18 (47.4)	20 (52.6)

Table 3: Poisson regression of caesarean section predictors (N=180)

Characteristics	RR (95% CI)	P value	aRR (95% CI)	P value
Age				
≤24	1.0			
25-29	1.1 (0.7-1.7)	0.647		
30-34	1.2 (0.7-2.0)	0.462		
≥35	1.4 (0.6-3.3)	0.439		
History of fertility treatment				
No	1.0			
Yes	1.3 (0.6-3.0)	0.534		
Gestation age at booking				
<8 weeks	1.0			
8-12 weeks	0.7 (0.3-1.6)	0.407		
>12 weeks	1.2 (0.6-2.4)	0.638		
Number of ANC visits				
<4	1.0			
4--8	0.9 (0.4-1.9)	0.723		
>8	0.8 (0.3-2.4)	0.714		
Gestation age at delivery				
≤40	1.0			
>40	1.4 (0.9-2.3)	0.167		
BMI				
Normal (18-24.9)	1.0			
Overweight (25.0-29.9)	1.1 (0.6-1.8)	0.781		
Obesity (>=30)	1.1 (0.7-1.9)	0.68		
Cervical dilation on admission				
4-7	1.0		1.0	
<4	0.5 (0.2-0.8)	0.012	0.6 (0.3-1.1)	0.055
≥8	0.7 (0.3-1.6)	0.349	0.64 (0.3-1.3)	0.189
Type of labor onset				

Spontaneous	1.0		1.0	
Induced	2.3 (1.7-3.2)	<0.001	1.9 (1.3-2.7)	0.001
Presence of birth companion				
Present	1.0		1.0	
Absent	3.4 (2.3-4.9)	<0.001	3.1 (2.1-4.4)	<0.001
Fetal weight (kg)				
≤3.5	1.0		1.0	
>3.5	1.5 (1.0-2.2)	0.036	1.3 (0.9-1.8)	0.198

1.0 Reference group, RR Risk Ratio, aRR Adjusted Risk Ratio, CI Confidence interval, Risk Ratio adjusted by marital status, occupation, place of residence, level of education, Gestation at delivery, Time of membrane rapture, type of membrane rapture and fetal presentation.

Table 4: Maternal outcomes

	Mode of delivery	
Maternal outcomes	**SVD n (%)**	**CS n (%)**
Postpartum hemorrhage (PPH)	7 (70)	3 (30)
Hysterectomy	1 (100)	
ICU	1 (100)	
Sepsis	4 (57.1)	3 (42.9)
Maternal Death	1 (100)	

Table 5: Fetal outcomes (N=180)

	Mode of delivery	
Fetal outcomes	**SVD n (%)**	**CS n (%)**
	110 (61.1)	**70 (38.9)**
Neonatal admission after delivery		
NICU		3 (100)
Neonatal ward	12 (46.2)	14 (53.8)
No	98 (64.9)	53 (35.1)
Neonatal death within 24 hours		
No	109 (61.9)	67 (38.1)
Yes	1 (25)	3 (75)
Apgar score		
≤7	4 (44.4)	5 (55.6)
>7	106 (62)	65 (38)

Figures

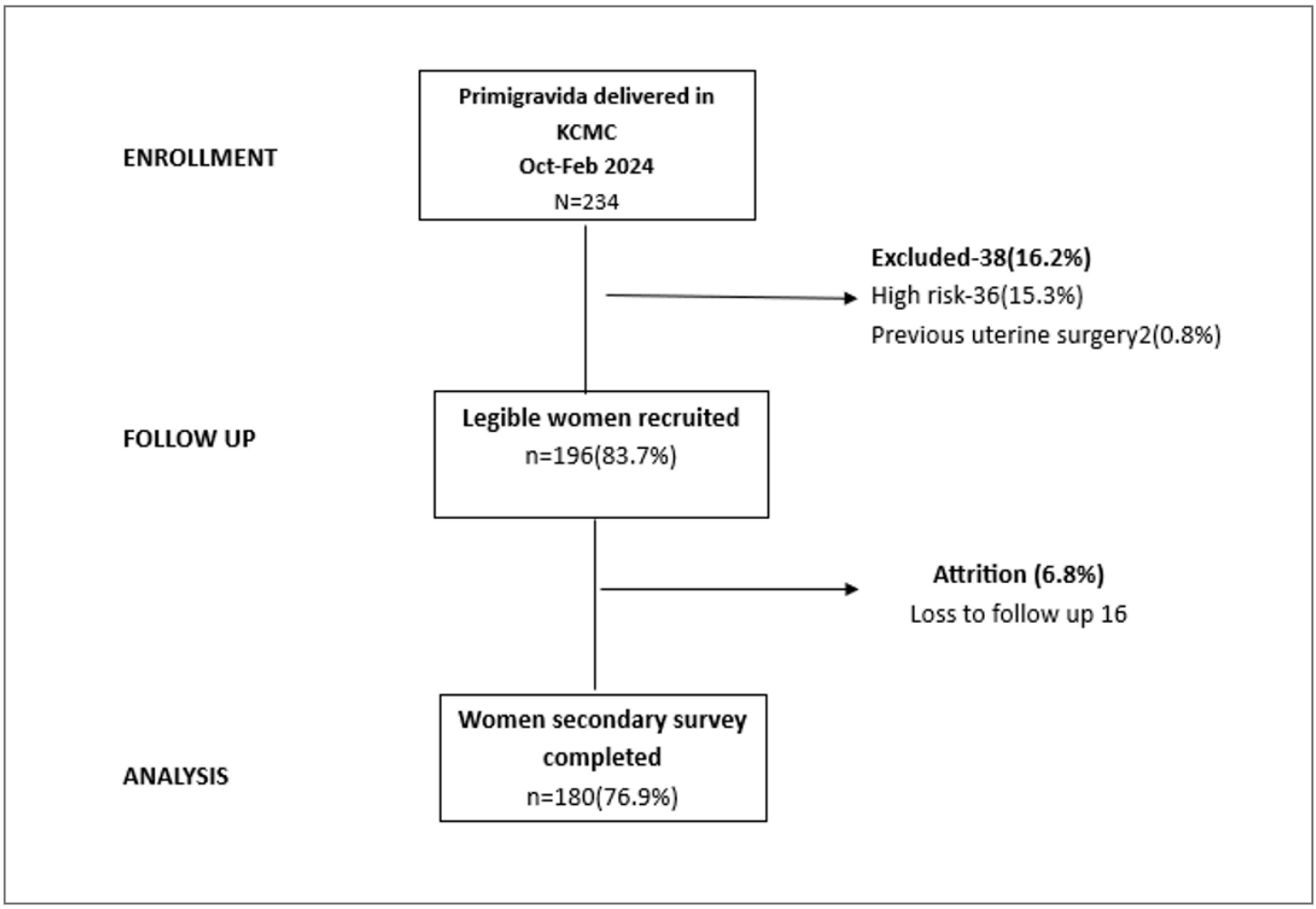


Figure 1

Data flow chart

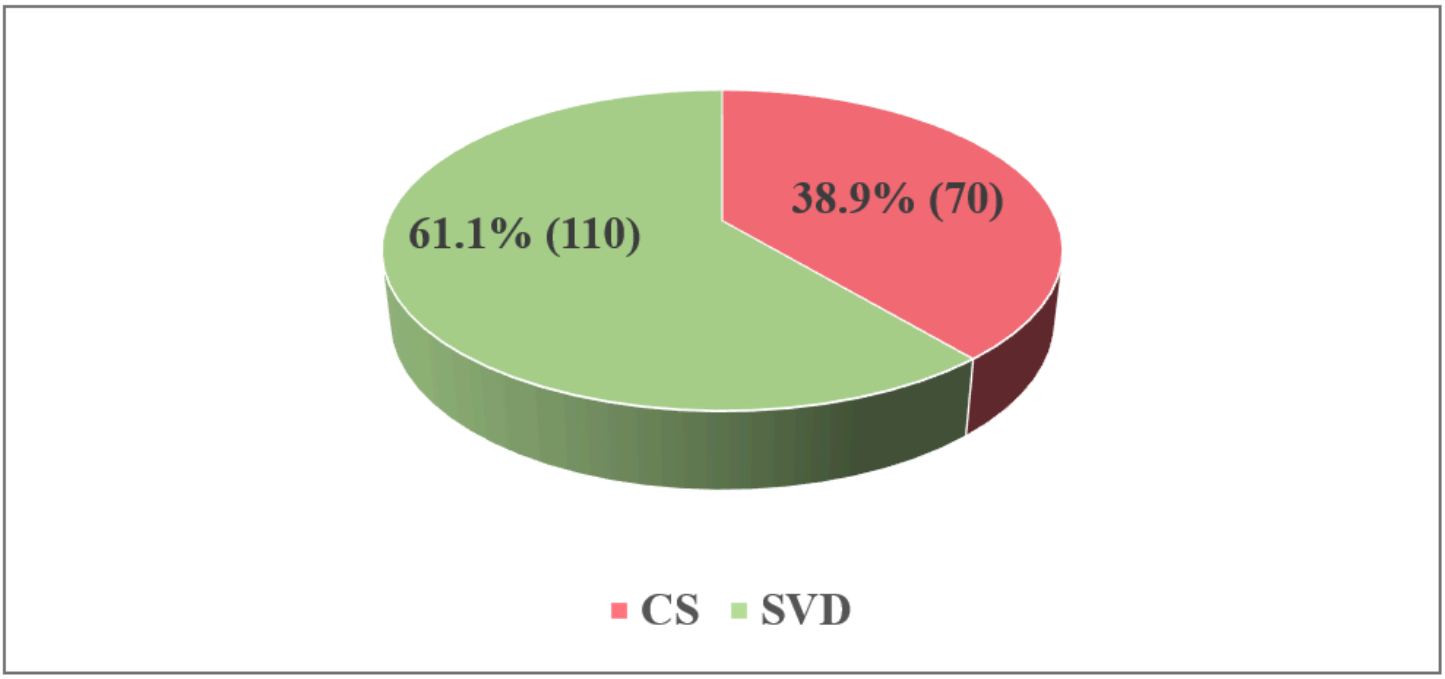


Figure 2

The prevalence of Caesarean section among low risk Primigravida women delivering at KCMC from October2024 March 2025.

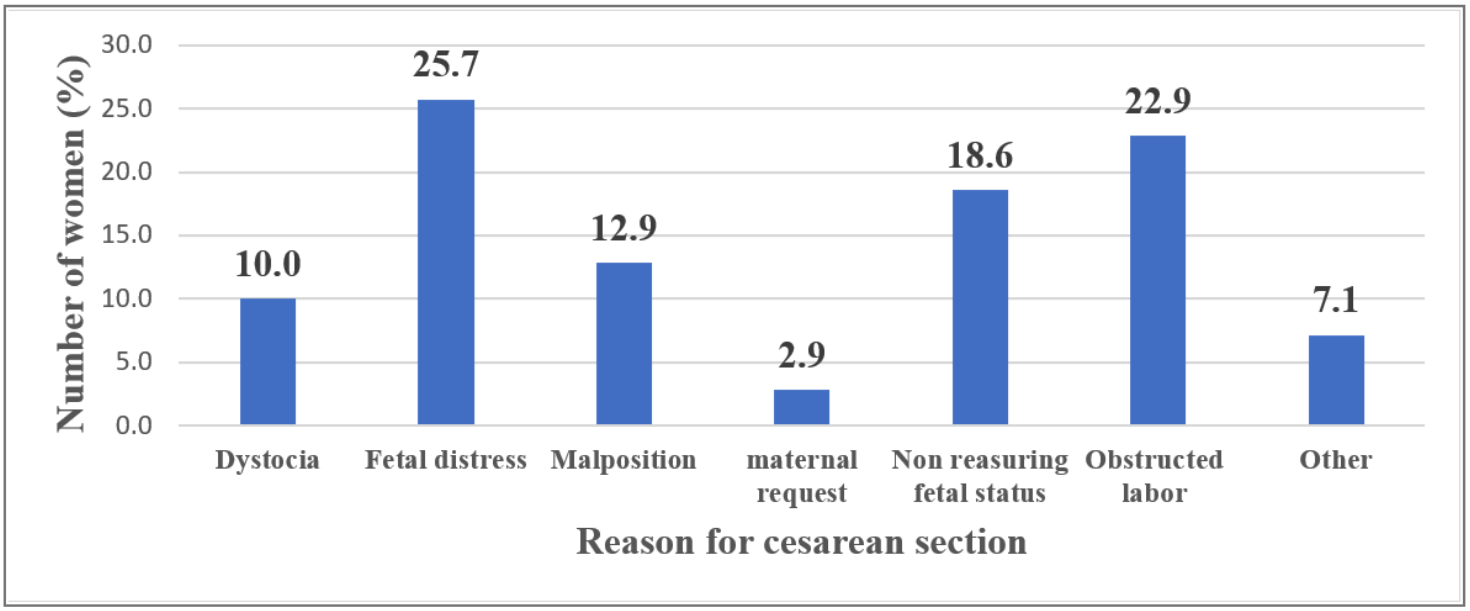


Figure 3

Reason for caesarian section

Supplementary Files

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