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TRENDS IN CESAREAN BIRTH AND VAGINAL BIRTH AFTER PREVIOUS CESAREAN NEW JERSEY, 1990-1999

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Abstract
This report examines trends in cesarean section-delivered births by age and race/ethnicity of the mother, previous method of delivery, county of residence, and other maternal and infant characteristics. Data and rates are based on New Jersey resident birth certificate files for 1990-1999. After declining during the early 1990s, cesarean delivery rates rose during the latter part of the decade. The rate of vaginal birth after cesarean section peaked in 1996 and then decreased through the remainder of the decade.

Introduction

Reducing the rate of births delivered by cesarean section (c-section) among low-risk women and increasing the rate of vaginal birth after previous cesarean (VBAC) is a goal of the federal Healthy People 2010 program[1] and c-section rate reduction and VBAC rate increase among all women was a goal of the Healthy People 2000 program.[2] Nonetheless, there is debate over the risk of c-sections versus vaginal deliveries, especially among women who have previously delivered via c-section.[3-4] While the general consensus is that vaginal births are inherently safer than c-sections, some medical professionals and other concerned parties feel that the risks of vaginal birth, though different, are also serious and that doctors and women should be allowed to choose the method of delivery when neither is clearly indicated.[4-8] Additionally, though it was previously thought that once a women delivered by c-section, all subsequent births should be by c-section, in the early 1980s the National Institutes of Health recommended that VBAC be attempted unless there were strong indications otherwise.[9] However, recent evidence suggests that this practice may cause unnecessary complications in women who may have a weak uterine wall due to a previous c-section.[10-13]

Data and Methods

All data used in this analysis were from birth certificates of New Jersey residents born in 1990 through 1999. Data on method of delivery were unavailable prior to revision of the birth certificate in 1989. Method of delivery is recorded on the certificate as vaginal, vaginal birth after previous c-section (VBAC), primary c-section, or repeat c-section. These four methods are mutually exclusive and only the one ultimately used to deliver the baby should be reported. For example, if a vaginal delivery is attempted but then abandoned in favor of a c-section, only the

c-section (primary or repeat) is reported. Use of forceps and/or vacuum may also be reported in conjunction with any of the four methods.

Maternal variables collected on the birth certificate and used in this analysis included age, race, ethnicity, county of residence, birthplace, education, and marital status. Other birth certificate variables used were live-birth order, trimester of prenatal care onset, plurality, length of gestation, five-minute Apgar score, birthweight, medical risk factors of this pregnancy, complications of labor and/or delivery, and abnormal conditions of the newborn.

The total cesarean delivery rate is the number of live births delivered by primary or repeat c-section as a percentage of all live births. The primary cesarean delivery rate is the number of primary cesarean live deliveries as a percentage of live births to women who have never had a previous cesarean (as determined by a response of vaginal or primary c-section to the method of delivery item on the certificate). The VBAC rate is the number of VBAC deliveries as a percentage of live births to women with a previous cesarean delivery (as determined by a response of VBAC or repeat c-section to the method of delivery item on the certificate).

Results

Cesarean delivery rates, both total and primary, declined slightly during the early part of the 1990s but began increasing steadily after 1995. By the end of the decade, both rates were higher than at the beginning of the decade. The VBAC rate increased steadily and rapidly through 1996 but then began a slow and then sharp decline through the remainder of the decade. Preliminary figures for 2000 and 2001 indicate that these trends will likely continue. (Table A and Figure 1).

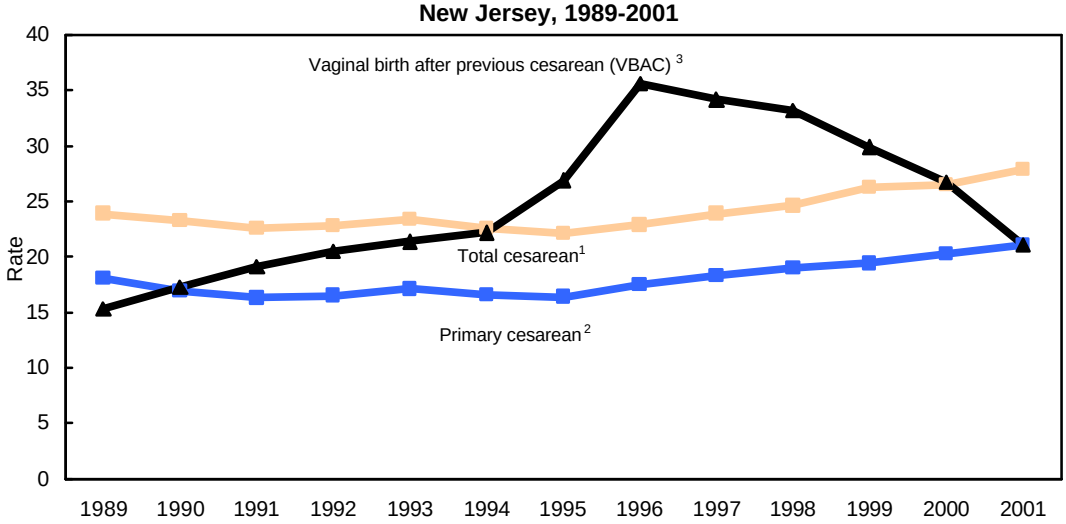
Table A. Total and primary cesarean rates and vaginal births after previous cesarean delivery rates: New Jersey, 1989-2001

Year	Total[1]	Primary[2]	VBAC rate[3]
1989	23.9	18.1	15.3
1990	23.3	16.9	17.3
1991	22.6	16.3	19.1
1992	22.8	16.5	20.5
1993	23.4	17.1	21.4
1994	22.6	16.6	22.2
1995	22.1	16.4	26.9
1996	22.9	17.5	35.6
1997	23.9	18.3	34.2
1998	24.6	19.0	33.2
1999	25.3	19.4	29.9
2000	26.5	20.3	26.7
2001	27.9	21.1	21.1

[1]Percent of all live births by cesarean delivery.
[2]Number of primary cesareans per 100 live births to women who have not had a previous cesarean.
[3]Number of vaginal births after previous cesarean (VBAC) delivery per 100 live births to women with a previous cesarean delivery.
NOTE: Data for 2001 are preliminary.

There were 113,810 births to New Jersey residents in 1999. Of those, 28,803 (25.3%) were delivered by cesarean section. More than 60 percent (18,183) were primary c-sections. Total and primary cesarean rates were fairly uniform across race/ethnicity groups, but varied by age. Younger women were less likely to have c-sections than older women. Nearly 30 percent of women who delivered vaginally in 1999 had a previous cesarean delivery. VBAC rates were consistent for most races/ethnicities, although black non-Hispanic mothers had a slightly higher

Figure 1. Total and primary cesarean rates and vaginal birth after previous cesarean rate
New Jersey, 1989-2001



[1] Per 100 births.
[2] Per 100 births to women with no previous cesarean.
[3] Per 100 births to women with a previous cesarean.
NOTE: Data for 2001 are preliminary.

VBAC rate in 1999 (33.7%) compared to other groups. VBAC rates were negatively correlated with age (Table B).

Nationally, cesarean rates decreased through 1996 but then increased 6 percent from 1996 to 1999 while VBAC rates increased dramatically through 1996 but then dropped 17 percent between 1996 and 1999. These changes were experienced by women of all ages, races, and ethnicities and in most states and for nearly all medical risk factors and complications of labor and/or delivery.[14] New Jersey was somewhat different from the nation as a whole in terms of the timing of the trend in cesarean rates, and also in the trend for the youngest and oldest age groups (Figure 2 and Table 1) and among black non-Hispanic women, for whom cesarean rates never declined (Figure 3 and Table 1). VBAC rates in New Jersey increased between 1990 and 1996 and decreased between 1996 and 1999 for all ages and all races and ethnicities (Table 2).

The National Center for Health Statistics reports that New Jersey had the third highest c-section rate in the country in 1999. State rates ranged from 14.8 percent to 27.3 percent.[14] Within the state, rates varied considerably by county from 15.3 percent in Salem County to 29.4 percent in Hudson County (Table 3 and Figure 4). As can be seen in Figure 4, there is some evidence of a regional pattern in cesarean rates, with the counties nearest New York City showing the highest rates while a group of counties in Southern New Jersey show the lowest rates. While differences in maternal age may explain some of the differences in county rates, it is unlikely that they are the source of the regional differences shown in Figure 4, which is more suggestive of some type of practice style variation.

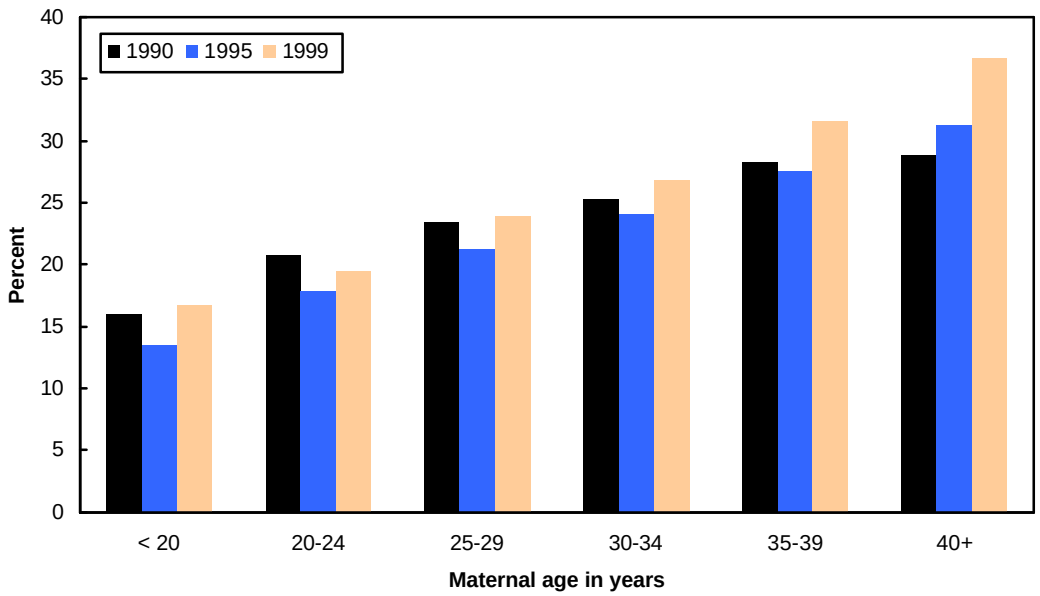
There were county differences in time trends as well. Between 1990 and 1995, Warren County experienced the sharpest decline in c-section rates (18.8%) among New Jersey counties while Camden County had a 9.7 percent increase. Between 1995 and 1999, the cesarean delivery rate in Cape May County only increased 0.1 percent, while in Gloucester County it increased 33.4 percent (Table 3).

Table B. Live births by cesarean delivery and by vaginal birth after previous cesarean by age and race/ethnicity: New Jersey, 1999

Age and race/ethnicity of mother	All births	Number of births by cesarean delivery			Cesarean delivery rate		Rate of vaginal birth after previous cesarean[3]
		Total	Primary	Repeat	Total[1]	Primary[2]	
All races[4]	113,810	28,803	18,138	10,665	25.3	19.4	29.9
< 20	8,392	1,398	1,266	132	16.7	15.6	40.8
20-24	18,451	3,589	2,573	1,016	19.5	15.6	35.7
25-29	28,817	6,906	4,671	2,235	24.0	19.1	31.3
30-34	35,344	9,518	5,620	3,898	26.9	20.2	28.9
35-39	18,870	5,956	3,175	2,781	31.6	23.0	28.1
40+	3,918	1,436	833	603	36.7	29.5	24.2
White non-Hispanic	62,395	16,102	10,243	5,859	25.8	19.7	29.7
< 20*	1,996	311	286	25	15.6	14.9	32.4
20-24	6,370	1,125	882	243	17.7	15.0	33.6
25-29	15,268	3,562	2,601	961	23.3	19.3	29.6
30-34	23,408	6,138	3,762	2,376	26.2	19.6	30.3
35-39	12,811	4,021	2,168	1,853	31.4	22.2	29.4
40+	2,534	945	544	401	37.3	28.4	24.1
Black non-Hispanic	18,634	4,827	3,051	1,776	25.9	19.3	33.7
< 20	3,116	543	489	54	17.4	16.2	43.2
20-24	4,987	1,064	722	342	21.3	16.4	39.8
25-29	4,476	1,219	726	493	27.2	19.8	34.5
30-34	3,698	1,127	641	486	30.5	21.8	31.6
35-39	1,883	683	362	321	36.3	25.8	27.2
40+	469	191	111	80	40.7	31.6	26.6
Hispanic	21,009	5,566	3,315	2,251	26.5	18.5	27.2
< 20	3,027	499	448	51	16.5	15.3	42.0
20-24	5,862	1,238	837	401	21.1	15.9	33.2
25-29	5,537	1,452	836	616	26.2	18.0	30.4
30-34	4,139	1,438	708	730	34.7	22.1	21.3
35-39	2,000	753	370	383	37.7	24.7	23.1
40+	442	186	116	70	42.1	33.1	23.1
Asian/Pacific Islander non-Hispanic	7,808	2,009	1,348	661	25.7	19.8	28.9
< 20**	100	14	14	0	14.0	14.0	--
20-24*	790	131	111	20	16.6	14.7	35.5
25-29	2,631	598	458	140	22.7	19.0	30.7
30-34	2,756	737	470	267	26.7	20.0	29.6
35-39	1,291	430	239	191	33.3	23.6	27.4
40+*	240	99	56	43	41.3	30.8	21.8

[1] Percent of all live births by cesarean delivery.
[2] Number of primary cesareans per 100 live births to women who have not had a previous cesarean.
[3] Number of vaginal births after previous cesarean delivery per 100 live births to women with a previous cesarean delivery.
[4] Includes races other than white, black, Asian, and Pacific Islander and race not stated.
* VBAC numbers are too small to calculate reliable rates. Interpret with caution.
** Primary cesarean and VBAC numbers are too small to calculate reliable rates. Interpret with caution.

Figure 2. Total cesarean rate by age: New Jersey, 1990, 1995, and 1999

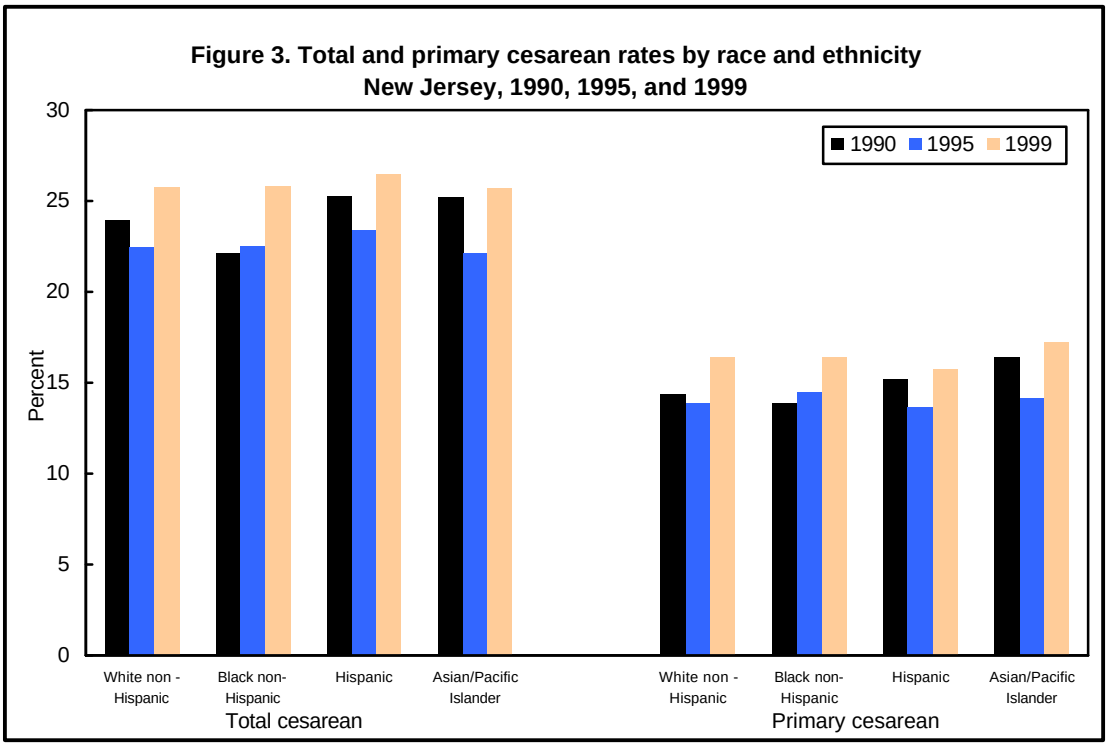


Over most of the decade, women delivering their first child had a higher rate of c-sections than women delivering their second child. By 1999, the rates were virtually equal. Women delivering their third or higher child had the lowest cesarean delivery rates. However, while the c-section rate for first and second deliveries declined through 1995 and then increased through 1999, the rate for women delivering a third or higher child increased throughout the decade (Table 4).

Throughout most of the decade, foreign-born women were slightly more likely to deliver via cesarean than U.S.-born women, but both groups experienced a decline in the rate during the first half of the decade and an increase in the latter part (Table 4). Women with more education had higher cesarean delivery rates (Table 4), but this is most likely linked to maternal age since younger mothers have lower c-section rates (Table 1). For all education levels, cesarean rates decreased between 1990 and 1995 and then increased through 1999 (Table 4). Married women in the 1990s were somewhat more likely to have c-sections than unmarried women even as rates for both groups rose between 1990 and 1995 and dropped between 1995 and 1999 (Table 4).

Earlier onset of prenatal care was positively correlated with higher c-section rates throughout the decade, but regardless of when prenatal care began, the rates follow the trend of decreasing between 1990 and 1995 and then increasing between 1995 and 1999 (Table 4).

Multiple births are more than twice as likely to be delivered via cesarean section and the rate for multiples increased between 1990 and 1995 as well as between 1995 and 1999 (Table 4). The increase in multiple births does not explain the overall increase in cesarean rates because the rate also increased among singletons who comprise more than 95 percent of deliveries. Note that multiple deliveries are considered high risk and are not included in the Healthy People 2010 objective to lower cesarean delivery rates.[1] Cesarean rates for premature babies delivered prior to 32 weeks of gestation increased through the early part of the 1990s and again in the later



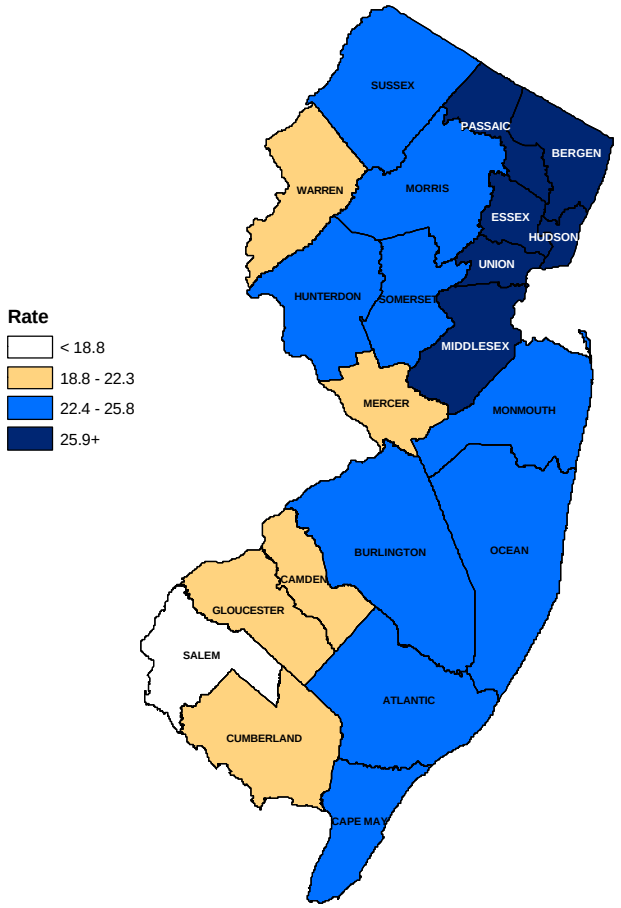
part for an overall increase of 47 percent during the decade. Rates for infants delivered between 32 and 41 weeks decreased between 1990 and 1995 and then increased between 1995 and 1999. A lower percentage of babies born at 42 weeks or later were delivered via c-section in 1999 than in 1990 (Table 4).

Infants with low five-minute Apgar scores were more likely to have been delivered via cesarean section than those with normal Apgar scores, but for both low and normal Apgar scores, the rates decreased between 1990 and 1995 and then increased between 1995 and 1999 (Table 4). Low birth weight (< 2,500 grams) and high birth weight (4,000+ grams) infants were more likely to be delivered by c-section than normal weight babies (2,500- 3,999 grams). In 1999, very low birth weight (< 1,500 grams) babies were more than twice as likely to have been delivered by cesarean than those of normal weight. While the c-section rate for normal weight infants declined between 1990 and 1995 before rising between 1995 and 1999, the rates for low and high birth weight babies generally increased throughout the decade (Table 4).

Some medical risk factors of pregnancy were associated with higher cesarean rates. Two-thirds of New Jersey mothers with eclampsia delivered via c-section in 1999 (Table 5). Nationally, slightly less than half of women with eclampsia had a c-section.[14] Diabetes and hypertension were also risk factors associated with high cesarean delivery rates in New Jersey and nationally (Table 5).[14] For genital herpes and pregnancy-associated hypertension, the c-section rates decreased in both halves of the decade (Table 5).

Nearly all deliveries with cephalopelvic disproportion and placenta previa were cesareans. Other complications of labor and/or delivery associated with high c-section rates were breech/malpresentation, cord prolapse, dysfunctional labor, abruptio placenta, and fetal distress. Since many complications of labor and/or delivery are indications for a cesarean delivery, high rates are to be expected (Table 5).

Figure 4. Total cesarean rates by county of residence New Jersey, 1999



NOTE: New Jersey rate is 25.3 per 100 live births.

More than 60 percent of newborns with Fetal Alcohol Syndrome (FAS), hyaline membrane disease/respiratory distress syndrome (RDS), or assisted ventilation (= 30 minutes) were delivered via cesarean section in 1999. Only 20 percent of infants with birth injuries were delivered by c-section. For many abnormal conditions of newborns the cesarean rate increased in both halves of the decade (Table 5).

Discussion

The topic of cesarean rates is controversial, since the procedure is viewed by some as largely optional and overused. Since every woman, pregnancy, labor, delivery, and infant are different, no one recommendation on method of delivery will fit all situations. Recent challenges to the idea that cesareans are more risky for the mother and infant may explain some of the increase in the cesarean rate in the late 1990s.[14] In certain situations like placenta previa, maternal herpes, and breech presentation, a cesarean delivery may be preferable or even necessary for the health of the newborn and/or the mother.[11,15-16] However, in the majority of pregnancies, the need for a cesarean delivery is not indicated. Vaginal delivery is generally preferred because it is not surgery, requires a shorter hospital stay, has a lower risk of infection, has less need for blood transfusions, and results in a quicker recovery.[17] However, it may lead to higher rates of certain birth injuries as well as adverse maternal conditions such as urinary incontinence and possible uterine rupture in cases of VBAC.[10,18-19] Practice style, desire to avoid litigation, or patient demand may explain the substantially higher c-section rate in New Jersey compared to the national average.[14] Some of the difference is also due to the fact that New Jersey has above average maternal age. Within the state, there is some evidence of practice style variation, as c-sections appear to be more common in the northeastern part of the state, and less common in parts of South Jersey. While the debate continues over elective cesareans and vaginal birth after previous cesarean, it appears that, at least in the near future, in New Jersey the number and rate of cesareans, both primary and repeat, will continue to grow while the number and rate of vaginal births after cesarean section declines (Table A and Figure 1).[19]

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List of Detailed Tables

Table 1. Total and primary cesarean rates by age and race/ethnicity of mother: New Jersey, 1990-1999 and percent changes 1990-1995 and 1995-1999

Age and race/ethnicity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percent change 1990-1995	Percent change 1995-1999
Total cesarean[1]												
All races[2]												
< 20	16.0	15.1	14.1	14.7	15.0	13.5	15.3	15.4	16.5	16.7	-15	23
20-24	20.8	19.5	19.0	19.2	18.4	17.9	17.9	18.7	19.0	19.5	-14	9
25-29	23.4	22.6	23.0	23.3	22.1	21.3	21.3	22.5	23.1	24.0	-9	13
30-34	25.3	24.8	25.2	25.6	24.5	24.1	25.0	25.4	26.2	26.9	-5	12
35-39	28.3	27.6	27.5	28.3	27.5	27.6	28.8	30.4	31.0	31.6	-2	14
40+	28.8	29.1	29.1	30.8	30.6	31.3	32.6	34.9	36.0	36.7	9	17
Total	23.3	22.6	22.8	23.4	22.6	22.1	22.9	23.9	24.6	25.3	-5	14
White non-Hispanic												
< 20	16.0	15.8	12.7	13.9	12.6	12.2	13.5	14.5	15.0	15.6	-24	28
20-24	21.2	19.2	18.3	18.3	17.8	17.5	16.9	17.5	17.3	17.7	-18	1
25-29	23.4	22.5	22.7	22.6	21.8	20.8	20.3	22.0	22.3	23.3	-11	12
30-34	25.2	24.8	25.0	25.1	24.0	23.5	24.7	24.7	25.8	26.2	-7	12
35-39	28.8	27.9	27.6	28.2	27.2	27.2	28.2	29.9	30.3	31.4	-6	15
40+	30.5	30.4	29.8	30.9	31.4	30.5	33.1	34.2	36.1	37.3	0	22
Total	24.0	23.3	23.3	23.7	22.9	22.5	23.3	24.2	25.0	25.8	-6	15
Black non-Hispanic												
< 20	16.0	14.7	14.3	14.7	16.5	14.7	15.8	16.5	17.7	17.4	-8	19
20-24	20.4	19.3	19.7	19.3	18.7	18.7	18.8	19.6	20.6	21.3	-8	14
25-29	23.7	23.0	23.9	24.8	23.7	23.6	24.6	23.7	25.0	27.2	0	15
30-34	27.9	27.8	27.4	29.6	29.2	28.9	27.4	29.2	30.5	30.5	4	6
35-39	30.5	28.2	30.3	30.9	30.3	32.7	33.2	34.5	35.6	36.3	7	11
40+	22.8	27.0	26.7	30.0	33.7	34.6	33.5	39.3	38.2	40.7	51	18
Total	22.1	21.3	21.8	22.6	22.6	22.6	22.9	23.8	24.9	25.9	2	15
Hispanic												
< 20	16.4	15.3	15.5	15.6	15.3	13.3	16.3	14.8	16.2	16.5	-19	24
20-24	21.6	21.5	20.4	21.4	19.9	18.6	19.1	19.7	20.6	21.1	-14	13
25-29	26.7	26.1	27.4	28.4	26.0	24.0	25.1	26.2	26.8	26.2	-10	9
30-34	31.8	29.3	32.2	31.7	31.3	31.2	32.0	32.5	33.0	34.7	-2	11
35-39	35.2	33.1	34.6	37.7	36.1	35.0	37.3	38.0	41.3	37.7	-1	8
40+	38.1	35.1	37.2	37.0	35.1	39.5	39.0	44.0	45.5	42.1	4	7
Total	25.3	24.2	25.2	26.0	24.7	23.4	24.9	25.3	26.4	26.5	-8	13
Asian/Pacific Islander non-Hispanic												
< 20*	15.2	12.3	13.2	16.4	12.1	6.3	13.9	12.8	18.9	14.0	-59	124
20-24	18.6	17.8	15.5	19.1	17.7	17.0	17.3	19.5	17.3	16.6	-8	-3
25-29	22.7	22.0	21.2	20.7	17.6	19.5	19.1	20.7	21.5	22.7	-14	16
30-34	26.9	24.6	25.3	25.8	24.3	21.3	23.4	26.1	24.8	26.7	-21	25
35-39	33.2	36.5	31.1	29.5	30.9	29.6	32.2	34.6	31.4	33.3	-11	12
40+	39.0	38.3	34.1	46.2	32.0	47.0	41.2	44.1	41.9	41.3	20	-12
Total	25.2	24.6	23.6	24.3	22.5	22.2	23.1	25.4	24.5	25.7	-12	16

Table 1. Total and primary cesarean rates by age and race/ethncity of mother: New Jersey, 1990-1999 and percent changes 1990-1995 and 1995-1999 (continued)

Age and race/ethnicity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percent change 1990-1995	Percent change 1995-1999
Primary cesarean[3]												
All races[2]												
< 20	14.2	13.6	12.8	13.4	14.1	12.5	14.5	14.3	15.5	15.6	-12	25
20-24	16.0	15.0	14.7	14.9	14.6	14.5	14.8	15.4	16.0	15.6	-9	7
25-29	17.3	16.7	17.1	17.9	17.0	16.3	16.8	17.9	18.6	19.1	-6	17
30-34	17.0	16.4	17.2	17.5	16.9	17.0	18.4	18.9	19.6	20.2	0	18
35-39	19.4	18.2	18.7	19.1	18.5	19.0	21.0	22.0	22.3	23.0	-2	21
40+	22.9	23.7	22.9	24.1	24.3	24.0	25.9	27.9	30.1	29.5	5	23
Total	16.9	16.3	16.5	17.1	16.6	16.4	17.5	18.3	19.0	19.4	-3	18
White non-Hispanic												
< 20	15.0	15.0	12.0	13.2	12.4	11.7	13.4	14.0	14.4	14.9	-22	27
20-24	17.1	15.5	14.8	15.0	14.9	15.2	14.7	15.1	15.3	15.0	-11	-1
25-29	17.4	16.9	17.0	17.8	17.2	16.5	16.8	17.9	18.5	19.3	-5	17
30-34	16.4	16.2	16.7	16.9	16.1	16.4	18.3	18.2	19.1	19.6	0	19
35-39	18.5	17.5	17.9	18.1	17.6	18.0	19.9	21.2	21.1	22.2	-3	23
40+	22.8	22.8	21.5	22.6	23.8	22.2	25.7	25.9	29.1	28.4	-3	28
Total	17.1	16.5	16.6	17.0	16.5	16.5	17.7	18.3	19.0	19.7	-4	19
Black non-Hispanic												
< 20	13.6	12.7	12.6	13.4	15.2	13.5	14.7	15.2	16.6	16.2	-1	20
20-24	14.4	14.0	14.5	14.1	13.7	14.5	15.1	15.7	16.5	16.4	0	14
25-29	16.3	15.7	16.5	17.8	16.9	16.4	17.9	17.8	18.6	19.8	0	21
30-34	18.6	18.3	17.7	20.0	20.1	19.9	19.3	20.8	21.8	21.8	7	10
35-39	21.8	19.8	21.6	22.1	20.8	23.2	24.8	24.4	26.0	25.8	7	11
40+	19.7	23.4	26.1	25.6	28.5	27.7	25.2	31.5	29.6	31.6	41	14
Total	15.8	15.2	15.7	16.5	16.6	16.6	17.4	18.0	19.0	19.3	5	17
Hispanic												
< 20	14.4	13.6	14.0	13.7	14.0	11.9	15.1	13.7	15.0	15.3	-17	29
20-24	15.2	15.4	14.7	15.3	14.8	13.6	14.7	15.0	16.5	15.9	-11	17
25-29	18.0	17.2	18.1	19.2	17.5	15.4	16.8	18.6	18.7	18.0	-14	17
30-34	19.5	17.3	20.3	19.7	19.1	19.7	19.7	20.9	21.6	22.1	1	12
35-39	22.6	20.2	21.1	24.6	21.5	21.6	24.1	23.8	26.7	24.7	-4	15
40+	25.4	28.0	26.6	26.8	24.9	26.0	27.2	32.6	35.9	33.1	2	28
Total	17.2	16.4	17.1	17.7	16.8	15.7	17.2	17.8	18.9	18.5	-9	18
Asian/Pacific Islander non-Hispanic												
< 20*	13.3	10.9	12.0	17.3	12.5	5.1	13.9	12.8	18.9	14.0	-62	173
20-24	17.3	16.2	13.6	17.6	16.2	15.1	16.5	18.7	16.4	14.7	-13	-3
25-29	18.7	18.1	16.8	16.2	13.9	16.1	15.7	17.2	18.5	19.0	-14	18
30-34	18.1	15.4	17.1	17.9	17.2	14.8	16.4	19.7	18.3	20.0	-18	35
35-39	22.1	22.9	19.4	18.0	19.9	18.7	22.3	24.6	21.3	23.6	-16	27
40+*	25.4	25.6	25.3	33.0	18.9	36.4	27.3	33.9	30.4	30.8	43	-15
Total	18.8	17.6	17.0	17.6	16.4	16.3	17.2	19.7	19.0	19.8	-13	22

[1] Percent of all live births by cesarean delivery.

[2] Includes races other than white, black, Asian, or Pacific Islander and race not stated.

[3] Number of primary cesareans per 100 live births to women who have not had a previous cesarean.

* Numbers are too small to calculate reliable rates. Interpret with caution.

Table 2. Rates of vaginal births after previous cesarean by age and race/ethnicity of mother: 1990-1999 and percent changes 1990-1996 and 1996-1999

Age and race/ethnicity	VBAC rate[1]										Percent change 1990-1996	Percent change 1996-1999
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		
All races[2]												
< 20	29.2	30.5	35.9	34.6	37.1	40.5	50.4	44.2	46.8	40.8	73	-19
20-24	18.4	24.1	25.4	25.8	27.7	34.1	42.8	41.1	41.5	35.7	132	-17
25-29	17.2	18.9	19.7	22.9	23.5	28.3	37.8	36.0	35.6	31.3	120	-17
30-34	17.8	18.4	20.0	20.8	20.8	25.8	34.7	34.5	33.1	28.9	94	-17
35-39	13.2	16.0	17.9	17.9	20.0	24.1	32.6	30.3	28.7	28.1	146	-14
40+	12.9	12.7	16.4	12.3	17.2	18.8	27.3	25.2	26.3	24.2	112	-11
Total	17.3	19.1	20.5	21.4	22.2	26.9	35.6	34.2	33.2	29.9	106	-16
White non-Hispanic												
< 20*	25.7	33.9	27.5	30.0	46.2	42.9	56.5	38.2	31.3	32.4	120	-43
20-24	18.0	24.5	27.2	28.6	30.1	38.4	44.3	40.4	40.3	33.6	146	-24
25-29	18.2	19.3	20.7	25.0	25.0	30.2	41.0	35.0	36.0	29.6	125	-28
30-34	18.8	19.1	21.2	22.9	22.3	27.8	36.9	35.9	33.9	30.3	97	-18
35-39	14.0	17.1	19.4	19.7	21.7	26.0	34.7	32.7	29.9	29.4	147	-15
40+	15.9	12.1	16.9	15.6	17.5	21.7	29.2	25.8	28.1	24.1	84	-18
Total	17.7	19.2	21.1	22.9	23.1	28.2	37.1	34.5	33.0	29.7	109	-20
Black non-Hispanic												
< 20	30.3	27.2	36.5	38.8	36.6	44.1	53.0	43.4	51.6	43.2	75	-19
20-24	21.0	27.3	27.5	26.0	29.4	36.6	46.7	44.9	45.1	39.8	123	-15
25-29	17.7	20.9	22.6	22.9	25.4	27.4	37.8	43.3	40.6	34.5	113	-9
30-34	18.2	18.9	18.8	17.2	19.1	22.0	35.4	35.9	37.1	31.6	94	-11
35-39	12.4	16.1	13.7	16.4	16.3	20.6	33.2	31.0	30.0	27.2	168	-18
40+*	12.5	14.6	16.7	2.4	19.4	12.7	32.4	28.2	25.6	26.6	159	-18
Total	19.3	22.1	23.0	21.9	23.9	27.4	38.8	38.9	38.7	33.7	101	-13
Hispanic												
< 20	29.3	33.7	38.8	31.3	33.8	36.1	44.6	48.9	46.2	42.0	52	-6
20-24	15.5	18.9	19.6	21.8	23.3	26.6	36.2	36.8	38.0	33.2	133	-8
25-29	12.3	14.7	13.3	16.0	16.8	23.8	31.1	29.8	28.8	30.4	154	-2
30-34	10.4	12.1	13.6	13.4	14.2	16.7	23.9	27.5	24.7	21.3	130	-11
35-39	8.1	9.7	12.1	9.5	13.2	17.1	23.9	20.0	21.4	23.1	196	-3
40+*	2.1	16.1	13.3	7.3	11.9	13.0	21.3	23.2	21.9	23.1	903	8
Total	12.7	15.4	15.6	16.2	17.1	21.4	28.7	29.3	28.2	27.2	127	-6
Asian/Pacific Islander non-Hispanic												
<25*	18.2	36.8	27.3	25.0	25.0	37.0	60.0	58.6	58.6	35.5	230	-41
25-29	19.8	22.9	21.1	26.8	26.4	31.9	37.9	39.6	37.1	30.7	91	-19
30-34	20.0	21.1	19.3	17.1	21.6	31.2	35.4	33.3	35.9	29.6	77	-17
35-39*	10.7	10.4	17.2	11.6	19.2	20.7	27.0	22.9	28.5	27.4	152	2
40+*	11.8	4.8	19.0	3.6	15.4	14.3	12.2	22.8	15.1	21.8	4	78
Total	17.6	18.8	19.5	17.8	21.6	27.7	33.2	32.3	33.6	28.9	89	-13

[1] Number of vaginal births after previous cesarean (VBAC) delivery per 100 live births to women with a previous cesarean delivery.

[2] Includes races other than white, black, Asian, or Pacific Islander and race not stated.

* Numbers are too small to calculate reliable rates. Interpret with caution.

Table 3. Cesarean delivery rates: New Jersey and counties, 1990-1999 and percent changes 1990-1995 and 1995-1999

County of residence	Cesarean delivery rate[1]										Percent change 1990-1995	Percent change 1995-1999
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		
Atlantic	22.8	22.3	20.6	23.6	23.0	21.9	24.3	25.0	24.7	25.4	-4	16
Bergen	24.2	23.9	24.3	25.0	24.2	23.0	24.9	25.7	25.5	25.9	-5	13
Burlington	23.8	21.8	21.7	22.2	21.8	21.6	21.7	21.5	22.5	23.4	-9	8
Camden	16.7	14.9	14.6	17.5	17.6	18.3	18.9	20.3	21.4	22.3	10	22
Cape May	24.1	22.3	25.1	21.7	23.0	23.0	23.4	22.8	23.9	23.1	-4	0
Cumberland	17.5	17.0	17.2	17.0	16.8	15.8	17.9	18.3	19.9	19.9	-9	26
Essex	23.5	23.5	23.1	22.4	23.0	23.1	23.2	23.6	25.3	27.0	-2	17
Gloucester	19.9	17.6	17.5	17.8	17.9	16.4	18.9	20.1	21.2	21.9	-17	33
Hudson	28.4	25.0	26.9	29.8	28.8	28.1	27.4	28.7	29.3	29.4	-1	5
Hunterdon	20.2	21.6	18.5	18.9	20.1	20.0	19.3	20.8	19.8	24.9	-1	24
Mercer	19.2	17.4	17.9	17.7	18.4	19.6	19.1	19.2	20.5	20.2	2	3
Middlesex	27.1	25.7	26.1	24.7	22.9	22.8	23.8	25.1	24.8	26.3	-16	16
Monmouth	21.2	22.5	22.6	23.4	21.7	20.5	21.6	24.1	25.4	25.6	-3	25
Morris	24.8	24.6	25.0	24.9	23.1	21.9	22.8	22.5	23.9	24.9	-12	14
Ocean	24.9	24.4	24.1	24.0	22.2	22.9	22.8	24.2	23.4	25.7	-8	12
Passaic	24.6	25.6	25.7	28.2	26.6	24.5	25.8	26.6	27.6	27.0	-1	10
Salem	17.8	13.4	14.9	14.5	13.7	14.6	16.1	16.3	17.5	15.3	-18	4
Somerset	22.9	23.8	22.5	22.9	20.4	20.7	22.3	23.5	25.0	25.8	-9	24
Sussex	22.8	22.8	24.7	23.7	24.4	22.7	22.8	23.4	24.9	22.9	0	1
Union	22.6	22.5	23.0	22.6	21.6	21.9	23.0	24.2	25.5	25.9	-3	18
Warren	26.6	26.2	26.8	27.6	23.7	21.6	22.2	23.4	21.8	22.2	-19	3
New Jersey	23.3	22.6	22.8	23.4	22.6	22.1	22.9	23.9	24.6	25.3	-5	14

[1] Percent of all live births by cesarean delivery.

Table 4. Total cesarean rates by selected characteristics: New Jersey, 1990-1999 and percent changes 1990-1995 and 1995-1999

Selected characteristics	Cesarean delivery rate[1]										Percent change 1990-1995	Percent change 1995-1999
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		
Live-birth order												
First child	26.1	25.3	25.4	26.1	25.3	24.3	25.5	26.6	27.4	26.5	-7	9
Second child	25.0	23.8	24.3	24.2	23.3	23.0	23.5	24.5	25.1	26.6	-9	16
Third child or higher	21.5	20.9	21.5	21.9	21.5	21.6	22.1	23.0	23.6	24.1	1	12
Mother's birthplace												
U.S.-born	24.2	23.5	23.6	24.0	23.5	23.0	23.9	24.7	25.4	26.5	-5	15
Foreign-born	24.6	24.3	25.1	25.3	24.3	23.7	24.3	25.5	26.1	26.5	-4	12
Education												
0-11 years	19.9	18.7	18.9	19.5	19.0	18.4	19.2	19.3	21.1	21.6	-8	17
12 years	24.8	24.3	24.8	24.8	24.5	24.0	25.0	26.2	26.4	27.1	-4	13
13-15 years	26.8	25.8	26.2	26.4	25.3	24.9	25.6	26.5	26.8	27.4	-8	10
16 years or more	26.1	25.4	25.3	25.6	24.7	24.0	24.3	25.6	26.3	27.7	-9	15
Marital status												
Married	24.2	23.6	23.8	24.5	23.5	23.0	24.5	25.6	26.3	26.9	-5	17
Unmarried	20.4	19.8	20.1	20.4	20.4	19.8	20.8	21.4	22.5	23.5	-3	19
Prenatal care onset												
First trimester	25.8	25.1	25.1	25.6	24.8	24.0	24.8	26.1	26.6	26.8	-7	12
Second trimester	21.2	20.4	21.7	21.4	20.5	20.5	21.3	21.2	21.9	22.4	-4	10
Third trimester	18.4	19.0	18.2	18.9	18.1	18.4	18.7	19.2	20.8	20.3	0	11
No care	15.1	12.1	13.3	13.4	13.6	12.3	14.3	14.1	14.7	15.7	-23	28
Plurality												
Singleton	22.6	21.8	21.9	22.5	21.7	21.1	21.7	22.5	23.1	23.8	-7	13
Multiple	54.2	53.7	54.5	54.8	53.1	56.1	58.2	57.9	60.4	61.2	3	9
Gestation												
<28 weeks	27.9	28.2	28.4	31.1	33.1	35.7	39.4	42.7	44.7	44.2	22	24
28-31 weeks	43.2	41.2	43.6	49.8	49.5	53.4	54.5	58.7	58.0	61.2	19	15
32-36 weeks	32.4	30.4	33.1	32.7	32.0	32.1	36.2	35.9	38.6	39.5	-1	23
37-41 weeks	23.5	22.7	23.0	23.4	22.6	21.9	22.4	23.4	23.9	24.7	-7	13
42+ weeks	29.7	29.3	28.5	28.3	29.3	29.1	28.4	29.3	30.0	27.0	-2	-7
Apgar score												
0-6	35.0	35.4	35.5	36.8	37.0	34.7	39.1	38.1	41.8	43.0	-1	24
7-10	24.4	23.6	23.9	24.3	23.6	23.1	23.9	24.9	25.5	26.3	-6	14
Birthweight												
<1500 grams	38.3	36.5	38.0	42.5	44.0	48.9	51.7	52.5	57.1	54.3	22	11
1500-2499 grams	31.7	30.4	32.0	33.2	33.0	32.6	36.2	36.8	40.0	41.3	3	27
2500-3999 grams	22.2	21.3	21.5	21.9	21.0	20.3	21.0	21.8	22.4	23.1	-9	14
4000+ grams	30.4	30.5	30.4	30.4	30.5	31.3	30.5	32.6	32.8	33.4	3	7

[1] Percent of all live births by cesarean delivery.

Table 5. Cesarean delivery rates by selected maternal medical risk factors, complications of labor and/or delivery, and abnormal conditions of newborn: New Jersey, 1990-1999 and percent changes 1990-1995 and 1995-1999

Medical risk factor, complication, and abnormal condition	Cesarean delivery rate[1]										Percent change 1990-1995	Percent change 1995-1999
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		
All births	23.3	22.6	22.8	23.4	22.6	22.1	22.9	23.9	24.6	25.3	-5	14
Medical risk factors												
Anemia (Hct.<30/Hgb.<10)	28.3	24.8	25.7	25.0	24.6	24.9	24.0	25.2	24.6	26.6	-12	7
Cardiac disease	26.3	29.7	27.1	27.8	28.9	24.4	25.1	28.0	28.6	29.8	-7	22
Acute or chronic lung disease	28.5	27.2	28.1	26.9	28.1	26.8	25.3	26.3	27.3	29.2	-6	9
Diabetes	39.0	39.7	39.8	41.7	40.8	39.8	39.0	40.8	41.0	43.4	2	9
Genital herpes	50.9	44.5	43.0	41.7	39.5	36.9	35.5	35.6	36.4	35.0	-28	-5
Other sexually transmitted diseases	22.4	21.0	20.5	22.0	20.7	18.2	21.7	22.1	22.8	23.3	-19	28
Hydramnios/oligohydramnios	46.6	42.4	40.2	40.7	41.8	38.5	38.1	39.3	39.3	39.9	-17	4
Hemoglobinopathy*	27.1	34.1	37.8	33.3	28.6	29.0	20.8	30.2	27.3	32.8	7	13
Hypertension, chronic	42.2	43.9	45.5	44.0	46.7	42.6	41.3	45.2	43.8	45.8	1	8
Hypertension, pregnancy-associated	44.2	44.0	43.0	44.7	43.0	42.4	41.7	39.7	42.5	42.0	-4	-1
Eclampsia	60.5	60.4	59.4	57.5	59.7	53.0	45.3	56.8	62.2	67.6	-12	28
Incompetent cervix	36.7	25.1	32.4	34.5	36.6	35.9	35.7	33.4	38.9	40.3	-2	12
Previous infant 4000+ grams	34.3	30.5	33.5	30.9	33.6	34.2	33.1	32.4	35.0	35.4	0	4
Previous preterm or small-for-gestational-age infant	24.7	24.0	24.3	27.8	25.6	26.3	24.6	27.3	28.0	29.2	7	11
Renal disease	27.0	37.4	21.5	31.9	28.2	27.7	32.8	26.4	27.3	30.1	2	9
Rh sensitization	31.4	27.4	25.7	25.7	25.8	22.7	25.3	23.2	26.2	26.1	-28	15
Uterine bleeding	39.7	42.5	43.3	42.4	43.9	38.7	37.7	42.6	40.5	39.6	-3	3
Other risk factor	31.8	29.5	30.9	31.3	29.9	31.5	33.5	34.2	33.9	35.6	-1	13
Complications of labor and/or delivery												
Febrile (>100 F or 38C)	34.6	34.6	36.6	35.8	39.4	36.1	39.7	39.6	38.9	39.0	4	8
Meconium, moderate/heavy	25.6	25.7	24.7	24.7	24.7	25.3	25.5	25.0	24.7	25.4	-1	0
Premature rupture of membrane (>12 hours)	32.2	30.9	30.6	31.4	30.0	29.4	27.6	30.6	28.7	29.2	-9	-1
Abruptio placenta	62.7	57.0	61.9	63.5	60.4	64.1	64.1	64.1	67.7	64.9	2	1
Placenta previa	82.4	88.5	87.3	85.4	85.6	86.3	89.4	90.3	90.5	94.6	5	10
Other excessive bleeding[2]	23.2	31.6	21.1	29.4	26.2	71.2	81.2	48.6	37.6	39.5	207	-45
Seizures*	54.5	50.0	64.1	48.8	59.3	65.0	59.4	65.7	50.0	55.8	19	-14
Precipitous labor (<3 hours)[2]	2.1	1.5	1.3	2.8	3.8	9.0	18.8	13.3	12.3	11.2	326	24
Prolonged labor (>20 hours)	52.4	49.9	43.2	40.4	41.2	42.1	36.3	34.5	37.0	35.2	-20	-16
Dysfunctional labor	43.9	45.7	49.9	52.2	54.6	56.4	57.9	60.8	63.2	66.4	29	18
Breech/malpresentation	87.2	87.5	87.3	88.9	86.2	85.9	86.8	87.9	88.5	87.2	-2	2
Cephalopelvic disproportion	97.8	98.1	98.1	98.2	98.4	97.7	98.0	97.5	97.3	97.1	0	-1
Cord prolapse	69.8	45.3	33.6	52.8	46.7	53.3	63.8	59.8	65.2	68.5	-24	29
Anesthetic complications	65.6	58.6	64.9	60.5	54.4	49.3	60.9	66.1	59.2	54.4	-25	10
Fetal distress	78.0	78.5	76.7	76.8	75.5	66.5	58.3	58.9	59.1	62.1	-15	-7
Other complication	49.0	49.4	45.6	44.2	43.1	34.3	26.3	25.2	24.3	25.3	-30	-26
Abnormal conditions of newborn												
Anemia (Hct. <39/Hgb. <13)	40.3	39.8	40.0	41.7	27.0	53.6	49.6	51.3	52.6	57.9	33	8
Birth injury*	21.0	16.0	10.4	16.0	14.0	22.4	17.4	18.1	20.5	20.7	7	-7
Fetal Alcohol Syndrome*	20.0	33.3	23.5	18.2	18.2	25.0	33.3	40.7	61.8	66.7	25	167
Hyaline membrane disease/RDS	47.4	42.9	47.3	51.7	46.2	51.3	49.7	58.7	57.6	63.5	8	24
Meconium aspiration syndrome	41.4	42.3	43.4	37.4	39.0	34.9	39.0	49.8	45.3	46.7	-16	34
Assisted ventilation < 30 minutes	41.5	47.2	40.2	46.8	46.6	50.5	44.3	35.7	43.1	53.9	22	7
Assisted ventilation >= 30 minutes	44.5	40.4	50.0	47.6	51.7	53.8	53.0	56.7	57.7	61.5	21	14
Seizures*	45.5	47.4	37.1	39.1	31.8	38.2	34.9	48.5	43.3	39.4	-16	3
Other condition	32.6	33.8	34.1	34.3	32.8	32.0	31.2	26.7	30.3	32.4	-2	1

[1] Percent of all live births by cesarean delivery.

[2] Electronic Birth Certificate system cross-edits introduced in 1995-1996 are responsible for the fluctuations in rates.

* Numbers are too small to calculate reliable rates. Interpret with caution.