



**TIPQC**

Tennessee Initiative for  
Perinatal Quality Care

# What is SMMM?

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Danielle Tate, MD, MBA, FACOG

Immediate Past Maternal Medical Director

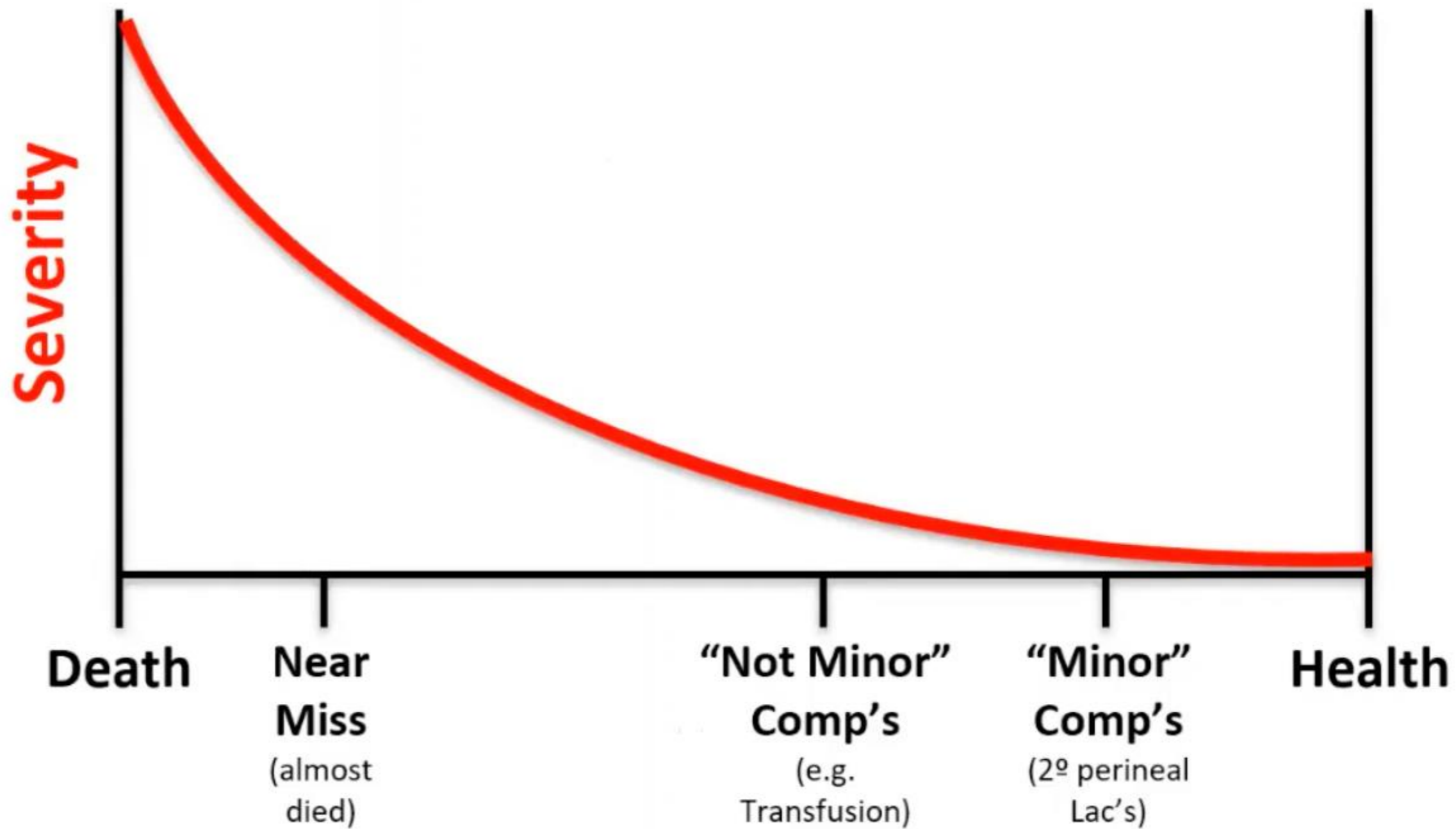


# **WHAT IS SMM?**

## **DEFINITIONS AND BACKGROUND**

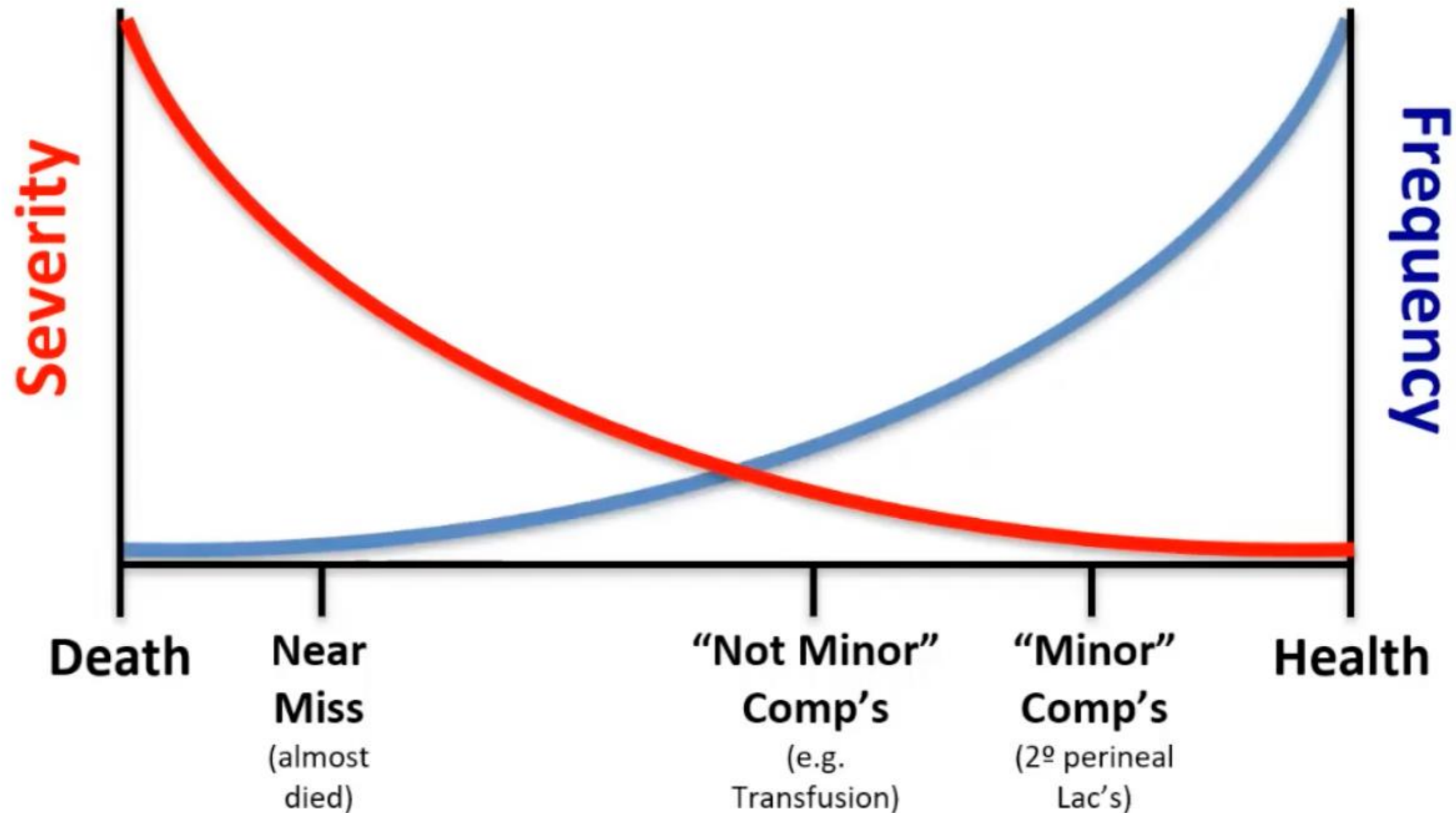
# Continuum of “Morbidity”

Where does **Severe Maternal Morbidity** Fit?



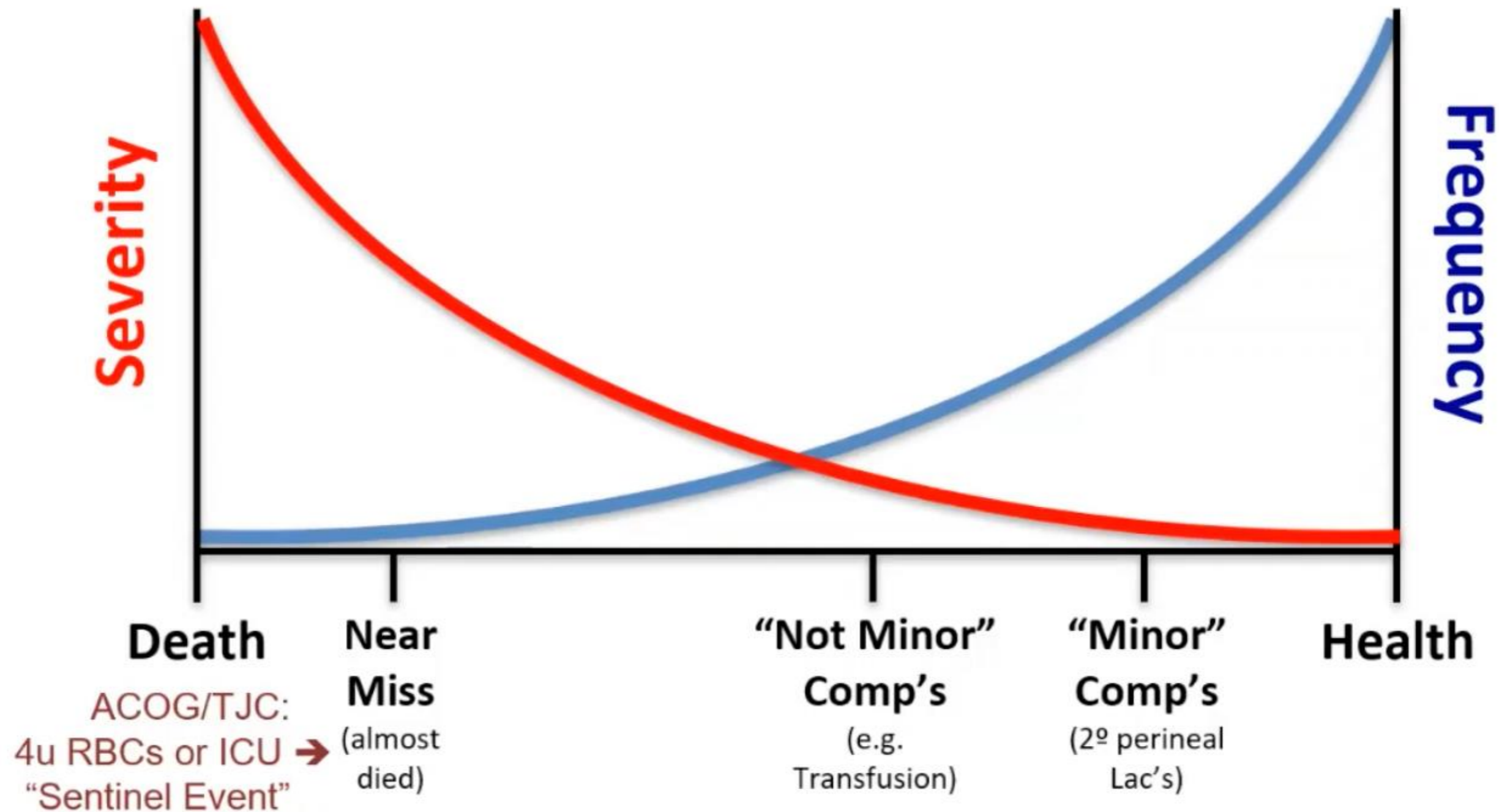
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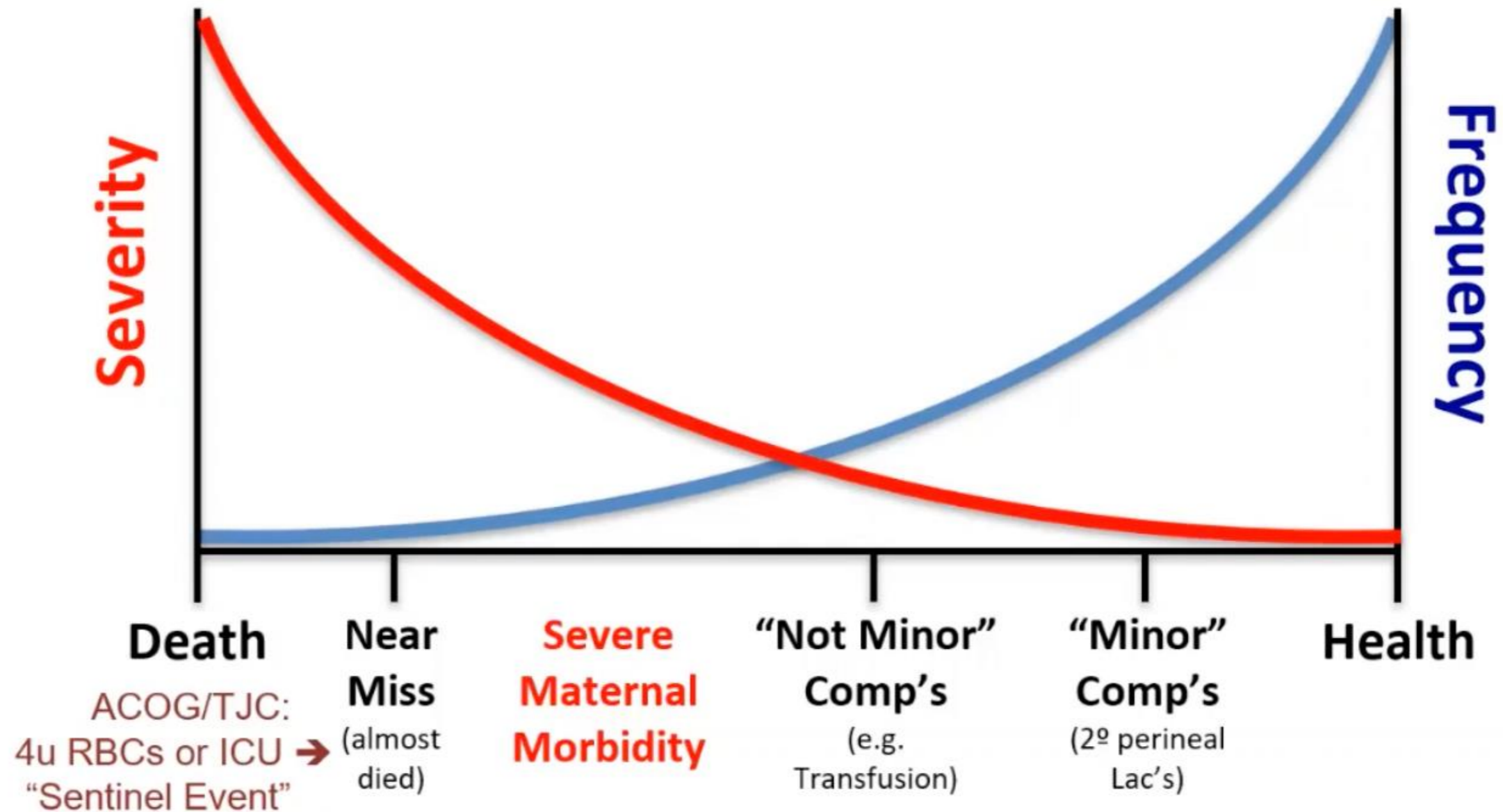
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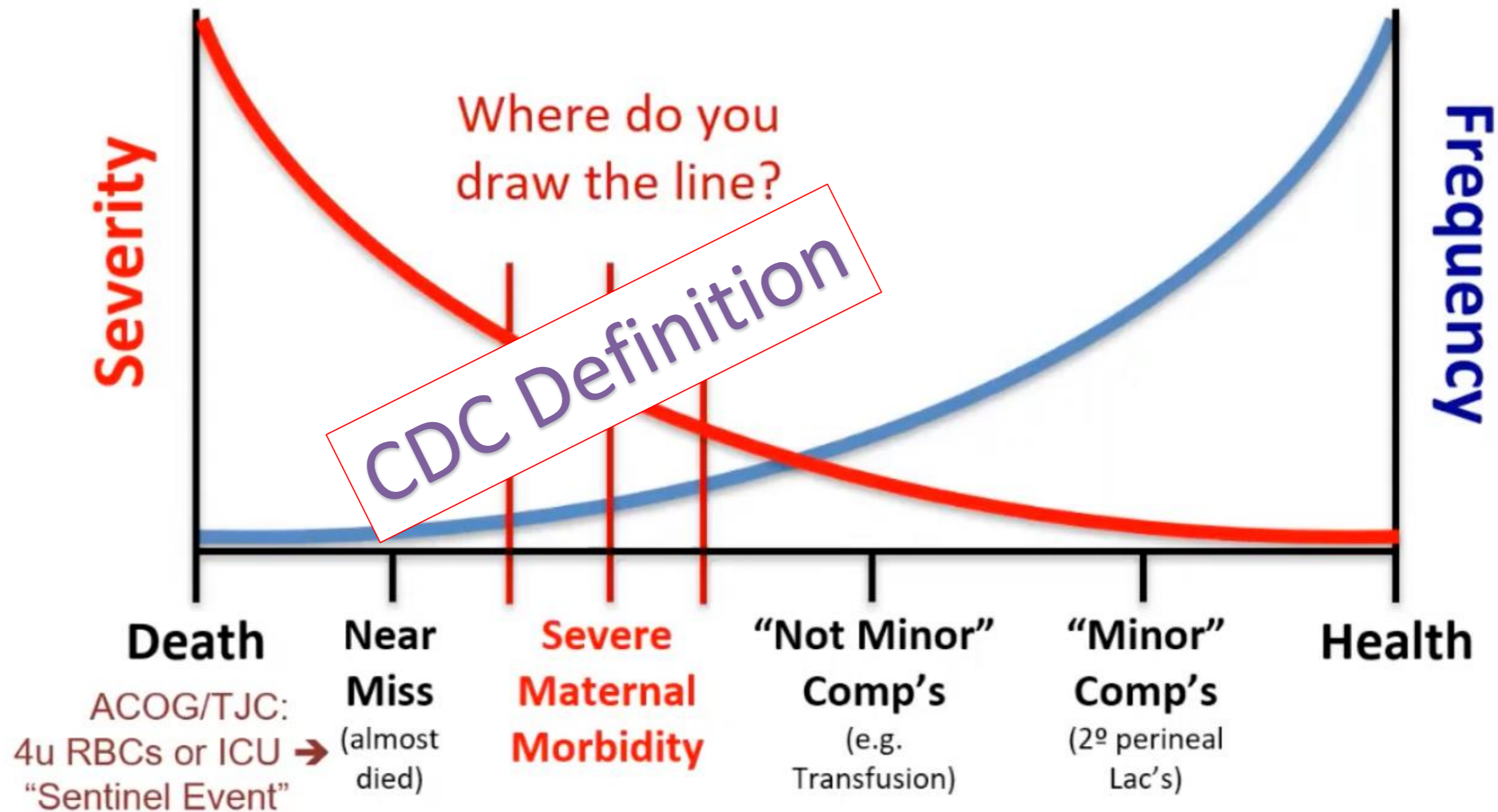
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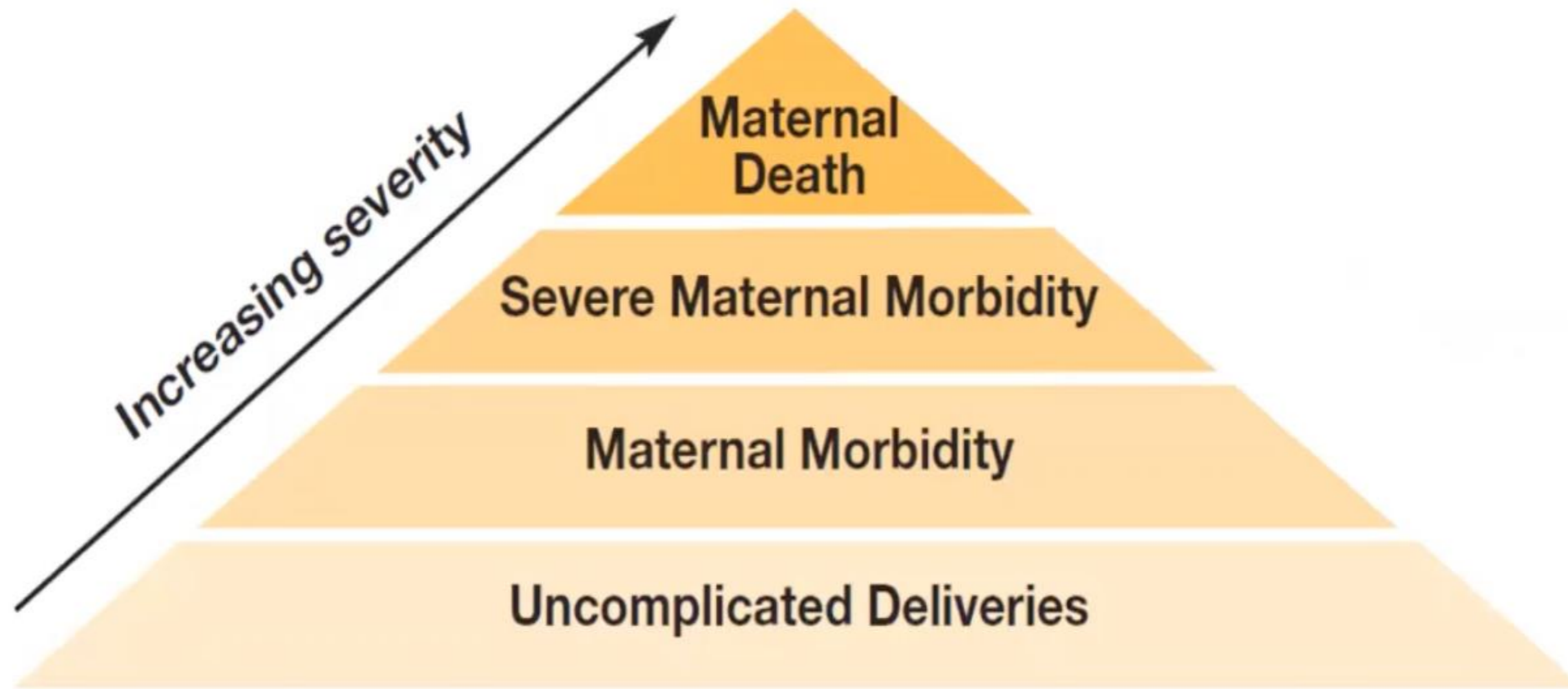


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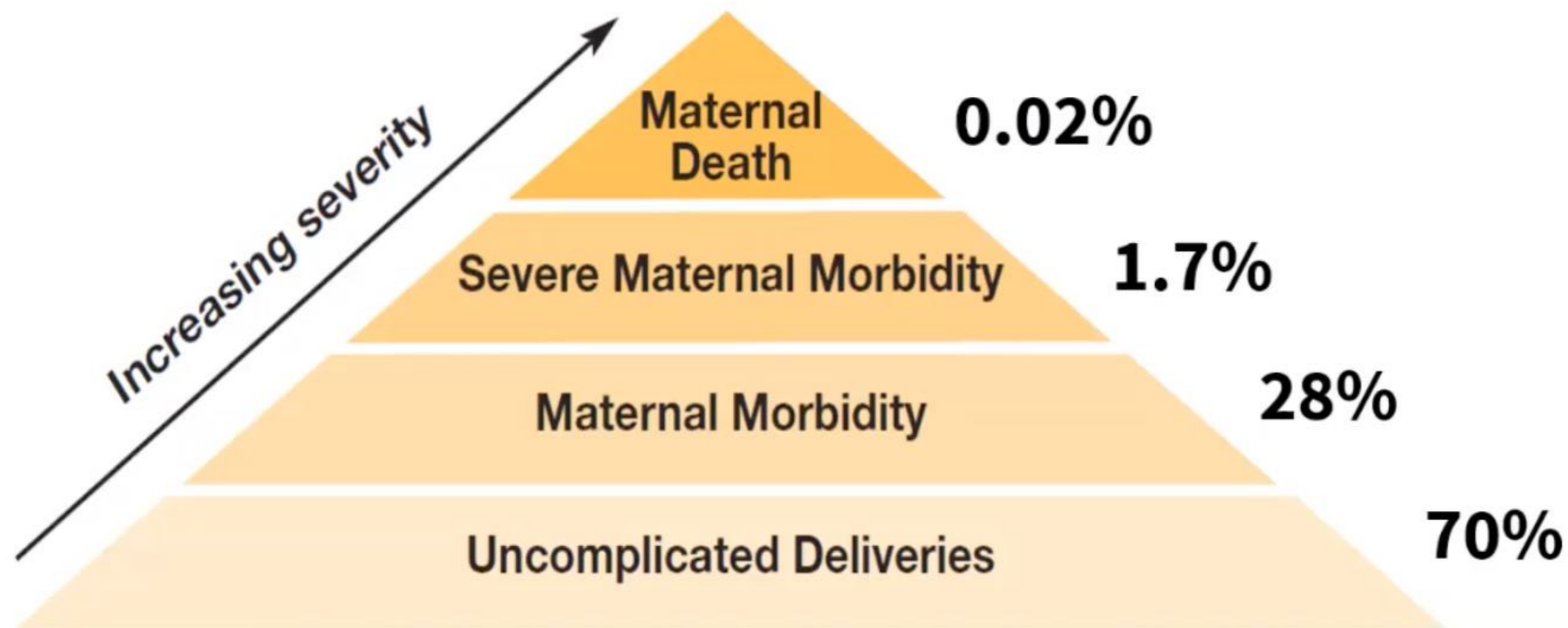
# Continuum of maternal morbidity



New York City Department of Health and Mental Hygiene (2016).  
Severe Maternal Morbidity in New York City, 2008–2012.

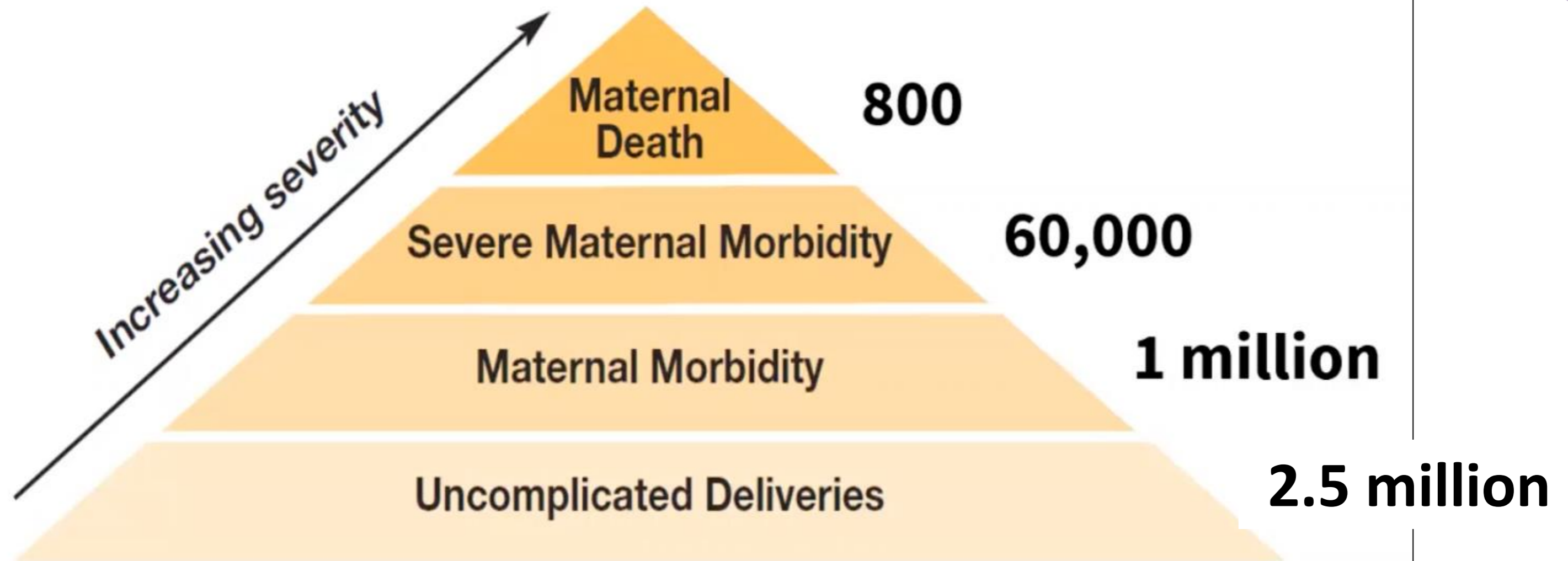


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New York City Department of Health and Mental Hygiene (2016).  
Severe Maternal Morbidity in New York City, 2008–2012.

# Continuum of maternal morbidity



New York City Department of Health and Mental Hygiene (2016).  
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Commentary

## Ways Forward in Preventing Severe Maternal Morbidity and Maternal Health Inequities: Conceptual Frameworks, Definitions, and Data, from a Population Health Perspective

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Womens Health Issues. 2022 May-Jun;32(3):213-218.

# Severe Maternal Morbidity Among Delivery and Postpartum Hospitalizations in the United States

*William M. Callaghan, MD, MPH, Andreea A. Creanga, MD, PhD, and Elena V. Kuklina, MD, PhD*

**OBJECTIVES:** To propose a new standard for monitoring severe maternal morbidity, update previous estimates of severe maternal morbidity during both delivery and postpartum hospitalizations, and estimate trends in these events in the United States between 1998 and 2009.

**METHODS:** Delivery and postpartum hospitalizations were identified in the Nationwide Inpatient Sample for the period 1998–2009. International Classification of Diseases, 9<sup>th</sup> Revision codes indicating severe complications were used to identify hospitalizations with severe maternal morbidity and related in-hospital mortality. Trends

**CONCLUSIONS:** Severe maternal morbidity currently affects approximately 52,000 women during their delivery hospitalizations and, based on current trends, this burden is expected to increase. Clinical review of identified cases of severe maternal morbidity can provide an opportunity to identify points of intervention for quality improvement in maternal care.

*(Obstet Gynecol 2012;120:1029–36)*

DOI: <http://10.1097/AOG.0b013e31826d60c5>

**LEVEL OF EVIDENCE: III**

# CDC Definition of Severe Maternal Morbidity

- Composite of specific severe complications
  - Initial criteria was association with in-hospital mortality
  - Divided into 21 categories (of quite variable frequency)
  - Used procedure or diagnosis ICD hospital codes:
  - Did not use traditional obstetric codes as they are nonspecific for severity (e.g. instead of PPH, used complications from hemorrhage such as transfusion or hysterectomy)
- Later Refinements
  - Delivery admission only
  - No severity adjustment based on LOS

# CDC Severe Maternal Morbidity (SMM) Indicators

Diagnoses	Procedures
1: Acute myocardial infarction	18: Blood transfusion (excluded)
2: Aneurysm	19: Hysterectomy
3: Acute renal failure	20: Temporary tracheostomy
4: Adult respiratory distress syndrome	21: Ventilation
5: Amniotic fluid embolism	
6: Cardiac arrest/ventricular fibrillation	
7: Conversion of cardiac rhythm	
8: Disseminated intravascular coagulation	
9: Eclampsia	
10: Heart failure/arrest during surgery or procedure	
11: Puerperal cerebrovascular disorders	
12: Pulmonary edema / Acute heart failure	
13: Severe anesthesia complications	
14: Sepsis	
15: Shock	
16: Sickle cell disease with crisis	
17: Thrombotic and air embolism	

# CDC Severe Maternal Morbidity (SMM) Indicators

Diagnoses	Procedures
<ul style="list-style-type: none"><li>1: Acute myocardial infarction</li><li>2: Aneurysm</li><li>3: Acute renal failure</li><li>4: Adult respiratory distress syndrome</li><li>5: Amniotic fluid embolism</li><li>6: Cardiac arrest/ventricular fibrillation</li><li>7: Conversion of cardiac rhythm</li><li>8: Disseminated intravascular coagulation</li><li>9: Eclampsia</li><li>10: Heart failure/arrest during surgery or procedure</li><li>11: Puerperal cerebrovascular disorders</li><li>12: Pulmonary edema / Acute heart failure</li><li>13: Severe anesthesia complications</li><li>14: Sepsis</li><li>15: Shock</li><li>16: Sickle cell disease with crisis</li><li>17: Thrombotic and air embolism</li></ul>	<ul style="list-style-type: none"><li>18: Blood transfusion (excluded)</li><li>19: Hysterectomy</li><li>20: Temporary tracheostomy</li><li>21: Ventilation</li></ul> <div data-bbox="1902 874 2878 1478" style="border: 1px solid black; background-color: #f8d7da; padding: 10px; margin-top: 20px;"><p style="text-align: center;"><b>Caveat:</b> All Composite Measures have the challenge of differing frequencies and differing severities among their indicators</p></div>



ALLIANCE FOR INNOVATION  
ON MATERNAL HEALTH

**Changes Made since the June 2021 Version**

**ICD-9 & 10 SMM Numerator Codes**

Changes to 2021 version dated 06/22/2021

All changes are highlighted in green.

SMM Indicator	D/P Code?	ICD-9 or ICD-10	Code	Notes
5. Amniotic fluid embolism	Diagnosis	ICD10	O88.112	Changed from shorthand O88.1x to align with FAD Resource Document's sample SAS code for SMM. Shorthand includes 1 erroneous code - <b>O88.111 was removed from v2 of the AIM 2021 SMM Code List.</b>
	Diagnosis	ICD10	O88.113	
	Diagnosis	ICD10	O88.119	
	Diagnosis	ICD10	O88.12	
	Diagnosis	ICD10	O88.13	
14. Sepsis	Diagnosis	ICD10	I76	2021 code addition was not reflected in original AIM 2021 SMM codes list. <b>These codes were added to v2 of the AIM 2021 SMM Code List.</b>
	Diagnosis	ICD10	T81.12XA	
17. Air and thrombotic embolism	Diagnosis	ICD10	I26.01	Changed from shorthand I26.x to align with FAD Resource Document's sample SAS code for SMM. Shorthand includes 2 erroneous codes - <b>I26.0 and I26.9 were removed from v2 of the AIM SMM Code List.</b>
	Diagnosis	ICD10	I26.02	
	Diagnosis	ICD10	I26.09	
	Diagnosis	ICD10	I26.90	
	Diagnosis	ICD10	I26.92	
	Diagnosis	ICD10	I26.93	
	Diagnosis	ICD10	I26.94	
	Diagnosis	ICD10	I26.99	

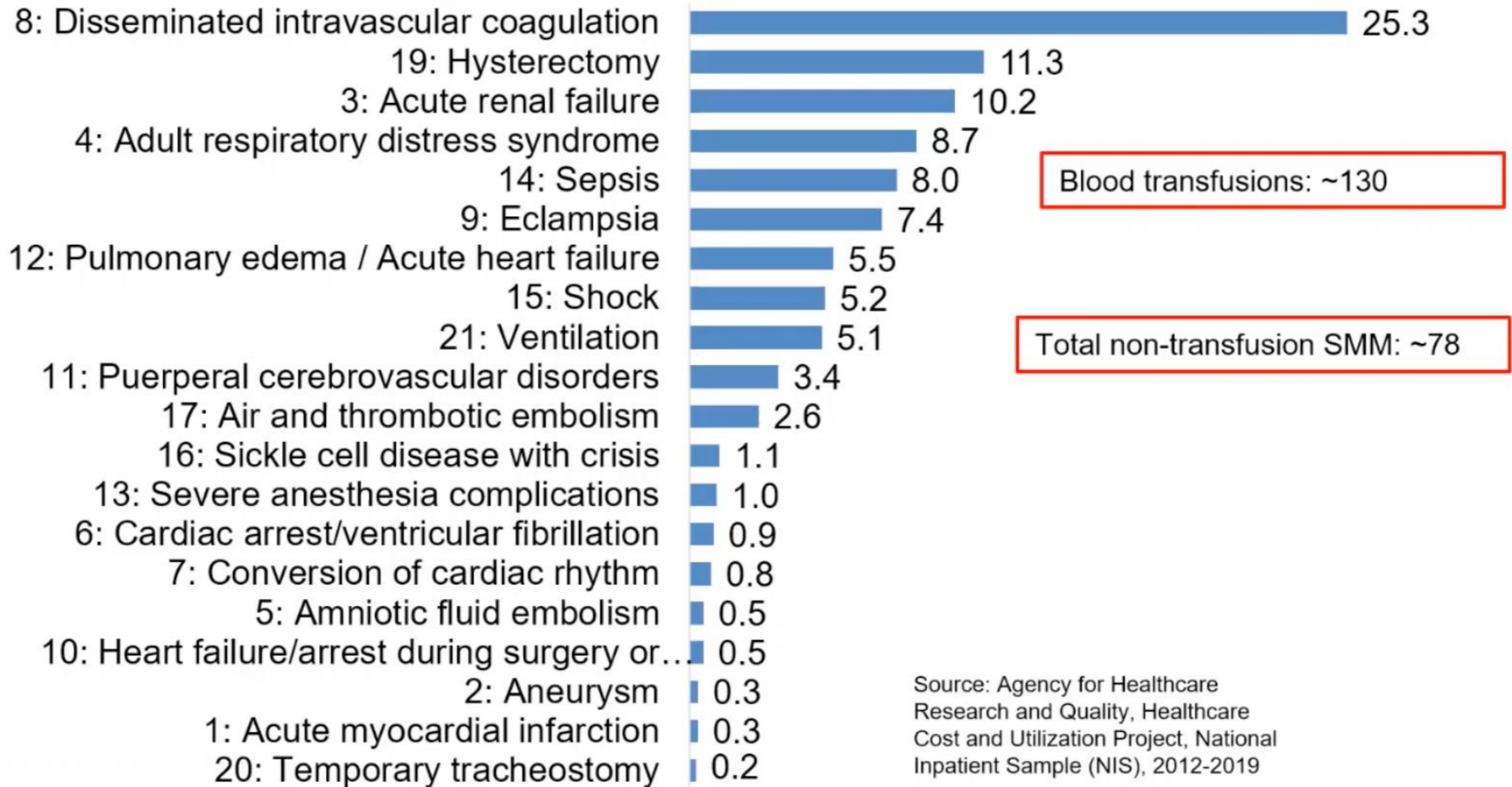
**Additions from 2020 Version**

All additions are highlighted in blue.

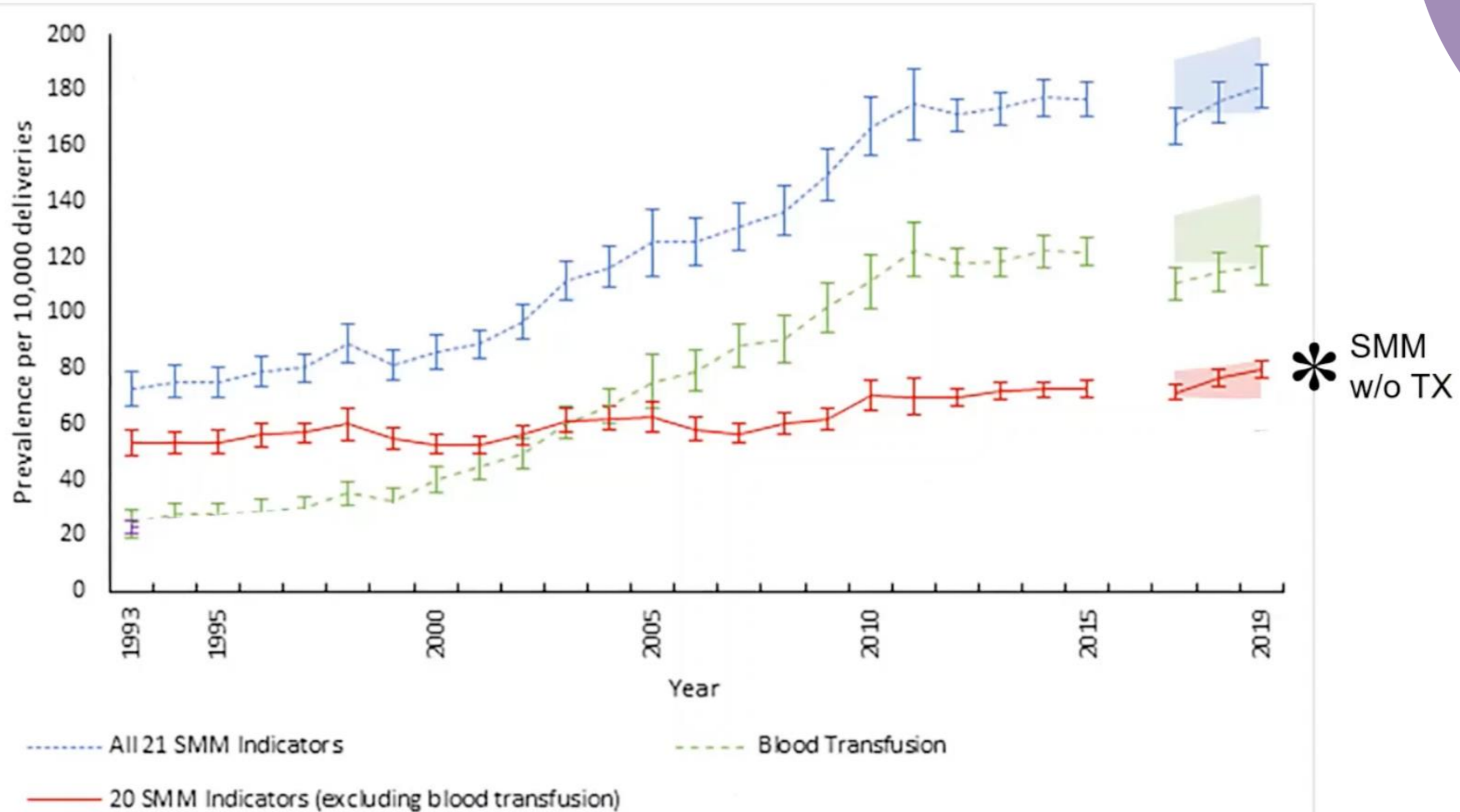
SMM Indicator	D/P Code?	ICD-9 or ICD-10	Code
4. Adult respiratory distress syndrome	Diagnosis	ICD10	J96.9x
	Diagnosis	ICD10	R06.03
8. Disseminated intravascular coagulation	Diagnosis	ICD9	641.3x
	Diagnosis	ICD10	O45.002, O45.003, O45.009
	Diagnosis	ICD10	O45.012, O45.013, O45.019
	Diagnosis	ICD10	O45.022, O45.023, O45.029
	Diagnosis	ICD10	O45.092, O45.093, O45.099



# Rate of SMM per 10,000 delivery hospitalizations by indicator, 2012-2019



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, National Inpatient Sample (NIS), 2012-2019



Kuklina, EV et al. PLoS ONE 18(11): e0294140, November 2023.

# SMM excluding transfusion only cases

- Under ICD-10 some hospitals are poorly coding or even skipping transfusions (“not required”)
- States are very different in the availability of transfusion data (eg some utilize **claims** data while other do not)
- Transfusions have risen much faster than all other complications
- Review of transfusion-only SMM cases indicate that they almost never result in maternal mortality



The American College of  
Obstetricians and Gynecologists  
WOMEN'S HEALTH CARE PHYSICIANS



Society for  
Maternal-Fetal  
Medicine

ACOG/SMFM Consensus

[smfm.org](http://smfm.org)

ACOG/SMFM OBSTETRIC CARE CONSENSUS

## Severe maternal morbidity: screening and review



CrossMark

This document was developed by the American College of Obstetricians and Gynecologists and the Society for Maternal–Fetal Medicine in collaboration with Sarah K. Kilpatrick, MD, PhD; Jeffrey L. Ecker, MD; and the Centers for Disease Control and Prevention’s representative member William M. Callaghan, MD. The views do not necessarily represent those of the Centers for Disease Control and Prevention or the U.S. government

The information reflects emerging clinical and scientific advances as of the date issued, is subject to change, and should not be construed as dictating an exclusive course of treatment or procedure. Variations in practice may be warranted based on the needs of the individual patient, resources, and limitations unique to the institution or type of practice.

This document builds upon recommendations from peer organizations and outlines a process for identifying maternal cases that should be reviewed. Severe maternal morbidity is associated with a high rate of preventability, similar to that of maternal mortality. It also can be considered a near miss for maternal mortality because without identification and treatment, in some cases, these conditions would lead to maternal death. Identifying severe morbidity is, therefore, important for preventing such injuries that lead to mortality and for highlighting opportunities to avoid repeat injuries. The two-step screen and review process described in this document is intended to efficiently detect severe maternal morbidity in women and to ensure that each case undergoes a review to determine whether there were opportunities for improvement in care. Like cases of maternal mortality, cases of severe maternal morbidity merit quality review. In the absence of consensus on a comprehensive list of conditions that represent severe maternal morbidity, institutions and systems should either adopt an existing screening criteria or create their own list of outcomes that merit review.

# Choice of Data Source Drives the Measure

- Evaluation of data source
  - How widely available (can it be used for everyone)
  - All relevant data elements?
  - Error potential—Missing? and Wrong?
- Hospital Discharge data (ICD-10 codes)
  - All birth admissions (exploring ante and postpartum)
  - Only data that is in ICD-10 codes (eg no ICU, labs, meds)
  - Some codes have more error potential both missing and overcalled

# Specific Challenges for the CDC Definition of Severe Maternal Morbidity

- DIC
  - Most frequent indicator group after transfusion-but also quite variable among hospitals and even states
  - Case reviews: many cases are trivial, e.g. mild thrombocytopenia
- Acute Kidney Injury
  - Also frequent and variable among hospitals, likely over-coding: transient oliguria being coded as ATN (acute tubular necrosis)
- Sepsis
  - Variable adoption of international consensus SEP-3 definition for sepsis requiring end organ injury

# Approaches under Study to Mitigate the Issues

- AHRQ (seeking public ideas and comments)
  - Not yet developed but goal is to address the issues with DIC, AKI, case-mix and add new diagnosis and procedure codes
- CMS / TJC (required v1 for 2024)
  - Case-mix adjusted for hospital level use
  - eMeasure that adds selected labs, VS and SnoMed codes
  - More at end of session

## A Reminder:

SMM is a Composite of Complication Indicator Codes NOT the Underlying Causes

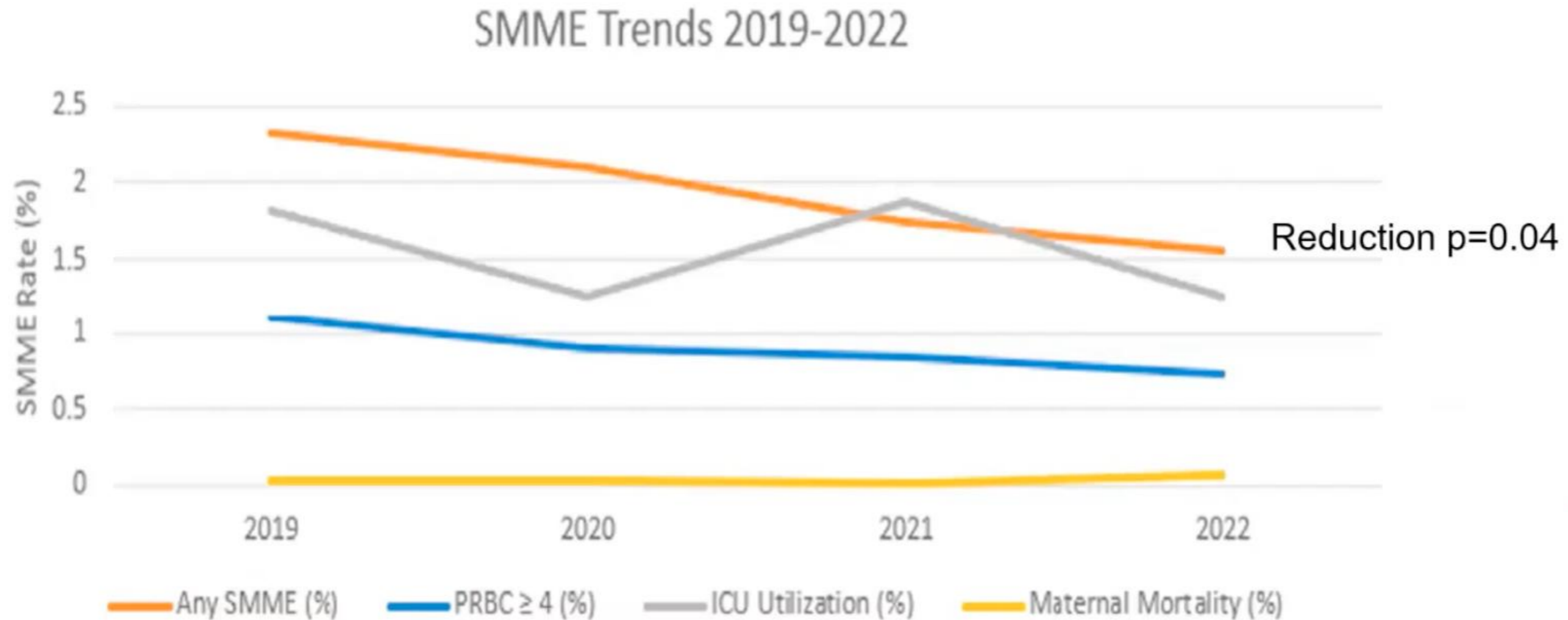
- Heart failure, DIC/Coagulation, Renal injury
  - Each can be caused by a variety of underlying causes, most common: **Hypertensive disorders, Hemorrhage, Sepsis and Cardiovascular disease (Hence the AIM Bundles!)**
  - The QI approach will depend on the underlying cause NOT the complication Indicator group



# SMM Measure has Two Purposes

- Population Health Surveillance
  - Similar to maternal mortality, but 70-100X more common
  - Can be used to identify health equity issues
  - Potentially useful to trend outcomes
- Driver for hospital, system and state QI
  - Identification of cases to analyze for system-level improvement
  - Every hospital in our PQCs should be equipped with case review tools to examine SMM cases and learn from them
  - This approach can be very effective
  - Case review forms are now now available from many PQCs and AIM

## Structured Case Reviews as Part of a QI Process can Reduce Severe Maternal Morbidity Events in a Large Hospital



Kimura, AM et al. Impact of an SMME committee on all cause and preventable maternal morbidity. Abst #658 SMFM Annual Meeting Feb 2024.

# Severe Maternal Morbidity: Background and Definition Summary

- The definition of SMM remains a work in progress
  - Multiple agencies and research groups are actively at work
  - Likely to end with several definitions depending on the particular use and the data sets that are available: Public Health Surveillance, clinical Quality Improvement; Public Reporting; Outpatient QI (antepartum and postpartum)
- Numbers get state attention, but the Case Reviews drive the hospital change



# WHAT FACTORS INFLUENCE SMM?

# What SMM is and what it is not

- SMM appropriate for
  - Determining improvement in outcomes over time for an individual hospital
  - Used as a quality improvement outcome measure
  - Identifying cases for multi-disciplinary case review
  - Identifying disparities in quality

# What SMM is and what it is not

- SMM appropriate for
  - Determining improvement in outcomes over time for an individual hospital
  - Used as a quality improvement outcome measure
  - Identifying cases for multi-disciplinary case review
  - Identifying disparities in quality
- SMM NOT appropriate for
  - Comparing hospitals
  - Encompassing all of the factors to determining maternal outcomes
  - Encompassing all clinical conditions impacting maternal outcomes

# Factors Impacting SMM



PATIENT

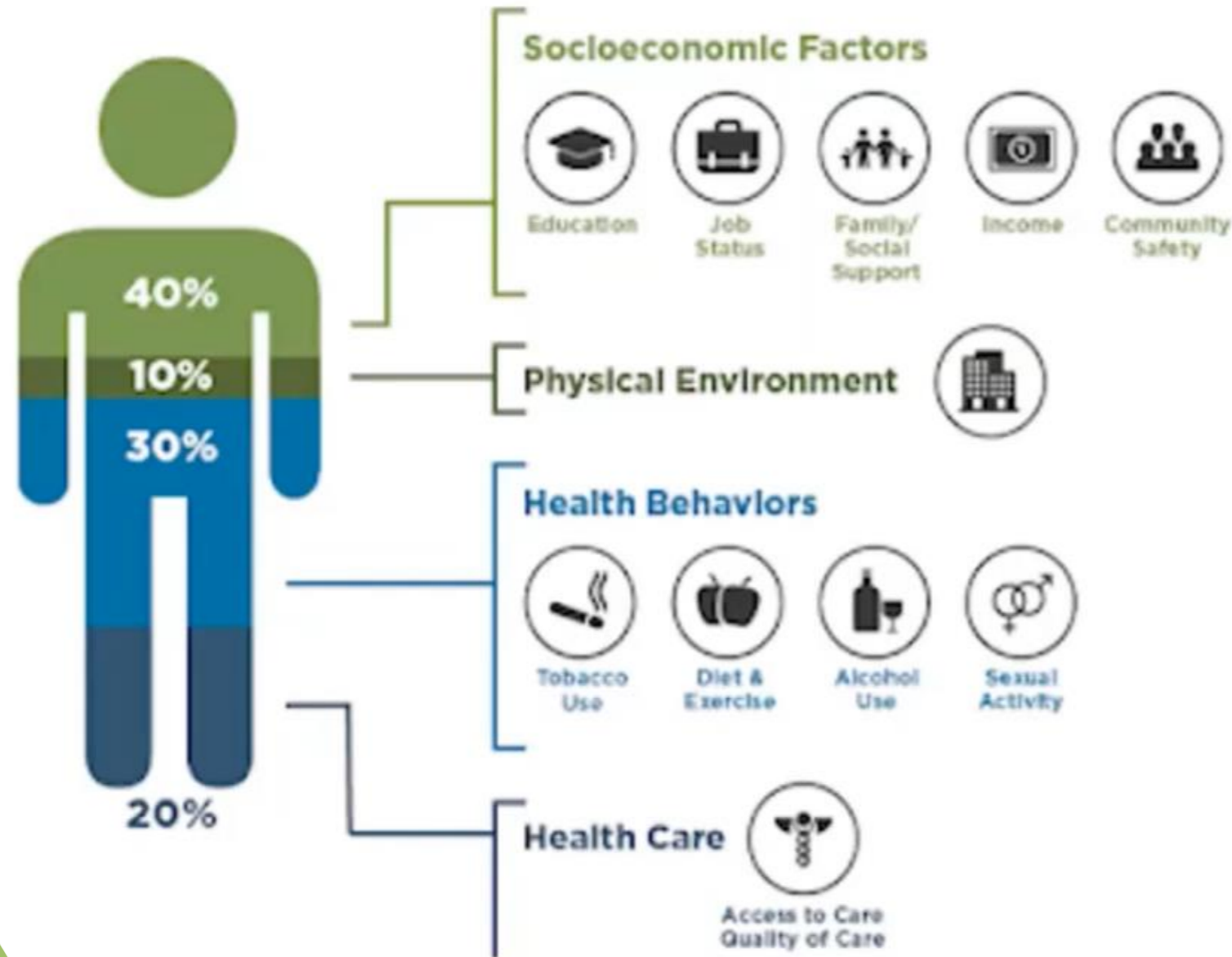


ORGANIZATIONAL



PROVIDER

# Patient Factors Impacting SMM



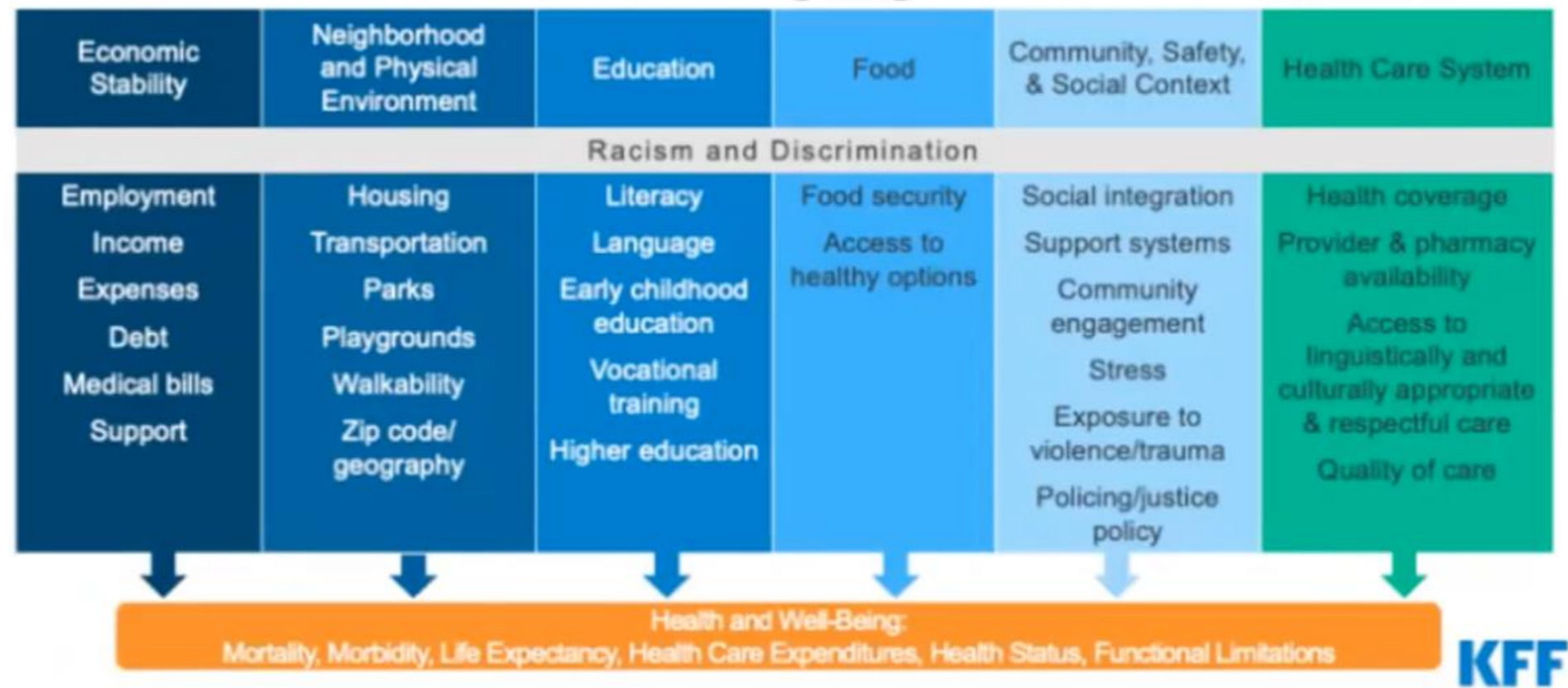
80% of clinical outcomes are due to social factors



# Before patients step into the hospital...

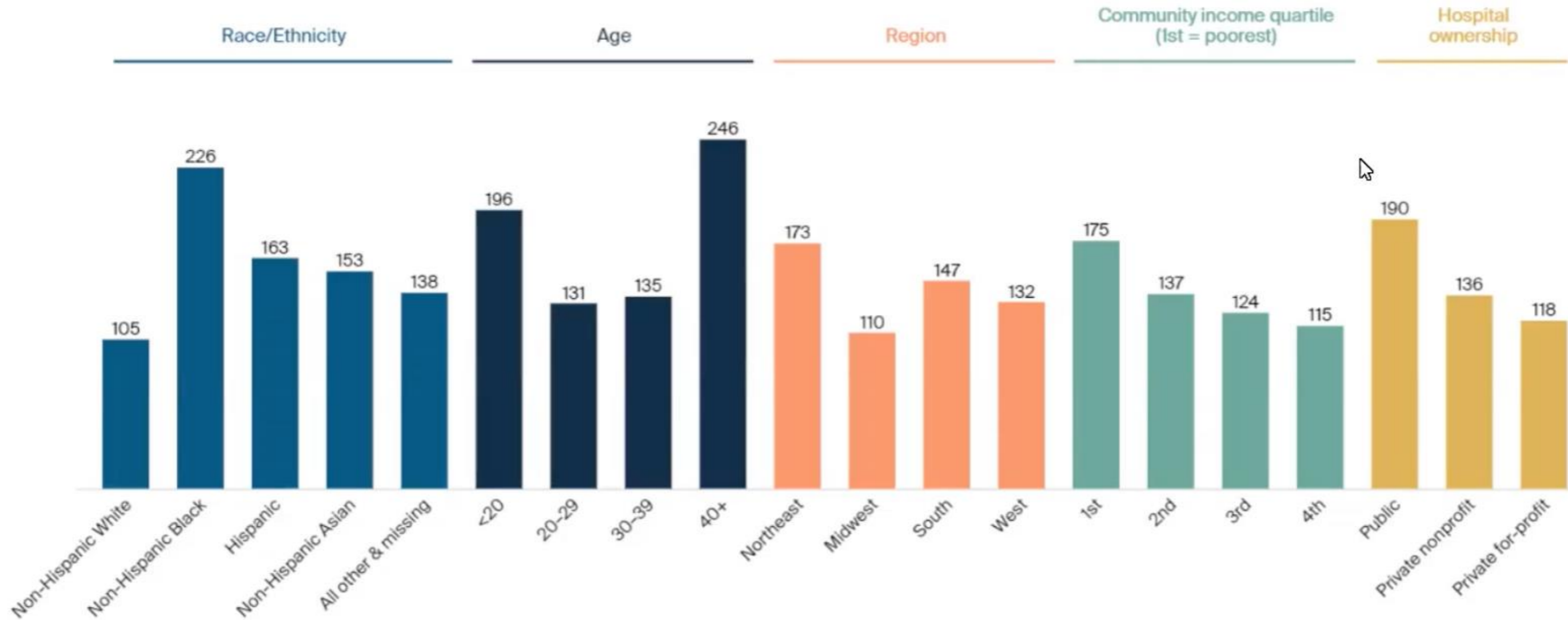
Figure 6

Health disparities are driven by social and economic inequities that are rooted in historic and ongoing racism and discrimination



Source Hill L, Artiga S, Ranji U. *Racial Disparities in Maternal and Infant Health: Current Status and Efforts to Address Them*. KFF. Nov 1, 2022. [Racial Disparities in Maternal and Infant Health: Current Status and Efforts to Address Them | KFF](#)

# Disparities in SMM



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). <https://doi.org/10.26099/r43h-vh76>

# Organizational Factors Impacting SMM

**Delivery  
volume**

**Staffing**

**Services  
available**

# Provider Factors Impacting SMM

**Lack of  
coordination of  
care**

**Lack of  
standardized  
practices**

**Failure to  
screen**

**Misdiagnosis**

**Provider Bias**

**Failure to refer**



# STEPS TO IMPROVE SMM

# Donabedian Model for Quality of Care



# Severe Hypertension in Pregnancy

## Structure



- Debriefs
- Multidisciplinary case reviews
- Patient Education
- ED screening for pregnancy status
- Unit Policy and Procedure
- Screening for SDoH

## Process



- Provider and Nursing Education
- Number and Topics for drills
- Timely Treatment of Severe Hypertension
- Postpartum BP and symptom check

## Outcome



- Overall SMM
- SMM among those with preeclampsia, eclampsia and HELLP syndrome



# Obstetric Hemorrhage

## Structure



- Debriefs
- Multidisciplinary case review
- Patient education
- Hemorrhage cart
- Policies and procedures
- Screening for SDoH

## Process



- Provider and Nursing Education
- Number and topics for drills
- Risk assessment for hemorrhage
- Patient Support
- QBL

## Outcome



- Overall SMM
- SMM among those who experienced hemorrhage







**WHAT DOES SMM LOOK  
LIKE IN PRACTICE?**

# SMM among Patients with Hypertension and/or Hemorrhage

		Baseline* (per 10,000 deliveries)	2020** (per 10,000 deliveries)	2022*** (per 10,000 deliveries)	% change from baseline
SMM among patients experiencing Hypertension	<b>Total</b>	<b>823.2</b>	<b>727.6</b>	<b>547.2</b>	<b>35% decrease</b>
	Non-Hispanic Black	733.9	793.7	685.3	<b>6.5% decrease</b>
	Non-Hispanic White	1095.9	751.5	352.9	<b>70% decrease</b>
SMM among patients experiencing Hemorrhage	<b>Total</b>	<b>1037.3</b>	<b>676.1</b>	<b>709.0</b>	<b>39% decrease</b>
	Non-Hispanic Black	1423.2	722.0	681.0	<b>58% decrease</b>
	Non-Hispanic White	682.7	575.5	771.9	<b>3% increase</b>

\* Q1 2016; \*\* Q2 2020; \*\*\* Q3 2022



# Take Aways

- While there was improvement in SMM for both hypertension and hemorrhage, the greatest degree of improvement was among those patients with hemorrhage
  - **35%** improvement in SMM among patients with hypertension; **39%** improvement in SMM among patients with hemorrhage
- In reviewing process measures, there was a greater percentage of patients consistently receiving those process measure for improving obstetric hemorrhage

Hypertension
<ul style="list-style-type: none"><li>• Timely treatment ranged from 65% to 86%</li></ul>

Hemorrhage
<ul style="list-style-type: none"><li>• Risk assessment ranged from 89% to 96%</li><li>• QBL ranged from 36% to 92%, but consistently above 88% from 2020-2023</li></ul>



# WHAT IS ON THE HORIZON FOR SMM?

# The Joint Commission / CMS eMeasure ePC-07: Severe Obstetric Complications

- Developed jointly by the Yale CORE and TJC under CMS Contract (over 4 years of design and testing).
- Required by CMS (2024) as part of Birthing Friendly Initiative
  - eMeasure calculated by a vendor from hospitals' EHR data
  - Submitted to TJC and IQR (CMS)
- Current specs
  - Outcomes based on the AHRQ code list for the CDC SMM indicator categories PLUS maternal deaths
  - To be reported with and without transfusion

# What is new/different with ePC-07 is the addition of risk adjustment

- Risk adjustment is performed to account for patient characteristics and/or comorbidities associated with the measure outcome that are reasonably beyond the control of the hospital
  - Aim is to isolate assessment of quality
  - Accounts for case mix differences between hospitals, and “levels the playing field” for better comparisons between hospitals on the care patients receive at the hospital
  - Risk variables must be factors that were present on admission when the patient arrives at the hospital

# What is new/different with ePC-07 is the addition of risk adjustment

- Risk adjustment is achieved using multivariable regression that included all risk factors as covariates.
- Candidate risk variables were identified from literature review, hospital core data elements, and input from clinicians and patients
  - Only conditions or comorbidities present on admission were included in risk adjustment
  - Race/Ethnicity is not part of the risk adjustment algorithm but results will be presented stratified by the major categories

# ePC-07 Risk Adjustment Uses these Pre-existing Conditions

<ul style="list-style-type: none"><li>• Anemia</li><li>• Asthma</li><li>• Autoimmune Disease</li><li>• Bariatric Surgery</li><li>• Bleeding disorder</li><li>• BMI</li><li>• Cardiac Disease</li><li>• Gastrointestinal Disease</li><li>• Gestational Diabetes</li><li>• HIV</li><li>• Housing Instability</li><li>• Hypertension</li><li>• Maternal Age</li><li>• Mental Health Disorder</li><li>• Multiple Pregnancy</li></ul>	<ul style="list-style-type: none"><li>• Neuromuscular Disease</li><li>• Other Pre-eclampsia</li><li>• Placenta Previa</li><li>• Placental Abruption</li><li>• Placental Accreta Spectrum</li><li>• Pre-existing Diabetes</li><li>• Preterm Birth</li><li>• Previous Cesarean</li><li>• Pulmonary Hypertension</li><li>• Renal Disease</li><li>• Severe Pre-eclampsia</li><li>• Substance Abuse</li><li>• Thyrotoxicosis</li><li>• Long-term Anticoagulant Use</li><li>• Obstetric VTE</li></ul>	<p>First resulted value 24 hours prior to start of encounter and before time of delivery:</p> <ul style="list-style-type: none"><li>• Heart Rate</li><li>• Systolic Blood Pressure</li><li>• White Blood Cell Count</li><li>• Hematocrit</li><li>• <del>Platelets (for future consideration)</del></li></ul>
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# References

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- Declercq E, Zephyrin L. Severe Maternal Morbidity in the United States: A Primer (Commonwealth Fund, October 2021). <https://doi.org/10.26099/r43h-vh76>

