Who Caesarean Section Rate: Relevance and Ubiquity at the Present Day – A Review Article

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Abstract

Background: In 1985 the World Health Organization (WHO) claimed that there were no reasons for any region in the world to have a caesarean section (CS) rate above 10-15%. Even so, many of the developed countries present superior CS rate. Although CS rate rise in countries with high maternal and neonatal morbi-mortality is benefice, doubts exist about countries that already present a high CS rate, because some concern exist that above a certain limit, the risks are superior to the benefits. The aim of this review is to analyse the CS rate in different countries and to determine if the WHO limit can be applied to all. Also to compare the maternal and neonatal morbidity and mortality between vaginal and CS birth, trying to evaluate the best way to deliver.

Methods: Data about CS rate, maternal mortality, neonatal mortality and Human Development Index (HDI) was collected from official reports and scientific papers.

Results: The world CS rates varies from 1.5% in Ethiopia to 56.6% in Brazil. The rate is superior in countries with high HDI, and inferior in poor countries. In general, countries with high CS rate present a low maternal and neonatal mortality. The opposite is observed in poor countries.

Conclusion: Since the WHO declaration many changes occurred in society, in the women status and in medicine, making us question if the 15% limit is still updated. The different social-economic, cultural and ethnographic reality of each country suggests that a global CS rate should not exist. Instead, each country should adjust CS rate to its necessities and focus on providing this option to any women who needs it. Some evidence suggests that CS can have a higher maternal and neonatal morbi-mortality when compared with vaginal delivery, however it has also positive aspects that should be taken in consideration.

Keywords: Caesarean section; Vaginal delivery; Maternal mortality; Neonatal mortality; Neonatal morbidity; Maternal morbidity; Human development index

Abbreviations

WHO: World Health Organization; CS: Caesarean Section; HDI: Human Development Index; USA: United States of America

Introduction

Caesarean section (CS) rate is an important health indicator, which determines the proportion of all births that occur by CS in a given geographical area. It allows evaluation of the accessibility and effectiveness use of a common obstetric procedure, whose objectives are the reduction of maternal and neonatal mortality, and the prevention of obstetric complications [1].

As with other medical procedures, CS demonstrates a pattern of inequity in the world, with reduced rates in underdeveloped countries, and adequate or high in developed ones [2]. While its increase in areas of high maternal and neonatal morbidity, is clearly beneficial [3], its increase in regions that have already high rates may suggest a use of inappropriate resources that do not necessarily imply improvements in maternal and fetal morbidity and mortality [4]. There are even studies linking high CS rate with negative consequences for the mother and the fetus [2,5], since the caesarean is not a risk-free procedure. Additionally, high CS rates increase economic burden on national health systems, as CS is a procedure that increases costs when compared to vaginal delivery [6].

Thus, in 1985 the WHO has determined that there would be no justification for any country or region to present a CS rate greater than 10% - 15%. This percentage was based on limited scientific evidence existing at the time and in the Nordic European countries CS rates, as they presented low levels of maternal and perinatal mortality [7]. Nevertheless, the CS rate in most developed countries continued to rise [2,8].

This review pretends to analyse the CS rate in different countries of the world, in order to question if the threshold of 10% - 15% determined by the WHO, is still updated and could be applied to all countries and regions, since there is a huge economic, social, cultural and even racial/ethnic diversity worldwide. Also to establish a comparison between vaginal and caesarean delivery in terms of maternal and neonatal morbidity-mortality, trying to assess what is the best way to born.
Materials

Google and PubMed databases were searched for official reports and scientific articles on maternal and neonatal morbi-mortality associated with CS and vaginal delivery, as well as factors that can influence CS rate. Cross-references of relevant articles were included in the review.

Data about CS rate, maternal mortality, neonatal mortality and the human development index (HDI) were obtained from WHO official statistics, from official reports or articles. To our knowledge, these data have 1.0 as limit. It evaluates the economy of each country in an indirect way, although it relates not only to economic factors [9].

Results

| Country            | CS rate (%) | Year | Reference | Year | Maternal Mortality | Reference | Year | Neontal Mortality | Reference | HDI | Year | Reference |
|--------------------|-------------|------|-----------|------|--------------------|-----------|------|------------------|-----------|-----|-------|-----------|
| Turkey             | 50.4        | 2013 | [10]      | 2013 | 11.2               | 2013      | 2013 | 0.759            | 2013      |     |       |           |
| Italy              | 36.9        | 2013 | [10]      | 2013 | 2.2                | 2013      | 2013 | 0.872            | 2013      |     |       |           |
| Portugal           | 34.8        | 2011 | [8]       | 2013 | 2                   | 2013      | 2013 | 0.822            | 2013      |     |       |           |
| Switzerland        | 33          | 2011 | [8]       | 2013 | 3                   | 2013      | 2013 | 0.917            | 2013      |     |       |           |
| Germany            | 31.1        | 2011 | [8]       | 2013 | 2.2                | 2013      | 2013 | 0.911            | 2013      |     |       |           |
| Czech Republic     | 26.1        | 2013 | [10]      | 2013 | 2.1                | 2013      | 2013 | 0.861            | 2013      |     |       |           |
| Spain              | 25.1        | 2013 | [10]      | 2013 | 2.6                | 2013      | 2013 | 0.869            | 2013      |     |       |           |
| United Kingdom     | 23          | 2013 | [10]      | 2013 | 2.8                | 2013      | 2013 | 0.892            | 2013      |     |       |           |
| Russia             | 22.6        | 2011 | [8]       | 2013 | 5.3                | 2013      | 2013 | 0.778            | 2013      |     |       |           |
| France             | 20.8        | 2012 | [10]      | 2013 | 2.3                | 2013      | 2013 | 0.884            | 2013      |     |       |           |
| Norway             | 16.4        | 2013 | [10]      | 2013 | 1.6                | 2013      | 2013 | 0.944            | 2013      |     |       |           |
| Sweden             | 16.4        | 2013 | [10]      | 2013 | 1.6                | 2013      | 2013 | 0.898            | 2013      |     |       |           |
| Finland            | 15.8        | 2013 | [10]      | 2013 | 1.3                | 2013      | 2013 | 0.879            | 2013      |     |       |           |
| Netherlands        | 15.6        | 2010 | [10]      | 2013 | 2.6                | 2013      | 2013 | 0.915            | 2013      |     |       |           |
| Iceland            | 14.7        | 2011 | [8]       | 2013 | 0.9                | 2013      | 2013 | 0.895            | 2013      |     |       |           |
| Middle East        |             |      |           |      |                    |           |      |                  |           |     |       |           |
| Iran               | 40          | 2010 | [10]      | 2013 | 10.3               | 2013      | 2013 | 0.749            | 2013      |     |       |           |
| Iraq               | 25          | 2010 | [10]      | 2013 | 18.7               | 2013      | 2013 | 0.642            | 2013      |     |       |           |
| Saudi Arabia       | 20.7        | 2010 | [10]      | 2013 | 19                 | 2013      | 2013 | 0.836            | 2013      |     |       |           |
| Israel             | 18.9        | 2012 | [10]      | 2013 | 3.8                | 2013      | 2013 | 0.888            | 2013      |     |       |           |
| Afghanistan        | 3.5         | 2010 | [10]      | 2013 | 36.3               | 2013      | 2013 | 0.468            | 2013      |     |       |           |
| Africa             | 27.6        | 2010 | [10]      | 2013 | 11.8               | 2013      | 2013 | 0.682            | 2013      |     |       |           |

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and ethnic realities in the
Ethiopia to the highest one in Brazil. In general this rate is higher in
countries with high or very high HDI, being lower in poor countries.

In all continents/regions is observed a large discrepancy of values
between different countries.

In general, CS rate follows an inverse association with maternal
mortality and neonatal mortality, i.e., countries with lower CS rates
presents a higher maternal and neonatal mortality. This association is
least felt in the presence of lower maternal mortality values. African
continent is the one with highest values of maternal and neonatal
mortality. Europe is the continent where neonatal mortality values are
generally lower.

### Discussion

Although this analysis only included 46 countries, an effort was
made so that they represent the global reality. Another limitation is

| Country       | CS Rate | Year | Data | Maternal Mortality | Neonatal Mortality |
|---------------|---------|------|------|--------------------|-------------------|
| Angola        | 2.3     | 2005 | [8]  | 460                | 2013 [11]         |
| South Africa  | 20.6    | 2013 | [10] | 140                | 2013 [11]         |
| Morocco       | 5.4     | 2010 | [10] | 120                | 2013 [11]         |
| Sierra Leone  | 4.5     | 2013 | [10] | 1100               | 2013 [11]         |
| Mozambique    | 3.9     | 2013 | [10] | 480                | 2013 [11]         |
| Nigeria       | 2       | 2013 | [10] | 560                | 2013 [11]         |
| Ethiopia      | 1.5     | 2013 | [10] | 420                | 2013 [11]         |
| Brazil        | 56.6    | 2013 | [13] | 69                 | 2013 [11]         |
| Mexico        | 49      | 2011 | [8]  | 49                 | 2013 [11]         |
| Chile         | 37.7    | 2011 | [8]  | 22                 | 2013 [11]         |
| USA           | 32.7    | 2013 | [14] | 28                 | 2013 [11]         |
| Canada        | 26.1    | 2011 | [8]  | 11                 | 2013 [11]         |
| Panama        | 23.3    | 2013 | [15] | 85                 | 2013 [11]         |
| Haiti         | 10.3    | 2012 | [16] | 380                | 2013 [11]         |
| Republic of Korea | 34.6    | 2011 | [8]  | 27                 | 2013 [11]         |
| China         | 33.1    | 2011 | [10] | 32                 | 2013 [11]         |
| Japan         | 23.3    | 2008 | [10] | 14                 | 2013 [11]         |
| Thailand      | -       | -    | -    | 26                 | 2013 [11]         |
| Philippines   | 9.5     | 2008 | [10] | 120                | 2013 [11]         |
| India         | 8.5     | 2008 | [17] | 190                | 2013 [11]         |
| Cambodia      | 3       | 2010 | [10] | 170                | 2013 [11]         |
| Australia     | 32.2    | 2011 | [8]  | 6                  | 2013 [11]         |
| New Zealand   | 23.6    | 2010 | [10] | 8                  | 2013 [11]         |
| Papua New Guinea | -       | -    | -    | 220                | 2013 [11]         |
| Fiji          | -       | -    | -    | 59                 | 2013 [11]         |

Table 1: Shows a total of 46 countries that were considered for analysis, having been selected not only based in those with the highest and lowest CS rate, maternal and neonatal mortality, but also in a random way around the world, so the sample represented different social, economic, racial and ethnic realities in the different continents with the caesarean section (CS) rate values, maternal mortality, perinatal mortality and Human development Index (HDI) in several countries across the world. Countries are organized by continent and sorted in descending order of CS rate.
that data in Table 1 does not correspond to the same year. However, due to the limited temporal discrepancy, it should only differ in a few decimals. It is also important to note that the CS rate is an indicator that should be analyzed carefully because it can mask the real access that women have to this procedure. Since it reflects the national average, it gives no indication whether caesareans are being carried out in rural or urban areas [1,10], in private or public hospitals [10]. It also does not translate why the procedure was held, making it impossible to know the percentage off CS that were planned versus elective ones [1]. For a better analysis of this index it would be of particular interest to have these data at a global level.

**CS rate – How does it relate to maternal mortality, neonatal mortality and HDI?**

Since the WHO declaration in 1985 that the international community has used the 10-15% as the optimum level to reach. Analysis of the results shows that most countries with high maternal and neonatal mortality present a CS rate below this level. However, this relationship is not linear. These are the also the countries that present a lower HDI. In turn, countries with high or very high HDI clearly have higher CS rates as well as lower levels of maternal and neonatal mortality. Again this relation is not linear, since not all countries with higher CS rates present lower levels of maternal and neonatal mortality, as it happens in Turkey, Brazil and Mexico. This is confirmed by Volpe, which concluded that maternal mortality and infant mortality have an inverse exponential relationship with the CS rate [11]. These results also seem to confirm the conclusion reached by Betran et al. in 2015, that above a certain CS rate risks outweigh the benefits [7]. As for HDI, Ye et al., concluded in a study published in 2014, that this index has a significantly positive relationship with CS rate and negative with maternal and neonatal mortality [12], which is also suggested by the results.

A study by Vogel et al. concluded that most of the early neonatal deaths occur in the presence of a medical or obstetric maternal complication, and two thirds of these complications occur intrapartum. This is one of the reasons why in countries with high maternal mortality, there are also high levels of neonatal mortality. Identification and treatment of maternal complications is an important step in reducing early neonatal mortality [13].

Despite maternal mortality reduction of approximately 45% worldwide between 1990 and 2013 [1], there are countries with truly unacceptable levels of mortality. This is the case of Sierra Leone, the country where the lowest HDI is found. Most countries with reduced CS rate and high mortality levels are low HDI countries, which are located in sub-Saharan Africa.

A great disparity in the CS rate of countries with similar HDI, shows that there is little consensus about the best way to deliver [14]. It also shows that there may be other conditions beyond the medical and economic ones determining whether or not a CS is performed.

**What can influence the CS rate of a country?**

To define the conditions that interfere with the CS rate in each country is a difficult task to accomplish. In recent years it has been pointed out that the increasing CS rate is primarily due to economic, social and cultural factors [15]. The prevalent race in a particular country may also have some influence.

**Economic factors**

CS rate varies considerably between countries. At one extreme we have the poor countries, most of them localized in sub-Saharan Africa, where most of the population has no access to this procedure. At the other extreme we have the rich countries where in the vast majority, the CS rate largely exceeds 15%. This shows that the association between CS rate and mortality is thus very dependent on the socio-economic level of the country [16,17].

It is also important to note that within each country, even in poor countries, access to this obstetric procedure is uneven and higher social classes have a greater attainability [18]. CS rate is also significantly higher in private hospitals than in public [19]. This may lead to think that private sector is doing more CS, motivated by economic factors [10].

**Social and cultural factors**

Nowadays, CS is assumed by many as a safer procedure, more controlled and morally appropriate. This creates a hidden social obligation that determines women to choose it, especially in developing countries [20]. The preference for CS is mainly associated with fear of vaginal delivery. This inordinate fear is called tokophobia. The worldwide estimated incidence of tokophobia is 6% to 10% [15]. Studies have suggested that the request for a caesarean delivery is more common in women with a higher educational and economic level [10]. This phenomenon is seen by many as a milestone in the empowerment of women, who now have a word to say in the mode of deliver [21]. The origin of CS on maternal request, besides tokophobia, may also be associated with traumatic previous births, psychosomatic/psychiatric reasons, lack of self-confidence [15], multiple births, increased maternal age, as well as an increase infertility, which causes the pregnancy to be seen as precious [10,22]. In countries like India, religious factors are also of particular importance, since parents want babies to born on specific days according to astrology or the request of a family member [10]. The request for CS by women is the most often cited reason for the increased incidence of CS rate.

While in Northern Europe about 6% to 8% of all CS were performed on maternal request, this values rise to 11% in USA and 17% in Australia. In Brazil, the number of women who want CS takes a whopping 80%, with high claim rates for this procedure remaining even among Brazilian immigrants in Portugal [15]. These facts seem to confirm that there are some socio-cultural conditions at the origin of CS maternal request.

Some authors also refer medical choice as another factor largely responsible for this increase. Obstetricians, increasingly comfortable with technology, are not willing to take risks, practicing a defensive medicine, in order to reduce the perception of risk [10].

**Racial factors**

CS rate in a country can also vary according to the predominant race, since it is very likely that there may be anatomical and/or physiological differences that may determine a higher or lower likelihood of CS in a race than another.

Khalil, et al., performed a study in England, which showed that CS realization probability was higher in Afro-Caribeans women and South Asian [31]. Min, et al conducted a study between 2004 and 2010 in a United States regional hospital, which concluded that the CS rate in black women were higher than for Caucasian ones, regardless the
socio-economic, medical and obstetric factors. It also concluded that in this race, labor induction in nulliparous women, as well as higher maternal age in multiparous women are superior risk factors to perform CS for black women than for Caucasian [24].

Racial differences persist even in terms of neonatal mortality, with existing studies claiming that it is higher in the black population [25].

Many have speculated in the origin of this discrepancy between races. Some claim that more than medical factors, medico-legal factors are leading to the option for CS [26]. To date, and according to our knowledge, there are no studies to determine the medical, social and cultural conditions that determine a higher CS rate within certain racial groups.

Caesarean section - An alternative to vaginal delivery?

In some places elective CS has often been used as an alternative to vaginal delivery [15]. Replacement of vaginal delivery by a caesarean one has inevitably contributed to an increase in the CS rate. This has created increasing concerns in the scientific community, since some claim that above a certain level of CS rate, risks can be greater than the benefits [17]. Thus, in recent years numerous studies have been conducted in order to determine the best way to deliver, taking into account potential risks and benefits to the mother and the newborn. However, the results of many of these studies have been conflicting. It is broadly agreed that emergent caesarean sections are an essential procedure that can significantly reduce maternal and neonatal mortality. The same consensus does not exist in relation to elective ones [27].

Maternal and neonatal morbidity

Elective CS have been associated with a higher short-term maternal morbidity than vaginal delivery [11]. However in 2015, Liu et al. conducted a study in China, which concluded that nulliparous women undergoing elective CS, showed short-term maternal results similar to those that perform vaginal delivery [28]. In some studies it has even been a slight protective effect of CS for urinary incontinence and pelvic organ prolapse [5,15], as well as a decrease in perineal pain [5]. Fecal incontinence occurs in about 4% of women after vaginal delivery, yet still was not observed in caesarean delivery. In terms of sexual function there are no differences between vaginal and CS delivery [15].

In addition to possible anesthetic complications, which are minimal in vaginal delivery and high in emerging CS, there are also potential surgical complications associated, including organ damage [29] as well as complications for future pregnancies, as a higher risk of abnormal placentaion, ectopic pregnancy and ruptured uterus [5,22,30]. A CS is also associated with more prolonged hospital stay times, and re-hospitalization is more common in women after vaginal delivery than after caesarean one [30].

As for neonatal morbidity, the scarce existing data suggests that elective CS is associated with a higher risk of neonatal respiratory fetal morbidity and tear caused by the instruments used during the CS. However, studies have shown that it reduces the occurrence of transient or permanent brachial plexus injury and other forms of physical trauma to the fetus. CS is also associated with a lower risk of neonatal sepsis, intracranial hemorrhage, asphyxia and neonatal encephalopathy [31,32]. In some cases reduces the risk of neurological compromise in the long term and intrauterine fetal death, especially if carried out after 39 weeks [31]. There are also data suggesting that the rapid passage from intrauterine environment to external one, can bring greater inability of the infant to adapt to the environment, which can translate to develop hypothermia, hypoglycemia and a larger number of hospitalizations in intensive care units. CS may also delay the mother-neonate interaction, which can translate into greater difficulty in initiating breastfeeding [15,29]. More recently it has been speculated about the consequences of not exposing children to the vaginal microflora in the caesarean delivery. Studies have shown that a lack of exposure may interfere with the immune profile of newborns [33,34]. These children are more likely to develop allergic diseases (food allergies, allergic rhinitis and asthma), some immune-mediated diseases (diabetes mellitus type 1) and some types of neoplasia (neuroblastoma, myeloid leukemia and leukemia acute lymphoblastic) [34,35]. The hypothesis that the way one is born can influence motor and cognitive development, have also been placed [33,36]. Autism and some psychiatric disorders like schizophrenia, have also been associated with CS [37].

Maternal and neonatal mortality

CS have been associated with a greater amount of maternal adverse effects [38]. Liu et al demonstrated that in regard to vaginal delivery, the risk of maternal mortality is increased by 9 times in emergent CS, and 3 times in elective ones [39]. However, in recent years there have been several contradictory studies on maternal mortality associated with elective CS [11]. Some claim that establishing a direct relationship between maternal mortality and the type of delivery is difficult and mortality could be associated with other preexisting conditions [29].

Regarding to neonatal mortality, available data suggest that this parameter is increased in elective CS [25, 32], because it’s correlated with lower gestational age and birth weight [33]. Studies suggest that to minimize the risk of neonatal death, childbirth should not be performed before 39 weeks of gestation [32,40]. On the other hand, elective caesarean sections are associated with a lower perinatal mortality compared to vaginal delivery, since the prolongation of pregnancy is associated with an increase of intrauterine unexplained mortality. Studies have suggested that at 38 weeks of gestation the likelihood of intrauterine death is 0.08%, while at 41 weeks it rises to 0.34% [32].

This facts give the idea that it’s impossible to say without a doubt that a type of delivery has clear advantages over another. While an elective CS may result in a premature infant with risk of respiratory dysfunction, the extension of a pregnancy can result in a stillbirth with no apparent cause or else a spontaneous vaginal delivery that can be associated with intrapartum complications that can compromise the well-being of the fetus or neonate [41].

In addition, the risks associated with a CS may vary depending on where it is held. Complications are more likely to occur in countries with underdeveloped health systems [6].

Conclusion

Changes in maternal population, society and in medicine are all factors that have been contributing to CS rate increase. This changes can lead to question whether the limit of 10%-15% given by WHO in 1985 still makes sense in today’s world. Although some studies continue to reach the conclusion that this would be the ideal level, they have only considered medical factors, which seems extremely reductive, since birth is an event with great emotional charge, heavily conditioned by social and cultural factors. Thus, assuming a rate of CS...
and extended it to all countries seems somewhat unrealistic and possibly dangerous. It seems essential that instead of governments continue to assume the 10% - 15% as the ideal level to be reached in CS rate policies, they should determine a CS rate based on their population needs.

While there are several studies that take CS as a cause of higher maternal and neonatal morbi-mortality, others report positive aspects of this birth option. Currently there are no certainties about what is the best mode of delivery. However, being a procedure whose implementation is strongly motivated by social factors, it seems essential that the entire population be educated regarding potential risks and benefits, in order to avoid the numerous cases of tokophobia.

While the appropriate CS rate for each country remain a subject of debate, more than obey to a number, it is essential that all women needing a CS receive it.

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