

Trends in Cesarean Birth and Vaginal Birth After Previous Cesarean, 1991–99

by Fay Menacker, Dr. P.H. and Sally C. Curtin, M.A.

Abstract

Objectives—This report presents trends in rates of cesarean delivery and rates of vaginal birth after previous cesarean (VBAC) delivery for 1991–99. Data for the United States showing trends by maternal age, race/ethnicity, and State are presented. Also trends in cesarean rates by selected maternal characteristics, medical risk factors, and complications of labor and/or delivery are shown. A brief explanation of the Healthy People 2010 objective regarding cesarean and VBAC rates for low-risk women is also included. Summary statistics for 2000 based on preliminary data are also included, but most tabular and text information is based on detailed final statistics for 1999.

Methods—Cesarean and VBAC rates were computed based on the information reported on birth certificates.

Results—The U.S. cesarean rate dropped 8 percent between 1991 and 1996 (from 22.6 to 20.7 per 100 births) but then increased 6 percent between 1996 and 1999 (to 22.0); preliminary data show that the rate increased again by 4 percent between 1999 and 2000 (to 22.9). The decline between 1991 and 1996 was present for women of all ages but was most pronounced for those under 30 years of age. The decline was greatest for non-Hispanic white women, 10 percent, compared with a 7-percent decline for Hispanic women and only a 1-percent decline for non-Hispanic black women. All groups experienced increases in cesarean rates of about 6 to 7 percent between 1996 and 1999. The increase in cesarean rates between 1996 and 1999 was greatest for women 30 years of age and over. The VBAC rate increased 33 percent between 1991 and 1996 (from 21.3 to 28.3 per 100 births to women with a previous cesarean) but then fell 17 percent between 1996 and 1999 (to 23.4). The dramatic increase in VBAC rates between 1991 and 1996, followed by the subsequent decline, was experienced by women of all ages and for each major race/ethnicity group. Similar trends in cesarean rates were present for nearly all States and for most medical risk factors and complications of labor and/or delivery.

Keywords: cesarean • primary cesarean • VBAC • birth certificate

Introduction

Lowering the cesarean rate in the United States has been a goal for two decades (1, 2). However, the appropriate target for the rate as well as effective methods for safely lowering the rate have been extensively debated (3–6). The target in place for the 1990s was to achieve a cesarean rate of no more than 15 cesarean births per 100 total births by the year 2000 (2).

A previous report presented trends in cesarean and vaginal birth after previous cesarean (VBAC) rates for the period 1991–95 (7). This report updates the earlier report by presenting trends in cesarean and VBAC rates for the period 1991–99. Summary statistics for 2000 based on preliminary data are also included, but most tabular and text information is based on detailed final statistics for 1999.

Cesarean and VBAC rates by maternal age and race/ethnicity for the United States are presented as well as rates by State. In addition, trends in cesarean rates by selected maternal characteristics, medical risk factors, and complications of labor and/or delivery are also presented.

Data on cesarean and VBAC deliveries were computed based on the information reported on birth certificates filed for all babies born in the United States. The information is transmitted by the States and territories to the Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS) through the Vital Statistics Cooperative Program (VSCP). Data for the territories are shown in the State table but are not included in the totals for the United States.

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In 1989 cesarean data became available from certificates of live birth when the standard certificate of live birth was revised to include an item on "method of delivery." By 1991 all States and the District of Columbia were reporting information on method of delivery. Data from the birth certificate provide detail on the demographic and lifestyle characteristics of the mother. Also available from birth certificate data is detailed information by State and even smaller geographic areas such as large counties and cities (only cesarean rates by State are presented in this report).

Nearly all of the cesarean rates presented in this report are per 100 total births to women in the specified group (total, primary cesarean, or VBAC). This is because the target in place for the 1990s was based on 100 births. A short section on rates per 100 births to low-risk women (as defined in the Healthy People 2010 objective) is also presented. See the [Technical notes](#) for more detail on the calculation of cesarean and VBAC rates.

Cesarean rates decline between 1991 and 1996; increase between 1996 and 1999

The total and primary cesarean rates declined 8 percent between 1991 and 1996, and increased 6 percent between 1996 and 1999. The total rate increased by 4 percent, and the primary rate increased by 3 percent between 1999 and 2000; the total and primary rates increased 11 and 10 percent, respectively, between 1996 and 2000 according to preliminary data ([table 1](#), [table A](#), and [figure 1](#)). In 1999 there were 862,086 births by cesarean delivery, yielding a rate of 22.0 per 100 births compared with 22.6 in 1991 ([table 1](#) and [table B](#)). There were 542,080 births by primary cesarean delivery resulting in a primary rate of 15.5 (per 100 births to women with no previous cesarean) compared with a rate of 15.9 in 1991. The declines from 1991 to 1996 in the total and primary cesarean rates have essentially been reversed. The lowest rates of total and primary

cesarean delivery during the 1990s were in 1996 with rates of 20.7 and 14.6, respectively.

Disparity in cesarean rates by age increases

Cesarean rates are lowest for teenage mothers and increase with maternal age ([table 1](#) and [table B](#)). This relationship was present every year of the 1991–99 period. All age groups of women experienced declines in cesarean rates between 1991 and 1996 and increases in rates between 1996 and 1999. The disparity in cesarean rates by age increased somewhat during the 1990s because percent declines between 1991 and 1996 were greater for women in their twenties than for those 30 years of age and over, while percent increases between 1996 and 1999 were greater for older than for younger women ([figure 2](#)). As a result, the cesarean rate for women in their forties was 131 percent higher in 1999 than the rate for teenagers (34.7 and 15.0, respectively) compared with 96 percent higher in 1991 (32.1 and 16.4, respectively).

Primary cesarean rates also increased with additional maternal age after 25 years, but the disparity in rates between younger and older women is not as great as that for total cesarean rates. Similar to the total rate, the disparity in primary rates by maternal age actually increased over the period due to greater declines between 1991 and 1996 for younger than older women and smaller increases for younger women between 1996 and 1999. In 1999 the primary cesarean rate was 80 percent higher for women 40 years of age and over compared with teenagers (24.6 and 13.7, respectively).

Strong declines between 1991 and 1996 for non-Hispanic white and Hispanic women; little change for non-Hispanic black women

In 1991 total and primary rates were highest for non-Hispanic whites. Between 1991 and 1996, rates dropped steeply for non-Hispanic white and Hispanic women and changed little for non-Hispanic black women. Thus, in 1996, rates were highest for non-Hispanic black women. Rates increased for all groups between 1996 and 1999, reversing completely or, in part, the earlier declines. In 1999, rates were highest for non-Hispanic black women, followed by non-Hispanic white and Hispanic women. Total and primary cesarean rates for non-Hispanic white women declined 10 percent each between 1991 and 1996 and then increased 6 percent between 1996 and 1999 ([table 1](#) and [figure 3](#)).

For each year of the 1991–99 period, cesarean rates for Hispanic women were lower than those for non-Hispanic white women and non-Hispanic black women. The disparity in rates between non-Hispanic white and Hispanic women closed somewhat over the period, while the disparity in rates between non-Hispanic black and Hispanic women increased.

Trends in cesarean rates by age differ between race/ethnicity groups

Total cesarean rates for non-Hispanic white women dropped between 1991 and 1996 for all age groups, ranging from 16-percent declines for women under 25 years of age to a 3-percent decline for women 40 years of age and over ([table 1](#)). Rates increased between 1996 and 1999 for all age groups of non-Hispanic white women with the largest increase (10 percent) for women 40 years of age and

Table A. Total and primary cesarean rates and vaginal births after previous cesarean delivery rates: United States, 1989–2000

Year	Total ¹	Primary ²	VBAC rate ³
2000	22.9	16.0	20.7
1999	22.0	15.5	23.4
1998	21.2	14.9	26.3
1997	20.8	14.6	27.4
1996	20.7	14.6	28.3
1995	20.8	14.7	27.5
1994	21.2	14.9	26.3
1993	21.8	15.3	24.3
1992	22.3	15.6	22.6
1991	22.6	15.9	21.3
1990 ⁴	22.7	16.0	19.9
1989 ⁵	22.8	16.1	18.9

¹Percent of all live births 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 (VBAC) delivery per 100 live births to women with a previous cesarean delivery.

⁴Excludes data for Oklahoma, which did not report method of delivery on the birth certificate. The reporting area comprised 99 percent of births in 1990.

⁵Excludes data for Louisiana, Maryland, Nebraska, Nevada, and Oklahoma, which did not report method of delivery on the birth certificate. The reporting area comprised 94 percent of births in 1989.

NOTE: Data for 2000 are preliminary.

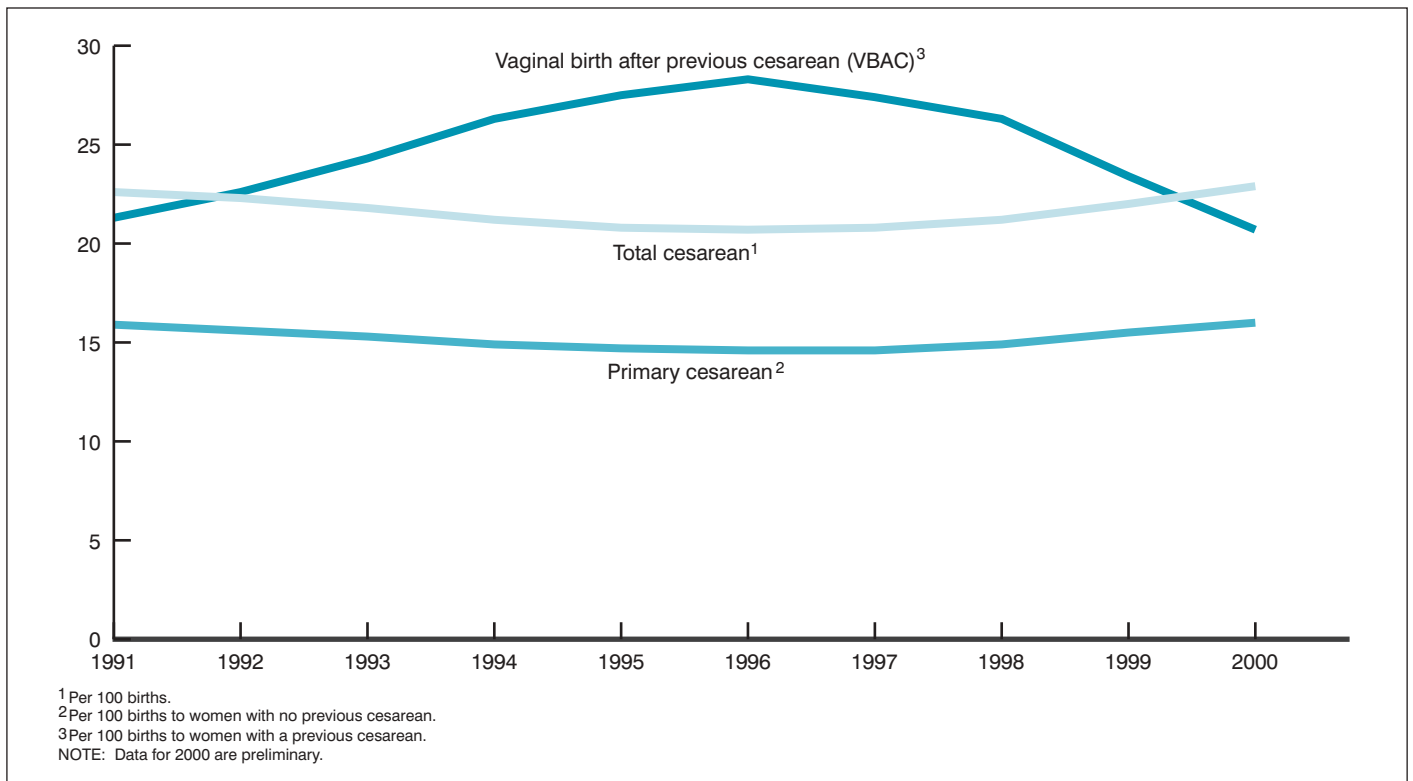


Figure 1. Total and primary cesarean rates and vaginal birth after previous cesarean rate: United States, 1991–2000

over. During the 1991–96 period, cesarean rates dropped for non-Hispanic black women under 30 years of age, were level for those 30–34 years, and rose for women 35 years of age and over. All age groups of non-Hispanic black women experienced increases in cesarean rates between 1996 and 1999, with those 35 years of age and over having the highest percent increases (10 percent). Similar to non-Hispanic black women, cesarean rates declined between 1991 and 1996 for younger Hispanic women, but increased for their older counterparts. As was true for non-Hispanic white and black women, Hispanic women of all ages experienced increases in cesarean rates between 1996 and 1999, particularly those 40 years of age and over (a 10-percent increase). As a result of the differing trends, cesarean rates in 1999 were higher for non-Hispanic black than for non-Hispanic white and Hispanic women for all age groups. Cesarean rates for Hispanic women under 25 years of age were lower than for their non-Hispanic white counterparts, but higher at older ages. The trends in primary cesarean rates for non-Hispanic white, black, and Hispanic women were generally similar to those of the total cesarean rate for these groups.

VBAC births increase dramatically but then decline

The rate of vaginal birth after previous cesarean delivery (VBAC) increased by 33 percent from 1991 to 1996, to 28.3 per 100 births to women with a previous cesarean (table 2), and then declined by 17 percent from 1996 to 1999, down to 23.4. In 1999 a total of 97,680 births were delivered by VBAC (8). For every year of the period 1991–99, VBAC rates were highest for teenagers and declined with increasing maternal age (table 2). The disparity in rates by age narrowed slightly over the period as the percent increases in rates during 1991–96 for women 40 years of age and over were higher

than those for teenagers (37 compared with 33 percent), while the percent declines between 1996 and 1999 were the same (16 percent).

Between 1991 and 1996, VBAC rates increased most dramatically for non-Hispanic white women (37 percent) followed by Hispanic women (31 percent) and non-Hispanic black women (27 percent). Between 1996 and 1999, the decline in the VBAC rate was greater for non-Hispanic white and Hispanic women (18 percent each) than for non-Hispanic black women (14 percent). For every year of the period, the overall VBAC rate was highest for non-Hispanic white women, lowest for Hispanic women, and intermediate for non-Hispanic black women. In 1999 the VBAC rate for non-Hispanic white women (24.1) was 4 percent higher than that for non-Hispanic black women (23.2) and 19 percent higher than the rate for Hispanic women (20.3).

However, among women under 25 years of age, non-Hispanic black women had the highest rate of VBAC. For women under 20 years of age, the rate for non-Hispanic black women (29.1 percent) was 8 percent higher than the rate for non-Hispanic white women (27.0 percent), and 6 percent higher than the rate for Hispanic women (27.4 percent). For women 20–24 years of age, the rate for non-Hispanic black women (26.6 percent) was 2 percent higher than the rate for non-Hispanic white women (26.0 percent) and 9 percent higher than the rate for Hispanic women (24.4 percent).

Cesarean rates for all regions and nearly all States increase between 1996 and 1999

For every year of the period 1991–99, cesarean rates were highest in States in the South and lowest in the Midwest and West (tables 3 and 4). All regions experienced declines in cesarean rates between 1991 to 1996, ranging from an 11-percent decline for the

Table B. Live births by cesarean delivery and by vaginal birth after previous cesarean by age, race, and Hispanic origin of mother: United States, 1999

Age, race, and Hispanic origin	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	3,959,417	862,086	542,080	320,006	22.0	15.5	23.4
Under 20 years	485,104	72,258	64,254	8,004	15.0	13.7	28.1
20–24 years	981,929	174,252	120,238	54,014	17.9	13.4	26.0
25–29 years	1,078,252	232,492	144,759	87,733	21.8	15.2	24.1
30–34 years	892,400	224,387	126,681	97,706	25.4	16.7	23.0
35–39 years	434,294	128,610	68,532	60,078	29.9	19.3	20.7
40–54 years	87,438	30,087	17,616	12,471	34.7	24.6	18.2
White, total	3,132,501	678,952	424,148	254,804	21.9	15.3	23.2
Under 20 years	342,627	49,886	44,663	5,223	14.7	13.4	27.2
20–24 years	748,371	130,749	91,163	39,586	17.6	13.2	25.5
25–29 years	873,654	186,903	116,674	70,229	21.6	15.1	23.8
30–34 years	739,948	183,763	102,932	80,831	25.0	16.4	23.1
35–39 years	356,959	103,671	54,743	48,928	29.3	18.8	21.2
40–54 years	70,942	23,980	13,973	10,007	34.1	24.1	18.6
White non-Hispanic	2,346,450	514,051	327,106	186,945	22.1	15.7	24.1
Under 20 years	214,971	31,961	28,984	2,977	15.0	13.9	27.0
20–24 years	514,386	90,579	64,658	25,921	17.8	13.6	26.0
25–29 years	663,569	141,398	91,998	49,400	21.5	15.6	24.8
30–34 years	600,830	146,621	84,695	61,926	24.6	16.5	24.3
35–39 years	294,590	84,028	45,256	38,772	28.8	18.7	22.4
40–54 years	58,104	19,464	11,515	7,949	33.8	24.1	19.7
Black, total	605,970	139,471	88,269	51,202	23.2	16.5	23.2
Under 20 years	125,143	20,431	17,824	2,607	16.4	14.8	29.3
20–24 years	193,211	37,854	24,777	13,077	19.7	14.2	26.6
25–29 years	138,868	33,889	19,551	14,338	24.6	16.4	23.8
30–34 years	91,486	26,960	14,884	12,076	29.7	19.7	21.4
35–39 years	47,277	16,479	8,957	7,522	35.1	23.6	17.1
40–54 years	9,985	3,858	2,276	1,582	38.9	28.3	15.9
Black non-Hispanic	588,981	135,508	85,898	49,610	23.2	16.5	23.2
Under 20 years	122,175	19,988	17,426	2,562	16.5	14.8	29.1
20–24 years	188,247	36,965	24,169	12,796	19.8	14.3	26.6
25–29 years	134,784	32,920	19,020	13,900	24.6	16.5	23.8
30–34 years	88,403	26,032	14,446	11,586	29.6	19.8	21.5
35–39 years	45,746	15,898	8,655	7,243	35.0	23.6	17.2
40–54 years	9,626	3,705	2,182	1,523	38.7	28.1	15.7
Hispanic ⁵	764,339	161,035	94,433	66,602	21.2	14.0	20.3
Under 20 years	127,402	17,905	15,660	2,245	14.1	12.7	27.4
20–24 years	231,475	39,841	26,277	13,564	17.3	12.4	24.4
25–29 years	203,985	44,513	23,900	20,613	21.9	13.5	21.1
30–34 years	131,369	35,731	17,320	18,411	27.4	16.0	18.1
35–39 years	58,146	18,733	8,939	9,794	32.4	19.4	15.6
40–54 years	11,962	4,312	2,337	1,975	36.2	24.3	13.1

¹Percent of all live births 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 delivery.⁴Includes races other than white and black and origin not stated.⁵Includes all persons of Hispanic origin of any race.

Midwest to a 6-percent decline in the Northeast. Increases in cesarean rates from 1996 to 1999 were present for all regions, with the highest percent increase reported for the West (8 percent). In 1999 the cesarean rate was 23.7 in the South, 22.9 in the Northeast, 20.5 in the West, and 20.0 in the Midwest.

Between 1991 and 1999, there was considerable variation in cesarean rates by State. In 1999 the highest rates were reported for Arkansas, Louisiana, Mississippi, and New Jersey, ranging between 25

and 27 per 100 births (table 3). Arkansas, Louisiana, Mississippi, and Texas had the highest rates in 1991. In 1999 rates were generally highest in the South, lowest in the West and Midwest (figure 4 and table 4). Five states consistently reported the lowest rates—Alaska, Colorado, Idaho, Utah, and Wisconsin—with rates ranging from 14.8 to 17.3 in 1999. The State with the lowest rate in 1999 was Alaska (14.8), thus achieving the Healthy People 2000 health objective of 15 per 100 births (2).

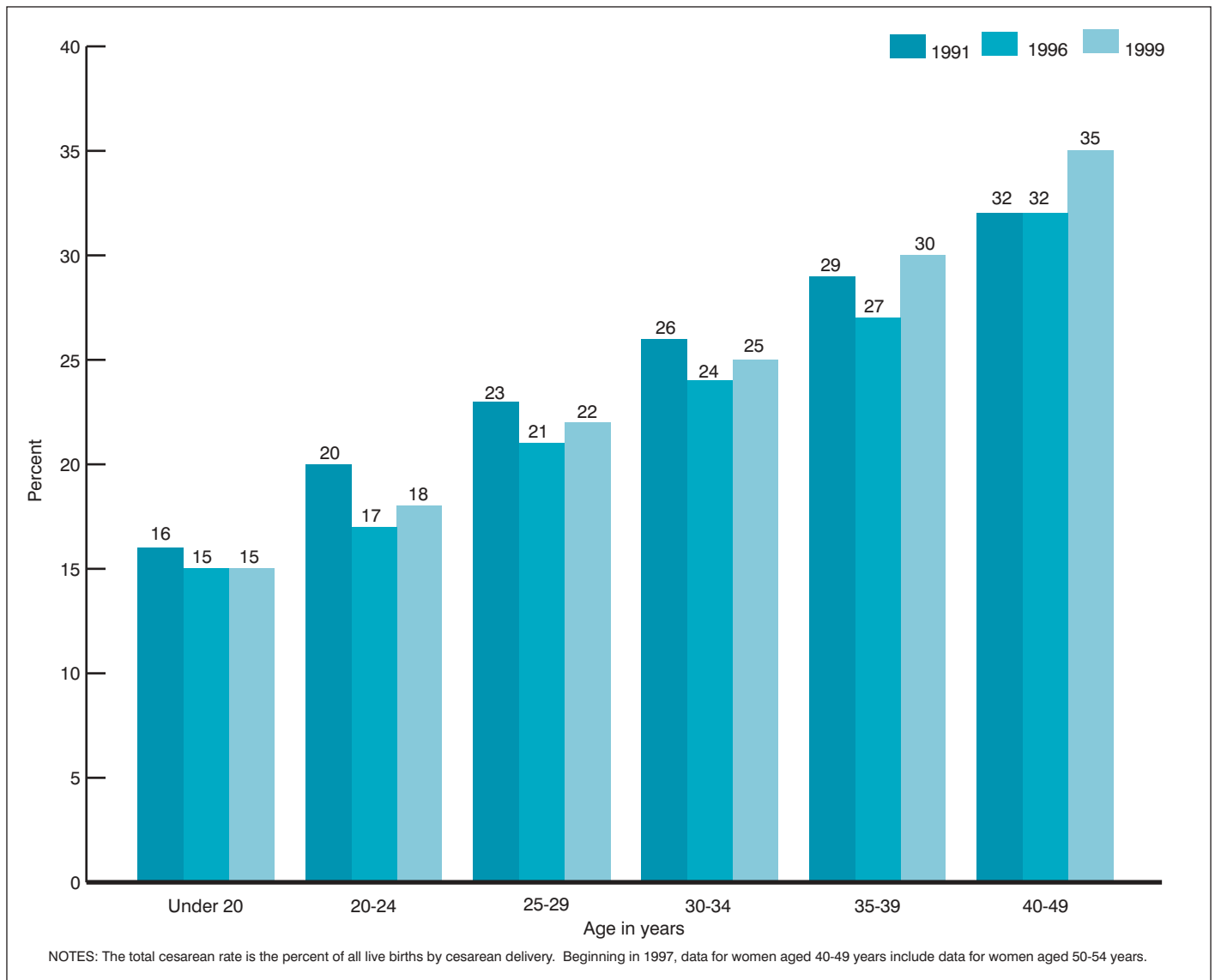


Figure 2. Total cesarean rate by age: United States, 1991, 1996, and 1999

Between 1991 and 1996, the cesarean rate declined for all but five States. Areas with the steepest declines (between 15 and 19 percent) were the District of Columbia, Hawaii, Kansas, Ohio, Texas, and Vermont. Three States had small increases of up to 3 percent in cesarean rates over the 1991–96 period: Alaska, Nebraska, and South Dakota. South Carolina had a negligible increase. The rate for New Jersey was unchanged. Between 1996 and 1999, cesarean rates increased in all but five States. In fact, 14 States reported increases of at least 10 percent. Four States—Montana, New Hampshire, New Mexico, and Vermont—had small drops in cesarean rates between 1996 and 1999, while Alaska had an 11-percent decline.

Cesarean rates vary according to maternal characteristics

Table 4 shows cesarean rates for each year 1991–99 by live-birth order and education of the mother. Cesarean rates were

consistently highest for women having their first child and lowest for those giving birth to a third- or higher-order child. However, the disparity in cesarean rates by live-birth order diminished somewhat over the period as the decline between 1991 and 1996 was greater for women having their first or second child (10 percent) than for women having a third- or a higher-order child (3 percent). All groups experienced increases in cesarean rates between 1996 and 1999. In 1999 the cesarean rate was 23.1 for women having their first child, 21.9 for those having a second child, and 20.4 for those having a third-or-higher order child.

Cesarean rates generally increase with additional educational attainment, but the declines between 1991 and 1996 were greatest for women with the most education, thus diminishing the disparity. Rates increased between 1996 and 1999 for all groups and ranged in 1999 from less than 19 per 100 births for those with less than a high school education to 24 for women with 16 years or more of education.

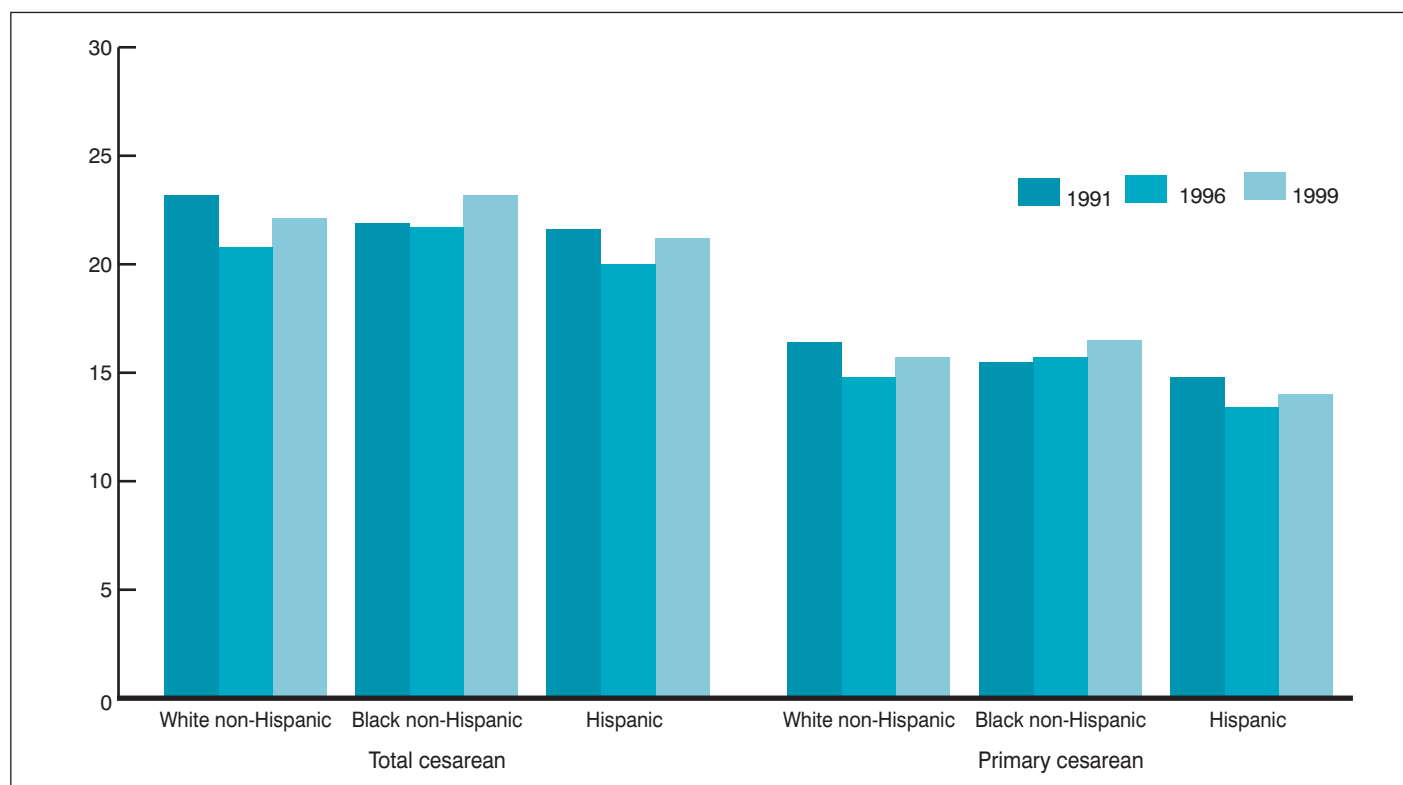


Figure 3. Total and primary cesarean rates by race and Hispanic origin: 1991, 1996, and 1999

Cesarean rates for many medical risk factors and complications of labor and/or delivery increase between 1996 and 1999

Table 5 presents cesarean rates by selected medical risk factors and complications of labor and/or delivery. Between 1991 and 1996, the rates for all but one medical risk factor (incompetent cervix) declined. The declines ranged from 4 percent for diabetes to 18 percent for genital herpes. There was a 5-percent increase in cesarean rates for incompetent cervix. Between 1996 and 1999, the rates for all but two medical risk factors increased. For every year 1991–99, cesarean rates for all of the selected medical risk factors were higher than the national average. Risk factors with the highest cesarean rates, more than 30 per 100 births, were diabetes, genital herpes, hydramnios/oligohydramnios, chronic or pregnancy-associated hypertension, eclampsia, incompetent cervix, and uterine bleeding. In 1999 cesarean rates were generally similar among the racial and ethnic groups for anemia, genital herpes, and chronic hypertension. For the remaining medical risk factors, cesarean rates were generally higher for either non-Hispanic white or black mothers and lowest for Hispanic mothers (tabular data not shown). These findings were similar to those reported in 1995 (7).

Between 1991 and 1996, rates for only three complications of labor (abruptio placenta, precipitous labor, and cord prolapse) increased, while the remaining declined. Between 1996 and 1999, rates for 6 of the 15 complications increased. Increases were between 2 and 7 percent for five of the complications and 23 percent for seizures.

During the 1990s, cesarean rates were highest for mothers with cephalopelvic disproportion (above 96 percent), breech malpresentation (above

84 percent), and placenta previa (82 percent). More than 50 percent of mothers with abruptio placenta, seizures during labor, dysfunctional labor, cord prolapse, and fetal distress had cesarean births. Rates were lowest for mothers with precipitous labor, fluctuating between 2 and 3 percent. In 1999 cesarean rates for most complications were generally highest for non-Hispanic black mothers (tabular data not shown).

Objectives regarding cesarean rates revised

In 1989 cesarean data became available from the birth certificate; however, NCHS first began collecting information on cesarean deliveries in 1965 from the National Hospital Discharge Survey (NHDS). In response to growing concerns in the 1980s about the rising cesarean rate (as shown in NHDS data), the Department of Health and Human Services established lowering the cesarean rate as one of the Healthy People Year 2000 objectives (2). The specific goal was to lower the rate to no more than 15 cesareans per 100 births. When objectives were evaluated for Healthy People 2010, lowering the cesarean rate was again included (9). However, for 2010, the focus of the objective was changed from *all* women giving birth to *low-risk* women—those having singleton babies at 37 weeks gestation or more with a vertex presentation. Birth certificate data were identified as the source of data for monitoring this objective. The change in the focus of the objective was to concentrate on women for whom lowering the rate was appropriate and achievable.

Table C shows the 2010 objective for cesarean births, the 1998 baseline, and the data for 1999. For low-risk women giving birth for the first time, the objective is for a cesarean rate of no more than 15 per 100 births. In 1999 the cesarean rate for births to these women was

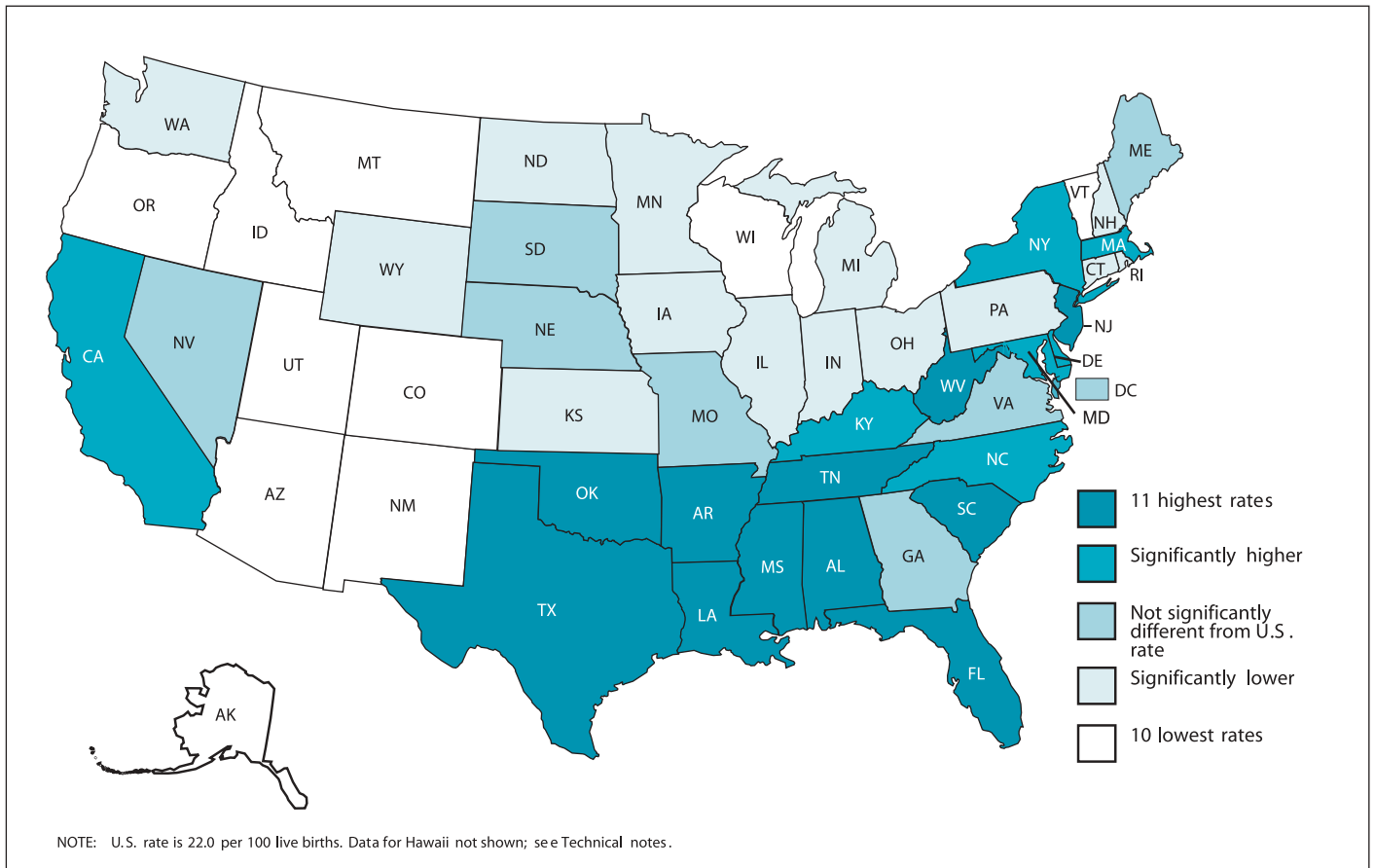


Figure 4. Total cesarean rates by State: United States, 1999

19. Thus a 21-percent drop in this rate will be necessary to achieve the objective. For low-risk women who have had a prior cesarean, the objective is for a cesarean rate of 63 per 100 births; the 1999 rate for these women was 75. Reaching this objective will require a 16-percent drop in the rate.

Discussion

As has been the case since the late 1970s, the U.S. cesarean rate continues to be the focus of considerable attention (3–6, 10,11,12). The data in this report show that the total cesarean rate decreased by 8 percent between 1991 and 1996 and then increased during the next three years, reaching 22.0 percent in 1999, the highest rate since 1992 (22.3 percent). There is still considerable debate in the medical community as to the appropriate level for the cesarean rate and the role of VBAC deliveries in its reduction (3,4,6,10). While it was once widely held that cesarean deliveries entailed more risk to the mother and baby than vaginal deliveries (13), this has been challenged recently, especially with regard to VBAC deliveries (6,10,14). This changing attitude towards the relative risks and benefits of cesarean versus vaginal deliveries may explain some of the recent rise. The fact that the rise has been widespread—for women of all ages and races and for nearly all States—supports the idea that there has been a general change in the approach to childbirth in the United States.

There continues to be considerable variation in cesarean and VBAC rates by State. In fact, one State achieved and a few States closely approached the year 2000 objective of 15 per 100 births, while many States had rates that were at least 50 percent higher than the objective. The pronounced disparities in State-specific cesarean rates

Table C. Healthy People 2010 Objectives regarding cesarean and vaginal birth after previous cesarean delivery

Target and baseline:

Objective	Reduce cesarean births among low-risk women ¹	1998 baseline	1999	2010 target ²
Percent of live births				
16–9a	Women giving birth for the first time	18	19	15
16–9b	Women who had a prior cesarean birth	72	75	63

¹A low-risk woman is defined as one with a full-term (at least 37 weeks since last menstrual period (LMP)), singleton (not a multiple pregnancy), vertex fetus (head facing in a downward position in the birth canal).

²<http://www.wonder.cdc.gov> and go to data 2010 objectives.

SOURCE: U.S. Department of Health and Human Services. *Tracking Healthy People 2010*. Washington, D.C. U.S. Government Printing Office. November 2000.

persist even after differences in maternal age and birth order are considered (15). It is probable that these marked variations are related to local practice patterns (11). Research on strategies used by States that safely maintain a lower rate of cesarean births might assist those working toward a decreased rate.

The data in this report combined with preliminary birth data for 2000, show that the Year 2000 objective for cesarean deliveries of 15 per 100 births was not met (16). In fact, the cesarean rate for the year 2000 (22.9) was the highest reported since this information has been collected on the birth certificate (table A). However, lowering the rate is still considered a national goal and is generally supported by the American College of Obstetricians and Gynecologists (ACOG) in its most recent comprehensive guidelines (17). Successful strategies to lower rates continue to be implemented in various institutions (11, 12,18). Research is needed to explore the apparent contradiction between goals for cesarean rates and the vast majority of current practice.

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Table 1. Total and primary cesarean rates by age, race, and Hispanic origin of mother: United States, 1991–99, and percent changes 1991–96 and 1996–99

Age and race	1999	1998	1997	1996	1995	1994	1993	1992	1991	Percent change between 1991 and 1996	Percent change between 1996 and 1999
Total cesarean¹											
All races²:											
Total	22.0	21.2	20.8	20.7	20.8	21.2	21.8	22.3	22.6	-8	6
Under 20	15.0	14.5	14.3	14.5	14.7	15.0	15.5	16.1	16.4	-12	3
20–24	17.9	17.4	17.3	17.4	17.8	18.3	18.9	19.5	19.9	-13	3
25–29	21.8	21.0	20.6	20.6	20.9	21.5	22.1	22.8	23.3	-12	6
30–34	25.4	24.4	23.9	23.8	23.8	24.2	24.8	25.3	25.7	-7	7
35–39	29.9	28.7	28.0	27.4	27.4	27.7	28.5	28.7	29.0	-6	9
40–49 ³	34.7	33.1	32.4	31.6	31.6	31.5	32.2	31.7	32.1	-2	10
White non-Hispanic⁴:											
Total	22.1	21.2	20.9	20.8	21.0	21.5	22.2	22.8	23.2	-10	6
Under 20	15.0	14.4	14.3	14.3	14.5	15.0	15.6	16.6	17.1	-16	5
20–24	17.8	17.2	17.2	17.4	18.0	18.6	19.4	20.2	20.7	-16	2
25–29	21.5	20.7	20.3	20.4	20.7	21.4	22.2	23.0	23.5	-13	5
30–34	24.6	23.6	23.2	23.1	23.2	23.6	24.3	25.0	25.4	-9	6
35–39	28.8	27.4	26.9	26.4	26.4	26.8	27.8	28.2	28.7	-8	9
40–49 ³	33.8	32.0	31.5	30.8	30.9	30.8	31.4	31.0	31.8	-3	10
Black non-Hispanic⁴:											
Total	23.2	22.4	21.8	21.7	21.8	21.9	22.0	22.2	21.9	-1	7
Under 20	16.5	16.0	15.5	15.9	15.9	16.1	16.2	16.6	16.4	-3	4
20–24	19.8	19.3	18.8	18.8	19.1	19.4	19.5	19.9	19.9	-6	5
25–29	24.6	23.7	23.2	23.2	23.5	23.7	23.8	24.3	24.1	-4	6
30–34	29.6	28.9	28.2	27.8	27.7	27.9	28.0	27.9	27.7	0	6
35–39	35.0	33.7	32.6	31.8	31.6	31.2	31.8	31.6	30.6	4	10
40–49 ³	38.7	36.8	36.0	35.3	34.6	34.5	36.1	34.6	34.4	3	10
Hispanic^{4,5}:											
Total	21.2	20.6	20.2	20.0	20.2	20.5	20.9	21.2	21.6	-7	6
Under 20	14.1	13.7	13.5	13.8	14.1	14.2	14.9	15.1	15.7	-12	2
20–24	17.3	17.0	16.9	16.8	17.1	17.5	18.1	18.4	18.8	-11	3
25–29	21.9	21.3	21.1	20.7	21.3	21.8	22.0	22.5	23.1	-10	6
30–34	27.4	26.3	26.0	25.7	25.6	26.1	26.4	26.7	26.6	-3	7
35–39	32.4	31.9	30.9	30.0	30.0	29.6	30.0	30.0	29.8	1	8
40–49 ³	36.2	35.3	33.7	33.0	32.8	33.3	33.8	33.5	32.0	3	10
Primary cesarean⁶											
All races²:											
Total	15.5	14.9	14.6	14.6	14.7	14.9	15.3	15.6	15.9	-8	6
Under 20	13.7	13.3	13.1	13.2	13.4	13.6	13.9	14.3	14.6	-10	4
20–24	13.4	13.0	13.0	13.1	13.5	13.7	14.1	14.4	14.8	-11	2
25–29	15.2	14.6	14.4	14.5	14.6	14.8	15.3	15.7	16.1	-10	5
30–34	16.7	16.1	15.6	15.5	15.5	15.5	15.9	16.2	16.5	-6	8
35–39	19.3	18.6	18.0	17.6	17.6	17.9	18.5	18.7	18.9	-7	10
40–49 ³	24.6	23.3	22.6	22.2	22.2	22.3	22.7	22.4	22.9	-3	11
White non-Hispanic⁴:											
Total	15.7	15.1	14.8	14.8	14.9	15.1	15.6	16.0	16.4	-10	6
Under 20	13.9	13.4	13.3	13.3	13.5	13.9	14.3	15.0	15.5	-14	5
20–24	13.6	13.2	13.2	13.5	13.9	14.2	14.8	15.2	15.7	-14	1
25–29	15.6	14.9	14.6	14.7	14.8	15.1	15.6	16.0	16.4	-10	6
30–34	16.5	15.8	15.3	15.2	15.1	15.2	15.6	16.0	16.3	-7	9
35–39	18.7	17.8	17.4	17.0	16.9	17.2	17.9	18.2	18.6	-9	10
40–49 ³	24.1	22.7	22.0	21.6	21.8	21.7	22.1	21.7	22.6	-4	12
Black non-Hispanic⁴:											
Total	16.5	16.0	15.6	15.7	15.7	15.7	15.7	15.7	15.5	1	5
Under 20	14.8	14.3	13.9	14.2	14.2	14.3	14.1	14.2	14.0	1	4
20–24	14.3	13.9	13.5	13.5	13.9	13.9	13.7	13.9	13.8	-2	6
25–29	16.5	15.9	15.6	15.9	15.9	16.0	16.1	16.3	16.1	-1	4
30–34	19.8	19.3	18.8	18.6	18.7	18.5	18.7	18.5	18.4	1	6
35–39	23.6	22.9	22.1	21.6	21.2	21.5	21.8	21.9	21.1	2	9
40–49 ³	28.1	26.7	25.6	25.9	25.3	25.6	27.2	26.3	25.7	1	8

See footnotes at end of table.

Table 1. Total and primary cesarean rates by age, race, and Hispanic origin of mother: United States, 1991–99, and percent changes 1991–96 and 1996–99—Con.

Age and race	1999	1998	1997	1996	1995	1994	1993	1992	1991	Percent change between 1991 and 1996	Percent change between 1996 and 1999
Primary cesarean ⁶ —Con.											
Hispanic ^{4,5} :											
Total	14.0	13.6	13.4	13.4	13.7	13.9	14.2	14.4	14.8	-9	4
Under 20	12.7	12.2	12.2	12.4	12.6	12.6	13.2	13.3	13.9	-11	2
20–24	12.4	12.2	12.1	12.2	12.5	12.7	13.1	13.4	13.7	-11	2
25–29	13.5	13.3	13.1	13.0	13.5	13.8	13.9	14.3	14.9	-13	4
30–34	16.0	15.5	15.2	14.9	15.0	15.3	15.8	16.0	16.1	-7	7
35–39	19.4	19.1	18.3	17.9	18.1	18.2	18.5	18.5	19.0	-6	8
40–49 ³	24.3	23.0	22.4	22.3	21.9	22.9	23.1	23.1	22.5	-1	9

¹Percent of all live births by cesarean delivery.

²Includes races other than white and black and origin not stated.

³Beginning in 1997, data are for women aged 40–54 years.

⁴In 1991–92, all births to New Hampshire residents were assumed to be non-Hispanic. See Technical notes.

⁵Includes all persons of Hispanic origin of any race.

⁶Number of primary cesareans per 100 live births to women who have not had a previous cesarean.

Table 2. Rates of vaginal birth after previous cesarean by age, race, and Hispanic origin of mother: 1991–99, and percent changes 1991–96 and 1996–99

Age and race	VBAC rate ¹									Percent change between 1991 and 1996	Percent change between 1996 and 1999
	1999	1998	1997	1996	1995	1994	1993	1992	1991		
All races ²											
Total	23.4	26.3	27.4	28.3	27.5	26.3	24.3	22.6	21.3	33	-17
Under 20	28.1	31.7	33.4	33.5	32.3	31.2	28.4	26.3	25.1	33	-16
20–24	26.0	28.7	29.8	30.6	29.6	28.4	26.1	24.0	22.6	35	-15
25–29	24.1	26.9	28.4	29.3	28.3	26.8	25.1	23.0	21.6	36	-18
30–34	23.0	26.0	27.3	28.0	27.3	25.8	23.6	22.3	20.9	34	-18
35–39	20.7	23.5	24.2	25.4	24.2	23.3	21.5	20.2	18.6	37	-19
40–49 ³	18.2	20.8	20.5	21.6	21.0	20.2	18.4	17.1	15.8	37	-16
White non-Hispanic ⁴											
All ages	24.1	27.3	28.5	29.5	28.4	27.0	24.9	23.0	21.6	37	-18
Under 20	27.0	31.9	32.5	34.5	31.6	31.0	27.3	24.3	22.5	53	-22
20–24	26.0	29.1	30.3	31.1	29.5	28.1	25.8	23.3	22.0	41	-16
25–29	24.8	27.8	29.4	30.2	29.2	27.6	25.6	23.3	21.9	38	-18
30–34	24.3	27.5	28.8	29.6	28.7	27.1	24.9	23.3	21.9	35	-18
35–39	22.4	25.4	26.1	27.5	26.0	24.9	23.0	21.6	19.8	39	-19
40–49 ³	19.7	23.3	22.1	23.3	22.6	21.7	20.0	18.3	17.4	34	-15
Black non-Hispanic ⁴											
All ages	23.2	25.7	26.4	26.9	26.0	25.5	23.7	22.3	21.1	27	-14
Under 20	29.1	32.7	34.1	32.9	34.0	31.3	29.5	27.8	27.5	20	-12
20–24	26.6	28.7	29.5	30.0	29.7	28.8	26.8	24.8	23.6	27	-11
25–29	23.8	26.7	27.5	27.6	25.8	25.5	24.1	22.4	20.9	32	-14
30–34	21.5	23.5	24.1	24.6	23.4	23.1	20.2	19.4	17.7	39	-13
35–39	17.2	19.6	20.0	20.9	20.1	19.1	17.9	16.1	14.9	40	-18
40–49 ³	15.7	16.8	16.5	18.6	16.4	17.4	15.7	15.1	13.2	40	-16
Hispanic ^{4,5}											
Total	20.3	22.4	23.5	24.8	24.4	23.2	21.4	20.1	19.0	31	-18
Under 20	27.4	29.4	32.3	32.3	30.0	30.3	27.8	26.2	25.0	29	-15
20–24	24.4	26.9	27.5	29.2	28.7	27.3	24.6	23.7	22.0	33	-16
25–29	21.1	23.5	24.5	26.2	25.7	24.0	22.6	20.7	19.5	34	-19
30–34	18.1	20.4	21.5	21.9	21.8	20.4	18.6	17.3	16.3	34	-17
35–39	15.6	16.6	17.4	18.7	18.0	18.0	15.7	14.7	15.0	25	-17
40–49 ³	13.1	13.4	14.8	16.4	16.8	14.7	13.8	13.0	11.3	45	-20

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

²Includes races other than black and white and origin not stated.

³Beginning in 1997, data are for women aged 40–54 years.

⁴In 1991–92, all births to New Hampshire residents were assumed to be non-Hispanic. See Technical notes.

⁵Persons of Hispanic origin may be of any race.

Table 3. Cesarean delivery rates: United States, each State and Territory, 1991–99, and percent changes 1991–96 and 1996–99

[By place of residence]

State	Cesarean delivery rate ¹									Percent change between 1991 and 1996	Percent change between 1996 and 1999
	1999	1998	1997	1996	1995	1994	1993	1992	1991		
United States ²	22.0	21.2	20.8	20.7	20.8	21.2	21.8	22.3	22.6	-8	6
Alabama	24.8	24.0	23.9	23.3	23.4	23.2	24.8	24.9	25.1	-7	6
Alaska	14.8	14.7	16.8	16.7	14.4	16.3	15.2	16.0	16.3	2	-11
Arizona	17.8	17.0	16.8	16.1	16.8	16.8	16.8	17.8	18.3	-12	11
Arkansas	25.4	24.9	24.5	25.3	25.6	25.9	27.0	28.3	27.4	-8	0
California	22.7	21.7	21.0	20.6	20.6	20.8	21.3	21.6	22.3	-8	10
Colorado	17.3	16.4	15.3	15.1	15.2	15.3	15.4	16.0	16.3	-7	15
Connecticut	21.0	20.1	19.8	19.8	19.2	19.1	20.5	20.8	21.6	-8	6
Delaware	23.0	23.2	21.0	21.0	21.5	21.9	22.5	22.4	22.5	-7	10
District of Columbia	22.2	20.8	21.2	21.3	22.0	22.4	22.3	22.3	25.2	-15	4
Florida	23.8	22.4	22.2	21.6	21.7	22.2	22.9	23.9	23.9	-10	10
Georgia	21.7	20.8	20.8	20.9	21.2	21.3	21.3	21.7	22.1	-5	4
Hawaii ³	---	15.6	16.7	17.5	18.5	17.2	18.4	19.4	20.6	-15	---
Idaho	17.3	15.7	16.4	16.0	15.7	15.3	16.2	16.6	17.9	-11	8
Illinois	20.1	19.4	19.1	19.3	19.9	20.1	21.0	21.8	22.2	-13	4
Indiana	20.5	20.0	19.7	20.3	20.7	21.2	21.3	21.6	21.6	-6	1
Iowa	19.9	19.6	18.9	18.6	18.6	19.0	19.0	20.0	20.6	-10	7
Kansas	21.2	18.6	18.5	19.2	19.7	20.7	21.1	21.8	23.2	-17	10
Kentucky	23.3	22.8	22.4	21.3	22.0	22.5	24.3	24.7	24.8	-14	9
Louisiana	26.8	26.0	25.4	26.4	27.2	28.3	27.7	28.5	27.9	-5	2
Maine	21.5	19.7	20.8	20.8	21.0	20.7	20.9	21.5	21.3	-2	3
Maryland	23.2	21.3	21.0	21.6	22.0	22.6	23.2	24.0	24.3	-11	7
Massachusetts	22.4	20.9	19.7	19.8	20.6	20.7	21.4	22.2	22.2	-11	13
Michigan	21.0	20.6	20.1	20.2	20.3	20.7	21.0	21.5	21.6	-6	4
Minnesota	18.9	18.0	17.1	16.9	16.3	16.5	16.6	16.6	17.0	-1	12
Mississippi	27.3	27.0	26.7	26.6	25.9	26.2	26.7	27.2	26.9	-1	3
Missouri	21.7	20.6	20.1	20.4	20.5	20.8	21.6	22.4	22.5	-9	6
Montana	18.8	18.9	19.0	19.1	19.1	19.0	19.1	20.1	20.2	-5	-2
Nebraska	22.0	20.6	20.2	19.8	19.2	18.7	20.6	19.3	19.6	1	11
Nevada	21.8	21.4	20.1	19.3	19.2	19.2	20.3	20.3	20.2	-5	13
New Hampshire	19.9	18.5	19.3	20.3	20.0	19.3	20.1	20.9	21.4	-5	-2
New Jersey	26.3	25.4	24.9	24.0	23.3	23.9	24.7	24.3	24.0	0	10
New Mexico	16.4	16.4	16.6	17.2	18.1	17.4	17.4	18.9	19.0	-10	-5
New York	23.6	22.9	23.0	22.9	22.7	22.9	23.4	23.3	23.3	-2	3
North Carolina	22.7	21.5	21.2	21.1	21.7	22.1	22.1	22.3	22.4	-6	8
North Dakota	19.5	19.4	18.4	18.9	19.3	20.1	19.1	19.0	19.2	-2	3
Ohio	19.4	18.9	19.0	19.0	19.6	21.0	21.9	23.2	23.4	-19	2
Oklahoma	24.1	22.8	22.3	22.5	22.8	23.2	23.1	23.9	23.7	-5	7
Oregon	18.4	17.8	16.9	16.9	17.4	17.4	17.5	18.2	18.7	-10	9
Pennsylvania	20.9	19.6	19.4	19.4	19.7	20.2	21.2	21.8	22.2	-13	8
Rhode Island	20.5	19.5	18.6	17.7	18.4	17.3	18.3	19.1	19.4	-9	16
South Carolina	24.2	23.4	22.8	22.6	22.4	23.2	23.0	23.0	22.5	0	7
South Dakota	22.3	21.5	20.0	20.8	19.9	21.2	20.1	20.5	20.2	3	7
Tennessee	24.0	22.6	21.9	21.7	21.2	21.1	22.0	23.1	23.2	-7	11
Texas	23.8	23.5	23.1	23.1	23.6	24.4	25.0	26.4	27.2	-15	3
Utah	16.0	16.0	15.8	15.9	16.3	16.2	17.3	17.2	17.8	-11	1
Vermont	16.4	16.5	15.6	16.5	16.7	17.1	18.5	18.4	19.8	-17	-1
Virginia	21.7	21.2	21.5	21.1	21.3	22.0	22.4	23.0	23.1	-9	3
Washington	18.9	17.9	17.2	16.8	17.1	16.9	17.4	17.3	18.9	-11	13
West Virginia	24.8	24.1	24.4	22.8	23.5	23.9	24.9	25.8	25.8	-12	9
Wisconsin	17.0	16.0	15.7	15.6	15.4	15.7	15.7	16.7	17.4	-10	9
Wyoming	19.6	18.6	18.6	18.3	17.9	17.8	19.3	20.0	19.5	-6	7
Puerto Rico	37.8	35.1	33.4	31.5	29.7	31.2	31.6	31.3	31.6	0	20
Virgin Islands	22.7	22.7	22.8	22.4	21.2	19.9	22.0	22.1	17.5	28	1
Guam	16.6	14.7	15.8	15.1	14.5	17.8	20.4	19.2	18.5	-18	10
American Samoa	---	---	---	---	---	---	---	---	---	---	---
Northern Marianas	14.9	17.1	---	---	---	---	---	---	---	---	---

--- Data not available.

¹Percent of all live births by cesarean delivery.²Excludes data for the territories.³Data not shown for 1999; see Technical notes.

Table 4. Total cesarean rates by selected maternal characteristics: United States, 1991–99 and percent changes 1991–96 and 1996–99

Selected maternal characteristics	Cesarean delivery rate ¹									Percent change between 1991 and 1996	Percent change between 1996 and 1999
	1999	1998	1997	1996	1995	1994	1993	1992	1991		
Region of residence ²											
Northeast	22.9	21.9	21.7	21.5	21.5	21.7	22.5	22.7	22.8	-6	7
Midwest	20.1	19.3	19.0	19.1	19.3	19.9	20.4	21.1	21.4	-11	5
South	23.7	22.9	22.6	22.5	22.8	23.3	23.8	24.6	24.7	-9	5
West	20.5	19.7	19.2	18.9	19.1	19.2	19.7	20.0	20.8	-9	8
Live-birth order											
First child	23.1	22.4	22.0	22.0	22.2	22.6	23.5	24.1	24.5	-10	5
Second child	21.9	20.9	20.4	20.2	20.4	20.9	21.5	22.2	22.5	-10	8
Third child or higher	20.4	19.7	19.4	19.2	19.3	19.3	19.6	19.7	19.8	-3	6
Education											
0–8 years	18.6	18.0	17.6	17.2	17.2	17.4	17.6	17.9	18.0	-4	8
9–11 years	18.4	17.8	17.5	17.5	17.7	18.0	18.4	18.8	19.1	-8	5
12 years	22.1	21.4	21.1	21.0	21.3	21.7	22.3	22.9	23.2	-9	5
13–15 years	23.5	22.6	22.2	22.2	22.4	22.8	23.5	24.1	24.7	-10	6
16 years or more	23.8	22.7	22.2	22.0	22.1	22.6	23.4	24.1	24.7	-11	8

¹Percent of all live births by cesarean delivery.²See Technical notes for listing of States comprising each region.

Table 5. Cesarean delivery rates by selected maternal medical risk factors and complications of labor and/or delivery: United States, 1991–99, and percent changes 1991–96 and 1996–99

[Between 1991–99, some of the reporting areas did not include all of the listed risk factors and complications on the birth certificate; see Technical notes]

Medical risk factor and complication	Cesarean delivery rate ¹									Percent change between 1991 and 1996	Percent change between 1996 and 1999
	1999	1998	1997	1996	1995	1994	1993	1992	1991		
All births	22.0	21.2	20.8	20.7	20.8	21.2	21.8	22.3	22.6	-8	6
Medical risk factors											
Anemia	22.2	21.9	22.3	22.0	22.6	23.2	23.7	24.7	24.7	-11	1
Cardiac disease	26.1	25.1	24.5	24.1	24.0	24.5	26.0	25.4	27.0	-11	8
Acute or chronic lung disease	25.4	24.4	24.0	24.2	24.8	25.7	25.9	26.8	27.4	-12	5
Diabetes	37.2	36.1	35.6	35.2	35.4	35.4	35.9	35.8	36.8	-4	6
Genital herpes ²	34.5	33.9	35.0	36.0	37.8	38.4	39.9	42.6	44.0	-18	-4
Hydramnios/oligohydramnios	36.7	36.4	35.8	37.0	37.8	38.8	40.5	41.7	43.1	-14	-1
Hemoglobinopathy	25.8	24.8	25.1	24.0	25.6	24.2	27.7	27.9	26.9	-11	8
Hypertension, chronic	41.2	40.2	39.7	38.6	39.6	39.6	40.0	40.2	41.1	-6	7
Hypertension, pregnancy associated	36.9	36.1	35.5	36.1	36.8	37.4	38.9	40.0	40.7	-11	2
Eclampsia	49.1	48.8	48.0	47.8	49.1	49.5	50.7	51.0	51.7	-8	3
Incompetent cervix	35.3	32.9	31.2	31.8	30.1	30.4	31.2	30.7	30.3	5	11
Renal disease	26.1	25.4	24.7	24.1	24.8	26.1	27.2	27.2	27.2	-11	8
Rh sensitization ³	22.8	21.2	21.7	21.5	21.3	21.6	22.6	23.7	24.0	-10	6
Uterine bleeding ²	32.6	31.2	31.2	31.2	30.5	31.1	31.8	32.2	33.2	-6	5
Complications of labor and/or delivery											
Febrile	29.7	30.2	30.1	30.3	30.9	31.4	32.8	33.7	35.1	-14	-2
Meconium, moderate/heavy	20.5	20.4	20.1	20.6	20.9	21.2	21.5	22.2	22.3	-8	-1
Premature rupture of membranes	25.6	25.4	25.1	25.1	25.6	26.0	27.1	28.0	28.7	-13	2
Abruptio placenta	59.5	59.0	58.2	58.1	57.7	57.9	58.8	58.2	57.8	1	2
Placenta previa	81.7	81.5	82.0	81.6	81.8	82.8	82.9	81.7	82.5	-1	0
Other excessive bleeding	26.5	30.3	26.7	27.3	32.6	28.3	27.3	32.9	34.0	-20	-3
Seizures during labor	52.2	53.9	49.1	42.6	45.4	44.1	50.6	51.1	49.3	-14	23
Precipitous labor (less than 3 hours)	2.5	2.4	2.4	2.8	2.0	1.7	1.9	1.8	1.8	56	-11
Prolonged labor (more than 20 hours)	36.3	35.0	35.0	35.5	35.9	36.9	36.7	37.6	39.6	-10	2
Dysfunctional labor	67.3	64.9	63.2	63.1	63.4	65.2	67.4	67.4	66.5	-5	7
Breech/malpresentation	84.5	84.2	84.5	84.7	85.1	85.5	85.2	85.0	85.2	-1	0
Cephalopelvic disproportion	96.4	96.2	96.2	96.5	96.9	97.4	97.6	97.8	97.8	-1	0
Cord prolapse	65.6	67.2	66.4	66.4	63.1	61.8	67.2	64.6	60.9	9	-1
Anesthetic complication	40.1	43.8	41.4	41.8	42.1	45.0	46.6	53.5	53.6	-22	-4
Fetal distress ⁴	57.5	55.7	54.4	54.5	54.9	56.5	58.9	60.7	61.4	-11	6

¹Percent of all live births by cesarean delivery.²Texas did not report this risk factor for all years.³Kansas did not report this risk factor for all years.⁴Texas did not report this complication for all years.

Technical notes

Sources of data

The National Center for Health Statistics (NCHS) collects 100 percent of all birth certificates through the Vital Statistics Cooperative Program. Cesarean rates were computed for those birth records in which the "method of delivery" item was stated, which comprised more than 96 percent of all births for 1991–93 and more than 99 percent of all births since 1994.

In 1989 data on method of delivery were reported on the birth certificates of 45 States and the District of Columbia. Information was not available for Louisiana, Maryland, Nebraska, Nevada, and Oklahoma. In 1990 information was not available for Oklahoma. Beginning in 1991 all States and the District of Columbia reported information on method of delivery. The percent of birth records with missing information declined from 2.6 percent in 1991 to less than 1 percent in 1994–99.

The proportion of cesarean deliveries among births in Hawaii in 1999 is not shown in this report because it is substantially understated, due to incomplete reporting of method of delivery in some hospitals.

Race and Hispanic origin

Data are tabulated by race of mother. Hispanic origin is reported and tabulated independently of race. Thus, persons of Hispanic origin may be of any race. In 1999 the vast majority of births to Hispanic women were reported as white (97 percent) (8). In 1991 and 1992, all States and the District of Columbia reported Hispanic origin except New Hampshire. All States and the District of Columbia reported Hispanic origin during the period 1993–99. According to data from the 1990 census, less than 0.1 percent of the Hispanic population resided in New Hampshire, so the Hispanic reporting area was essentially complete (19). For computing cesarean and vaginal birth after previous cesarean (VBAC) rates by Hispanic origin for 1991 and 1992, all births to New Hampshire residents were assumed to be non-Hispanic.

Region of residence

States are classified by region of residence as follows:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

Medical risk factors

With few exceptions, all medical risk factors listed on the birth certificate were reported by all States every year. In 1991 and 1992, New York City (but not New York State) reported hemoglobinopathy and incompetent cervix. Between 1991–93 New York City (but not New York State) reported genital herpes and hydramnios/

oligohydramnios. Alabama did not report renal disease in 1996 or 1997. Trends as reported in [table 5](#) were not affected by these changes.

Complications of labor and/or delivery

With few exceptions, all complications of labor and/or delivery listed on the birth certificate were reported by all States every year. In 1991 Arizona did not report cord prolapse. In 1991–92, cephalopelvic disproportion was reported by New York City but not New York State. Texas did not report cephalopelvic disproportion between 1991–93 or anesthetic complications in 1991–96. New Jersey did not report other excessive bleeding in 1997. Trends as reported in [table 5](#) were not affected by these changes.

Computation of rates

Only records in which the "method of delivery" item was completed were used in the computation of cesarean and VBAC rates. The formula for the *total cesarean rate* is:

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

The primary cesarean rate relates the number of first cesarean births to the total number of births to women who have not had a previous cesarean.

The formula for the *primary cesarean rate* is:

$$\frac{\text{Number of primary cesarean births}}{\text{Number of primary cesarean births} + \text{number of vaginal births (excluding VBACs)}} \cdot 100$$

The VBAC rate relates the number of vaginal births to women who had a previous cesarean to the total number of women with a previous cesarean.

The formula for the *VBAC rate* is:

$$\frac{\text{Number of vaginal births after a previous cesarean}}{\text{Number of vaginal births after a previous cesarean} + \text{number of repeat cesarean births}} \cdot 100$$

Random variation and relative standard error

Although the birth data in this report are not subject to sampling error, the data may be affected by random variation in the number of births involved. When the number of events is small (perhaps less than 100), considerable caution must be observed in interpreting the data. Nearly all cesarean and VBAC rates in this report were computed based on substantially more than 100 births. The only exceptions are for some rare complications of labor and/or delivery. These events may be assumed to follow a Poisson probability distribution. A detailed description of the method for computing relative standard errors and for conducting significance tests is published elsewhere (20).

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National Center for Health Statistics

Director, Edward J. Sondik, Ph.D.
Deputy Director, Jack R. Anderson

Division of Vital Statistics

Director, Mary Anne Freedman

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National Center for Health Statistics
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