Review

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The increasing cesarean rate globally and what we can do about it

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Summary **Cesarean sections sometimes save the lives of mothers and babies; however, they are excessively used compared to medical necessity, which is influenced by various factors that are explored in this article. Since, in most cases the risks of cesarean sections are greater than the benefits, particularly in cesareans that are not medically indicated, it is astonishing that cesarean surgery is the most common surgical procedure, taking away resources from medically necessary care. While economic incentive is counted among the reasons for the increasing cesarean trend, the situation is not so simple since many factors interact to cause the trend. Since reversal of the vaginal birth after cesarean (VBAC) trend downward is correlated with revised policy statements by *e.g.* American College of Obstetricians and Gynecologists (ACOG), which have since been partially moderated, it became much more difficult for medical institutions to provide VBACs due to concerns about liability. Although whether to give birth by cesarean delivery is a matter for informed consent, yet childbearing women are influenced significantly by their health service providers' opinions. Even though the World Health Organization (WHO) recommends the most peripheral level of maternity care for normal pregnancy and childbirth that is safe using midwives, yet the percentage of midwife deliveries is low. Among other things, it has been suggested that more childbirth by midwife delivery and in out-of-hospital settings can reduce medically unnecessary cesareans and the undue risks associated with them, and free up medical resources for those in need.**

Keywords: Cesarean sections, medicalization, VBAC, midwife

1. Introduction

The increasing cesarean section rate is a global issue in developed countries (Figure 1; Table 1). According to Figure 1, Mexico had the highest cesarean rate among 22 selected developed countries in 2007 or 2008 (latest year reported) (43.9%), followed by Italy (39.8%) and South Korea (35.3%). The U.S. cesarean rate was 31.8%. The three lowest rates were 13.9% in the Netherlands, 16.1% in Iceland and 16.5% in Finland. The remaining countries were clustered in the band between 32.7% and 19.8%.

The research indicates that generally there are more disadvantages than advantages to cesarean sections although they are medically beneficial in appropriate situations. Literature review of what the developed countries learned about the benefits and risks and increase of cesareans during this time can inform us to plan the strategy going forward.

2. Methods

Five databases were used in a search strategy to identify the relevant literature: PubMed, EBSCO, Science Direct, the Cochrane Library and Google Scholar, from 1990 through 2011 limited to the last two decades and current to be able to follow the recent trends. I reviewed the relevant literature accessible by internet from Japan and selected over 30 articles, books and surveys as research sources for this article. After review of the literature accessed through the foregoing databases, the research was updated by internet search.

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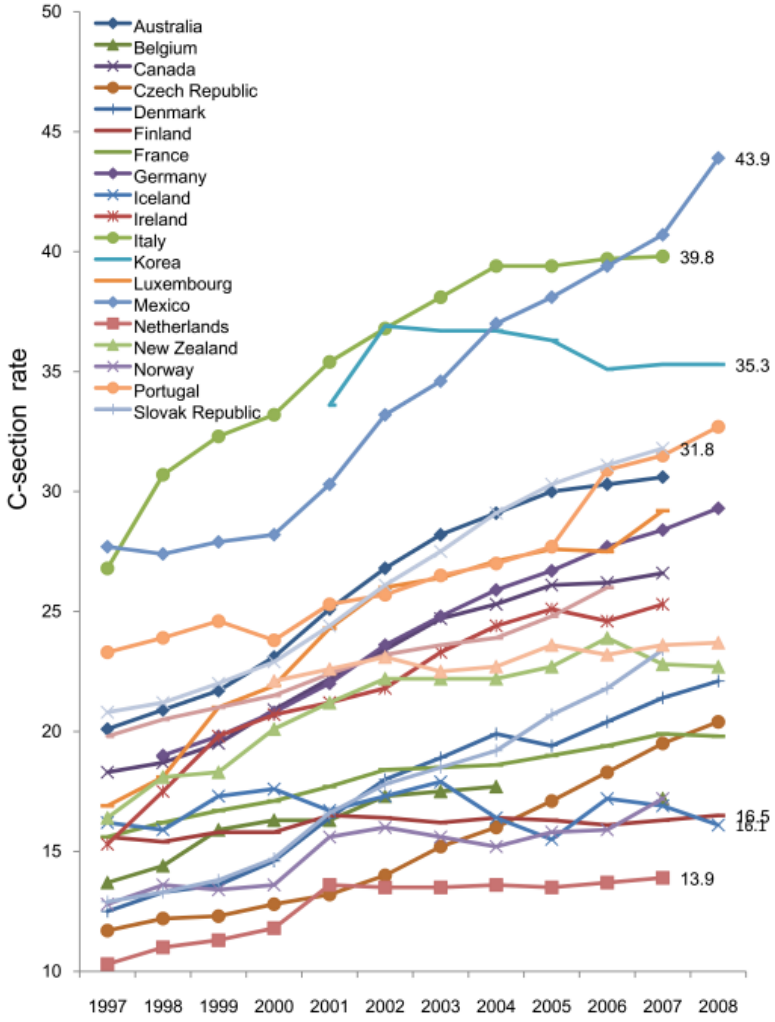

Figure 1. C-section rate within 22 developed countries. SOURCE: OECD HEALTH DATA, 2010 October (eliminated 9 countries from 31 OECD reported due to missing data for 3 recent consecutive years).

3. What are the trend, policy, and protocol?

3.1. *Steeply increasing trend*

Cesarean rates in the U.S. range from less than 10% for some caregivers and birth settings to over 50% for others (*1*,*2*) and cesarean section is the most common operating room procedure in the country (*3*). Various studies have shown that the rate of cesareans with no indicated medical risk is between 3% to 7% (*4*) and that between 4% to 18% of cesarean deliveries in 2006 were without medical indications therefor or on maternal request (*5*).

Between 1965 and 1986, the United States cesarean section rate increased from 4.5% to 24.1% (*1*) and the global rate rose from about 5% in developed countries in the early 1970s to more than 50% in some regions in the late 1990s (*6*). By 2004, the cesarean rate climbed to 29.1% in the U.S., an increase of more than 40% since 1996 reflecting an increase in the primary rate from 14.6% to 20.6% and a steep decline in the VBAC rate from 28.3% to 9.2%, with a repeat cesarean rate of almost 91% (*4*). By 2007 it rose to 32%, a nearly 60% increase (*7*).

On the other hand, the repeat cesarean rate rose by 28 percent from 1996 to 2005, when 92 percent of mothers with prior cesareans elected to undergo cesarean sections. Meanwhile, the global cesarean rate reached 25.7% as of 2010 (*3*). In 2008, it was estimated that one-third of deliveries in the U.S. were by cesarean, reflecting a steep rise in primary cesareans and a 72% decline in VBACs from 28% in 1996 to 8% in 2005 (*8*).

Many other countries also experienced a sharply rising cesarean section rate in recent decades. The medical indications for cesarean section are very subjective and culture bound such that there is a significant variation among countries with respect to cesarean rates for particular medical indications. Also, the country differences are salient regarding the rate at which particular common indications for cesarean birth apply to childbearing women (*9*).

Among the various countries compared by Sakala,

Table 1. C-section rate from 1997 to 2008 within 22 developed countries.

Country	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Australia	20.1	20.9	21.7	23.1	25.1	26.8	28.2	29.1	30.0	30.3	30.6	-
Belgium	13.7	14.4	15.9	16.3	16.3	17.3	17.5	17.7	-	-	17.2	-
Canada	18.3	18.7	19.5	20.9	22.2	23.4	24.7	25.3	26.1	26.2	26.6	-
Czech Republic	11.7	12.2	12.3	12.8	13.2	14.0	15.2	16.0	17.1	18.3	19.5	20.4
Denmark	12.5	13.3	13.6	14.6	16.4	18.0	18.9	19.9	19.4	20.4	21.4	22.1
Finland	15.6	15.4	15.8	15.8	16.5	16.4	16.2	16.4	16.3	16.1	16.3	16.5
France	15.6	16.2	16.7	17.1	17.7	18.4	18.5	18.6	19.0	19.4	19.9	19.8
Germany	-	19.0	19.8	20.8	22.0	23.6	24.8	25.9	26.7	27.7	28.4	29.3
Iceland	16.2	15.9	17.3	17.6	16.7	17.3	17.9	16.4	15.5	17.2	16.9	16.1
Ireland	15.3	17.5	19.8	20.7	21.2	21.8	23.3	24.4	25.1	24.6	25.3	-
Italy	26.8	30.7	32.3	33.2	35.4	36.8	38.1	39.4	39.4	39.7	39.8	-
Korea	-	-	-	-	33.6	36.9	36.7	36.7	36.3	35.1	35.3	35.3
Luxembourg	16.9	18.1	21.0	21.9	24.3	26.0	26.4	27.1	27.6	27.5	29.2	-
Mexico	27.7	27.4	27.9	28.2	30.3	33.2	34.6	37.0	38.1	39.4	40.7	43.9
Netherlands	10.3	11.0	11.3	11.8	13.6	13.5	13.5	13.6	13.5	13.7	13.9	-
New Zealand	16.4	18.1	18.3	20.1	21.2	22.2	22.2	22.2	22.7	23.9	22.8	22.7
Norway	12.8	13.6	13.4	13.6	15.6	16.0	15.6	15.2	15.8	15.9	17.2	-
Portugal	23.3	23.9	24.6	23.8	25.3	25.7	26.5	27.0	27.7	30.9	31.5	32.7
Slovak Republic	12.9	13.3	13.8	14.7	16.6	17.8	18.5	19.2	20.7	21.8	23.4	-
Spain	19.8	20.5	21.0	21.5	22.4	23.2	23.6	23.9	24.8	26.0	-	-
United Kingdom	-	-	-	22.1	22.6	23.1	22.5	22.7	23.6	23.2	23.6	23.7
United States	20.8	21.2	22.0	22.9	24.4	26.1	27.5	29.1	30.3	31.1	31.8	-

Source: OECD HEALTH DATA, 2010 October (eliminated 9 countries from 31 OECD reported due to missing data for 3 recent consecutive years)

Portugal, Sweden and Japan, and especially Japan stabilized the most through 1985. Notwithstanding Japan's bucking against the increasing cesarean trend at that time, the rate has since increaseed (Figure 2). The cesarean rates between 1970 and 1987 were compared by Sakala for 21 countries as of mostly around 1985. As of 1985, the lowest rates were in Czechoslovakia and the Netherlands at 6.5 and 6.6% with Japan showing at that time a bit more than 7%. The highest was in Puerto Rico at 29.3%, followed by Brazil at 26.1%, and then followed by the U.S. and Canada at around 23% and 19% respectively. Nine countries fell in the range of 10% to 15%. Of all the countries compared by Sakala, the Netherlands was the only one with a relatively high home birth rate of around 1/3 (*9*).

Figure 2 shows the comparative trends in Japan from 1984 through 2008 for cesarean sections in clinics and hospitals. Please note that Figure 2 commences from 1984 for Japan, to show the dramatically increasing rate for hospital cesareans in Japan compared to cesareans in clinics, which is a phenomenon regarding which salient data is available in Japan during this time period, even though Figure 1 showing developed countries merely commences in 1997. The in-hospital cesarean section slope in Figure 2 is more steeply increasing and the difference is especially salient between 2002 and 2008. Please note that between 2002 and 2005, the clinic cesarean rate increased about the same as the historical rate and then between 2005 and 2008 leveled off; the in-hospital rate however, shows its steepest incline between 2002 and 2008.

The rate in public hospitals in Brazil and South American countries had reached 80% in the early two thousands (*5*). A WHO global survey in 2005 disclosed a median rate of 33% based on a study of eight countries in Latin America, with 55% in private hospitals. Of the 33%, 49% thereof were elective, 46% were intrapartum, 5% were emergency cesareans without labor and 30% thereof had a prior cesarean delivery history. Among women whose labor was induced, a median of 28% had a cesarean delivery. The caesarean rate was positively associated with severe maternal mortality and morbidity, after adjustment for risk factors, and with increased fetal mortality, and antibiotics in postnatal treatment, but higher rates did not indicate better perinatal outcomes (*6*).

In Peru, the health reform enacted in 1997 increased the rate of caesarean sections in the private sector from 28% to 53%, apparently due to monetary incentives for overuse (*1*). Villar, Valladares and Wojdyla found that in Latin America, while the median rate of cesarean delivery was 33%, it was 51% in private hospitals. The caesarean rate in the private sector more than doubled in 15 years from less than 30% to more than 60% in the mid-two thousands, while in the public sector cesarean sections remained almost constant in MOH hospitals (for unemployed or informal employees) and increased at a slower rate in ESSALUD (social security) hospitals. It was concluded that one reason for such discrepancy might be that there was incentive to overutilize cesarean sections in private hospitals. Doctors in public hospitals work for fixed fees, while doctors in private hospitals are paid by a fee-for-service basis. Moreover, the increasing number of cesarean sections raised mortality and morbidity in mothers and babies as well as costs (*6,10*).

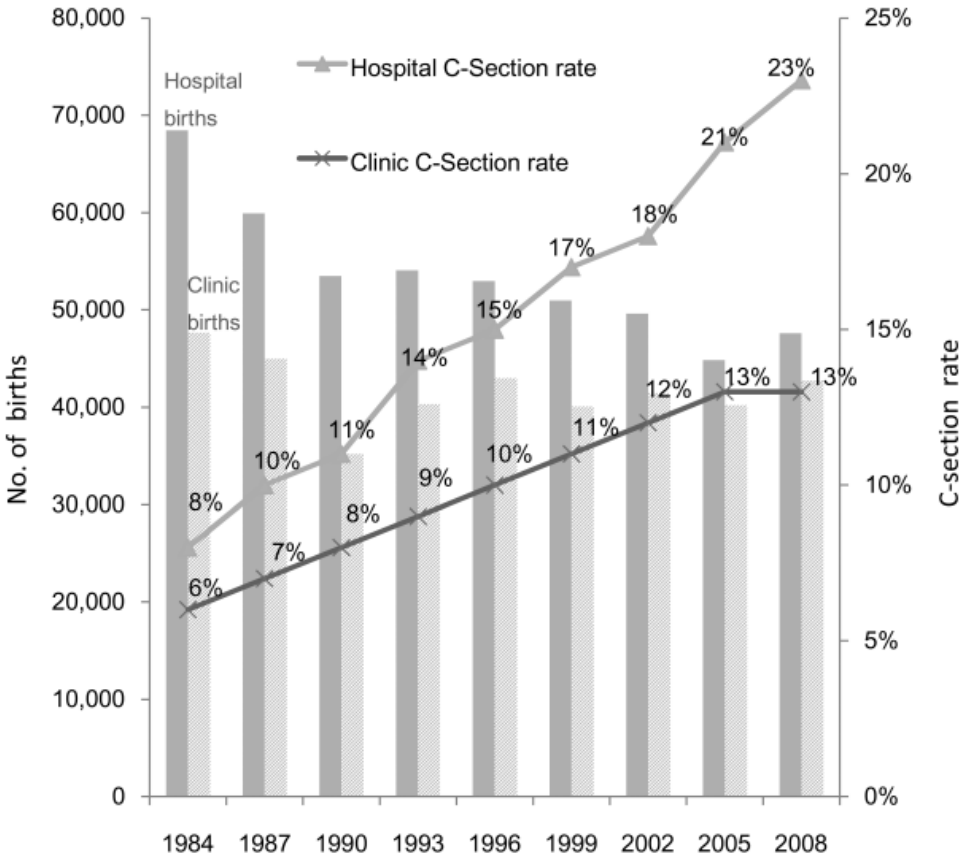

Figure 2. Births in Hospitals and Clinics. SOURCE: Report on Survey of Medical Institutions (September, 1986-2010, Ministry of Health, Labour & Welfare, Japan).

To give some context to the foregoing analysis, the increases of the cesarean rates in Peru were related to health reform which increased available funding but failed to provide good oversight or transparency. Prior to the reform, the probability of having a cesarean in a private hospital was only 7% greater than in a public hospital. According to WHO statistics, after the reform, 13% of Peruvian women had a cesarean section in 2000. More than 40% of deliveries were reported as non-institutionalized and mainly in homes, where the cesarean rate in the range of 1.4% to 1.9%. On the other hand, there was a cesarean rate of almost 50% for the 7% in private care facilities. While the cesarean rate increased in all facilities, the increase in the private sector was by 86% compared to 31% increase in the public sector (*10*).

Arrieta concluded that the fact that hospital ownership is the most significant non-medical factor in cesarean sections after the legislative reform suggests that physician incentives are playing an important role, although women's requests for cesarean sections are often psychologically driven and based on perceptions of safety and cultural and social factors as well (*10*).

In 2008, the cesarean rate was 20% in the UK, with many cesareans due to indications such as fear of pain or uncertainty of outcome (*11*).

In Australia, the rate of cesarean sections climbed from 22% in 1991 in private hospitals to 41% in 2006, with the rate in public hospitals rising from 16% to 28% and other interventions such as induction of labor, epidural anesthesia and pharmacological analgesia rising as well during the same period (*12*). It should be noted that medical interventions, such as labor induction, cause the likelihood of cesarean sections to increase (*13*), and there is a tendency for Electronic Fetal Monitoring (EFM) to do the same (*14*). During the same time period the cesarean rate was 14% in the Netherlands and ranged from 16% to 20% in Sweden and Finland (*12*).

A WHO study reported in a study of 24 countries that Chinese health facilities had the highest rate of 46.2% and China had an 11.6% rate of cesarean deliveries without medical indications (*15*).

3.2. *Shifting slope*

Due to questioning of the rationality of the trend to increasing cesarean sections, the rate in the U.S. stabilized, without significantly varying between 1986 and 1990 (*9*). There was a six year decline from 1990 through 1996, with cesarean delivery rates in the United States then rising from 21% in 1996 to 33% in 2007.

It would appear from a review of the comparison of the total cesarean delivery slope with the slope rate of the sharply rising (1989-1997) and then sharply falling (1997-2006) VBAC rate that the primary reason for the falling and then rising again cesarean rate was the steep incline and then decline in VBACs during the relevant period (*16*). In 1993, Stafford *et al.* hypothesized three reasons for the decline in cesarean deliveries between 1988 through 1992, for the first time after two decades of increase, namely: (a) literature critical of high cesarean section rates; (b) increasing public awareness of cesarean section practices; and/or (c) changing reimbursement policies of insurers (*17*).

Even so, while some of the foregoing factors may have had an effect on stabilization to some degree, considering the sharp reversal of the decline in cesarean deliveries, which correlated inversely with the changing VBAC practice and statistics, the changing VBAC rate would seem to be a controlling factor. This is particularly the case since a sharp increase in cesarean deliveries preceded the steep reversal and also inversely correlated with the changing VBAC practice and statistics (*16*). For example, from 1996 to 2004 the cesarean rate increased from 14.6% to 20.6% while the VBAC rate declined from 28.3% to 9.2%. During those years the cesarean rate increased by 40% to 29.1% (*4*).

A growing body of research literature has demonstrated the safety of VBACs, and policy statements from the leading professional association for obstetricians have supported VBAC under many circumstances (*9*). According to one study, best available evidence supports access to VBAC for most women with a previous cesarean delivery (*8*). Certain types of morbidity are higher with vaginal birth and there is some evidence that morbidity is higher for VBACs than repeat cesareans, with most studies finding maternal morbidity to be highest for unplanned cesareans, lower for planned cesareans and lowest for vaginal birth (*5*). Overall VBACs have the lowest morbidity, yet unsuccessful Trial of Labors (TOLs) ending in cesareans have the highest morbidity (*16*).

For most of the twentieth century it was believed that once a woman underwent a cesarean delivery, future pregnancies should be by cesarean delivery. The option for a woman with a prior cesarean to have a TOL was used more often in the 1980s through 1996, after which the number of VBACs declined. At the same time the cesarean rate rose from 21 % in 1996 to 33% in 2007 (*16*).

Until recently, since 1996, one-third of hospitals and approximately one-half of physicians no longer offered TOL. A survey of American College of Obstetricians and Gynecologists (ACOG) fellows showed that 26% stopped offering TOLs for Medicaid patients. VBAC rates are higher for women enrolled in HMOs who give birth at public rather than private hospitals (*16*). Still, as of 2004, nearly 91% of women with prior cesareans gave birth by cesarean (*4*). Repeat cesareans accounted for 35% of all cesareans in 1987 (*18*).

Seventy-nine percent of low-risk New Jersey women underwent repeat cesareans without TOLs between 2003 and 2005. At the same time that the TOL rate has been rapidly declining, the vaginal delivery rate after TOL has remained constant at approximately 74% (*16*).

Among low-risk women, the repeat cesarean rate increased to 89% by 2003. In one study 92% of women had repeat cesareans for their next delivery. TOLs have a success rate in the range of 60% to 80%. The risk of uterine rupture, which is the main reason given for reduced VBACs is less than 1% (*16*).

It has been suggested that concern over medical malpractice issues might also be a factor in the reduction of VBACs. In fact, ACOG members confirmed that 30% of obstetricians stopped offering TOLs or performing VBACs because of the fear of professional liability claims or litigation. In a survey of ACOG fellows, fear of litigation was among the primary reasons for performing cesarean deliveries (*16*).

According to a study by Stafford in California, repeat cesareans were at the rate of 91.9% for private insurance, compared to 75.2% for indigent services, with the rate of VBAC at 24.8% for indigent women compared to 8.1% of the privately insured. Comparative rates reflecting economic incentive based on payer source were associated no matter what the diagnosis leading to the cesarean section, whether breech presentation, dystocia or fetal distress, or other diagnosis (*19*). Overall, by 2010, the rate of repeat cesareans in the U.S. exceeded 90% (*20*).

4. What factors caused the increasing cesarean trend?

4.1. *Economic incentives and related factors*

Women of higher socio-economic class, better insured and/or cared for by private services are more likely to have cesarean delivery. Possible reasons are physicians' interest in economic gain (due to higher income or insurance coverage), defensive medicine (because private physicians bear personal risk of malpractice) and the need to deal with more scheduling pressure of doctors in private practice. In such connection, cesareans are correlated with doctor's scheduling in Brazil and scheduling in Canada and Italy. Also, it has been thought that house staff in public institutions may be held more strictly to conservative protocols and private physicians have a closer relationship with their patients and ironically value them more (as they are receiving less appropriate treatment) (*9*).

As a striking example, in Rio de Janeiro cesarean rates at four hospitals in 1977 and 1978 ranged from 14.9% at the facility serving the poor to 80.2% at the facility for private patients. In the late 1970s the

cesarean rates at nine Sao Paulo hospitals ranged from less than 25% for the indigent to about 75% for private patients. In 1980 and 1981, 7.5% of indigent and 49.6% of privately insured women out of a population of 6,000 childbearing women using a Brazilian hospital had cesarean deliveries (*9*).

Fifty-five percent of women in Brazil, from families earning more than $1,000 per month had a caesarean section and many lower to middle class women sought caesarean deliveries to avoid poor quality care and medical neglect from social prejudice. The factors prominently associated with whether or not a woman underwent a caesarean delivery were social power and affinity for medicalization among the subject women (*21*). The Hopkins study in 2000 showed that doctors tend to recommend cesarean delivery by taking advantage of women's concerns over potential complications arising from childbirth (*22*).

Although a prior study by Gruber, Kim and Mayzlin in 1999 related cesarean sections to the fee premium paid by Medicaid to physicians when a cesarean delivery is performed rather than a vaginal birth, concluding that such fee premium increased the probability of cesarean delivery within the range of 3.04% to 5.51%, when, such study was later replicated by Grant in 2008, it was concluded that the effect of financial incentives (fee premium of $1,000) is only around 1%, whereas on the other hand cesarean probabilities were higher with mothers having clinical risk factors and matching between privately insured mothers and physicians with predisposition to do caesareans. Grant said that his group's findings were consistent with reports of Blue Cross's unsuccessful efforts to lower cesarean section rates through financial incentives (*17*).

A WHO study found a strong correlation between cesarean sections and the economic incentive therefor of the relevant institution such that seven out of twelve private institutions showed evidence thereof, as compared to 5% of social security institutions and 24% of public hospitals (*6*).

A study by Stafford of cesarean sections performed in California in 1990 based on 1986 data revealed women covered by private insurance had a cesarean delivery rate of 29.1%, whereas indigent women had a rate of 15.6%, with the overall rate being 24.4% (*19*).

Another study by Leone, Padmadas and Matthews in 2008 based on analysis of six countries, Bangladesh, Colombia, Dominican Republic, Egypt Morocco and Vietnam, concluded that women of higher socio-economic background with better access to antenatal services are most likely to undergo a caesarean section, but that women who exchange reproductive health information with friends and family are less likely to do so (*22*).

Women's personal choices and institutional factors such as financial incentives and fear of litigation account for high rates of caesarean sections among the wealthy, according to studies by Behague, Victoria, & Barros in 2002, Gould *et al.* in 1989 and Rosmans *et al.* in 2006. In Egypt, the increasing rate of non-medically indicated caesareans has been driven by physician practice patterns and financial incentives in the private sector. In Bangladesh, the relatively high percentage within the public sector was attributed to emergencies with limited access to hospital birthing, compared with private caesarean driven by choice or supply side factors (*22*).

4.2. *Increasingly high technology in medicine and increasing medicalization of childbirth*

There is a relationship between the international trends for high-technology obstetrics and an increasing number of cesarean sections (*9,18*). In general, cesarean sections have been part of or a result of the significant general trend of intensified use of medical technology for childbirth in the U.S. Interestingly, skills and knowledge for turning babies have been retained in the industrialized countries of Holland, Sweden and Germany (*9*).

The Avon Longditudinal Study of Parents and Children study concluded that epidural use is associated with increased risk of emergency cesarean, while being in a preferred labor position decreased the risk therefore. In an American trial by Thorp *et al.* in 1993, the number of cesarean sections was increased when epidural analgesia was used. In addition, the relative risk of primiparous women having a cesarean section was found in a study by Tracy *et al.* in 2007 to be 11.4 times greater after epidural during labor, which study was aborted because of the ethical issues of having a control group of women receiving epidural where there is such a significant statistical difference. The Tracy study noted that contrary results exist in research by Eriksson, Olausson and Olofsson in 2006, which was distinguished on the basis that they used institutions with a 40% to 49% epidural usage rate as a referent group (*13*).

4.3. *Four major cesarean indicators are gray areas*

Sakala opined that "The vast majority of cesareans performed in the U.S. are … attributed to official 'diagnoses' that are ambiguous and/or for which a cesarean offers no or highly questionable benefit (*6*)". In particular, the four major indicators of uterine scar, obstructed labor, fetal distress and breech presentation are gray areas (*9*).

For example, the assumption that a uterine scar from a prior cesarean section has a high risk of rupturing during a subsequent labor and birth led to a standard U.S. policy of cesareans in subsequent

pregnancies, regardless of medical status and has been a large factor in the rising rates of cesarean birth (*9*). Thus, as noted above, in 1987, 35% of all cesareans were subsequent cesareans (*18*).

Second, cesareans are often performed in case of dystocia or obstructed labor (*6,16*). In 1987, dystocia accounted for 40% of primary cesareans (*18*). It should be noted that while in 1980, 1.1% of births in the U.S. were labeled as involving obstructed labor; by 1989 the figure had risen to 4.3%, whereas the percentage of abnormal labor climbed from 3.0% to 7.4% in the same period (*9*).

Third, likewise, the increasing rate of cesarean births is associated with diagnosis of fetal distress. Thus, while 1.7% of all births were designated as involving fetal distress in 1980, 10% were so designated in 1987 (*18*), and, by 1989, 8.8% were so designated (*9*). To a large degree, this rise generally is a function of growing reliance upon EFM (*9*). However, there are false positives of around 50% and an excess of cesareans resulting therefrom, also with lack of expected benefits. In addition, EFM is testing for events that occur only in 1% to 2% of births (*14*). Moreover, while EFM is monitoring of the fetal heart rate (FHR) to detect risk of perinatal mortality due to inadequate oxygen supply to the fetal brain, EFM has not reduced perinatal mortality or the risk of cerebral palsy. It should be noted that the false positive rate for cerebral palsy from EFM is a whopping 99% (*23*).

By way of example, auscultation and EFM were compared in a number of trials by Haverkamp *et al.* in 1976 and 1979, Kelso *et al.* in 1978, MacDonald *et al.* in 1985, Wood *et al.* in 1981, and Neldam *et al.* in 1986. While cesarean section rate was higher in all electronically monitored groups, there is little evidence that the increased interventions in the electronically monitored groups led to substantive benefits for the infants according to the study by MacDonald *et al.* in 1985 (*24*).

In fact, clinical trials including high risk patients showed that nurse attendants are of more benefit to maternal or fetal outcome, while, on the other hand, a 50% false positive rate doubles the cesarean section rate. While the measures are precise, the interpretation of change of FHR is not. Such false positives have a tendency to cause intervention in the birth process, which causes problems in some cases. At the same time, EFM has a tendency to enhance defensive medicine practice (*14*).

Fourth, the assumption that cesarean birth is safer than vaginal birth for all babies in the breech presentation led to nearly universal cesareans in such cases, while the skills of inverting a breech baby and facilitating vaginal birth of breech babies were dropped from the medical curriculum (*9*). In 1987, breech births were associated with 10% of cesarean deliveries (*18*).

4.4. *Creeping diagnostic standards over time*

Particularly in connection with gray areas, the diagnostic standards and criteria have changed over time due to a more high-tech medical environment and a more medicalized approach to childbirth and a tendency to manage birth within more tightly controlled norms, which increasingly drives the cesarean rate, because the percentages of the diagnoses to perform cesareans have significantly crept up over time. Over time, factors leading to a diagnosis to perform a cesarean were more plentiful, but perhaps the standards therefor have significantly changed due to sociological and iatrogenic rather than strictly medical reasons. Thus, the practice of obstetrics in a high technology and managed time environment with pharmacological aids may have caused physicians to diagnose basically similar medical facts with more of a predisposition to perform cesarean surgeries, or such evolving practice, itself, caused the symptoms for such diagnosis.

As an example, one midwife identified five instances of fetopelvic disproportion in over 1,000 births or less than one-half of one percent of all births, whereas 3% to 15% of all births are associated therewith in the medical literature. The gradual move away from midwifery, out-of-hospital settings and low technology obstetrics (changing labor positions; supporting companion encouraging opening up; laboring in a comfortable place with known trusted people) to high technology and time structured obstetrics practice might perhaps account for such statistical difference (*18*).

4.5. *Various miscellaneous factors*

The cesarean rate has been said to be driven by the interaction between mothers and their providers. For example, in a study in Brazil by Potter *et al.*, more than 80% of primiparous mothers anticipated a vaginal birth one month prior to the due date, but almost half of them and 66% in private hospitals ended up with a cesarean (*4*).

Other reasons given for the increasing cesarean rate include improved surgical techniques, providers' and patients' perception of the safety of the procedure, change in health systems, the supposed benefits of protection against urinary incontinence, prolapse and sexual dissatisfaction, patient demand (*6*), and physician practice patterns (*22*). Also, it was reported by Declercq *et al.* in 2006 and the National Collaborating Centre for Women's and Children's Health in 2008, that a substantial proportion of cesarean sections in 2005 were performed because of caregivers' judgment and concern about a large fetus. Yet, according to studies by Chauhan *et al.* in 2005, Coomarasamy *et al.* in 2005, Pattinson and Farrell in 1997 and Rouse and Owen in 1999, the conclusion to perform a cesarean section because of concern about

a large fetus is not supported by the best research (*8*). In addition, another reason for the increasing number of cesarean births is the anxiety of physicians and mothers due to the increased use of obstetrical screening technologies and interventions, including for example EFM and labor inductions (*9*).

4.6. *Sociology of medicine type reasons*

Reasons for the increasing cesarean rate include, among others, under-use of care that can enhance the natural progress of labor and childbirth, such as a labor support companion, encouraging upright or moving positions during labor, rather than on the back (which inhibits labor), ensuring expectant mothers are well-rested and well-nourished while giving birth; the willingness of some caregivers to move to cesarean section before trying measures that may avoid the surgery, for example, by failing to attempt to turn babies in a breech position in late pregnancy or by failing to allow more time for a vaginal birth to occur due to institutional pressures; pressures on caregivers to practice "defensive medicine"; failure to offer women with a previous cesarean section a choice of VBAC, loss of skills or unwillingness to offer vaginal birth to women in some situations, *e.g.* breech birth or twins, the growing perception that a cesarean section is "safe" (*2*); casual attitudes about cesarean sections (*8,23*), low priority of enhancing women's own ability to give birth, limited awareness of harms that are more likely with cesarean section, defensive medicine, and incentives to practice in a manner that is efficient for providers (*25*).

4.7. *Midwives perspective*

From the midwives' perspective, many women receive cesareans due to pseudo-problems, to easily preventable problems or those that might be solved through less drastic measures. Sakala opines that midwifery knowledge and practice are based more directly on the interests, needs and circumstances of childbearing women as compared to obstetrical knowledge and practice (*9,18*). Thus, independent midwives, particularly, can construct the meaning of birth and practice maternity care largely unconstrained by prevailing medical practices since they have the opportunity to develop a women-derived and centered body of knowledge and practice of childbearing reflecting women's subjective experience, as distinguished from externally imposed obstetrical models. Thus, midwifery results in individualized care in dignity with respect, giving women a primary role in informed decision making, emphasizing health promotion and illness prevention, minimizing technological intervention and iatrogenesis and addressing physical, psychological and social issues of childbearing women (*18*).

5. Cesarean section protocols and health policy guidelines

The International Federation of Gynecologists and Obstetricians (FIGO) stated that:

"FIGO considers surgical intervention without a medical rationale to fall outside ... best professional practice. Caesarean delivery should be undertaken only … to enhance the well-being of mothers and babies and improve outcomes (*22*)."

"At present, because hard evidence of net benefit does not exist, performing cesarean delivery for nonmedical reasons is not ethically justified (*4*)."

However, the guidelines from ACOG leave it more up to the belief of the physician involved, as follows: "In the absence of significant data on the risks and benefits of cesarean delivery … if the physician believes that cesarean delivery promotes the overall health and welfare of the woman and her fetus more than vaginal birth, he or she is ethically justified in performing a cesarean delivery (*4*)".

National Healthy People 2010 objectives call for a substantial decrease in the cesarean rate and an increase in the rate of VBACs from 2000 to 2010, from the U.S. Department of Health and Human Services 2000 (*8*).

In the past, WHO recommended that optimal national cesarean rates were in the range of 5% to 10%, and that rates above 15 percent are likely to do more harm than good (*8*) and that the maximum caesarean rate should not exceed 15% (*22*). Various programs and policies have been proposed or implemented to reduce cesarean rates (*1*). A WHO study concluded that caesarian sections should be performed when a clear benefit is anticipated that would compensate for additional cost and risk (*15*).

In the UK, after a three-day conference on maternal request cesareans, the National Institute of Health (NIH) did not recommend against medically unnecessary cesareans (*11*).

In 1999, the ACOG changed its practice guideline encouraging VBAC to a recommendation that women should be offered TOL if there are no contraindications, and that such TOL should be performed only in institutions equipped to respond to emergencies where physicians able to perform cesareans are immediately available. Concern over medical malpractice played a role in the adoption of the guideline (*16*), and this writer would suggest also in the reaction to the guideline.

NIH in its 2010 Consensus statement stated that VBAC is a reasonable option, that the decision whether to undergo one should be made jointly by the childbearing woman and her physician after informed consent regarding risk assessment and that the woman's preference should be honored as much as possible (*16*).

ACOG's guidelines, under which one third of hospitals and doctors had blocked VBACs since the time of the trend re-reversal (from upward to downward), were then eased following NIH's Consensus statement. The new guidelines declared that cesareans are a safe and appropriate option for most women, even including those giving birth to twins or with two prior cesareans, and that childbearing women with prior cesareans should be informed of the pros and cons and decide whether they want to try. It was reported that women with prior cesareans try labor and between 60% to 80% successfully give birth vaginally (*26*,*27*).

ACOG's guidelines, however, still continued to stress that women attempting vaginal birth after a prior cesarean section should labor in a facility that is equipped to handle emergency care. However, under the new guidelines, a trial of labor can be made even if such emergency resources are unavailable if the childbearing woman and her physician know and plan the logistics of the community medical resources in advance considering incremental risk. Also, it was declared that a woman cannot be forced to undergo a repeat cesarean (*26*,*27*). It was reported that ACOG's new guidelines also stated that if such emergency resources are unavailable, women should "be allowed to accept increased levels of risk" if they are made aware of the potential dangers (*28*).

More generally, WHO has said that midwives are generally most appropriate to ascertain the risks of normal pregnancy, as follows: "The midwife appears to be the most appropriate and cost effective type of health care provider to be assigned to the care of normal pregnancy and normal birth, including risk assessment and the recognition of complications…"; "However, in many developed and developing countries midwives are either absent or are present only in large hospitals where they may serve as assistants to the obstetricians (*24*)".

6. Do the risks of medically unnecessary cesarean deliveries outweigh the benefits?

A substantial proportion of cesarean section deliveries involve medical risk for mothers and infants without medical benefit (*9*). Variations in cesarean rates do not closely correspond with variation in the risk status of the populations being served, but rather are associated with a large number of nonmedical variables. Nonmedical factors include maternal, medical system and physician factors (*9*,*18*). Maternal mortality is two to seven times higher, and morbidity five to ten times higher, in cesarean sections compared to vaginal delivery. Women undergoing cesarean sections have more pain than women delivering vaginally, longer and more difficult postpartum recovery, a higher likelihood of complications and cesarean sections in subsequent pregnancies, and more difficulty in conceiving after cesarean sections, as well as greater likelihood of stillbirth and miscarriage in subsequent pregnancies. One study by MacDorman, Declercq, Menacker, & Malloy in 2006 concluded that neonatal mortality for cesarean deliveries was 2.9 times greater than for vaginal deliveries in women with no medical risk factors. There is more prevalent respiratory distress syndrome and persistent pulmonary hypertension in surviving neonates after cesarean delivery compared to vaginal delivery, followed by more childhood asthma, but less infant injuries (*5*).

Even though it is thought that that 85% to 90% of pregnancies and births can safely take place by vaginal delivery, one quarter of childbearing women are told otherwise. As of 1986, the 24.1% cesarean rate in the U.S. substantially exceeded the estimated rate with medical benefits of 6% to 16.5% (*9*), the 5% to 10% optimal rate set in earlier editions and the maximum 10 to 15% rate previously recommended by WHO in 1985 (which has since more modestly suggested regions might want to set the rate between 5% to 15% or set their own standards) (*22*,*29*), as well as the optimal rate for industrial nations of about 7% according to a study by Francome and Savage (*9*).

A WHO study conducted through 2008 concluded that absent medical indication therefor, cesarean delivery has an increased risk of 280% for severe adverse short-term outcomes for the mother as compared to spontaneous vaginal delivery (42/1,000 compared to 15/1,000, respectively) and nearly six times as much (adjusted odds ratio 5.93, 95% confidence interval 3.88-9.05) if before labor onset, but after labor onset fourteen times as much (adjusted odds ratio 14.29, 95% confidence interval 10.91-18.72) (*15*).

According to Childbirth Connection, cesarean section is riskier than vaginal delivery in 33 areas and vaginal birth is riskier than cesarean delivery in four areas (*1*,*3*). Among others, the risks in cesarean sections include physical problems to mothers, including but not limited to maternal death, emergency hysterectomy, hemorrhage, blood-clots and stroke, bowel obstruction, injuries from surgery, infection (*1*,*3*,*8*,*15*), antibiotic resistance (*15*), pain, including ongoing pelvic pain; emotional problems to mothers, including, poor birth experience, later contact between mother and baby, unfavorable early reaction of mother to baby, depression, psychological trauma, poor overall mental health and self-esteem and poor overall functioning; reproductive problems for mothers, including but not limited to ectopic pregnancy, infertility, reduced fertility, placenta previa, placenta accrete, placental abruption and rupture of the uterus; concerns about babies in future pregnancies, such as premature, low-weight or physical abnormality (malformation) or central nervous system injury (to brain or spinal cord), stillbirth or death of infant; and risks to health of babies, including but not limited to, getting cut during surgery, breathing problems, childhood and adult asthma and reduced

breast-feeding. Risks in vaginal birth are perineal pain, incontinence, and nerve injury in babies (*1,3,8*).

There is evidence from studies by Allen, O'Connell, Liston & Baskett in 2003, Ecker in 2004 and Murphy, Liebling, Verity, Swingler, & Patel in 2001 that medically unnecessary caesarean sections could increase morbidity risks to mother and newborn (*22*). Cesarean sections also cost a lot more (*30*).

Dissatisfaction with childbirth is well-documented for cesarean delivery, which can cause postpartum depression; negatively affect perception of the newborn, with less positive reactions impeding infant cognitive and socio-emotional development, physical growth and health, parenting behavior and likelihood to choose to have another child. Women delivering by cesarean delivery provide less tactile stimulation, caretaking and intimate play with their babies within the first five months. Ironically, dissatisfaction may also lead to a lawsuit, while litigation defensiveness has been explained as one of the reasons why doctors perform cesarean sections (*5*).

Passage of the newborn through the birth canal helps expulsion of fluids from the baby's lungs facilitating early breathing efforts (*11*) and immunological defense (*8*). In addition, there may be an association between cesarean section and vulnerable child syndrome (*9*). Babies born by cesarean section are reported to have a greater risk for asthma and allergy, diabetes mellitus, childhood leukemia and testicular cancer (*31*).

Needless to say, medically unnecessary cesarean surgeries are a huge waste of medical resources (*9*). WHO reported in 2010 that the global cost of excess cesarean sections was estimated at approximately US$2.32 billion. Money spent on medically unnecessary cesarean sections must necessarily be taken away from money to fund necessary or desirable medical care for other medical conditions or for medically necessary cesareans that is unavailable for such reason (*30*). Some services in the U.S. have been able to considerably reduce cesarean rates without adversely affecting perinatal outcomes. Other nations with similar populations have been able to achieve similar or better perinatal outcome indicators with much lower cesarean rates. Furthermore, in the U.S. and abroad, services skilled in and committed to low-technology approach have maintained excellent outcomes and cesarean section rates below 2% (*9,18*). In fact, in Vienna, the clinic Ignaz Semmelweiss Frauenklink had a cesarean section rate for the 20-year period from 1966 through 1985 of 1.3%, compared to 8% in the rest of Vienna, even declining from first to second decade against the trend in the rest of the developed world (*18*).

7. Solutions and alternatives

Among solutions to a perceived excess of medically appropriate cesarean surgeries, the following basic strategies have been proposed and pursued: (a) resistance by child-bearing women and their advocates; (b) managed care strategies; and (c) more midwife birthing and out of hospital settings (*9*).

With respect to (b), above, one example is a hospital program requiring a second opinion, objective criteria for the most common indications, review of all cesarean sections and reporting of individual physician's rates (*9*).

As regards (c), above, American women beginning labor with midwives and/or in out-of-hospital settings have attained cesarean section rates that are considerably lower than similar women using physicians in hospitals. Moreover, groups of women at elevated risk for adverse perinatal outcomes have attained excellent outcomes and cesarean rates well below the general population rate with these care arrangements. One assessment by Rooks *et al.* found that the cesarean section rate in out-of-hospital centers was 4.4% at a time when the national rate was more than 20% (*18*). This cesarean reduction involved no compromise in mortality and morbidity outcome measures. Similarly, supportive labor companions or childbirth assistants are associated with a favorable effect on cesarean rates in several countries. In one trial with a doula present by Kennell *et al.* there was an 8% cesarean rate as compared with 13% with a silent observer and 18% with neither (*9,18*).

In connection with (c), above, Sakala concluded: "Because of the dim prospects for rational reduction of cesarean section rates with the prevailing medical care system, a growing number of analysts and organizations … recommend a third approach to the problem: midwives should have a much greater role in the care of childbearing women, and midwifery should be an autonomous profession…"; "Therefore, the most effective solution to the pandemic of medically unnecessary cesarean births is to demedicalize birth, and to limit the involvement of obstetrical specialists and acute medical settings to the case of genuine medical need…"; "Supporting and strengthening midwifery care and designating midwifery care as the most appropriate form of care for health childbearing women may be expected to lead to far more conservative and appropriate use of cesarean section than is now occurring… (*9*)".

Other suggested solutions are: (a) to provide access and caregivers with conservative practice style and low cesarean rates to pregnant women; (b) delay of women in labor going to hospital until labor is established; (c) a support companion for women in labor; (d) maternity care providers' retaining and applying skills to facilitate vaginal delivery, such as manually turning breech babies; (e) when possible, avoiding interventions which increase likelihood of cesarean delivery such as continuous EFM, labor induction, and early epidural; and (f) facilities limiting

cesareans to clearly established indications and taking measures to deal with unsupported indications, such as large baby, *etc*. (*8*).

8. Conclusion

Since cesarean sections generally have more medical risk than benefit, they should not be performed for non-medical reasons even before considering the enormous waste of medical and financial resources. Even if there are medical reasons for doing cesarean sections, there are limited parameters for cesarean deliveries considering a medical risk/reward analysis. The various professionals involved in maternal health should take care to see that the cesarean rate does not further increase and to lower the rate to one based on medical appropriateness. Since one primary reason for the tendency to perform cesareans has been the medicalization of the normal birth process, greater use of independent midwives and out-of hospital settings in the childbirth process is one of the possible solutions.

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