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Literature Review

Variation of caesarean section rates in Sub-Saharan Africa: A literature review

Abstract

Introduction: Ensuring access to quality caesarean section (CS) care is a key millenium development strategy and the next sustainable development goal to reduce maternal and infant mortality. The WHO recommends that the caesarean section rate should not exceed 10-15%. The objective of our analysis is to document the variability of caesarean section rates in Sub- Saharan Africa.

Material and method: we carried out a review of 26 studies for the simple proportions of events using the R metafor package (Viechtbauer, 2010). The studies were selected in the following way: the type of study, target population and keys words (such as intra operative complications, caesarean section utilization, maternal mortality or perinatal mortality or morbidity and caesarean section, Africa south of the Sahara or sub Saharan Africa). We performed a random-effects meta-analysis, and heterogeneity was assessed using the I^2 value.

Result: the overall proportion of caesarean sections is 19% (14%-24%) for 26 selected studies. The I^2 index is equal to 99.92%, suggesting a very high level of heterogeneity. Journal impact factors accounted for this heterogeneity.

Conclusion: the best CS rate is the one that gives the best outcome with regard to foetal and maternal benefit. This rate may vary as obstetric problems differ from one country to another. Studies published in higher impact journals tend to report a lower proportion of CS than articles published in lower impact journals.

Introduction

Ensuring quality access to caesarean section (CS) care is a key millennium development strategy and the next sustainable development goal [1] to reduce maternal and infant mortality. As with any surgical procedure, a CS involves risks and complications, which means that it should be performed in an approved way and should not be performed excessively. Although the optimum CS rate at population level is difficult to assess, the World Health Organisation (WHO) recommends that the national CS should not exceed 10 - 15% [2]; however, in many countries, the CS is rising [3].

Studies on the relationship between the CS rate and maternal and perinatal mortality and morbidity have concluded contradictory results [4]. In Latin American hospitals, for example, the increase in the CS rate above 10-15% was associated with more premature deliveries and an increase in neonatal mortality [5]. However, in Sub-Saharan Africa, where the average CS rate was 8.8%, the risk of maternal death was lower in hospitals with a higher elective CS rate [6]. Studies on CS have reported that the 10-15% rate represented the optimum result as regards maternal and neonatal mortality [7]. However, these studies were limited by data that was sometimes incomplete. These ecological studies did not consider the individual risks because they were based on data aggregated by different countries.

The goal of our analysis is to document, based on the selection of population studies, the variability in CS rates based on studies conducted in Sub-Saharan Africa.

Material and Methods

The data were selected according to the selection: The type of study on CS, the target population, data analysis using the following PubMed search equations for a period of 7 years, from 2010 to 2017. Inclusion criteria selected articles with frequency of CS in sub-Saharan Africa from 2010 to 2017.

Exclusion criteria: Absence of data on CS frequency, clinical cases as well as articles published before 2010.

Selected studies are retrospective, prospective, clinical trials and ecological studies. The target population is the population of sub-Saharan Africa. We carried out a meta-analysis to calculate the simple proportions of events using the R metafor

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package (Viechtbauer, 2010). The studies were selected in the following way: the type of study, target population, and key words for selecting the publication (caesarean frequency, emergency caesarean, programmed caesarean, sub-Sahara Africa). Twenty-six selected studies from 2010 to 2017 had relevant data to fit into a meta-analysis with 100% reliable numbers. We chose prospective and retrospective analytical studies, clinical trials and ecological studies. The target population is the population of Sub-Saharan Africa, composed of women who had a CS during the period under study. Patient and public involvement: Pregnant women who delivered by CS among the selected studies. The dependent variable is the CS rate, calculated as the number of CS deliveries divided by the total number of births. We carried out a random-effect meta-analysis, and heterogeneity was assessed using the I^2 value (Higgins & Thompson, 2002). Logistic meta-regression was used to explore the potential sources of heterogeneity when the I^2 value was greater than 25%, including the following factors: 1) the impact factor of the journal in which the article was published; 2) the subdivision of the African continent in two parts (such as the Horn of Africa vs. the rest of Africa) and 3) the type of study (a programmed or emergency CS vs programmed and emergency CS). The software R (R Core Team, 2016), version 3.2.2. was used for the statistical analyses.

Results

These data were obtained after research on PubMed using key words. 570 citations were found, 544 articles were excluded and 26 studies retained (Table 1) (Graph 1).

The study by Adu-Bonsaffoh et al. shows a CS rate of 45.7%, which is very high in relation to the WHO estimate. This increase is associated with the population studied: women with high blood pressure disorders during pregnancy. High blood pressure disorders increase the risk of CS, and the maternal and perinatal risks, especially in developing countries. [8]. The study by Briand V et al. shows an elective CS rate of 2.2% and an emergency CS rate of 12.5%. This study indicates that CS are carried out more often as emergencies, with all the associated maternal and perinatal complications, in comparison to elective CS [9]. The study by Donat J et al. shows a CS rate of 23.8%. This approximate rate is due to the presence of Western experts during the study period [10].

The Fawole AO et al. study shows an elective CS rate of 3.1% and an emergency CS rate of 11.5%, and there must be an adequate maternal healthcare policy to reduce maternal mortality [11]. The study by Onyema AO et al. gives a CS rate of 23% and shows that supervised prenatal care, actively managed labour, and emergency obstetric care are necessary to reduce post-partum haemorrhage [12]. The study by Nyatema AS et al. shows a CS rate of 10%, and concludes that auditing CS practices is necessary in low-income countries [13]. The study by Mongbo et al. shows an average CS rate of 37.6% and concludes that access to CS is still difficult in Benin, and that diagnostic errors and delays are frequent [14]. The study by Makanya V et al. shows an average CS rate of 42.4% and concludes that use of the Robson classification helps reduce the CS rate [15]. The study by Muti M et al. presents an average CS rate of 12.5% and concludes that high blood pressure during pregnancy affects 5 to 8% of pregnant women and that this increases maternal and perinatal mortality and morbidity [16]. The study by Rukewe A et al. shows an average CS rate of 31.1% and concludes that maternal risk increases with general anaesthesia [17]. The study by Ugwa E et al. shows the average CS rate of 17.1% and concludes that there is an absence of significant correlation between the CS rate and perinatal mortality [18] (Graph 2).

The forest plot above shows an overall CS proportion of 19%, with a confidence interval of 95% [14% - 24%]. The I^2 index is equal to 99.92%, suggesting a very high level of heterogeneity. This heterogeneity is associated with the studies that are included in the analysis. The different studies show variable CS rates depending on the indications for a CS, the CS being performed in a rural or urban setting, the population studied, and on whether the CS is an emergency or programmed (Table 2).

The only variable explaining some of the heterogeneity observed is the impact factor. As the graph below shows (graph 2), the studies published in higher impact journals tend to show a lower CS rate than the articles published in lower impact journals (Graph 2).

This graph shows the link between the impact factor of the journal and the reported proportion of CS. The purpose of this graph is to identify the source of the difference in CS rates reported in the different articles analysed, and we can conclude that the only predictive factor for the difference in the rates reported in the various articles is the impact factor.

Discussion

The objective of this study is to document the variability in CS rates in Sub-Saharan Africa.

The average CS rate of 19% reported in this analysis corresponds with the overall estimate described in the literature (WHO). 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 10-15%” [34]. This declaration was based on evidence that was limited, but available at that time, on the CS rate (CS) observed in North European countries, which had the lowest maternal and perinatal mortality rate. Over time, this figure came to be considered by the international community as the “optimum” CS rate. Since then, these rates have risen in developed and developing countries alike, sometimes reaching very high rates as, for example, in Brazil and the United States [4,35,36]. Our study shows that this CS rate varies depending on the population studied and especially on access to healthcare [21]. Experts and public health officials have expressed concern over the unprecedented increase in CS sections and the consequences. However, the validity of the historical declaration of 1985 has sometimes been challenged in light of data accumulated over three decades on the basis of major improvements in obstetric practices, and which could justify a higher CS rate according to certain publications and recommendations [4,37]. Worldwide concern over this uncontrolled increase in CS rate is not unjustified.

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Table 1: 26 Papers in the final analysis study.

References	Data	Studied period	Caesarean section rate		Comments
[11]	Retrospective study	2012	30.1%		More than 89.1% of CS are performed in the 2nd phase of labor with increased maternal and perianal complications
[12]	Randomised cross sectional study	2007-2008	Elective CS and emergen 12.5%	2.2% cy CS	More emergency CS increases maternal and perinatal risks
[13]	Prospective study	2010-2011	6.2%		This low CS rate is related to decreased maternal and perinatal risks
[14]	Retrospective study	2014	11.3-44.6%		Maternal and perinatal complications increase with CS rate
[15]	Cross sectional study	2014-2015	23.8%		This CS rate is due to the presence of western experts during the period of study
[16]	Crosse sectional study	2002-2003	Elective CS emergency 11.5%	3.1%, CS	It will take an adequate health policy by practicing CS when necessary
[17]	Cross sectional study	2007	35.5%		Improving maternal health will reduce complications related to CS
[18]	Retrospective study	2009-2011	51.5%		Hypertensive disorders increase CS rate as well as maternal and perianal complications
[19]	Retrospective study	2009-2011	2.5 à4.7%		This low CS rate is related to lack of access and lack of infrastructure as well as qualified personnel
[20]	Cross sectional study	2014	42.4%		The use of the Robson classification reduces the rate of CS and complications
[21]	Cross sectional study	2013-2014	37.6%		The authors conclude that quality CS is not yet a reality in Benin
[22]	Cross-sectional study	2009-2011	12.5%		This study shows that hypertensive disorders increase the risk of CS
[23]	Prospective study	2013-2014	15.9 à 22.3%		This study shows that elective CS is associated with more maternal and perinatal risks than vaginal delivery
[24]	Retrospective study	2012	19.7%		This CS level is associated with an increase in haemorrhagic and infectious complications
[25]	Cross-sectional study	2000-2013	28.9%		Higher CS rate among less educated women living in rural areas
[26]	Retrospective study	2012-2014	9.9%		The interest of a good selection of CS indications to reduce maternal and perinatal complications
[27]	Retrospective study	2001-2010	9.9%		A significant number of cases have high perinatal mortality. Unbooked ,high parity ,advanced maternal age and previous CS scar were significant aetiological risk factors
[28]	Cross sectional study	2012-2014	10%		This study shows the audit's interest in CS practice in low-income countries to improve the quality of this intervention
[29]	Retrospective study	2009-2012	9%		This study shows that there is interest in improving maternal and perinatal health in less health-care regions
[30]	Retrospective study	2009-2015	23%		Post-partum haemorrhage is more common after CS than after vaginal delivery
[31]	Cross sectional study	2008-2010	31%		General anaesthesia during CS increases maternal and perinatal risks as loco-regional anaesthesia
[32]	Retrospective study	2010-2012	17.09%		No significant correlation between CS and perinatal mortality
[33]	Prospective study	2012-2013	10.6%		Tranexamic acid reduces death due to bleeding in women with postpartum haemorrhage with no adverse effects. When used as a treatment for post-partum haemorrhage, tranexamic acid should be given as soon as possible after bleeding onset.

In Sub-Saharan Africa, a CS increases the risk of maternal and neonatal morbidity and mortality [16]. Although a CS is an effective technique for preventing maternal and perinatal mortality when performed properly, this technique is not without risk, and is associated with short and long-term consequences [4,38]. Although the CS rate for a population with limited healthcare services measures that population's access to obstetric care, this rate must be effective to save lives. The CS rate has been used as an assessment measure for governments, policymakers and public healthcare professionals when seeking to assess progress in the field of maternal and infant health, the monitoring of obstetric emergencies, and the use of different resources [2]. However, determining the optimum CS rate within a population is not an easy task. Several studies have addressed this issue by analysing the link between the type of delivery and the maternal and infant outcome at population level [7,35]. However, these analyses used different methodologies and led to different interpretations.

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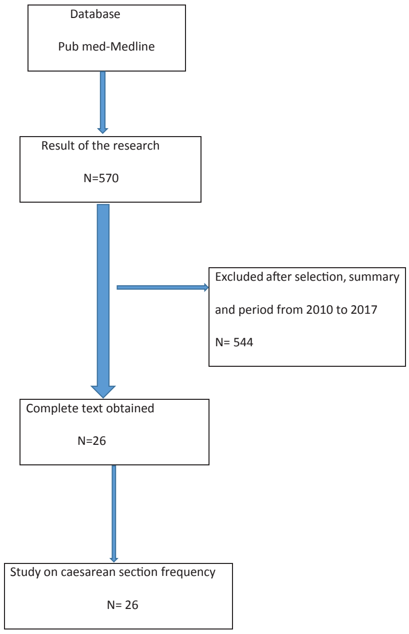
Bertran et al. analysed eight studies concerning CS rates (35) and showed that a rate of 9-16% is associated with lower maternal and neonatal mortality, only when there are no associated factors. However, when socioeconomic factors are applied, this link disappears. These studies determine that there is an optimum CS rate at which maternal mortality is the lowest. They show that the optimum CS rate fixed at around 19% is associated with reduced maternal mortality and does not improve when the CS rate exceeds the 19% threshold. Our study shows the average CS rate of 19% with a variability of 2% to 45%; however, the maternal and perinatal risks are higher [8,12,16]. The study by Molina et al., [39], aimed to provide better estimates for the relationship between the CS rate and maternal and neonatal mortality. The optimum CS rates

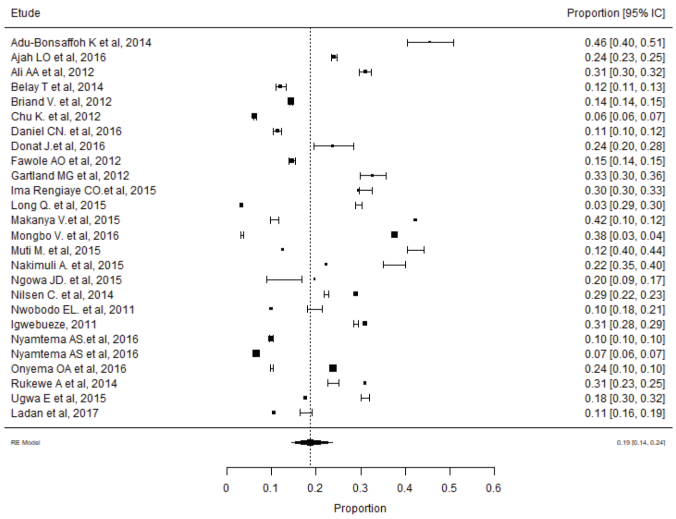


Graph 1: Twenty-six studies were analysed according to the selection criteria.

Table 2: Sources of heterogeneity

Variable	estimator	se	zval	pval	ci.lb	ci.up
intrcpt	0.3569	0.1446	2.4678	0.0136	0.0734	0.6403
AfricaPart	0.0338	0.0453	0.7449	0.4564	-0.0551	0.1226
CS Type	-0.0804	0.0675	-1.1901	0.2340	-0.2128	0.0520
Impact Factor	-0.0301	0.0152	-1.9728	0.0485	-0.0599	-0.0002 *

1. Estimator = coefficient of the regression line (if negative, negative link between the variables (when variable X is higher, variable Y is lower), and if positive, positive link between the variables (when variable X is higher, variable Y is higher))
2. Se = standard error = measurement error for each measurement point on the regression line
3. Zval = critical value for this variable
4. Pval = p-value associated with this critical value (if the zval is sufficiently high, the p-value will be significant). In this case, only the impact factor has a p-value below 0.05.
5. ci.lb and ci.up = 95% confidence interval lower bound and upper bound for the estimator (point 1). Note the link between the confidence interval and the p-value: if the confidence interval contains 0, the P-value is not significant, but if it does not contain 0, the p-value is significant.



Graph 2: Caesarean frequency in 26 studies.

associated with a low maternal and neonatal mortality rate were estimated using recent data on maternal and neonatal mortality for 2012 only. This analysis concerned 172 WHO member countries out of a total of 194 (88.7%), which covered 97.6% of all births worldwide. Among the data from these 172 countries, South Sudan had the lowest CS rate (0.6%), and Brazil the highest (55.6%). The total estimate was 22.9 million CS(CI 95%, 22.5 to 23.2), in other words, an average world rate of 19.4% (CI 95%, 18.5-20.3). These authors [38], suggest that the optimum CS rate might be higher than the rate estimated by the WHO, at approximately 19%. To explain the discrepancy between their analyses and the WHO's recommendations, Molina et al. highlight that international recommendations are due to consensus based on the data of certain countries, which have low neonatal mortality and a CS rate of 10% [2].

Previous studies suggest that a low CS rate was optimum for maternal health [4,7,35], and the assessment of neonatal mortality was incomplete, as it was based on a limited set of data from wealthy countries. No study contains CS rate data for all member countries of the WHO [7,35]. By focusing on the estimate for a single year (2012), the authors avoided potential biases generated by the use of CS rates from different years. Likewise, there are countries that have a low maternal and neonatal mortality rate and which have a relatively low CS rate, suggesting a complex interaction between all maternal health services, emergency obstetric services and other services. The optimum CS rate, which is derived from these studies, cannot be applied to all countries, because a certain level of national resources may be required.

Conclusion

The caesarean rate is the one that gives the best outcome as regards foetal-maternal benefit. This rate can vary depending on the various obstetric problems in the different countries. The articles published in higher impact journals tend to report a lower caesarean rate than the articles published in lower impact journals.

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