The Prevalence and Indications of Caesarean Sections among Women of Reproductive Age at Ndola Teaching Hospital

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Abstract

Caesarean section (CS) is a life-saving obstetric procedure for both mother and Foetus, yet its prevalence varies widely across regions. While global CS rates range from 19.2% in Asia to 31.1% in Oceania, sub-Saharan Africa reports a much lower rate of 7.3%. In Zambia, a previous study at Ndola Teaching Hospital reported a CS rate of 20.7%. Socio-demographic factors—including education level, economic status, and healthcare access—significantly influence CS prevalence. For instance, in Ethiopia, women with secondary or higher education were twice as likely to undergo CS compared to those with only primary education.

This retrospective, hospital-based study analyzed 2,248 CS cases performed at Ndola Teaching Hospital from January to December 2022. Data were extracted from patients files then verified with theatre and delivery registers, cleaned in Excel, and analyzed using SPSS version 20.0. Ethical clearance was obtained from the National Health Research and Training Institute (formerly Tropical Disease Research Centre) and institutional permission was granted.

The CS prevalence was 28.8%. Foetal distress (32.3%) was the most common indication for emergency CS, while a history of three or fewer previous CS (28%) was the leading reason for elective CS. Caesarean sections were more common among women aged ≤34 years, those with primary-level education, informal employment, and residents of low-income areas. The most frequent maternal complication was postpartum haemorrhage, while birth asphyxia was the most prevalent neonatal outcome, particularly in emergency cases.

These findings highlight a rising trend in CS at the institution, driven by clinical indications and socio-demographic vulnerabilities. Improved diagnostic tools for foetal distress and enhanced antenatal counselling tailored to high-risk groups may reduce unnecessary interventions and improve maternal and neonatal outcomes.

Keywords: *Caesarean section, foetal distress, maternal outcomes, neonatal outcomes, socio-demographic factors.*

1. INTRODUCTION

1.1. Background

Caesarean section (CS) is one of the most frequently performed surgical procedures in obstetrics, primarily because of its potential to save the lives of both mother and foetus in complicated pregnancies (Mishra et al., 2020). The procedure involves making incisions in the abdomen and uterus to deliver the baby (Jones, 2022). Caesarean sections are categorized into two types: classical and lower segment. A classical CS involves a vertical incision on the upper uterine segment, while a lower segment CS is performed through a transverse incision on the lower uterine segment (Jones, 2022). Indications for caesarean delivery can be elective or emergency, and emergency cases are further classified based on the urgency of intervention (Jones, 2022).

Category	Description
1	*Immediate threat to the life of the woman or fetus*
2	*Maternal or fetal compromise that is not immediately life-threatening*
3	*No maternal or fetal compromise but needs early delivery*
4	*Elective – delivery timed to suit woman or staff*

Source: *Jones, O. (2022, December 20). Caesarean Section. Retrieved from https://teachmeobgyn.com/labour/delivery/ceasarean-section/*

The World Health Organization (WHO, 2015) recommends an ideal CS rate between 10% and 15%, though this standard has been debated due to variations in healthcare infrastructure, population coverage, and resource availability across countries. Bizuayew et al. (2020) also proposed an optimal rate between 5% and 15%. Despite these benchmarks, CS rates have increased globally in both developed and developing nations (WHO, 2015).

Caesarean section is considered a critical intervention in managing high-risk pregnancies such as those involving antepartum haemorrhage, foetal distress, prior caesarean delivery, and cephalopelvic disproportion (Harrison et al., 2016). A multi-country analysis by Médecins Sans Frontières in sub-Saharan Africa identified obstructed labour (31%) as the most common indication for CS, followed by malpresentation (18%), prior CS (14%), foetal distress (10%), uterine rupture (9%), and antepartum haemorrhage (8%) (Harrison et al., 2016). However, findings differ across regions. For example, in Nepal, Maskey et al. (2019) identified foetal distress as the leading indication for CS, a trend also noted by Nkhata et al. (2016) in their study at Ndola Teaching Hospital.

Socio-demographic factors also play a significant role in CS rates. Harrison et al. (2016) observed that women with secondary or tertiary education, those from wealthier households, and those delivering in private hospitals were more likely to undergo caesarean delivery than those from lower socio-economic backgrounds. Similar trends were observed in a study from Ethiopia, highlighting the influence of education, wealth, and healthcare setting on CS prevalence.

Despite being a life-saving procedure, caesarean section is a major surgery associated with short- and long-term complications, particularly in low-resource settings where access to comprehensive obstetric care is limited (Mishra et al., 2020). Harrison et al. (2016) noted increased maternal morbidity and mortality in low-income countries, often due to underqualified personnel performing the procedure. For instance, a study by Maskey et al. (2019) conducted in South Africa found that maternal mortality was three times higher following caesarean delivery compared to vaginal delivery.

Surgical site infection (SSI) is one of the most common complications of CS, defined as an infection occurring within 30 days post-operation and involving skin, subcutaneous tissue, or deeper tissues manipulated during surgery (Mishra et al., 2020). The global rate of SSI ranges between 3% and 15% (Mishra et al., 2020). Typical signs include erythema, discharge, and wound induration, with infections developing in 2%–7% of patients, generally within 4–7 days post-surgery (Kawakita et al., 2017). Group A or B hemolytic streptococci can cause infection within 48 hours, while other pathogens such as *Ureaplasmaurealyticum*, *Proteus mirabilis*, *Staphylococcus epidermidis*, *Enterococcus faecalis*, *Staphylococcus aureus*, and *Escherichia coli* have also been implicated (Kawakita et al., 2017). Although preoperative and postoperative antibiotics have proven efficacy, SSIs remain a burden, especially in resource-limited settings.

Globally and in many low- to middle-income countries, CS rates continue to rise (Harrison et al., 2016), accompanied by increasing reports of adverse maternal and neonatal outcomes. This study aimed to determine the prevalence, indications, and outcomes of caesarean sections at Ndola Teaching Hospital, a major referral and teaching institution in Zambia.

1.2. Problem Statement

Ndola Teaching Hospital is a tertiary referral centre serving Ndola district and the northern region of Zambia. It also functions as a training institution for specialist doctors in obstetrics and gynaecology, among other medical disciplines. Due to the limited number of consultants in obstetrics and gynaecology, the hospital relies heavily on trainee specialists to manage and perform a significant proportion of caesarean sections.

As a major referral facility, the hospital receives a high volume of maternal cases, many of which require operative delivery. The presence of obstetricians, anaesthetists, and theatre professionals in tertiary hospitals has been associated with increased caesarean section rates, a trend that may also be present at Ndola Teaching Hospital. However, there is currently insufficient statistical evidence to determine whether the reliance on doctors in training has significantly contributed to the observed increase in caesarean section rates.

A previous study by Nkhata et al. (2016) reported a caesarean section prevalence of

20.7% at Ndola Teaching Hospital (formerly Ndola Central Hospital), with foetal distress identified as the most common indication. However, that study did not distinguish between indications for elective and emergency caesarean sections, nor did it examine the contributing factors or maternal and neonatal outcomes associated with each type. Given that this was the only published study from Ndola at the time, there was a clear need for updated and more comprehensive data.

Additionally, reports from the hospital's theatre superintendent indicated a significant increase in the use of medical supplies, primarily driven by the rising number of caesarean sections performed each week. This underscored the need for evidence-based data to inform clinical planning, staffing, and resource allocation. The current study aimed to fill these knowledge gaps by establishing the current prevalence, indications, contributing factors, and outcomes of both elective and emergency caesarean sections at Ndola Teaching Hospital.

1.3. Justification

There has been a notable increase in the number of caesarean sections performed in Zambia, particularly at Ndola Teaching Hospital. This rise has led to an increase in the hospital's expenditure on theatre supplies. A previous study by Nkhata et al. (2016) reported a caesarean section prevalence of 20.7% at Ndola Teaching Hospital, while a more recent study by Kamanda et al. (2021) at Kitwe Teaching Hospital—located in the same province—found a significantly higher prevalence of 37.5%. This figure exceeds the World Health Organization's recommended rate. Given the high patient inflow at Ndola Teaching Hospital, an elevated caesarean section rate may be expected, potentially surpassing the recommended threshold. This highlights the need for WHO and other stakeholders to consider region-specific or country-specific baselines for caesarean section rates.

Since the last study at Ndola was conducted over five years ago, it is reasonable to expect a change in trends. Therefore, a new study was necessary to update the prevalence data and assess current indications for caesarean sections. Additionally, this study aimed to determine whether the common indications identified in the 2016 study by Nkhata et al. have shifted over time.

Crucially, the study also evaluated the maternal and neonatal outcomes of caesarean sections, which are vital for understanding the associated risks and benefits. These outcomes were analyzed separately for elective and emergency caesarean sections. Such information is essential for healthcare providers during antenatal counselling and surgical decision-making, as it helps them anticipate and manage potential complications in both scenarios. In addition, it identified key factors contributing to both types of caesarean deliveries. Understanding these factors is crucial during antenatal counselling, as it enables healthcare providers to better anticipate the likelihood of caesarean delivery and prepare accordingly, thereby improving patient education, preparedness, and clinical outcomes.

1.4. General Objectives

1.4.1. To assess the prevalence and indications of caesarean section from January, 2022 to December, 2022.

1.5. Specific Objectives

1.5.1. To determine the prevalence of caesarean section at Ndola Teaching Hospital.

1.5.2. To determine the factors contributing to elective and emergency caesarean section such as: level of education, parity, social economic factors.

1.5.3. To determine the common indications for elective and emergency caesarean section at Ndola Teaching Hospital

1.5.4. To determine the outcomes of elective and emergency caesarean section e.g. maternal outcomes like, postpartum haemorrhage, hysterectomy, maternal death. Neonatal outcomes like birth asphyxia, neonatal injuries and death.

1.6. Research Questions

1.6.1. What is the prevalence of caesarean section

1.6.2. What are the indications of caesarean sections at Ndola Teaching hospital from January to December, 2022?

1.6.3. What are the factors contributing to either elective or emergency caesarean section?

1.6.4. What are the outcomes associated with elective and emergency caesarean section done at Ndola Teaching hospital from January to December, 2022?

2. LITERATURE REVIEW

2.1. Epidemiology

The World Health Organization (WHO) promotes the availability, accessibility, and quality of healthcare for pregnant women and children through its Sustainable Development Goals (Harrison et al, 2016). Within this framework, the concept of Emergency Obstetric Care (EmOC) has been defined to include the provision of parenteral antibiotics, uterotonics, magnesium sulfate, assisted vaginal delivery, manual removal of the placenta and retained products of conception, as well as basic neonatal resuscitation (Harrison et al, 2016). Health institutions that also provide caesarean sections and blood transfusions are classified as offering comprehensive EmOC services (Harrison et al, 2016).

The WHO recommends an optimal caesarean section (CS) rate between 10% and 15%, with some studies suggesting a broader acceptable range of 5% to 15% (Bizuayew et al, 2020). However, CS rates have been steadily increasing globally in both developed and developing countries (WHO, 2015). According to recent WHO data, the global average CS rate rose from 12.4% to 18.6%, with rates varying between 6% and 27.2% depending on the region and increasing annually at an average rate of 4.4% (Harrison et al., 2016). Nkurunziza et al. (2019) also reported that 19.1% of global deliveries are now conducted via caesarean section, making the lower uterine segment CS the most commonly performed surgical procedure worldwide.

Despite this global increase, sub-Saharan Africa continues to report low CS rates, averaging about 7.3% of all deliveries (Nkurunziza et al, 2019). In contrast, higher rates are observed in Asia (19.2%), Europe (25%), Oceania (31.1%), and North America (23%) (Harrison et al., 2016). Latin America and the Caribbean report the highest regional average at 40.5% (Betrán et al, 2016).

In Zambia, the national CS rate remains below international recommendations. Musonda et al. (2012) reported a prevalence of 4.4%, which is lower than the WHO-recommended threshold. This low figure may be due to underreporting, poor documentation, or inadequate health information systems (Musonda et al, 2021). However, some institutions report higher rates.

For example, Nkhata et al. (2016) found a CS prevalence of 20.7% at Ndola Central Hospital (now Ndola Teaching Hospital), while Kamanda et al. (2021) reported a higher rate of 37.5% at Kitwe Teaching Hospital—both tertiary-level hospitals located in the Copperbelt Province of Zambia, approximately 60 kilometers apart. Additionally, a study conducted at the University Teaching Hospital, Zambia's largest referral hospital, reported a CS prevalence of 18.5% (Musonda et al, 2012).

2.2. Factors Contributing to Caesarean Section

Epidemiological studies have demonstrated that socio-demographic factors significantly contribute to the rising rates of caesarean section in various populations. For example, Harrison et al. (2016) reported that social and economic characteristics influence access and utilization of caesarean delivery. In Ethiopia, Gebremedhin (2014) found that women with secondary or higher education were twice as likely to undergo caesarean section compared to those with only primary education. Additionally, women from poor or middle-income families and those who received maternal services in private hospitals were also twice more likely to deliver via caesarean section than those using public healthcare facilities (Gebremedhin, 2014). Similarly, a study conducted in Tanzania by Nilsen et al. (2014) revealed disparities in caesarean section rates among different socio-demographic groups, suggesting inequitable access to obstetric services.

The availability of specialized healthcare personnel has also been shown to influence caesarean section rates. Briand et al. (2012) found that the presence of an obstetrician and a medical anesthetist significantly increased the likelihood of caesarean delivery. Meanwhile, there is ongoing debate regarding the role of labour induction in caesarean section rates. While some researchers argue that induction increases the risk, Vogel, Souza and Gülmezoglu (2013) reported that labour induction may actually reduce the need for caesarean section.

Other maternal characteristics have been linked to higher caesarean rates. These include advanced maternal age and medico-legal concerns, such as the fear of litigation (Nedberg et al, 2020). In Georgia, Rahman et al. (2015) found that women with a body mass index (BMI) ≥ 30 kg/m² had an increased risk of

caesarean delivery. Similarly, macrosomia has been identified as a contributing factor. Nedberg et al. (2020) noted that women delivering infants weighing over 4,000 grams were at increased risk for caesarean section, and in some regions like Georgia, where macrosomia is defined as a birth weight ≥4,500 grams, caesarean delivery is often recommended.

Pregnancy characteristics such as gravidity and antenatal care utilization also influence the type of caesarean delivery. According to Singh et al. (2020), primigravida women, those with limited antenatal care (one or no visits), and those with lower education levels were more likely to undergo emergency caesarean section. Conversely, women with a history of previous lower segment caesarean section were more likely to have an elective caesarean. These findings are consistent with those of Benzouina et al. (2016), who also reported higher emergency caesarean rates among primigravida and illiterate women, and elective procedures among women with previous caesarean histories. Similarly, Darnal et al. (2020) reported that emergency caesarean sections were more common in younger women and primigravida, while elective caesareans were more frequently performed in older and multigravida women.

Local data also support the influence of residential and socio-economic status on caesarean rates. A study conducted at the University Teaching Hospital (UTH) in Zambia found that 66.5% of pregnant women from high residential areas underwent caesarean section, compared to 33.5% from low residential areas (Musonda et al., 2012). These findings highlight the complex interplay between clinical, demographic, and systemic factors influencing caesarean section rates.

2.3. Indications for Caesarean Sections

Caesarean section (CS) is a critical component of comprehensive obstetric care and is considered an essential intervention in managing life-threatening obstetric conditions. It plays a significant role in reducing severe maternal and neonatal complications associated with preeclampsia, eclampsia, antepartum hemorrhage, fetal distress, and obstructed labour. Depending on the clinical context, CS may be performed as an emergency or as an elective procedure, based on various obstetric indications.

Several studies have explored the common indications for caesarean delivery across different settings. In a study conducted in Nepal, Maskey et al. (2019) reported that 28% of caesarean sections were performed due to fetal distress. Other identified indications included a history of previous caesarean section (18%), non-progress of labour (12%), oligohydramnios (7%), malpresentation (7%), cephalopelvic disproportion (6.5%), and hypertensive disorders in pregnancy (4%). Similarly, Tamrakar et al. (2021) found that 24.9% of CS cases in their study were attributed to fetal distress.

In Zambia, Musonda et al. (2012) conducted a study at the University Teaching Hospital and found that 36.3% of primigravida women delivered via caesarean section. The most common indication in that study was a previous caesarean section, accounting for 28.8% of cases. These findings contrast with those of Nkhata et al. (2019) and Kamanda et al. (2021), who identified fetal distress as the leading indication for caesarean delivery in their respective studies, accounting for 14.9% and 20.6% of cases. These variations highlight the influence of institutional protocols, patient demographics, and clinical practices on caesarean section rates and indications

2.4. Outcomes Associated with Caesarean Sections

The rising rate of caesarean sections worldwide has become a concern for both public health professionals and obstetricians, due to the increased financial burden and heightened health risks to mothers compared to vaginal delivery (Turner, 1997). In developed countries, this rise is largely attributed to the availability of advanced and comprehensive labour monitoring techniques, such as electronic fetal monitoring, which facilitate the early diagnosis of foetal distress (Maskey et al., 2019). Caesarean section, however, is associated with complications that may be immediate, short-term, or long-term—risks that are particularly significant in resource-limited settings where access to comprehensive obstetric care is often lacking (Mishra et al., 2020).

A study conducted across various regions, including Africa, Asia, Latin America, and Eastern countries, found that 28.6% of women were delivered by caesarean section (Souza et al., 2013). Among these, 62.5% experienced severe maternal outcomes, compared to 37.5%

of women who delivered vaginally (Gebhardt et al., 2015). The findings also revealed that severe maternal outcomes were more common in women with more than one previous caesarean section compared to those without (Souza et al., 2013). Additionally, non-labouring caesarean sections were associated with poorer pregnancy outcomes. The same study reported that, among all participants who experienced severe maternal outcomes, 26.7% were due to postpartum haemorrhage, while 25.9% were related to hypertensive disorders (Souza et al., 2013).

According to a study conducted in South Africa, the risk of maternal death is three times higher following a caesarean section compared to vaginal delivery (Gebhardt et al., 2015). Haemorrhage was identified as a major cause of death, occurring at a rate of 5.5 deaths per 10,000 caesarean sections. The same study also reported other significant causes of maternal death following caesarean section, including embolism (4.5 times higher risk) and hypovolemic shock (4.8 times higher risk), with case fatality rates ranging from 10.1 to 31.9 deaths per 10,000 caesarean sections. Specific complications associated with maternal death included intraoperative or postoperative bleeding, anaesthesia-related complications, preeclampsia, eclampsia, pregnancy-related sepsis, embolism, and acute vascular collapse (Gebhardt et al., 2015). In addition, a study by Darnal et al. (2020) found that adverse maternal outcomes such as fever, postpartum haemorrhage, need for blood transfusion, wound infection, and admission to intensive care were significantly more common in emergency caesarean sections than in elective ones.

In a study conducted in Senegal and Mali involving 78,166 pregnant women, Briand et al. (2012) found that a small percentage (22%) underwent caesarean section before the onset of labour. This group experienced a significant reduction in stillbirths and neonatal mortality within the first 24 hours of life compared to those who underwent a trial of labour. However, intrapartum caesarean sections (12.5%) were associated with a higher risk of maternal death, increased maternal morbidity, and greater neonatal mortality beyond 24 hours of life. The study concluded that while caesarean section can improve certain outcomes, it may also exacerbate others (Briand et al., 2012).

Onsrud et al. (2011) demonstrated that urogenital fistula and genitourinary injuries during caesarean section are key indicators of the quality of surgical care provided. Urogenital fistula is often associated with obstructed or prolonged labour, where devascularisation leads to necrosis of pelvic tissues. With the increasing rate of caesarean sections, poor surgical technique has become a contributing factor to fistula formation. This typically occurs when the bladder or ureter is unintentionally injured during surgery, and the injury goes unnoticed. Over time, epithelialization of the injured site may result in the development of a urogenital fistula (Onsrud et al., 2011). Thus, the occurrence of fistula following surgery serves as an indicator of surgical performance. According to the same study, 40% of women who developed fistula had undergone a caesarean section, and 24% of these fistulae were directly attributed to the procedure—highlighting that many cases are due to poor or inadequate surgical technique (Onsrud et al., 2011).

Surgical site infection (SSI) is defined as an infection occurring within 30 days post-operation and may involve the skin, subcutaneous tissue, deep soft tissue, or any body part manipulated during surgery (Mishra et al., 2020). Globally, the incidence of SSI ranges from 3% to 15%, making it a significant complication of caesarean section procedures (Mishra et al., 2020). Common signs of wound infection include erythema, discharge, and induration at the incision site, typically developing in 2%–7% of patients within 4 to 7 days post-caesarean delivery (Kawakita et al., 2017). Infections occurring within 48 hours are commonly caused by Group A or B haemolytic streptococcus (Kawakita et al., 2017). Other pathogens implicated in SSIs include Ureaplasmaurealyticum, Proteus mirabilis, Staphylococcus epidermidis, Enterococcus faecalis, Staphylococcus aureus, and Escherichia coli (Kawakita et al., 2017). Although the efficacy of pre- and post-operative antibiotics has been established, SSIs remain a frequent challenge in daily obstetric care (Yerba et al., 2020).

The increased accessibility of caesarean sections in sub-Saharan Africa has led to a rise in SSIs, with 7%–48% of patients affected. Risk factors include young maternal age, obesity, prolonged labour, premature rupture of membranes, and hyperthermia upon admission (Nkurunzia et al., 2019). While regional variation exists, the average SSI burden ranges from 2% to 10% (Kawakita et al., 2017). A study in Rwanda

reported an SSI prevalence of 10.9%, while another study found 12.4% of women developed SSIs following caesarean section (Bizuayew et al., 2020).

SSIs exert both direct and indirect effects on individuals, families, and healthcare systems. For instance, infected patients often experience extended hospital stays, increased out-of-pocket expenses, prolonged antibiotic use, and mental distress (Bizuayew et al., 2020). Clinical presentations of wound infections include erythema and induration, typically appearing 2 to 7 days postoperatively. If symptoms occur within 48 hours, Group A or B streptococcus is often the causative agent (Kawakita et al., 2017). Although necrotising fasciitis is rare, it is a severe condition marked by rapid tissue necrosis. Type 1 necrotising fasciitis is polymicrobial, involving both aerobic and anaerobic bacteria, whereas Type 2 is caused by a single organism (Kawakita et al., 2017). Goepfert et al. (1997) reported a necrotising fasciitis incidence of 0.18% with a high mortality rate of 22%.

Postpartum endometritis is another common infection, presenting with fever ≥38°C, abdominal pain or tenderness, and purulent vaginal discharge. It is primarily polymicrobial (Rosene et al., 1986). Between 2% and 16% of women who undergo caesarean delivery develop postpartum endometritis, with higher rates (3%–11%) in those who were in labour before surgery, compared to 0.5%–5% in those who were not (Haas et al., 2014). These postpartum infections lead to prolonged hospitalization, placing an additional burden on healthcare systems (Kawakita et al., 2017). One study reported that treating wound infections incurred a cost of $3,700, while managing endometritis added approximately $4,000 (in 2008 USD; equivalent to $4,200 and $4,500 today) (Kawakita et al., 2017).

SSI is a pressing global public health concern, with low- and middle-income countries bearing 75% more of the burden compared to high-income nations (Nkurunzia et al., 2019). Globally, SSIs contribute to prolonged hospitalization, increased complications, heightened mortality risk, and increased financial strain on patients, families, and healthcare systems (Nkurunzia et al., 2019).

Numerous studies have identified risk factors associated with SSI development. A high number of vaginal examinations (more than five), prolonged labour, premature rupture of membranes, and maternal anaemia significantly increase the risk (Yerba et al., 2020). Other associated factors include obesity, tobacco use, chorioamnionitis, subcutaneous hematoma, corticosteroid use, and low socio-economic status—especially among women from rural areas, who are two to three times more likely to develop SSIs (Bizuayew et al., 2020). Additionally, receiving pre-operative antibiotics has been shown to significantly reduce the risk of SSI compared to not receiving those (Nkhata et al., 2016)

In 2021, Tamrakar et al. conducted a study which found that 29.1% of neonates (out of 1,412) delivered by caesarean section required admission to the intensive care unit. The most common reason for admission was transient tachypnoea, occurring in 60.46% of elective and 44.28% of emergency caesarean section cases. Similarly, Benzouina et al. (2016) reported that fetal complications—such as low birth weight, early neonatal morbidity, and mortality—were more common in emergency caesarean sections compared to elective ones. Supporting this, a study by Darnal et al. (2020) revealed that birth asphyxia, meconium-stained liquor, and neonatal intensive care unit admissions were significantly higher in emergency caesarean sections than in elective procedures.

2.5. Cost Attached to Caesarean Section

A study conducted in Uganda found that the cost per caesarean section was US$28 in public facilities and US$52 in private facilities, with the overall cost per delivery averaging US$23.90 (Mayora et al., 2014). Several studies have suggested that caesarean section is a cost-effective intervention. For example, research in the Democratic Republic of Congo reported a caesarean rate of 9.2%, with each procedure costing approximately US$144 (Deboutte et al., 2013). Similarly, an analysis conducted at a district hospital in Zambia demonstrated the cost-effectiveness of caesarean sections, with emergency procedures costing US$7.42 and elective ones US$20.50 (Roberts et al., 2016).

2.6. Theoretical Framework

A pregnant woman has the right to choose her mode of delivery, whether in an emergency or elective situation. However, this choice is often influenced by external factors such as advice from health professionals, peers, family members, and husbands, as well as by her level

of education. These influences make the decision-making process complex, especially in emergencies where time is limited.

The Theory of Planned Behavior (TPB) provides a useful framework to explain the factors influencing a pregnant woman's choice of delivery mode. According to Wayne (2022), TPB predicts an individual's intention to engage in a particular behavior at a specific time and place. This theory can help healthcare professionals anticipate a pregnant woman's delivery mode preference when she is at the hospital near term or during labor.

Wayne (2022) identifies several key factors influencing behavior. First, attitude refers to the pregnant woman's evaluation of the outcome; she may opt for a caesarean section if she perceives the outcome to be favorable, with a stronger behavioral intention if this option is believed to be better than vaginal delivery. Second, subjective and social norms represent societal expectations about how one should behave. In Zambian culture, for example, there is a prevailing belief that a "real woman" should deliver naturally rather than by caesarean section. This cultural norm can affect decisions about caesarean delivery, especially in emergencies. However, such beliefs may be overridden by health professionals' advice, enabling the mother to make an informed decision.

Third, perceived behavioral control (or perceived power) reflects the woman's awareness of her right to choose the mode of delivery, positioning her as a key stakeholder. If a woman chooses a caesarean section without clear medical indication, her choice should still be respected, which could contribute to an increase in caesarean rates. Nevertheless, physicians play a critical role in guiding mothers toward the most appropriate delivery method.

2.7. Conceptual Framework
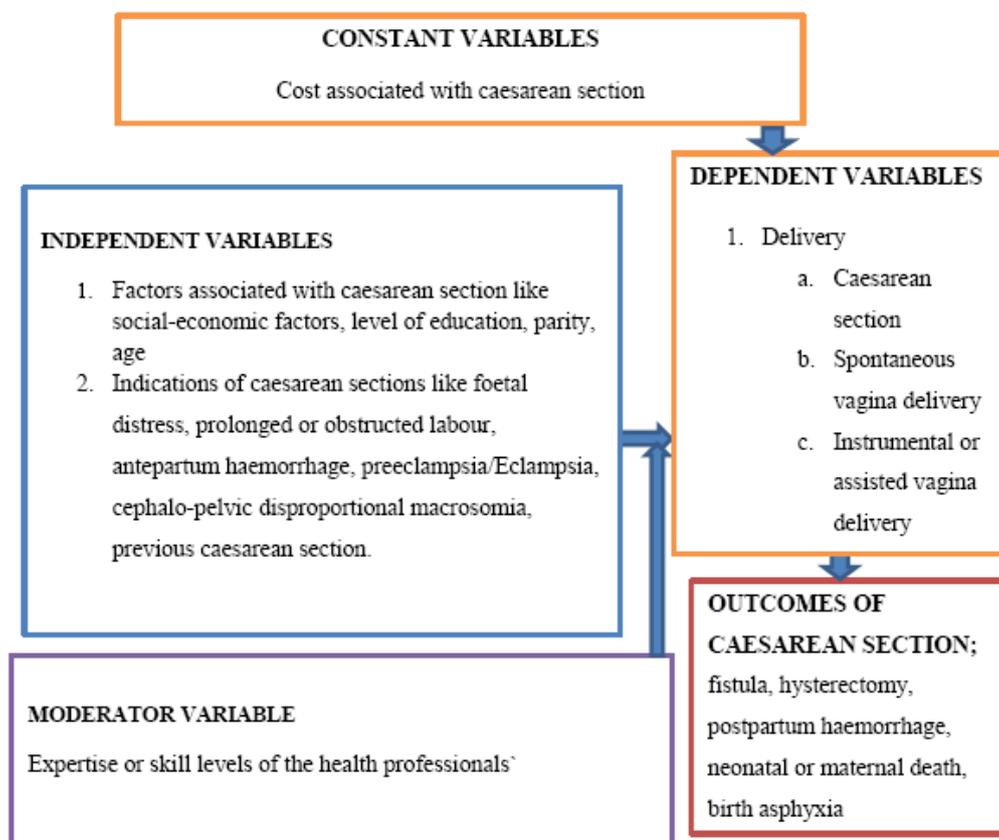
3. METHODOLOGY

3.1. Study Design

This was a retrospective, descriptive, hospital-based cross-sectional study covering the period from January to December 2022.

The retrospective design was appropriate for this study because it was cost-effective and could be completed within the required timeframe, unlike a prospective study design, which would have demanded more time.

3.2. Study Population

All Pregnant women, who delivered at Ndola Teaching Hospital by caesarean section from January, 2022 to December, 2022 were considered for this study.

3.3. Study Site

The study was conducted at Ndola Teaching Hospital, the second tertiary hospital in Zambia, with a bed capacity of 851 and 91 cots, and the hospital has a dedicated Obstetrics and Gynecology department. In 2021, the hospital recorded a total of 7,637 deliveries. It is affiliated with Copperbelt University and the Zambia College of Medicine and Surgery (ZACOMS), serving as a training center for specialists across various fields. Located in Ndola district along Broadway Road in the Copperbelt Province, the hospital's geographic coordinates are 12.97023 latitude and 28.63401 longitude (GPS: 12° 58′ 12.82″ S, 28° 38′ 02.43″ E). Ndola Teaching Hospital receives referrals from the northern part of Zambia and serves the entire Ndola district, which had a population of 624,579 according to the 2022 Zambia Statistics Agency census.

3.4. Sampling Method

The sampling technique used was purposive sampling of patient files for those who had undergone caesarean section. This approach was employed to allow comparison between the patient details recorded in the files and those documented in the delivery registers.

3.5. Inclusion Criteria

All pregnant women who delivered at Ndola Teaching Hospital between January, 2022 and December, 2022 by caesarean section (electives and emergencies) were included in the study. This included all age group which helped to determine age as a factor for caesarean section which is supported by literature.

3.6. Exclusion Criteria

Pregnant women who delivered at other Health facilities than Ndola Teaching Hospital, not falling under the period of review and vagina deliveries were not included in the study.

3.7. Sample Size

Assumptions:

1. Normal distribution
2. confidence interval at 95%, marginal of error at 5%
3. Z score of 1.96 at 95% CI,
4. prevalence (p) at 20.7% [12]
   - Sample Size = [z2 * p(1-p)] / e2
   - z = z-score
   - e = margin of error
   - p = prevalence (from previous study)
   - $n=[1.96^2 \times 0.207(1-0.207)]/0.05^2$
   - n=252 will be the minimum sample size
   - Number of caesarean section done from January to December, 2022 was 2,248 which was obtained to have a good representative in order to calculate prevalence from the total deliveries.

3.8. Data Collection

Patients files were used to get the sociodemographic, parity, indications maternal and neonatal outcomes. This information was verified using delivery registers for labour ward and operating theatre. These figures were then compared with entries in the labour ward delivery register—which includes spontaneous vaginal deliveries, instrumental deliveries, and caesarean sections—to ensure consistency and avoid double counting. This comparison was essential to verify the accuracy of records and eliminate discrepancies between registers. The patient data reviewed covered the period from January 2022 to December 2022. Data were collected using a questionnaire and subsequently entered into an Excel spreadsheet for cleaning and preparation for analysis.

3.9. Data Analysis

The collected data were analysed using SPSS version 20 to calculate descriptive statistics such as frequencies and percentages, and the results were presented in tables.

3.10. Validity/Reliability

3.10.1. Interrater reliability will be used whereby the study will be subjected for review and be compared with other studies which will be conducted at the same hospital in a similar manner

3.10.2. Content validity was applied to this study to ascertain the validity of the results by analysing the results to determine the coverage of all aspects needed to be measured.

3.11. Ethical Consideration

Ethical approval was gotten from National Health Research and Training Institute (formerly known as TDRC); **TDREC/062/03/23** in Ndola. Thereafter, the administration at Ndola Teaching Hospital approved the permission to access patients' files. The files and delivery registers were reviewed in a secluded room to maintain confidentiality and no patient identity was recorded.

4. RESULTS

In January to December, 2022, Ndola Teaching Hospital recorded 7,810 deliveries of which 2,248 were caesarean sections making the rate of caesarean section at 28.8%. Routine caesarean sections were 314 out of 2,248 making it 13.9%, and emergence caesarean sections were 1,934 out of 2,248 making it 86% of total caesarean sections done.

Table 1. *Indications for Elective caesarean sections*

≤ 3 previous caesarean section	28%
Other indications	13.4%
≥ 4 previous caesarean section	8.9%
Multiple pregnancy	8.2%
Cephalo Pelvic Disproportion	7.6%
Breech presentation	6.1%
Severe pre-eclampsia, placenta abruption and bad obstetric history	5.7%
Transverse lie	3.8%
Pregnancy Induced Hypertension	3.5%

Table 2. *Indications for emergency caesarean section*

Foetal distress	32.3%
≥ 2 previous caesarean section in labour	12.7%
Cephalo Pelvic Disproportion	11.3%
Prolonged labour	8.1%
Severe Pre-eclampsia	7.5%
Breech presentation	6.0%
Antepartum Haemorrhage	4.6%
Anhydaminous	3.9%
Multiple pregnancy	2.8%
Cord prolapse	1.8%
Failed induction	1.7%
Bad obstetric history	1.7%
Eclampsia	1.3%
Malposition	1.3%
Fresh scar of caesarean section	1.1%
Ruptured uterus	0.05%
Malpresentation	0.04%

Table 3. *Factors contributing to elective caesarean section*

Age (years)	≤ 34	37.6%
	≥ 35	16.9%
Parity	Nulliparity	6.3%
	≥ 1	42%
Home address	Low social economical area	30.6%
	High social economical area	13.7%
	Outside Ndola district	1.3%
Level of education	Primary	53%
	Secondary	40%
	Tertiary	11.1%
Employment status	Yes	30%
	No	45%

Table 4. *Factors contributing to emergency caesarean section*

Age (years)	≤ 34	82.9%
	≥ 35	15.9%
Parity	Nulliparity	37.8%
	≥ 1	61.0%

Home address	Low social economical	51.4%
	High social economical	16.1%
	Outside Ndola district	2.3%
Level of education	Primary	60%
	Secondary	29.7%
	Tertiary	10.2%
Employment status	Yes	18%
	No	61.6%

Table 5. *Maternal outcomes*

	Elective caesarean section	**Emergency caesarean section**
Postpartum haemorrhage	40%	58.9%
Spinal anaesthesia accidents	18.3%	24.1%
Hysterectomies	17.8%	28.2%
Obstetric high dependence admissions	10.3%	30.6%
Intensive care unit admission	0.6%	19.0%
Surgical site infections/puerperal sepsis	1.3%	2.3%
Fistula	0.08%	1.4%
Maternal death	0.9%	1.8%

Table 6. *Neonatal outcome after caesarean section*

	Elective caesarean section	Emergency caesarean section
Birth asphyxia	1.2%	30.7%
Neonatal injury	0.02%	1.6%
Fresh still birth	0.01%	2.3%
Neonatal death	0.01%	3.3%
Macerated still birth	0.003%	0.6%

5. DISCUSSION

The prevalence of caesarean sections at Ndola Teaching Hospital from January to December 2022 was 28.8%. This represents a notable increase compared to the 20.7% reported by Nkhata et al. (2016) in a previous study at the same institution. Although still lower than the 37.5% prevalence reported at Kitwe Teaching Hospital by Kamanda et al. (2021), the current figure at Ndola Teaching Hospital exceeds the World Health Organization's (WHO) recommended caesarean section rate, which ranges between 5% and 15% of total deliveries (World Health Organization, 2015).

The rise in caesarean section prevalence may be attributed to several factors. As a tertiary referral centre, Ndola Teaching Hospital receives a high number of obstetric referrals, including complicated pregnancies that may necessitate surgical intervention. Additionally, the presence of trainee obstetricians and gynaecologists may contribute to the higher rate, as teaching institutions often perform more procedures for training and clinical decision-making purposes. Advances in foetal monitoring and growing emphasis on risk aversion may also lead clinicians to opt for caesarean delivery, particularly in cases of suspected foetal distress. Therefore, the increased prevalence is likely multifactorial, reflecting both institutional dynamics and broader shifts in obstetric practice.

The present study identified various indications for both elective and emergency caesarean sections. The most common indication for emergency caesarean section was foetal distress, accounting for 32.3% of cases. For elective caesarean sections, the leading indication was a history of three or fewer previous caesarean sections, which accounted for 28% of cases. These findings are consistent with several previous studies that have highlighted foetal distress as a predominant reason for emergency caesarean delivery. For instance, Maskey et al. (2019) reported foetal distress as the indication in 28% of cases, Tamrakar et al. (2021) in 24%, Musonda et al. (2012) in 36.3%, Nkhata et al. (2016) in 14.9%, and Kamanda et al. (2021) in 20.6%.

The consistency of foetal distress as a leading indication across different settings suggests a universal challenge in intrapartum fetal monitoring and timely decision-making during labor. This may reflect limitations in access to advanced monitoring tools or delays in recognizing signs of compromised fetal well-being, particularly in resource-limited settings.

Similarly, the finding that 28% of elective caesarean sections were due to a history of three

or fewer previous caesarean deliveries aligns closely with Musonda et al. (2012), who reported 28.8% for the same indication. This pattern likely reflects adherence to clinical guidelines and concerns over uterine rupture or other complications associated with vaginal birth after caesarean (VBAC), prompting clinicians to recommend repeat caesarean delivery in women with prior surgeries. These findings underscore the importance of strengthening antenatal risk assessment and intrapartum monitoring to optimize delivery outcomes

Pregnant women who underwent caesarean section—whether elective or emergency—were found to differ across various socio-demographic characteristics, including age, parity, residential area, level of education, and employment status. In this study, women aged 34 years or younger accounted for a higher proportion of both elective (37.6%) and emergency caesarean sections (82.9%) compared to women aged 35 years or older, who accounted for only 16.9% and 15.9%, respectively. This trend may be attributed to the relatively young population in Ndola District. Additionally, the prevalence of teenage pregnancies could be a contributing factor, suggesting the need for further studies to explore this demographic disparity in greater detail.

These findings align with those of Darnal et al. (2020), who reported that emergency caesarean sections were more commonly performed on younger women than on those of advanced maternal age, although their study did not clearly define the age categories. Interestingly, Darnal et al. (2020) also found that elective caesarean sections were more common among older women, which contrasts with the current study where elective caesareans were more prevalent among women aged 34 years or younger. This discrepancy could be due to regional differences in maternal health-seeking behavior, access to services, or population structure.

Parity also played a significant role in caesarean delivery rates. In this study, nulliparous women accounted for 6.3% of elective and 37.8% of emergency caesarean sections. In contrast, women with one or more children accounted for a larger proportion—42.4% of elective and 61.0% of emergency caesarean sections. This indicates that women with prior births were

more likely to undergo both elective and emergency caesarean sections compared to nulliparous women. This pattern contrasts with findings by Singh et al. (2020), Benzouina et al. (2016), and Darnal et al. (2020), who reported higher rates of emergency caesarean sections among nulliparous women and higher rates of elective procedures among multigravidas. The deviation in findings may be related to the specific population characteristics of women in Ndola District.

Furthermore, the current study found that a majority of elective and emergency caesarean sections were performed on women from low socio-economic backgrounds—30.6% and 51.4%, respectively. Similarly, women with primary education comprised 53% of elective and 60% of emergency cases, while those with no formal employment accounted for 45% and 61.6%, respectively. These findings are consistent with those of Singh et al. (2020) and Benzouina et al. (2016), who also observed a higher rate of emergency caesarean sections among women with lower educational levels.

However, the results differ from those reported by Gebremedhin et al. (2014), who found that women with secondary or tertiary education in Ethiopia were more likely to undergo caesarean delivery than those with only primary education. This contrast may be due to differences in educational attainment levels across populations. In Ndola District, fewer women may have access to higher education compared to national-level populations studied in Ethiopia, making direct comparison less conclusive.

Overall, the findings from this study highlight the importance of considering socio-demographic factors in antenatal counselling and birth preparedness. Understanding the predictors of elective and emergency caesarean sections can aid healthcare providers in anticipating delivery outcomes and tailoring interventions to individual patient profiles.

The current study found that maternal outcomes following caesarean section were generally favorable, with a relatively low incidence of adverse events. Postpartum haemorrhage emerged as the most common maternal complication for both elective and emergency caesarean sections, accounting for 40% and 58.9%, respectively (see Table 5). Although this study did not analyze which specific indications of elective or emergency caesarean sections led to the observed maternal outcomes, the findings

align with those of Souza et al. (2013), who reported that severe maternal outcomes were more frequent in women with multiple prior caesarean sections and in non-labouring patients. In the same study, 26.7% of severe maternal outcomes were attributed to postpartum haemorrhage, which supports the current findings.

Additionally, Gebhardt et al. (2015) identified haemorrhage as a leading contributor to maternal mortality, with the risk being three times higher following caesarean section compared to vaginal delivery. While this study did not include a comparison of maternal outcomes between caesarean and vaginal deliveries, future research could address this gap to provide a more comprehensive understanding of relative risks.

Further supporting the findings, Darnal et al. (2020) reported that postpartum haemorrhage, wound infections, and the need for intensive care unit (ICU) admission were more common in emergency caesarean sections than in elective ones. This trend was mirrored in the current study, where wound infections occurred more frequently in emergency cases (2.3%) than in elective cases (1.3%), and ICU admissions were substantially higher for emergency cases (19%) compared to elective cases (0.6%).

Maternal mortality was also higher in emergency caesarean sections (1.8%) compared to elective procedures (0.9%). Although the current study did not detail the specific causes of maternal deaths, studies such as Gebhardt et al. (2015) attributed maternal deaths post-caesarean section to causes like embolism, anaesthesia-related complications, preeclampsia, eclampsia, sepsis, intraoperative bleeding, and hypovolemic shock. Similarly, Briand et al. (2012) reported that intrapartum caesarean sections were associated with higher risks of maternal death, morbidity, and neonatal mortality beyond 24 hours of life. This is consistent with the findings of the current study, where maternal deaths and adverse outcomes were more prevalent in emergency caesarean sections.

The rationale behind these findings may lie in the urgent and often less controlled nature of emergency procedures, which can limit preoperative preparation and increase clinical risks. These findings underscore the importance of timely decision-making and careful risk assessment during antenatal care, especially in women with known risk factors for emergency intervention.

Neonatal outcomes serve as critical indicators of the quality of care provided to pregnant women throughout the antenatal, intrapartum, and immediate postnatal periods. According to Briand et al. (2012), elective caesarean sections performed before the onset of labour were associated with a 22% reduction in stillbirths and neonatal mortality within the first 24 hours of life compared to cases involving a trial of labour. The findings from the current study align with this observation. Specifically, the rate of fresh stillbirths was significantly lower in elective caesarean sections (0.01%) compared to emergency caesarean sections (2.3%). Similarly, neonatal mortality was also lower in elective cases (0.01%) than in emergency cases (3.3%).

Furthermore, the incidence of birth asphyxia was notably higher in emergency caesarean sections (30.7%) compared to elective procedures (1.2%). This discrepancy can likely be attributed to the primary indication for emergency caesarean sections in this study—foetal distress. When caesarean delivery is performed in response to acute foetal compromise, there is often limited time for optimal preparation, which may adversely affect neonatal outcomes.

Additional factors may also contribute to the observed differences in outcomes, including delays in diagnosing foetal distress, prolonged decision-to-delivery intervals, and variations in neonatal resuscitation skills among attending midwives. These elements are crucial, as they can significantly influence the severity of birth asphyxia and other neonatal complications. Therefore, improving early diagnosis, reducing response time, and enhancing neonatal resuscitation competencies are essential to improving outcomes, particularly in emergency caesarean cases

6. CONCLUSION

This study demonstrated an increase in the caesarean section rate at Ndola Teaching Hospital to 28.8%, compared to the 20.7% reported by Nkhata et al. (2016). Although this represents a significant rise, it remains lower than the 37.5% recorded at the neighbouring Kitwe Teaching Hospital in 2021, as reported by Kamanda et al. (2021). Foetal distress continues to be the most common indication for emergency caesarean sections, while a history of

three or fewer previous caesarean sections remains the predominant reason for elective procedures.

Given the high frequency of foetal distress as an indication, there is a need to invest in improving its diagnostic accuracy. Enhancing diagnostic capabilities could not only improve neonatal outcomes but also help reduce potential over diagnosis, which may sometimes arise from fear of litigation.

Furthermore, maternal age, parity, and socio-economic status were found to be important factors influencing the decision to perform caesarean sections. These variables provide insight into the categories of women most likely to undergo elective or emergency procedures in this setting.

Ultimately, the benefits of caesarean delivery—whether elective or emergency—are best measured through associated maternal and neonatal outcomes.

7. RECOMMENDATIONS

7.1. This study provides foundational data and should serve as a basis for a larger, district-wide investigation involving all healthcare facilities in Ndola. Such a study would enable the determination of the overall caesarean section rate across the district, incorporating both public and private health institutions, to better inform policy and resource allocation.

7.2. To conduct a prospective comparative study to determine the outcomes of caesarean sections and vaginal deliveries

7.3. To conduct a study to ascertain the cost attached to performing a caesarean section in order to budget for this very important procedure.

7.4. Seeing foetal distress is the commonest indication for emergency caesarean section, a study should be conducted to establish parameters and equipment used to make the diagnosis, and determine the neonatal outcomes

8. STUDY LIMITATIONS

This study was limited to data collected exclusively from Ndola Teaching Hospital and did not account for deliveries that occurred in other health facilities within Ndola district. Many of these facilities refer patients to Ndola Teaching Hospital, where a portion of the referred cases ultimately undergo caesarean section. As a result, the caesarean section rate reported in this study may not fully represent the overall district-level rate. Including delivery data from all referring facilities would provide a more comprehensive and accurate estimate of the caesarean section prevalence within the entire district.

Additionally, the study design—being retrospective in nature—limited the ability to comprehensively assess certain maternal outcomes such as obstetric fistula and post-operative wound infections. These complications often require follow-up over time, which is better captured in a prospective cohort study design. In this case, some patients who may have experienced complications could have sought care at other facilities or not returned to Ndola Teaching Hospital, resulting in incomplete outcome data.

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