



Cesarean Delivery: Background, Trends, and Epidemiology

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OBJECTIVE To examine trends in cesarean delivery for the overall population and for women with “no indicated risk” for cesarean section, and to summarize the available literature on “maternal request” cesarean deliveries.

FINDINGS Nearly 3 in 10 births were delivered by cesarean section in 2004 (29.1%), the highest rate ever reported in the United States. The overall rate has increased by over 40% since 1996, reflecting two concurrent trends: an increase in the primary rate (14.6% to 20.6%), and a steep decline in the rate of vaginal birth after cesarean (28.3% to 9.2%). There has been a clear increase in primary cesarean delivery without a medical or obstetrical indication, and studies using hospital discharge data or birth certificate data estimate the rate of primary cesarean deliveries with no reported medical or obstetrical indication to be between 3% and 7% of all deliveries to women who had not had a previous cesarean delivery. However, these studies contain no direct information on whether these cesareans were the result of maternal request or because of physician recommendation. There was little data to support the contention that the rise in the cesarean rate was the result of maternal request.

CONCLUSION There are no systematic data available on cesarean delivery by “maternal request.” However, the rate of primary cesarean delivery is increasing rapidly for women of all ages, races, and medical conditions, as well as for births at all gestational ages. Since a first cesarean section virtually guarantees that subsequent pregnancies will be cesarean deliveries (the repeat cesarean delivery rate is now almost 91%), research is needed on physician practice patterns, maternal attitudes, clinical outcomes for mother and infant (harms, benefits), and clinical and nonclinical factors (institutional, legal, economic) that affect the decision to have a cesarean delivery.

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KEYWORDS cesarean delivery, primary cesarean, repeat cesarean, vaginal birth after cesarean, elective cesarean, birth certificate, maternal request cesarean

In 2004, approximately 1.2 million women in the United States had a cesarean birth, representing 29.1% of all births. Cesarean delivery continues to be the most common major surgical procedure for women in the United States.¹

The cesarean rate increased dramatically during the 1970s and early 1980s and then began to decline in the late 1980s (based on data from the National Hospital Discharge Survey). Between 1989 and 1996, the total cesarean rate decreased as

a result of a decrease in the primary rate and an increase in the rate of vaginal birth after cesarean (VBAC). Since 1996, these trends have reversed² (Fig. 1). This paper examines recent trends in cesarean delivery for the overall population and for women with “no indicated risk” for cesarean section and summarizes the available literature on “maternal request” cesarean deliveries.

Methods

Data on cesarean delivery used in this paper are based on the method of delivery as reported on the more than 4 million birth certificates filed each year in the United States and compiled by the National Center for Health Statistics. Cesarean data became available from birth certificates in 1989; and by 1991, all States and the District of Columbia were reporting

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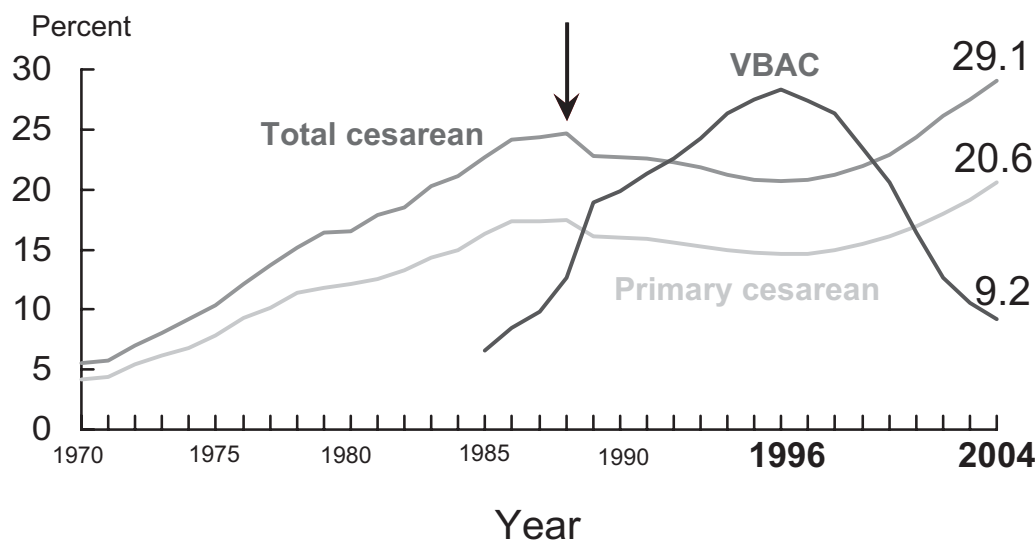


Figure 1 Total and primary cesarean rate, 1970 to 2004, and VBAC, 1985 to 2004. (Source: Data for 1970–1988 are from the National Hospital Discharge Survey [NHDS]. Data for 1989–2004 are from the National Vital Statistics System. For 1989 the estimate of the total cesarean rate from the NHDS was 23.8 percent; the estimate from vital records was 22.8 percent. Data for 2004 are preliminary.)

this information. Before 1989, data from the National Hospital Discharge Survey were used to track trends in cesarean delivery.

Cesarean rates are calculated by the National Center for Health Statistics (NCHS), as shown in Table 1. Briefly, the *total cesarean rate* is the percent of cesarean births out of all births in a given year. The *primary cesarean rate* is the percent of cesarean births to women who have not had a previous cesarean delivery in a given year. The rate of *repeat cesarean delivery* is the percent of cesarean births to women who have had a previous cesarean. The rate of vaginal birth after previous cesarean (VBAC) is the complement of the repeat cesarean rate, and is the percent of vaginal births to women who have had a previous cesarean.

This paper examines changes in cesarean rates among all US mothers, as well as among a subgroup of mothers

comprising the lowest risk population identifiable from the birth certificate: mothers who have full-term, singleton births and none of the 31 medical risk factors (eg, diabetes, hypertension) or labor and delivery complications (eg, fetal distress and prolonged labor) reported on the birth certificate. Although data on maternal intent are not available from birth certificates, this population comprises the best population-based approximation of “medically elective” cesarean delivery available for the US as a whole. Available literature on “maternal request” is also reviewed.

Results

The latest data show that nearly 3 in 10 births (29.1%) were delivered by cesarean in 2004, the highest rate ever reported in the United States.³ The overall cesarean rate

Table 1 Computation of Cesarean Rates

Total cesarean rate:

$$\frac{\text{Total number of births by cesarean}}{\text{Total number of births}} \times 100$$

Primary cesarean rate:

$$\frac{\text{Number of births to women with no previous cesarean}}{\text{Number of primary cesarean births} + \text{number of vaginal births (not VBACs)}} \times 100$$

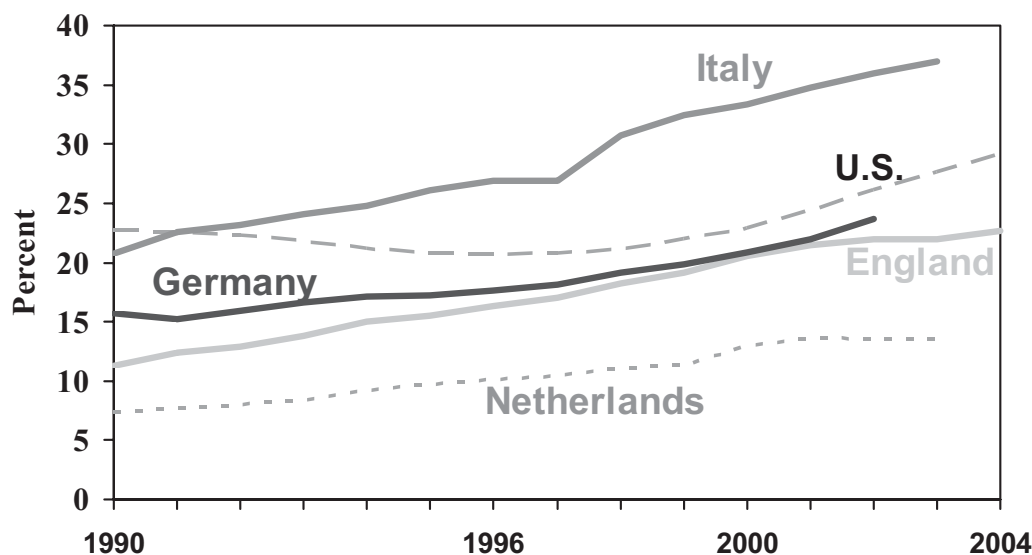
Repeat cesarean rate:

$$\frac{\text{Number of cesarean births to women with a previous cesarean}}{\text{Number of vaginal births after a previous cesarean} + \text{number of repeat cesarean births}} \times 100$$

VBAC rate:

$$\frac{\text{Number of vaginal births to women with a previous cesarean}}{\text{Number of vaginal births after a previous cesarean} + \text{number of repeat cesarean births}} \times 100$$

Figure 2 National overall cesarean rates, 1990 to 2004. (Sources: OECD Health Data 2005. Paris: OECD 2005; Office for National Statistics. Birth Statistics England and Wales 2004. London Office for National Statistics, 2005.)



has increased by over 40% since 1996, reflecting 2 concurrent trends: an increase in the primary rate (14.6% to 20.6%) and a steep decline in the VBAC rate (28.3% to 9.2%) (Fig. 1). A decrease in the VBAC rate implies a corresponding increase in the repeat cesarean rate, which has now reached almost 91%.³

An examination of the US rates in relation to those of other industrialized countries reveals that, although the US has had one of the higher cesarean rates in a comparative context, it alone among industrialized nations experienced a decrease in its cesarean rates in the early 1990s^{4,5} (Fig. 2). Even the Netherlands, starting from a much lower base, experienced consistent increases over the past 15 years. The US, based on the parallel decreases in its primary and repeat cesarean rates, was able to reduce the overall cesarean rate significantly over a 7-year period. However, the rapid growth in the cesarean rate since 1996 has more than reversed those reductions.

Trends by Maternal Age, Race, Education, and Gestational Age

Since final 2004 natality data were not yet available when this research was completed, subgroup analysis focused on the period from 1996 to 2003. During this period, substantial increases in both primary and repeat cesarean rates occurred for women of all ages, all race/ethnic groups, all educational levels, and all periods of gestation (Table 2). In 2003, primary cesarean rates were highest for women aged 35 and over, for non-Hispanic black women, and for women who attended college. Rates were also higher for infants born preterm (at <37 completed weeks of gestation) than for those born at term (37-41 weeks) or postterm (42+ weeks).

In 1996, the repeat cesarean rate varied by maternal characteristics, with the highest rates among older mothers, Hispanic mothers, and mothers who did not complete college. In

contrast, by 2003, repeat cesarean rates were similar at about 90% for all socio-demographic groups studied.

Trends for Women with No Indicated Medical or Obstetrical Risk for Cesarean Section

Among the subset of mothers for whom there was “no indicated risk” (NIR) (full-term, singleton births, no medical risk factors reported on the birth certificate) (about 40% of all mothers nationally), the rate of primary cesareans has been rising since 1991, and especially rapidly since 1996. In 2003, the overall primary cesarean rate for births to mothers with NIR was 6.9%, and the rate for first-time mothers was even higher at 11.2% (Fig. 3). Cesarean rates for NIR women were higher for first-time and non-Hispanic black mothers and increased with age (data not shown).

These results compare favorably with those of other studies. Bailit and coworkers, using birth certificate data, estimated the primary cesarean delivery rate among women with no medical or obstetrical indication at approximately 7%.⁶ Two other recent studies used hospital discharge data to estimate the cesarean rate among women with no medical or obstetrical indication at between 3% and 7%.^{7,8} The methodology for the hospital discharge studies is similar to that for the birth certificate studies, and involves identifying mothers who had low-risk births (full term, singletons) and no ICD-9 codes associated with labor or with complications of labor and delivery in their hospital discharge records.⁷

All birth certificate and hospital discharge studies share an important characteristic: they do not involve any measure of maternal opinion (ie, there is no actual measure of maternal request); hence, the designation of such births as “maternal request” is not justified. Instead, we prefer to describe these cesareans with the more conservative term, “no indicated risk.” This is because: (1) data on maternal request were not available; and (2) there might possibly have been some other

Table 2 Primary* and Repeat† Cesarean Rates by Selected Characteristics United States, 1996-2003 (numbers shown for 2003) and percent change, 1996-2003

	Primary		Percent Change, 1996-2003	Repeat		Percent Change, 1996-2003
	2003	1996		2003	1996	
Total	19.1 (684,484)	14.6	31	89.4 (434,699)	71.7	25
Maternal age (years)						
<20	17.2 (70,150)	13.2	30	89.5 (10,030)	66.5	35
20-24	16.4 (154,407)	13.1	25	89.7 (78,157)	69.4	29
25-29	18.1 (172,845)	14.5	25	88.8 (112,353)	70.7	26
30-34	20.8 (170,728)	15.5	34	89.4 (134,296)	72.0	24
35-39	24.2 (90,685)	17.6	38	89.7 (80,403)	74.6	20
40-49/‡	30.4 (25,669)	22.2	37	90.2 (19,460)	78.4	15
Race/ethnicity						
White non-Hispanic	19.5 (398,368)	14.8	32	89.3 (238,990)	70.5	27
Black non-Hispanic	20.7 (103,694)	15.7	32	88.7 (63,802)	73.1	21
Hispanic§	17.0 (134,231)	13.4	27	90.6 (106,912)	75.2	20
Education						
<12 years	15.1 (109,180)	12.1	25	89.0 (84,464)	72.5	23
12 years	18.3 (185,927)	14.6	25	90.3 (127,198)	73.3	23
13-15 years	20.1 (141,627)	15.8	27	90.2 (92,535)	72.6	24
16+ years	22.3 (197,700)	16.5	35	89.5 (108,145)	69.2	29
Gestational age						
<32 weeks	44.5 (31,293)	35.7	25	88.1 (8,029)	76.6	15
32-36 weeks	28.9 (104,235)	22.3	30	91.3 (51,706)	76.4	20
<37 weeks	31.4 (135,528)	24.6	28	90.9 (59,735)	76.5	19
37-41 weeks	17.3 (499,626)	13.2	31	89.3 (349,274)	71.4	25
42+ weeks	18.4 (42,830)	15.4	19	86.0 (20,674)	66.7	29

*Number of primary cesareans to women who have not had a previous cesarean.

†Number of repeat cesareans to women who have had a previous cesarean.

‡Beginning in 1997, includes data for women aged 40-54 years.

§Includes all persons of Hispanic origin of any race.

||Excludes data for Pennsylvania and Washington, which implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth for data year 2003. The educational attainment item on the 2003 revision is not comparable to the item on the 1989 revision in use by 48 states and the District of Columbia.

reason for the cesarean that was not available or not reported through these data sources.

Mothers' Perspectives

As noted above, little is known about mothers' perspectives on cesareans in the US. Results from one national US survey of mothers found little interest in a future elective primary cesarean with just 6% of primiparous mothers interested in that option in the future.⁹ Research from other countries with high cesarean rates, most notably Brazil¹⁰ and Chile,¹¹ have found that, rather than the cesarean rate being driven by maternal demands, it is the interaction between mothers and their providers that leads to the decision to perform a cesarean without a clear medical indication. For example, in Potter's study in Brazil,¹⁰ more than 80% of primiparous mothers in the study anticipated a vaginal birth 1 month before their due date, yet almost half of these mothers (66% in private hospitals) ended up with a cesarean.

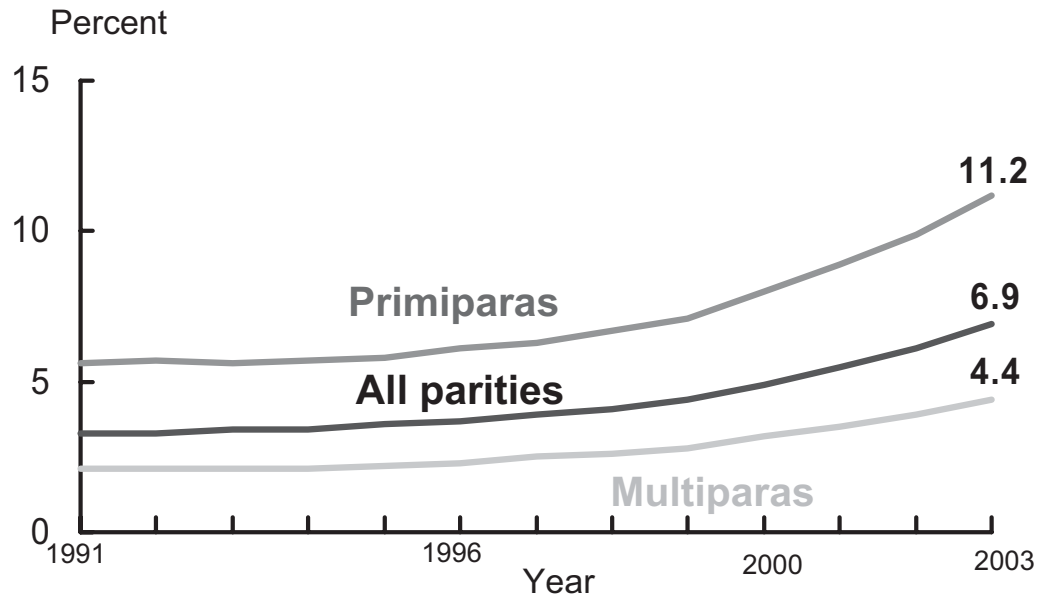
Discussion

Cesarean rates fell between 1991 and 1996, and then began to rise rapidly. In 2004, over 29% of all births were by cesar-

ean section. The rise in both the total and repeat cesarean rate has been widespread for women of all ages, races, medical indications, and for all infant gestational ages. At the same time, the VBAC rate decreased more steeply. This suggests that the influence of recent medical opinion discouraging VBAC has had a strong effect on practice patterns, and had led to greater uniformity as well as a large increase in repeat cesarean deliveries by 2003. The trend for mothers at "no indicated risk" has been for slow increases in primary cesareans from 1991 to 1996 and rapid increases thereafter.¹² Primary and repeat cesareans are at the highest rates ever recorded in the U.S.

Strengths of birth certificate data to track trends in cesarean delivery include the comprehensive population-based nature of these data, which include all births in the US for a given year. Most demographic items and some medical items (including maternal age, parity, and method of delivery) are considered to be very well reported on birth certificates.^{13,14} There are limitations with regard to a measure of no indicated medical or obstetrical risk. There has been documentation of underreporting of medical risk factors and complications of labor and delivery on birth certificates.¹³⁻¹⁵ However, we would expect that reporting of a risk factor or complication associated with a resulting

Figure 3 Primary cesarean rates by parity for women with no indicated risk factors in the US, 1991 to 2003. (Women with full-term vertex singletons, with birth-weight <4000 grams, and no reported medical risk factors or complications of labor and/or delivery. Source, National Vital Statistics System, NCHS, CDC, 1991–2003.)



cesarean would be encouraged. Most importantly, because we examined changes in cesarean rates among women at “no indicated risk” over time, there is no reason to expect that bias would result in a change in reporting of these variables at different time periods.¹⁶

The changes in the VBAC rate have been associated with a vigorous debate in the obstetrical literature, and the last 20 years have been marked by shifts in practice guidelines for VBACs¹⁷⁻²²; however, there is no comparable literature on primary cesareans, even though the changes in the primary rate have a greater impact on the overall cesarean rate. Notably, the primary cesarean rate decreased from 1989 to 1996 and then increased from 1996 to 2003 for essentially every medical risk factor and labor and/or de-

livery complication. There is virtually no evidence that the growth in the primary cesarean rate is a function of demographic changes or shifts in the risk profile of US mothers.¹⁶ Discussions of the reasons for the growth in primary cesareans have centered on changing attitudes concerning cesareans among physicians and mothers,²³⁻²⁵ whereas media reports have focused intensely on elective cesarean delivery.²⁶⁻²⁹ Despite the rapidly growing literature on medically elective cesareans, little is known about maternal opinion and there is very little evidence that the changes described are the result of maternal request. It appears more likely that the changes are driven primarily by shifts in obstetric practice, but further research into these trends is needed.

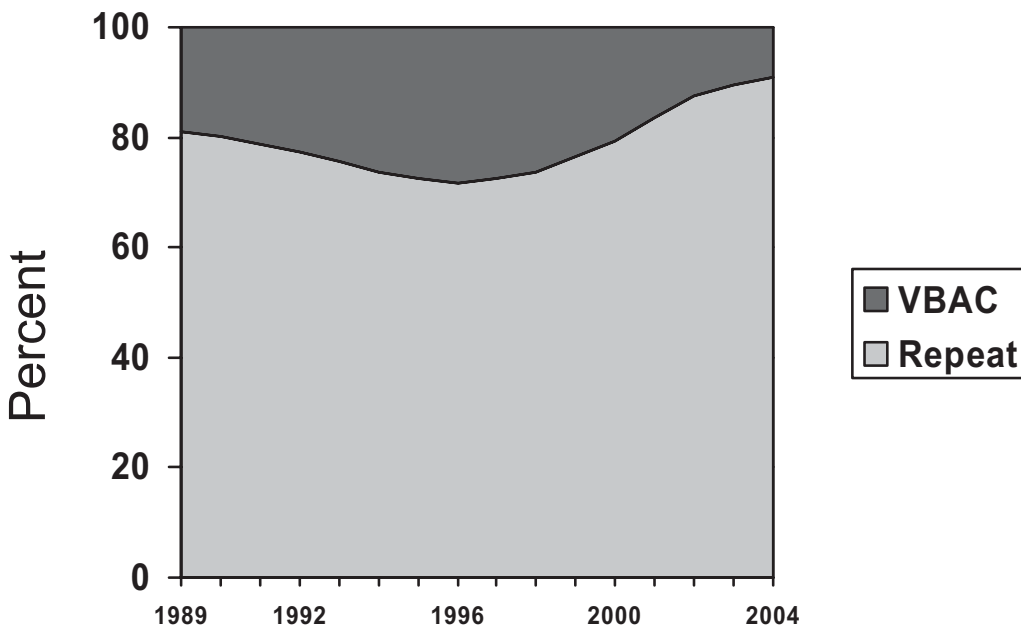


Figure 4 Rates of repeat cesarean delivery and VBAC, 1989 to 2004. (Data for 2004 are preliminary. Source: National Vital Statistics System, NCHS, CDC, 1989–2004.)

Interestingly, there are markedly different practice recommendations regarding cesarean delivery from the American and International obstetrical groups. The American College of Obstetricians and Gynecologists (ACOG) states that:

*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.*²⁴

In contrast, the International Federation of Gynecology and Obstetrics (FIGO) states that:

*At present, because hard evidence of net benefit does not exist, performing cesarean delivery for nonmedical reasons is not ethically justified.*³⁰

The most recent revision of the U.S. Standard Certificate of Live Birth will provide useful information for future studies on trends in obstetric practices on whether or not a trial of labor was attempted before a cesarean delivery.³¹

The underlying “question is not the ethics of patient choice, but lack of scientific proof of risks and benefits.”³² Thus, in attempting to address the question of cesareans among women with no medical or obstetrical indication, we need to first do the basic research to provide answers to questions about the risks and benefits of elective cesarean versus spontaneous vaginal birth.

Directions for Future Research

There is a clear need for research on health outcomes for mothers and infants associated with cesarean delivery without a medical or obstetrical indication in current and subsequent deliveries. A more detailed examination is needed of mother, insurer, hospital, and provider attitudes toward primary and repeat cesareans and on the nature of decision-making surrounding elective cesareans. More studies, both quantitative and qualitative, of how mothers and clinicians view the birth process and the interaction between mothers and providers could assist in resolving some of these issues. Research on the economic implications of the rising cesarean rate for hospitals, providers, insurers, and parents is also essential.

Finally, based on the trend in the repeat cesarean rate, a first cesarean delivery now virtually guarantees that subsequent deliveries will be cesarean deliveries (Fig. 4). Therefore, more research is needed into outcomes of multiple repeat cesareans. Continued monitoring of the trends in medically unnecessary cesarean delivery and objective research on the outcomes of this procedure, especially compared with normal, spontaneous vaginal delivery, is crucial.

References

- DeFrances CJ, Hall MJ, Podgornik MN: 2003 National Hospital Discharge Survey. Advance Data from Vital and Health Statistics, no. 359. Hyattsville, MD, National Center for Health Statistics, 2005
- Martin JA, Hamilton BE, Sutton PD, et al: Births: Final Data for 2003. National Vital Statistics Reports; vol. 54, no. 2. Hyattsville, MD, National Center for Health Statistics, 2005
- Hamilton BE, Martin JA, Ventura SJ, et al: Births: Preliminary Data for 2004. National Vital Statistics Reports; vol. 54, no. 6. Hyattsville, MD, National Center for Health Statistics, 2005
- Organization for Economic Cooperation and Development. OECD Health Data 2005: Statistics and Indicators for 30 Countries. Frequently Requested Data, 2005
- Office for National Statistics. Birth Statistics. Review of the Registrar General on births and patterns of family building in England and Wales, 2004. Series FM 1 no. 33. London, Office for National Statistics, 2005. Available at: <http://www.statistics.gov.uk>
- Bailit JL, Love TE, Mercer B: Rising cesarean rates: are patients sicker? *Am J Obstet Gynecol* 191:800-801, 2004
- Gregory KD, Korst LM, Gornbein JA, et al: Using administrative data to identify indications for elective cesarean delivery. *Health Serv Res* 37: 1387-1401, 2002
- Healthgrades: Healthgrades Third Annual Report on “Patient-Choice” Cesarean Section Rates in the United States, September 2005. Available at: <http://www.healthgrades.com>
- Declercq ER, Sakala C, Corry MP, et al: Listening to Mothers: Report of the First National U.S. Survey of Women’s Childbearing Experiences. New York, NY, Maternity Center Association, October 2002. Available at: <http://www.childbirthconnection.org/pdfs/LtMreport.pdf>
- Potter JE, Berquó E, Perpétuo IHO, et al: Unwanted caesarean sections among public and private patients in Brazil: prospective study. *Br Med J* 323:1155-1158, 2001
- Murray SF: Relation between private health insurance and high rates of caesarean section in Chile: qualitative and quantitative study. *Br Med J* 321:1501-1505, 2000
- Declercq E, Menacker F, MacDorman MF: Rise in “no indicated risk” primary cesareans in the United States, 1991-2001. *Br Med J* 330:71-72, 2005
- Roohan PJ, Josberger RE, Acar J, et al: Validation of birth certificate data in New York State. *J Community Health* 28:335-346, 2003
- DiGiuseppe DL, Aron DC, Rambom L, et al: Reliability of birth certificate data: a multi-hospital comparison to medical records information. *Matern Child Health J* 6:169-179, 2002
- Lydon-Rochelle MT, Holt VL, Cardenas V, et al: The reporting of pre-existing maternal medical conditions and complications of pregnancy on birth certificates and in hospital discharge data. *Am J Obstet Gynecol* 193:125-134, 2005
- Declercq E, Menacker F, MacDorman MF: Maternal risk profiles and the primary cesarean rate in the United States, 1991-2002. *Am J Public Health* 96:867-872, 2006
- McMahon MJ, Luther ER, Bowes WA, et al: Comparison of a trial of labor with an elective second cesarean section. *N Engl J Med* 335:689-695, 1996
- Zimberg S: Vaginal delivery after previous cesarean delivery: a continuing controversy. *Clin Obstet Gynecol* 44:561-569, 2001
- Lydon-Rochelle M, Holt VL, Easterling TR, et al: First-birth cesarean and placental abruption or previa at second birth. *Obstet Gynecol* 97:765-769, 2001
- Greene M: Vaginal delivery after cesarean section: is the risk acceptable? *N Engl J Med* 345:55, 2001
- Smith GCS, Pell JP, Cameron AD, et al: Risk of perinatal death associated with labor after previous cesarean delivery in uncomplicated term pregnancies. *J Am Med Assoc* 287:2684-2690, 2002
- Guise J-M, McDonagh M, Hashima J, et al: Vaginal births after cesarean (VBAC). Evidence Report/Technology Assessment No. 71 (Prepared by the Oregon Health & Science University Evidence-based Practice Center under Contract No. 209-977-0018). AHRQ Publication No. 03-Eoi8. Rockville, MD, Agency for Healthcare Research and Quality, March 2003
- Minkoff H, Powderly KR, Chervenak F, et al: Ethical dimensions of elective primary cesarean delivery. *Obstet Gynecol* 103:387-392, 2004
- American College of Obstetricians and Gynecologists: Surgery and patient choice, in *Ethics in Obstetrics and Gynecology* (ed 2). Washington

- DC, The American College of Obstetricians and Gynecologists, 2004, p 21
25. Hale RW, Harer WB: Elective prophylactic cesarean delivery. Editorial. *ACOG Clin Rev* 10:1 and 15, 2005
 26. "Too Posh to Push? Cesarean sections have spiked dramatically. Progress or convenience?" *US News and World Report*, August 5, 2002
 27. Stein R: "Once a C-Section, Always a C-Section? Women who want to try labor in later deliveries are increasingly refused." *Washington Post*, November 24, 2005
 28. Brink S: "When 'natural' seems too risky." *Los Angeles Times*, Health F1, January 17, 2006
 29. CBS Evening News. "Despite Risks Cesarean Births are on the Rise." Broadcast January 26, 2006
 30. *Issues in Obstetrics and Gynecology* by the FIGO Committee for the Ethical Aspects of Human Reproduction and Women's Health. 41-42, (1998), 2003
 31. National Center for Health Statistics: U.S. Standard Certificate of Live Birth, 2003 revision. Available at: <http://www.cdc.gov/nchs/data/dvs/birth11-03final-ACC.pdf>
 32. Queenan JT: Elective cesarean delivery, Editorial. *Obstet Gynecol* 103: 1135-1136, 2004