



## Changes in Primary and Repeat Cesarean Delivery: United States, 2016–2021

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### Abstract

**Objectives**—This report presents trends in primary and repeat cesarean delivery from 2016 to 2021 and recent changes in these rates by maternal age, race and Hispanic origin, gestational age, and state of residence from 2019 to 2021.

**Methods**—Data are based on all birth certificates registered to U.S. residents in the 50 states and the District of Columbia. Data for 2021 are provisional; data for 2016–2020 are final.

**Results**—The primary cesarean delivery rate fluctuated from 2016 to 2019 (21.6% to 21.9%) and then increased by 4% from 2019 to 2021 (22.4%). In comparison, the repeat cesarean delivery rate decreased by less than 1% each year from 2016 to 2021 (87.6% to 85.9%). From 2019 to 2021, primary cesarean delivery rates increased for women under age 40, for most race and Hispanic-origin groups, and for all gestational age groups under 41 weeks. Repeat cesarean delivery rates decreased from 2019 to 2021 for women aged 25–39, for non-Hispanic White and Hispanic women, and for gestational ages 39 to 41 weeks.

**Keywords:** method of delivery • race and Hispanic origin • age of mother • gestational age • state of residence • National Vital Statistics System

### Introduction

The overall cesarean delivery rate in the United States increased 60% from 1996 to 2009, from 20.7% to 32.9% (1). From 2009 to 2019, the cesarean delivery rate generally declined, reaching 31.7%

in 2019 (2) before increasing in 2020 (31.8%) and 2021 (32.1%) (3).

Cesarean delivery is abdominal surgery with short- and long-term risks and consequences, such as surgical complications, admission of the infant to neonatal intensive care, and higher costs, compared with vaginal delivery (4,5). The overall cesarean delivery rate is comprised of the primary cesarean delivery rate and the repeat cesarean delivery rate. Most cesarean deliveries every year (about three out of five) are primary cesareans, that is, cesarean deliveries among women who have not had a previous cesarean delivery (6). The primary cesarean delivery rate directly influences the overall cesarean delivery rate because most women with a primary cesarean delivery (more than four out of five) will go on to have another cesarean delivery for subsequent births (repeat cesarean) (6). Therefore, it is important to examine trends and characteristics of primary and repeat cesarean deliveries separately.

This report presents trends in primary and repeat cesarean delivery from 2016 (the first year for which national data are available) and recent changes (2019–2021) in these rates by maternal age, race and Hispanic origin, gestational age, and state of residence.

### Methods

The birth certificate data shown in this report were collected through the National Vital Statistics System. Data for 2016–2020 are final and based on 100% of the birth certificates registered in all states and the District of Columbia (D.C.) in each year.

Data for 2021 are provisional and based on 99.94% of all birth records received and processed by the National Center for Health Statistics as of February 10, 2022 (3). Detailed information on reporting completeness and criteria may be found elsewhere (2,6,7).

Comparable national data on primary and repeat cesarean delivery have been available since 2016 with the completion of the staggered implementation of the 2003 revision of the U.S. Standard Certificate of Live Birth (7). Primary and repeat cesarean delivery data are derived from information on vaginal and cesarean deliveries from the “method of delivery” item on the birth certificate and from information on whether the mother had a previous cesarean from the “risk factors in this pregnancy” item. The primary cesarean delivery rate is the number of women having a first cesarean delivery divided by all women giving birth who have never had a cesarean delivery (the sum of primary cesareans and vaginal births without a previous cesarean). The repeat cesarean rate is the number of women who have a repeat cesarean delivery divided by all women giving birth who have had a previous cesarean delivery (the sum of repeat cesareans and women having a vaginal birth after previous cesarean) (7).

Hispanic origin and race are reported separately on the birth certificate. Data shown by Hispanic origin include all people of Hispanic origin of any race. Data for non-Hispanic people are shown separately for each single-race group. Data by race are based on the revised standards issued by the Office of Management and Budget in 1997 (8). The race and Hispanic-origin groups

shown are non-Hispanic, single-race White; non-Hispanic, single-race Black; non-Hispanic, single-race American Indian or Alaska Native (AIAN); non-Hispanic, single-race Asian; non-Hispanic, single-race Native Hawaiian or Other Pacific Islander (NHOPI); and Hispanic. For brevity, text references to race omit the term “single-race.”

Gestational age is reported in completed weeks and is based on the obstetric estimate of gestation.

All changes presented in this report are statistically significant at the 0.05 level based on a two-tailed  $z$  test, unless noted otherwise. Trends for consecutive years were assessed using the Cochran-Armitage test, a modified chi-squared test, at the 0.05 level.

## Results

### Trends in primary and repeat cesarean delivery rates

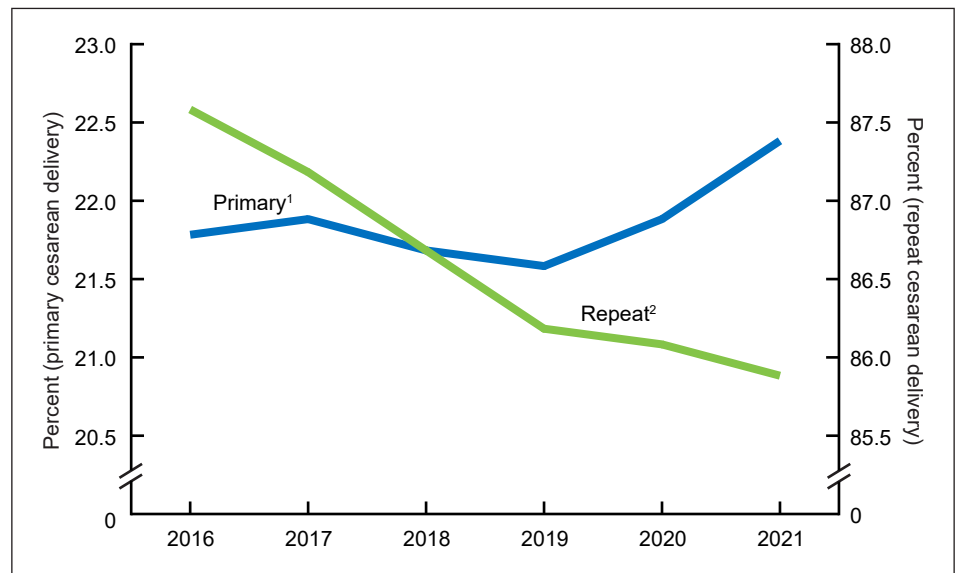
The primary cesarean delivery rate fluctuated from 2016 to 2019. After increasing to 21.9% in 2017 (from 21.8% in 2016), the rate decreased in 2018 (21.7%) and 2019 (21.6%). The rate then increased 1% in 2020 (back up to 21.9%) and 2% in 2021 (22.4%) (Figure 1 and Table 1).

In comparison, the repeat cesarean delivery rate declined each year from 2016 to 2021. For 2016–2019 the rate declined an average of 0.6% per year, from 87.6% to 86.2%, then declined an average of 0.2% for 2020–2021 to 85.9%.

### Changes in primary and repeat cesarean delivery rates by maternal age

Between 2019 and 2021, primary cesarean delivery rates increased for all maternal age groups (the change for women aged 40 and over was not significant) (Figure 2 and Table 2). Primary cesarean delivery rates increased 4% for women in their 20s (from 19.2% to 20.0% for women aged

Figure 1. Primary and repeat cesarean delivery: United States, 2016–2020 final and 2021 provisional



<sup>1</sup>Significant quadratic trend for 2016–2021; significant increasing trend for 2019–2021 at  $p < 0.05$ .

<sup>2</sup>Significant decreasing trend at  $p < 0.05$ .

NOTES: All rates are significantly different from the previous year at  $p < 0.05$ . Primary is cesarean delivery to women without a previous cesarean. Repeat is cesarean delivery to women with a previous cesarean delivery.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality.

20–24 and from 20.2% to 21.0% for women aged 25–29). Among women in their 30s, primary cesarean delivery rates increased 2% for women aged 30–34 (22.2% to 22.7%) and 1% (25.9% to 26.2%) for women aged 35–39.

Repeat cesarean delivery rates decreased less than 1% for all maternal age groups between 2019 and 2021 (changes were not significant for women under age 25 and aged 40 and over) (Figure 2 and Table 2). Rates decreased from 85.5% to 84.9% for women aged 25–29, from 85.7% to 85.5% for women aged 30–34, and from 87.3% to 86.7% for women aged 35–39.

### Changes in primary and repeat cesarean delivery rates by race and Hispanic origin

Primary cesarean delivery rates increased for all race and Hispanic-origin groups between 2019 and 2021; the change was not significant for non-Hispanic AIAN women (Figure 2 and Table 2). Increases ranged from 3% for non-Hispanic Asian (from 23.3% to 23.9%) and non-Hispanic White (21.3% to 21.9%) women to 14% for non-Hispanic NHOPI women (19.8% to 22.6%).

Repeat cesarean delivery rates decreased less than 1% for non-Hispanic White (86.1% to 85.6%) and Hispanic (86.9% to 86.5%) women. Changes for other groups were not significant (Figure 2 and Table 2).

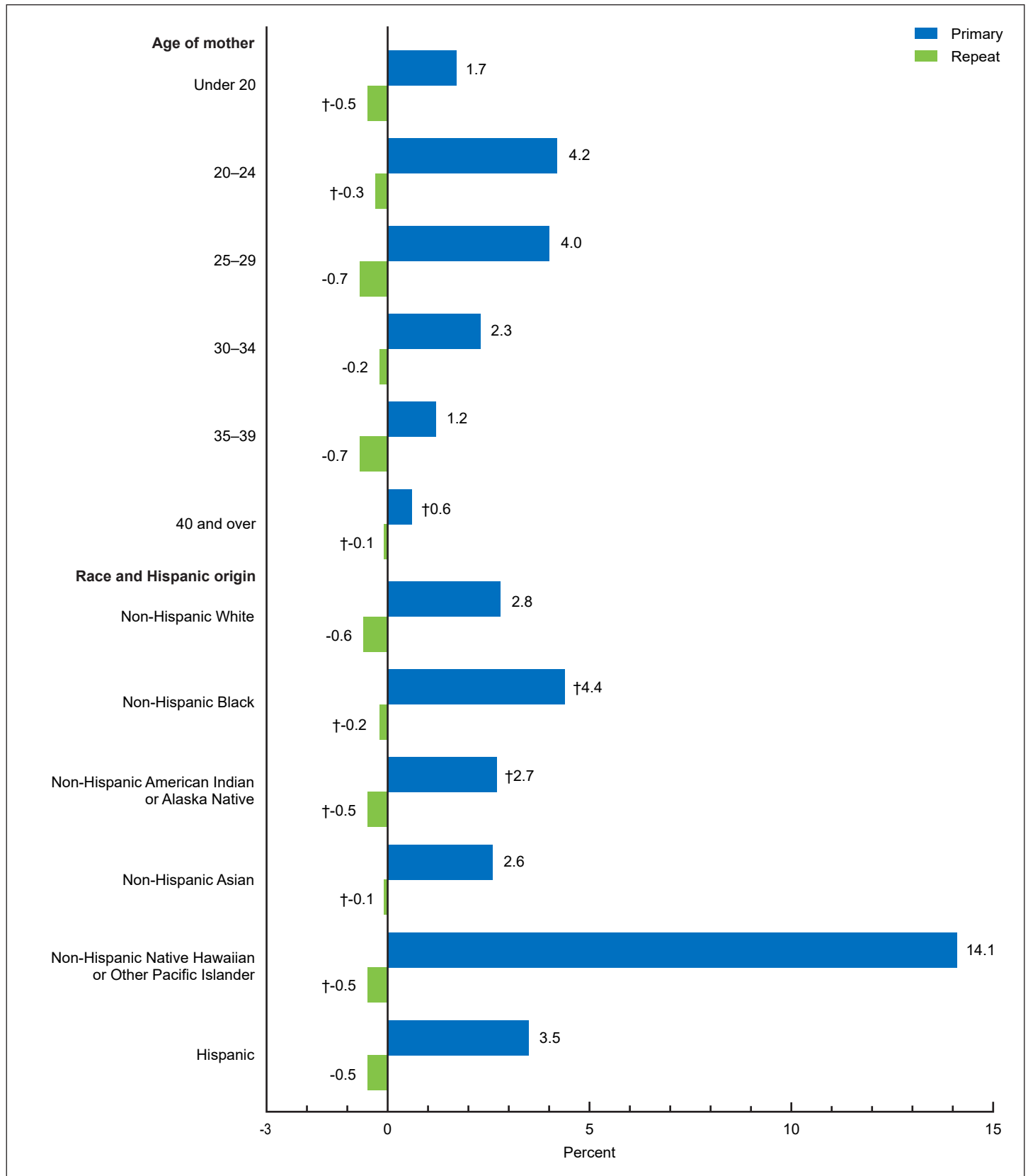
### Changes in primary and repeat cesarean delivery by gestational age

Between 2019 and 2021, primary cesarean delivery rates increased for all gestational age groups under 41 weeks (Figure 3 and Table 2). Primary cesarean delivery rates increased 3%–5% for births at all gestational ages 40 weeks and under. For births at 41 weeks, primary cesarean delivery decreased 1%, from 21.9% to 21.6%. The increase in primary cesarean delivery at 42 or more weeks (23.4% to 24.4%) was not significant.

The repeat cesarean delivery rate increased 2% for births at less than 34 weeks (from 86.2% to 87.5%) (Figure 3 and Table 2). Repeat cesareans declined 1% among births at 39–40 weeks (86.7% to 85.8%) and 4% for births at 41 weeks (52.0% to 50.2%).

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Figure 2. Percent change in primary and repeat cesarean delivery, by age of mother and race and Hispanic origin: United States, 2019 final and 2021 provisional

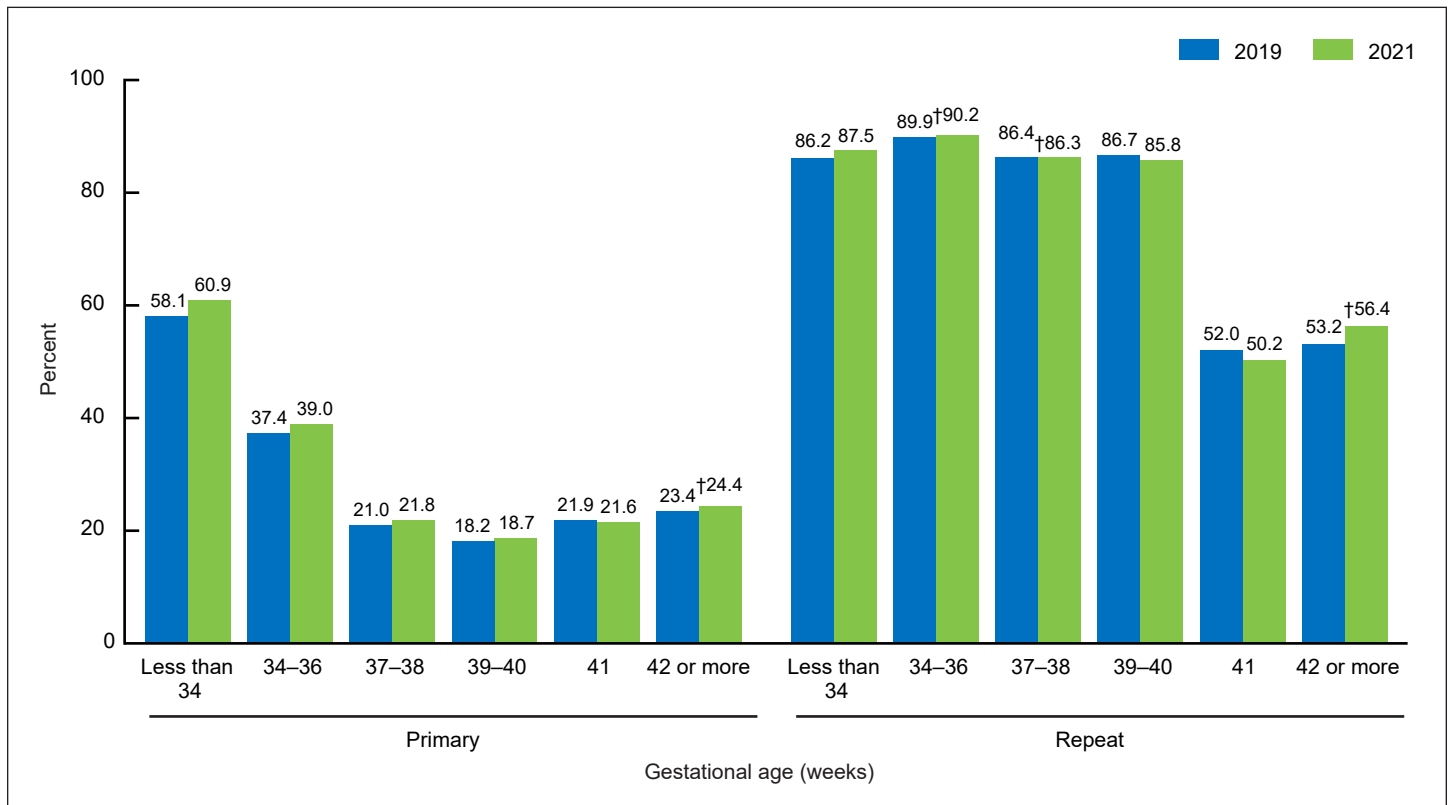


† No significant change at  $p < 0.05$ .

NOTES: Primary is cesarean delivery to women without a previous cesarean. Repeat is cesarean delivery to women with a previous cesarean delivery.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality.

Figure 3. Primary and repeat cesarean delivery, by gestational age: United States, 2019 final and 2021 provisional



† No significant change at  $p < 0.05$ .

NOTES: Primary is cesarean delivery to women without a previous cesarean. Repeat is cesarean delivery to women with a previous cesarean delivery. Gestational age is expressed in completed weeks based on the obstetric estimate of gestation.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality.

Changes for births at 34–36 weeks, 37–38 weeks, and 42 or more weeks were not significant.

## Changes in primary and repeat cesarean delivery by state of residence

Primary cesarean delivery rates increased in 31 states and D.C. from 2019 to 2021 (Figure 4 and Table 3). Increases ranged from 1% in Pennsylvania to 17% in Alaska. Primary cesarean delivery rates declined in two states (Kansas and New Jersey) between 2019 and 2021.

Repeat cesarean delivery rates declined by 2% or less in seven states (Alabama, California, Florida, Georgia, Kentucky, New Jersey, and West Virginia) (Figure 4 and Table 3). Repeat cesarean delivery rates increased by 1%–2% in two states (Connecticut and Washington). Changes for other states were not significant.

## Summary

Between 2016 and 2019, the primary cesarean delivery rate generally declined before increasing 1% in 2020 and 2% in 2021, reaching the highest rate (22.4%) reported since comparable national data have been available (2016). In contrast, the repeat cesarean delivery rate decreased every year during this period, resulting in a 2% total decline. From 2019 to 2021, primary cesarean delivery rates increased for all age groups (not significant for women aged 40 and over), for all race and Hispanic-origin groups (not significant for non-Hispanic AIAN women), and all gestational age groups under 41 weeks. In contrast, repeat cesarean delivery rates trended downward for women aged 25–39, non-Hispanic White and Hispanic women, and for full- and late-term births (39–41 weeks).

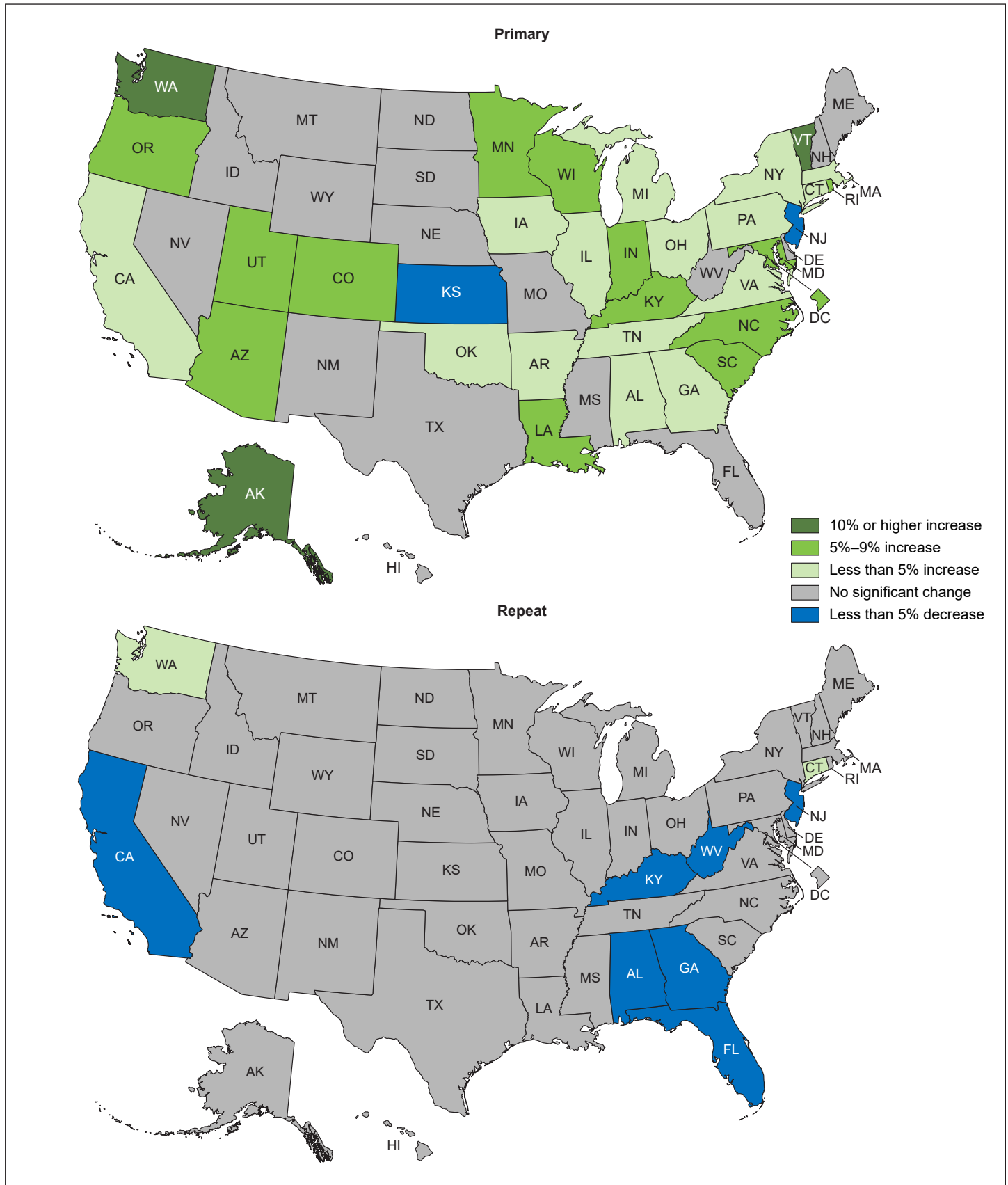
The overall cesarean delivery rate, which is influenced by both the primary and repeat cesarean delivery rates,

increased in both 2020 and 2021. This increase was driven by the increase in primary cesarean delivery and would have been greater if not for the continued decline in repeat cesarean deliveries during this period. Because most women with a primary cesarean delivery (86.1% in 2020) will go on to have a repeat cesarean delivery for future births, the overall cesarean delivery rate is likely to continue to increase (2).

Ongoing evaluation will monitor future trends in primary and repeat cesarean deliveries. For ongoing surveillance of related measures such as the overall and low-risk cesarean delivery rates and the rate of vaginal birth after previous cesarean delivery provided by the National Center for Health Statistics, see the Natality Quarterly Provisional Estimates (available from <https://www.cdc.gov/nchs/nvss/vsrr/nativity-dashboard.htm>) (9).

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Figure 4. Percent change in primary and repeat cesarean delivery, by state of residence: United States, 2019 final and 2021 preliminary



NOTES: Primary is cesarean delivery to women without a previous cesarean. Repeat is cesarean delivery to women with a previous cesarean delivery.  
SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality.

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Table 1. Primary and repeat cesarean delivery rates: United States, 2016–2020 final and 2021 provisional

Year	Primary <sup>1</sup>			Repeat <sup>2</sup>		
	Number	Percent	Percent change from previous year	Number	Percent	Percent change from previous year
2021 <sup>3</sup>	690,537	22.4	2.3	481,470	85.9	-0.2
2020	666,599	21.9	1.4	481,392	86.1	-0.1
2019	683,900	21.6	-0.5	502,005	86.2	-0.6
2018	693,276	21.7	-0.9	514,399	86.7	-0.6
2017	710,963	21.9	0.5	520,702	87.2	-0.5
2016	728,500	21.8	...	529,388	87.6	...

... Category not applicable.

<sup>1</sup>Primary cesarean rate is the number of births to women having a cesarean delivery per 100 births to women without a previous cesarean.

<sup>2</sup>Repeat cesarean rate is the number of births to women having a cesarean delivery per 100 births to women with a previous cesarean.

<sup>3</sup>Provisional 2021 data; based on 99.94% of births.

NOTE: All changes from the previous year are significant at  $p < 0.05$ .

SOURCE: National Vital Statistics System, National Center for Health Statistics, Natality.



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Table 2. Primary and repeat cesarean delivery rates and percent change, by age, race and Hispanic origin, and gestational age: United States, 2019 final and 2021 provisional

Characteristic	Primary cesarean <sup>1</sup>			Repeat cesarean <sup>2</sup>		
	Percent		Percent change	Percent		Percent change
	2019	2021 <sup>3</sup>		2019	2021 <sup>3</sup>	
Total . . . . .	21.6	22.4	3.7	86.2	85.9	-0.3
Age of mother (years)						
Under 20 . . . . .	17.8	18.1	1.7	85.6	85.2	†-0.5
20–24 . . . . .	19.2	20.0	4.2	86.2	85.9	†-0.3
25–29 . . . . .	20.2	21.0	4.0	85.5	84.9	-0.7
30–34 . . . . .	22.2	22.7	2.3	85.7	85.5	-0.2
35–39 . . . . .	25.9	26.2	1.2	87.3	86.7	-0.7
40 and over . . . . .	33.5	33.7	†0.6	88.6	88.5	†-0.1
Race and Hispanic origin <sup>4</sup>						
Non-Hispanic, single race:						
White . . . . .	21.3	21.9	2.8	86.1	85.6	-0.6
Black . . . . .	25.1	26.2	4.4	86.4	86.2	†-0.2
American Indian or						
Alaska Native . . . . .	18.3	18.8	†2.7	86.2	85.8	†-0.5
Asian . . . . .	23.3	23.9	2.6	85.2	85.1	†-0.1
Native Hawaiian or						
Other Pacific Islander . . . . .	19.8	22.6	14.1	79.2	78.8	†-0.5
Hispanic <sup>5</sup> . . . . .	20.1	20.8	3.5	86.9	86.5	-0.5
Gestational age (weeks) <sup>6</sup>						
Less than 34 . . . . .	58.1	60.9	4.8	86.2	87.5	1.5
34–36 . . . . .	37.4	39.0	4.3	89.9	90.2	†0.3
37–38 . . . . .	21.0	21.8	3.8	86.4	86.3	†-0.1
39–40 . . . . .	18.2	18.7	2.7	86.7	85.8	-1.0
41 . . . . .	21.9	21.6	-1.4	52.0	50.2	-3.5
42 or more . . . . .	23.4	24.4	†4.3	53.2	56.4	†6.0

†Not significant at  $p < 0.05$ .

<sup>1</sup>Primary cesarean rate is the number of births to women having a cesarean delivery per 100 births to women without a previous cesarean.

<sup>2</sup>Repeat cesarean rate is the number of births to women having a cesarean delivery per 100 births to women with a previous cesarean.

<sup>3</sup>Provisional 2021 data; based on 99.94% of births.

<sup>4</sup>Race and Hispanic origin are reported separately on birth certificates; people of Hispanic origin may be of any race. In this table, non-Hispanic women are classified by race. Race categories are consistent with the 1997 Office of Management and Budget standards. Single race is defined as only one race on the birth certificate.

<sup>5</sup>Includes all people of Hispanic origin of any race.

<sup>6</sup>Expressed in completed weeks based on the obstetric estimate.

SOURCE: National Vital Statistics System, National Center for Health Statistics, Natality.

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Table 3. Primary and repeat cesarean delivery rates and percent change, by state of residence: United States, 2019 final and 2021 provisional

Reporting area	Primary cesarean <sup>1</sup>			Repeat cesarean <sup>2</sup>		
	Percent		Percent change	Percent		Percent change
	2019	2021 <sup>3</sup>		2019	2021 <sup>3</sup>	
Alabama	25.2	25.8	2.4	90.3	89.0	-1.4
Alaska	14.9	17.4	16.8	73.8	77.0	†4.3
Arizona	18.4	19.7	7.1	82.8	82.6	†-0.2
Arkansas	22.9	23.9	4.4	90.6	90.9	†0.3
California	19.5	20.3	4.1	88.5	87.2	-1.5
Colorado	19.3	20.3	5.2	79.4	78.7	†-0.9
Connecticut	24.6	25.5	3.7	84.4	85.7	1.5
Delaware	22.3	23.1	†3.6	86.7	87.2	†0.6
District of Columbia	23.4	24.9	6.4	77.8	76.2	†-2.1
Florida	26.3	26.2	†-0.4	89.7	89.1	-0.7
Georgia	25.3	26.2	3.6	91.4	90.6	-0.9
Hawaii	19.1	19.9	†4.2	82.9	83.7	†1.0
Idaho	15.8	16.3	†3.2	78.9	80.4	†1.9
Illinois	20.7	21.4	3.4	83.8	83.9	†0.1
Indiana	20.1	21.7	8.0	85.5	85.2	†-0.4
Iowa	20.1	20.7	3.0	83.7	83.2	†-0.6
Kansas	20.2	19.6	-3.0	84.0	83.4	†-0.7
Kentucky	22.4	23.7	5.8	89.8	88.8	-1.1
Louisiana	24.7	25.9	4.9	90.3	90.1	†-0.2
Maine	21.5	22.1	†2.8	85.5	83.8	†-2.0
Maryland	23.1	24.4	5.6	83.2	83.8	†0.7
Massachusetts	21.9	22.4	2.3	84.3	83.9	†-0.5
Michigan	22.8	23.8	4.4	85.7	85.8	†0.1
Minnesota	19.1	20.3	6.3	78.2	78.3	†0.1
Mississippi	24.9	25.5	†2.4	93.5	92.9	†-0.6
Missouri	21.1	21.4	†1.4	83.3	82.7	†-0.7
Montana	19.0	19.4	†2.1	85.1	83.0	†-2.5
Nebraska	18.8	18.9	†0.5	82.9	81.6	†-1.6
Nevada	24.0	24.1	†0.4	86.0	85.6	†-0.5
New Hampshire	23.0	23.9	†3.9	84.5	84.7	†0.2
New Jersey	22.4	21.6	-3.6	86.2	84.9	-1.5
New Mexico	18.8	19.5	†3.7	80.7	81.4	†0.9
New York	22.4	23.4	4.5	86.3	86.0	†-0.3
North Carolina	19.9	21.3	7.0	82.6	83.3	†0.8
North Dakota	17.1	16.4	†-4.1	81.6	81.4	†-0.2
Ohio	20.6	21.2	2.9	84.7	84.3	†-0.5
Oklahoma	21.0	21.7	3.3	90.4	89.9	†-0.6
Oregon	19.9	21.5	8.0	80.9	80.8	†-0.1
Pennsylvania	21.2	21.5	1.4	82.2	82.0	†-0.2
Rhode Island	22.5	24.3	8.0	83.6	84.0	†0.5
South Carolina	22.7	24.0	5.7	87.3	87.3	†0.0
South Dakota	15.7	16.5	†5.1	79.5	77.7	†-2.3
Tennessee	21.8	22.7	4.1	86.5	86.5	†0.0
Texas	24.2	24.2	†0.0	90.8	90.7	†-0.1
Utah	14.7	15.5	5.4	75.7	74.5	†-1.6
Vermont	18.0	19.8	10.0	76.2	76.9	†0.9
Virginia	20.9	21.7	3.8	85.3	85.1	†-0.2
Washington	19.3	21.2	9.8	80.0	81.1	1.4
West Virginia	23.6	23.9	†1.3	91.5	89.3	-2.4
Wisconsin	17.7	18.6	5.1	79.7	79.4	†-0.4
Wyoming	17.7	18.4	†4.0	83.5	84.5	†1.2

†Not significant at  $p < 0.05$ .

<sup>1</sup>Primary cesarean rate is the number of births to women having a cesarean delivery per 100 births to women without a previous cesarean.

<sup>2</sup>Repeat cesarean rate is the number of births to women having a cesarean delivery per 100 births to women with a previous cesarean.

<sup>3</sup>Provisional 2021 data; based on 99.94% of births.

SOURCE: National Vital Statistics System, National Center for Health Statistics, Natality.

## Acknowledgments

This report was prepared in the Division of Vital Statistics (DVS) under the general direction of Steven Schwartz, Director; Isabelle Horon, Chief, Reproductive Statistics Branch (RSB); and Joyce Martin, Team Leader, RSB Birth Team. Rajesh Virkar, Chief, Information Technology Branch (ITB), and Steve J. Steimel, Annie S. Liu, Jasmine N. Mickens, and Legesse Alemu of ITB provided computer programming support and statistical tables. Steve J. Steimel and Annie S. Liu also prepared the natality file. The Data Acquisition, Classification and Evaluation Branch staff of DVS evaluated the quality of and acceptance procedures for the state data files on which this report is based. Elizabeth C.W. Gregory of RSB provided content review.

### Suggested citation

Osterman MJK. Changes in primary and repeat cesarean delivery: United States, 2016–2021. Vital Statistics Rapid Release; no 21. Hyattsville, MD: National Center for Health Statistics. July 2022. DOI: <https://dx.doi.org/10.15620/cdc:117432>.

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