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**Keywords:** Caesarean section; Sub-Saharan Africa; Indications; Morbidity; Mortality



Research Article

# An analysis of the practices of caesarean section in sub-Saharan Africa: A summary of the literature

## Abstract

**Introduction:** Ensuring access to quality caesarean sections (CS) is a challenge for the next millennium and a sustainable development goal to reduce maternal and infant mortality. A CS involves risks and complications and should therefore be performed in an approved way and not used excessively. The WHO recommends that the CS rate should not exceed 10–15%. Approximately 99% of maternal deaths occur in developing countries where efforts to reduce maternal deaths are still low. This review of the literature aims to provide a summary of CS practices in sub-Saharan Africa and the consequences in terms of morbidity and mortality.

**Material and Method:** The data was collected following the selection criteria on the NCBI's PubMed.

**Result:** Across the four main themes selected for this summary, the frequency of CS varies from 2 to 51%. Indications for caesarean CS are mainly dystocia, foetal distress, scarred uterus, breech presentation, antenatal haemorrhage and hypertensive disorders. Maternal risks related to CS are surgical site infections, obstetric fistulae, anaesthetic complications, pulmonary embolism, postpartum haemorrhage, haemostatic hysterectomy and maternal death, and the perinatal risks related to CS are respiratory distress, prematurity and perinatal death.

**Conclusion:** In the current working conditions, the risks incurred by the mother and the foetus during a CS are significantly greater than during a vaginal delivery. CS is not yet a factor in reducing maternal and perinatal morbidity and mortality in Sub-Saharan Africa. To reduce maternal and perinatal morbidity and mortality, working conditions at referral centre level, transfer conditions, and improve the training of health staff should be improved.

## Introduction

A caesarean section (CS) is a major procedure in the management of complications during pregnancy and labour. In countries in the Global South, it accounts for the vast majority of obstetric interventions regardless of whether the indication is absolute, necessary or prudent. Ensuring quality access to CS is a key challenge for the millennium [1], and the next sustainable development goal to reduce maternal and infant mortality. As with any surgical procedure, a CS involves risks and complications and should therefore be performed in an approved way and not used excessively. Although the optimum CS at population level is difficult to assess, the World Health Organization (WHO) recommends that the national CS rate should not exceed 10% to 15% [2]; however, in many countries, the CS rate is rising [3]. Studies on the relationship between the CS rate and maternal and perinatal mortality and morbidity have concluded contradictory results [4-8]. Maternal mortality has a significant impact on the surviving family, the broader community, healthcare providers and society in general. It is also frequently used as a regional or national public health indicator to assess a healthcare system's quality. Nearly 300,000 women die every year as a result of a pregnancy or a CS or vaginal delivery. Approximately 99% of these deaths occur in developing countries [9]. Systemic action is therefore needed to reduce maternal mortality. These efforts are real but remain insufficient, particularly in the Democratic Republic of the Congo (DRC), which is among the sub-Saharan African countries making the slowest progress in combating maternal mortality [10].

The goal of this systematic review of the literature is to provide a summary of CS practices in sub-Saharan Africa and of the consequences in terms of morbidity and mortality. It looks successively at the CS rate, its indications and the consequences of the practice in terms of maternal and perinatal mortality and morbidity.



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## Materials and Method

References were selected based on the following criteria: the type of study on CS, the target population and the data analysis using the following search terms on PubMed (intra-operative complications, caesarean section, maternal mortality and morbidity, perinatal mortality and morbidity, Africa South of the Sahara) for the period from 2011 to 2016 (the period during which we started missions to support the training of gynaecologists and obstetricians in the east of the Democratic Republic of the Congo).

The following inclusion criteria were applied: articles focusing essentially on the CS, the indications for a CS, and maternal and perinatal complications associated with CS in sub-Saharan Africa. The studies selected were retrospective, prospective, clinical trials and ecological studies. Clinical cases were excluded from this review.

The target population is the population of sub-Saharan Africa: the population studied was composed of women who had a CS delivery and their new-borns infants. The registrations of the participants involved in the various studies were examined along with the outcomes according to the indications for CS, post-operative complications, and maternal and perinatal mortality. The following keywords were used: intra-operative complications, caesarean section, maternal mortality and morbidity, perinatal mortality and morbidity, indications, frequency and caesarean section, Africa South of the Sahara.

The criteria for excluding articles were: absence of data and worthwhile results, absence of information on the chosen themes, clinical cases, and articles published outside the period under study.

## Results

This data was obtained after searching on PubMed in English using the keywords. 570 citations were found, 165 of which were summary articles during the five years. Some of these articles did not meet the selection criteria and were therefore not used (maternal and neonatal morbidity and mortality associated with CS, indications, and CS frequency); ultimately, 68 scientific articles were used.

Figure 1. Flowchart for the selection of the articles included in the review.

For the four key themes in this summary, 68 articles were selected and analysed based on the type of study, the target population, keywords and the data analysis.

Table 1. Caesarean frequency in sub-Saharan Africa varies from 2 to 51% [4,10-42].

Table 2. The main indications for caesarean section described by these authors are: a previous CS or scarred uterus, dystocia, foetal distress, breech presentation, antenatal haemorrhage (haemorrhagic placenta praevia, abruption of a normally positioned placenta) and pregnancy-related hypertensive disorders [10,16,21,33,38,43-47].

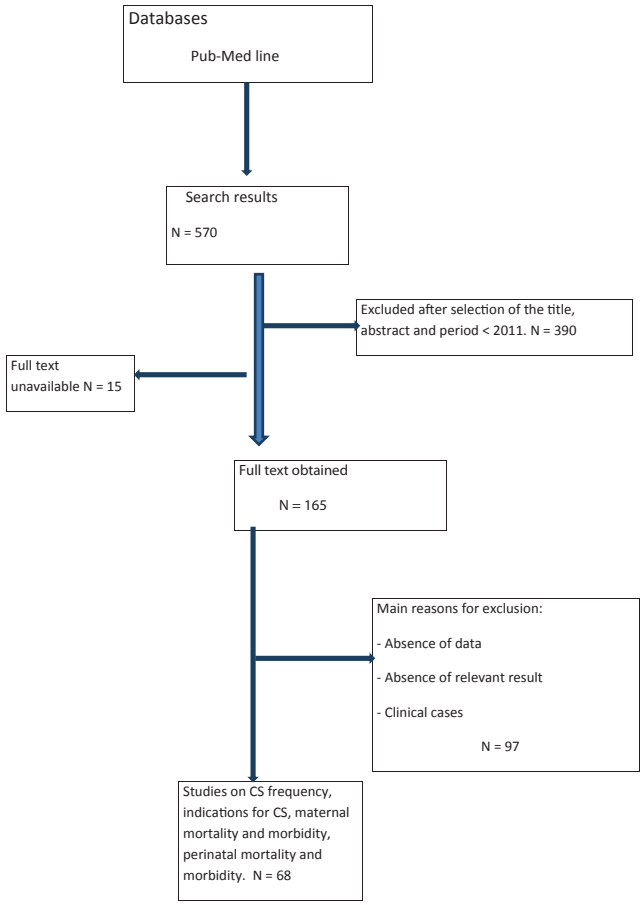


**Figure 1:** Flowchart of 68 selected articles.

Table 3. The main maternal post-operative complications associated with caesarean sections are: surgical site infections, obstetric fistulae, pulmonary embolism, postpartum haemorrhage, maternal death, and the peroperative complications are anaesthetic complications, complicated haemorrhage in haemostatic hysterectomy and maternal death [10,15,16,19,21,28,33,37-39,45,48-62]

Table 4. The main perinatal complications are: respiratory distress, prematurity and perinatal death [12,63-75]

## Discussion

**Caesarean frequency:** The CS rate seen in this systematic review of the literature varies between 2 and 51%. Indeed, in 1985, a group of WHO experts concluded that there was 'no justification for any region in the world to have a CS rate higher than 10 to 15% [76,77], It is important to note that these recommendations from the WHO are particularly valid for planned CS, the rate of which should be very low except in centres that handle high-risk pregnancies. The study by Briand [18], unfortunately shows that there are more emergency CS than elective CS performed in developing countries, which results in an increase in maternal and perinatal complications. Although a CS is an effective technique for preventing maternal and perinatal mortality when used appropriately, it is not free of risk and is associated with short- and long-term complications [6]. In our review, pregnancy-related hypertensive disorders, especially pre-eclampsia, foetal distress, antenatal haemorrhage (placenta praevia, abruption



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Table 1: Caesarean frequency.

| Authors / References | Types of data | Year | Main findings | Comments |
|---|---|---|---|---|
| Adu-Bonsaffoh K et al., 2014, Ghana [11] | Cross-sectional study | 2013 | CS rate 45.7% | Pregnancy-related hypertensive disorders, especially pre-eclampsia, increase the CS rate and the maternal and perinatal risks. |
| Ajah LO et al., 2016, Nigeria [12] | Retrospective study | 2008–2014 | CS rate 24.05% | Foetal distress leads to error in CS diagnosis and increases the CS rate. |
| Ali AA et al., 2012, Sudan [13] | Retrospective study | 2009 | CS rate 31.1% | This CS rate of 31% is associated with high maternal and perinatal morbidity and mortality. |
| Althabe et al., 2015 [14] | Prospective cohort study | 2010–2013 | CS rate 1.3-2.8 | Absence of association between the CS rate and maternal and perinatal risks. |
| Ameh C et al., 2012 [15] | Cross-sectional study | 2009–2011 | CS rate lower than 2% | The majority of women in the population studied did not have access to a CS, hence the rate of 2%. |
| Belay T et al., 2014, Ethiopia [16] | Retrospective study | 2012 | CS rate of 30.1% | 10% of caesareans are performed during the first stage of labour, and 89.1% in the second stage of labour. |
| Bertrand AP et al., [17] | Retrospective analysis | 2000–2014 | CS rate of 9–16% | The authors determine that there is a CS threshold under which maternal mortality is lowest, whereas it does not improve if the rate exceeds 19%. |
| Briand V. et al., 2012, Mali, Senegal [18] | Randomised cross-sectional study | 2007–2008 | Elective CS 2.2%<br>Emergency CS 12.5% | This study shows that more emergency CS are performed than elective CS. This increases the maternal and perinatal risks. |
| Chu K. et al., 2012, Sub-Saharan Africa [10] | Prospective study | 2010–2011 | CS rate 6.2% | This study shows that the optimal CS rate can be achieved in sub-Saharan Africa in order to decrease maternal and perinatal risks. |
| Daniel CN. et al., 2016, Nigeria [19] | Descriptive longitudinal study | 2014 | 11.3–44.6% | The CS rate has gradually risen. This has led to more maternal and perinatal complications. |
| Delamou A. et al., 2016, Sub-Saharan Africa [20] | Retrospective analysis | 1970–2016 | Elective CS 45.3%<br>Emergency CS 16.3% | This study shows that there are more elective CS than emergency CS after fistula repair surgery. |
| Donat J.et al., 2016, Uganda [21] | Cross-sectional study | 2014–2015 | CS rate 23.8% | This CS rate is due to the presence of Western experts during the study period. This is compatible with the CS rate in certain developed countries. |
| Fawole AO et al., 2012, Nigeria [22] | Cross-sectional study | 2002–2003 | Elective CS (3.1%),<br>Emergency CS (11.5%) | An appropriate healthcare policy is needed to reduce maternal mortality by performing CS when necessary. |
| Gartland MG et al., 2012, Liberia [23] | Cross-sectional study | 2007 | CS rate 35.5% | The CS rate of 35.5% shows maternal health needs to be improved in order to reduce maternal and perinatal risks. |
| ImaRengiaye CO. et al., 2015, Benin [24] | Cross-sectional study | 2006–2010 | CS rate 51.5% | The CS rate is high in the event of hypertensive disorders, and this leads to greater maternal and perinatal complications. |
| Long Q. et al., 2015, Mozambique [25] | Descriptive retrospective study | 2009–2011 | CS rate of 2.5 to 4.7% | The rate was lower among the poorest population due to lack of access to CS, and higher among the more affluent population. |
| Makhanya V. et al., 2015, South Africa [26] | Cross-sectional study | 2014 | CS rate of 42.4%, group 1 Robson (27.4%), group 5 (17.2%), 10 groups (23.4%) | Use of the Robson classification helps reduce the CS rate and thereby decrease the maternal and perinatal risks. |
| Mbaluka CM. et al., 2014, Kenya [27] | Randomised clinical trial | | CS rate 17–19% | This study shows that there are more CS when labour is induced with misoprostol than with ocytocin, but this difference is not statistically significant. |
| Mongbo V. et al., 2016, Benin [28] | Multi-centric cross-sectional study | 2013–2014 | CS rate 37.6% | This rate of 37.6% leads the authors to conclude that quality caesareans are still not a reality in Benin. |
| Molina G. et al., 2015 [29] | Ecological study | 2005–2012 | Average global CS rate 19.4% | The average CS rate of around 19% is associated with low maternal and perinatal risks. |
| Mooij R. et al., 2015, Tanzania [30] | Cross-sectional study | 2011–2012 | CS rate 19% | Severe pre-eclampsia and eclampsia further increase maternal and perinatal complications when a CS is performed. |
| Muti M. et al., 2015, Zimbabwe [31] | Cross-sectional analytical study | 2009–2011 | CS rate 12.5% | This study shows that women with hypertensive disorders are at greater risk of a CS delivery than women not at risk of hypertension. |
| Nakimuli A. et al., 2015, Uganda [32] | Prospective cross-sectional study | 2013–2014 | CS rate of 15.9–22.3% | This study shows that elective CS are associated with greater maternal and perinatal risks than vaginal deliveries. |
| Ngowa JD. et al., 2015, Cameroon [33] | Descriptive cohort study | 2012 | CS rate 19.7% | This study shows that the CS rate of 19.7% increases haemorrhagic and infectious complications. |
| Nilsen C. et al., 2014, Tanzania [34] | Descriptive cross-sectional study | 2000–2013 | CS rate 28.9% | There are different variations in CS rate in the different socio-economic groups. The CS rate is higher among women who are less educated and live in rural areas. |
| Nwobodo EL. et al., 2011, Nigeria [35] | Retrospective analysis | 2002–2010 | CS rate 9.9% | The increase in CS rate increases the maternal and perinatal risks, hence the need to select the right indications. |
| Nyatema AS.et al., 2016, Tanzania [36] | Cross-sectional analysis | 2012–2014 | CS rate 10% | This study shows that an audit of CS practice is necessary in low-income countries in order to improve the quality of this intervention. |
| Nyatema AS. et al., 2016, Tanzania [37] | Descriptive study | 2009–2012 | CS rate 9% | This study shows that it is worth improving maternal and perinatal health in regions with fewer healthcare services. |



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| Onyema OA. et al., 2015, Nigeria [38] | Descriptive study | 2009–2015 | CS rate 23% | This study shows that caesareans are associated with more cases of post-partum haemorrhage than vaginal deliveries. |
| Rukewe A et al., 2012, Nigeria [39] | Cross-sectional study | 2008–2010 | CS rate 31.1% | This study shows that the CS rate of 31.1% increases the maternal and perinatal risks, especially if general anaesthetic is used. |
| Ugwu E. et al., 2015, Nigeria [40] | Retrospective analytical study | 2010–2012 | CS rate 17.09% | This study shows the absence of any significant correlation between the CS rate and perinatal mortality. |
| Volpe FM. et al., 2015 [41] | Longitudinal ecological study | 2000–2009 | CS rate 15% | A CS rate below 15% is associated with poor maternal and neonatal outcomes, whereas a rate higher than 15% is not associated with maternal and perinatal risks. |
| Ye J. et al., 2016 [4] | Longitudinal ecological study | 2000–2012 | CS rate 5–10% | A CS rate higher than 10% is not associated with a decrease in maternal and perinatal mortality. |
| Zizza A et al. [42] | Ecological study | | CS rate 15% | This study shows an inverse relationship between the CS rate and maternal and neonatal mortality except in Europe. |

**Table 2:** The main indications for a caesarean.

| Authors / References | Types of data | Year | Main findings | Comments |
|---|---|---|---|---|
| Adamu AN. et al., 2012, Nigeria [43] | Retrospective analytical study | 2000–2009 | Eclampsia accounts for 19.6% of caesareans in this study. | The incidence of eclampsia is clearly rising due to lack of antenatal check-ups. This increases the maternal and perinatal risks, especially if a caesarean is performed. |
| Adegbola O. et al., 2015, Nigeria [44] | Retrospective analytical study | 2005–2007 | Foetal macrosomia accounts for 44% of emergency caesareans. | Foetal macrosomia increases maternal and perinatal morbidity and mortality in the event of a caesarean. |
| Belay T. et al., 2014, Ethiopia [4] | Cross-sectional analytical study | 2012–2013 | First stage of labour: distress (37%), dystocia (23.4%)<br>Second stage: DFP (48.5%) | CS performed in the second stage of labour are associated with higher maternal and perinatal risks than during the first stage. |
| Chu K. et al., 2012, Sub-Saharan Africa [10] | Prospective cross-sectional study | 2010–2011 | Dystocia (31%), abnormal presentation (18%), previous CS (14%), foetal distress (10%), uterine rupture (9%), antepartal haemorrhage (8%) | Dystocia was the leading indication for CS delivery in this study. |
| Donat J. et al., 2016, Uganda [18] | Cross-sectional study | 2014–2015 | Previous CS, cephalopelvic disproportion and dystocia | Previous CS, cephalopelvic disproportion and dystocia were the main indications in this study. |
| Lyoke CA. et al., 2014, Nigeria [45] | Prospective cohort study | 2010–2012 | Previous CS 75.8% | A previous CS is the main indication in this study, hence the need to decrease the number of first caesareans. |
| Mark TB. et al., 2014, Guinea [45] | Retrospective analytical study | 2009–2013 | Protracted labour, cephalopelvic disproportion, abnormal presentation and foetal distress account for 88% of caesareans.<br>Other indications: maternal age over 30 years old, antepartal haemorrhage | This study shows that to determine the maternal and perinatal risks associated with these indications, a prospective study is necessary. |
| Ngowa JD. et al., 2012, Cameroon [33] | Prospective analytical study | 2012 | Elective CS (41.52%), emergency caesareans with no labour (14.56%), emergency caesareans during labour (43.91%) | Haemorrhagic and infectious complications are significant, hence the need for asepsis in the operating theatre and improved training among health staff on improving preparations for the delivery. |
| Nwobolo EL. et al., 2011, Nigeria [35] | Retrospective analytical study | 2002–2010 | Previous CS (30.7%), abnormal presentation (17.1%) | A previous CS is the leading indication in this study, hence the value of proper diagnosis for the first CS. |
| Ugwa E. et al., 2015, Nigeria [40] | Retrospective analytical study | 2010–2012 | Dystocia (31.7%), foetal distress (2.6%), previous CS (17.1%), other (1.4%) | This study shows that caesareans are associated with an increase in maternal and perinatal morbidity and mortality. |
| Zuniga I. et al., 2013, Burundi [47] | Descriptive retrospective study | 2011 | Protracted labour (14%), dystocia (10%), scarred uterus (9%), breech (8%), multiple pregnancy (7%) | Protracted labour is the most frequent indication for a CS in this study and that leads to greater maternal and perinatal risk. |

of a normally positioned placenta) lead to an increase in the CS rate and in the maternal and perinatal risks [11,12]. In sub-Saharan Africa, a high CS rate is associated with an increase in maternal and perinatal mortality and morbidity [13], however, the 2% rate is related to lack of access to CS for most of the women in the population group studied [15], (lack of transport infrastructure, lack of local centres, lack of financial means among the population). Most CS are performed during labour and more specifically in the second stage (between 4 cm and full dilation), which leads to an increase in maternal and perinatal complications [16,18]. The CS rate is increasing in certain developed countries because this intervention is associated with low maternal risk when combined with proper use of anaesthesia, blood transfusion, antibiotics and a safe surgical technique. It does not lead to an increase in maternal mortality and prevents possible medicolegal problems associated with foetal distress. However, in developing countries, excessive use of CS increases maternal mortality. In these countries, neonatal mortality increases in line with maternal mortality. In order to decrease maternal mortality, we should promote access to CS for all women who need one, improve the quality of the intervention and avoid its excessive use.



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Table 3: Maternal risks associated with a caesarean.

| Authors / References | Types of data | Year | Main findings | Comments |
|---|---|---|---|---|
| Ameh C. et al., 2012, Sub-Saharan Africa [15] | Cross-sectional study | 2009–2011 | 2 to 9.3% obstetric complications | Most women do not have access to a CS, and perinatal complications are higher in relation to a vaginal delivery. |
| Ashimi AO. et al., 2014, Nigeria [48] | Cross-sectional prospective study | 2010–2013 | Anaemia (39%), surgical site infection (24.4%), incisional hernia (7.3%), prolonged stay (26.7%) | The prevalence of uterine rupture increases in the event of protracted labour and a previous CS and this increases maternal and perinatal morbidity and mortality. |
| Bachier AO. et al., 2013, Sudan [49] | Retrospective analytical study | 2010 | CS-related maternal death: 2.1% | This study shows that there is an approach based on maternal risk factors to identify complications in order to decrease maternal mortality. |
| Barageine JK. et al., 2014, Uganda [50] | Control case study | 2011–2012 | A quarter of fistulae are CS-related iatrogenic complications. | CS are an important risk factor of obstetric fistulae. |
| Belay T. et al., 2014, Ethiopia [16] | Cross-sectional analytical study | 2012 | 5 haemostatic hysterectomy | A CS during the second stage of labour is associated with high maternal risks. |
| Chu K. et al., 2012, Sub-Saharan Africa [10] | Prospective study | 2010–2011 | Incidence of surgical site infection 7.3%, with 93% of cases being superficial. | Sterilisation of equipment and the use of antibiotics reduces surgical site infection. |
| Daniel CN. et al., 2016, Nigeria [19] | Descriptive longitudinal study | 2014 | 13.3% maternal complications, 59.7% of which are postpartum haemorrhage | Maternal complications, especially postpartum haemorrhage, increase in the case of CS. |
| Donat J. et al., 2016, Uganda [21] | Cross-sectional study | 2014–2015 | Maternal mortality: 5.3/1000 CS | This study shows that there is a need to improve emergency services and for appropriate training for healthcare staff in order to reduce the maternal risks associated with a CS. |
| Ezegwui HU. et al., 2015, Nigeria [51] | Randomised clinical trial | 2012 | Maternal risks are the same in the two groups. | This study shows that there is no difference in terms of maternal risks with or without cervical dilation during CS. |
| Filippi V. et al., 2015, Burkina Faso [52] | Prospective cohort study | 2011 | In addition to infectious and haemorrhagic complications, there is greater psychological distress, reduced fertility and greater use of contraceptives. | This study shows that CS can be accompanied by psychological distress, sterility and infectious and haemorrhagic complications. |
| Gebhardt GS. et al., 2015, South Africa [53] | Retrospective analytical study | 2011–2013 | Maternal mortality during CS of 3.5%, MM associated with haemorrhage of 14.5%. | This study shows the need to find the necessary equipment and to train health staff in order to reduce maternal mortality associated with CS. |
| Girma M. et al., 2013, Ethiopia [54] | Cross-sectional study | 2009–2010 | MM 1.9%, postpartum haemorrhage 42%, protracted labour 15%, puerperal infections 15% | This study shows that insufficient emergency obstetric services lead to an increase in maternal mortality. |
| Hyginus E. et al., 2012, Nigeria [55] | Control case study | 1999–2007 | Postpartum haemorrhage and blood transfusion increase among the caesarean group. | Work is required to reduce the first CS in order to reduce maternal complications. |
| Imarengiaye O. et al., 2015, Benin [56] | Cross-sectional study | 2006–2010 | MM: 307/1000 | Hypertensive disorders are responsible for the increase in maternal mortality, especially if a CS is performed. |
| Litorp H. et al., 2014, Tanzania [57] | Cross-sectional study | 2,012 | CS complications 7.9%, MM associated with CS 13% | The risks of complications from a CS were higher at the general hospital than at the university hospital due to the presence of qualified health staff. |
| Lyoke CA. et al., 2014, Nigeria [45] | Prospective cohort study | 2010–2012 | More cases of postpartum haemorrhage and transfusion in the event of a previous caesarean. | The risk of maternal complications is higher in the event of a previous CS. |
| Minsart AF. et al., 2014, Djibouti [58] | Cohort study | 2012–2013 | 127% risk of CS if obesity occurs before 22 weeks | The prevalence of obesity is increasing in Djibouti with a higher risk of a CS and its complications, which can be treated if antenatal check-ups are properly carried out. |
| Mongbo V. et al., 2016, Benin [28] | Cross-sectional study | 2013–2014 | MM 0.2% | Access to caesareans remains difficult in Benin and quality caesareans are not yet a reality. |
| Mpogoro FJ. et al., 2014, Tanzania [59] | Prospective cohort study | 2011–2012 | Puerperal infection rate 10.9% with an incidence of 37.5/10,000. | Surgical site infections are associated with several factors: hypertensive disorders, anaemia, burst stitches, inexperienced doctor, long duration of the intervention. |
| Mukasa PK. et al., 2013, Uganda [60] | Control case study | 2005–2006 | 84 uterine ruptures/10,940 deliveries MM 106/100,000, 12% of deaths associated with uterine rupture. | Previous CS, lack of education, use of herbs, and a distance of more than 5 km increases the risk of uterine rupture. |
| Ngowa JD. et al., 2012, Cameroon [33] | Retrospective analytical study | 2012 | Early maternal complications: 16.95% haemorrhagic complications 8.48%, infectious complications 7.17% | Early complications (hypotension, uterine atony) of a CS remain higher in this study. |
| Nyateme AS. et al., 2016, Tanzania [37] | Cross-sectional analysis | 2012–2014 | 16.4% of maternal deaths associated with delivery, including 3.1/1,000 caesareans, death associated with anaesthetic 0.5/1,000. | Improving the quality of the CS intervention is necessary to reduce maternal and perinatal complications. |



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| Onyema OA. et al., 2015, Nigeria [38] | Descriptive study | 2009–2015 | Postpartum haemorrhage 3.4% (43.8% for multiparity and 22% for nulliparity), uterine atony 43.4%, cervical tear 7.7% | Quality CS are necessary to reduce postpartum haemorrhage. |
| Rukewe A. et al., 2012, Nigeria [39] | Cross-sectional study | 2008–2010 | The rate of complications was 10.5% (34.5% associated with general anaesthetic and 6.7% associated with local anaesthetic). | General anaesthetic is associated with a high maternal and perinatal risk in relation to local anaesthetic. |
| Uribe-Leitz T. et al., 2015 [61] | Descriptive study | 2000–2015 | MM: 7.9/1000 | Maternal mortality associated with CS is higher in sub-Saharan Africa. |
| Weiser TG. et al., 2015 [62] | Descriptive study | 2005 | MM 7.7/1,000 CS | Maternal mortality associated with CS is higher in sub-Saharan Africa. |

**Table 4:** Perinatal risks associated with caesareans.

| Authors / References | Types of data | Year | Main findings | Comments |
|---|---|---|---|---|
| Aduloju OP. et al., 2015, Nigeria [63] | Retrospective analysis | 2009–2012 | Perinatal mortality: 105/1000 | CS reduce this perinatal mortality in cases of complicated twin pregnancies at risk of premature delivery. |
| Adanikin AL. et al., 2015 [64] | Retrospective analysis | 2012–2015 | Incidence of foetal distress 233/1,000 births, perinatal mortality 47/1,000 | Urgent need for appropriate equipment to reduce perinatal morbidity and mortality. |
| Akintayo AA. et al., 2016, Nigeria [65] | Retrospective analytical study | 2010–2013 | Perinatal mortality of 55.9% | The incidence of haemostatic hysterectomy is high in cases of complicated CS for uterine atony and hysterotomy extension. The rate of perinatal mortality in this study is very high. |
| Ajah LO. et al., 2016, Nigeria [12] | Retrospective analytical study | 2008–2014 | Perinatal mortality 31.25/1,000 | This study shows that foetal distress increases the caesarean rate along with an increase in perinatal risks. |
| Bassey G. et al., 2014, Nigeria [66] | Retrospective analytical study | 2008–2012 | The main intrapartal complication is foetal distress (42.86%), perinatal mortality 55.85/1,000 | Twin pregnancies, especially monochorionic, are associated with an increase in perinatal morbidity and mortality. Perinatal morbidity and mortality decreases if the CS is performed correctly. |
| Browne JL. et al., 2015 [67] | Prospective cohort study | 2012–2014 | The risk of prematurity increases in the case of chronic hypertension. | CS indicated for hypertensive disorders increase the perinatal risks. |
| Fouelifack FY. et al., 2014, Cameroon [68] | Cross-sectional analysis | 2008–2010 | Perinatal mortality (AOR 1.75) | Pregnancy in adolescents is associated with poorer perinatal outcomes, particularly when a CS is performed. |
| Kaboré C. et al., 2015, Sub-Saharan Africa [69] | Prospective study | 2011–2015 | Perinatal mortality (OR 4.53) | Women with a low obstetric risk and a previous CS do not have a higher risk of perinatal morbidity and mortality associated with a CS. |
| Landry E. et al., 2014, [70] | Cross-sectional study | 2008 | The low rate of use of partographs at the six sites, absence of foetal outcomes in 40% of records. | This study shows that out of the 2,941 CS records analysed, 40% of records lack perinatal outcomes and low use of partographs, resulting in abusive use of CS. |
| Lgwegbe AO. et al., 2013, Nigeria [71] | Retrospective analytical study | 2001–2010 | Perinatal mortality 52.2% | Advanced maternal age, multiparity and a previous CS are major risk factors of abruption of a normally positioned placenta with an increase in perinatal mortality. |
| Lilungulu A. et al., 2015, Tanzania [72] | Prospective cohort study | 2012–2013 | Low APGAR score. | A short intergenesic interval leads to high perinatal risks after a CS. |
| Macheku GS. et al., 2015, Tanzania [73] | Prospective cohort study | 2000–2010 | Respiratory distress(5.6%), perinatal mortality (OR 17.6). | CS are a risk factor of abruption of a normally positioned placenta associated with chronic hypertension, pre-eclampsia and eclampsia, which increase the perinatal risks. |
| Mbamara SU. et al., 2012, Nigeria [74] | Descriptive study | 2004–2009 | Perinatal mortality 6/1,000 | The perinatal risks increase in the event of uterine rupture. |
| Mongbo V. et al., 2016, Benin [28] | Cross-sectional study | 2013–2014 | Perinatal mortality 7.4% | Access to CS remains difficult in Benin, diagnosis errors and delayed management are frequent. These diagnosis errors and delayed management increase perinatal mortality. |
| Nakimuli A. et al., 2015, Uganda [32] | Prospective study | 2013–2014 | Respiratory distress syndrome if under 37 weeks associated with general anaesthetic. | CS lead to more cases of respiratory distress in infants than vaginal deliveries, especially when unnecessary CS are performed. |
| Ugwa E. et al., 2015, Nigeria [40] | Retrospective analytical study | 2010–2012 | Perinatal mortality of 165.6/1,000 | Perinatal mortality increases in the event of CS. |
| Van den Boogaard W. et al., 2016, Burundi [75] | Descriptive cross-sectional study | 2014 | 3 stillbirths | Emergency CS increase perinatal risks. |
| Zuniga L. et al., 2013, Burundi [47] | Descriptive retrospective study | 2011 | Neonatal mortality 5% | Perinatal morbidity and mortality were high among low birthweight infants. |

The main indications for a CS are a previous CS or scarred uterus, dystocia, foetal distress, breech presentation, antenatal haemorrhage (haemorrhagic placenta praevia, abruption of a normally positioned placenta) and pregnancy-related hypertensive disorders [10,16,21,33,38,43-47]. The 'once a CS always a CS' policy is widely applied in sub-Sahara Africa,



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mainly from fear of uterine rupture during labour. This policy helps reduce both the uterine rupture rate and the emergency surgery responsible for the increase in maternal and perinatal mortality and morbidity. These repeat CS do not, however, result in the medical benefits expected. In fact, a vaginal delivery after a CS has a low risk both for the mother and for the child. Although the International Federation of Gynecology and Obstetrics (IFGO) has published guidelines promoting vaginal delivery after a CS [78], fewer women are having vaginal deliveries in referral hospitals in sub-Saharan Africa. After analysing these indications, dystocia (difficult and protracted labour) was the main indication for the first CS. Dystocia is mainly caused by insufficient uterine contractions, sometimes by cephalopelvic disproportion, no progress in foetal descent due to a tumour, and abnormal presentation of the foetus.

However, lack of resources and qualified staff sometimes makes this diagnosis difficult prior to labour. It is possible that dystocia is currently being over-diagnosed in order to warrant greater use of CS [10]. Use of partographs to assess the eutocic or dystocic progress of labour is very low [70].

Breech presentation (buttocks or feet) accounts for approximately 3.5% of all births [79]. When parameters are properly monitored, caesarean CS have not always resulted in the best outcomes in relation to a vaginal breech birth. The freer use of CS for breech presentation in sub-Saharan Africa has led to an increase in maternal mortality and morbidity and in potential risks for future pregnancies [47]. The use of external cephalic version (ECV) has attracted interest in reducing breech presentations. In developing countries, due to lack of selection criteria for vaginal or CS breech births, ECV is not widely practiced, and this leads to an increase in perinatal morbidity and mortality [79]. It is, however, worthwhile, but screening for complications of the procedure, particularly acute distress, requires foetal monitoring equipment (ultrasound, monitors, emergency delivery room) that is very rarely available due to lack of resources. Foetal distress is one of the main indications for CS in this review of the literature. Foetal distress is indicated by a change in foetal heart rhythm and this means that the foetus is not receiving sufficient oxygen via the placenta. Lack of oxygen, or hypoxia, can cause foetal death and brain damage. As with dystocia, there were doubts over the accuracy of this diagnosis. The study by Ajah et al. on foetal monitoring was unable to show an improvement in the infants' well-being parameters in relation to the use of a Pinard stethoscope [12]. However, this study shows an increase in the use of CS when monitoring was used, because it is difficult to make the distinction between foetal stress and true distress [80]. The less training staff have had in foetal monitoring, the higher the false positive rate. As such, more than half of the diagnoses of foetal distress are inappropriate. In developed countries, use of STAN (ST segment analysis) has reduced the rate of false diagnosis of foetal distress. Unfortunately, its use in sub-Saharan Africa is practically non-existent [81]. Antenatal haemorrhage (placenta praevia, abruption of a normally positioned placenta) is a common indication for CS in our study. Unfortunately, it is often unavoidable and increases maternal and perinatal mortality and morbidity.

In our study, the CS risks for the mother are infections, anaesthetic risks, pulmonary embolism, postpartum haemorrhage, haemostatic hysterectomy, obstetric fistulae and maternal death. While a CS is currently safer in developed countries, it still entails the risks of many major abdominal procedures in sub-Saharan Africa. Maternal mortality after CS is 2 to 11 times higher than after a vaginal delivery [62]. Maternal morbidity associated with CS is 5 to 10 times higher than with vaginal deliveries. As the prevalence of uterine rupture increases in the event of protracted labour and a previous CS, studying the maternal risk factors can help prevent these complications [48,49]. Performing a CS during the second stage of labour increases the risk of complications. Anticipating the diagnosis of dyskinesia should make it possible to remove the foetus earlier and therefore reduce those risks [16]. Haemorrhagic and infectious complications are frequently seen due to lack of asepsis in the operating theatre as well as due to insufficient surgical training [33,59]. Improving the quality of CS is necessary to reduce maternal and perinatal complications in sub-Saharan Africa.

The main perinatal complications seen in our study are prematurity, respiratory distress and perinatal death. Elective CS account for approximately 9% of neonatal intensive care admissions. This rate increases in the event of an emergency CS. The main cause for admissions to the neonatal unit is lung disease due to complicated iatrogenic prematurity, primarily hyaline membrane disease or infant respiratory distress syndrome, due to pulmonary immaturity [32]. Due to lack of an adequate resuscitation service, CS in sub-Saharan Africa increase the perinatal risks. It is important to wait for pulmonary maturity before performing elective or repeat CS in order to prevent respiratory distress syndrome. However, infants born via elective CS account for more cases of this syndrome [32]. The factor that leads to respiratory diseases in infants born via CS before labour is the absence of catecholamine secretions (stress hormone) which are normally released by uterine contractions during labour [32]. Babies born via elective CS before labour have low levels of catecholamine after the birth compared with babies born via vaginal delivery. The other risks for the child after a CS are less frequent and are estimated at approximately 0.4% of birth trauma in children born via CS, such as lacerations. General anaesthetic causes respiratory depression especially if the intervention is long. Local anaesthetic does not cause hypoxia, but does cause maternal hypotension.

Proper training of gynaecologists, anaesthetists and midwives is essential in order to decrease these complications.

## Conclusions

In the current working conditions in sub-Saharan Africa, the risks to the mother and foetus during a CS are significantly greater than during a vaginal delivery. The high maternal and perinatal morbidity and mortality rate during and after a CS is associated with a number of factors such as the indication for CS, the conditions of the intervention, the period between indication and intervention, particularly in the case of transfers, insufficient resuscitation equipment, as well as the quality and continuity of pre-, per- and post-operative care. The foeto-



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maternal prognosis, therefore, depends on the quality of the transfer and their management, the quality of care, and the population's level of understanding of health problems. CS is not yet a factor in reducing foeto-maternal morbidity and mortality. The different results reflect the inefficiency of the referral system for quality obstetric care. CS should be a factor in reducing foeto-maternal morbidity and mortality by improving the transfer conditions, the working conditions at referral centre level and the training of health staff. In order to help clarify the grey areas and to implement appropriate interventions, it is desirable to carry out a periodic audit to assess the quality of obstetric and neonatal care in countries where maternal mortality is high.

## Author comments

This review of the literature discusses the higher maternal and perinatal mortality and morbidity in CS in relation to vaginal deliveries. This seems normal given that the CS were performed after diagnosis of often life-threatening complications. Anticipating these complications would help reduce excessive use of CS and to assess the effectiveness of the obstetrics team. Monitoring the foetal heart rhythm with continuous recording is more reliable than intermittent monitoring using a Pinard stethoscope, and greater awareness of the criteria for defining the external and internal foetal monitoring graphs makes it possible to diagnose foetal distress. In the majority of cases, training staff to correctly interpret monitoring is essential.

Although we here demonstrated CS percentage and characterized conditions related to CS in this area, we cannot answer the question 1) what percentage is the "adequate" for CS in this area, and 2) whether CS itself (surgery itself) ameliorate or deteriorate materno-neonatal mortality/morbidity. CS should be performed under an appropriate indication, at an appropriate timing and conditions. It also requires before and after care of the surgery. In this area, these are considered not well done. Therefore, it is impossible to conclude whether CS itself or non-employment of CS itself relates with the outcome. In short, CS in developed countries and CS in developing countries (like here) is difficult to compare. We understand this, and still we believe that reporting these data is important as a basic data for making better health policy regarding materno-neonatal health promotion, including CS.

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