



© World Health Organization, 2010
All rights reserved.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters. All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use. The findings, interpretations and conclusions expressed in this paper are entirely those of the author and should not be attributed in any manner whatsoever to the World Health Organization.



The Global Numbers and Costs of Additionally Needed and Unnecessary Caesarean Sections Performed per Year: Overuse as a Barrier to Universal Coverage

World Health Report (2010) Background Paper, No 30

Luz Gibbons¹, José M. Belizán¹, Jeremy A Lauer², Ana P Betrán³, Mario Meriardi³ and Fernando Althabe¹

¹ Department of Maternal and Child Health, Institute of Clinical Effectiveness and Health Policy (IECS). Viamonte 2146, Buenos Aires, Argentina.

² Department of Health Systems Financing, World Health Organization (WHO), Geneva, Switzerland.

³ Improving Maternal and Perinatal Health, Department of Reproductive Health and Research. World Health Organization (WHO), Geneva, Switzerland.

Abstract

Objective

To estimate the additional number of needed CS (cesarean section) that would be required in countries with lower than recommended national rates, as well as the number of excess CS in countries in which the procedure is arguably overused and to understand the resource-use implications of the 'needed' and 'excess' CS.

Methods

We obtained data on the number of CS performed in 137 countries, accounting for approximately 95% of global births for that year. Countries with C-section rates below 10% were considered to show underuse, while countries with rates above 15% were considered to show overuse. We estimated the units costs and the quantities of the physical inputs needed in performing CS. Only the marginal costs of the C-section procedure itself were included.

Results

A total of 54 countries had C-section rates below 10%, whereas 69 showed rates above 15%. 14 countries had rates between 10 and 15%. We estimated that in 2008, 3.18 million additional CS were needed and 6.20 million unnecessary sections were performed. The cost of the global “excess” CS was estimated to amount to approximately U\$S 2.32 billion, while the cost of the global “needed” CS on approximately U\$S 432 million.

Conclusions

Worldwide, CS that are possibly medically unnecessary appear to command a disproportionate share of global economic resources. CS arguably function as a barrier to universal coverage with necessary health services. 'Excess' CS can therefore have important negative implications for health equity both within and across countries.

Introduction

Cesarean section (CS) was introduced in clinical practice as a life saving procedure both for the mother and the baby. As other procedures of some complexity, its use follows the health care inequity pattern of the world: underuse in low income settings, and adequate or even unnecessary use in middle and high income settings. [1-4]

Several studies have shown an inverse association between CS rates and maternal and infant mortality at population level in low income countries where large sectors of the population lack access to basic obstetric care. [2-4] On the other hand, CS rates above a certain limit have not shown additional benefit for the mother or the baby, and some studies have even shown that high CS rates could be linked to negative consequences in maternal and child health. [2,3,5-8]

Bearing in mind that in 1985 the World Health Organization (WHO) stated: "There is no justification for any region to have CS rates higher than 10-15%", [9] we set out to update previous published estimates of CS rates worldwide [2-3], and calculate the additional number of CS that would be necessary in those countries with low national rates as well as the number of CS in excess in countries in which CS is overused. In addition to understand the resource-use implications of the 'needed' and 'excess' procedures, we performed a global costing analysis of both categories of C-section.

Methods

Sources of data and estimation of national CS rates

We obtained national cesarean section rates from several data sources as explained below.

- I. CS rates from routine statistical surveillance systems reports or national surveys from government health offices were considered to provide nation-wide estimates (12 countries).
- II. CS rates retrieved from the WHO Health Indicators Database [10], the WHO European Health for all database [11], or the 2005 WHO World Health Report [12] were assumed as national CS rates unless stated otherwise (52 countries).
- III. CS rates reported in national surveys including the Demographic and Health Surveys (DHS). The DHS reports from surveys conducted since 1990 [13] were included and considered nationally representative (59 countries).

IV. CS rates published in the literature (13 countries) or personal communication by the ministry of health (1 country) were considered to provide country-level estimates if they specifically stated that the figures represented country rates. In published manuscripts reporting hospital CS rates (only considering births occurred at hospital level), we considered them national rates if the country had a proportion of deliveries at health facilities >90%. For countries with a proportion of hospital deliveries <90% the same assumption would result in overestimates of CS national rates. Thus, in those cases we adjusted the rate by multiplying the CS rate by the proportion of births in health facilities. When the proportion of hospital deliveries was not available, we used the proportion of births attended by skilled health personnel (4 countries).

When country data were available for several years or several sources, the most recent data were retrieved. In cases in which data from different sources differed, the most reliable source was used at the authors' judgement. Sources of data for each included country are shown in Web Table 1

Estimation of worldwide number of CS needed and in excess

The annual number of CS performed in each country was calculated multiplying the CS rate by the annual number of births. The number of births was obtained from health statistics provided by UNICEF for year 2008 [14]. Data by country is available in web table 1.

The adequate range for the CS rate in a country remains a matter of debate. [9,15-17] We based our decisions on the following assumptions:

1. The recommended minimum necessary CS rate at population level to avoid death and severe morbidity in the mother lays between 1-5%, according to WHO and others. [15-17] Regarding neonatal outcomes, studies evaluating the association of CS rates with neonatal death have shown outcome improvements up to a CS rate of 10%. [2,3,6] Thus the minimum threshold for a population level CS rate could be considered to lay between 5-10%.
2. Regarding the upper level, the best known recommended upper limit is 15%, suggested by WHO in 1985. [9] Although these figures are based on theoretical estimates, two recent observational studies support that recommendation. [3,6] Both studies assessed the association between CS rates and mortality and morbidity in mothers and neonates, and found no reductions in those indicators when frequency of caesarean section was more than 15%. Moreover, one study showed that an increased rate of intervention was associated with higher mortality and morbidity in mothers and neonates. [6] Until further research gives new evidence, rates >15% may result in more harm than good. [1]

On the basis of the two assumptions above, we primarily classified countries in three groups according to the national rates of CS: (i) Countries where CS is underused: those with CS rates <10%; (ii) countries with adequate use of CS: those with rates between 10% to 15%; and (iii) countries where CS is overused: with rates >15%. In a secondary more conservative analysis, we expanded the range of the “adequate use of CS” category to 5%-20%.

In countries with CS rates <10%, we calculated the number of additionally needed CS as those required to raise the national rate to 10% and were obtained by multiplying the annual number of births by ten minus the CS rate. In countries with CS rates >15% we calculated the CS in excess as those performed above 15% and were obtained by multiplying the annual number of births by the CS rate minus fifteen. We followed the same approach for the secondary analysis using the 5% as the limit to classify underuse and the 20% as a limit to classify overuse.

Estimation of the cost

A standardized ingredients approach was used to measure the costs of CS. This approach requires information on the quantities of the physical inputs needed and on their unit costs. Only the marginal resources directly associated with the C-section procedure were costed; in other words, none of the routine costs associated with antenatal care visits were included, nor were other services that would be considered part of normal vaginal delivery (such as the costs of skilled birth attendants, tetanus prophylaxis or clean cord practices).

The quantities of inputs required at the point of care were estimated from various sources, including expert opinion and treatment practice guidelines. [18,19] A standardized profile for C-section inputs at point of care was used for all countries, and included: initiation of labour at referral level, diagnosis of obstructed labour and referral, C-section associated devices and medicines, operative facility time, medical human resources time, management of shock including hysterectomy and blood transfusion (assumed for 1% of CS performed), and post-operative hospital stay for stabilization.

The point-of-care input profile was further augmented by standardized estimates of the resources required to establish and maintain these point-of-care services, including programme administration, training, and the corresponding office space, electricity and other services, as well as a variety of standard consumables and equipment. [20-22]

For point-of-care inputs, the cost of 'needed' CS was calculated as the cost of the resources required to bring the country's C-section rate up to 10% (as a proportion of live births in that country); the cost of 'excess' CS was calculated as the cost of the resources involved in

performing CS in excess of 15% (of live births in that country). For the costs of programme administration etc., which are not incurred at the point of care, only the proportional component of the costs attributable to the 'excess' or 'needed' CS, respectively, was included in estimates of total costs.

Unit costs for the inputs identified were derived from a search of published and unpublished literature and databases, as well as from consultation with costing experts. For goods traded internationally, the most competitive international price identified was used. For example, drug prices were estimated on the basis of the median supply price published in the International Drug Price Indicator Guide, with a standardized mark-up applied to account for transportation and distribution. [23] For goods available only locally (e.g. human resources, inpatient bed days) costs have been shown to vary substantially across countries [22], so cross-country regressions accounting for national income levels and local characteristics of the supply of health care were used to generate estimates of unit costs. [20, 24]

Results

CS rates were obtained for 137 countries from 192 United Nations member states of the world [25], representing 95% of global births in the year 2008 [14]. In 133 countries the available CS rates were considered national rates. For 4 low and middle income countries, national figures were estimated from hospital rates adjusted as explained above (Web Table 1).

We calculated that approximately 18.5 million cesarean sections are performed yearly worldwide. About 40% of the countries have CS rates <10%, about 10% have CS rates between 10 and 15%, and approximately 50% have CS rates >15% (Table 1). 54 countries with CS rates <10% account for only 25% (4.5 millions) of the global CS but for 60% (77 millions) of the total number of births worldwide. On the other hand, 73% (13.5 millions) of the total number of CS are performed in the 69 countries with CS rates >15% where 37.5% (48.4 millions) of the total number of births occur.

Table 2 and 3 list the CS rate and the numbers of additionally needed CS and CS in excess by country. We calculated that 3.2 million additional CS would be needed in the 54 countries with CS rates <10%. The vast majority of these countries are from Africa (68.5%), 29.6% from Asia and 1 country from Latin America and the Caribbean.

Table 2 shows that 6 countries (Nigeria, India, Ethiopia, Congo Democratic Republic, Pakistan and Indonesia) account for 50% of the total number of additional CS needed. Using 5% as the threshold rate to define the underuse of CS, nearly 1 million CS would be additionally needed in 33 countries.

On the other hand, Table 3 shows that 6.2 million CS in excess are yearly performed. China and Brazil account almost for 50% of the total number of unnecessary CS. Using 20% as the threshold rate to define the overuse of CS, 4 million CS are in excess in 46 countries.

The cost of global 'excess' CS in 2008 was estimated to amount to approximately US\$ 2.32 billion (all costs are denominated in 2005 constant \$), while the cost of the global 'needed' CS in 2008 was estimated to amount to approximately US\$ 432 million (Table 2 and 3). In countries with 'needed' CS, the average cost of a C-section was estimated to be approximately US\$ 135; whereas in countries with excess CS, the average cost of the procedure was estimated as approximately US\$ 373, meaning that CS are estimated to be about 2.8 times more expensive in countries with 'excess' procedures than in those where procedures are 'needed'. The lowest cost per ('needed') procedure was found to be in Nepal (US\$ 97), whereas the highest cost per ('excess') procedure was found to be in Iceland (US\$ 18,040). Furthermore, the number of global 'excess' CS in 2008 exceeded the number of 'needed' ones by a factor of approximately 1.9.

However, since 'excess' CS occur in countries with, on average, substantially higher costs (mainly on account of higher average income levels), the combined implications of higher costs per procedure and a higher number of procedures is that the total cost of 'excess' CS in 2008 was approximately 5.4 times the cost of the 'needed' procedures.

'Excess' CS could thus potentially finance the 'needed' ones over 5 times over; in other words, if all the resources currently devoted to 'excess' CS could be directed towards countries where additional procedures are 'needed', the 'needed' procedures could be fully financed and there would in addition be a surplus of resources with a value of nearly US\$ 2 billion.

Discussion

This analysis shows that every year in the world there is an additional need for 0.8 – 3.2 million CS in low income countries where 60% of the world's births occur. Simultaneously, 4.0-6.2 million CS in excess are performed in middle and high income countries where 37.5% of the births occur. From a population based approach, those CS in excess are likely to be medically unjustified and should be then considered unnecessary CS.

This analysis has several strengths. We were able to retrieve nationally representative CS rates from 137 countries representing more than 95% of the world annual number of births. The sources of these estimates are considered reliable and valid, and are all publicly available. The DHS programme represents the largest worldwide effort to obtain nationally representative demographic and health data from household surveys in developing countries. Surveys are implemented by institutions in the host country, usually government statistical offices, and 5,000–30,000 women of childbearing age are interviewed in a standard survey. As the DHS use standardized questionnaires and methods of training, data collection and processing, they are often considered the 'best available gold standard' for many health indicators in developing countries and are used for global monitoring efforts. [26,27] DHS figures are considered valid estimations of actual CS rates at country level, although they might be imprecise. [28]

The CS rates limits used to define underuse and overuse may be a matter for discussion since any classification has some constraints. The 15% upper limit suggested by WHO in 1985 could be less valid nowadays taken in account changes of the population in high income countries, such as mother's age at the first child, birthweight and other factors that may result in needing more or less CS. However, as we mentioned above, recent studies have shown that until now there is no evidence of benefit for the health of mothers and babies in populations with values of CS above 15%. [2,3,5-8] Regarding the lower limit, it has been argued that CS rates of 5% could achieve major improvement on maternal outcomes. However, for neonatal health, rates between 5% and 10% have been reported to attain better outcomes. [1-4] Yet, and acknowledging the debatable nature of these limits, we made a secondary analysis broadening the range of cesarean section rates that can be considered adequate use. The figures are nonetheless striking.

The study has limitations mainly related to the data quality that cannot be excluded as possible explanations of the findings. The validity of the analyses presented is crucially dependent on the extent to which CS rates are representative of each country. [29-30] It is more likely that CS rates were more imprecise in low-income countries than in middle- or high-income countries. 45% of the estimates are from DHS surveys, or needed to be adjusted from hospital rates, all of them low-income countries. Therefore it is more likely that the needed number of CS is a much more imprecise figure than the number of CS in excess, which is based on much more reliable data.

These results show an unequal distribution of a major medical intervention. On one hand, low and some middle income countries should improve accessibility to this intervention which could reduce adverse maternal and perinatal outcomes. [2-5] At the other extreme, in high and

in some middle income countries, excessive use of this surgical procedure could result in added morbidity and no discernable benefits. [8,31-32]

Worldwide, CS that are possibly, in the large majority at least, medically unnecessary appear to command a disproportionate share of global economic resources. Since these resources could potentially be directed towards other, medically necessary, objectives, both in the countries where the 'excess' procedures occur and elsewhere, in the face of limited resources, 'excess' CS (as well as other overused procedures, drugs and services) can function as a potent barrier to universal coverage with necessary health services. 'Excess' CS can therefore have important negative implications for health equity both within and across countries.

Concerted actions need to be taken to offer timely CS to women in need and to advocate for a rationale use of CS in countries with a surplus and unnecessary use of this procedure. One possible outcome of this approach would be to progressively engage professional associations, health care organizations and the general public in richer countries to support programmes aimed at providing emergency obstetric care in very low resource settings. The argument of some countries having more of what others totally lack, which for example has been used in the past to generate awareness and stimulate international action in cases of food crisis and famine in the third world, could apply to the lack of CS and emergency obstetric care as well.

References

- 1) Althabe F, Belizán JM. Caesarean section: the paradox. *Lancet*. 2006; 368 (9546):1472-3.
- 2) Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. *Paediatr Perinat Epidemiol*. 2007; 21 (2):98-113.
- 3) Althabe F, Sosa C, Belizán JM, Gibbons L, Jacquerioz F, Bergel E. Cesarean section rates and maternal and neonatal mortality in low-, medium-, and high-income countries: an ecological study. *Birth*. 2006; 33 (4): 270-7.
- 4) Ronsmans C, Holtz S, Stanton C. Socioeconomic differentials in caesarean rates in developing countries: a retrospective analysis. *Lancet* 2006; 368 (9546): 1516–23.
- 5) Belizán JM, Althabe F, Cafferata ML. Health Consequences of the Increasing Caesarean Section Rates. *Epidemiology*. 2007; 18 (4): 485-6.
- 6) Villar J, Valladares E, Wojdyla D, Zavaleta N, Shah A, Campodónico L, et al. Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. *Lancet* 2006; 367 (9525): 1819–29.
- 7) Barros FC, Victora CG, Barros AJ, Santos IS, Albernaz E, Matijasevich A, et al. The challenge of reducing neonatal mortality in middle income countries: findings from three Brazilian birth cohorts in 1982, 1993, and 2004. *Lancet* 2005; 365 (9462): 847–54.
- 8) Hall MH, Bewley S. Maternal mortality and mode of delivery. *Lancet*, 1999; 354 (9180): 776.
- 9) World Health Organization. Appropriate technology for birth. *Lancet* 1985; 2 (8452): 436-7
- 10) World Health Organization. WHO Core health Indicators. Statistical Information System. Available at: http://apps.who.int/whosis/database/core/core_select.cfm. Accessed May 10, 2010.
- 11) World Health Organization. WHO European Regional Office Health for all database. Available at: <http://data.euro.who.int/hfadb>. Accessed May 10, 2010.
- 12) World Health Organization. World Health Report 2005. Available at: <http://www.who.int/whr/2005/annex>. Published 2005. Accessed May 10, 2010.
- 13) Demographic and Health Surveys. Available at: <http://www.measuredhs.com>. Accessed March 10, 2010.
- 14) UNICEF. Basic Indicators 2008. Available at: http://www.unicef.org/spanish/rightsite/sowc/pdfs/statistics/SOWC_Spec_Ed_CRC_TABLE%201.%20BASIC%20INDICATORS_EN_111309.pdf. Accessed May 10, 2010.

- 15) Dumont A, de Bernis L, Bouvier-Colle MH, Breart G, MOMA study group. Caesarean section rate for maternal indication in sub-Saharan Africa: a systematic review. *Lancet* 2001; 358 (9290): 1328–33.
- 16) Ronsmans C, Van Damme W, Filippi V, Pittrof R. Need for caesarean sections in west Africa. *Lancet* 2002; 359 (9310): 974.
- 17) De Brouwere V, Dubourg D, Richard F, Van Lerberghe W. Need for caesarean sections in West Africa [Letter]. *Lancet* 2002; 359 (9310): 974-5.
- 18) World Health Organization. Managing complications in pregnancy and childbirth: a guide for midwives and doctors. Available at: http://www.who.int/making_pregnancy_safer/survey/en/index.html. Accessed May 10, 2010.
- 19) World Health Organization. Pregnancy, childbirth, postpartum and newborn care: a guide for essential practice. Available at: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/924159084X/en/index.html. Accessed May 10, 2010.
- 20) Adam T, Evans DB, Murray CJL. Econometric estimation of country-specific hospital costs. *Cost Eff Resour Alloc.* 2003 Feb 26;1(1):3.
- 21) Johns B, Baltussen R, Hutubessy RCW. Programme costs in the economic evaluation of health interventions. *Cost Eff Resour Alloc.* 2003 Feb 26;1(1):1.
- 22) Johns B, Adam T, Evans DB. Enhancing the comparability of costing methods: cross-country variability in the prices of non-traded inputs to health programmes. *Cost Eff Resour Alloc.* 2006 Apr 24;4:8.
- 23) Johns B, Baltussen R. Accounting for the cost of scaling-up health interventions. *Health Econ.* 2004 Nov;13(11):1117-24.
- 24) Adam T, Evans D. Determinants of variation in the cost of inpatient stays versus outpatient visits in hospitals: a multi-country analysis. *Soc Sci Med.* 2006 Oct;63(7):1700-10.
- 25) United Nations. Member States of the United Nations. Available at: <http://www.un.org/members/list.shtml>. Accessed October 31, 2009.
- 26) Murray CJL, Shengelia B, Gupta N, Moussavi S, Tandon A, Thieren M. Validity of reported vaccination coverage in 45 countries. *Lancet* 2003; 362:1022-1027.
- 27) Bryce J, Requejo J. The Countdown 2008 report: Tracking progress in maternal, newborn, and child survival. New York: UNICEF; 2008.
- 28) Stanton CK, Dubourg D, De Brouwere V, et al. Reliability of data on cesarean sections in developing countries. *Bull World Health Organ* 2005;83(6):449–455.
- 29) Susser M. The logic in ecological: I. The logic of analysis. *Am J Public Health* 1994;84:825–829.
- 30) Greenland S. Ecologic versus individual-level sources of bias in ecologic estimates of contextual health effects. *Int J Epidemiol* 2001;30:1343–1350.

- 31) Minkoff H, Chervenak FA. Elective primary cesarean delivery. *N Engl J Med.* 2003; 348 (10): 946-50.
- 32) Belizán JM, Cafferata ML, Althabe F, Buekens P. Risk of patient choice cesarean. *Birth* 2006; 33 (2):167-9.

Acknowledgements

We thank Agustina Mazzoni, Laura Gutierrez and María L. Cafferata for their contribution in obtaining national figures of cesarean sections.

Authors contributions

JMB, LG and JAL participated in the conception of the study. All the authors were involved in the design of the study. LG, APB and JAL performed the data collection. LG and JAL participated in the analysis of the data. All authors participated in the interpretation of data and in the first drafting and final version of the manuscript.

Table 1. Distribution of countries and number of cesarean sections and births according to the cesarean section rate categories

Cesarean Rates	Section	Countries		Annual number of cesarean sections (thousands)		Annual number of births (year 2006) (thousands)	
		N	%	N	%	N	%
<10%		54	39.4	4,556	24.7	77,417	60.0
Between 10 and 15%		14	10.2	414	2.2	3,177	2.5
>15%		69	50.4	13,479	73.1	48,390	37.5
Total		137	100.0	18,449	100.0	128,984	100.0

Table 2. Cesarean section rates, number of needed cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates below 10% sorted according the contribution on number of needed cesarean section

Country	Cesarean section rate (%)	Cesarean sections needed for year 2008			Estimated cost per year (US dollars)
		N	%	Cumulative %	
Nigeria	1.8	494,296	15.5	15.5	68,411,688
India	8.5	403,695	12.7	28.2	42,213,047
Ethiopia	1.0	278,370	8.7	36.9	36,940,008
Congo Democratic Republic	4.0	173,160	5.4	42.4	22,755,622
Pakistan	7.3	144,099	4.5	46.9	22,179,934
Indonesia	6.8	135,040	4.2	51.1	19,532,824
United Republic of Tanzania	3.2	120,428	3.8	54.9	16,790,318
Uganda	3.1	101,154	3.2	58.1	14,225,390
Kenya	4.0	90,360	2.8	60.9	12,563,130
Bangladesh	7.5	85,750	2.7	63.6	8,411,331
Sudan	3.7	81,648	2.6	66.2	12,771,298
Yemen	1.4	72,756	2.3	68.5	11,345,196
Niger	1.0	71,190	2.2	70.7	9,032,588
Mozambique	1.9	70,956	2.2	72.9	9,732,704
Burkina Faso	0.7	67,053	2.1	75.0	9,369,356
Madagascar	1.0	61,830	1.9	77.0	7,942,153
Cameroon	2.0	56,320	1.8	78.7	8,135,070
Nepal	2.7	53,436	1.7	80.4	5,167,033
Chad	0.4	47,808	1.5	81.9	6,671,882
Mali	1.6	45,528	1.4	83.3	6,122,609
Malawi	3.1	41,331	1.3	84.6	5,502,267
Zambia	3.0	37,940	1.2	85.8	5,635,761
Guinea	1.7	32,536	1.0	86.9	4,230,705
Senegal	3.3	31,490	1.0	87.8	4,450,548
Morocco	5.4	29,716	0.9	88.8	5,011,048
Cambodia	1.8	29,602	0.9	89.7	4,390,270
Rwanda	2.9	28,613	0.9	90.6	3,932,504
Algeria	6.0	28,560	0.9	91.5	5,720,662
Côte d'Ivoire	6.4	25,992	0.8	92.3	3,980,374
Ghana	6.9	23,467	0.7	93.1	3,190,301
Benin	3.6	21,888	0.7	93.7	3,099,599
Uzbekistan	6.3	20,461	0.6	94.4	2,757,576
Zimbabwe	4.8	19,656	0.6	95.0	2,749,128
Haiti	3.0	19,110	0.6	95.6	2,950,103
Sierra Leone	1.5	18,955	0.6	96.2	2,406,541
Togo	2.0	17,040	0.5	96.7	2,255,330
Tajikistan	2.1	15,247	0.5	97.2	2,043,552

Table 2. Cesarean section rates, number of needed cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates below 10% sorted according the contribution on number of needed cesarean section (cont.)

Country	Cesarean section rate (%)	Cesarean sections needed for year 2008			Estimated cost per year (US dollars)
		N	%	Cumulative %	
Eritrea	2.7	13,286	0.4	97.6	1,851,706
Central African Republic	1.9	12,474	0.4	98.0	1,957,447
Philippines	9.5	11,180	0.4	98.4	1,699,029
Liberia	3.5	9,425	0.3	98.7	1,278,555
Mauritania	3.2	7,344	0.2	98.9	1,184,720
Turkmenistan	3.8	6,882	0.2	99.1	1,237,991
Kyrgyzstan	5.8	5,040	0.2	99.3	693,914
Azerbaijan	7.6	3,984	0.1	99.4	597,711
Libyan Arab Jamahiriya	7.5	3,675	0.1	99.5	1,831,130
Tunisia	8.0	3,280	0.1	99.6	1,148,971
Lesotho	5.1	2,891	0.1	99.7	584,603
Mongolia	5.0	2,500	0.1	99.8	466,605
Oman	6.6	2,074	0.1	99.8	1,262,700
Gabon	5.6	1,760	0.1	99.9	635,007
Viet Nam	9.9	1,494	0.0	99.9	223,244
Comoros	5.3	987	0.0	100.0	139,393
Swaziland	7.9	735	0.0	100.0	165,915
Total		3,185,492	100.0		431,578,091

Table 3. Cesarean section rates, number of unnecessary cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates above 15% sorted according the contribution on number of unnecessary cesarean section

Country	Cesarean section rate (%)	Unnecessary cesarean sections for year 2008			Estimated cost per year (US dollars)
		N	%	Cumulative %	
China	25.9	1,976,606	31.8	31.8	326,574,644
Brazil	45.9	960,687	15.4	47.2	226,777,248
United States	30.3	673,047	10.8	58.0	687,167,996
Mexico	37.8	467,172	7.5	65.5	122,783,410
Iran	41.9	373,372	6.0	71.5	108,495,217
Egypt	27.6	253,890	4.1	75.6	41,085,585
Argentina	35.2	139,178	2.2	77.9	32,742,409
Italy	38.2	126,672	2.0	79.9	103,505,894
Colombia	26.7	107,406	1.7	81.6	23,027,552
Republic of Korea	37.7	102,604	1.6	83.3	30,381,162
Germany	27.8	85,248	1.4	84.6	72,307,555
Turkey	21.2	83,576	1.3	86.0	17,738,346
South Africa	20.6	61,096	1.0	87.0	12,241,688
Venezuela	25.1	60,499	1.0	87.9	15,395,020
Dominican Republic	41.9	60,256	1.0	88.9	16,125,808
Peru	24.1	55,663	0.9	89.8	11,316,358
Spain	25.9	53,519	0.9	90.7	39,899,298
United Kingdom	22.0	52,010	0.8	91.5	38,814,108
Russian Federation	18.0	46,350	0.7	92.3	32,191,503
Ecuador	29.8	41,650	0.7	92.9	9,574,142
Australia	30.3	40,851	0.7	93.6	37,990,115
Canada	26.3	39,889	0.6	94.2	47,598,044
Chile	30.7	39,407	0.6	94.9	11,107,876
France	18.8	28,576	0.5	95.3	23,122,636
Paraguay	32.2	26,466	0.4	95.7	5,701,984
Japan	17.4	24,816	0.4	96.1	28,186,982
Cuba	35.6	24,308	0.4	96.5	23,457,645
Thailand	17.4	23,448	0.4	96.9	3,948,376
Portugal	34.0	19,950	0.3	97.2	23,885,569
Romania	23.6	18,404	0.3	97.5	4,546,021
Hungary	28.0	12,870	0.2	97.7	25,833,427
El Salvador	25.0	12,400	0.2	97.9	3,024,630
Switzerland	28.9	10,147	0.2	98.1	20,277,952
Bolivia	18.6	9,468	0.2	98.2	1,573,282
Austria	27.1	9,196	0.1	98.4	10,232,906
Bulgaria	26.8	8,614	0.1	98.5	2,296,566
Uruguay	31.8	8,400	0.1	98.7	3,289,353
Nicaragua	20.6	7,890	0.1	98.8	1,488,783

Table 3. Cesarean section rates, number of unnecessary cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates above 15% sorted according the contribution on number of unnecessary cesarean section (cont.)

Country	Cesarean section rate (%)	Unnecessary cesarean sections for year 2008			Estimated cost per year (US dollars)
		N	%	Cumulative %	
Ireland	26.2	7,728	0.1	98.9	14,925,165
Israel	19.1	5,740	0.1	99.0	3,648,685
Jordan	18.5	5,495	0.1	99.1	1,688,279
Lebanon	23.3	5,478	0.1	99.2	2,237,762
Belarus	20.5	5,280	0.1	99.3	2,994,307
Albania	25.6	4,876	0.1	99.3	1,058,556
Costa Rica	20.8	4,350	0.1	99.4	1,149,694
Poland	16.1	4,092	0.1	99.5	1,031,147
Denmark	21.4	3,968	0.1	99.5	6,106,812
Georgia	22.2	3,744	0.1	99.6	693,756
Czech Republic	18.4	3,706	0.1	99.7	2,753,787
New Zealand	20.4	3,132	0.1	99.7	5,752,100
Slovakia	20.0	2,750	0.0	99.8	847,305
Sweden	17.3	2,461	0.0	99.8	3,263,538
Panama	18.2	2,240	0.0	99.8	687,235
Latvia	23.3	1,909	0.0	99.9	10,989,789
Lithuania	20.5	1,705	0.0	99.9	3,698,045
Belgium	15.9	1,071	0.0	99.9	861,686
Norway	16.6	928	0.0	99.9	1,915,956
Estonia	20.0	800	0.0	99.9	5,333,068
Finland	16.3	767	0.0	100.0	810,936
Malta	32.0	680	0.0	100.0	570,687
Croatia	16.4	588	0.0	100.0	736,864
Luxembourg	24.0	450	0.0	100.0	1,624,920
The FYR of Macedonia	16.9	418	0.0	100.0	489,542
Slovenia	16.8	342	0.0	100.0	648,372
Serbia	16.9	152	0.0	100.0	86,426
Bahrain	16.0	140	0.0	100.0	76,645
Qatar	15.9	135	0.0	100.0	563,930
Andorra	23.7	87	0.0	100.0	219,653
Iceland	15.6	30	0.0	100.0	541,213
Total		6,220,844	100.0		2,323,712,950

Web table 1. Cesarean sections rates and sources of data by country sorted by cesarean section rate

Country	Cesarean section			Births (per 1,000)
	Rate	Source	Year 's Source	
Brazil	45.9	Ministério de Saúde Brasil. Departamento de Informática do SUS (Accessed February 10, 2010. Available at: http://tabnet.datasus.gov.br/cgi/tabcgi.exe?idb2008/f08.def)	2006	3105
Dominican Republic	41.9	Centro de Estudios Sociales y Demográficos (CESDEM) y Macro International Inc. 2008. Encuesta Demográfica y de Salud 2007. Santo Domingo, República Dominicana: CESDEM y Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR205/FR205.pdf)	2007	224
Iran	41.9	Shahla Chaichian, Ali Akhlaghi, Firouzeh Rousta, Mahboobeh Safavi. Experience of Water Birth Delivery in Iran. Archives of Iranian Medicine, Volume 12, Number 5, 2009: 468 – 471 (Accessed December 10, 2009. Available at: http://www.ams.ac.ir/aim/09125/007.pdf)	2000	1388
Italy	38.2	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	546
Mexico	37.8	Villar J, et al. Cesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. Lancet. 2006 Jun 3;367 (9525):1819-29.	2005	2049
Republic of Korea	37.7	Lee SI, Khang YH, Lee MS. Women's attitudes toward mode of delivery in South Korea. A society with high cesarean sections rates. Birth 2004;31:108-116	2003	452
Cuba	35.6	Villar J, et al. Cesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. Lancet. 2006 Jun 3;367 (9525):1819-29.	2005	118
Argentina	35.2	Villar J, et al. Cesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. Lancet. 2006 Jun 3;367 (9525):1819-29.	2005	689
Portugal	34.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	105
Paraguay*	32.2	Villar J, et al. Cesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. Lancet. 2006 Jun 3;367 (9525):1819-29.	2005	154
Malta	32.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	4
Uruguay	31.8	Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. Paediatric and Perinatal Epidemiology 2007; 21:00 98-113.	2007	50

Chile	30.7	Betrán AP, Meriardi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	2002	251
Australia	30.3	Laws PJ, Abeywardana S, Walker J & Sullivan EA 2007. Australia's mothers and babies 2005. Perinatal statistics series no. 20. Cat. no. PER 40. Sydney: AIHW National Perinatal Statistics Unit (Accessed February 10, 2010. Available at: http://www.aihw.gov.au/publications/per/amb05/amb05.pdf)	2005	267
United States	30.3	Hamilton BE, Martin JA, Ventura SJ. Births: Preliminary data for 2007. National vital statistics reports, Web release; vol 57 no 12. Hyattsville, MD: National Center for Health Statistics. Released March 18, 2009 (Accessed February 10, 2010. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_12.pdf)	2007	4399
Ecuador**	29.8	Villar J, et al. Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. <i>Lancet</i> . 2006 Jun 3;367 (9525):1819-29.	2005	281
Switzerland	28.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	73
Hungary	28.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	99
Germany	27.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	666
Egypt	27.6	El-Zanaty, Fatma and Ann Way. 2009. Egypt Demographic and Health Survey 2008. Cairo, Egypt: Ministry of Health, El-Zanaty and Associates, and Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR220/FR220.pdf)	2008	2015
Austria	27.1	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	76
Bulgaria	26.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	73
Colombia	26.7	Ojeda G, Ordoñez M, Ochoa LH. Salud Sexual y Reproductiva en Colombia. Encuesta Nacional de Demografía y Salud 2005 (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR172/10Cap%C3%ADtulo10.pdf)	2005	918
Canada	26.3	British Columbia Perinatal Health Program. Caesarean Birth Task Force Report 2008. Vancouver, BC. February 2008 (Accessed February 10, 2010. Available at: http://www.canadianmidwives.org/pdf/CBTF_FinalApril08.pdf)	2005-2006	353
Ireland	26.2	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	69
China	25.9	Ronsmans C, Holtz S, Stanton C. Socioeconomic differentials in caesarean rates in developing countries: a retrospective analysis. <i>The Lancet</i> , Volume 368, Issue 9546, Pages 1516 - 15236	2003	18134

Spain	25.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	491
Albania	25.6	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	46
Venezuela	25.1	Betrán AP, Meriardi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	2002	599
El Salvador	25.0	Asociación Demográfica Salvadoreña, CDC, USAID. República de El Salvador, CA. Encuesta Nacional de Salud Familiar. Informe final. FESAL-2008	2008	124
Peru†	24.1	Villar J, et al. Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. <i>Lancet</i> . 2006 Jun 3;367 (9525):1819-29.	2005	609
Luxemburg	24.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2004	5
Andorra	23.7	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	1999	1
Romania	23.6	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	214
Latvia	23.3	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	23
Lebanon	23.3	Betrán AP, Meriardi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	1999–00	66
Georgia	22.2	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	52
United Kingdom	22.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2004	743
Denmark	21.4	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	62
Turkey	21.2	Hacettepe University Institute of Population Studies, Turkey Demographic and Health Survey, 2003. Hacettepe University Institute of Population Studies, Ministry of Health General Directorate of Mother and Child Health and Family Planning, State Planning Organization and European Union. Ankara, Turkey (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR160/10chapter10.pdf)	2003	1348

Costa Rica	20.8	Belizan JM, Althabe F, Barros FC, Alexander S. Rates and implications of cesarean sections in Latin America: Ecological study. <i>BMJ</i> 1999; 319: 1397-1400.	1993	75
Nicaragua‡	20.6	Villar J, et al. Caesarean delivery rates and pregnancy outcomes: the 2005 WHO global survey on maternal and perinatal health in Latin America. <i>Lancet</i> . 2006 Jun 3; 367 (9525): 1819-29.	2005	140
South Africa	20.6	Department of Health, Medical Research Council, OrcMacro. 2007. South Africa Demographic and Health Survey 2003. Pretoria: Department of Health (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR206/FR206.pdf)	2003	1091
Belarus	20.5	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	96
Lithuania	20.5	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	31
New Zealand	20.4	Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	1999	58
Estonia	20.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	16
Slovakia	20.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	55
Israel	19.1	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	140
France	18.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2003	752
Bolivia	18.6	Ministerio de Salud y Deportes (MSD), Programa Reforma de Salud (PRS), Instituto Nacional de Estadística (INE) y Macro International. 2009. Encuesta Nacional de Demografía y Salud ENDSA 2008. La Paz, Bolivia: MSD, PRS, INE y Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR228/FR228%5B08Feb2010%5D.pdf)	2008	263
Jordan	18.5	Department of Statistics [Jordan] and Macro International Inc. 2008. Jordan Population and Family Health Survey 2007. Calverton, Maryland, USA: Department of Statistics and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR209/FR209.pdf)	2007	157
Czech Republic	18.4	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	109
Panama	18.2	Belizan JM, Althabe F, Barros FC, Alexander S. Rates and implications of cesarean sections in Latin America: Ecological study. <i>BMJ</i> 1999; 319: 1397-1400.	1996	70

Russian Federation	18.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	1545
Japan	17.4	Maternal and Child Health Statistics of Japan. Published by Mothers' & Children's Health Organization, Tokyo, Japan, 2007.	2005	1034
Thailand	17.4	Betrán AP, Meriardi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	2001	977
Sweden	17.3	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	107
Serbia	16.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	8
The FYR of Macedonia	16.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	22
Slovenia	16.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	19
Norway	16.6	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	58
Croatia	16.4	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	42
Finland	16.3	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	59
Poland	16.1	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	1997	372
Bahrain	16.0	World Health Organization. The world health report 2005. Basic Indicators (Accessed at December 10, 2009. Available at: http://www.who.int/whr/2005/annex/indicators_country_a-f.pdf)	1995	14
Belgium	15.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	1999	119
Qatar	15.9	Betrán AP, Meriardi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	1998	15
Iceland	15.6	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	5

Syrian Arab Republic	15.0	Khawaja M, Choueiry N, Jurdi R. "Hospital-based Caesarean section in the Arab region: an overview". Eastern Mediterranean health journal. 2009;15(2):458-69 (Accessed December 10, 2009. Available at: http://www.emro.who.int/emhj/1502/15_2_2009_0458_0469.pdf)	2002	590
Ukraine	14.2	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	459
Armenia	14.1	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	47
Netherlands	13.5	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2005	185
Honduras	13.0	Secretaría de Salud [Honduras], Instituto Nacional de Estadística (INE) y Macro International. 2006. Encuesta Nacional de Salud y Demografía 2005-2006. Tegucigalpa, Honduras: SS, INE y Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR189/FR189.pdf)	2005 -2006	202
Saudi Arabia	13.0	Khawaja M, Choueiry N, Jurdi R. "Hospital-based Caesarean section in the Arab region: an overview". Eastern Mediterranean health journal. 2009;15(2):458-69 (Accessed February 10, 2010. Available at: http://www.emro.who.int/emhj/1502/15_2_2009_0458_0469.pdf)	2002	591
Namibia	12.7	Ministry of Health and Social Services (MoHSS) [Namibia] and Macro International Inc. 2008. Namibia Demographic and Health Survey 2006-07. Windhoek, Namibia and Calverton, Maryland, USA: MoHSS and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR204/FR204.pdf)	2006-2007	59
Montenegro	12.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	115
Moldova, Republic of	11.9	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	45
Guatemala	11.4	Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. Paediatric and Perinatal Epidemiology 2007; 21:00 98-113.	2002	453
Kuwait	11.2	Alnesef Y, Al-Rashoud RH, Farid SM. Kuwait Family Health Survey 1996. Ministry D71 of Health, Kuwait, 2000.	1996	52
Kazakhstan	11.0	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	304
Cape Verde	10.7	Instituto Nacional de Estatística (INE) [Cabo Verde], Ministério da Saúde, e Macro International 2008. Segundo Inquérito Demográfico e de Saúde Reprodutiva, Cabo Verde, IDSR-II, 2005. Calverton, Maryland, USA: INE (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR203/FR203.pdf)	2005	12

United Arab Emirates	10.0	World Health Organization. The world health report 2005. Basic Indicators (Accessed at December 10, 2009. Available at: http://www.who.int/whr/2005/annex/indicators_country_p-z.pdf)	1995	63
Viet Nam	9.9	Committee for Population, Family and Children [Vietnam], and ORC Macro. 2003. Vietnam Demographic and Health Survey 2002. Calverton, Maryland, USA: Committee for Population, Family and Children and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR139/08Chapter08.pdf)	2002	1494
Philippines	9.5	National Statistics Office (NSO) [Philippines], and ICF Macro. 2009. National Demographic and Health Survey 2008. Calverton, Maryland: National Statistics Office and ICF Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR224/FR224.pdf)	2008	2236
India	8.5	International Institute for Population Sciences (IIPS) and Macro International. 2007. National Family Health Survey (NFHS-3), 2005–06: India: Volume I. Mumbai: IIPS (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FRIND3/08Chapter08.pdf)	2005 -2006	26913
Tunisia	8.0	World Health Organization. The world health report 2005. Basic Indicators (Accessed at December 10, 2009. Available at: http://www.who.int/whr/2005/annex/indicators_country_p-z.pdf)	2000	164
Swaziland	7.9	Central Statistical Office (CSO) [Swaziland], and Macro International Inc. 2008. Swaziland Demographic and Health Survey 2006-07. Mbabane, Swaziland: Central Statistical Office and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR202/FR202.pdf)	2006-2007	35
Azerbaijan	7.6	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	166
Bangladesh	7.5	National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International 2009. Bangladesh Demographic and Health Survey 2007. Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training, Mitra and Associates, and Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR207/FR207%5BApril-10-2009%5D.pdf)	2007	3430
Libyan Jamahiriya	Arab 7.5	Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	1995	147
Pakistan	7.3	National Institute of Population Studies (NIPS) [Pakistan], and Macro International Inc. 2008. Pakistan Demographic and Health Survey 2006-07. Islamabad, Pakistan: National Institute of Population Studies and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR200/FR200.pdf)	2006-2007	5337
Ghana	6.9	Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF Macro. 2009. Ghana Demographic and Health Survey 2008. Accra, Ghana: GSS, GHS, and ICF Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR221/FR221.pdf)	2008	757
Indonesia	6.8	Statistics Indonesia (Badan Pusat Statistik—BPS) and Macro International. 2008. Indonesia Demographic and Health Survey 2007. Calverton, Maryland, USA: BPS and Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR218/FR218%5BApril-09-2009%5D.pdf)	2007	4220

Oman	6.6	Sulaiman AJM, Al-Riyami A, Farid SM. Oman Family Health Survey 1995. Ministry of Health, Muscat, 2000.	1995	61
Cote d'Ivoire	6.4	Institut National de la Statistique (INS) et Ministère de la Lutte contre le Sida [Côte d'Ivoire] et ORC Macro. 2006. Enquête sur les Indicateurs du Sida, Côte d'Ivoire 2005. Calverton, Maryland, U.S.A. : INS et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/AIS5/AIS5.pdf)	2005	722
Uzbekistan	6.3	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	553
Algeria	6.0	World Health Organization. The world health report 2005. Basic Indicators (Accessed at December 10, 2009. Available at: http://www.who.int/whr/2005/annex/indicators_country_a-f.pdf)	2000	714
Kyrgyzstan	5.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	120
Gabon	5.6	Direction Générale de la Statistique et des Études Économiques (DGSEE) [Gabon] et ORC Macro. 2001. Enquête Démographique et de Santé Gabon 2000. Calverton, Maryland : Direction Générale de la Statistique et des Études Économiques, et Fonds des Nations Unie (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR122/08chapitre08.pdf)	2000	40
Morocco	5.4	Ministère de la Santé [Maroc], ORC Macro, et Ligue des États Arabes. 2005. Enquête sur la Population et la Santé Familiale (EPSF) 2003-2004. Calverton, Maryland, USA : Ministère de la Santé et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR155/08Chapitre08.pdf)	2003-2004	646
Comoros	5.3	Mondoha, Kassim A., Juan Schoemaker et Monique Ban'ere. 1997. Enquête Démographique et de Santé, Comores 1996. Calverton, Maryland : Centre National de Documentation et de Recherche Scientifique et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR79/07Chapitre7.pdf)	1996	21
Lesotho	5.1	Ministry of Health and Social Welfare (MOHSW) [Lesotho], Bureau of Statistics (BOS) [Lesotho], and ORC Macro. 2005. Lesotho Demographic and Health Survey 2004. Calverton, Maryland: MOH, BOS, and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR171/09Chapter09.pdf)	2004	59
Mongolia	5.0	World Health Organization. The world health report 2005. Basic Indicators (Accessed at December 10, 2009. Available at: http://www.who.int/whr/2005/annex/indicators_country_g-o.pdf)	2000	50
Zimbabwe	4.8	Central Statistical Office (CSO) [Zimbabwe] and Macro International Inc. 2007. Zimbabwe Demographic and Health Survey 2005-06. Calverton, Maryland: CSO and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR186/FR186.pdf)	2005-2006	378
Congo Democratic Republic	4.0	Ministère du Plan et Macro International. 2008. Enquête Démographique et de Santé, République Démocratique du Congo 2007. Calverton, Maryland, U.S.A. : Ministère du Plan et Macro International (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR208/FR208.pdf)	2007	2886

Kenya	4.0	Central Bureau of Statistics (CBS) [Kenya], Ministry of Health (MOH) [Kenya], and ORC Macro. 2004. Kenya Demographic and Health Survey 2003. Calverton, Maryland: CBS, MOH, and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR151/09Chapter09.pdf)	2003	1506
Turkmenistan	3.8	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2007	111
Sudan	3.7	Betrán AP, Meriáldi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M. Rates of caesarean section: analysis of global, regional and national estimates. <i>Paediatric and Perinatal Epidemiology</i> 2007; 21:00 98-113.	1993	1296
Benin	3.6	Institut National de la Statistique et de l'Analyse Économique (INSAE) [Bénin] et Macro International Inc. 2007 : Enquête Démographique et de Santé (EDSB-III) - Bénin 2006. Calverton, Maryland, USA : Institut National de la Statistique et de l'Analyse Économique et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR197/08Chapitre08.pdf)	2006	342
Liberia	3.5	Liberia Institute of Statistics and Geo-Information Services (LISGIS) [Liberia], Ministry of Health and Social Welfare [Liberia], National AIDS Control Program [Liberia], and Macro International Inc. 2008. Liberia Demographic and Health Survey 2007. Monrovia, Liberia: Liberia Institute of Statistics and Geo-Information Services (LISGIS) and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR201/FR201.pdf)	2007	145
Senegal	3.3	Ndiaye, Salif, et Mohamed Ayad. 2006. Enquête Démographique et de Santé au Sénégal 2005. Calverton, Maryland, USA : Centre de Recherche pour le Développement Humain [Sénégal] et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR177/08Chapitre08.pdf)	2005	470
Mauritania	3.2	Office National de la Statistique (ONS) [Mauritanie] et ORC Macro. 2001. Enquête Démographique et de Santé Mauritanie 2000-2001. Calverton, Maryland, USA : ONS et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR127/07Chapter7.pdf)	2000-2001	108
United Republic of Tanzania	3.2	National Bureau of Statistics (NBS) [Tanzania] and ORC Macro. 2005. Tanzania Demographic and Health Survey 2004-05. Dar es Salaam, Tanzania: National Bureau of Statistics and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR173/09Chapter09.pdf)	2006	1771
Malawi	3.1	National Statistical Office (NSO) [Malawi], and ORC Macro. 2005. Malawi Demographic and Health Survey 2004. Calverton, Maryland: NSO and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR175/09Chapter09.pdf)	2004	599
Uganda	3.1	Uganda Bureau of Statistics (UBOS) and Macro International Inc. 2007. Uganda Demographic and Health Survey 2006. Calverton, Maryland, USA: UBOS and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR194/FR194.pdf)	2006	1466
Haiti	3.0	Cayemittes, Michel, Marie Florence Placide, Soumaïla Mariko, Bernard Barrère, Blaise Sévère, Canez Alexandre. 2007. Enquête Mortalité, Morbidité et Utilisation des Services, Haïti, 2005-2006. Calverton, Maryland, USA : Ministère de la Santé Publique et de la Population, Institut Haïtien de l'Enfance et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR192/FR192.pdf)	2005-2006	273

Zambia	3.0	Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), University of Zambia, and Macro International Inc. 2009. Zambia Demographic and Health Survey 2007. Calverton, Maryland, USA: CSO and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR211/FR211%5BRevised-05-12-2009%5D.pdf)	2007	542
Rwanda	2.9	Institut National de la Statistique du Rwanda (INSR) and ORC Macro. 2006. Rwanda Demographic and Health Survey 2005. Calverton, Maryland, U.S.A.: INSR and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR183/08Chapter08.pdf)	2005	403
Eritrea	2.7	National Statistics and Evaluation Office (NSEO) [Eritrea] and ORC Macro. 2003. Eritrea Demographic and Health Survey 2002. Calverton, Maryland, USA: National Statistics and Evaluation Office and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR137/09Chapter09.pdf)	2002	182
Nepal	2.7	Ministry of Health and Population (MOHP) [Nepal], New ERA, and Macro International Inc. 2007. Nepal Demographic and Health Survey 2006. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR191/FR191.pdf)	2006	732
Tajikistan	2.1	World Health Organization. European Regional Office Health for all database (Accessed March 10, 2010. Available at: http://data.euro.who.int/hfadb)	2006	193
Cameroon	2.0	Institut National de la Statistique (INS) et ORC Macro. 2004. Enquête Démographique et de Santé du Cameroun 2004. Calverton, Maryland, USA : INS et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR163/08chapitre08.pdf)	2004	704
Togo	2.0	Anipah, Kodjo, Gora Mboup, Afi Mawuéna Ouro-Gnao, Bassanté Boukpepsi, Pierre Adadé Messan, et Rissy Salami-Odjo. 1999. Enquete Démographique et de Santé, Togo 1998. CALVERTON, Maryland USA: Direction de la Statistique et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR101/09Chapter09.pdf)	1998	213
Central African Republic	1.9	Ndamobissi, Robert, Gora Mboup et Edwige Opportune Nguélébé. 1995. Enquête Démographique et de Santé, République Centrafricaine 1994-95. Calverton, Maryland, U.S.A. : Direction des Statistiques Démographiques et Sociales et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR67/10Chapitre10.pdf)	1994-1995	154
Mozambique	1.9	Instituto Nacional de Estatística da Maputo, Moçambique, Ministerio da Saude da Maputo, Moçambique and ORC Macro/DHS Program (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR161/FR161.pdf)	2003	876
Cambodia	1.8	National Institute of Public Health, National Institute of Statistics [Cambodia] and ORC Macro. 2006. Cambodia Demographic and Health Survey 2005. Phnom Penh, Cambodia and Calverton, Maryland, USA: National Institute of Public Health, National Institute of Statistics and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR185/FR185%5BNov-11-2008%5D.pdf)	2005	361

Nigeria	1.8	National Population Commission (NPC) [Nigeria] and ICF Macro. 2009. Nigeria Demographic and Health Survey 2008. Abuja, Nigeria: National Population Commission and ICF Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR222/FR222.pdf)	2008	6028
Guinea	1.7	Direction Nationale de la Statistique (DNS) (Guinée) et ORC Macro. 2006. Enquête Démographique et de Santé, Guinée 2005. Calverton, Maryland, U.S.A. : DNS et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR162/08Chapter08.pdf)	2005	392
Mali	1.6	Cellule de Planification et de Statistique du Ministère de la Santé (CPS/MS), Direction Nationale de la Statistique et de l'Informatique du Ministère de l'Économie, de l'Industrie et du Commerce (DNSI/MEIC) et Macro International Inc. 2007. Enquête Démographique et de Santé du Mali 2006. Calverton, Maryland, USA : CPS/DNSI et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR199/FR199.pdf)	2006	542
Sierra Leone	1.5	Statistics Sierra Leone (SSL) and ICF Macro. 2009. Sierra Leone Demographic and Health Survey 2008. Calverton, Maryland, USA: Statistics Sierra Leone (SSL) and ICF Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR225/FR225.pdf)	2008	223
Yemen	1.4	Central Statistical Organization (CSO) [Yemen] and Macro International Inc. (MI). 1998 Yemen Demographic and Maternal and Child Health Survey 1997 (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR94/08Chapter08.pdf)	1997	846
Ethiopia	1.0	Central Statistical Agency [Ethiopia] and ORC Macro. 2006. Ethiopia Demographic and Health Survey 2005. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR179/FR179.pdf)	2005	3093
Madagascar	1.0	Mariko, Soumaila et Victor Rabeza. 2005. Enquête de Base sur la Santé de la Reproduction et la Survie des Enfants dans les zones d'intervention USAID, à Madagascar - EBSRSE 2003-2004. Calverton, Maryland, USA : INSTAT et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR158/08Chapitre08.pdf)	2003-2004	687
Niger	1.0	Institut National de la Statistique (INS) et Macro International Inc. 2007. Enquête Démographique et de Santé et à Indicateurs Multiples du Niger 2006. Calverton, Maryland, USA : INS et Macro International Inc. (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR193/08Chapitre08.pdf)	2006	791
Burkina Faso	0.7	Institut National de la Statistique et de la Démographie (INSD) et ORC Macro. 2004. Enquête Démographique et de Santé du Burkina Faso 2003. Calverton, Maryland, USA : INSD et ORC Macro (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR154/08Chapitre8.pdf)	2003	721
Chad	0.4	Ouagadjo, Bandoumal, Kostelngar Nodjimadji, Tchobkréo Bagamla, Riradjim Madnodji, Joël Sibaye Tokindang, Ningam Ngakoutou, Joël Nodjimbajem Ngoniri, Caman Bédaou, Donato Koyalta, Bernard Barrère, Monique Barrère. 2004. Enquête Démographique et de Santé T (Accessed December 10, 2009. Available at: http://www.measuredhs.com/pubs/pdf/FR170/09Chapitre09.pdf)	2004	498

*The cesarean section was adjusted by the percentage of births attended by skilled health personnel (77.0%) (World Health Organization. World Health Statistics 2007. Accessed December 14, 2009. Available at: <http://www.who.int/whosis/whostat2007.pdf>)

**The cesarean section was adjusted by the percentage of births attended by skilled health personnel (74.0%) (World Health Organization. World Health Statistics 2007. Accessed December 14, 2009. Available at: <http://www.who.int/whosis/whostat2007.pdf>)

†The cesarean section was adjusted by the percentage of births attended by skilled health personnel (71.0%) (World Health Organization. World Health Statistics 2007. Accessed December 14, 2009. Available at: <http://www.who.int/whosis/whostat2007.pdf>)

‡The cesarean section was adjusted by the percentage of births attended by skilled health personnel (67.0%) (World Health Organization. World Health Statistics 2007. Accessed December 14, 2009. Available at: <http://www.who.int/whosis/whostat2007.pdf>)