
Vital and Health Statistics

Cesarean Delivery in the United States, 1990

Series 21:
Data on Natality, Marriage, and Divorce
No. 51

An analysis of the demographic and maternal and infant health characteristics associated with cesarean delivery from information derived from live birth certificates.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Center for Health Statistics

Hyattsville, Maryland
May 1994
DHHS Publication No. (PHS) 94-1929

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Suggested citation

Taffel SM. Cesarean delivery in the United States, 1990. National Center for Health Statistics. *Vital Health Stat* 21(51). 1994.

Library of Congress Cataloging-in-Publication Data

Taffel, Selma.

Cesarean delivery in the United States, 1990 / [S.M. Tafel].
p. cm. — (Vital and health statistics. Series 21. Data on natality, marriage,
and divorce; no. 51) (DHHS publication ; no. (PHS) 94-1929)

"An analysis of the demographic and maternal and infant health
characteristics associated with cesarean delivery from information derived from
live birth certificates."

"May 1994"

Includes bibliographical references.

ISBN 0-8406-0490-4

1. Cesarean section—United States—Statistics. I. National Center for
Health Statistics (U.S.) II. Title. III. Series. National Vital Statistics System ; no.
51. HA2211.A3 no. 51

[RG761]

304.6'3'0973021 s—dc20

[362.1'9886'0973021]

DNLM/DLC

for Library of Congress

94-671
CIP

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Washington, DC 20402-9328

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Symbols

- - - Data not available
 - . . . Category not applicable
 - Quantity zero
 - 0.0 Quantity more than zero but less than 0.05
 - Z Quantity more than zero but less than 500 where numbers are rounded to thousands
 - * Figure does not meet standard of reliability or precision
 - # Figure suppressed to comply with confidentiality requirements
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Cesarean Delivery in the United States, 1990

by Selma M. Taffel, Division of Vital Statistics

Introduction

In recent years cesarean delivery has become the most frequently performed major operative procedure for women in the childbearing ages. According to information derived from the National Hospital Discharge Survey (NHDS) conducted annually by the National Center for Health Statistics, the cesarean delivery rate (number of cesarean deliveries per 100 total deliveries) rose from 4.5 percent in 1965 to 24.1 percent in 1986 and then stabilized at about this level through 1991 (1).

Beginning in 1989, method of delivery was included on the U.S. Standard Certificate of Live Birth to complement the information on cesarean delivery available from the NHDS. In 1990, 49 States and the District of Columbia included this item on their birth certificates; the birth certificate of Okla-

homa did not request method of delivery in 1990 but this item was added in 1991. This study uses information from 1990 certificates of live birth to describe maternal demographic characteristics, predisposing medical risk factors, complications of labor and delivery, obstetric procedures, and infant characteristics associated with cesarean delivery. Because the number of births in Oklahoma in 1990 comprised only 1 percent of all births in the United States, the cesarean rates presented in this report can be assumed to be representative of the United States as a whole.

All data in this report are shown by race of the mother. Although the information presented is based on counts of births, many of the characteristics described refer to the mother, for example, age and education. Therefore, for ease in writing, the terms "mothers" and "women" are sometimes used interchangeably with "births" or "infants."

Highlights

Information from the live birth certificates of the 49 States and the District of Columbia that reported method of delivery indicates that in 1990, 914,096 births or 22.7 percent of the 4,110,563 births in these areas were by cesarean delivery. This rate is five times as high as the cesarean rate in 1965 (4.5 percent). The primary cesarean rate (first cesareans per 100 live births to women who had no previous cesarean) in 1990 was 16.0, and the rate of vaginal births following a previous cesarean delivery (VBAC) per 100 births to women with a previous cesarean, 19.9.

The South region has the highest total and primary cesarean rates, followed by the Northeast, Midwest, and West regions. The South has the lowest VBAC rate and the Northeast the highest. There are substantial differences in State rates within each region.

The overall cesarean rate was slightly higher for white births than for black births (23.0 compared with 22.1) and a similar racial differential is apparent for the majority of States. By race, the highest cesarean rate was for Filipino mothers (24.6 percent) and the lowest for American Indian mothers (17.5 percent). Mothers of Hispanic origin as a group were slightly less likely to have a cesarean delivery (21.2 percent) than non-Hispanic white (23.4 percent) or non-Hispanic black mothers (22.1 percent).

The risk of cesarean delivery is highly associated with both maternal age and the live-birth order of the child. The rate of cesarean delivery increases with mother's age, from 16.6 percent for teenage girls to 32.3 percent for women in their forties. Rates are highest for first births (24.7 percent) and decline steadily for each additional birth order to 17.5 percent for fourth or higher order births. When age and birth order are considered together, rates are highest for women 35–39 years of age having their first child (39.3 percent) and women 40–49 years of age having their first (47.1 percent) or second child (37.9 percent).

Married women are more likely to deliver by cesarean than unmarried women (23.8 percent compared with 19.9 percent), and the increased risk is apparent for married women less than 40 years of age.

Rates of cesarean delivery rise rapidly with additional educational attainment, and women with 12 or more years of schooling are about 30 to 40 percent more likely to have a cesarean delivery than women with less than 9 years of schooling (23 to 25 percent compared with 18 percent). Much of this differential in rates can be explained by the older ages of women with higher levels of educational attainment.

The risk of a cesarean delivery generally increases with added weight gain during pregnancy. However, for weight gains of less than 36 pounds, rates of cesarean delivery are about the same or lower than average, and the risk of a cesarean delivery is substantially higher than average only when weight gain is 46 pounds or more.

Period of gestation and birthweight are both closely related to the risk of cesarean delivery. Rates are highest for preterm births (less than 37 completed weeks of gestation), 28.7 percent, decline to a low of 18.8 percent for a gestational age of 40 weeks, and then rise to 23.0 percent for postterm births (gestations of 42 weeks or longer). Rates are particularly high when birthweight is less than 1,500 grams (5 pounds 8 ounces), 43.7 percent, decline to a low of 19.8 percent for birthweights of 3,000–3,499 grams (6 pounds 10 ounces–7 pounds 11 ounces), and then rise to 37.3 percent for birthweights of 4,500 grams or more (9 pounds 15 ounces or more).

The cesarean rate for plural births is more than twice that of singleton births (55.7 percent compared with 21.9 percent); 54.7 percent of births in twin deliveries, 86.0 percent in triplet deliveries, and 89.0 percent in quadruplet, quintuplet, and other multiple deliveries are by cesarean.

The cesarean rate for six of the eight abnormal conditions noted on birth certificates was 34 percent or higher. Similar high rates of cesarean delivery were evident for many of the medical risk factors of pregnancy, complications of labor and delivery, and obstetric procedures included on birth certificates. However, there is generally little difference by race in the incidence of cesarean delivery for these conditions and procedures.

Maternal characteristics

Region and State of residence

Of the 4,110,563 births in 1990 in the 49 States and the District of Columbia reporting method of delivery, 914,096 were cesarean deliveries (table 1). Method of delivery was not recorded for 2 percent of the births in the reporting area. Almost two-thirds (63 percent) of all cesareans were primary or first cesareans, and slightly over one-third (37 percent) were repeat cesareans. A relatively small number of births (84,299) were vaginal births following a previous cesarean delivery (VBAC). Table 1 presents the number of births in 1990 by method of delivery for the total reporting area and for each region and State where the mother resided.

The total cesarean rate for the reporting area in 1990 was 22.7, and the primary rate was 16.0. The VBAC rate was 19.9 (table 2). These rates are within 1 percentage point of those derived from the 1990 NHDS (23.5 for the total cesarean rate, 16.8 for the primary rate, and 20.4 for the VBAC rate) (1).

There are distinct regional and State variations in total, primary, and VBAC rates (table 2). The south region had the highest total and primary cesarean rates, followed by the northeast, midwest, and west regions. Consistent with its high cesarean rate, the south had the lowest VBAC rate. The highest VBAC rate was in the northeast, with the west and midwest regions intermediary (table 2). Within each region, State rates varied by as much as 7 percentage points for the total cesarean rate, by 5 percentage points for the primary rate, and by as much as 20 percentage points for the VBAC rate.

For the reporting area as a whole, the total cesarean rate was slightly higher for white births than for black births (23.0 compared with 22.1). While white rates exceeded black rates in the northeast, midwest, and south regions by about 2 percentage points, rates were higher in the west for black births by 3 percentage points. For the majority of reporting States, white rates were higher than black rates. Racial differences in primary rates follow the same pattern as noted for the total cesarean rate, while VBAC rates are generally higher for black births.

Race and age

Regardless of the mother's race, cesarean rates increase rapidly with age (table 3). For all races combined, the rate was about twice as high for mothers 40–49 years of age (32.3) as for teenage mothers (16.6). The age differential in rates is particularly noticeable for Chinese, Filipino, and "Other"

Asian or Pacific Islander mothers, who were about 3 to 3½ times as likely to have a cesarean delivery if they were 40–49 years old at the time of birth than if they were less than 20 years of age. Hawaiian mothers in the oldest years of child-bearing are about 2½ times as likely as teenage mothers to deliver by cesarean; the oldest white, black, American Indian, and Japanese mothers are about twice as likely as teenage mothers to deliver by cesarean (table 3).

By race the highest cesarean rates were for Filipino (24.6 percent), white (23.0 percent), and black mothers (22.1 percent), and the lowest for American Indian (17.5 percent) and Hawaiian mothers (18.2 percent). Racial differences in cesarean rates are affected by the proportion of births to teenage and older mothers as well as by differences in age-specific cesarean rates. If the age distribution of births for specific racial groups were the same as for all births, then the rates for white, Chinese, Japanese, Filipino, and "Other" Asian or Pacific Islander mothers would be reduced because the proportion of births to older mothers is higher for these groups than for the average of all racial groups combined. By contrast, the rates for black, American Indian, and Hawaiian mothers would be raised because of the far higher proportion of teenage births relative to all births for these races (table 3 and figure 1).

After differences in the age distributions of racial groups are taken into account, black mothers have the highest risk of a cesarean delivery (23.3 percent) followed by white mothers (22.8 percent) and Filipino mothers (22.2 percent); the lowest risk of cesarean delivery then is for "Other" Asian or Pacific Islander mothers (17.8 percent) and American Indian and Chinese mothers (each 18.0 percent).

Hispanic origin and age

Mothers of Hispanic origin as a group are somewhat less likely to have a cesarean delivery (21.2 percent) than non-Hispanic white (23.4 percent) or non-Hispanic black mothers (22.1 percent) (table 4). However, more than one-third of Cuban mothers (34.7 percent) delivered by cesarean in 1990, a rate substantially higher than for other Hispanic groups. Rates for the remaining Hispanic groups ranged from 20.3 percent for Mexican mothers to 22.8 percent for "other" and unknown Hispanic origin mothers. As was true for individual racial groups, rates of cesarean delivery increased rapidly with advancing age of mother for all Hispanic origin groups.

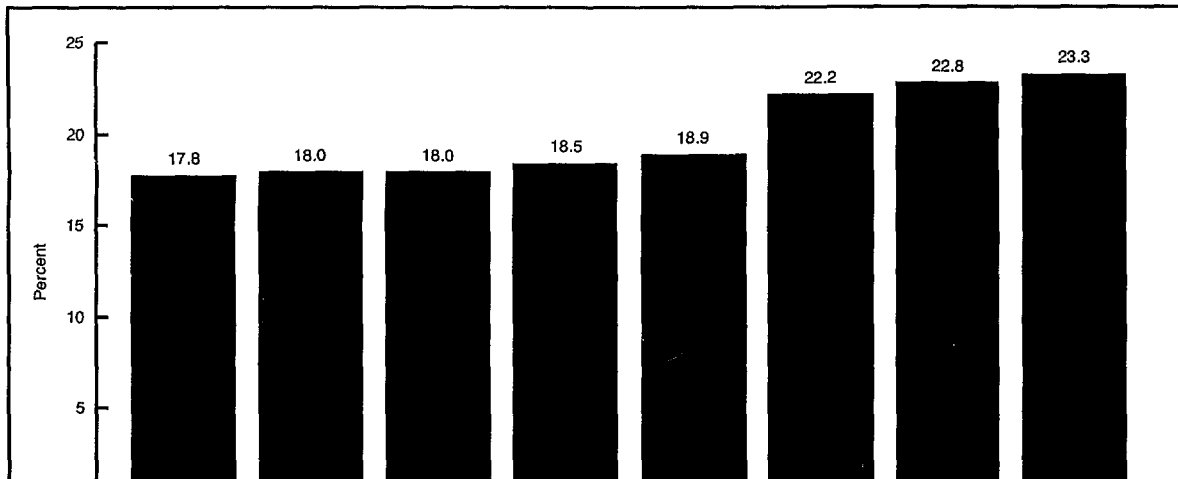


Figure 1. Age-adjusted cesarean rates by specified race of mother: Total of 49 reporting States and the District of Columbia, 1990

As noted for racial differences in the risk of cesarean delivery, variation in rates by Hispanic origin are affected by differences in age-specific rates and to a lesser extent, in the proportion of teenage and older mothers. For all maternal ages, Cuban mothers had a higher rate of cesarean delivery than any other Hispanic or non-Hispanic group, and this is reflected in their relatively high overall rate of 34.7 percent. After standardization for differences in the age at childbirth, Cuban mothers still have by far the highest risk of cesarean delivery (33.7 percent), followed by Puerto Rican mothers and “other” and unknown Hispanic origin mothers (each 23.6 percent). The lowest risk is still for Mexican mothers (21.0 percent) and Central and South American mothers (21.1 percent).

Live-birth order and age

As noted earlier, the rate of cesarean delivery increases with mother’s age and is particularly high for women in the oldest years of childbearing. As shown in table 5, a rapid increase in rates by maternal age is apparent for almost all live-birth orders. However, live-birth order affects the rate of cesarean delivery independent of maternal age (table 5 and figure 2). The risk of a cesarean delivery is highest for mothers having their first child regardless of age, and except for teenage mothers, the risk drops rapidly with succeeding births. This decline in cesarean rates as live-birth order increases for women 20 years of age and older is evident for both white and black mothers.

The highest cesarean rates for any age–birth order combination were for women 35–39 years of age having their first birth (39.3 percent) and women 40–49 years of age having their first (47.1 percent) or second child (37.9 percent); the

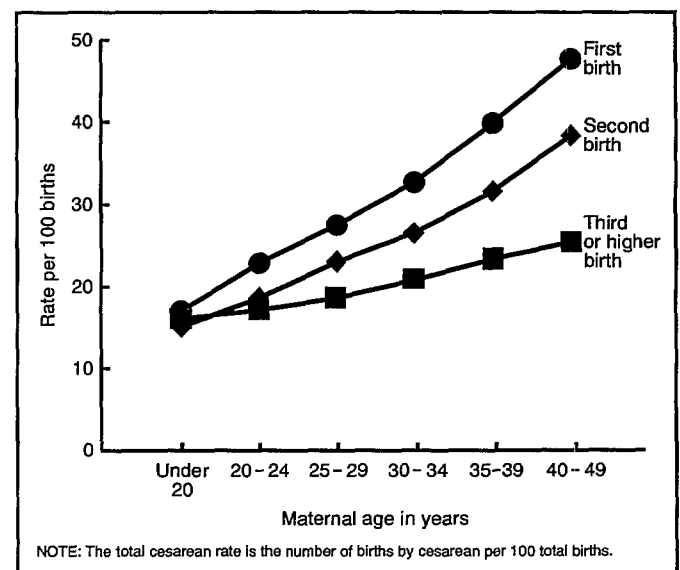


Figure 2. Total cesarean rates by age of mother and live-birth order: Total of 49 reporting States and the District of Columbia, 1990

lowest rates were for women in their twenties having a fourth or higher order birth (15.8–15.9 percent), and for teenage mothers having their second or third child (15.2 percent and 15.8 percent, respectively).

One explanation for the higher cesarean rates for first births is that women having a first child are more likely to have 16 or more years of schooling than women having higher order births. This level of educational attainment is associated with the highest risk of a cesarean delivery (see section “Educational attainment”).

The cesarean rate for first births to older women has apparently been quite stable since 1975, and thus did not contribute to the rapid rise in the overall cesarean rate during this time period. Information derived from the birth certificates of six States indicate that rates for first births to women 35 years and over ranged from 37 to 38 percent in the 1975–85 period (2). In 1990, the national cesarean rate for women in this age group having a first birth was 40 percent.

Cesarean rates for women 35 years of age or older are substantially higher for black than for white mothers for similar birth order, with differences particularly noticeable for mothers 40–49 years of age. For this age group, the cesarean rate for black mothers having their fourth or higher order birth is 28.7, compared with 21.9 for white mothers of similar parity (table 5).

For all age groups, total and primary cesarean rates are almost identical for first order live births (table 5), an indication that most women delivering their first live-born infant by cesarean have not had a previous cesarean delivery for a pregnancy resulting in a fetal death. Primary rates for second and higher order live births are generally only about one-third the level for first order births, suggesting that the risk of cesarean delivery is greatly lowered if a mother has had a previous vaginal birth.

Marital status

In 1990, the cesarean rate was 20 percent higher for married than for unmarried women (23.8 compared with 19.9 percent) (table 6). However, regardless of marital status, the risk of a cesarean delivery increases rapidly with maternal age.

The higher rate for married women reflects their slightly higher cesarean rate for all age groups, except 40–49 years, the far lower percentage of married mothers in their teenage years when the risk of cesarean delivery is lowest and the higher proportion of married women in the oldest years of childbearing when the risk is highest.

The higher cesarean rate for married mothers may also be a reflection of their generally higher level of educational attainment, with its attendant increased risk of cesarean delivery (see following section). Also, married mothers are more likely to have private insurance (68 percent) as the expected source of payment for delivery than unmarried mothers (21 percent) (3). Women with private insurance are more likely to have a cesarean delivery than women with government insurance or those with no insurance (1).

For similar ages, married black mothers are more likely than married white mothers to have a cesarean delivery, and the racial differential increases with age. However, racial differences for unmarried mothers are minimal for each age group and of no consistent pattern (table 6).

Educational attainment

The educational attainment of the mother is a commonly used measure of the socioeconomic status of the family. In 1990, educational attainment was reported on the birth certi-

ates of all States except Washington, by New York City (but not the remainder of New York State), and by the District of Columbia.

The rate of cesarean delivery increases with additional years of schooling and women with 12 or more years of schooling are 32 to 42 percent more likely to deliver by cesarean than women with less than 9 years of schooling (23.1 to 24.9 percent compared with 17.5 percent). An increase in the risk of cesarean delivery with added educational attainment can be seen for both white and black mothers. But an independent effect of maternal age is again evident. For all levels of education, the risk of a cesarean delivery rises with advancing age, regardless of mother's race (table 7).

The higher cesarean rates for women with at least a high school education is partly explained by the generally older ages of these mothers when the risk of cesarean delivery is greatest. For example, the cesarean rate for women with 16 or more years of education is 24.9 percent, or 42 percent higher than the rate for women with less than 9 years of schooling (17.5 percent). But if both groups of women had the same age distribution as all women giving birth in 1990, then the cesarean rate for women with 16 or more years of schooling would be only 16 percent higher than those with minimal schooling. In other words, 57 percent of the difference in rates can be explained by the older ages of women with the highest level of education, and 43 percent by the fact that at each age level cesarean rates are higher for women with 16 or more years of schooling than for women with less than 9 years of schooling.

An additional reason for the elevated risk of cesarean delivery for women with higher levels of education is that HMO and insurance coverage for delivery increases with added years of schooling; over 90 percent of mothers with 16 or more years of schooling had such coverage at the time of delivery compared with about 40 percent of mothers with less than 12 years of education (4). As noted in the section "Marital status," women who have insurance are more likely to deliver by cesarean than women without insurance coverage.

A recent study indicates that rates of primary cesarean delivery vary directly with socioeconomic status, and that this association cannot be completely explained by differences in maternal age, parity, birthweight, race, ethnic group, or complications of pregnancy or childbirth (5).

Weight gain during pregnancy

From 1974 to 1989, the medical community recommended that a mother gain 22–27 pounds during the course of a normal pregnancy (6,7). Guidelines for weight gain were revised in 1990 to take into account the mother's prepregnancy weight for height. For a mother of average size, the recommended weight gain was 25–35 pounds, for smaller than average women, 28–40 pounds, and for heavier women, no less than 15 pounds. Teenage mothers and black mothers were advised to gain at the upper end of these ranges (8).

This analysis of the risk of a cesarean delivery by mother's weight gain is limited to singleton births. Mothers of twins, triplets, and other multiple births tend to gain more

during pregnancy than mothers of singletons (9), and they have a far higher risk of a cesarean delivery (see section “Plurality of birth”).

Cesarean rates generally rise with increased maternal weight gain, increasing from 20.4 percent for gains of 16–20 pounds to 28.4 percent for gains of 46 pounds or more. A similar pattern is evident for all gestational ages and for all birthweights. For weight gains of less than 36 pounds, rates of cesarean delivery are about the same or lower than the overall average of 22.0 percent (table 8).

For gestational ages of under 37 weeks, 37–39 weeks, and 40 weeks and over, cesarean rates for weight gains below 36 pounds are about the same or lower than the respective averages for these gestational ages; for weight gains of 36–40 pounds, the cesarean rates are about 2 percentage points higher than average; for weight gains of 41–45 pounds, about 3 percentage points higher than average; and for the highest weight gains of 46 pounds or more, 6 to 7 percentage points

higher than average. Thus, regardless of gestational age, the risk of cesarean delivery is substantially higher only when weight gain is 46 pounds or more.

Similarly, for birthweights of 2,500 grams (5 pounds 8 ounces) or more, cesarean rates substantially exceed the average for the respective birthweight category only when weight gain is more than 46 pounds (table 8). For example, for birthweights of 2,500–3,499 grams (5 pounds 8 ounces–7 pounds 11 ounces, the birthweight of more than one-half of the infants born in 1990), the cesarean rate exceeded the average for these birthweights by more than 5 percentage points only for weight gains of at least 46 pounds.

Previous research indicated that for one population of women, only those who gained more weight than the 1990 Institute of Medicine recommendation for their weight and height had an increased risk of cesarean delivery after controlling for fetal size (10).

Infant characteristics

Period of gestation and birthweight

Period of gestation is strongly associated with the risk of a cesarean delivery, with rates highest for babies born preterm (less than 37 completed weeks of gestation)(table 9). The peak rate for preterm births was for gestations of 28–31 weeks (37.3 percent), with rates substantially lower for gestations of under 28 weeks (30.0 percent) and for 36 weeks (25.5 percent). For births with gestational ages of 37 weeks or longer, rates declined from 23.9 percent for gestations of 37–39 weeks to a low of 18.8 percent for 40 weeks gestation and then increased to 23.0 percent for postterm births (42 weeks gestation or longer). White mothers are more likely than black mothers to have a cesarean delivery for gestational ages of less than 40 weeks, but less likely to have a cesarean for longer gestational periods.

Birthweight is also closely related to the risk of a cesarean delivery, and newborns with the lowest and highest birthweight are the most likely to be delivered by cesarean

(table 10). The cesarean rate for very low birthweight infants (less than 1,500 grams or 3 pounds 4 ounces) was 43.7 percent, declining to 19.8 for birthweights of 3,000–3,499 grams (6 pounds 10 ounces–7 pounds 11 ounces), and then increasing to 37.3 percent for babies weighing 4,500 grams (9 pounds 15 ounces) or more. This same pattern of the highest cesarean rates at each end of the birthweight distribution is evident for all periods of gestation (figure 3). The lowest cesarean rates are for babies weighing 2,500–3,499 grams with gestational ages of 40 weeks or more (18–19 percent).

The high cesarean rates for births of less than 40 weeks gestation that weigh 4,500 grams or more probably reflect to some extent births that are to diabetic mothers. Diabetes is associated with a very high risk of cesarean delivery (see section “Medical risk factors of pregnancy”) and babies of diabetic mothers tend to be large for their gestational age (11,12).

For equivalent birthweights up to 3,500 grams, white mothers are more likely to deliver by cesarean than black mothers but at higher birthweights, black mothers have a higher rate of cesarean delivery.

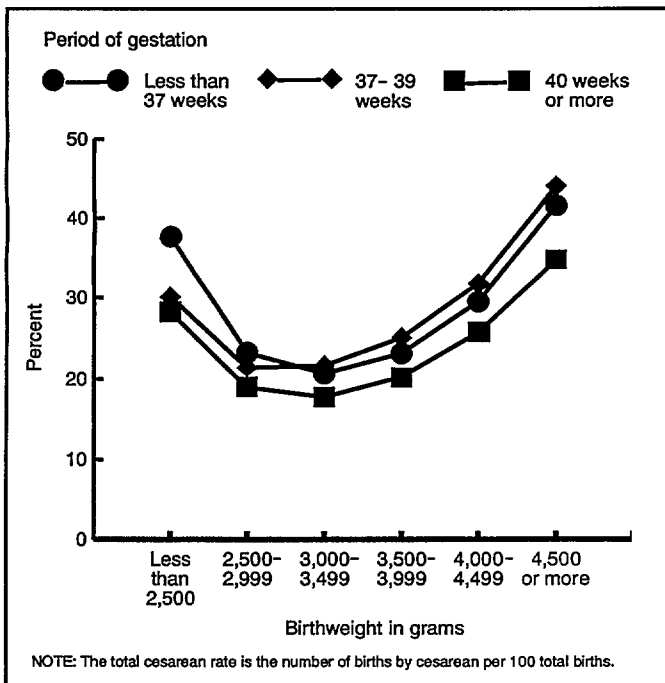


Figure 3. Total cesarean rates by birthweight and period of gestation: Total of 49 reporting States and the District of Columbia, 1990

Plurality of birth

According to information from the NHDS, the cesarean rate for plural deliveries rose nearly fivefold between 1970 and 1990 (from 9 percent to 51 percent) (3,13). In 1990, the cesarean rate for plural births derived from birth certificates was more than twice that of singleton births (55.7 compared with 21.9) (table 11). More than half of the births in twin deliveries (54.7 percent) were by cesarean and almost 9 in 10 births in triplet, quadruplet, or quintuplet deliveries (86.0 percent for triplet and 89.0 percent for quadruplet, quintuplet, and other multiple deliveries, respectively). The cesarean rate was 7 percent higher for white than for black twin births and 16 percent higher for other multiple births.

There are many reasons for the far higher cesarean rates for plural than for singleton births. Twins, triplets, and other plural births are more likely than singleton births to have a low or very low birthweight and to be delivered preterm (9,14), conditions that are associated with a higher-than-average rate of cesarean delivery. Mothers of plural births are more likely to have certain medical risk factors and complications of labor and delivery such as eclampsia, abruptio placenta, placenta previa, and breech/malpresentation (15,16) that are associated with high rates of cesarean delivery (see sections that follow).

In addition, mothers of plural births tend to be older than mothers of singletons. In 1990, 38 percent of the mothers of twins and 54 percent of the mothers of triplets and other plural births were 30 years or older compared with 30 percent of the mothers of singletons. As noted previously, the rate of cesarean delivery increases with advancing age.

Abnormal conditions of the newborn

Table 12 presents cesarean rates for abnormal conditions of the newborn for which information is available from birth certificates. Definitions of these conditions are included in the "Technical notes." Hyaline membrane disease/respiratory distress syndrome (RDS) occurred in 6 of every 1,000 births in 1990; almost one-half of these births (48 percent) were delivered by cesarean. There is evidence that cesarean delivery without labor increases the risk of this condition (17). Lending credence to this hypothesis is the fact that triple the proportion of newborns delivered by cesarean than delivered vaginally had hyaline membrane disease/RDS (12 per 1,000 compared with 4 per 1,000 births) (9).

Babies with meconium aspiration syndrome are also at higher than average risk of a cesarean delivery. This syndrome occurred in 3 of every 1,000 births in 1990, with one-third (35 percent) of these births a cesarean delivery.

More than one-third of the births (36 percent) needing assisted ventilation for up to 30 minutes after birth and almost one-half of those (48 percent) needing assistance for 30 minutes or longer were by cesarean delivery. Assisted ventilation of less than 30 minutes was performed in 13 of every 1,000 births, and assisted ventilation for 30 minutes or longer in 7 of every 1,000 births.

Seizures occurred in only about 1 in every 1,000 births, with one-third of these births (34 percent) a cesarean delivery. Some research indicates that cesarean delivery is protective against seizures (18) but this has been questioned (19). Information from birth certificates indicates that the incidence of seizures is 60 percent higher for newborns delivered by cesarean than those delivered vaginally (1.3 compared with 0.8 per 1,000 births, respectively). Cesarean rates for these abnormal conditions of the newborn were generally somewhat higher for white mothers than for black mothers.

Pregnancy and delivery

Brief definitions of each of the medical risk factors, complications of labor and delivery, and obstetric procedures included in this report are presented in the “Technical notes.”

Medical risk factors of pregnancy

A number of medical risk factors of pregnancy are associated with a much higher-than-average risk of cesarean delivery (table 13). The cesarean rate was more than 40 percent for eclampsia (52.3), genital herpes (46.0), hydramnios/oligohydramnios (45.6), pregnancy associated hypertension (41.6), and chronic hypertension (41.4). Except for acute or chronic lung disease, genital herpes, and hemoglobinopathy—where rates are substantially higher for white than black mothers—cesarean rates for the remaining 11 conditions studied are quite similar for white and black mothers.

Complications of labor and delivery

Many of the complications of labor and delivery for which information is available from birth certificates are associated with a greatly elevated risk of cesarean delivery (table 13). Rates are particularly high (more than 50 percent) for cephalopelvic disproportion (97.7 percent), breech/malpresentation (84.5 percent), placenta previa (82.3 percent), dysfunctional labor (65.2 percent), fetal distress (62.6), cord prolapse (59.5 percent), abruptio placenta (57.7 percent), and anesthetic complications (51.8 percent). As noted for medical risk factors of pregnancy, rates of cesarean delivery are generally quite similar for most complications for white and black mothers.

Cesarean rates for several of these complications of labor and delivery have risen sharply in the last 2 decades. Cesarean rates for 1970 are available from the 1970 NHDS (13) and these can be compared with the 1990 cesarean rates derived from live-birth certificates. For example, between 1970 and 1990 the rate for premature rupture of membrane increased from 13 to 29 percent; for prolonged labor, from 23 to 40 percent; and for breech/malpresentation, from 15 to 85 percent.

Obstetric procedures

The use of electronic fetal monitoring (EFM) during labor to assess fetal heart rate has grown rapidly since its introduc-

tion in 1960 (20). By 1980, 48 percent of mothers were monitored (21) and by 1990, 73 percent (22). Past research found that EFM was associated with a 30 percent or higher risk for a primary cesarean delivery for monitored than for nonmonitored births (20,23).

The overall cesarean rate of 21.7 percent for births with EFM, derived from information entered on 1990 birth certificates (table 13), was slightly lower than the national average of 22.7 for all births. The 1989 cesarean rate for EFM (21.4 percent) was also lower than the 1989 overall cesarean rate (22.8 percent) (24). There are several explanations for this apparent inconsistency. Since the early 1980's, the American College of Obstetricians and Gynecologists (ACOG) has repeatedly apprised its members on the appropriate use and interpretation of EFM readings (25–27). ACOG guidelines stress that fetal monitoring should be considered as only one parameter of fetal well being. Additionally, EFM is more often used for primary cesareans than for repeat cesareans (74 percent versus 60 percent), and the primary cesarean rate for EFM of 16.2 percent is about the same as the primary rate of 16.0 for all births.

Induction and stimulation of labor were far less frequently performed than EFM in 1990 (10 percent and 11 percent of all births, respectively). The cesarean rates for induction of labor (21.9 percent) and stimulation of labor (17.9 percent) were both lower than the overall average of 22.7 percent. However, both procedures are far more likely to precede a primary than a repeat cesarean delivery. The primary cesarean rates for induction of labor (20.5 percent) and for stimulation of labor (16.5 percent) were both higher than the primary cesarean rate of 16.0 percent for all births.

Amniocentesis and tocolysis are both infrequently performed during pregnancy (3 percent and 2 percent of women in 1990, respectively) but more than one-half of the mothers in 1990 (52 percent) had ultrasound. Mothers who have amniocentesis, tocolysis, or ultrasound during pregnancy are all at higher risk of a cesarean delivery (table 13). The cesarean rate for mothers having amniocentesis was 36.0 percent, 31.1 percent for mothers having tocolysis, and 26.3 percent for mothers who had ultrasound. As was observed for medical risk factors and complications of labor and delivery, rates by race were fairly similar for four of the six obstetric procedures analyzed.

Summary

Information now available on method of delivery from birth certificates confirms past findings on the groups at highest risk of cesarean delivery and greatly expands our knowledge of the demographic and health characteristics associated with cesarean delivery. Mothers who live in the South, who are in the oldest years of childbearing, having their first birth, married, or who have high educational attainment are all at increased risk of a cesarean delivery. Very short gestations, low or high birthweights, multiple delivery, the presence of certain complications of pregnancy, labor and/or delivery, abnormal conditions of the newborn, and the use of some obstetric procedures are also associated with elevated cesarean rates.

Several recent studies (28,29) have concluded that advanced maternal age in and of itself may be an independent risk factor for cesarean delivery, due to physician and patient concern over pregnancy outcome for older women. Many of the characteristics examined in this study are highly related to maternal age (for example, marital status and educational attainment). Therefore, for these variables, mother's age is also taken into account to determine if age itself is the underlying reason for differences in rates of cesarean delivery. The importance of the role of maternal age in the risk of cesarean delivery is clearly demonstrated throughout this report: Older mothers are more likely to deliver by cesarean regardless of race, Hispanic origin, parity, marital status, or educational attainment.

The overall rate of cesarean delivery is only slightly lower for black than for white mothers (22.1 percent compared with 23.0 percent), despite the generally lower educational attainment of black mothers and the higher percentage who are unmarried or in their teen years, all factors that tend to substantially lower the risk of cesarean delivery. However, there are many offsetting factors that tend to raise the cesarean rate for black mothers. A relatively high proportion of black births occur in the South, which has the highest cesarean rate of all regions; the incidence of low and very low birthweight is far higher for black births; and premature delivery is twice as frequent for black babies. Also, although rates of cesarean delivery for most medical risk factors, complications of labor and or delivery, and abnormal conditions of the infant are about the same for both races, the incidence of a number of these conditions is substantially higher for black mothers and babies, and that has the effect of increasing the overall cesarean rate for black mothers.

A national health objective for the year 2000 is to reduce the total cesarean rate to 15 or fewer per 100 deliveries (30). In 1990, only 17 States had cesarean rates below 20 percent, and only one (Alaska), a cesarean rate of 15 percent. With the 1989 revision of the standard certificate of live birth, annual data have become available that will enable medical and health researchers to track State cesarean rates, and to identify geographic areas and subgroups where cesarean rates substantially exceed the national average.

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Table 1. Live births by method of delivery by mother's region and State of residence: Total of 49 reporting States and the District of Columbia, 1990

Region and State	All births ¹	Births by method of delivery					
		Vaginal			Cesarean		
		Total	After previous cesarean	Total	Primary	Repeat	
All reporting areas	4,110,563	3,111,421	84,299	914,096	575,066	339,030	
Regions:							
Northeast	792,999	597,434	19,865	178,475	111,113	67,362	
Midwest	945,843	731,906	20,302	203,384	124,201	79,183	
South	1,361,731	990,230	23,371	323,530	207,552	115,978	
West	1,009,990	791,851	20,761	208,707	132,200	76,507	
Northeast:							
Connecticut	50,123	32,055	1,056	8,743	5,554	3,189	
Maine	17,359	13,596	428	3,680	2,329	1,351	
Massachusetts	92,654	70,905	2,215	20,542	12,812	7,730	
New Hampshire	17,569	13,686	492	3,825	2,443	1,382	
New Jersey	122,289	91,612	2,390	30,217	18,747	11,470	
New York	297,576	223,939	8,425	68,832	43,154	25,678	
Pennsylvania	171,961	133,343	4,218	38,246	23,374	14,872	
Rhode Island	15,195	11,638	396	2,797	1,657	1,140	
Vermont	8,273	6,660	245	1,593	1,043	550	
Midwest:							
Illinois	195,790	149,100	4,062	43,479	26,967	16,512	
Indiana	86,214	65,548	1,327	18,362	11,319	7,043	
Iowa	39,409	31,237	850	8,107	4,965	3,142	
Kansas	39,020	29,171	791	8,998	5,180	3,818	
Michigan	153,700	118,954	3,302	33,478	20,099	13,379	
Minnesota	68,013	54,409	1,990	11,906	7,308	4,598	
Missouri	79,260	60,931	1,755	18,077	11,466	6,611	
Nebraska	24,380	19,641	640	4,659	2,814	1,845	
North Dakota	9,250	7,427	238	1,782	1,038	744	
Ohio	166,913	126,682	3,223	39,561	24,263	15,298	
South Dakota	10,999	8,779	245	2,159	1,287	872	
Wisconsin	72,895	60,027	1,879	12,816	7,495	5,321	
South:							
Alabama	63,487	47,000	1,083	16,417	10,788	5,629	
Arkansas	36,457	26,181	532	10,054	6,398	3,656	
Delaware	11,113	8,277	216	2,767	1,876	891	
District of Columbia	11,850	8,690	236	3,072	1,961	1,111	
Florida	199,339	148,307	3,740	50,212	32,586	17,626	
Georgia	112,666	86,882	2,038	25,350	16,380	8,970	
Kentucky	54,362	39,026	867	12,905	8,186	4,719	
Louisiana	72,192	52,527	868	19,468	12,122	7,346	
Maryland	80,245	50,755	1,677	16,915	11,018	5,897	
Mississippi	43,563	31,901	678	11,572	6,968	4,604	
North Carolina	104,525	80,421	2,030	23,680	15,908	7,772	
South Carolina	58,610	45,300	937	13,112	8,242	4,870	
Tennessee	74,962	56,520	1,318	18,226	12,110	6,116	
Texas	316,423	217,015	4,754	70,545	43,906	26,639	
Virginia	99,352	74,934	2,140	23,214	15,210	8,004	
West Virginia	22,585	16,494	257	6,021	3,893	2,128	
West:							
Alaska	11,902	10,072	339	1,795	1,206	589	
Arizona	68,995	56,111	1,630	12,627	8,193	4,434	
California	612,628	475,706	10,025	136,315	85,935	50,380	
Colorado	53,525	44,316	1,551	9,078	6,098	2,980	
Hawaii	20,489	16,330	484	4,146	2,655	1,491	
Idaho	16,433	13,316	453	3,082	1,864	1,218	
Montana	11,613	9,188	309	2,383	1,484	899	
Nevada	21,599	17,287	471	4,239	2,799	1,440	
New Mexico	27,402	22,258	638	5,023	3,279	1,744	
Oregon	42,891	34,686	1,518	8,146	5,161	2,985	
Utah	36,277	29,729	928	6,415	3,798	2,617	
Washington	79,251	57,268	2,226	14,072	8,872	5,200	
Wyoming	6,985	5,584	189	1,386	856	530	

¹Includes births with method of delivery not stated.

Table 2. Rates of cesarean delivery and of vaginal birth after previous cesarean delivery by race of mother: Total reporting area, each region, and 49 reporting States and the District of Columbia, 1990

Region and State	Cesarean delivery rate								
	Total ¹			Primary ²			Vaginal birth after cesarean ³		
	All races ⁴	White	Black	All races ⁴	White	Black	All races ⁴	White	Black
All reporting areas	22.7	23.0	22.1	16.0	16.1	15.7	19.9	19.7	20.3
Regions:									
Northeast	23.0	23.5	21.2	16.1	16.3	15.3	22.8	22.1	26.1
Midwest	21.7	22.2	19.8	14.9	15.1	13.7	20.4	20.2	21.4
South	24.6	25.3	23.0	17.7	18.1	16.4	16.8	16.1	18.6
West	20.9	20.8	23.9	14.6	14.6	16.7	21.3	21.5	15.6
Northeast:									
Connecticut	21.4	21.7	19.5	15.2	15.3	14.4	24.9	24.6	27.4
Maine	21.3	21.3	*	15.0	15.0	*	24.1	23.9	*
Massachusetts	22.5	22.9	21.5	15.7	15.9	15.5	22.3	21.6	26.4
New Hampshire	21.8	21.7	24.8	15.6	15.6	*	26.3	26.4	*
New Jersey	24.8	25.3	22.9	17.4	17.5	16.5	17.2	16.8	19.0
New York	23.5	24.3	21.5	16.7	17.1	15.5	24.7	24.3	26.3
Pennsylvania	22.3	22.9	19.4	15.3	15.6	13.9	22.1	20.6	31.6
Rhode Island	19.4	19.6	19.6	12.8	13.0	12.8	25.8	25.7	27.3
Vermont	19.3	19.3	*	14.0	14.0	*	30.8	30.9	*
Midwest:									
Illinois	22.6	23.2	20.3	15.7	16.1	14.3	19.7	20.1	18.3
Indiana	21.9	22.0	21.4	15.0	15.0	14.6	15.9	16.1	13.5
Iowa	20.6	20.6	22.9	14.0	14.0	15.6	21.3	21.1	22.6
Kansas	23.6	23.6	24.5	15.4	15.4	16.0	17.2	16.9	17.4
Michigan	22.0	22.8	18.8	14.8	15.4	12.8	19.8	19.6	20.2
Minnesota	18.0	18.4	15.6	12.2	12.6	10.4	30.2	29.6	41.2
Missouri	22.9	23.8	18.5	16.2	16.8	13.6	21.0	19.0	32.7
Nebraska	19.2	19.3	17.7	12.9	13.0	11.8	25.8	25.9	26.2
North Dakota	19.4	19.0	*	12.6	12.5	*	24.2	25.1	*
Ohio	23.8	24.2	21.5	16.4	16.6	15.3	17.4	16.6	21.7
South Dakota	19.7	19.8	*	13.1	13.4	*	21.9	23.1	*
Wisconsin	17.6	18.2	14.4	11.4	11.9	8.6	26.1	25.8	25.4
South:									
Alabama	25.9	27.3	23.3	19.0	20.3	16.7	16.1	15.4	17.6
Arkansas	27.7	28.0	27.0	20.0	20.3	18.9	12.7	12.9	12.1
Delaware	25.1	25.3	24.1	18.9	19.1	18.0	19.5	19.3	20.1
District of Columbia	26.1	25.5	27.4	18.8	20.1	19.3	17.5	18.5	17.1
Florida	25.3	26.2	22.2	18.4	19.1	16.0	17.5	16.6	20.9
Georgia	22.6	23.5	21.0	16.2	16.9	15.0	18.5	17.4	20.5
Kentucky	24.9	25.0	24.0	17.7	17.7	17.2	15.5	15.3	18.1
Louisiana	27.0	29.9	23.2	19.0	21.2	16.2	10.6	8.3	14.5
Maryland	25.0	24.5	26.3	18.3	17.7	19.8	22.1	22.8	21.1
Mississippi	26.6	29.0	24.2	18.2	20.0	16.5	12.8	10.2	15.9
North Carolina	22.7	23.2	22.1	16.9	17.3	16.0	20.7	20.5	21.1
South Carolina	22.4	23.1	21.5	15.7	16.3	14.6	16.1	15.9	16.3
Tennessee	24.4	25.3	21.4	18.0	18.8	15.5	17.7	16.7	21.3
Texas	24.5	24.8	23.5	17.1	17.3	16.5	15.1	15.0	15.4
Virginia	23.7	23.8	23.4	17.3	17.2	17.5	21.1	20.2	23.8
West Virginia	26.7	26.7	27.5	19.3	19.3	19.7	10.8	10.6	*
West:									
Alaska	15.1	16.8	19.9	11.0	12.2	15.8	36.5	34.4	*
Arizona	18.4	18.9	19.6	13.1	13.5	13.8	26.9	24.7	22.2
California	22.3	22.2	24.8	15.6	15.5	17.2	16.6	16.9	12.9
Colorado	17.0	17.1	16.2	12.5	12.5	12.5	34.2	33.8	37.4
Hawaii	20.2	22.5	24.8	14.4	17.1	18.5	24.5	28.7	*
Idaho	18.8	18.7	*	12.7	12.6	*	27.1	27.2	*
Montana	20.6	20.4	*	14.3	14.4	*	25.6	27.2	*
Nevada	19.7	19.6	19.9	14.3	14.2	14.0	24.6	25.3	16.6
New Mexico	18.4	19.4	22.4	13.2	13.9	16.7	26.8	24.0	*
Oregon	19.0	19.1	19.0	13.5	13.5	14.0	33.7	33.6	36.3
Utah	17.7	17.7	25.8	11.7	11.6	16.0	26.2	25.9	*
Washington	19.7	19.7	24.3	13.9	13.8	18.7	30.0	29.8	31.1
Wyoming	19.9	19.7	34.3	13.7	13.5	*	26.3	26.1	*

¹Percent of all live births that are by cesarean delivery.

²Number of primary cesareans per 100 live births to women who have not had a previous cesarean.

³Number of vaginal births after previous cesarean delivery per 100 live births to women with a previous cesarean.

⁴Includes races other than white and black.

Table 3. Rates of cesarean delivery by age and specified race of mother: Total of 49 reporting States and the District of Columbia, 1990

Age of mother	All races ¹	White	Black	American Indian ²	Asian or Pacific Islander				
					Chinese	Japanese	Hawaiian	Filipino	Other
Total cesarean rate ³									
All ages	22.7	23.0	22.1	17.5	21.0	20.4	18.2	24.6	19.0
Under 20 years	16.6	16.7	16.6	14.2	10.6	15.0	13.8	12.3	8.5
20–29 years	21.9	22.1	21.9	17.1	16.1	17.0	17.9	19.9	16.3
30–39 years	26.6	26.5	28.5	21.1	24.1	22.3	22.4	30.2	24.5
40–49 years	32.3	31.9	35.8	25.0	36.3	32.3	34.0	44.7	24.9
Age standardized ⁴	22.7	22.8	23.3	18.0	18.0	18.5	18.9	22.2	17.8

¹Includes births of other races not shown separately.

²Includes births to Aleuts and Eskimos.

³Percent of all births that are by cesarean delivery.

⁴Standardized to reflect the age distribution of all races.

NOTE: Excludes data for Oklahoma, which did not require reporting of method of delivery.

Table 4. Rates of cesarean delivery by age and Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: Total of 48 reporting States and the District of Columbia, 1990

Age of mother	All origins ¹	Hispanic						Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total ²	White	Black
Total cesarean rate ³										
All ages	22.7	21.2	20.3	22.1	34.7	21.5	22.8	23.0	23.4	22.1
Under 20 years	16.6	15.2	15.3	14.9	19.4	12.3	16.9	16.9	17.3	16.6
20–29 years	21.9	20.3	19.7	22.2	33.5	19.3	22.2	22.2	22.6	21.9
30–39 years	26.6	27.1	25.7	29.6	40.0	27.9	28.8	26.6	26.4	28.4
40–49 years	32.3	32.5	30.1	35.6	46.9	35.5	35.4	32.3	31.9	35.9
Age standardized ⁴	22.7	21.8	21.0	23.6	33.7	21.1	23.6	22.9	23.1	23.3

¹Includes origin not stated.

²Includes races other than white and black.

³Percent of all births that are by cesarean delivery.

⁴Standardized to reflect the age distribution of all origins.

NOTE: Excludes New Hampshire and Oklahoma, which did not report either Hispanic origin of mother or method of delivery.

Table 5. Rates of cesarean delivery by age of mother, live-birth order, and race of mother: Total of 49 reporting States and the District of Columbia, 1990

Live-birth order and race of mother	Total	Age of mother					
		Under 20 years	20-24 years	25-29 years	30-34 years	35-39 years	40-49 years
Total cesarean rate ¹							
All races ^{2,3}	22.7	16.6	20.3	23.3	25.7	29.1	32.3
First child	24.7	17.0	22.7	27.2	32.3	39.3	47.1
Second child	22.7	15.2	18.7	22.9	26.3	31.3	37.9
Third child	21.2	15.8	17.6	20.4	23.0	26.6	30.5
Fourth child and over	17.5	17.4	15.9	15.8	17.7	20.1	22.4
White ³	23.0	16.7	20.5	23.4	25.6	28.9	31.9
First child	24.9	17.0	22.6	27.0	31.9	38.8	46.4
Second child	22.9	15.6	18.9	22.9	25.9	30.8	36.6
Third child	21.4	16.6	17.9	20.4	22.8	26.1	29.9
Fourth child and over	17.7	18.0	16.6	16.1	17.7	19.8	21.9
Black ³	22.1	16.6	20.2	24.0	27.5	31.1	35.8
First child	23.9	17.3	24.1	31.5	37.6	43.9	52.6
Second child	22.4	14.7	19.2	24.7	30.8	36.5	44.9
Third child	21.3	15.6	17.7	21.5	25.5	30.9	34.1
Fourth child and over	18.1	17.7	15.8	16.3	19.0	23.0	28.7
Primary cesarean rate ⁴							
All races ^{2,3}	16.0	14.7	15.0	16.0	16.5	19.0	23.5
First child	24.6	16.9	22.6	27.1	32.2	39.2	46.9
Second child	8.9	6.8	7.3	8.7	10.4	13.6	20.1
Third child	8.4	6.3	6.5	7.7	9.0	12.0	18.1
Fourth child and over	8.8	7.6	6.8	7.4	8.8	11.2	15.1
White ³	16.1	15.1	15.5	16.1	16.3	18.6	23.0
First child	24.8	17.0	22.5	26.9	31.8	38.7	46.1
Second child	8.7	7.0	7.1	8.4	9.9	12.8	18.7
Third child	8.2	6.7	6.6	7.5	8.6	11.2	17.5
Fourth child and over	8.7	8.4	7.0	7.3	8.4	10.5	14.6
Black ³	15.7	14.2	14.1	16.1	18.3	21.9	27.5
First child	23.8	17.2	23.9	31.3	37.4	43.7	52.3
Second child	10.4	6.6	8.1	11.3	15.8	21.7	31.1
Third child	9.5	6.0	6.6	9.3	12.7	18.3	24.1
Fourth child and over	9.7	7.5	7.0	8.1	10.7	15.0	20.5

¹Percent of all live births that are by cesarean delivery.

²Includes races other than white and black.

³Includes births with birth order not stated.

⁴Number of primary cesareans per 100 live births to women with no previous cesarean.

NOTE: Excludes data for Oklahoma, which did not require reporting of method of delivery.

Table 6. Rates of cesarean delivery by marital status, age, and race of mother: Total of 49 reporting States and the District of Columbia, 1990

Age and race of mother	Total	Marital status of mother	
		Married	Unmarried
		Total cesarean rate ¹	
All races ²	22.7	23.8	19.9
Under 20 years	16.6	17.7	16.0
20–29 years	21.9	22.4	20.4
30–39 years	26.6	26.7	25.8
40–49 years	32.3	32.1	33.2
White	23.0	23.7	20.1
Under 20 years	16.7	17.9	15.9
20–29 years	22.1	22.5	20.6
30–39 years	26.5	26.5	26.1
40–49 years	31.9	31.7	33.0
Black	22.1	26.4	19.9
Under 20 years	16.6	18.8	16.4
20–29 years	21.9	24.5	20.5
30–39 years	28.5	30.7	25.7
40–49 years	35.8	36.8	34.4

¹Percent of all births that are by cesarean delivery.

²Includes races other than white and black.

NOTE: Excludes data for Oklahoma, which did not require reporting of method of delivery.

Table 7. Rates of cesarean delivery by educational attainment, age, and race of mother: Total of 47 reporting States, the District of Columbia, and New York City, 1990

Age and race of mother	Total ¹	Years of school completed by mother				
		0–8 years	9–11 years	12 years	13–15 years	16 years or more
		Total cesarean rate ²				
All races ³	22.6	17.5	19.1	23.1	24.6	24.9
Under 20 years	16.5	15.2	16.4	17.4	17.2	...
20–29 years	21.9	16.3	20.1	22.5	23.1	22.2
30–39 years	26.6	21.5	24.1	27.2	27.8	26.5
40–49 years	32.2	26.2	29.7	32.7	33.6	33.7
White	22.9	17.9	19.7	23.7	24.5	24.4
Under 20 years	16.7	15.1	16.7	17.7	16.8	...
20–29 years	22.1	16.8	20.8	23.0	23.0	21.9
30–39 years	26.4	22.1	24.9	27.4	27.6	25.8
40–49 years	31.8	27.9	30.8	32.4	32.4	32.5
Black	22.0	18.2	17.7	21.8	25.8	31.7
Under 20 years	16.5	16.4	16.1	17.3	18.6	...
20–29 years	21.8	17.9	18.3	21.5	24.5	27.9
30–39 years	28.3	23.9	22.4	26.7	29.9	34.6
40–49 years	35.6	32.5	28.6	33.7	38.0	43.6

¹Includes births with educational attainment of mother not stated.

²Percent of all births that are by cesarean delivery.

³Includes races other than white and black.

NOTE: Excludes data for Oklahoma, Washington, and New York State (exclusive of New York City), which did not require reporting of either method of delivery or educational attainment of mother.

Table 8. Rates of cesarean delivery for singleton births by weight gain during pregnancy, by gestational age and birthweight: Total of 48 reporting States and the District of Columbia, 1990

Gestational age and birthweight	Total ¹	Weight gain during pregnancy							
		Less than 16 pounds	16–20 pounds	21–25 pounds	26–30 pounds	31–35 pounds	36–40 pounds	41–45 pounds	46 pounds or more
Total cesarean rate ²									
All gestational ages ³	22.0	22.2	20.4	20.0	20.8	21.6	23.6	24.7	28.4
Less than 2,500 grams	29.9	27.5	28.7	29.6	31.4	32.5	35.4	36.1	40.8
2,500–3,499 grams	19.6	19.6	18.1	18.2	19.1	20.0	21.6	22.3	24.9
3,500–4,499 grams	23.4	24.3	21.9	21.0	21.6	22.2	24.3	25.5	29.1
4,500 grams or more	37.2	37.9	36.2	34.8	34.6	33.1	36.2	37.1	43.2
Under 37 weeks ⁴	25.4	24.7	24.9	24.2	25.1	25.5	27.8	28.5	31.8
Less than 2,500 grams	32.7	29.2	31.9	33.0	34.8	36.6	39.7	39.6	46.0
2,500–3,499 grams	20.3	18.5	18.7	18.8	20.6	21.4	24.0	24.0	26.9
3,500–4,499 grams	24.2	23.8	22.3	21.8	22.8	23.6	25.2	28.7	30.7
4,500 grams or more	41.6	41.8	36.9	42.5	37.4	32.3	35.7	60.5	50.7
37–39 weeks ⁴	23.3	23.8	21.5	21.5	22.4	23.3	25.5	26.3	30.0
Less than 2,500 grams	26.0	24.2	23.7	24.9	27.6	28.5	31.6	32.3	36.0
2,500–3,499 grams	21.0	21.4	19.5	19.8	20.5	21.6	23.1	23.8	26.4
3,500–4,499 grams	26.6	29.8	25.8	24.7	24.9	25.3	27.7	28.3	32.0
4,500 grams or more	44.4	48.7	47.9	43.5	40.9	39.4	43.5	43.2	50.2
40 weeks and over ⁴	20.2	19.5	18.0	17.8	18.8	19.8	21.7	23.2	27.0
Less than 2,500 grams	25.7	22.9	23.3	25.8	27.0	28.0	29.3	33.4	34.4
2,500–3,499 grams	17.8	17.9	16.4	16.2	17.1	18.1	19.5	20.3	23.2
3,500–4,499 grams	21.5	21.0	19.5	18.8	19.7	20.5	22.4	24.0	27.6
4,500 grams or more	34.6	33.6	31.8	31.4	32.3	31.1	33.9	34.8	40.8

¹Includes births with weight gain not stated.

²Percent of all births that are by cesarean delivery.

³Includes births with gestational age or birthweight not stated.

⁴Includes births with birthweight not stated.

NOTE: Excludes data for California, which did not report weight gain during pregnancy, and Oklahoma, which did not report weight gain during pregnancy and method of delivery.

Table 9. Rates of cesarean delivery by period of gestation and race of mother: Total of 49 reporting States and the District of Columbia, 1990

Race of mother	All births ¹	Period of gestation							
		Under 28 weeks	28–31 weeks	32–35 weeks	36 weeks	37–39 weeks	40 weeks	41 weeks	42 weeks and over
Total cesarean rate ²									
All races ³	22.7	30.0	37.3	28.8	25.5	23.9	18.8	20.9	23.0
White	23.0	33.9	41.7	31.6	27.0	24.7	18.6	20.6	23.1
Black	22.1	25.3	30.7	23.3	21.7	21.2	20.6	23.4	23.5

¹Includes births with period of gestation not stated.

²Percent of all births that are by cesarean delivery.

³Includes races other than white and black.

NOTE: Excludes data for Oklahoma, which did not require reporting method of delivery.

Table 10. Rates of cesarean delivery by birthweight, period of gestation, and race of mother: Total of 49 reporting States and the District of Columbia, 1990

Period of gestation and race of mother	Birthweight											
	Less than 2,500 grams											
	Total ¹	Less than 1,500 grams										4,500 grams and over
		Total	Total	Less than 1,000 grams	1,000– 1,499 grams	1,500– 1,999 grams	2,000– 2,499 grams	2,500– 2,999 grams	3,000– 3,499 grams	3,500– 3,999 grams	4,000– 4,499 grams	
	Total cesarean rate ²											
All races ^{3,4}	22.7	34.5	43.7	35.3	51.8	42.7	29.4	21.0	19.8	22.1	27.5	37.3
Under 37 weeks	28.7	37.7	43.6	35.4	52.1	43.0	31.5	23.3	20.7	23.2	29.6	41.7
37–39 weeks	23.9	30.2	51.0	46.9	51.7	43.1	28.1	21.5	21.7	25.2	31.8	44.1
40 weeks and over.	20.4	28.2	45.0	36.3	46.8	39.8	26.3	19.0	17.8	20.2	25.7	34.8
White ⁴	23.0	37.8	48.4	39.2	56.6	47.0	32.3	22.3	20.0	21.9	27.0	36.6
Under 37 weeks	31.0	41.5	48.5	39.5	57.0	47.3	35.0	25.8	22.2	23.6	29.8	41.8
37–39 weeks	24.7	32.9	54.0	42.0	56.0	47.2	30.8	22.9	22.4	25.4	31.7	43.7
40 weeks and over.	20.2	29.8	45.3	32.4	48.3	43.3	27.9	19.4	17.5	19.7	25.1	34.2
Black ⁴	21.6	28.4	36.2	29.9	43.3	34.3	23.5	18.3	19.4	24.2	32.5	45.5
Under 37 weeks	24.1	30.4	36.0	29.8	43.3	34.3	24.2	18.0	18.0	22.5	29.3	44.0
37–39 weeks	21.2	24.6	45.5	62.0	43.5	35.1	22.7	18.4	19.6	24.5	33.4	49.1
40 weeks and over.	22.1	25.2	47.7	50.0	47.3	33.2	23.4	18.4	19.6	24.2	32.2	43.9

¹Includes births with birthweight not stated.

²Percent of all births that are by cesarean delivery.

³Includes races other than white and black.

⁴Includes births with period of gestation not stated.

NOTE: Excludes data for Oklahoma, which did not require reporting of method of delivery.

Table 11. Rates of cesarean delivery by plurality of birth and race of mother: Total of 49 reporting States and the District of Columbia, 1990

Race of mother	Plural births						
	Total	Singletons	Triplet and other plural births				
			Total	Twins	Total	Triplets	Quadruplets and higher order
	Total cesarean rate ¹						
All races ²	22.7	21.9	55.7	54.7	86.1	86.0	89.0
White	23.0	22.2	56.6	55.5	87.3	87.0	92.2
Black	22.1	21.3	52.2	51.8	75.5	75.7	*

¹Percent of all births that are by cesarean delivery.

²Includes races other than white and black.

NOTE: Excludes data for Oklahoma, which did not require reporting method of delivery.

Table 12. Rates of cesarean delivery for selected abnormal conditions of the newborn by race of mother: Total of 49 reporting States and the District of Columbia, 1990

Abnormal condition of the newborn	Total ¹	Race of mother	
		White	Black
		Total cesarean rate ²	
Anemia (Hct.<39/Hgb.<13)	26.8	28.3	22.7
Birth injury ³	12.6	11.9	19.1
Fetal alcohol syndrome ⁴	39.4	43.5	36.5
Hyaline membrane disease/RDS	47.6	48.6	44.1
Meconium aspiration syndrome ⁵	34.5	35.0	33.3
Assisted ventilation less than 30 minutes ⁶	36.3	36.3	36.6
Assisted ventilation 30 minutes or longer ⁶	48.3	49.2	45.5
Seizures	33.5	34.7	29.5

¹Includes races other than white and black.

²Percent of all births that are by cesarean delivery.

³Massachusetts, Nebraska, and Texas do not report this condition.

⁴New York State exclusive of New York City and Wisconsin do not report this condition.

⁵New York State exclusive of New York City does not report this condition.

⁶New York State and New York City do not report this condition.

NOTE: Excludes data for Oklahoma, which did not require reporting method of delivery or abnormal conditions of the newborn.

Table 13. Rates of cesarean delivery for selected medical risk factors, complications of labor and/or delivery, and obstetric procedures by race of mother: Total of 49 reporting States and the District of Columbia, 1990

Medical risk factor, complication, and obstetric procedure	Total ¹	Race of mother	
		White	Black
Medical risk factors			
Total cesarean rate ²			
Anemia	25.8	27.1	24.7
Cardiac disease	26.7	26.9	26.2
Acute or chronic lung disease	29.8	31.1	26.2
Diabetes	37.2	37.1	40.3
Genital herpes ^{3,4}	46.0	47.0	41.4
Hydramnios/oligohydramnios ³	45.6	46.3	43.5
Hemoglobinopathy ³	26.6	31.6	24.6
Hypertension, chronic	41.4	41.6	41.3
Hypertension, pregnancy-associated	41.6	41.5	42.9
Eclampsia	52.3	53.1	51.1
Incompetent cervix ³	29.9	30.3	27.9
Renal disease	28.3	28.7	27.9
Rh sensitization ⁵	24.4	24.4	24.4
Uterine bleeding ⁴	33.8	33.6	34.7
Complications of labor and/or delivery			
Febrile	36.4	36.6	34.3
Meconium, moderate/heavy	22.6	22.5	22.8
Premature rupture of membrane	29.3	29.8	27.6
Abruptio placenta	57.7	58.1	56.8
Placenta previa	82.3	81.8	82.8
Other excessive bleeding	28.3	26.7	38.4
Seizures during labor	47.0	46.8	49.6
Precipitous labor (less than 3 hours)	1.5	1.4	1.7
Prolonged labor (more than 20 hours)	40.4	40.3	41.7
Dysfunctional labor	65.2	64.7	68.7
Breech/malpresentation	84.5	85.4	78.3
Cephalopelvic disproportion ^{3,4}	97.7	97.8	97.7
Cord prolapse	59.5	59.1	59.9
Anesthetic complications ⁴	51.8	51.4	52.3
Fetal distress ³	62.6	61.2	67.0
Obstetric procedures			
Amniocentesis	36.0	35.7	40.3
Electronic fetal monitoring	21.7	21.7	22.1
Induction of labor	21.9	21.2	26.8
Stimulation of labor	17.9	17.5	19.5
Tocolysis	31.1	31.8	28.7
Ultrasound ⁶	26.3	26.5	26.3

¹Includes races other than white and black.

²Percent of all births that are by cesarean delivery.

³New York City (but not the remainder of New York State) reports this risk factor or complication.

⁴Texas does not report this risk factor or complication.

⁵Kansas does not report this risk factor.

⁶Illinois does not report this procedure.

NOTE: Excludes data for Oklahoma, which did not require reporting method of delivery, medical risk factors, complications of labor and/or delivery or obstetric procedures.

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Appendix

Technical notes

Source of data

Except as noted elsewhere, data shown in this report are based on 100 percent of the birth certificates of 49 States (all States except Oklahoma) and the District of Columbia. The data are provided to the National Center for Health Statistics through the Vital Statistics Cooperative Program. Information on selected maternal and infant health characteristics was derived from items on 1990 certificates of live birth.

Computation of rates

The overall cesarean rate or total cesarean rate is computed as the percent of all births that were delivered by cesarean. The denominator for this rate excludes births with method of delivery not stated. The primary cesarean rate is a measure that relates the number of women having a primary cesarean delivery to all women giving birth who have never had a cesarean delivery. The denominator for this rate includes all births less those with method of delivery classified as repeat cesarean, vaginal birth after previous cesarean, or method not stated. The rate for vaginal birth after previous cesarean (VBAC) delivery is computed by relating all VBAC deliveries to the sum of VBAC and repeat cesarean deliveries, that is, to women with a previous cesarean section.

Race of mother

Birth data are tabulated by the race of the mother as reported directly on the birth certificate. If race of mother was not stated, it was imputed as that of the father, if known. If neither race was stated, race of mother was imputed as the race of the mother on the preceding record with known race.

Definitions of medical terms

The definitions that follow are adapted and abbreviated from a set of definitions compiled by a committee of Federal and State health statistics officials for the Association for Vital Records and Health Statistics (31).

Abnormal conditions of the newborn

Anemia—Hemoglobin level of less than 13.0 g/dL, or a hematocrit of less than 39 percent.

Birth injury—Impairment of the infant's body function or structure due to adverse influences that occurred at birth.

Fetal alcohol syndrome—A syndrome of altered prenatal growth and development occurring in infants born of women who consumed excessive amounts of alcohol during pregnancy.

Hyaline membrane disease/RDS—A disorder primarily of prematurity, manifested clinically by respiratory distress and pathologically by pulmonary hyaline membranes and incomplete expansion of the lungs at birth.

Meconium aspiration syndrome—Aspiration of meconium by the fetus or newborn, affecting the lower respiratory system.

Assisted ventilation (less than 30 minutes)—A mechanical method of assisting respiration for newborns with respiratory failure.

Assisted ventilation (30 minutes or more)—Newborn placed on assisted ventilation for 30 minutes or longer.

Seizures—A seizure of any etiology.

Medical risk factors for this pregnancy

Anemia—Hemoglobin level of less than 10.0 g/dL during pregnancy, or a hematocrit of less than 30 percent during pregnancy.

Cardiac disease—Disease of the heart.

Acute or chronic lung disease—Disease of the lungs during pregnancy.

Diabetes—Metabolic disorder characterized by excessive discharge of urine and persistent thirst; includes juvenile onset, adult onset, and gestational diabetes during pregnancy.

Genital herpes—Infection of the skin of the genital area by herpes simplex virus.

Hydramnios/Oligohydramnios—Any noticeable excess (hydramnios) or lack (oligohydramnios) of amniotic fluid.

Hemoglobinopathy—A blood disorder caused by alteration in the genetically determined molecular structure of hemoglobin (for example, sickle cell anemia).

Hypertension, chronic—Blood pressure persistently greater than 140/90, diagnosed prior to onset of pregnancy or before the 20th week of gestation.

Hypertension, pregnancy-associated—An increase in blood pressure of at least 30 mm hg systolic or 15 mm hg diastolic on two measurements taken 6 hours apart after the 20th week of gestation.

Eclampsia—The occurrence of convulsions and/or coma unrelated to other cerebral conditions in women with signs and symptoms of pre-eclampsia.

Incompetent cervix—Characterized by painless dilation of the cervix in the second trimester or early in the third trimester of pregnancy, with premature expulsion of membranes through the cervix and ballooning of the membranes in the vagina, followed by rupture of the membranes and subsequent expulsion of the fetus.

Renal disease—Kidney disease.

Rh sensitization—The process or state of becoming sensitized to the Rh factor as when an Rh-negative woman is pregnant with an Rh-positive fetus.

Uterine bleeding—Any clinically significant bleeding during the pregnancy, taking into consideration the state of pregnancy; any second or third trimester bleeding of the uterus prior to the onset of labor.

Complications of labor and/or delivery

Febrile—A fever greater than 100 degrees F. or 38 C. occurring during labor and/or delivery.

Meconium, moderate/heavy—Meconium consists of undigested debris from swallowed amniotic fluid, various products of secretion, and excretion and shedding by the gastrointestinal tract; moderate to heavy amounts of meconium in the amniotic fluid noted during labor and/or delivery.

Premature rupture of membranes (more than 12 hours)—Rupture of the membranes at any time during pregnancy and more than 12 hours before the onset of labor.

Abruptio placenta—Premature separation of a normally implanted placenta from the uterus.

Placenta previa—Implantation of the placenta over or near the internal opening of the cervix.

Other excessive bleeding—The loss of a significant amount of blood from conditions other than abruptio placenta or placenta previa.

Seizures during labor—Maternal seizures occurring during labor from any cause.

Prolonged labor (more than 20 hours)—Abnormally slow progress of labor lasting more than 20 hours.

Dysfunctional labor—Failure to progress in a normal pattern of labor.

Breech/Malpresentation—At birth, the presentation of the fetal buttocks rather than the head, or other malpresentation.

Cephalopelvic disproportion—The relationship of the size, presentation, and position of the fetal head to the maternal pelvis, which prevents dilation of the cervix and/or descent of the fetal head.

Cord prolapse—Premature expulsion of the umbilical cord in labor before the fetus is delivered.

Anesthetic complications—Any complication during labor and/or delivery brought on by an anesthetic agent or agents.

Fetal distress—Signs indicating fetal hypoxia (deficiency in amount of oxygen reaching fetal tissues).

Obstetric procedures

Amniocentesis—Surgical transabdominal perforation of the uterus to obtain amniotic fluid to be used in the detection of genetic disorders, fetal abnormalities, and fetal lung maturity.

Electronic fetal monitoring—Monitoring with external devices applied to the maternal abdomen or with internal devices with an electrode attached to the fetal scalp and a catheter through the cervix into the uterus, to detect and record fetal heart tones and uterine contractions.

Induction of labor—The initiation of uterine contractions before the spontaneous onset of labor by medical and/or surgical means for the purpose of delivery.

Stimulation of labor—Augmentation of previously established labor by use of oxytocin.

Tocolysis—Use of medications to inhibit preterm uterine contractions to extend the length of pregnancy and, therefore, avoid a preterm birth.

Ultrasound—Visualization of the fetus and the placenta by means of sound waves.

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For answers to questions about this report or for a list of reports published in these series, contact:

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