



Maternal Intensive Care Unit Utilization by Mode of Delivery in the United States: a retrospective cohort study



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Background:

Increased understanding of obstetric ICU utilization can improve resource allocation

Range of incidence for maternal ICU admission (150-4,000 per 100,000 live births)

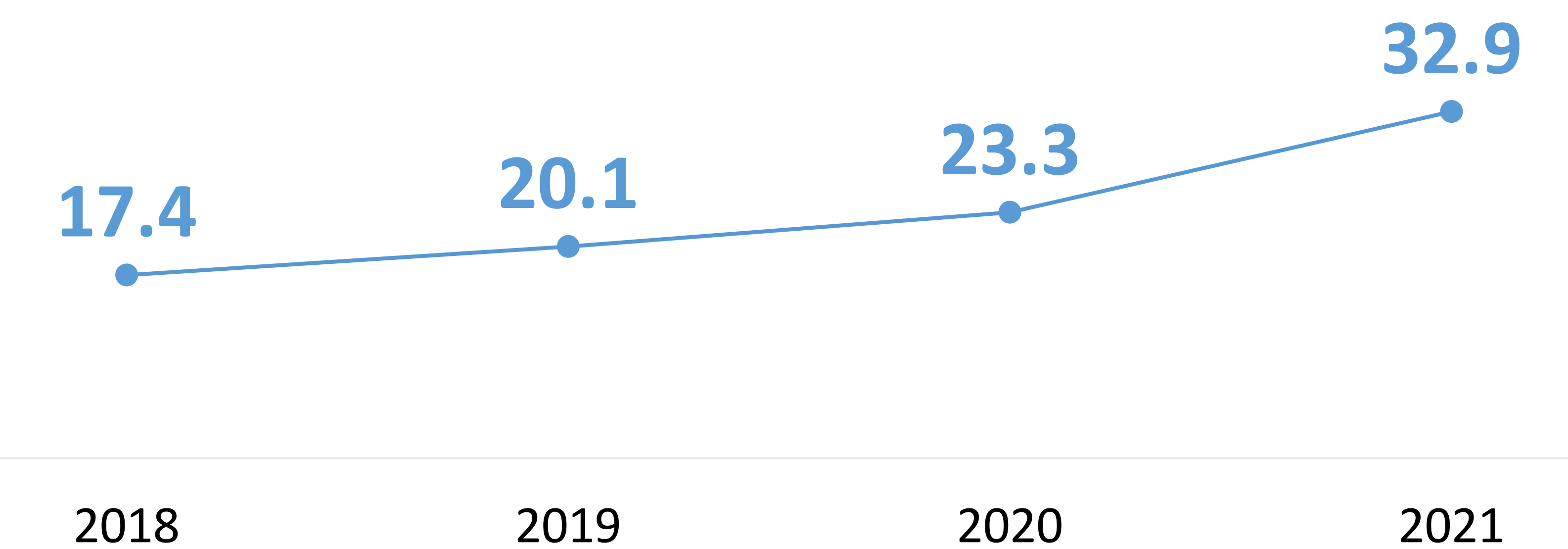
Study Aims:

1. Determine rates of ICU admission by mode of delivery
2. Describe severe maternal morbidity (SMM) events in ICU patients

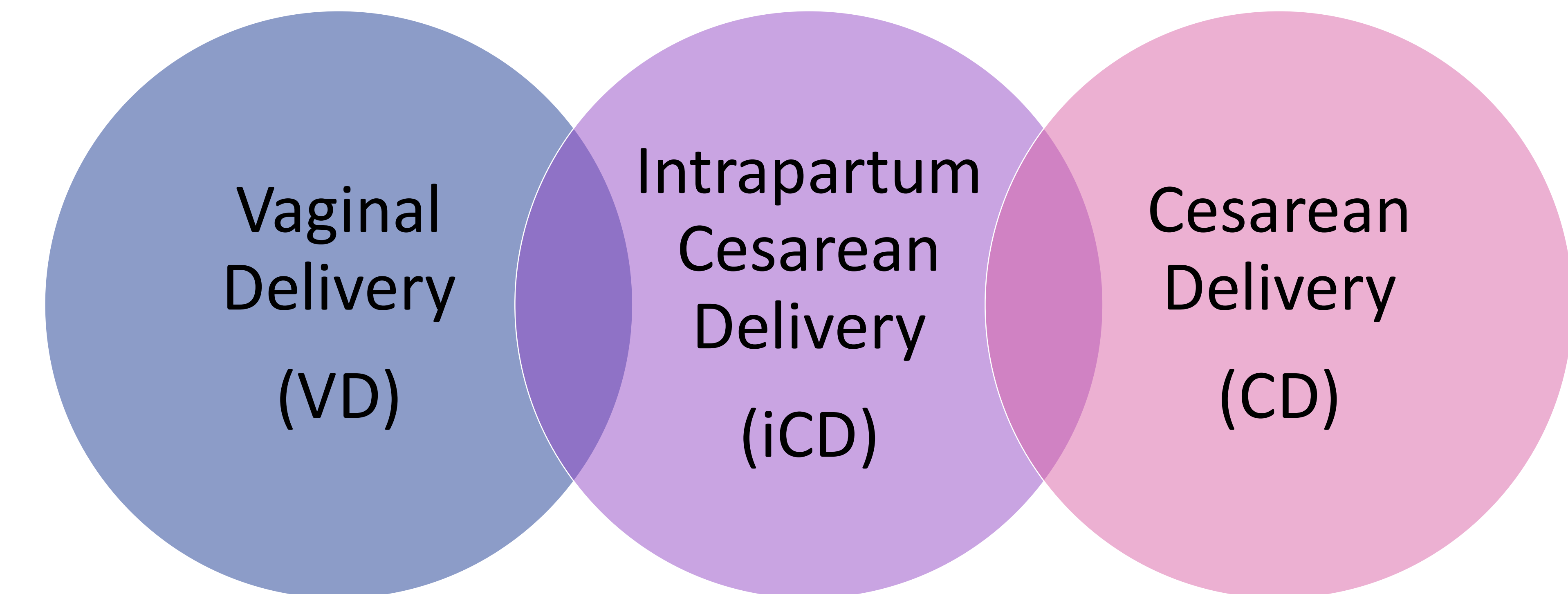
Hypothesis:

The highest need for ICU care during a delivery hospitalization is among patients who require intrapartum cesarean deliveries (iCD)

MATERNAL MORTALITY RATE IN THE US
per 100,000 live births (CDC¹)



Mode of Delivery



1. Hoyert DL. Maternal mortality rates in the United States, 2021. NCHS Health E-Stats. 2023. DOI: <https://dx.doi.org/10.15620/cdc:124678>

Methods

Retrospective Cohort Study

Premier Database: Delivery hospitalizations Oct 2015-Dec 2020

Statistical Analysis: Multivariable logistic regression analysis to examine the association of mode of delivery with ICU admission

Exposure: Mode of delivery

Outcome: Admission to ICU during delivery hospitalization

Covariates:

- Patient and hospital characteristics
- Payor status
- Location of care
- Comorbidities
- Transfusion of ≥ 4 pRBC

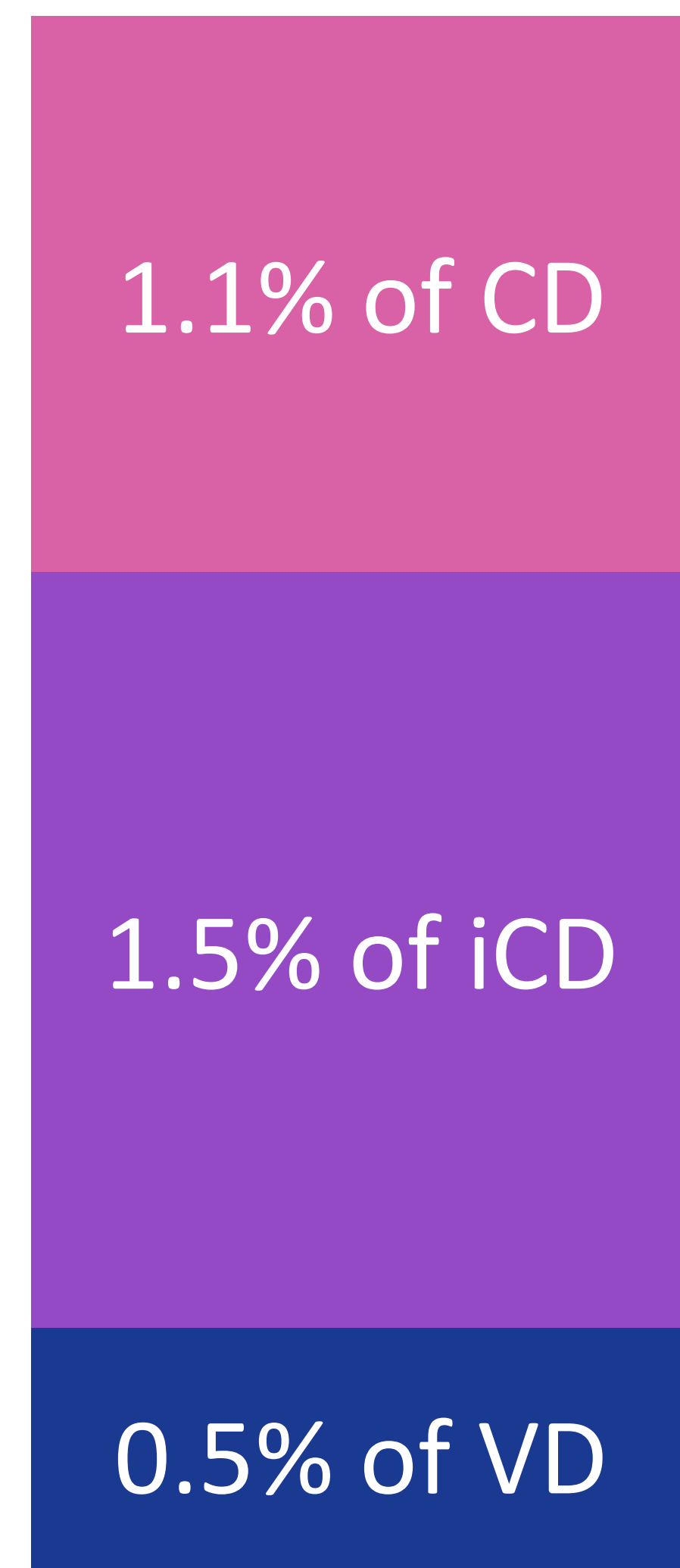
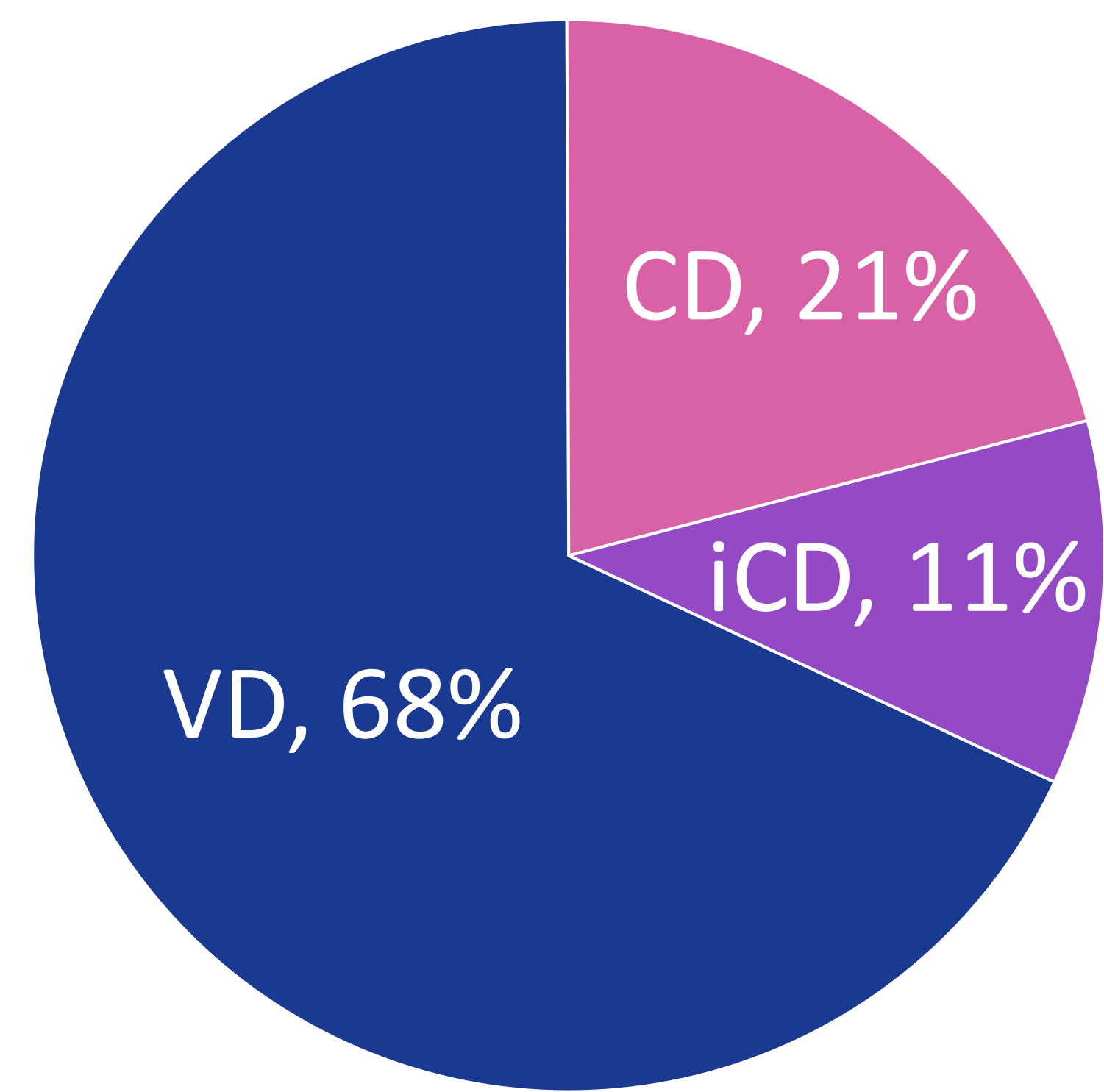
Descriptive analysis of the rate of SMM events by mode of delivery as a surrogate for ICU admission indication

CDC Severe Maternal Morbidity Indicators

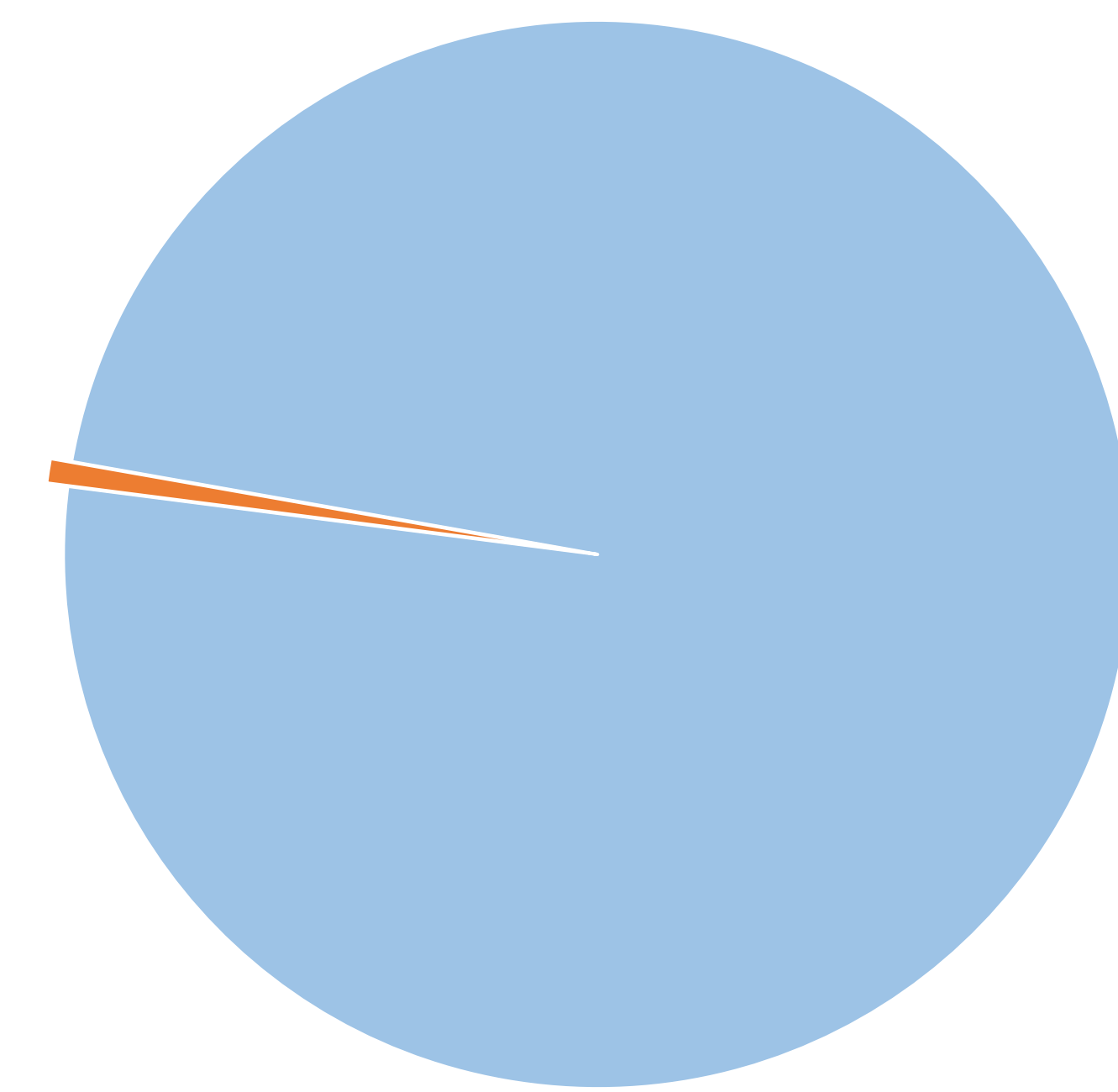
- Acute myocardial infarction
- Dissection
- Acute renal failure
- Acute respiratory distress syndrome
- Amniotic fluid embolism
- Cardiac arrest
- Ventricular fibrillation
- Conversion of cardiac rhythm
- Disseminated intravascular coagulation
- Heart failure or arrest during procedure or surgery
- Puerperal cerebrovascular disorders
- Pulmonary edema
- Acute heart failure
- Severe anesthesia complications
- Sepsis
- Shock
- Sickle cell disease with crisis
- Air and thrombotic embolism
- Hysterectomy
- Temporary tracheostomy
- Ventilation
- Blood Transfusion

Results

Database of 4.8 Million Delivery Hospitalizations



35,837 patients (<0.1%) required ICU admission



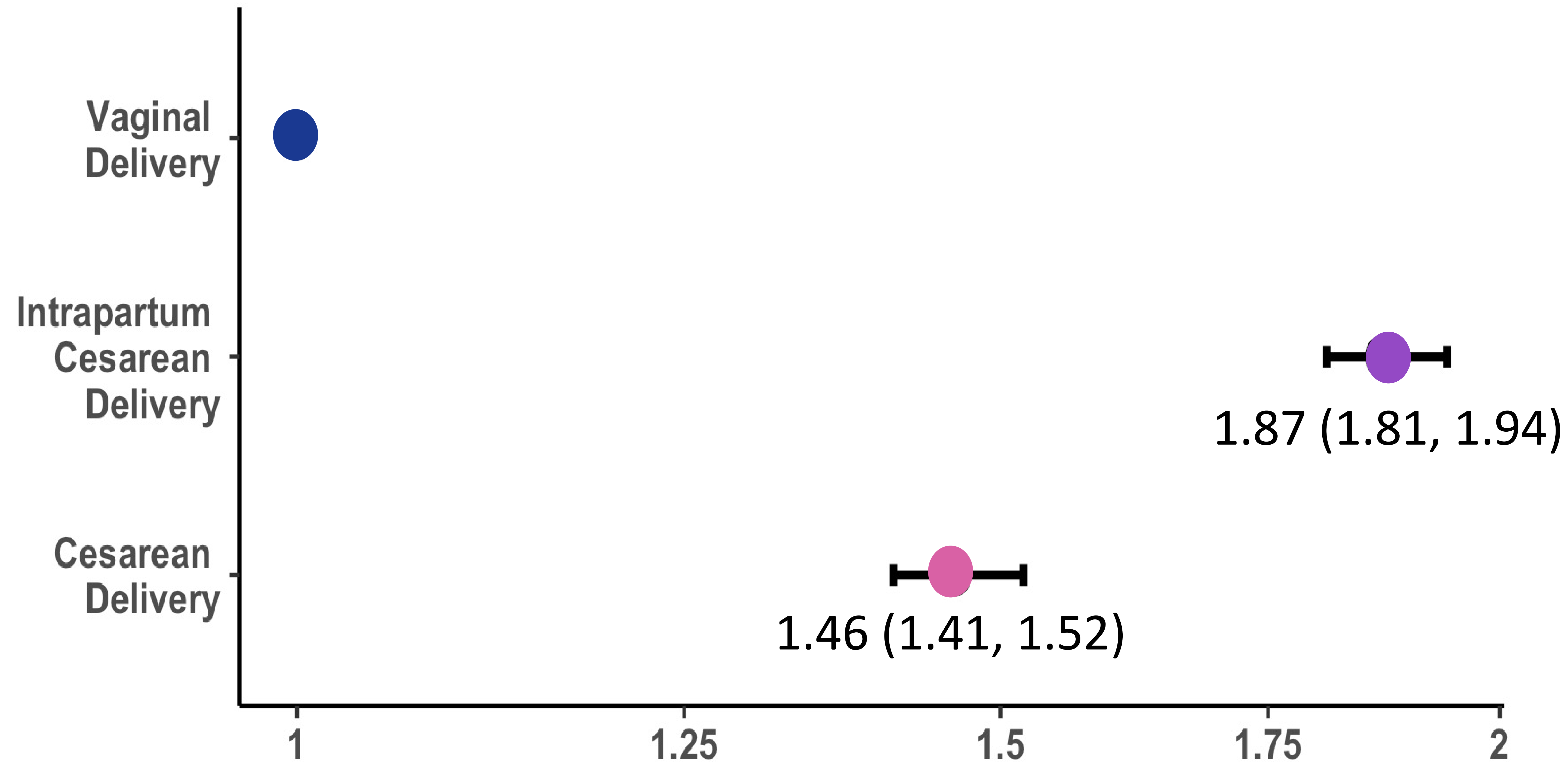
Premier Healthcare Database

(October 1, 2015-December 31, 2020)

	Vaginal Delivery n=3,261,071	Intrapartum CD n=539,670	Cesarean Delivery n=988,932
Patient Characteristics			
Age, years	28 [24, 32]	29 [24, 33]	31 [27, 35]
Race			
Asian	150100 (4.6%)	27012 (5.0%)	42013 (4.2%)
Black	457902 (14.0%)	100419 (18.6%)	142606 (14.4%)
Other	439264 (13.5%)	70848 (13.1%)	126162 (12.8%)
Unknown	140249 (4.3%)	23455 (4.3%)	39024 (3.9%)
White	2073556 (63.6%)	317936 (58.9%)	639127 (64.6%)
Ethnicity			
Hispanic	519176 (15.9%)	79015 (14.6%)	167075 (16.9%)
Non-Hispanic	2134639 (65.5%)	357625 (66.3%)	647645 (65.5%)
Unknown	607256 (18.6%)	103030 (19.1%)	174212 (17.6%)
Hospital Characteristics			
Urban hospital	2869242 (88.0%)	480920 (89.1%)	868771 (87.8%)
Teaching hospital	1535663 (47.1%)	270541 (50.1%)	459562 (46.5%)
Region of country			
Midwest	731655 (22.4%)	111539 (20.7%)	198267 (20.0%)
Northeast	466567 (14.3%)	85917 (15.9%)	135800 (13.7%)
South	1457671 (44.7%)	253232 (46.9%)	491316 (49.7%)
West	605178 (18.6%)	88982 (16.5%)	163549 (16.5%)

Results

Risk of ICU Admission by Mode of Delivery: Odds Ratio (95% CI)



Comorbidities associated with increased odds of ICU admission

Transfusion pRBC \geq 4 units	116.33 (110.30, 122.68)
Cardiomyopathy	18.46 (16.71, 20.40)
Preeclampsia w/ SF	6.72 (6.48, 6.97)
Pulmonary hypertension	6.53 (5.17, 8.25)
Arrhythmia	3.99 (3.60, 4.43)
Placenta accreta spectrum	3.90 (3.46, 4.39)
Preterm birth	3.55 (3.45, 3.66)
Chronic renal disease	2.48 (2.24, 2.75)

Results

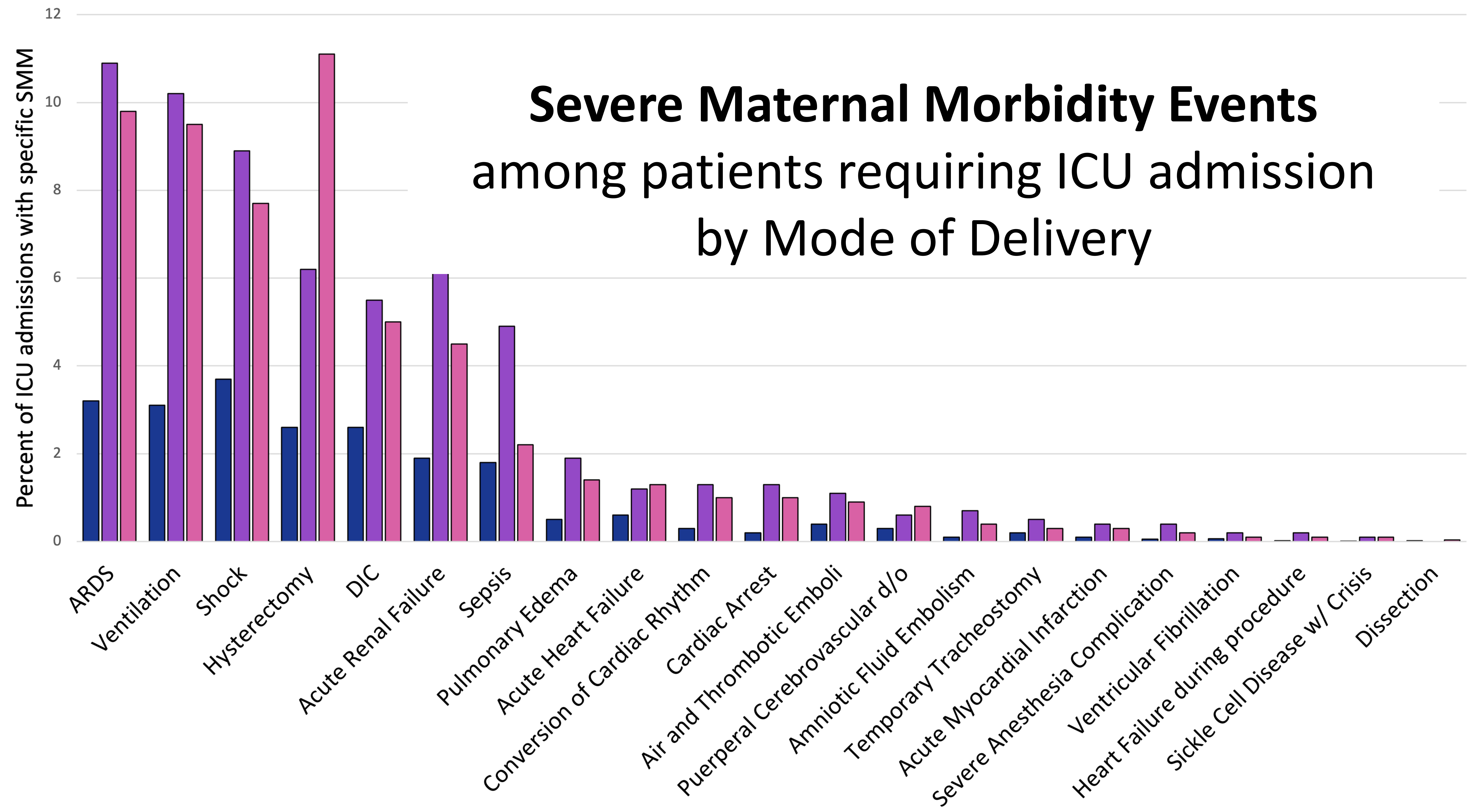
■ Vaginal Delivery
 ■ Intrapartum Cesarean Delivery
 ■ Cesarean Delivery

Severe Maternal Morbidity Events among patients requiring ICU admission by Mode of Delivery

All SMM rates were highest in patients who delivered via iCD, except hysterectomy, which was highest in those who delivered via CD.

Top SMM events for all patients admitted to the ICU:

1. ARDS (7%)
2. Ventilation (6.7%)
3. Shock (6.1%)
4. Hysterectomy (6%)
5. DIC (4.0%)



Discussion



Intrapartum Cesarean Delivery



increases a patient's odds of ICU admission by 87%

Compared to VD or CD; pts delivered via iCD are more likely to be

- Admitted to the ICU for advanced respiratory and hemodynamic support
- Severe maternal morbidity
- Death (VD 3, CD 13, iCD 15 per 100,000 live births)

Patient comorbidities also increase the risk of ICU admission:
cardiopulmonary disease, preeclampsia, PAS, and prematurity

Limitations:

- Cannot identify specific indications for ICU admission; proxy with SMM events
- Timing of ICU admission relative to delivery was not examined (anteartum vs postpartum)
- Some patient populations and regions may be underrepresented in the data