# *Patterns of Induction, Cesarean Section and Severe Maternal Morbidity in the U.S.*

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*Boston University School of Public Health*

**48th Annual High Risk Obstetrics Seminar**
October 28, 2022
Hilton Franklin Cool Springs, Franklin, TN


Collaboration in Research

# Warning!!

*This presentation is also:*

*1. Very heavy on data*

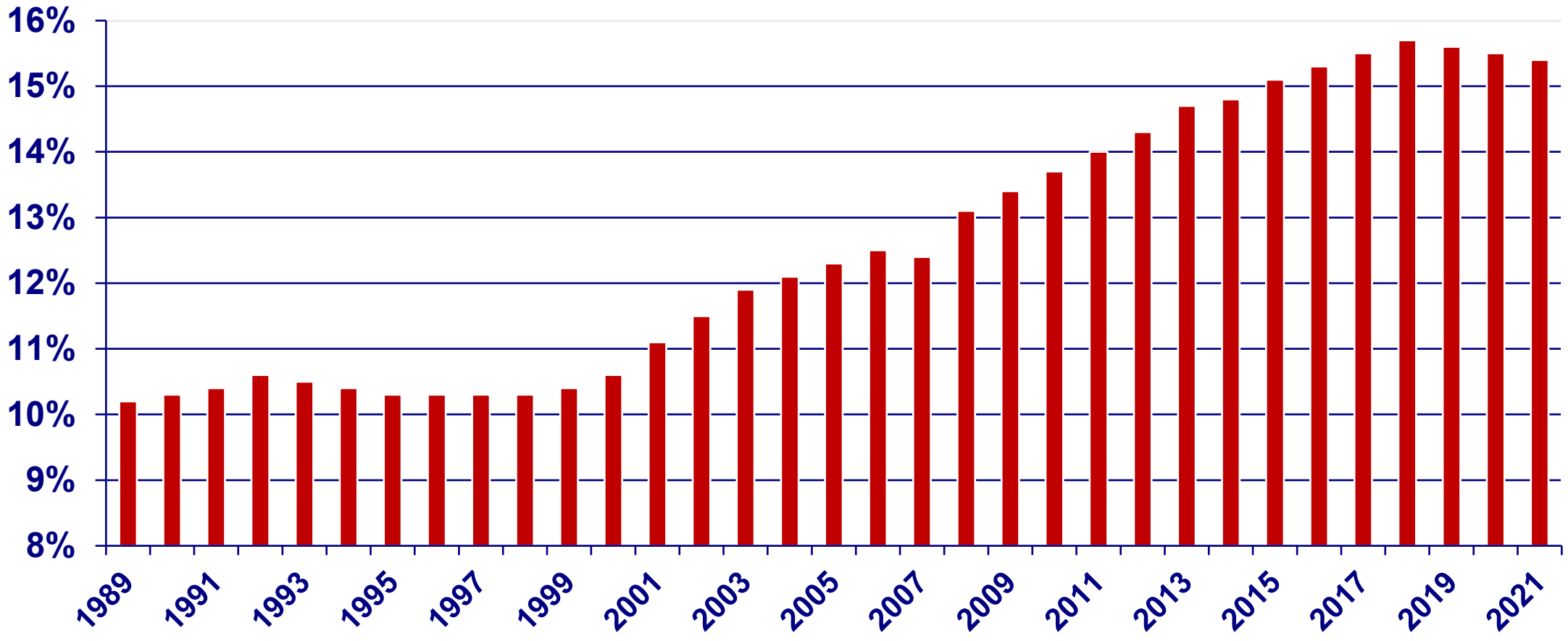
*2 Regrettably short on solutions*

*3. Speaker has a strange accent*

*4. Please don't take pictures of slides. They'll be posted*

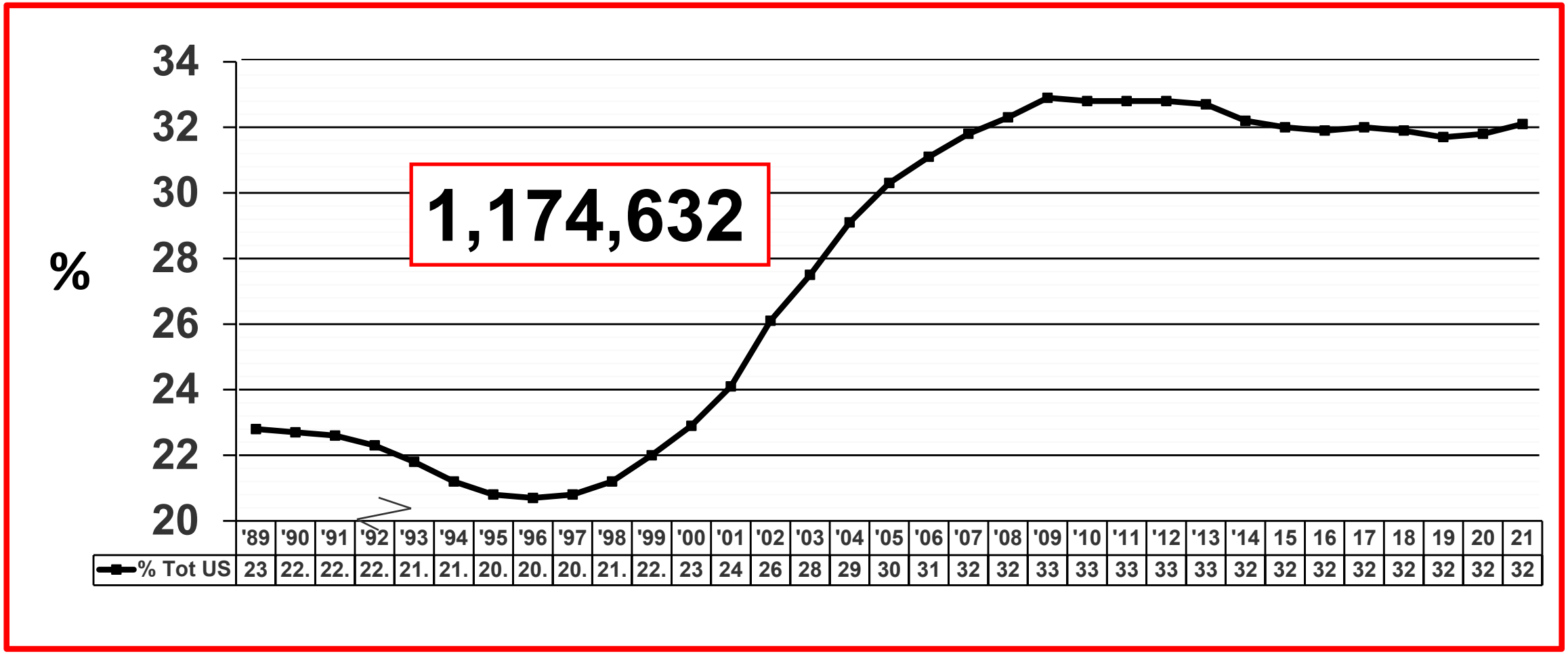
# Patterns of Cesarean Section in the U.S.

# Proportion of U.S. Women Giving Birth with a Prior Cesarean, 1989-2021




**Source: CDC Wonder**

# US Cesarean Rates, 1989-2021

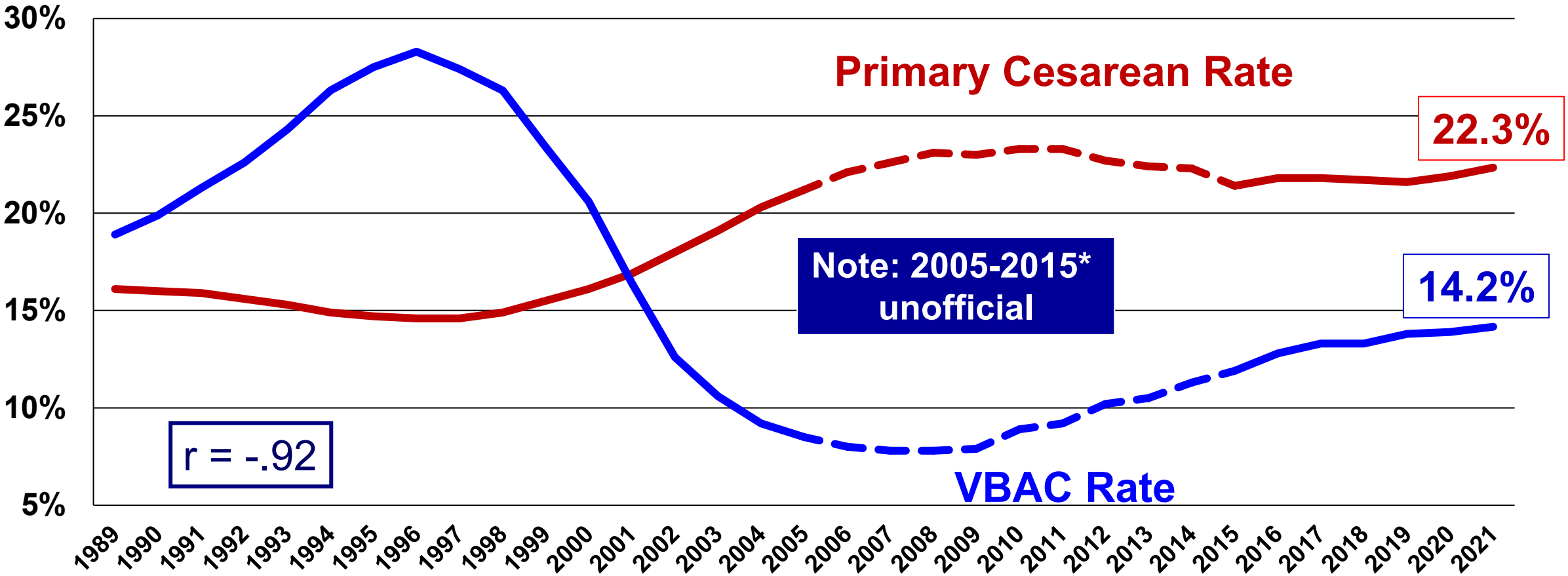



***If the 2021 cesarean rate (32.1%) was the same as in 1996 (20.7%), there would have been 417,000 fewer cesareans in the U.S. in '21.***

*Source: National Center for Health Statistics Annual Birth Reports*

*BirthByTheNumbers.org*

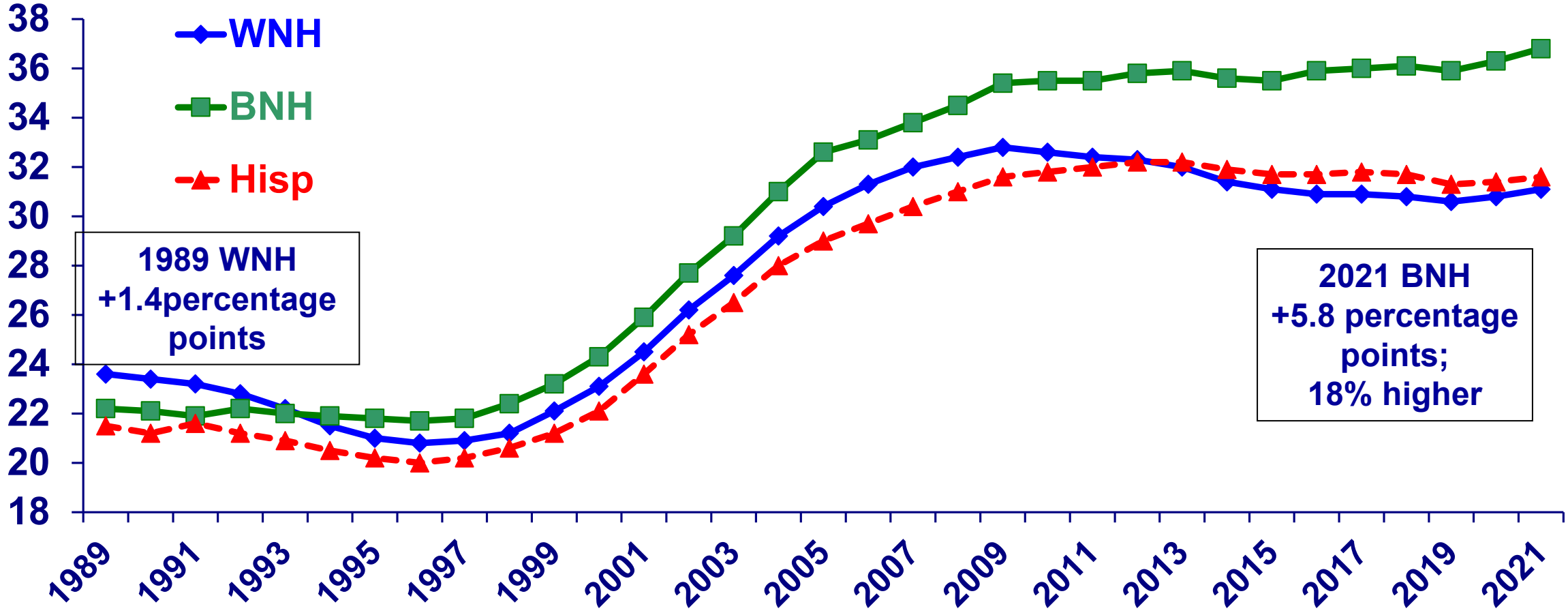
# Primary Cesarean and VBAC Rates, U.S., 1989-2021




BirthByTheNumbers.org

# The Demographics of Cesareans

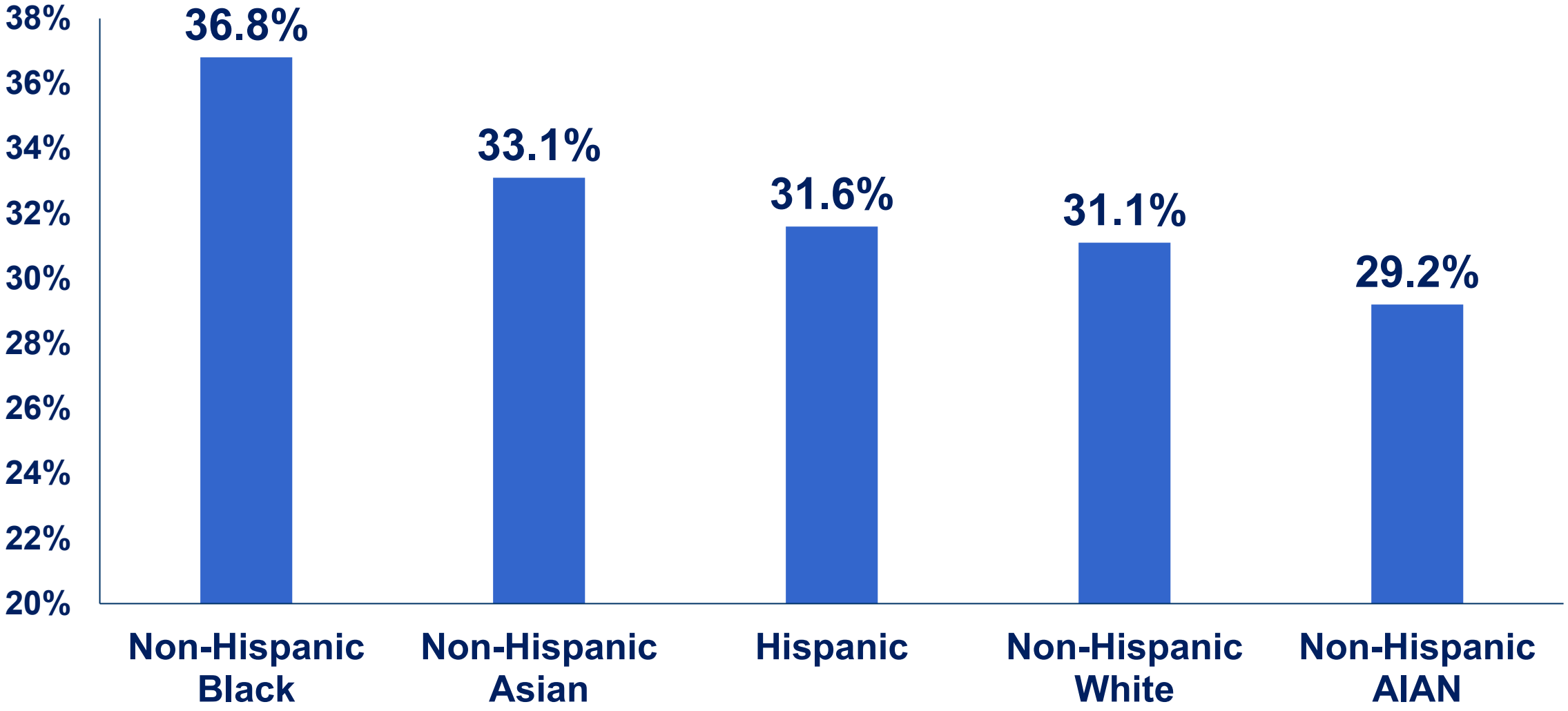
# Total cesarean rates by race/ethnicity, U.S. 1989-2021




**Source: CDC Wonder &** https://www.cdc.gov/nchs/nvss/vsrr/natality-dashboard.htm#

*www.BirthByTheNumbers.org*

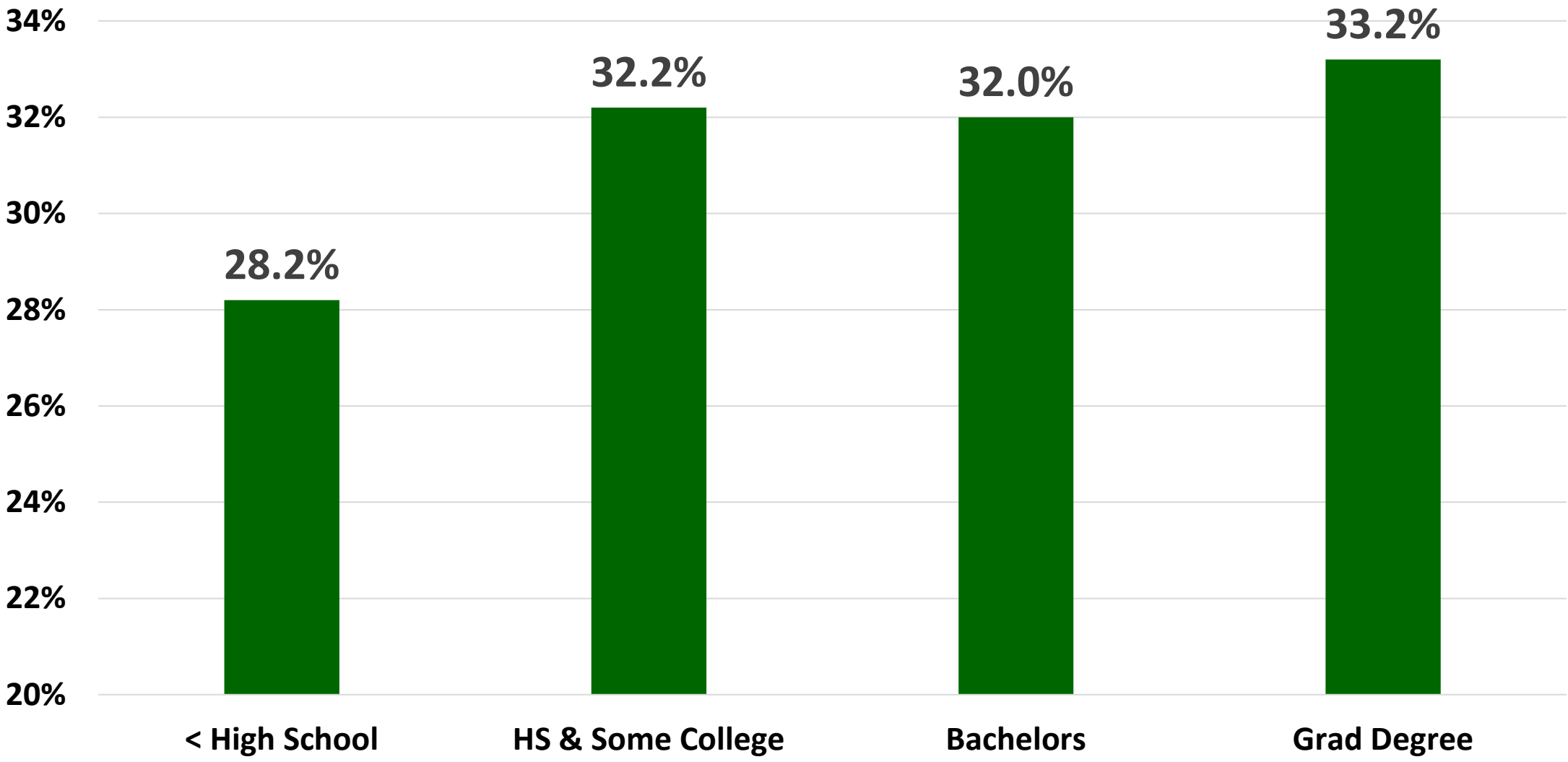
# 2021 Cesarean Rates* by Race/Ethnicity




**Source:** NCHS.

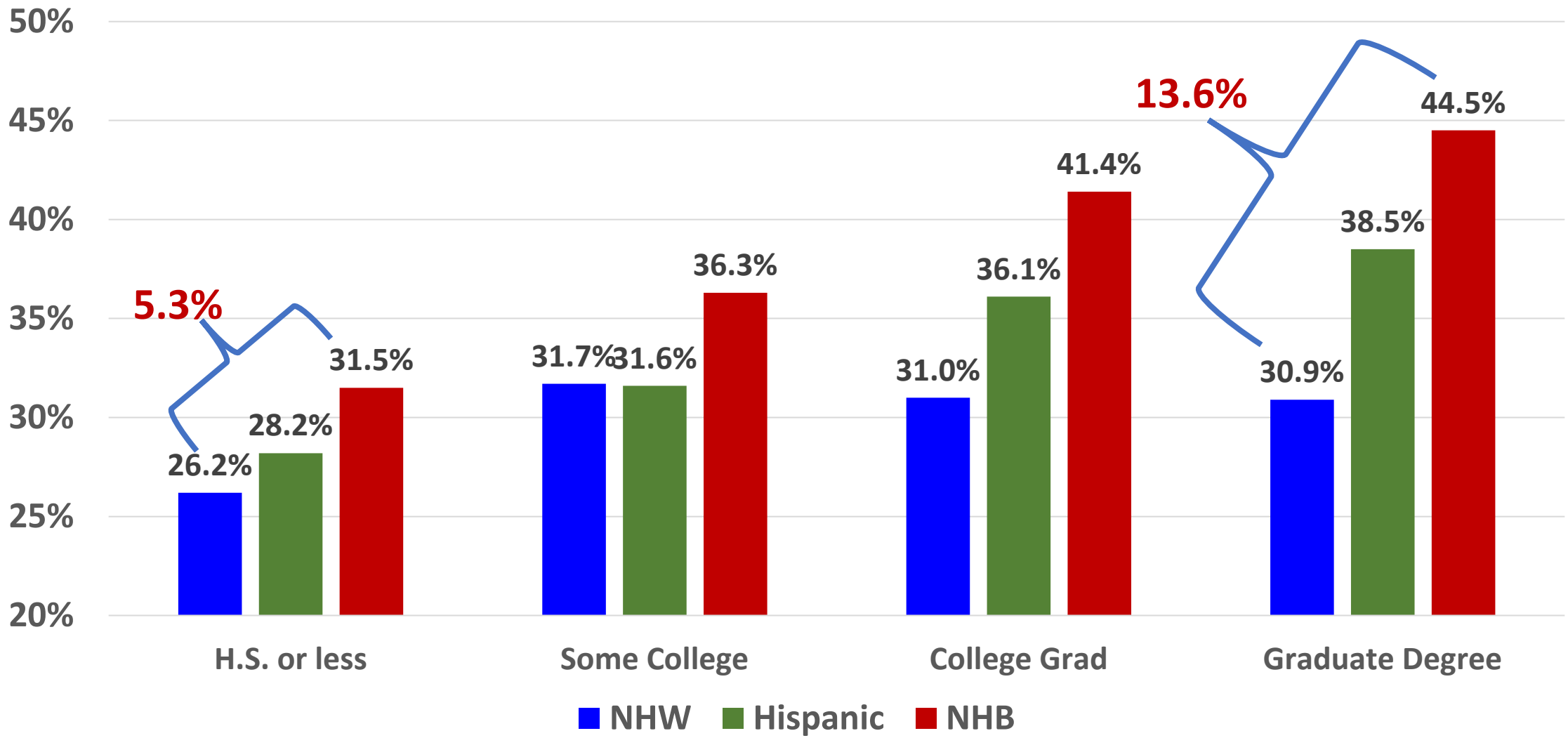
*BirthByTheNumbers.org*

# Cesarean Rate by Education Status , U.S., 2020




**Source: CDC Wonder**

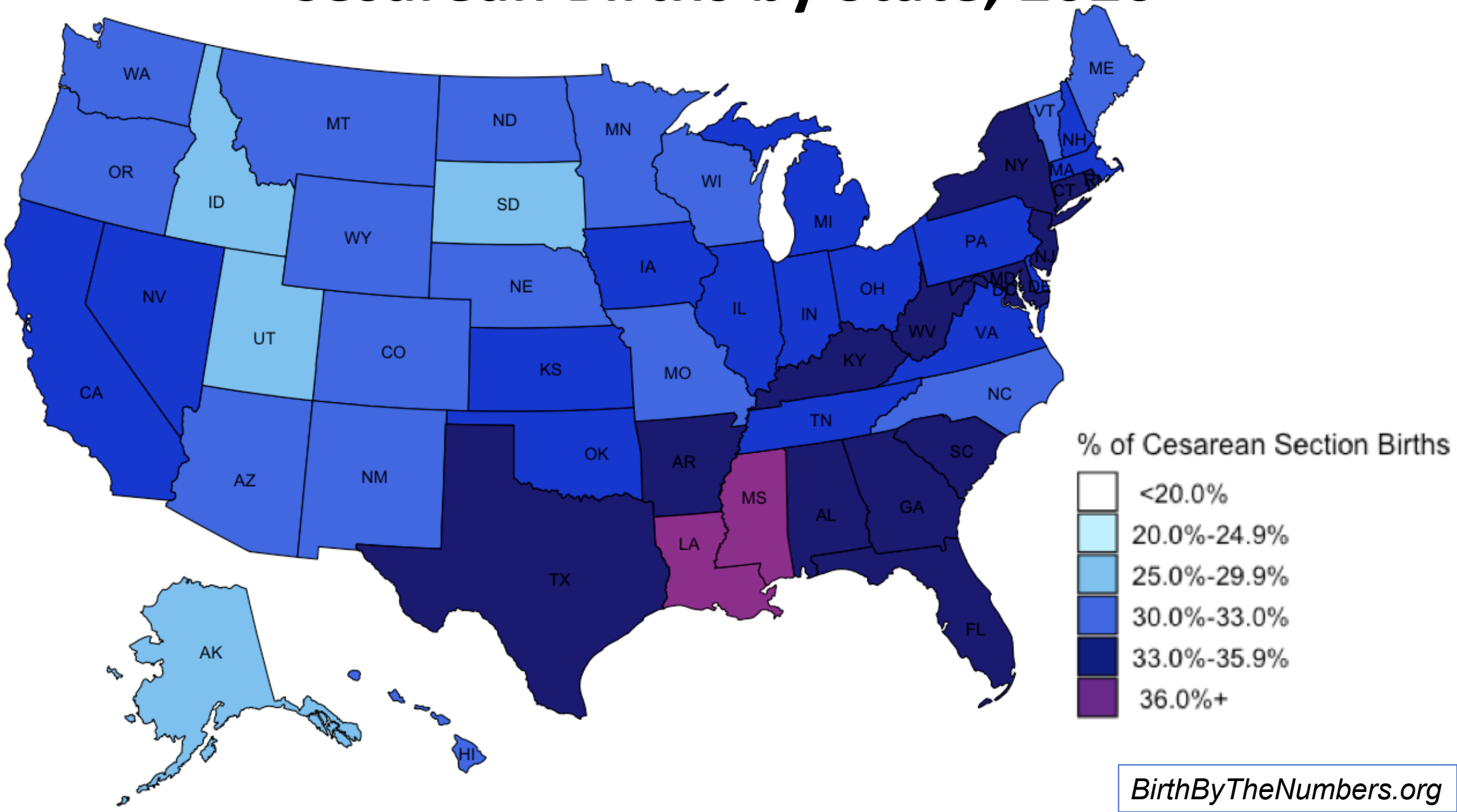
# U.S. Cesarean Rates by Education & Race/Ethnicity, 2021




**Source: CDC Wonder**

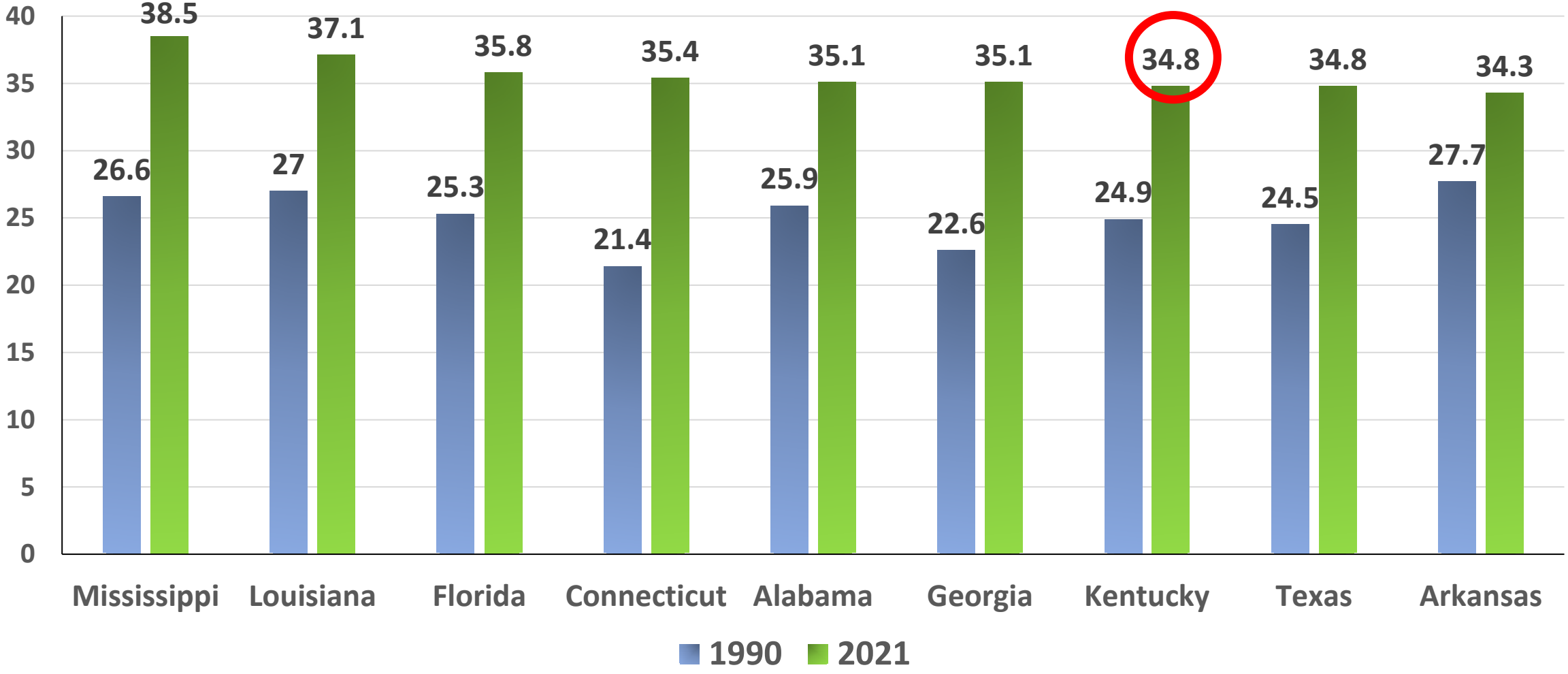
# Cesareans in the States

# Cesarean Births by State, 2020




BirthByTheNumbers.org

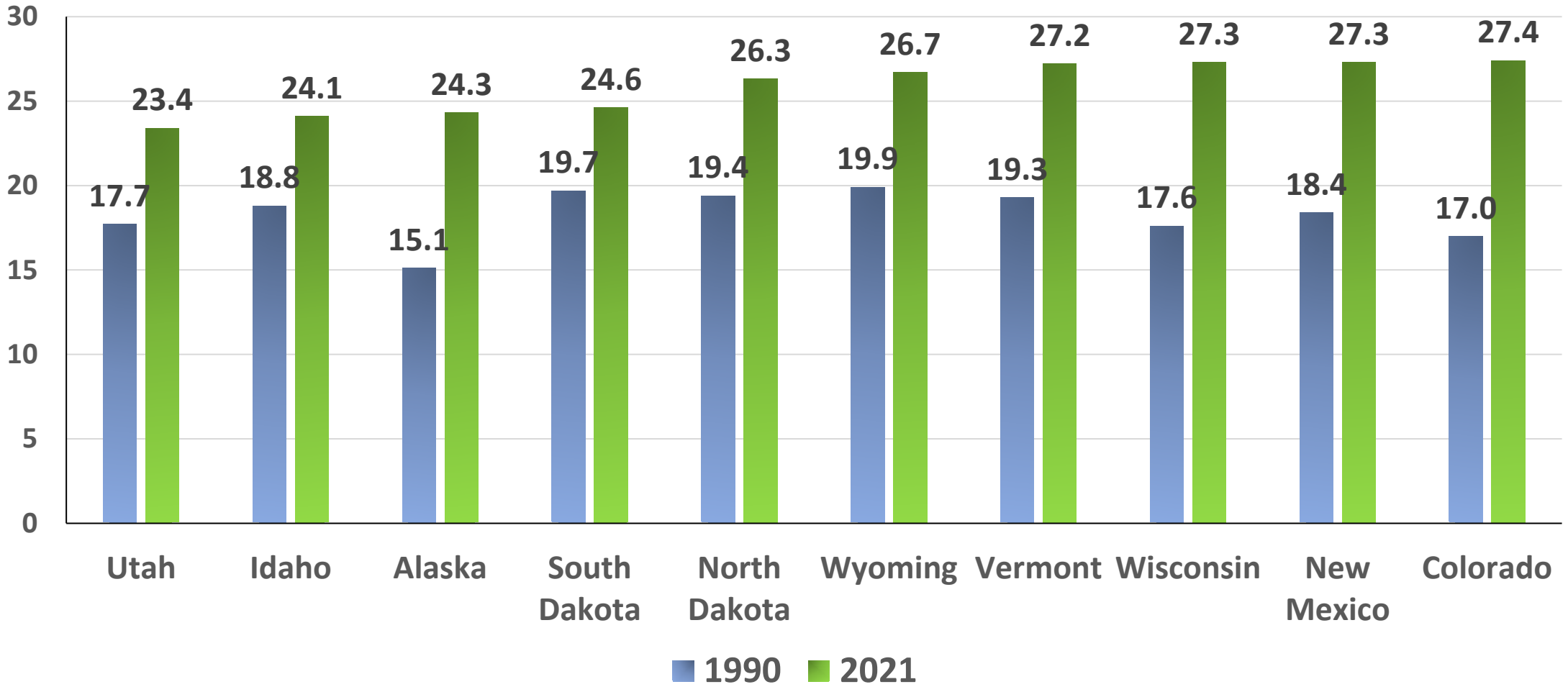
# States with the Highest 2021 Cesarean Rates (%)




**Source: CDC Wonder & NCHS Annual reports**

BirthByTheNumbers.org

# States with the Lowest 2021 Cesarean Rates (%)




**Source: CDC Wonder & NCHS Annual reports**

*BirthByTheNumbers.org*

***So what about us?***

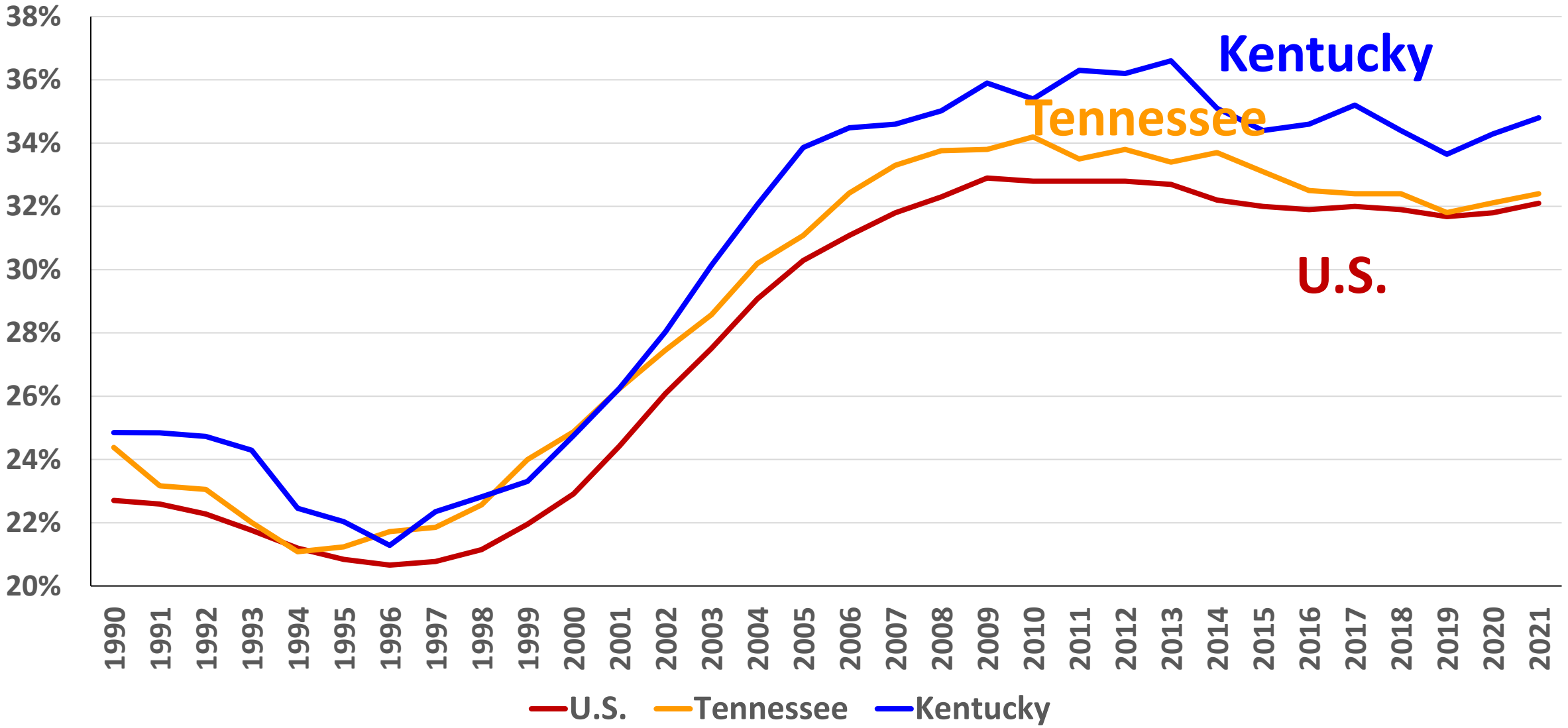
***Where does Tennessee rank?***

***So what about us?***

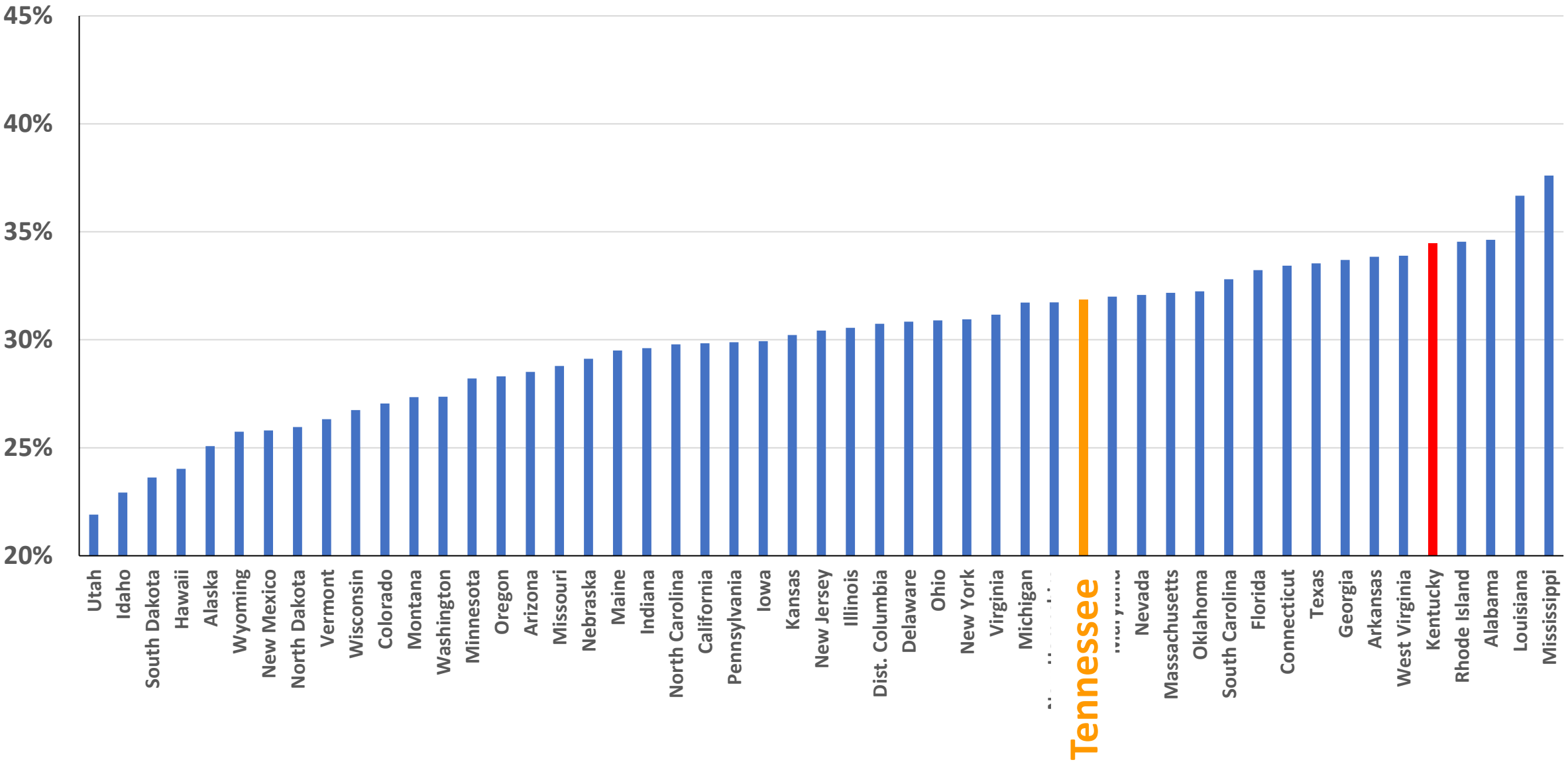
***Where does Tennessee rank?***

***$14^{th}$ highest in 1990 (24.4%)***
***$21^{st}$ highest in 2021 (32.4%)***

# Cesarean Rates, TN, KY, U.S., 1990-2021



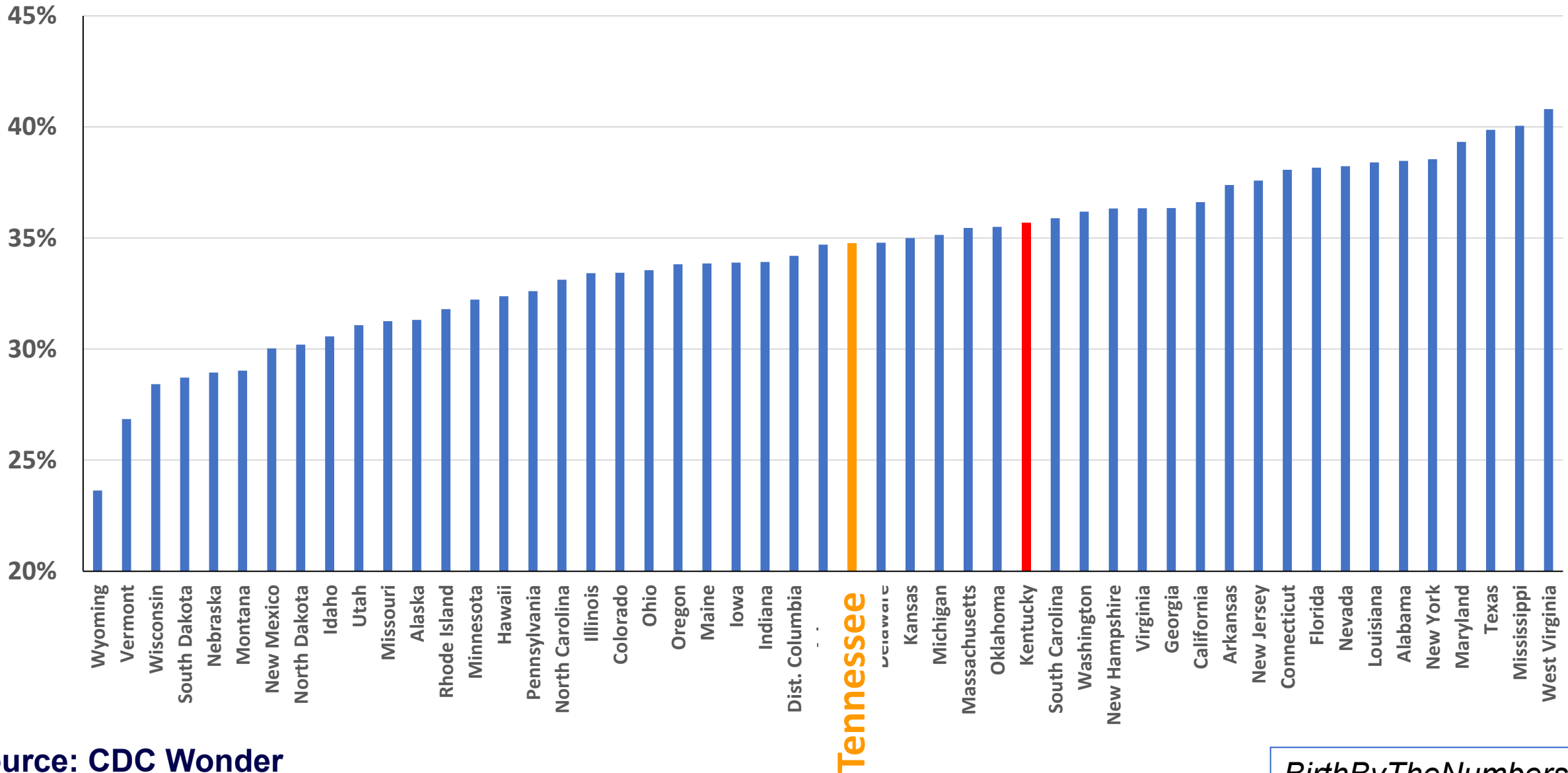
# Cesarean Rates, Non-Hispanic White Women, U.S. States, 2020




**Source: CDC Wonder**

*BirthByTheNumbers.org*

# Cesarean Rates, Non-Hispanic Black Women, U.S. States, 2020




**Source: CDC Wonder**

*BirthByTheNumbers.org*

# Risk and Protective Factors for Cesareans:

## Is it the Women's fault ?

## Spoiler alert – Pretty much NO

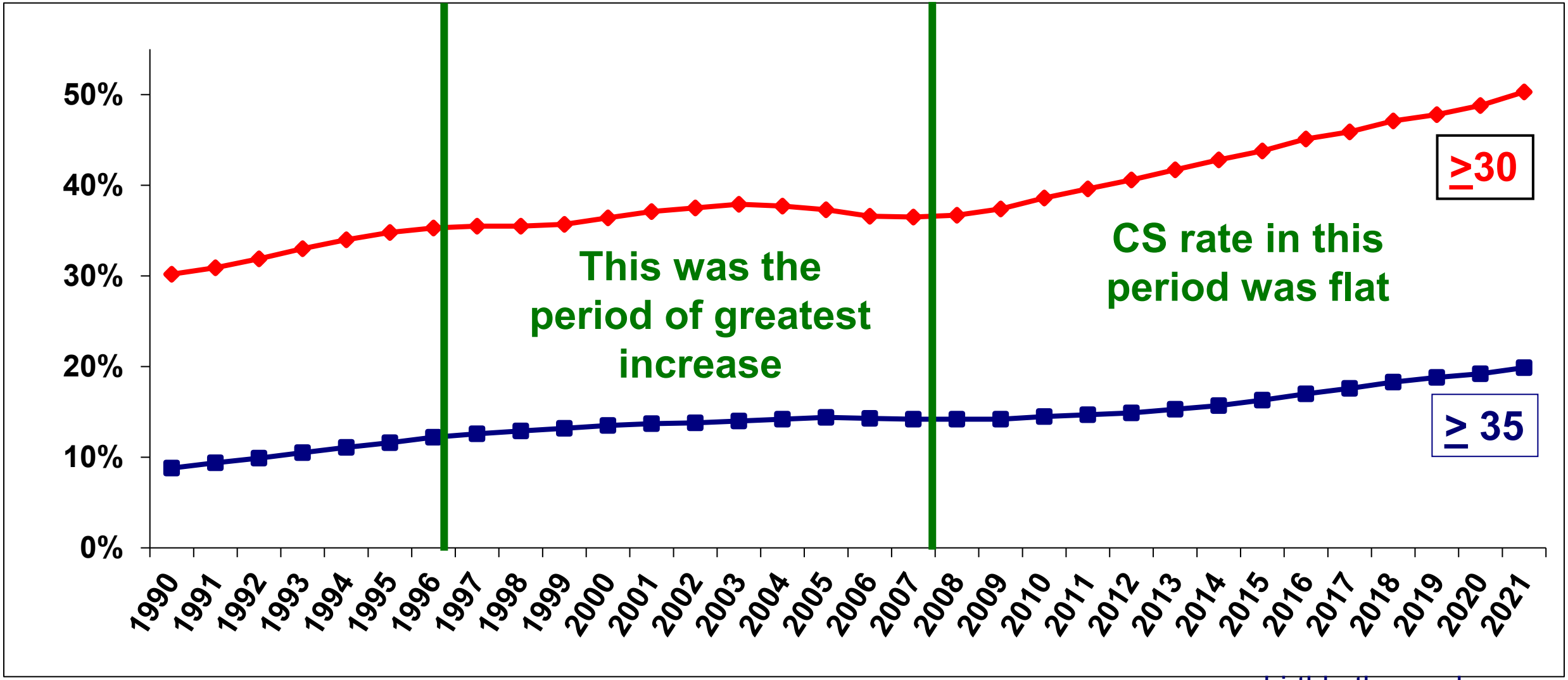
# Familiar Excuses: Too Old, Too Fat, Too Sick, Maternal Request

- *High cesarean rates are sometimes blamed on women themselves – claims that they are older, less healthy, too often obese, and asking for a cesarean – hence it's their fault.*

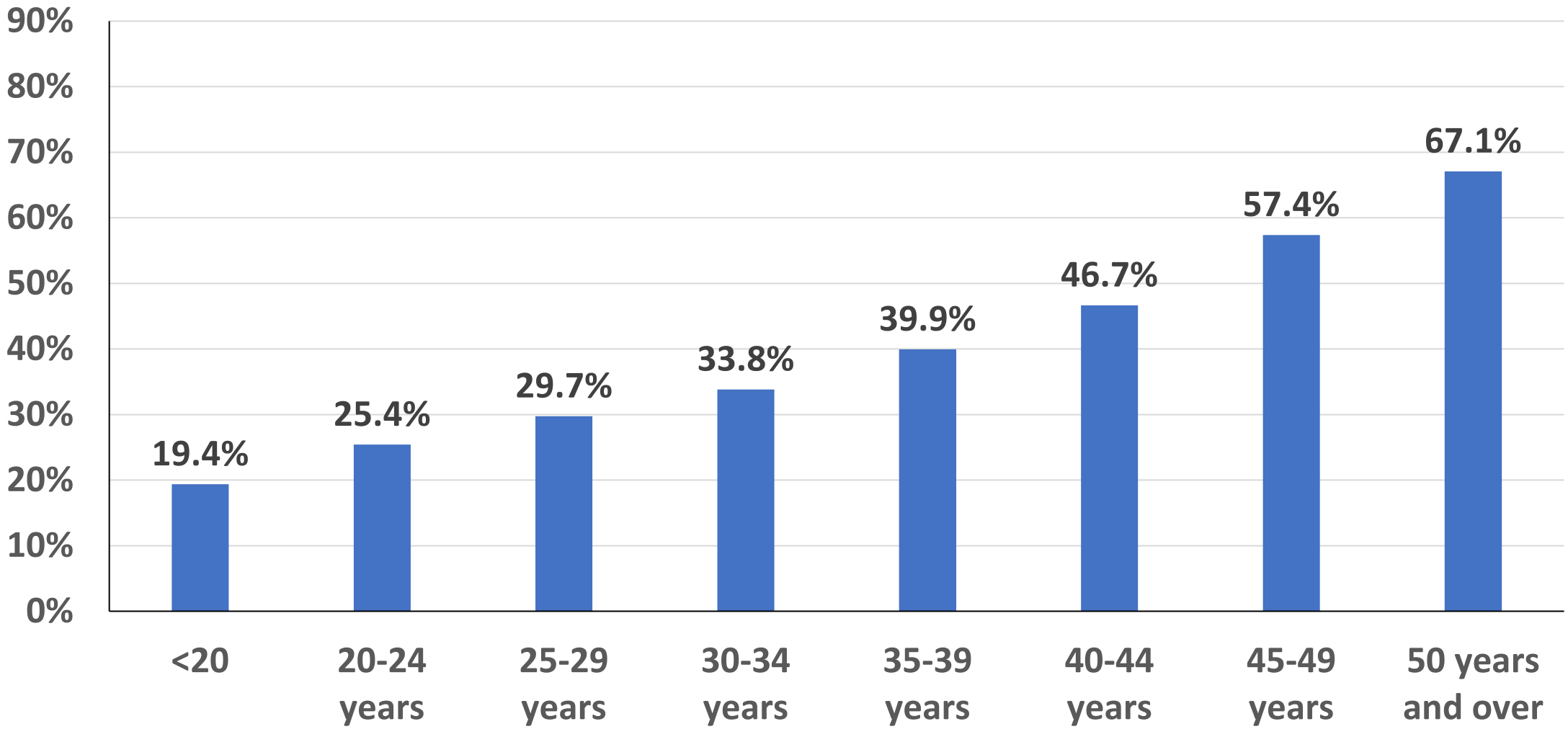
- *There are changes in the demographics of birth, but that's not driving the cesarean rate.*

# Is it older women?

## *Proportion of Births to Women 30+, U.S. 1990-2021*

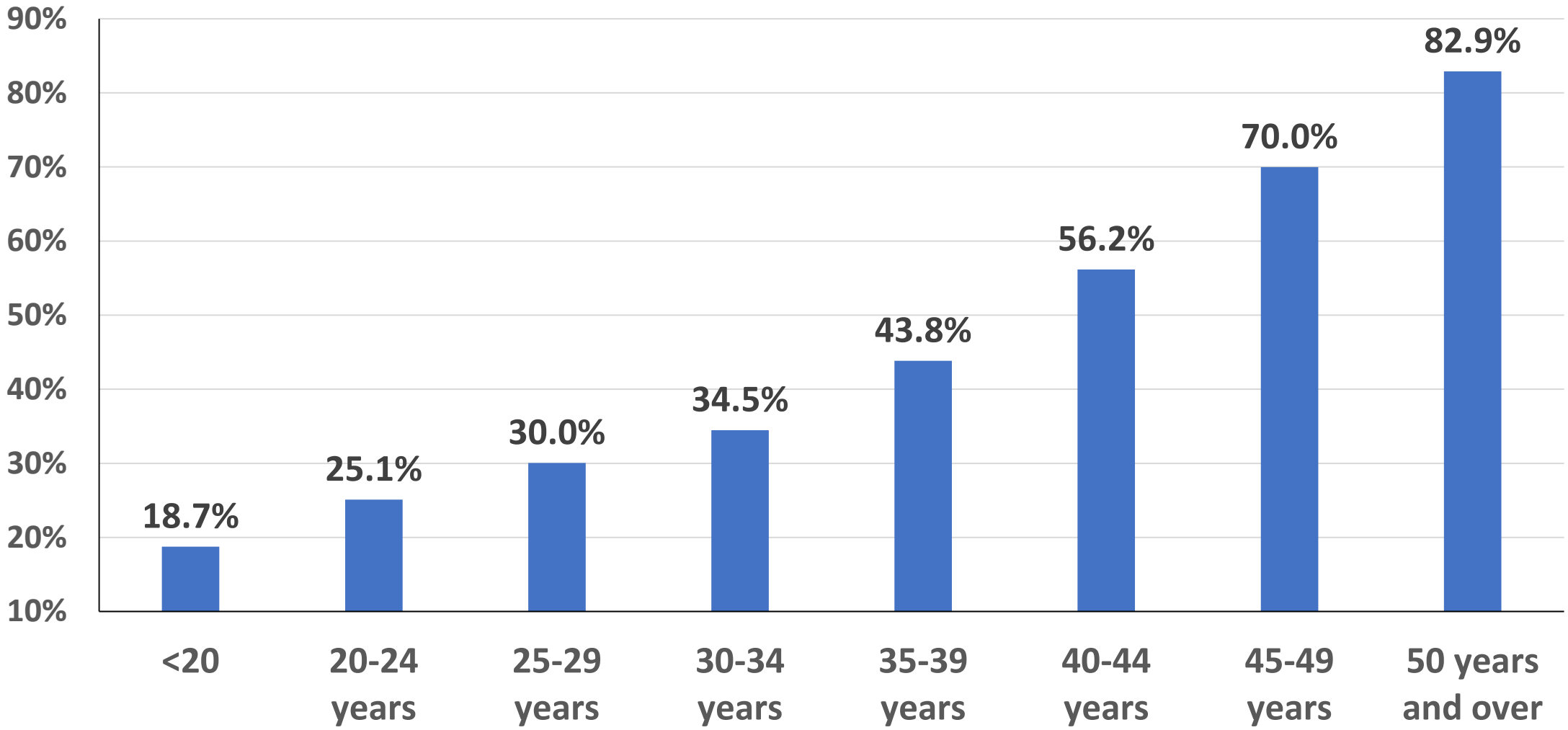


# Overall Cesarean Rate by Age, U.S., 2021




**Source: CDC Wonder**

# Cesarean Rate First Births, by Age, U.S., 2021

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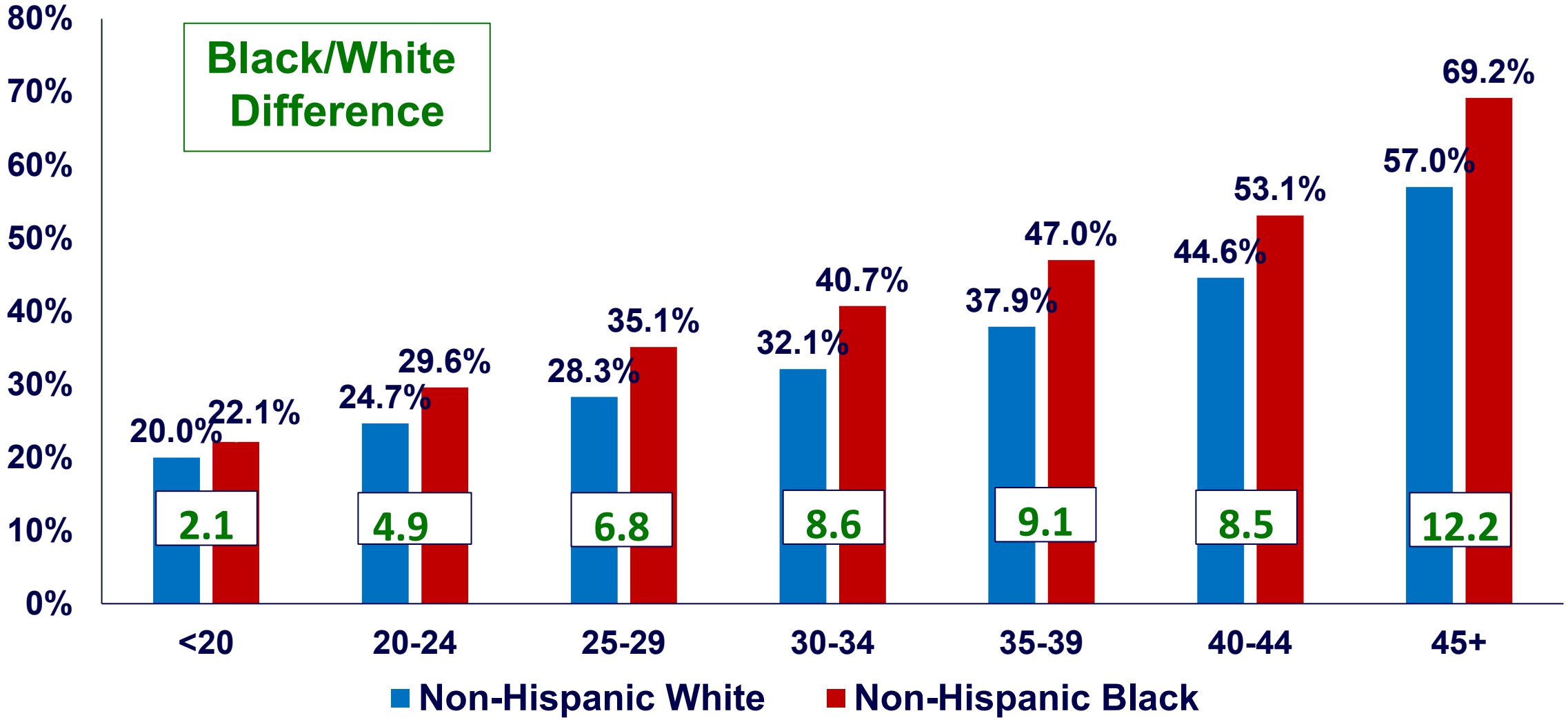
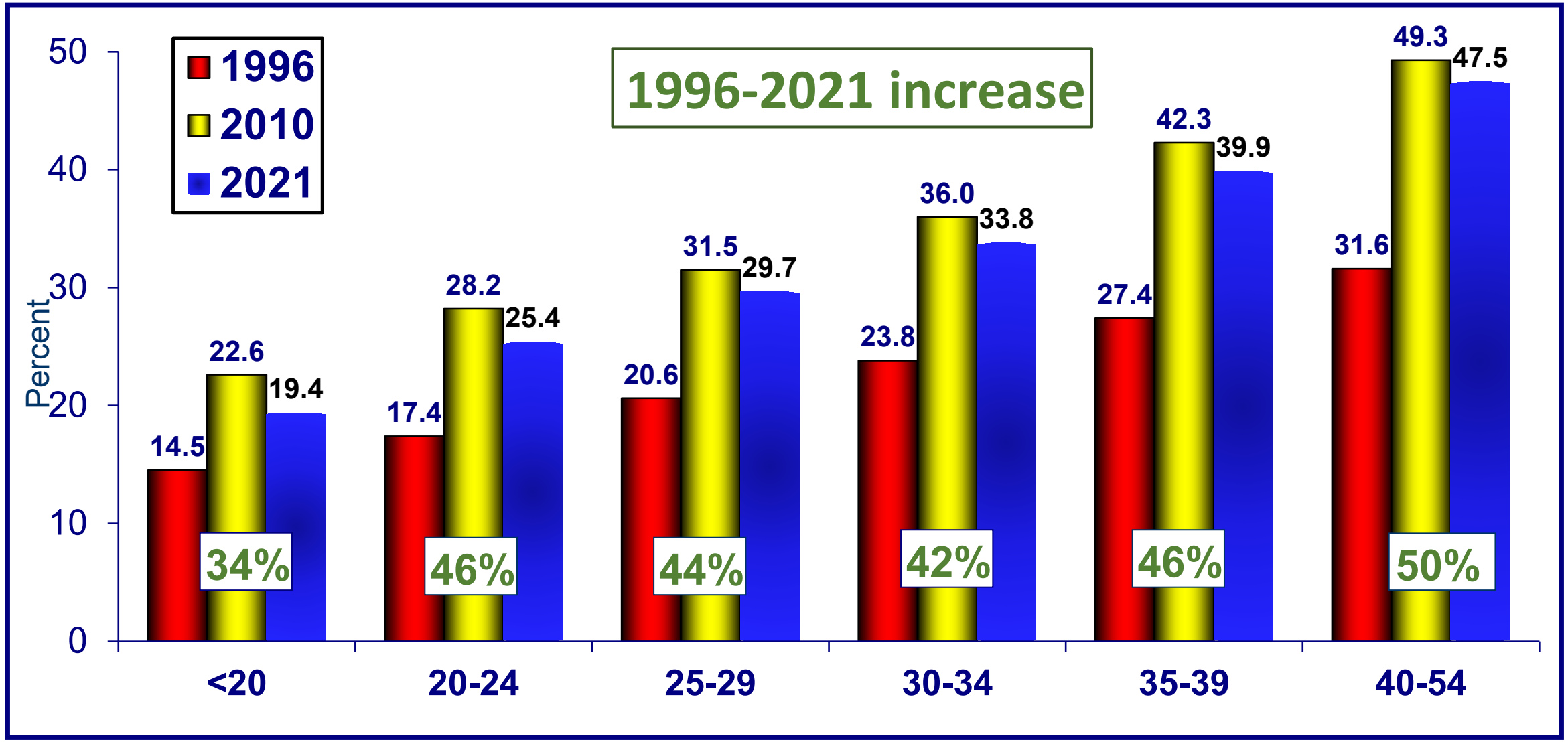
# Cesareans by Age & Race/Ethnicity, U.S. 2021




**Source: CDC Wonder**

*BirthByTheNumbers.org*

# Total Cesarean Rates (per 100 births) by Age of Mother: United States, 1996, 2010 & 2021

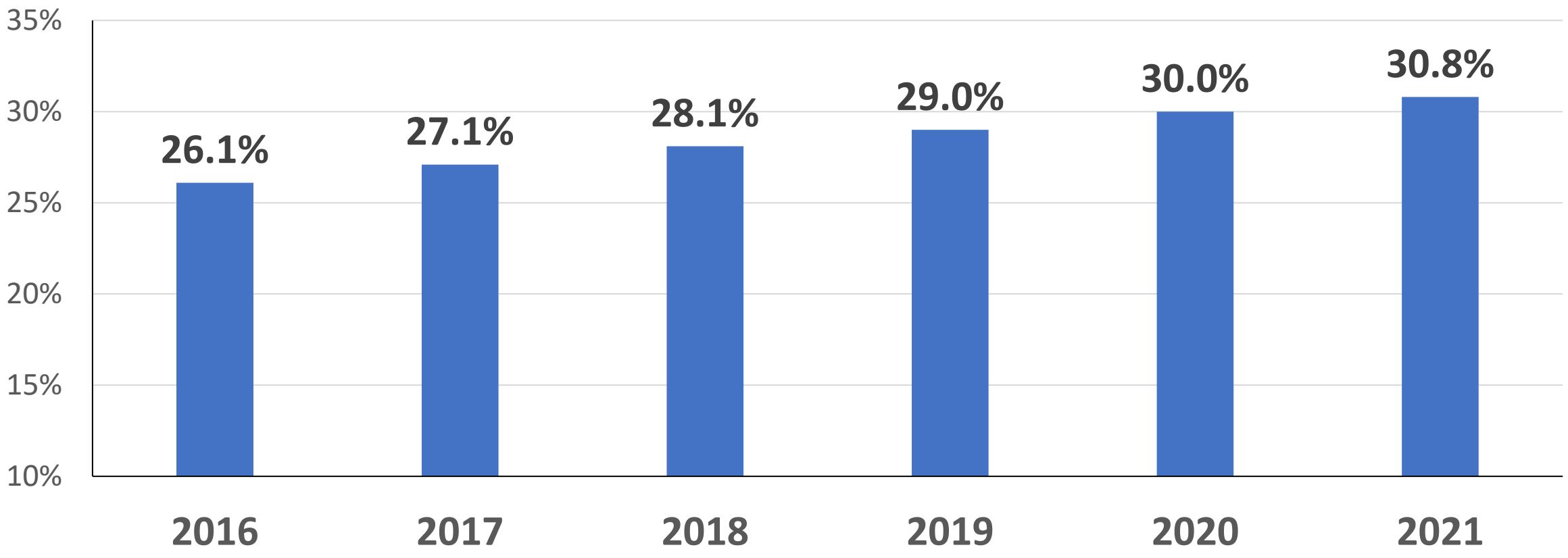



Source: National vital statistics system, NCHS, CDC.

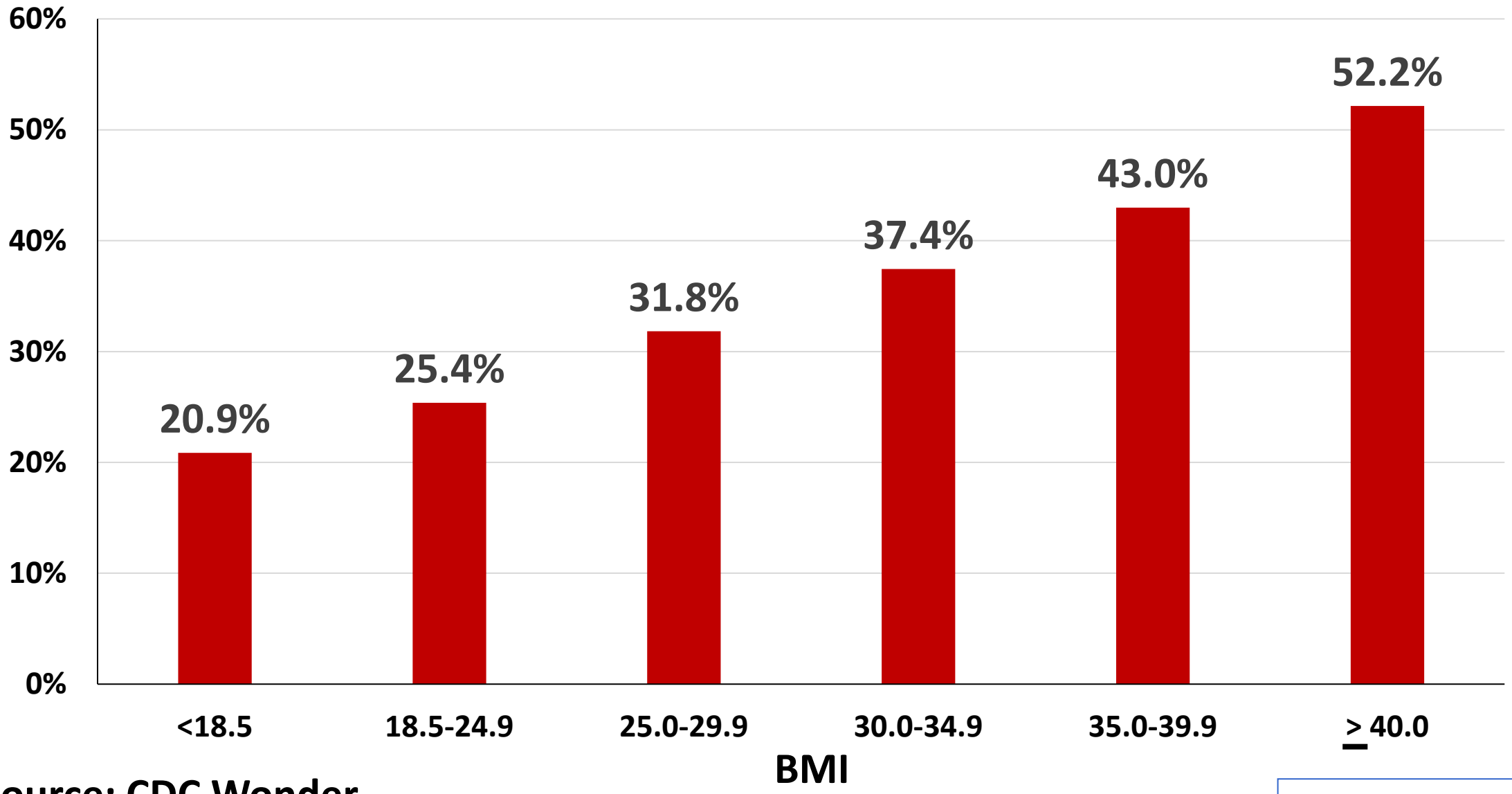
www.birthbythenumbers.org

# Is it body mass index?

## *Proportion of Women with Prepregnancy BMI in 30+, U.S., 2016-21*

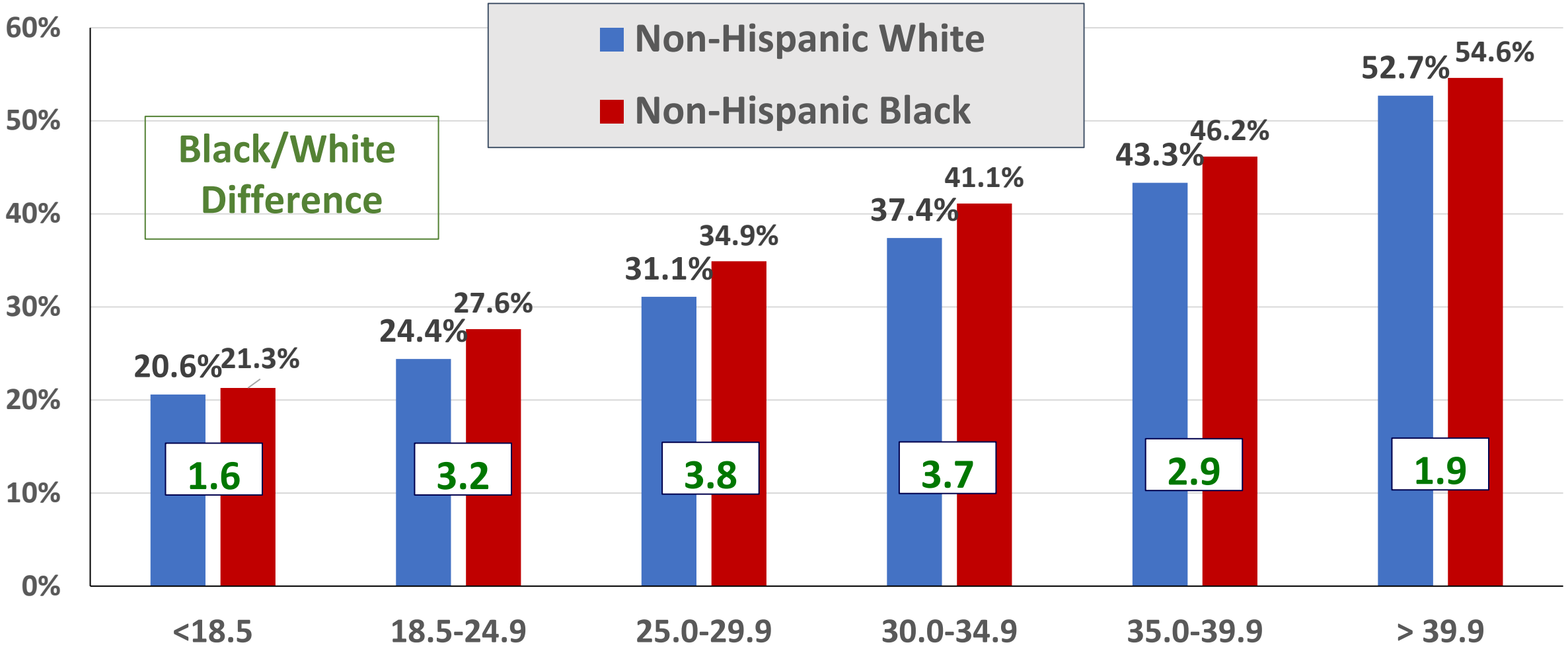


# Cesarean Rates by Body Mass Index, U.S., 2021




**Source: CDC Wonder**

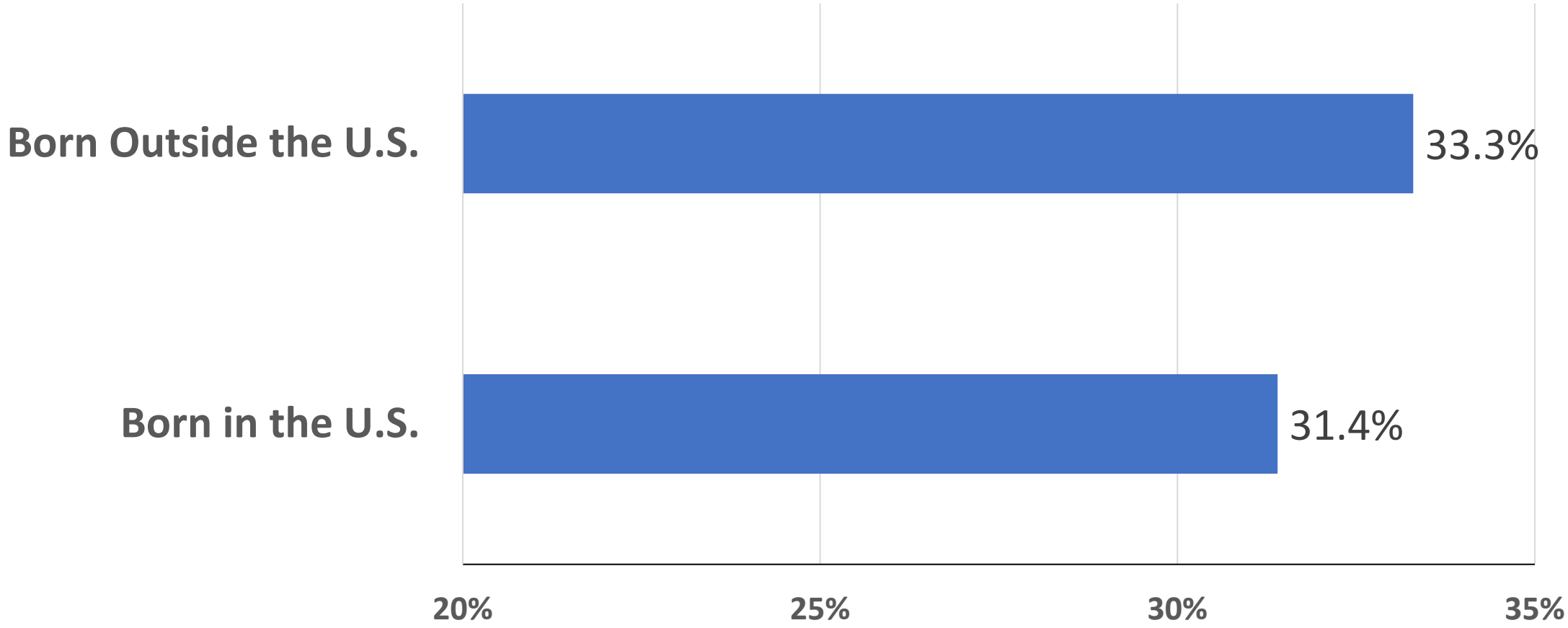
# Cesarean Rates by BMI Category & Race/Ethnicity, 2021



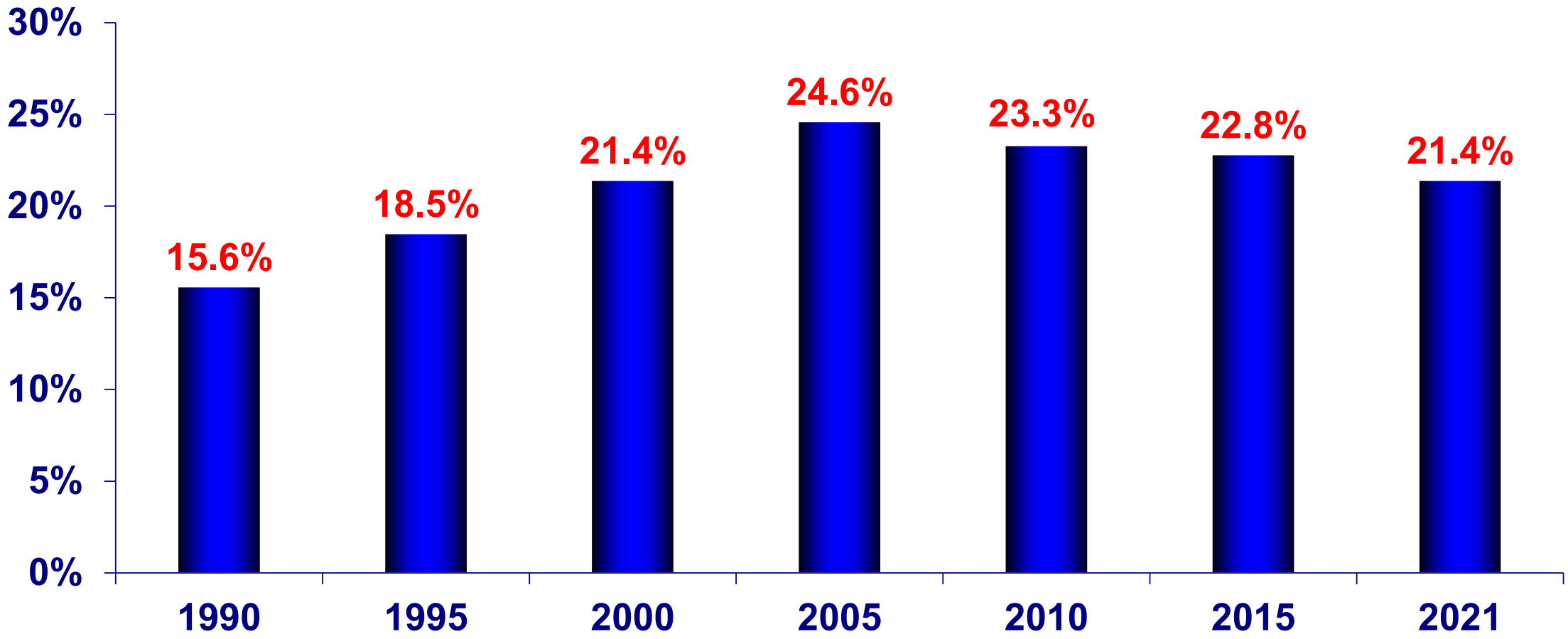

**Source: CDC Wonder**

# Is it foreigners?

## *Cesarean Rates by Mother's Nativity, U.S., 2021*

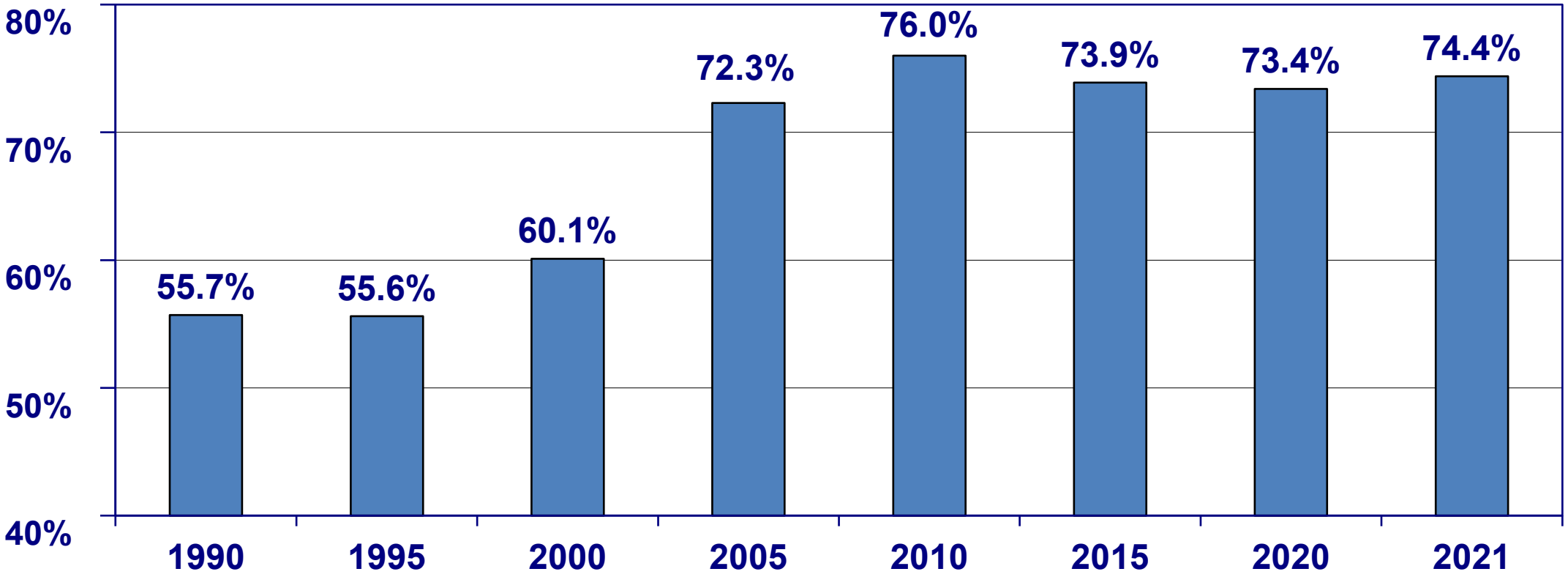


# Proportion of All U.S. Births to Foreign Born Mothers, 1990-2021

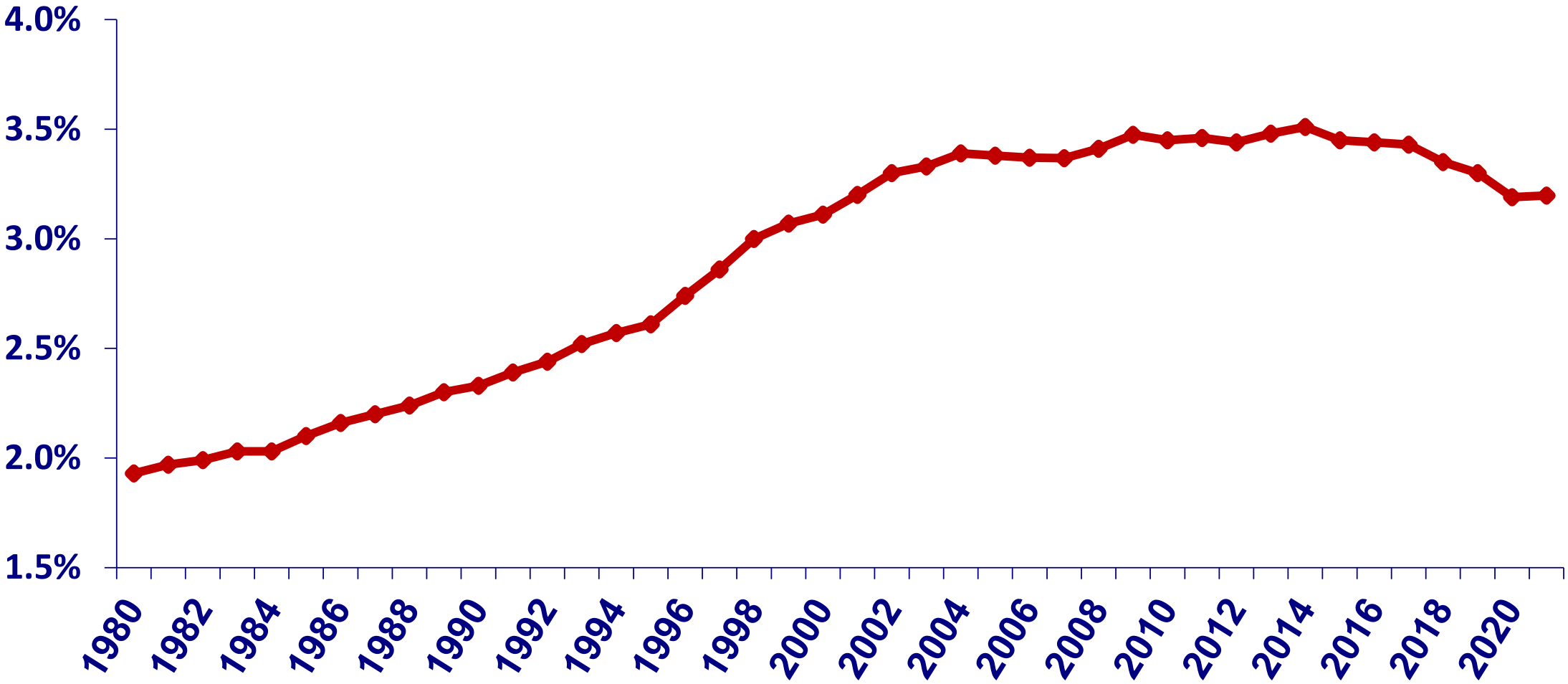


# Is it IVF & Multiple Births?

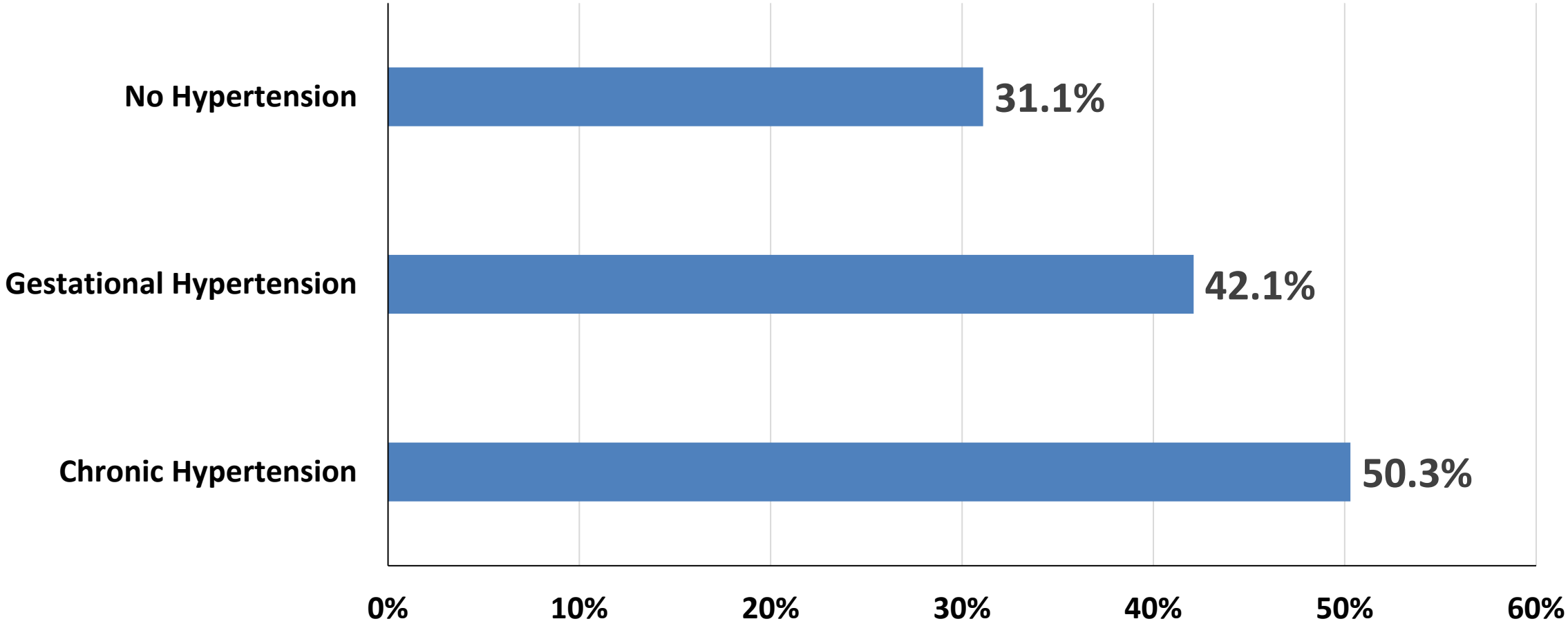
## *Cesarean Rates for Multiple Births, U.S., 1990-2021*



# Rates of Multiple Births (proportion of all babies in multiple births), U.S., 1980-2021



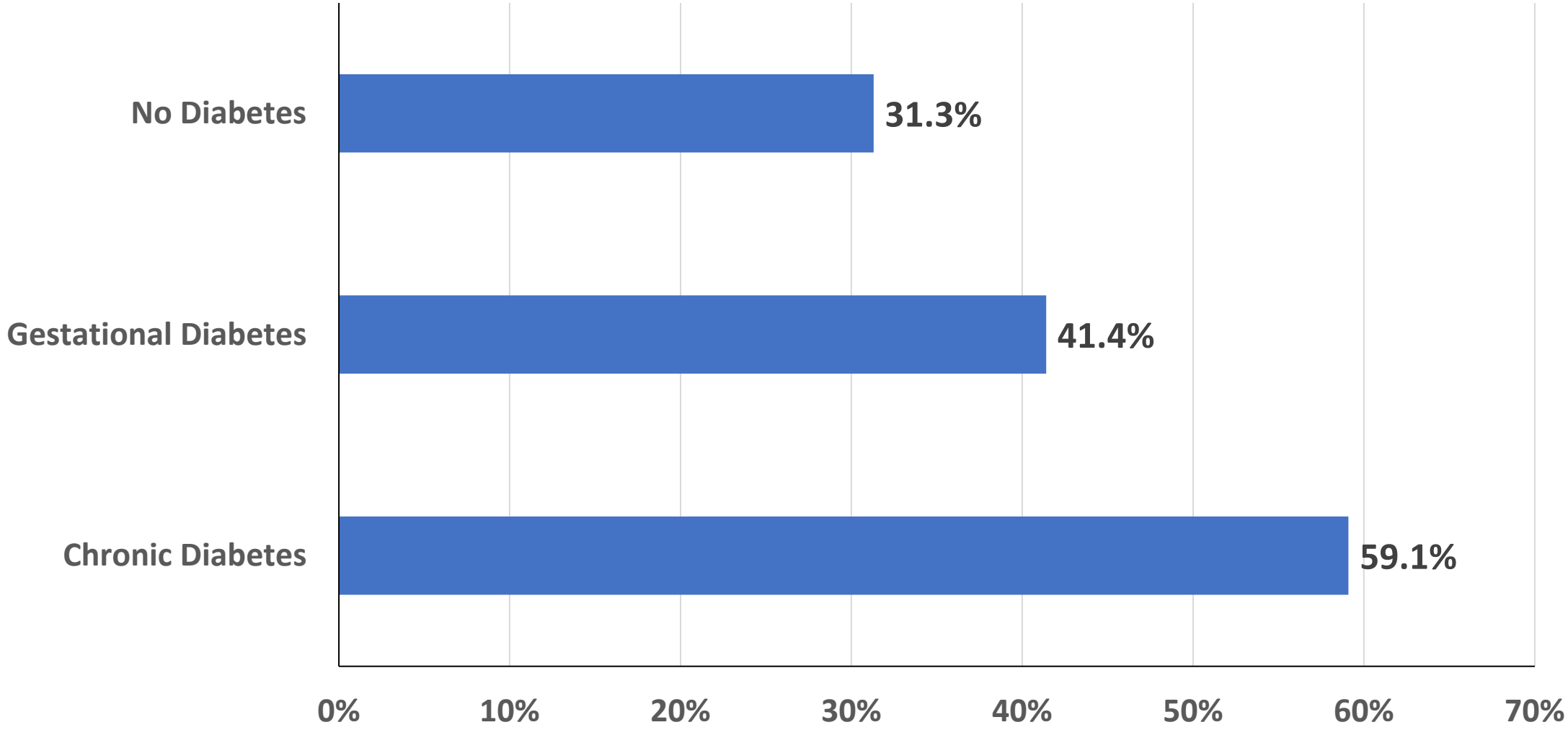
# Cesarean Rates by Hypertension, 2021




Data Source: CDC WONDER Online Database

BirthByTheNumbers.org

# Cesarean Rates by Diabetes Status, 2021

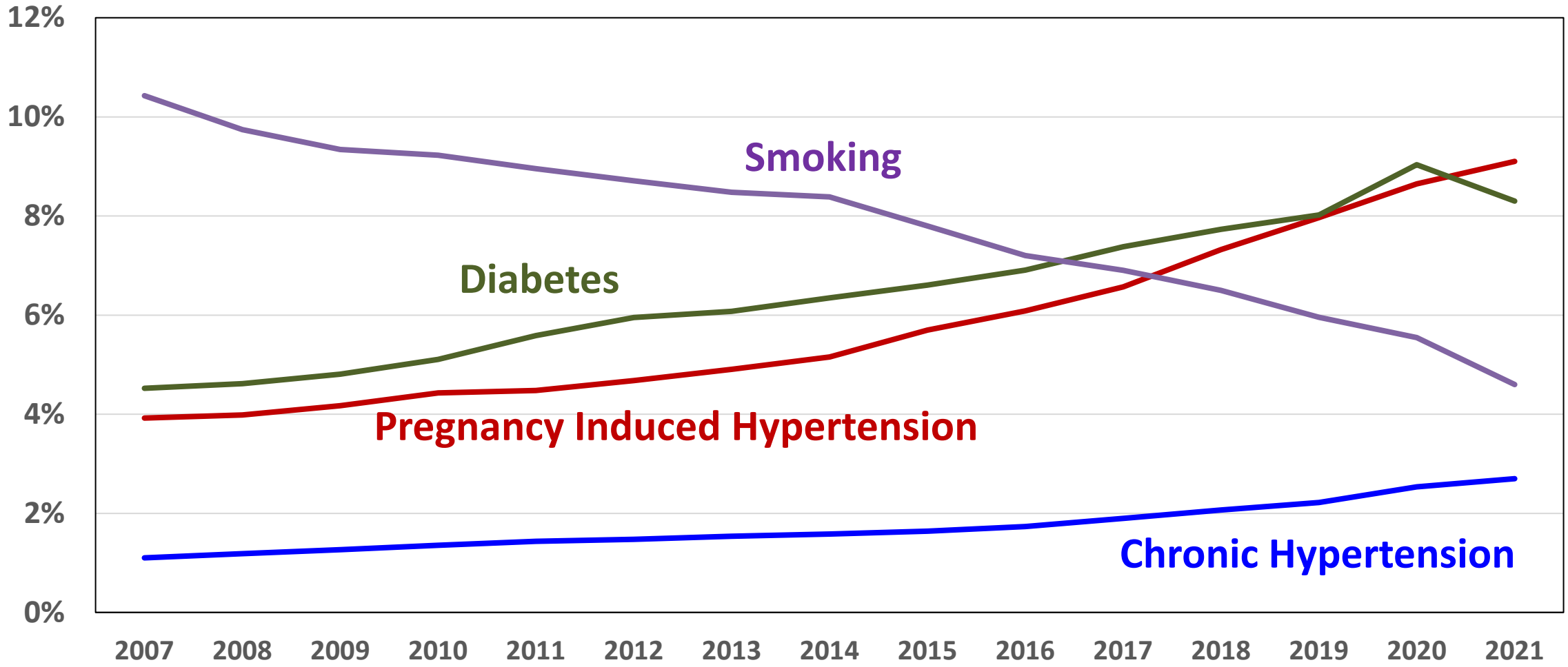



Data Source: CDC WONDER Online Database

BirthByTheNumbers.org

# Is it Poor Health?

## *Maternal Risk Status and Behaviors, U.S., 2007-2021*



Have maternal request cesareans played a major role in these increases?

# *Asking Mothers about Maternal Request Cesareans*

# Listening to Mothers II

http://www.childbirthconnection.org

Eugene R. Declercq
Carol Sakala
Maureen P. Corry
Sandra Applebaum

# Two Components to Maternal Request Primary Cesarean

1. Mother made request for planned cesarean before labor

# Two Components to Maternal Request Primary Cesarean

1. Mother made request for planned cesarean before labor

2. Cesarean for no medical reason

# Patient Choice Primary Cesareans

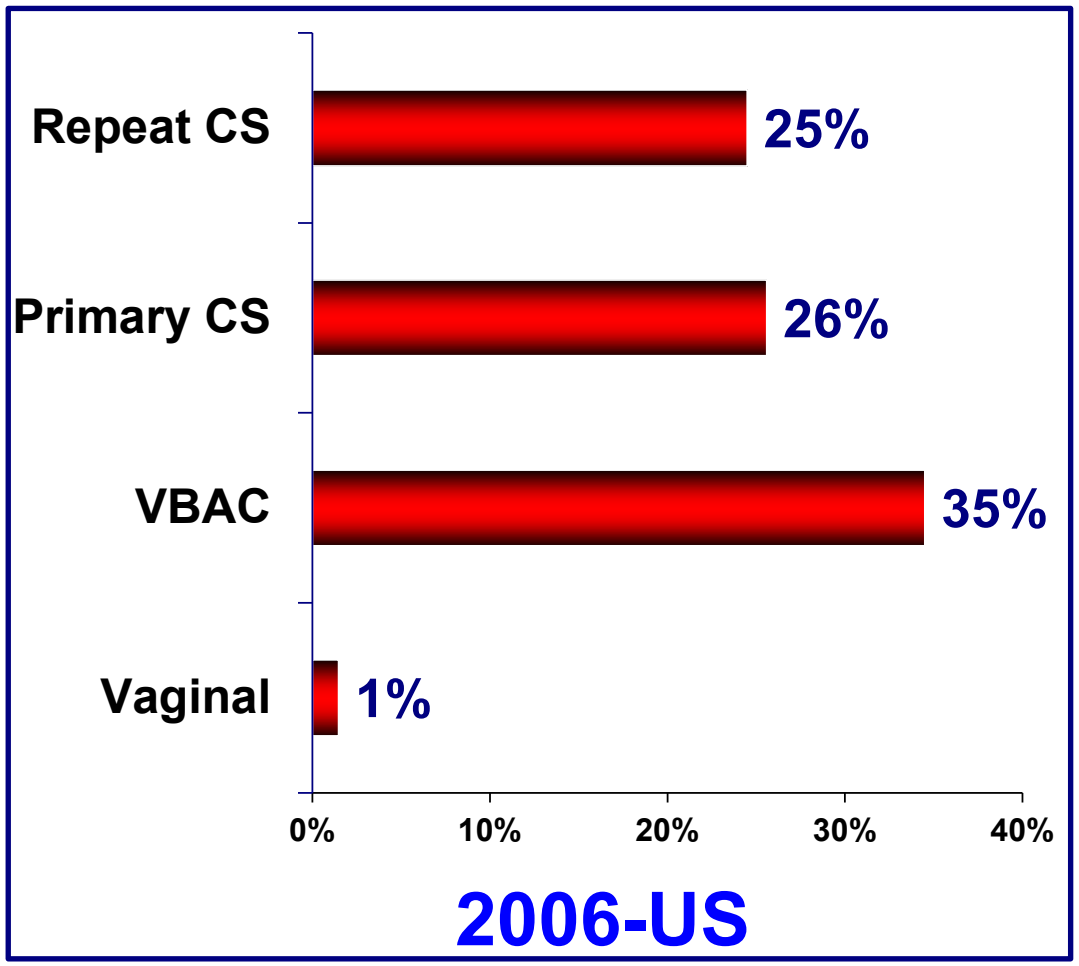
- Combining reason for cesarean and timing of decision found only 1 respondent of 252 (0.4%) had a planned primary cesarean for no medical reason.

> *"I think that [cesarean] is… the best way … to give birth. It is a planned way, no hassle, no pain, the baby doesn't struggle to come out, the baby is not pressed to come out …I think that … everybody should have the baby by cesarean section."*

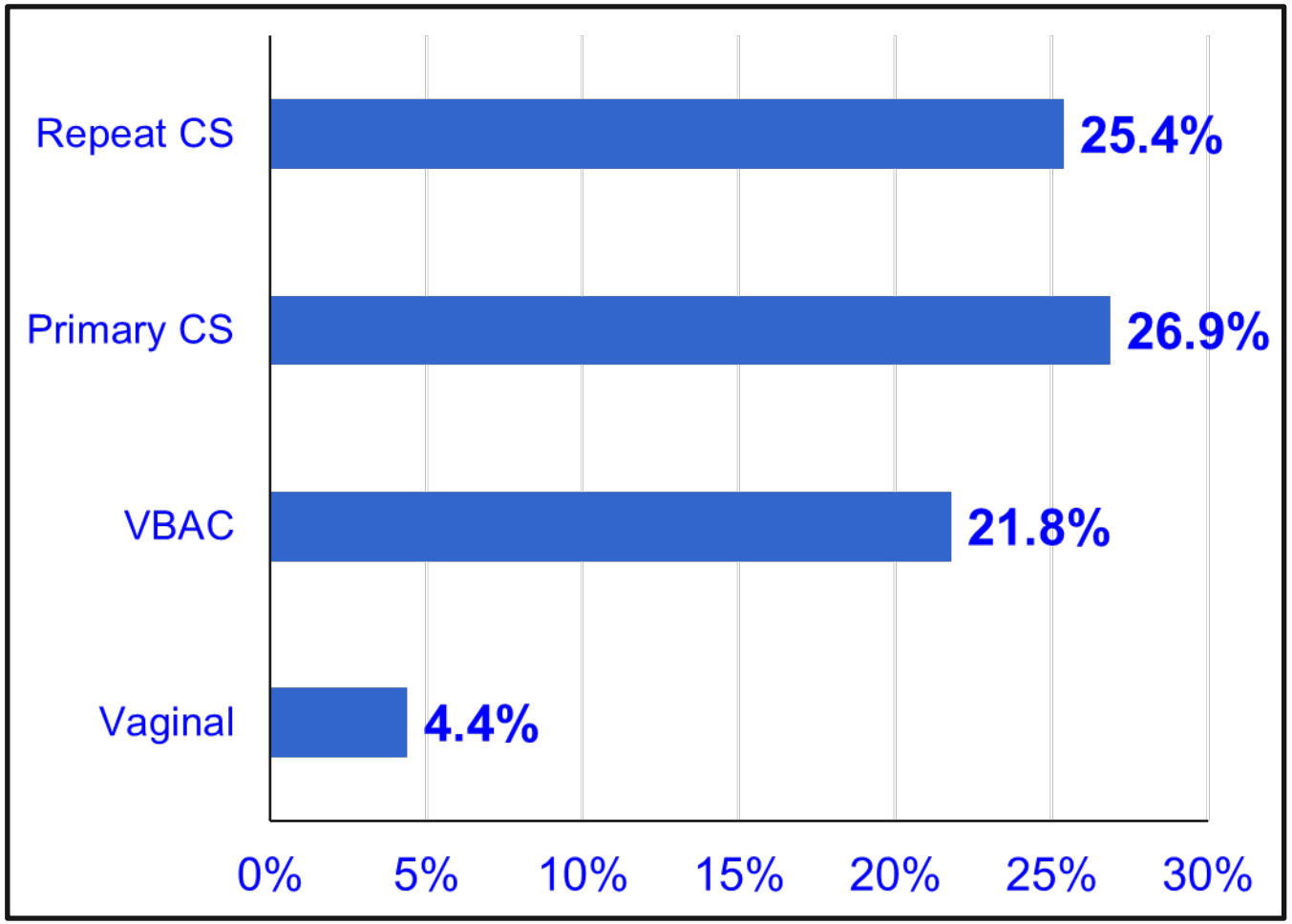
***Studies from England, Canada and Sweden & U.S. States confirm very low rates of maternal request cesareans***

# Pressure to Accept Interventions by Method of Delivery

## *Did you feel pressure from any health professional to have a cesarean? % yes*




**2006-US**




**2016-CA**

Source: Declercq et al. 2006. *Listening to Mothers II*.

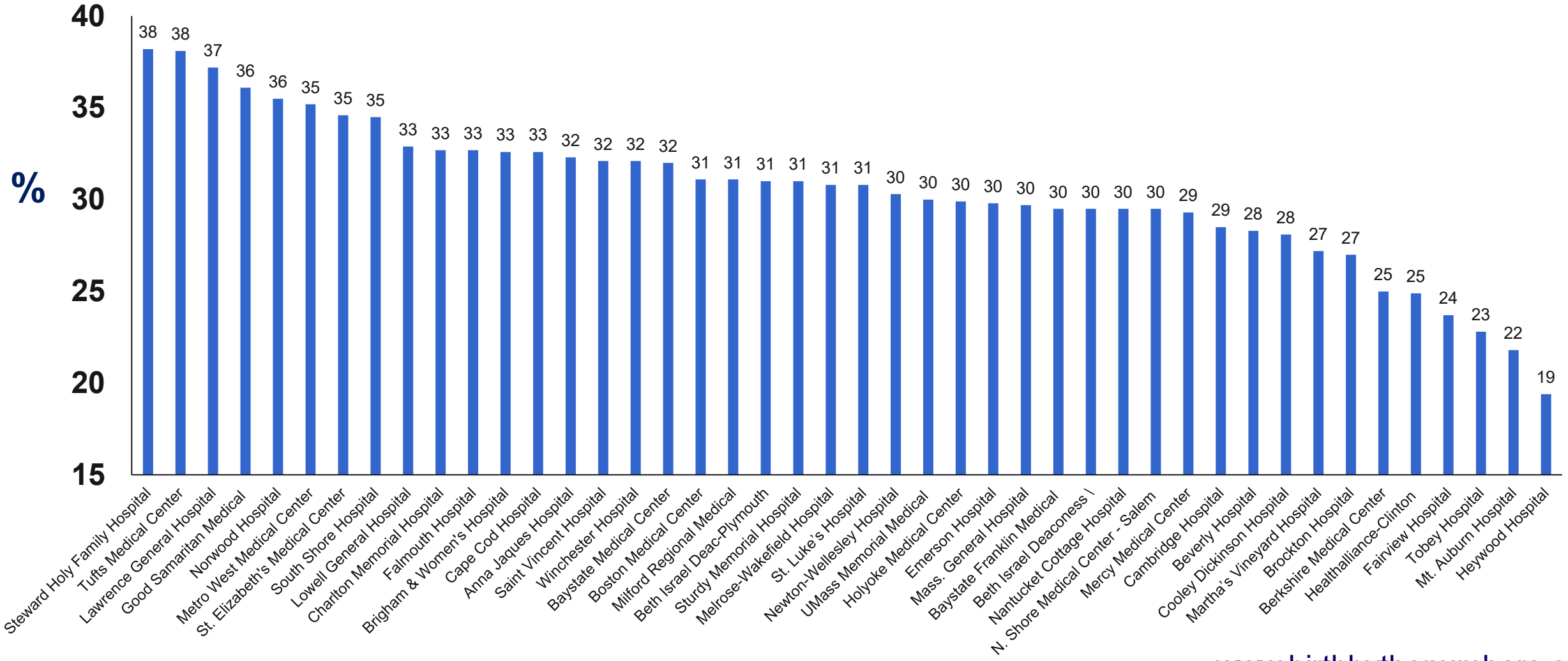
www.birthbythenumbers.org

*Overall, we see that changes in cesarean rates do not directly correspond to changes in maternal health status.*

***If it's not women driving CS rates, what explains them?***

# Hospital Practices?

## *Mass. CS Rates by Hospital, 2019*

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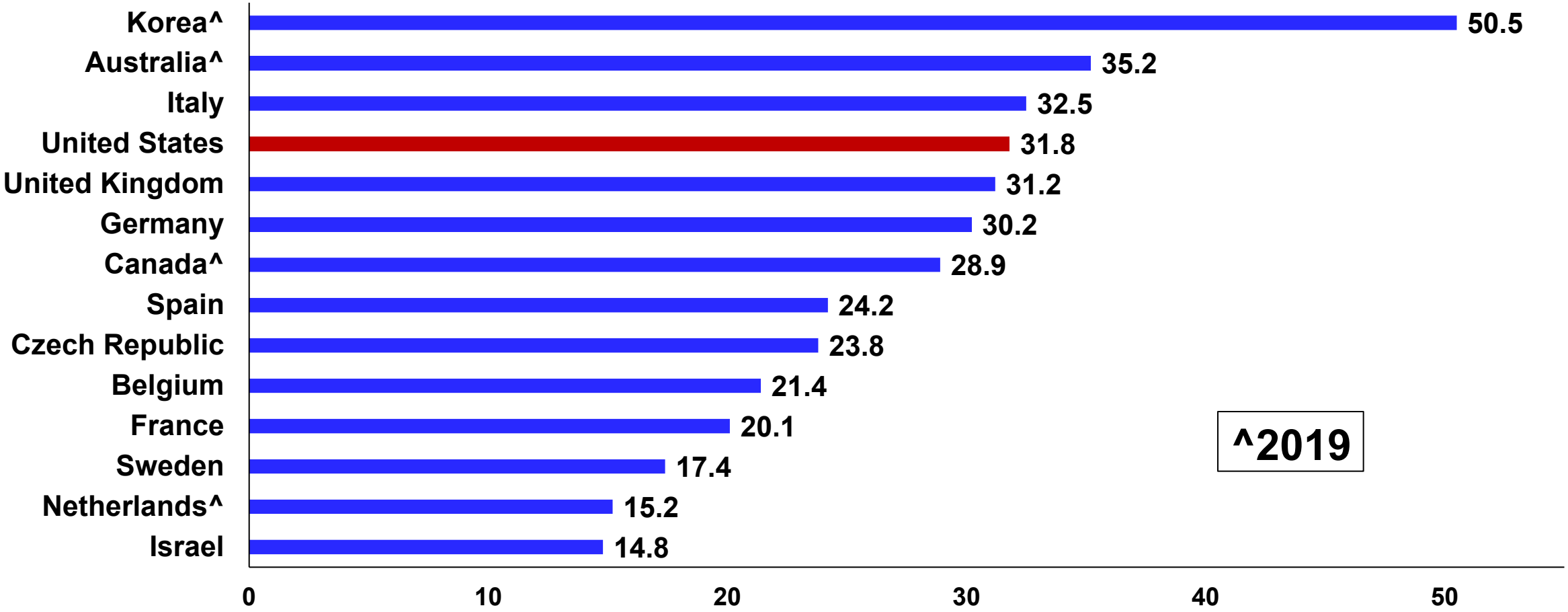
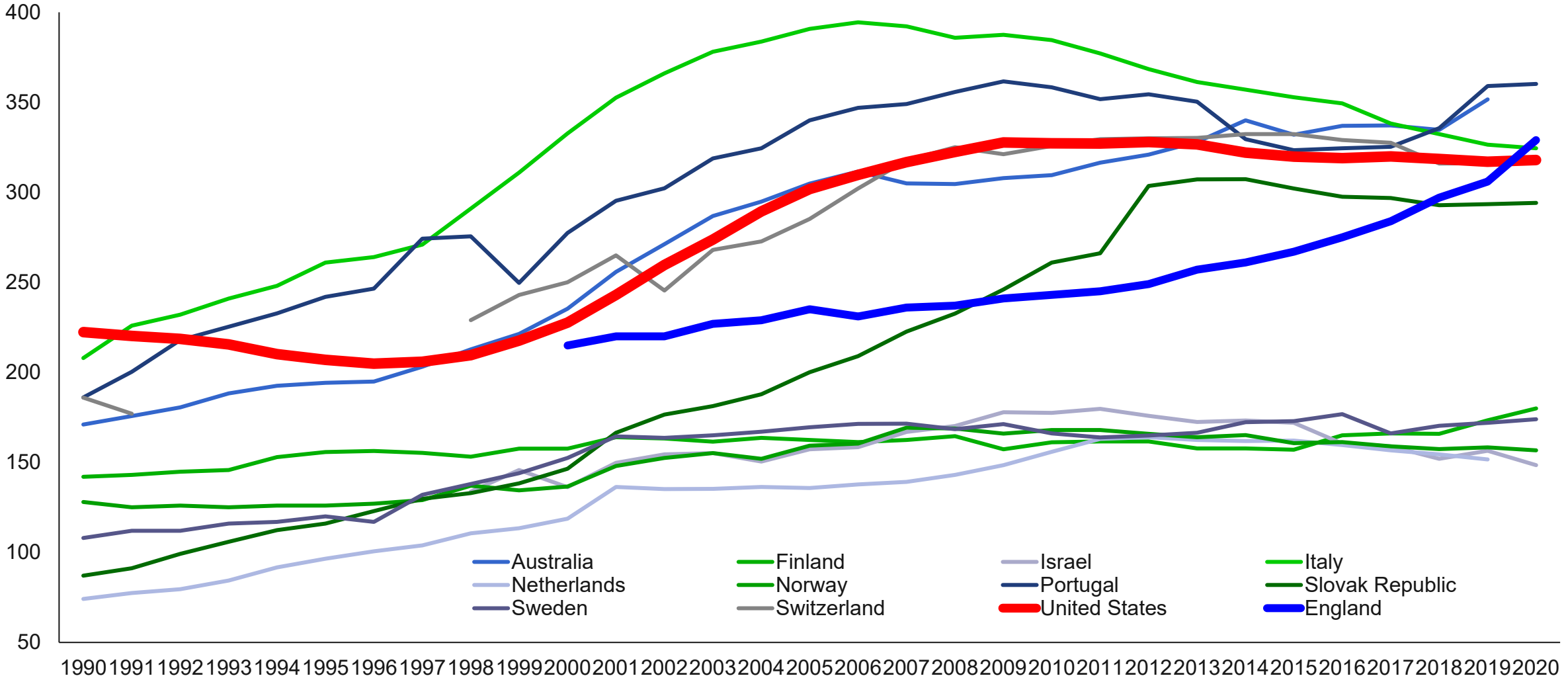
***How does the U.S. compare to other countries?***

# Cesarean Rates (%) in Industrialized Countries* with 100,000+ Births, 2020




Source: OECD data, 2022.

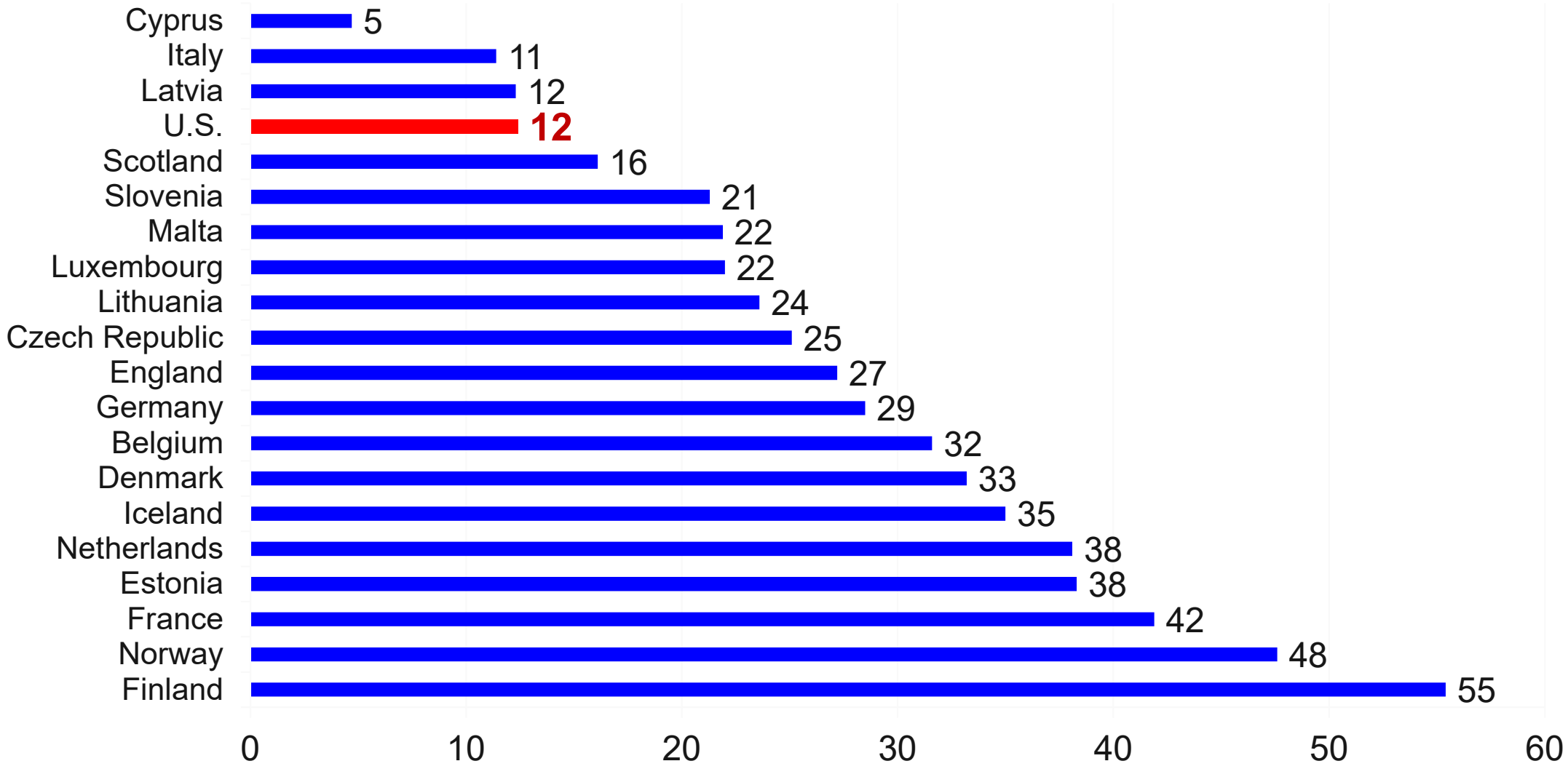
# Trends in Overall Cesarean Rate (per 1,000) 1990 – 2020, Countries with Current Highest & Lowest Rates




Sources: OECD data 2022; WHO Europe Health for All Database.

BirthByTheNumbers.org

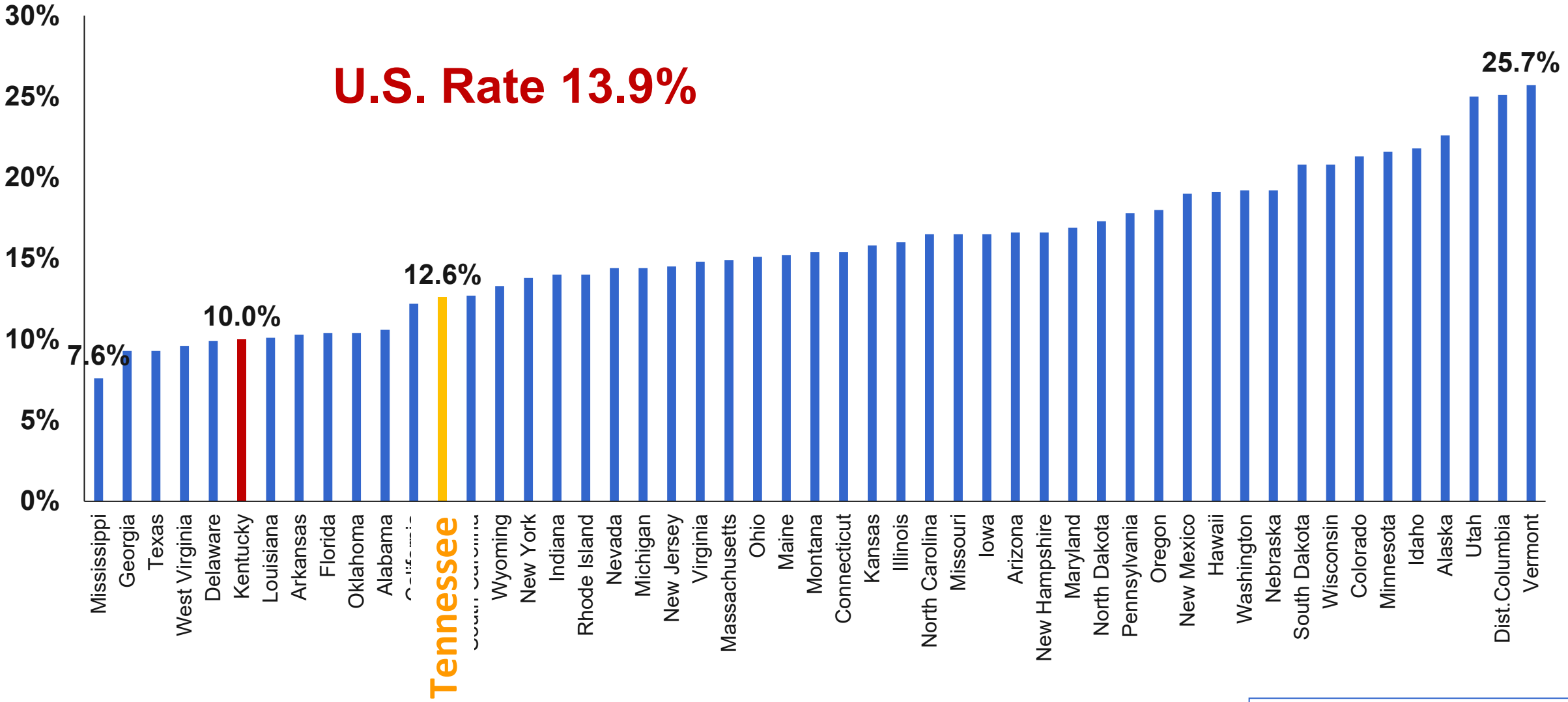
# VBAC Rates Industrialized Countries, 2015




Source: Euro-Peristat Project. European Perinatal Health Report. Core indicators of the health and care of pregnant women and babies in Europe in 2015. November 2018.

*BirthByTheNumbers.org*

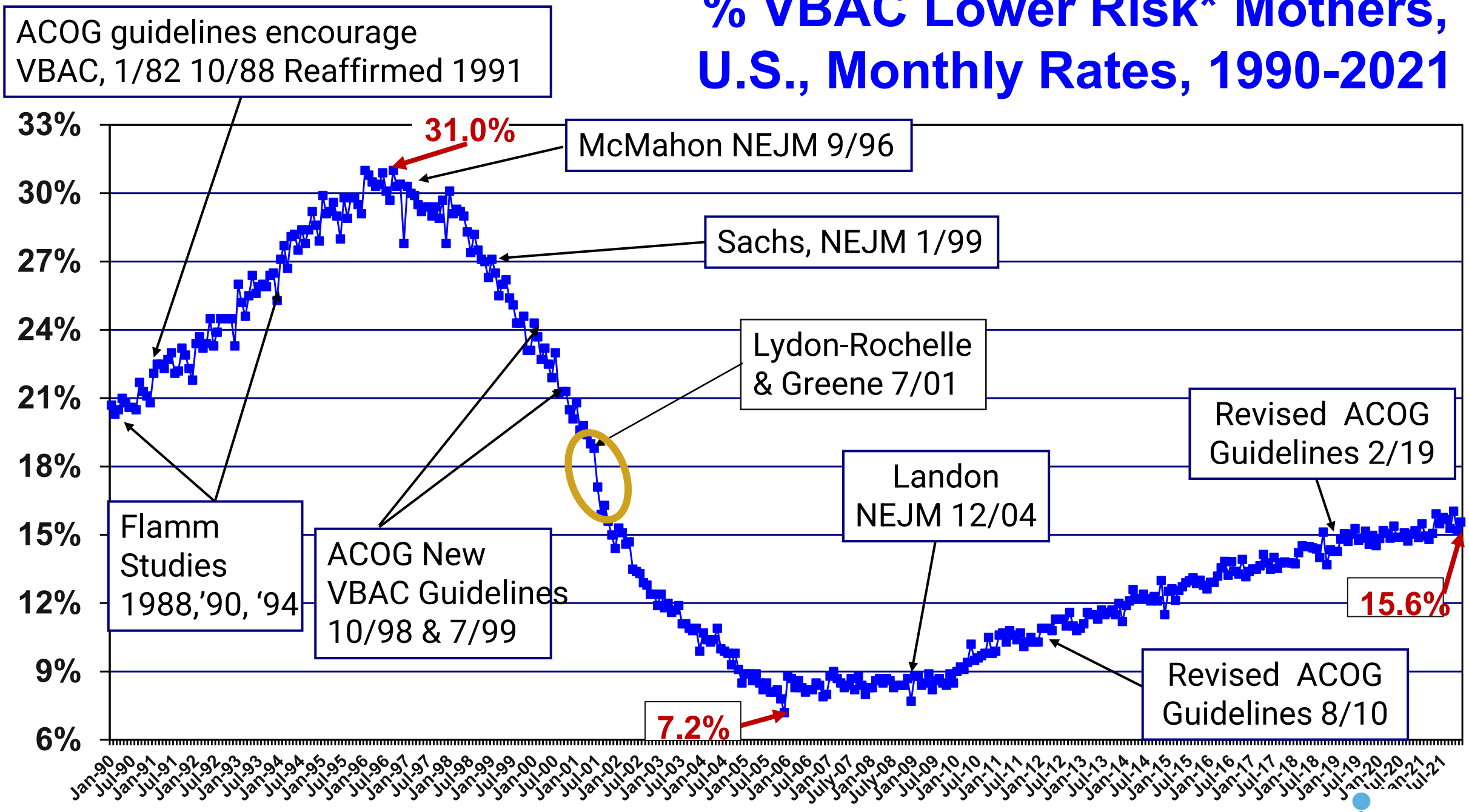
# State VBAC Rates 2020




Source: CDC Wonder

BirthByTheNumbers.org

# % VBAC Lower Risk* Mothers, U.S., Monthly Rates, 1990-2021




Data Source: 1990-2021, CDC Vital Statistics & VSS data sets * Full-gestation(37+ weeks), vertex presentation, singleton births

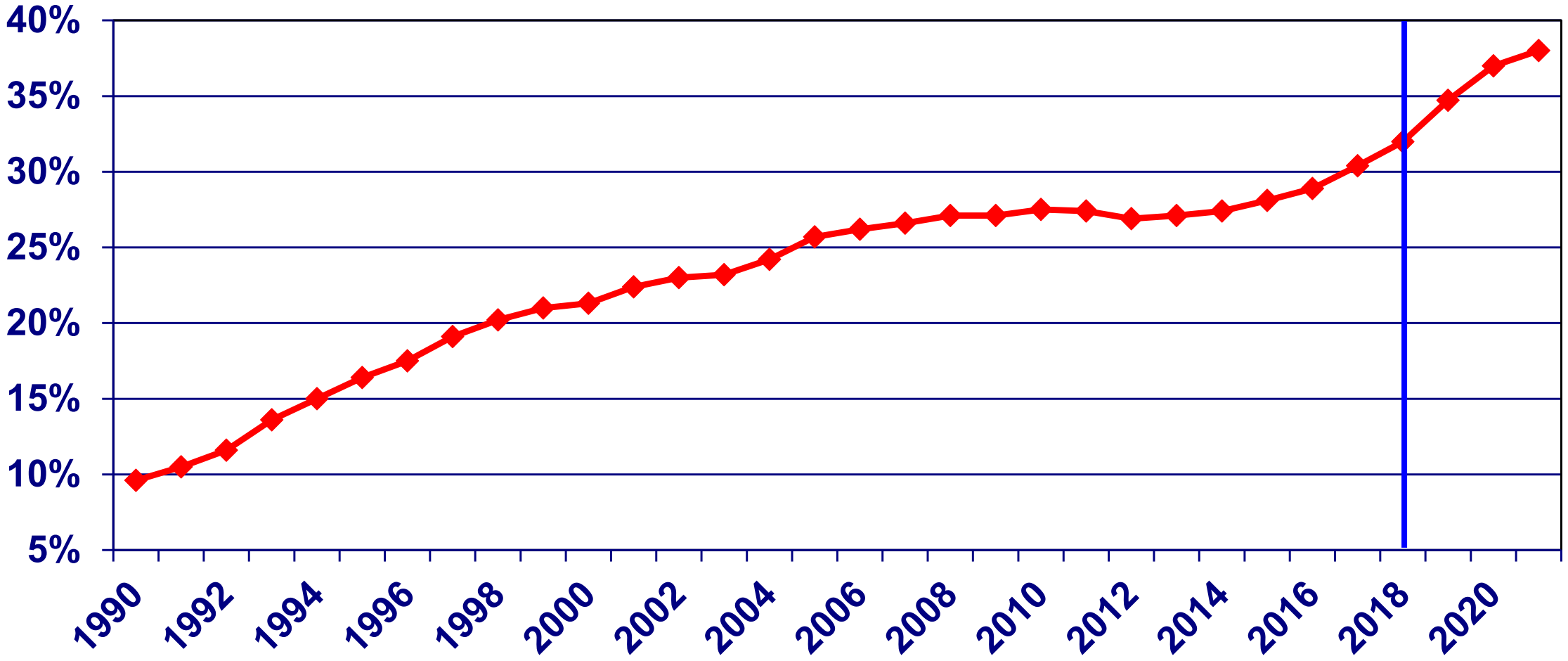
BIRTH by the NUMBERS

# What can we say about cesarean rates?

- *Been essentially level for the past 15 years after a rapid rise 1996-2007*
- *Fluctuations in the CS rate mirrored by VBAC rates*
- *Meanwhile outcomes haven't improved*
- *Largely not driven by changes in women, while hospital variation is wide*

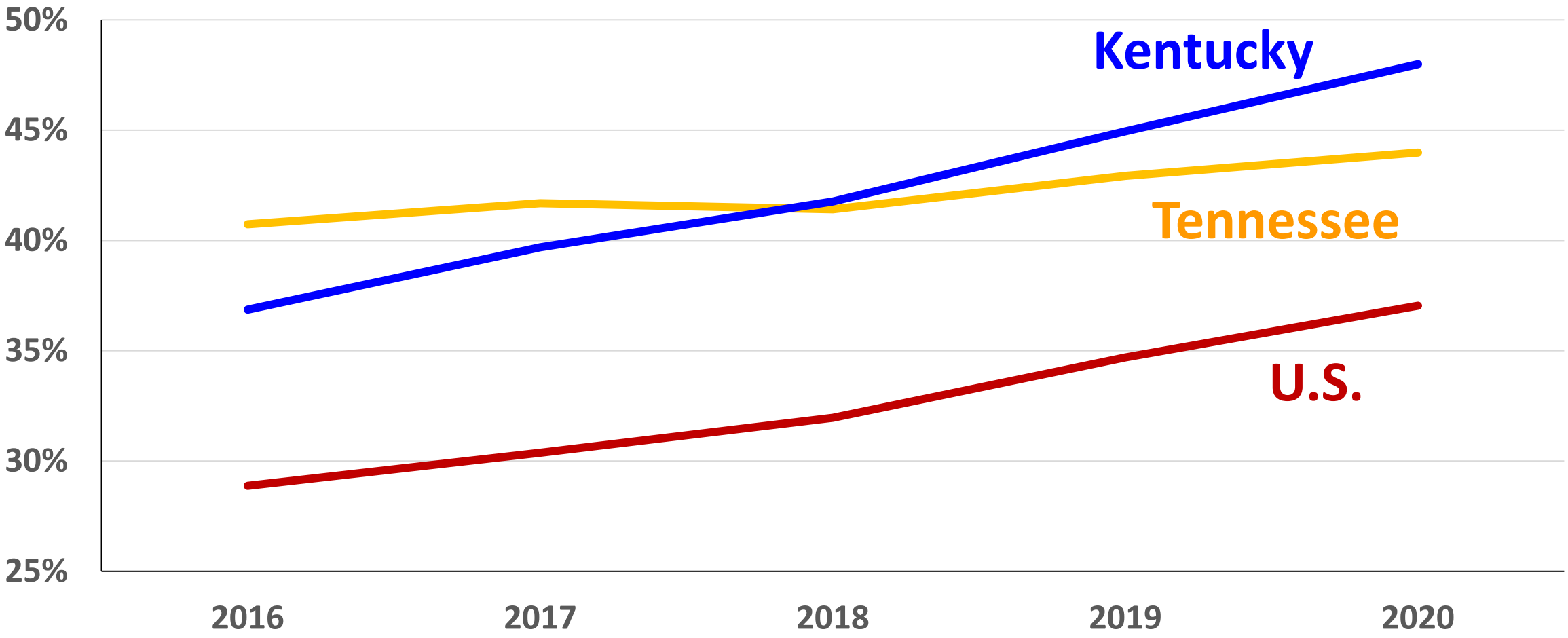
# *The Challenge of Rising Induction Rates*

# Inductions in Vaginal Births, U.S., 1990-2021




Source: CDC, NCHS. Downloadable annual natality datasets and CDC Wonder. (2016-2020)

# Inductions in Vaginal Births, U.S., TN, KY, 2016-20

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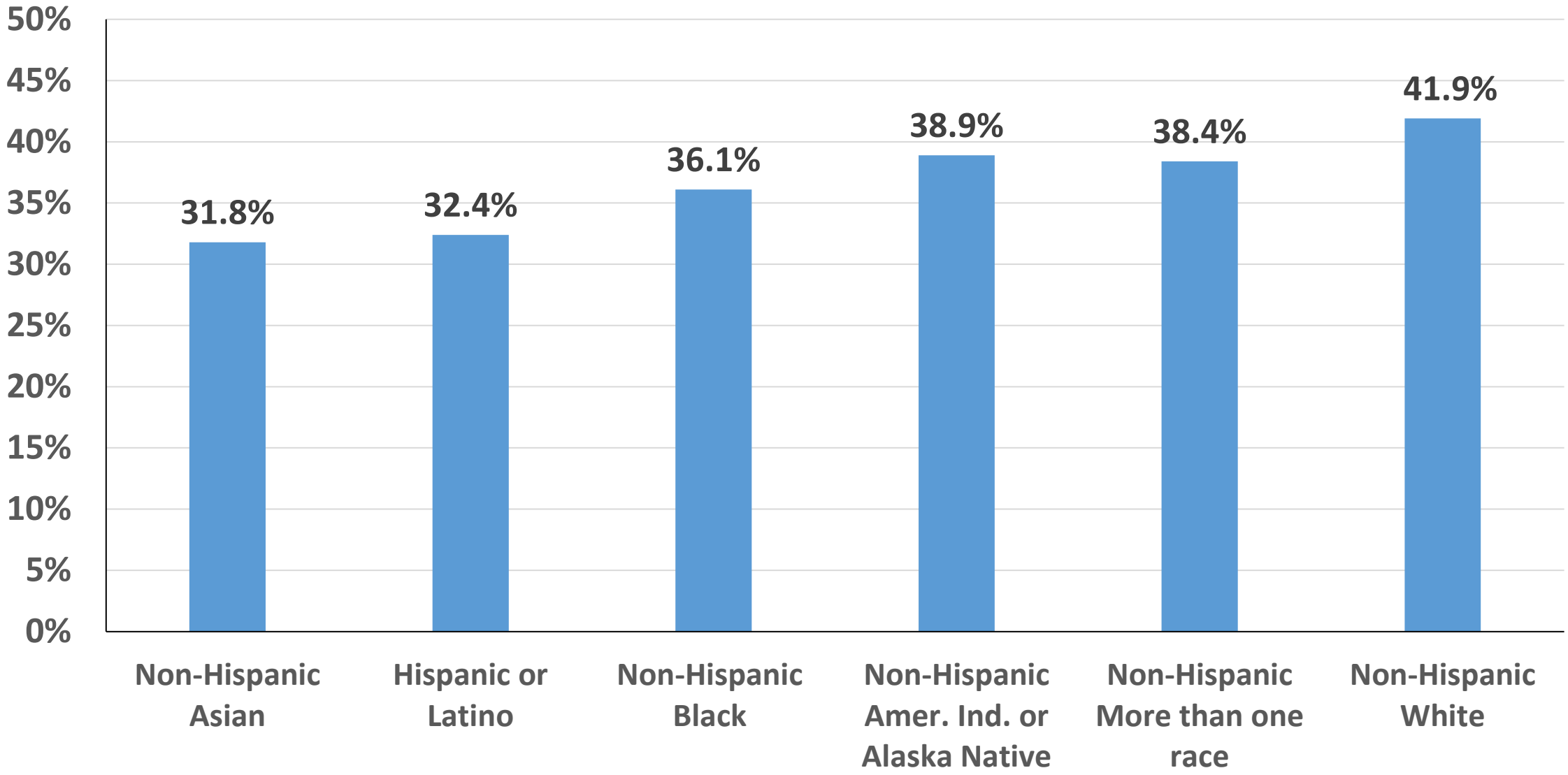
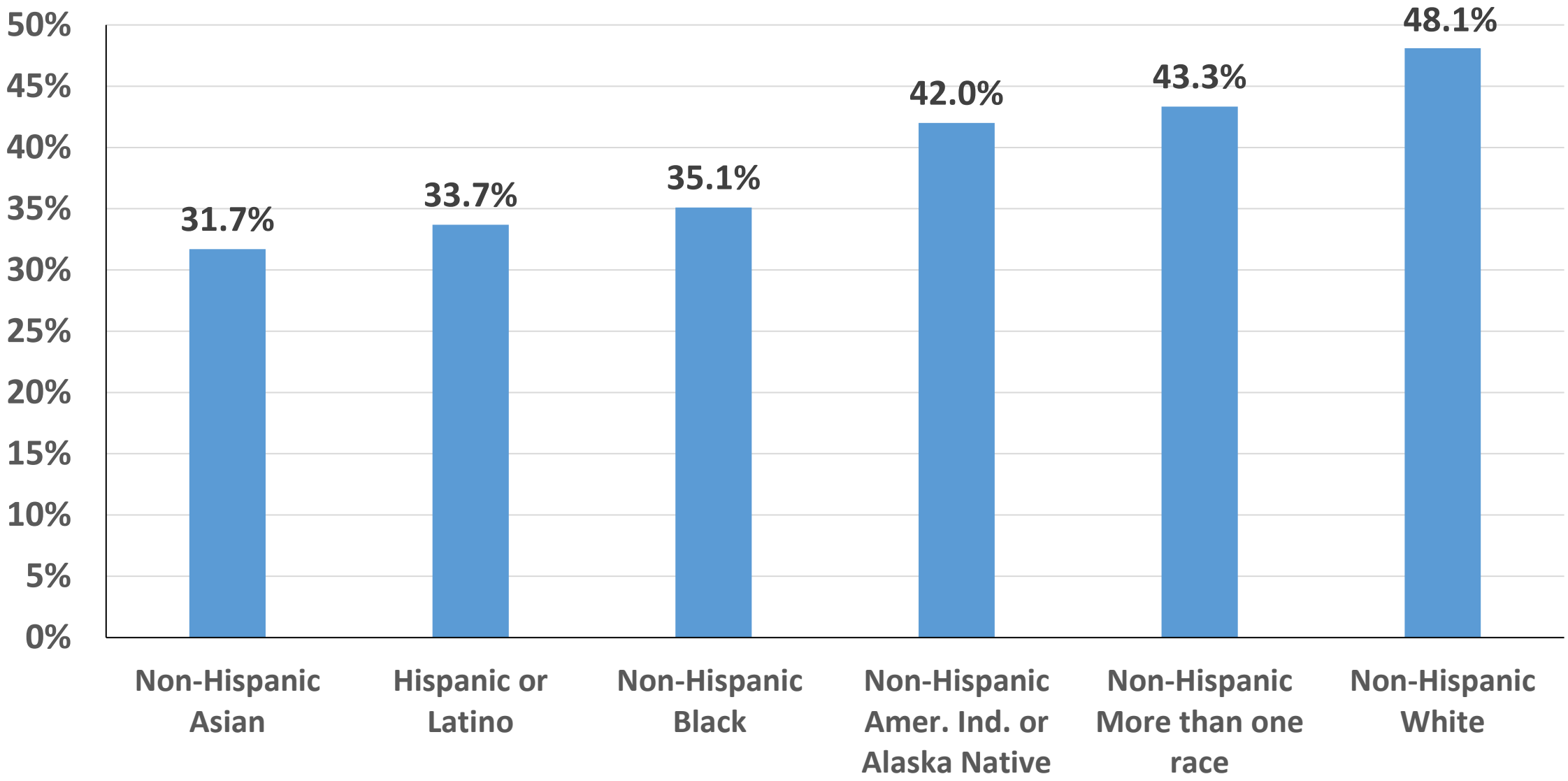
# Inductions by Race/Ethnicity, Vaginal Births, U.S. 2021




Source: CDC Wonder

# Inductions by Race/Ethnicity, Vaginal Births
# TN 2019-2020




Source: CDC Wonder

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# Labor Induction versus Expectant Management in Low-Risk Nulliparous Women

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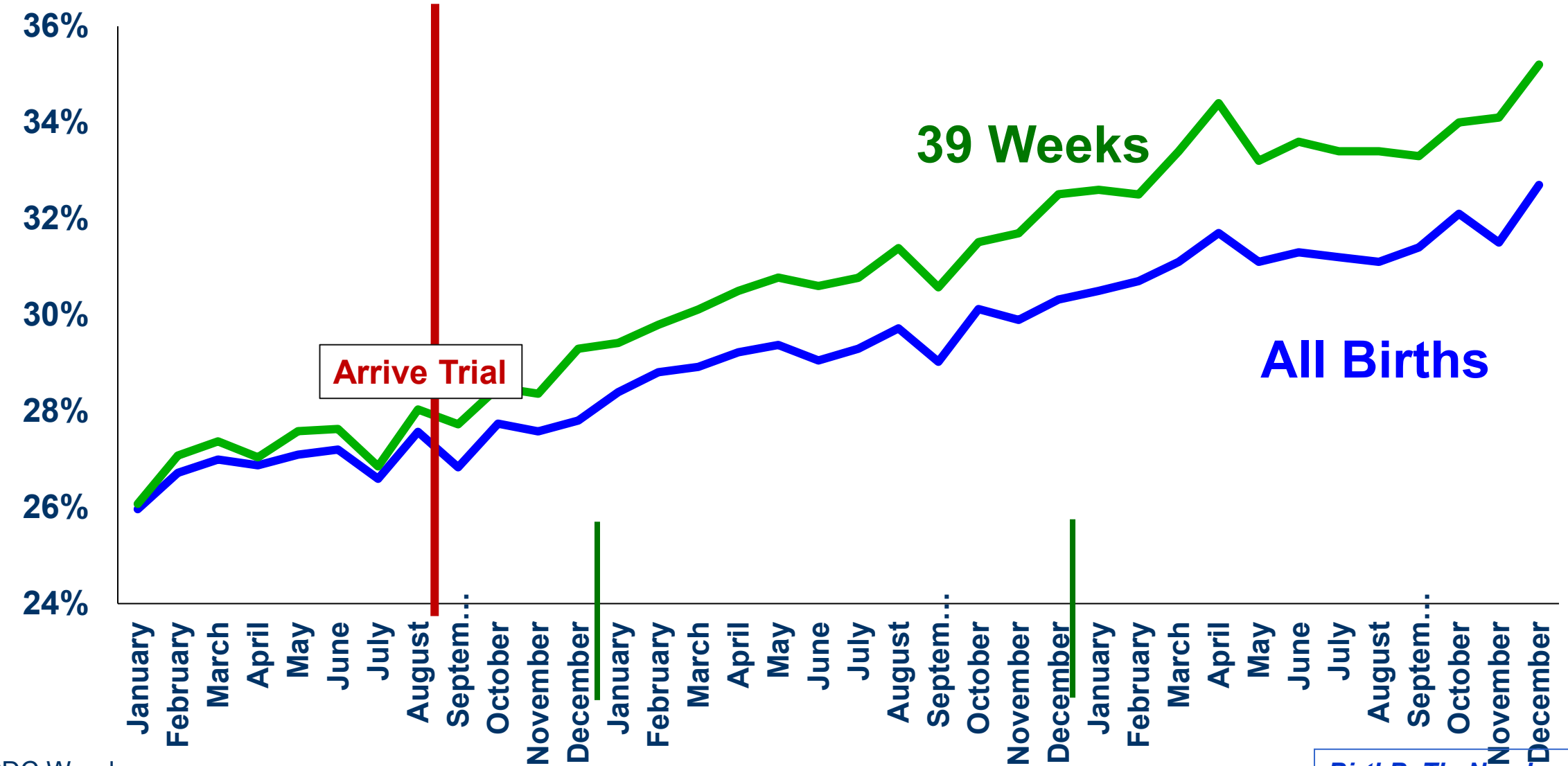
**CONCLUSIONS**

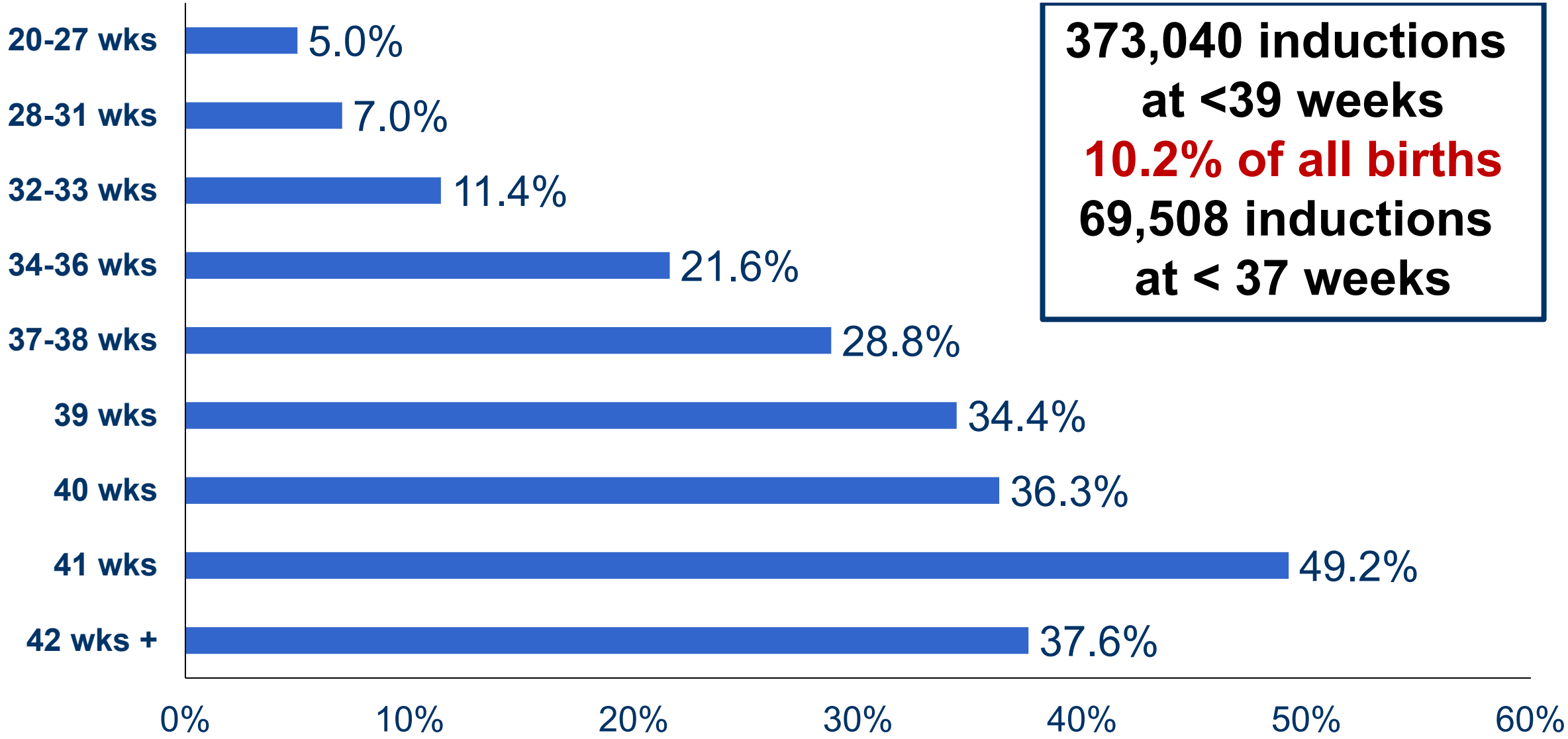
Induction of labor at 39 weeks in low-risk nulliparous women did not result in a significantly lower frequency of a composite adverse perinatal outcome, but it did result in a significantly lower frequency of cesarean delivery.

# 2018-20 Inductions Overall & at 39 Weeks by Month




Source: CDC Wonder

# Timing of inductions, U.S. 2021



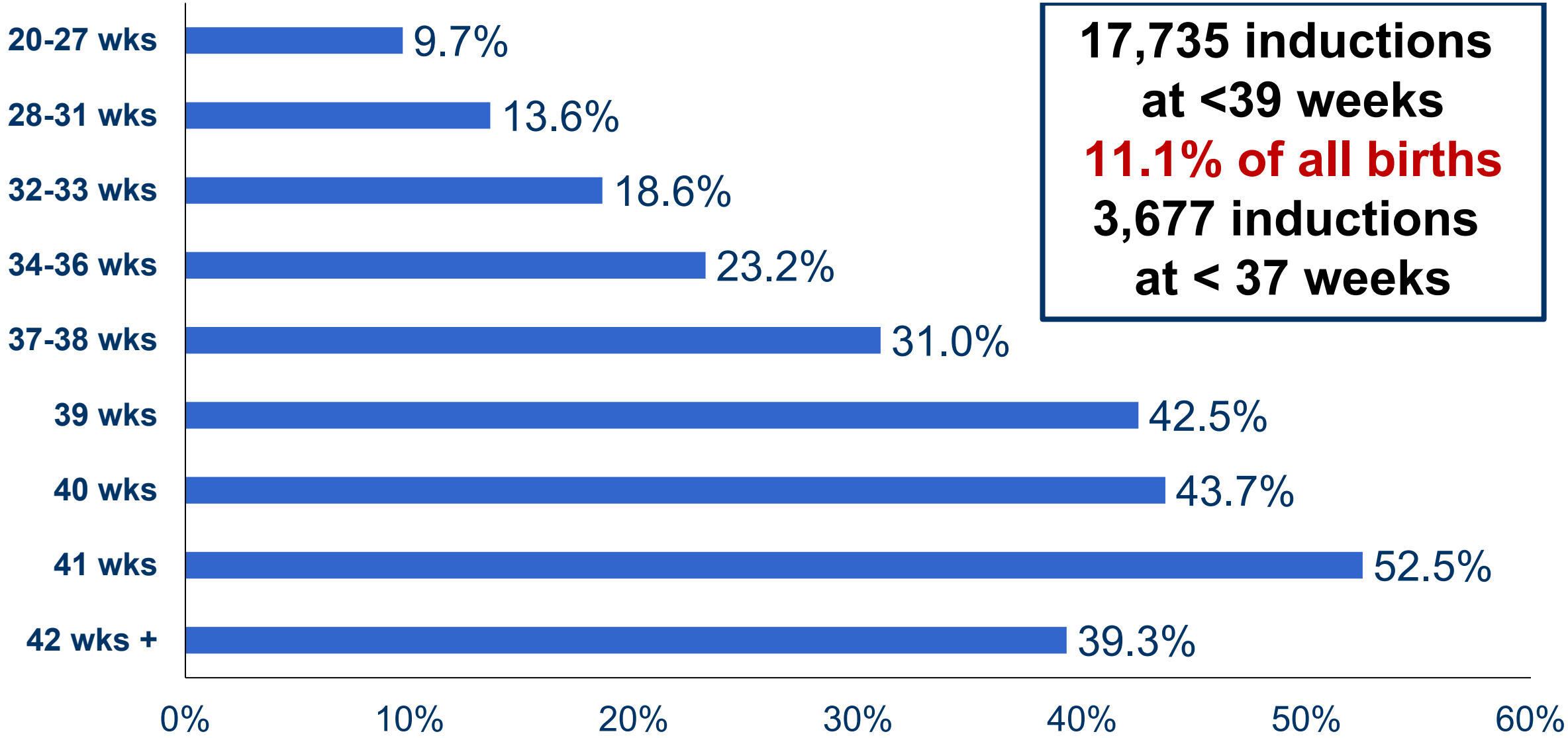

**373,040 inductions at <39 weeks**

**10.2% of all births**

**69,508 inductions at < 37 weeks**

Source: CDC Wonder

# Timing of inductions, TN, 2019-20

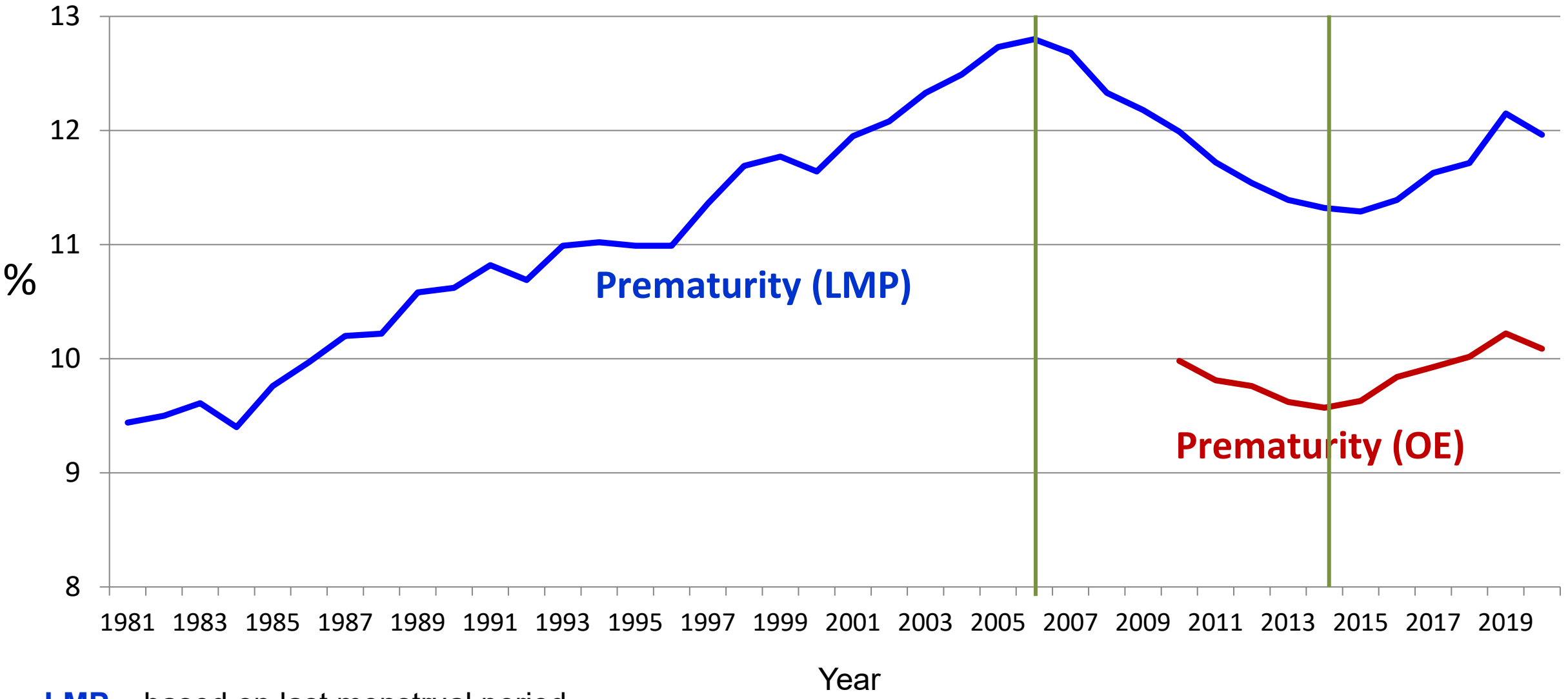



**17,735 inductions at <39 weeks**
**11.1% of all births**
**3,677 inductions at < 37 weeks**

***Why might this matter?***

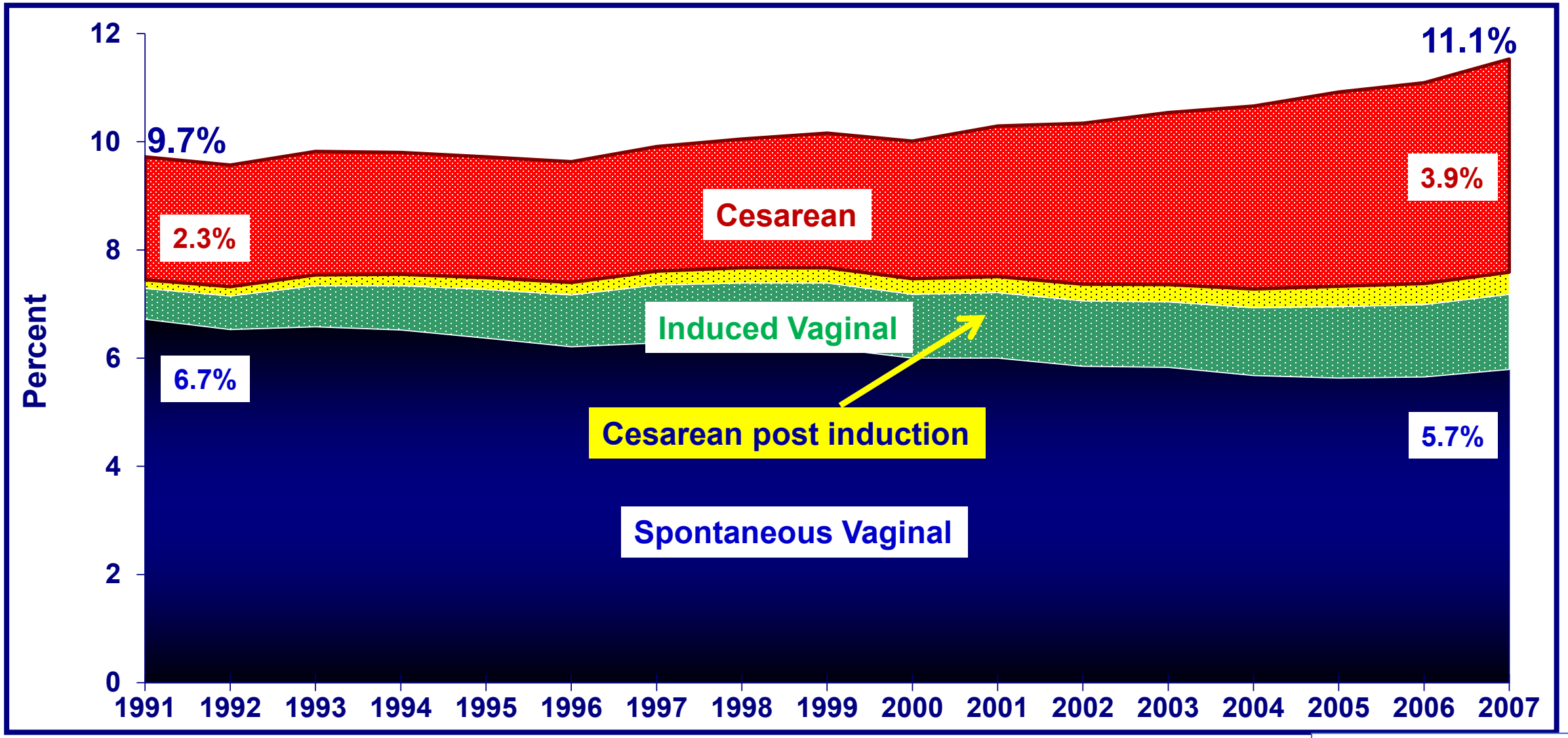
Source: CDC Wonder

# Prematurity(<37 weeks), U.S., 1981-2020



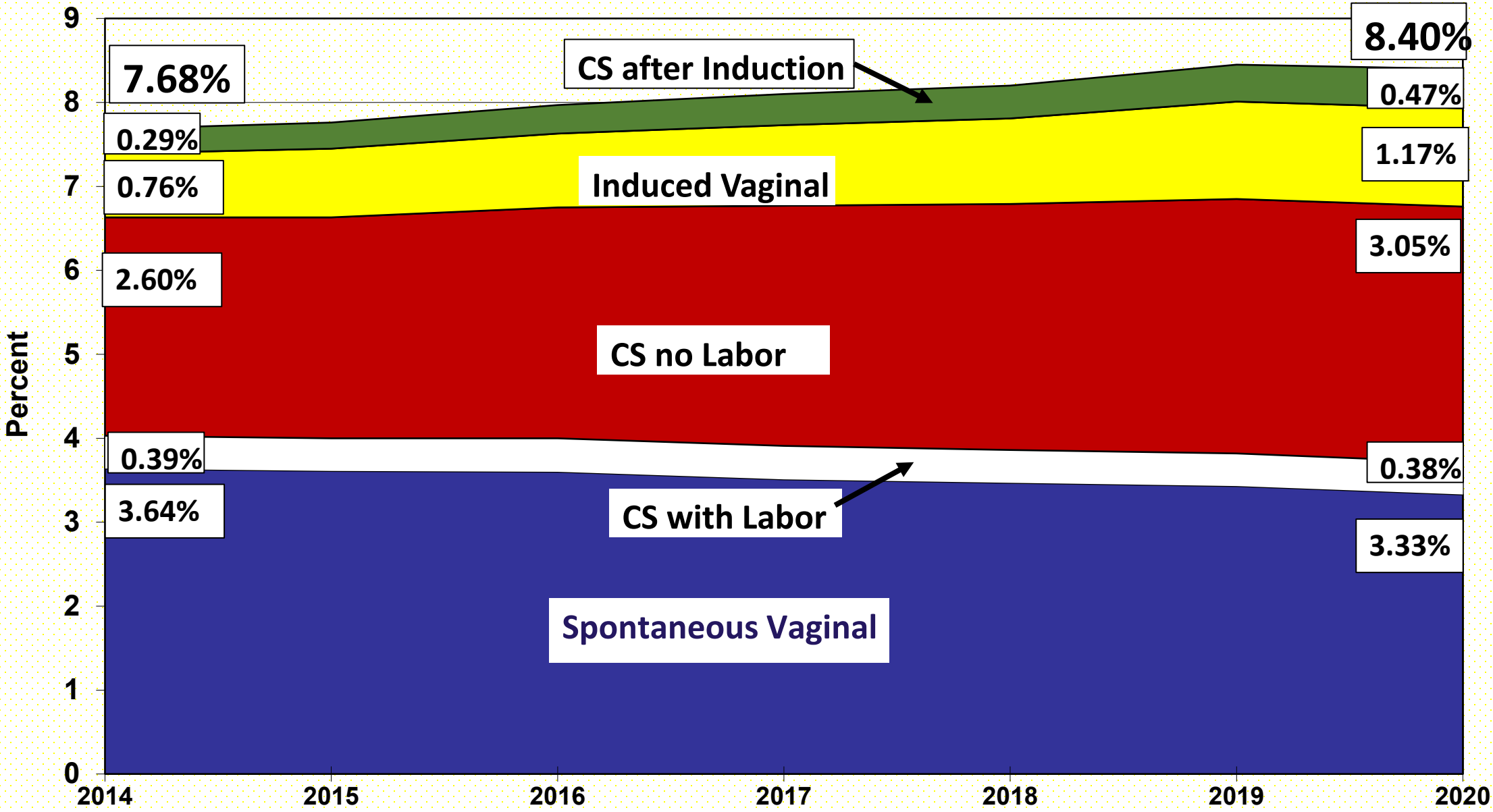

**LMP** – based on last menstrual period
**OE** – based on obstetric estimate

# Percent of singleton preterm (<37 weeks) births by method of delivery, United States, 1991-2007




Source: Adapted from MacDorman et al. AJPH, 2011.

# Percentage of singleton preterm births, out of total births, by method of delivery, U. S., 2014-2020

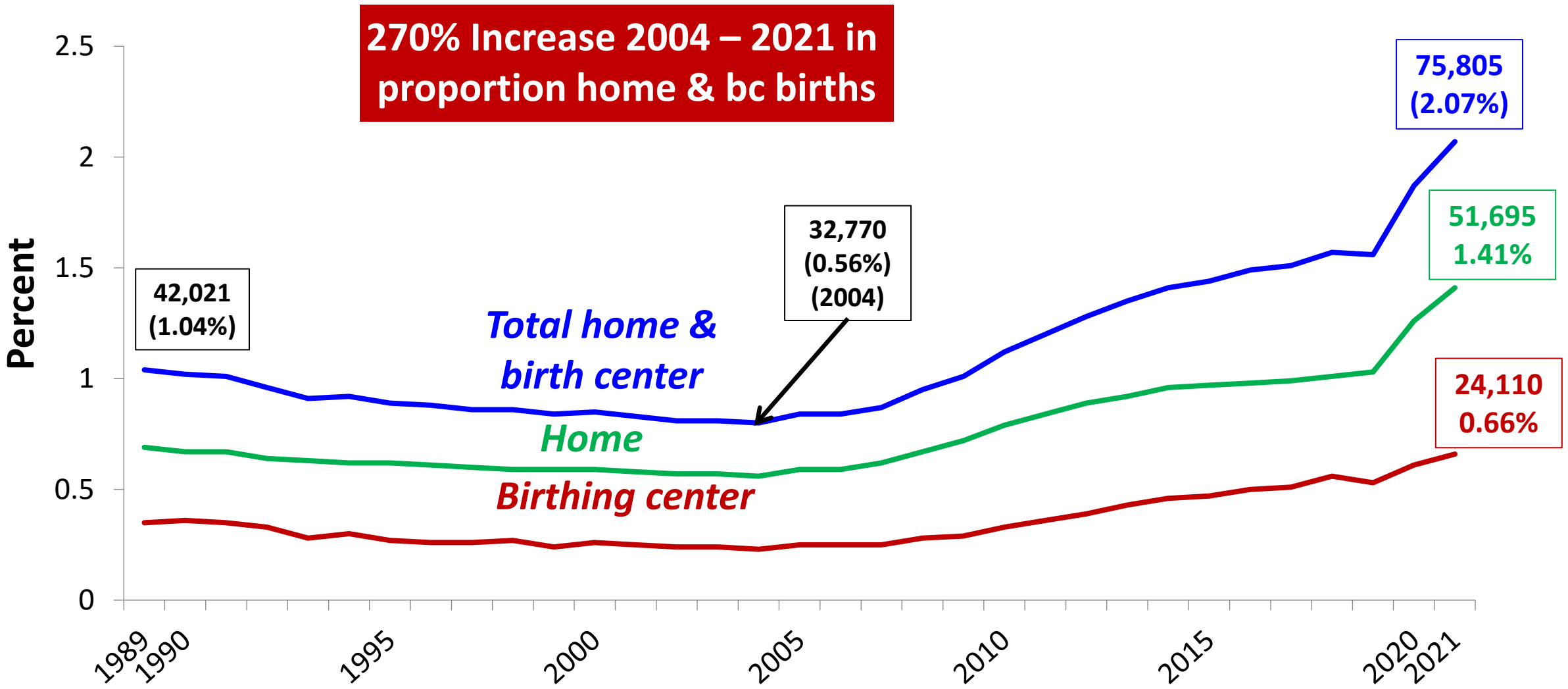



Source: Adapted from MacDorman PLOS One. 2022 Mar 30;17(3):e0265146..

BirthByTheNumbers.org

***Are women responding to the rise in medical interventions by voting with their feet when it comes to place of birth?***

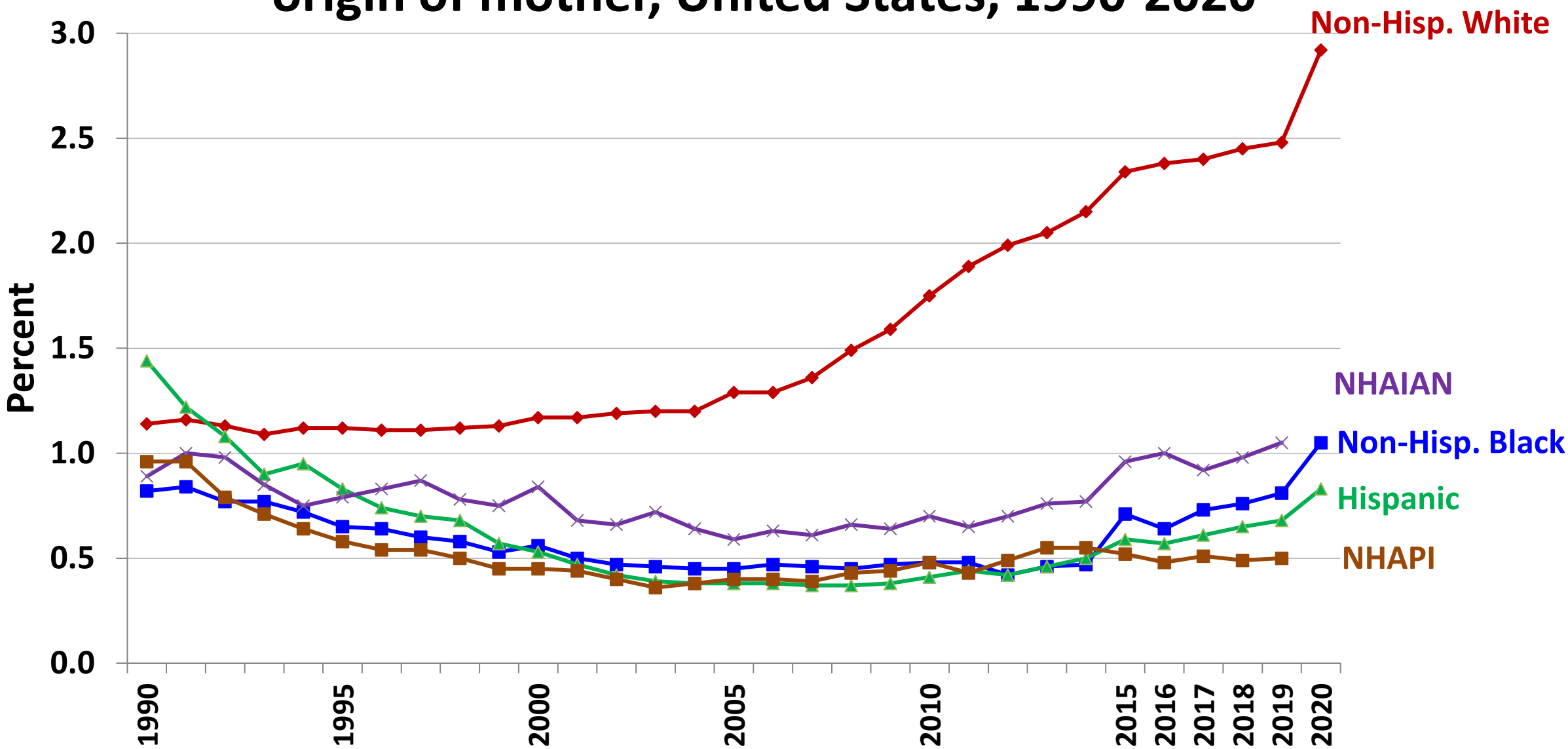
# Percent of all births at home, or in a birthing center, United States, 1989-2021




Source: NCHS Annual Birth Reports & CDC Wonder Datafile. https://wonder.cdc.gov/natality.html

www.BirthByTheNumbers.org

# Percentage of births occurring outside a hospital by race and Hispanic origin of mother, United States, 1990-2020




Notes. NHAPI - non-Hispanic Asian or Pacific Islander; NHAI/AN -- non-Hispanic American Indian/Alaskan Native;
Source: CDC Wonder Datafile. https://wonder.cdc.gov/natality.html

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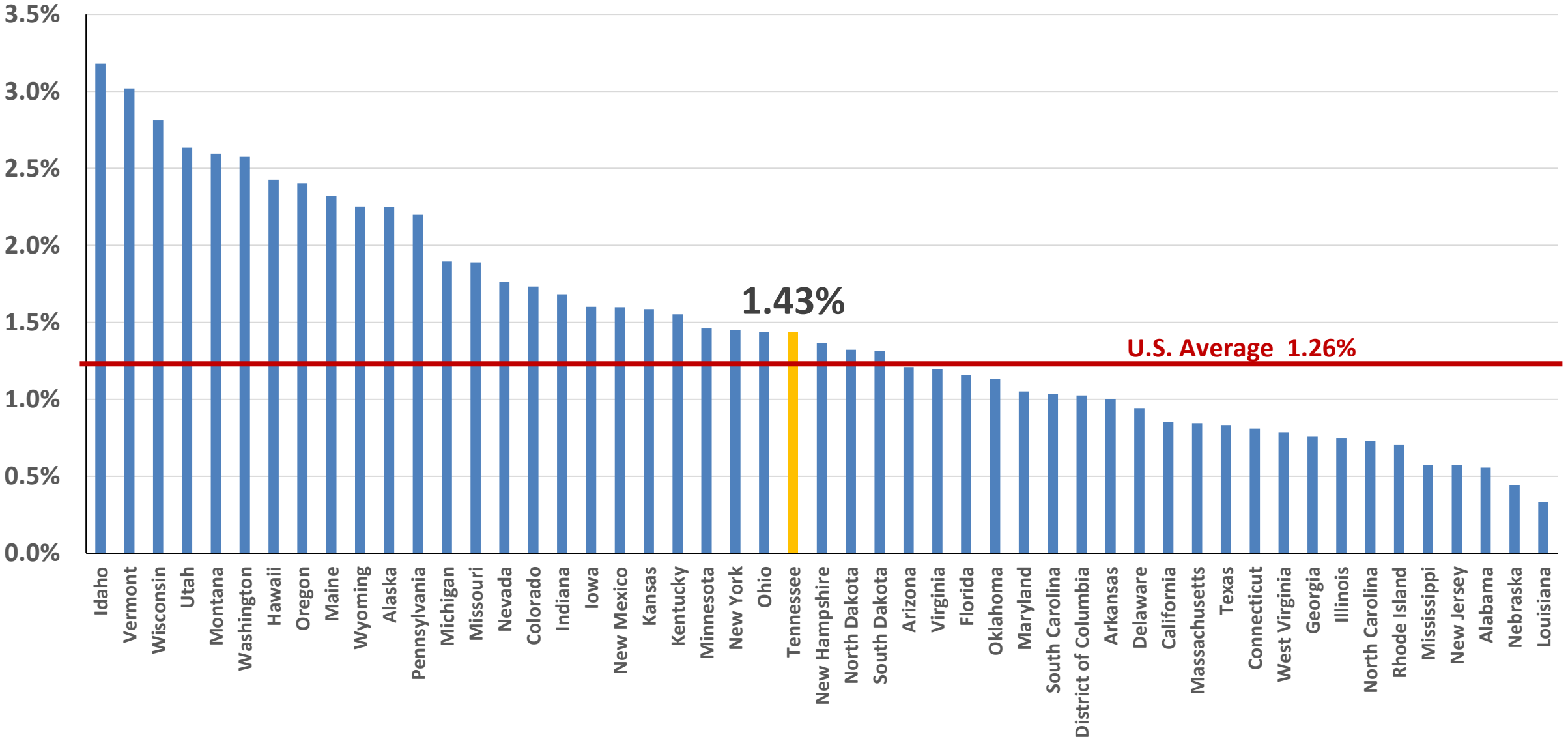
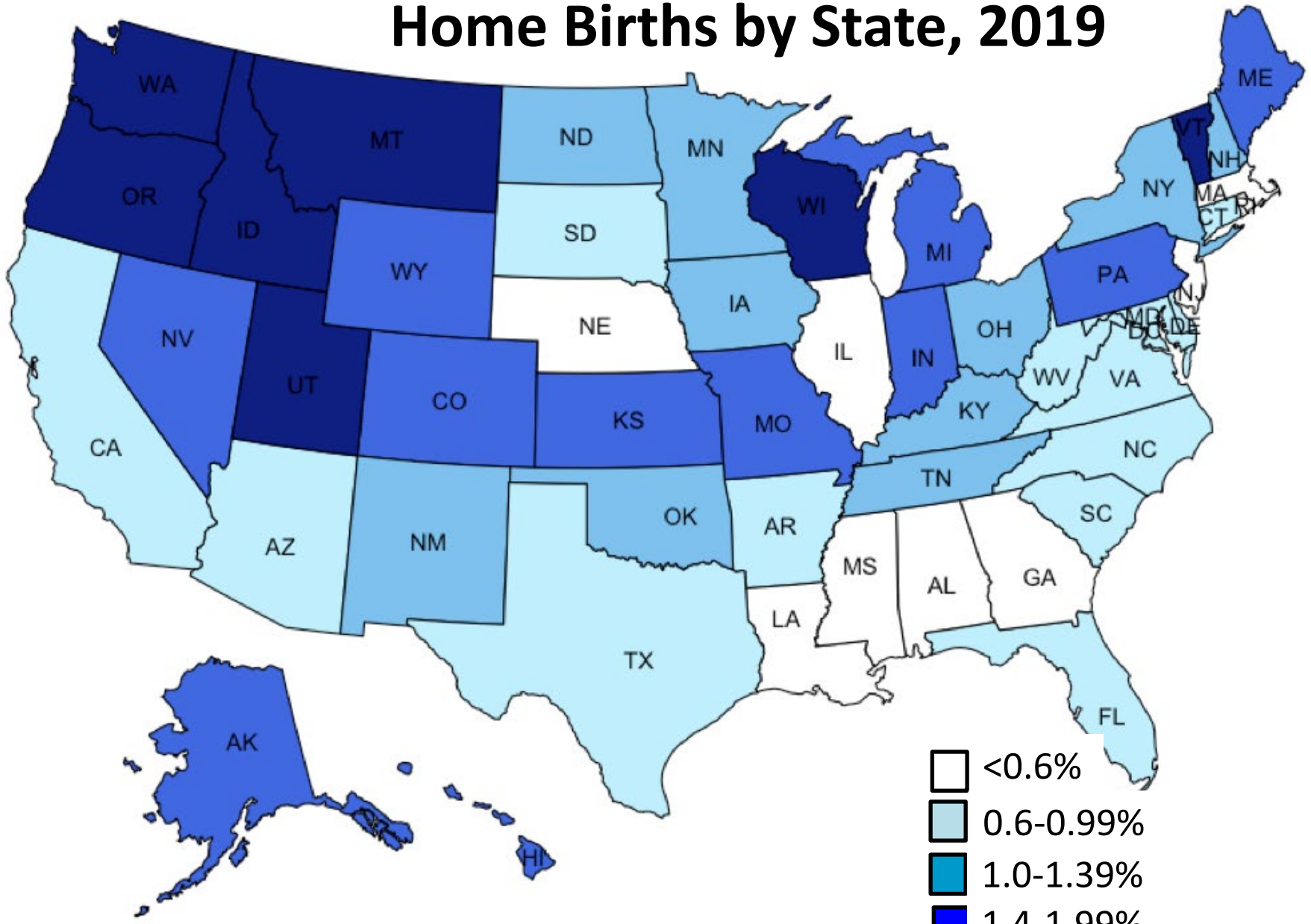
# Home Birth by States, 2020




Source: CDC Wonder Datafile. https://wonder.cdc.gov/natality.html

*www.BirthByTheNumbers.org*

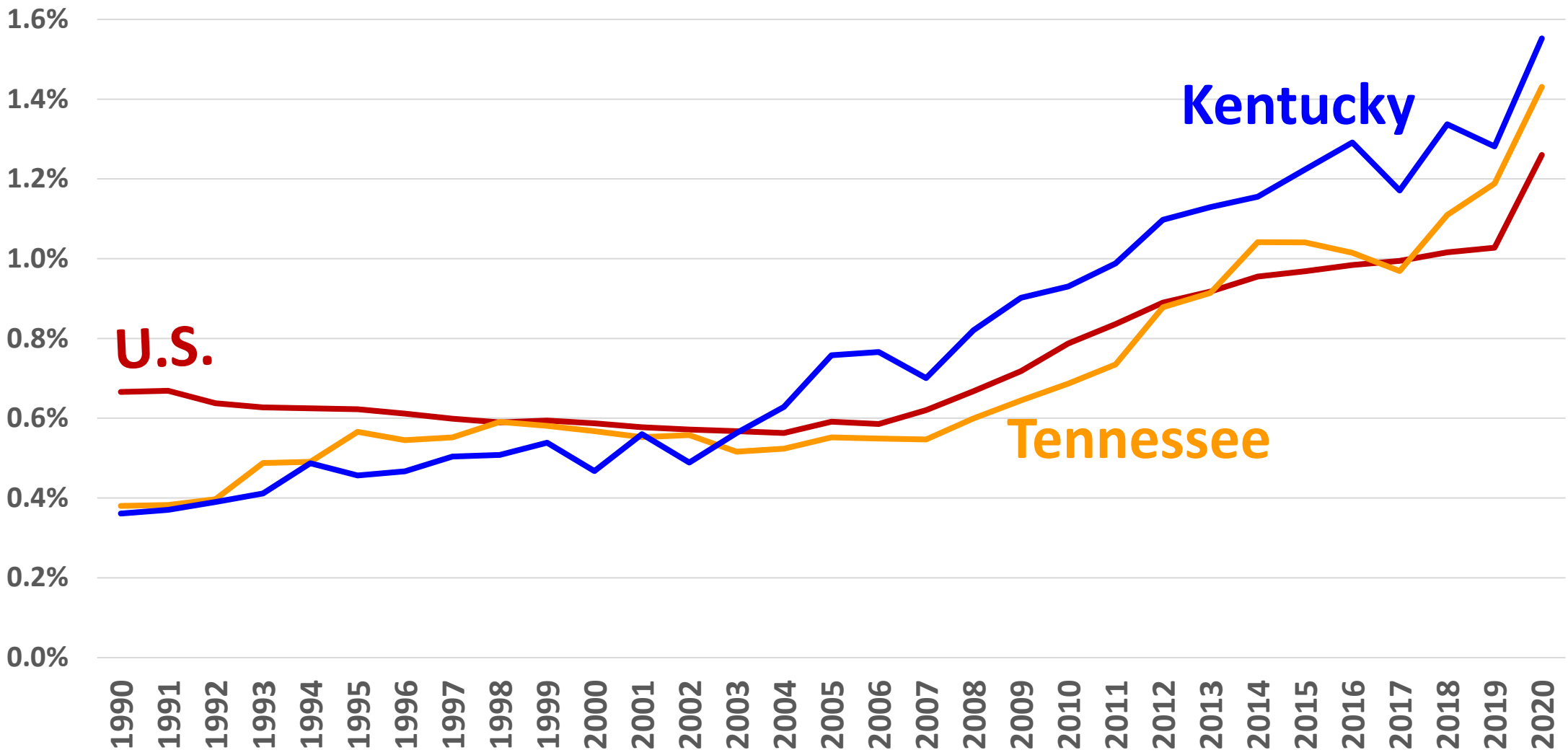
# Home Births by State, 2019




Legend <75% 75%-79.9% 80%-84.9% 85%-89.9% 90%+

www.birthbythenumbers.org

# Home Births, TN, KY, US, 1995-2020

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# Severe Maternal Morbidity

- If deaths are too rare to serve as a basis for policy and practice, can we identify and learn lessons from near death experiences?

- The problem with severe maternal morbidity

***"One searches where there is light"***

Goethe 1749–1832

Source: Barry. *The Great Influenza*. 2004 p. 71

# Considering Severe Maternal Morbidity

- *The "Textbook" definition of maternal morbidity:*
  - *"Condition directly caused by pregnancy, regardless of whether it manifests during or after pregnancy termination* [end]*."*

  ***Or….***

  - *"Condition that existed before pregnancy, but is exacerbated by pregnancy."*

  ***Or even….***

  - *"Condition whose causal relationship to pregnancy is undetermined." (but it occurred during or after pregnancy)*

*(Adams, Alexander, Kirby & Wingate, 2007)*

# Maternal Morbidity

- **How do you identify cases?**
  - **Diagnosis** of disease/condition (GDM, preeclampsia, depression, dehydration)
  - **Event** (stroke, seizure, hemorrhage, perineal tear, postpartum infection)
  - **Treatment/intervention** (blood transfusion, sutures, antibiotics, hydration therapy, etc…)

***Where would you find systematic data on these?***

| Severe maternal morbidity indicator | Diagnosis or procedure | ICD-9-CM code |
|---|---|---|
| Acute myocardial infarction | Diagnosis | 410.xx |
| Aneurysm | Diagnosis | 441.xx |
| Acute renal failure | Diagnosis | 584.5, 584.6, 584.7, 584.8, 584.9, 669.3x |
| Adult respiratory distress syndrome | Diagnosis | 518.5x, 518.81 518.82 518.84, 799.1 |
| Amniotic fluid embolism | Diagnosis | 673.1x |
| Cardiac arrest/ventricular fibrillation | Diagnosis | 427.41, 427.42, 427.5 |
| Disseminated intravascular coagulation | Diagnosis | 286.6, 286.9, 666.3x |
| Eclampsia | Diagnosis | 642.6x |
| Heart failure/arrest during surgery or procedure | Diagnosis | 997.1 |
| Puerperal cerebrovascular disorders | Diagnosis | 430.xx, 431.xx, 432.xx, 433.xx, 434.xx, 436.xx, 437.xx, 671.5x, 674.0x, 997.02 |
| Pulmonary edema/acute heart failure | Diagnosis | 518.4, 428.1, 428.0, 428.21, 428.23, 428.31, 428.33, 428.41, 428.43 |
| Severe anesthesia complications | Diagnosis | 668.0x, 668.1x, 668.2x |
| Sepsis | Diagnosis | 038.xx, 995.91, 995.92, 670.2x |
| Shock | Diagnosis | 669.1x, 785.5x, 995.0, 995.4, 998.0x |
| Sickle cell disease with crisis | Diagnosis | 282.42, 282.62, 282.64, 282.69 |
| Air and thrombotic embolism | Diagnosis | 415.1x, 673.0x, 673.2x, 673.3x, 673.8x |
| Blood transfusion | Procedure | 99.0x |
| Conversion of cardiac rhythm | Procedure | 99.6x |
| Hysterectomy | Procedure | 68.3x–68.9x |
| Temporary tracheostomy | Procedure | 31.1 |
| Ventilation | Procedure | 93.90, 96.01, 96.02, 96.03, 96.05 |

OBSTETRICS

## Severe maternal morbidity and comorbid risk in hospitals performing <1000 deliveries per year

Mark P. Hehir, MD, MBA, MRCPI; Cande V. Ananth, PhD, MPH; Jason D. Wright, MD; Zainab Siddiq, MS; Mary E. D'Alton, MD; Alexander M. Friedman, MD, MPH

## Evaluating Iowa Severe Maternal Morbidity Trends and Maternal Risk Factors: 2009–2014

Brittni N. Frederiksen[1,2,7] · Catherine J. Lillehoj[3] · Debra J. Kane[1,4] · Dave Goodman[5] · Kristin Rankin[6]

## The impact of socioeconomic position on severe maternal morbidity outcomes among women in Australia: a national case–control study

A Lindquist,[a,b,*] N Noor,[a,*] E Sullivan,[c] M Knight[a]

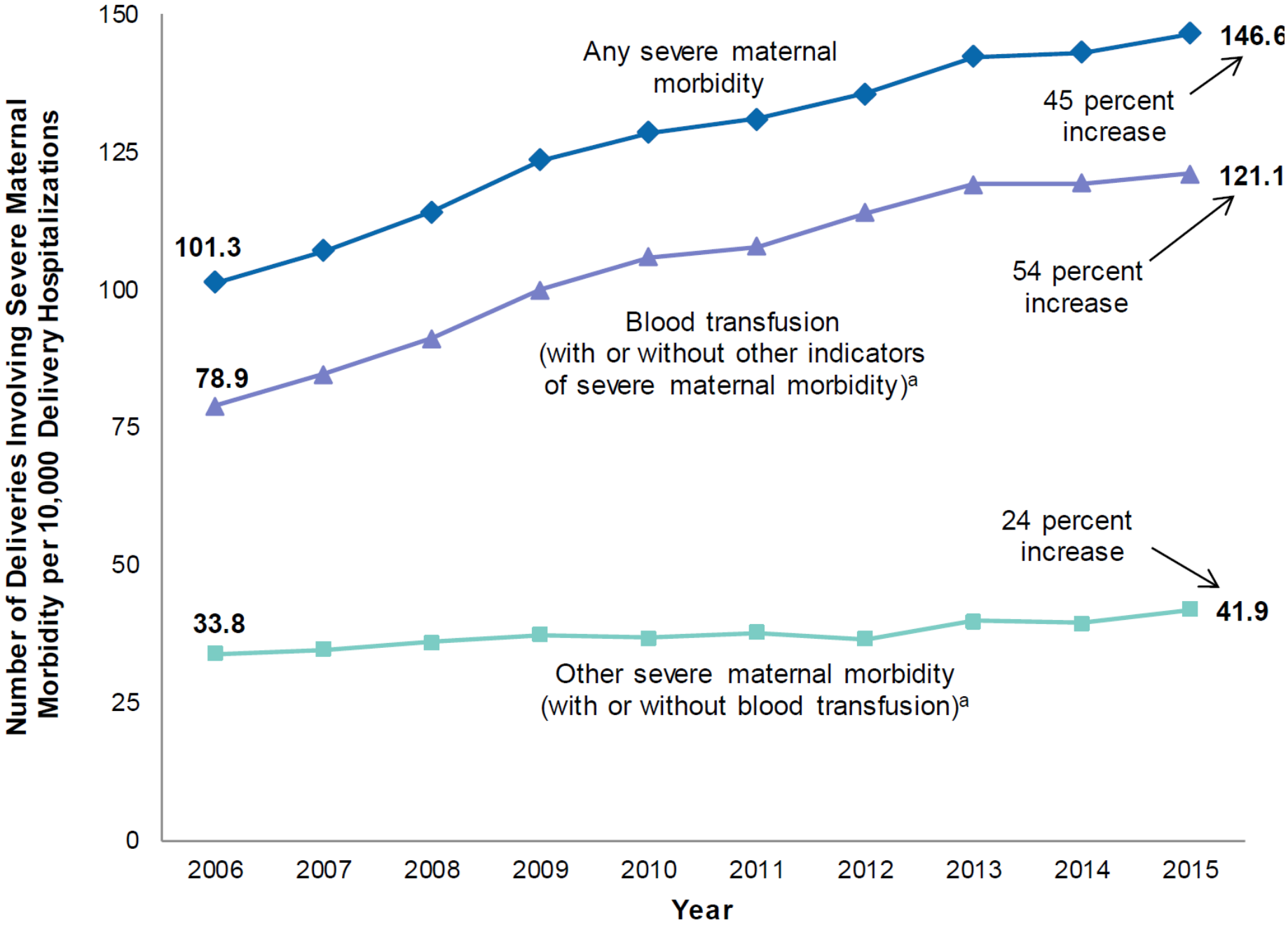
## Severe Maternal Morbidity Associated With Maternal Birthplace: A Population-Based Register Study

Marcelo L. Urquia, PhD;[1,2,3] Susitha Wanigaratne, PhD;[2,3] Joel G. Ray, MD, MSc;[3,4] K. S. Joseph, MD, PhD[5,6]

## Severe Maternal Morbidity and the Use of Assisted Reproductive Technology in Massachusetts

*Candice Belanoff, ScD, MPH, Eugene R. Declercq, PhD, Hafsatou Diop, MD, MPH, Daksha Gopal, MPH, Milton Kotelchuck, PhD, MPH, Barbara Luke, ScD, MPH, Thien Nguyen, MPH, and Judy E. Stern, PhD*

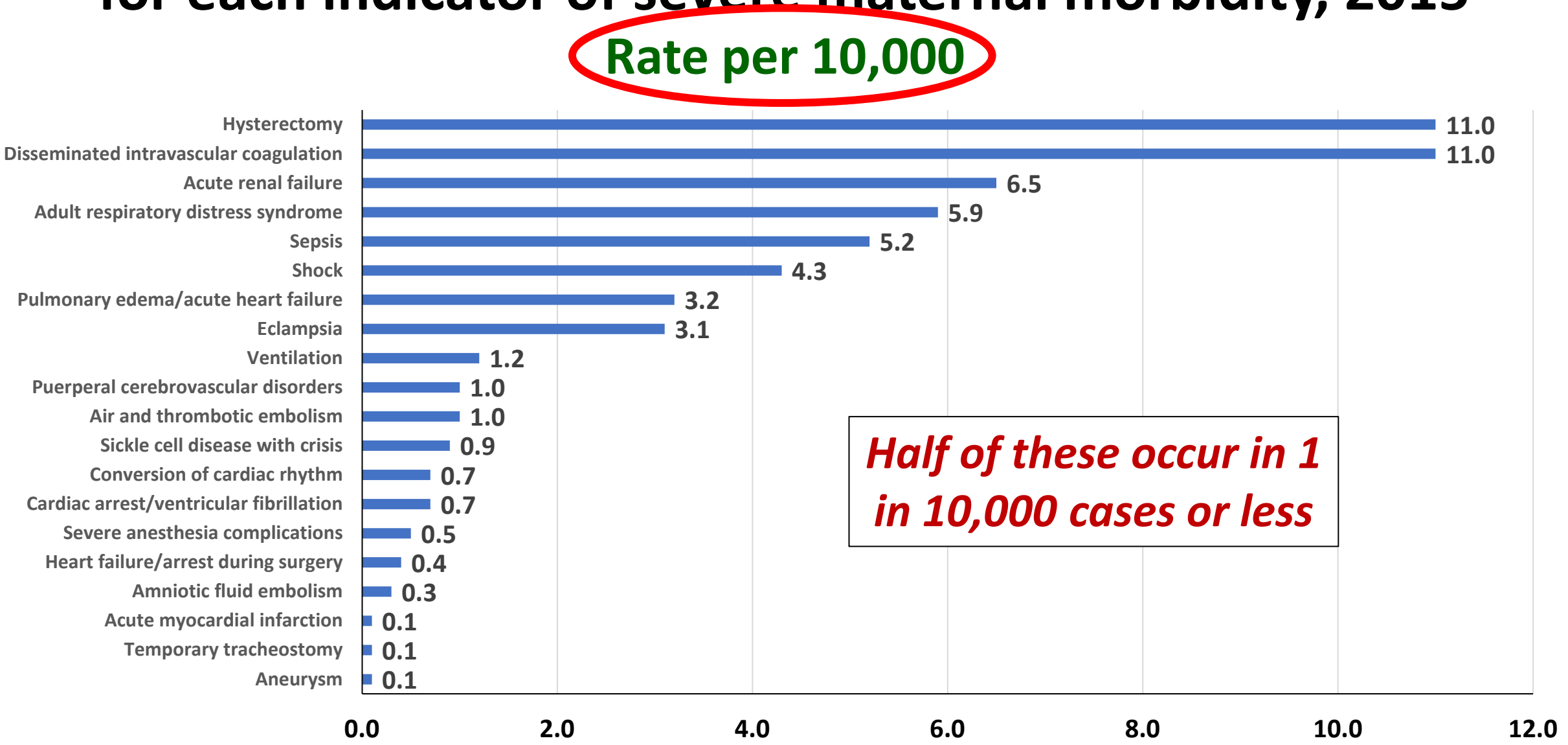
# Contemporary Studies of Maternal Morbidity




# Trends in delivery hospitali-zations involving severe maternal morbidity, 2006–2015

Source: Fingar K. Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006–2015. HCUP Stat Brief #243. Sept., 2018.

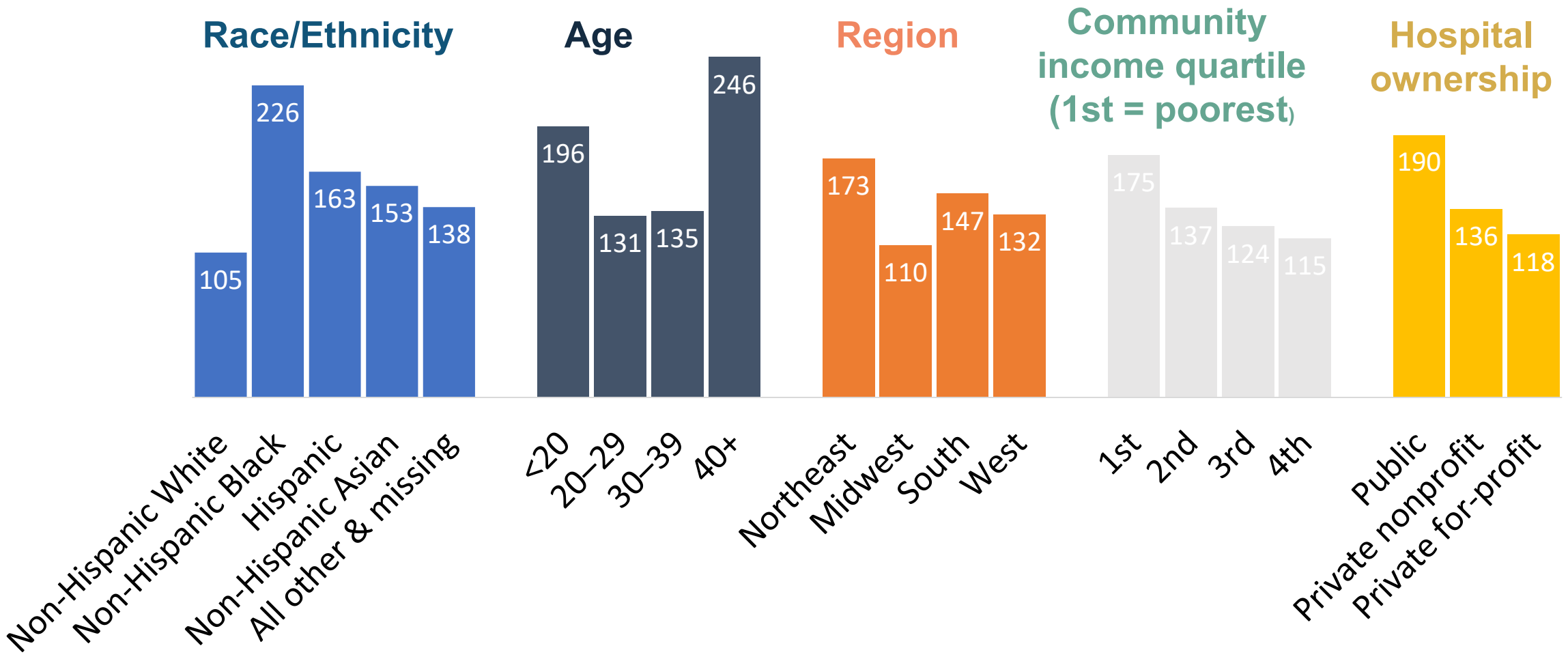
# Delivery hospitalizations involving severe maternal morbidity, for each indicator of severe maternal morbidity, 2015




Source: Fingar K. Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006–2015. HCUP Stat Brief #243. Sept., 2018.

# There are strong relationships between SMM & race/ethnicity, age, region, community-level income, and hospital type.

*Severe maternal morbidity per 10,000 births, 2016–17*

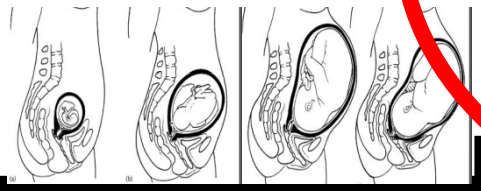



Data: Clare C. Brown et al., "Associations Between Comorbidities and Severe Maternal Morbidity," *Obstetrics and Gynecology* 136, no. 5 (Nov. 2020): 892–901.



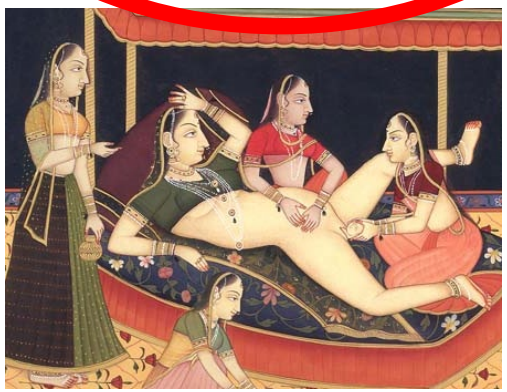
Source: Eugene Declercq and Laurie Zephyrin, *Severe Maternal Morbidity in the United States: A Primer* (Commonwealth Fund, Oct. 2021).

# Rethinking the Scope of Maternal Morbidity



## Peripartum

**Morbidities occurring during labor & delivery**



## Antepartum

**Morbidities caused by or exacerbated during pregnancy**

## Postpartum

**Morbidities occurring or persisting into the time after delivery (up to 12 mos.)**

# Rethinking the Scope of maternal morbidity

***Note**: These are <u>all unlikely</u> to happen to **you**. Especially the really bad ones…..*


- **Hyperemesis/dehydration**
- **Periodontal disease**
- **Depression**
- **Dermatologic issues**
- **Bleeding/PROM**
- **Ectopic pregnancy**
- **Cervical "incompetence"**
- **Placental issues (acrecia/previa)**
- **Gestational diabetes**
- **Pregnancy-related hypertension**
- **Infection (UTI/yeast)**
- **Anemia**
- **Violence**

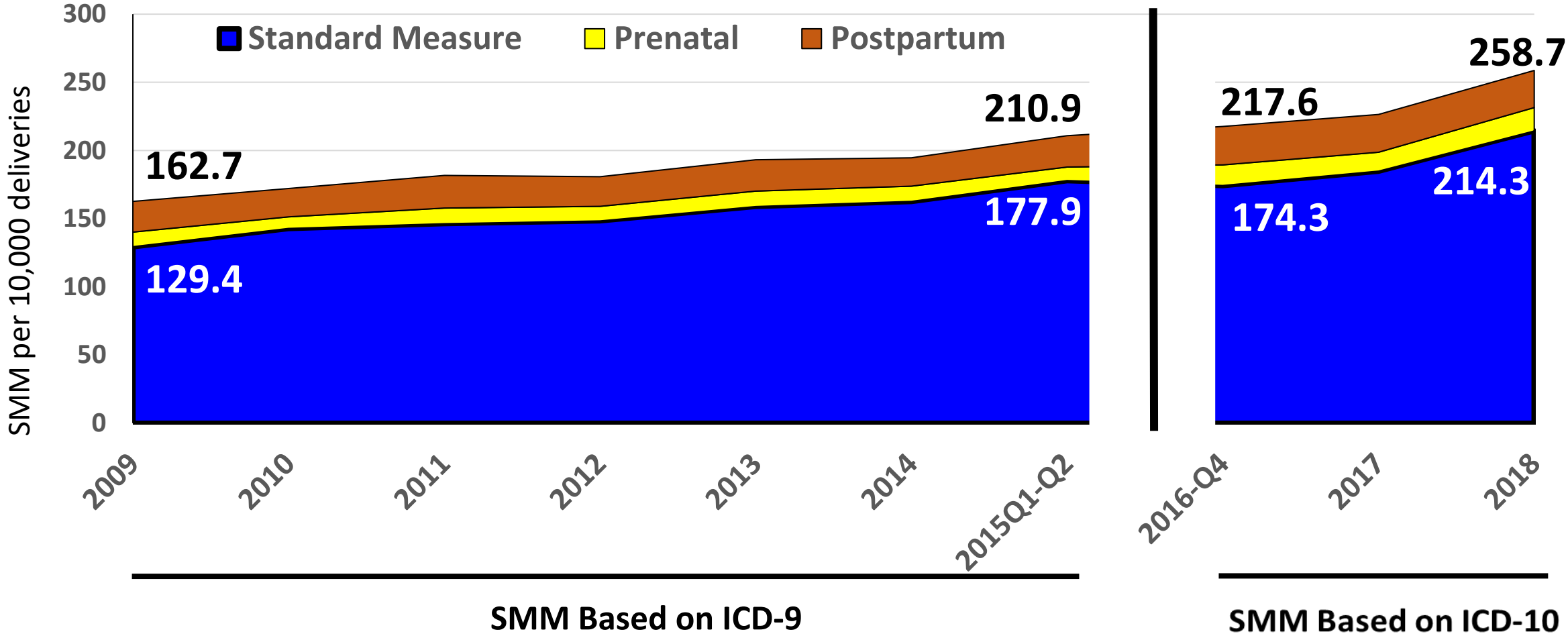
- **Hemorrhage**
- **Birth injuries (vaginal or related to c-sec)**
- **Uterine rupture**
- **Hysterectomy**
- **Preeclampsia/ Eclampsia**
- **Cardiovascular event**
- **Pulmonary embolism**
- **Puerpural infection (e.g. Chorioamnionitis)**

- **Postpartum Depression**
- **Exhaustion/sleep deprivation**
- **Post-delivery infection**
- **Complications related to cesarean delivery**
- **Pelvic injuries (longer term consequences of)**
- **Anemia**
- **Violence**

***We need to consider 2 more factors concerning severe maternal morbidity***

# (1) Frequency of severe morbidities outside of the birth hospitalization? (21% more cases)

## *Severe Maternal Morbidity (per 10,000 deliveries), by Timing, Mass. 2009-18*




Source: Declercq et al. *Obstet Gynecol* 2022;139:165–71

www.birthbythenumbers.org

# **(2) Mothers' voices** – what are the problems they face from *their perspective*? (often don't involve hospitals)

Table 4. Mothers' experience of selected new-onset health problems in first two months and at six months or more after birth

| Base: all mothers eligible for question (see notes) | In first two months | | | Problem persisted to six months or more |
|---|---|---|---|---|
| | Major new problem | Minor new problem | Major/minor new problem | |
| **Vaginal only*** | | | | |
| Painful perineum *n=1656* | 11% | 30% | 41% | 7% |
| Infection from cut or torn perineum *n=1656* | 5% | 13% | 18% | 4% |
| **Cesarean only** (base varies) | | | | |
| Pain at site of cesarean incision *n=744** | 19% | 39% | 58% | 16% |
| Infection at site of cesarean incision *n=744** | 8% | 16% | 24% | 5% |

Source: Declercq E et al. *Listening to Mothers III: New Mothers Speak Out*. 2013

# Learning from Listening to Mothers

## How much did pain interfere with your routine activities?

| | In two months after birth<br>Base: all initial *LTM III* mothers | | |
|---|---|---|---|
| | Vaginal<br>*n=1656* | Cesarean<br>*n=744* | All<br>*n=2400* |
| Extremely | 3% | 10% | 4% |
| Quite a bit | 6% | 16% | 7% |
| Moderately | 21% | 25% | 22% |
| A little bit | 43% | 36% | 42% |
| Not at all | 27% | 14% | 24% |

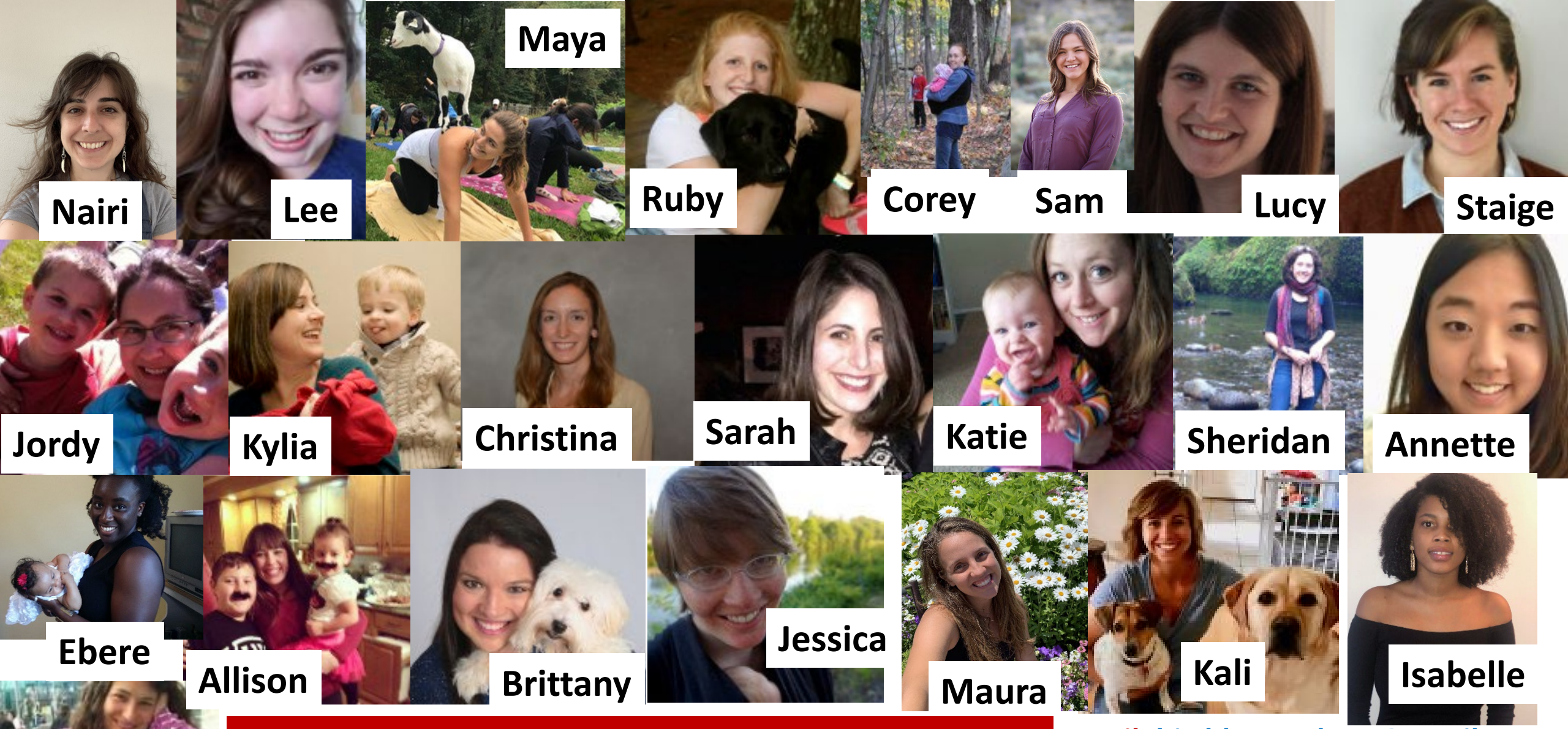
Source: Declercq E et al. *Listening to Mothers III: New Mothers Speak Out*. 2013

# *Lessons from Severe Maternal Morbidity*

- *The popular CDC definition, focusing on birth hospitalizations, is too narrow to really capture challenges we now face in childbirth and women's health care.*

- *Even with the narrow definition, including prenatal and postpartum experiences suggests a much larger scope of the problem.*

- *These are still hospital based and don't capture ambulatory care or the life experiences of pregnant women and new parents.*

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