



# DEVIL IN THE DETAILS: MATERNAL MORTALITY IN THE UNITED STATES

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## DISCLOSURE

- I worked as the Society for Maternal Fetal Medicine/the Pregnancy Foundation Queenan Fellowship International Agency Fellow for 6 months, working with the World Health Organization
- I continue to work as a consultant for the World Health Organization
- I am a member of the Global Health Committee for the Society for Maternal Fetal Medicine

## LEARNING OBJECTIVES

- Recognize the numeric trends in maternal mortality in the United States and globally
- Understand the etiologies of maternal mortalities
- Recognize the policy and practice changes that have enabled improvements in maternal mortality monitoring and trends
- Reaffirm how important documentation and good history-taking is



# MATERNAL MORTALITY

THE NUMBERS ARE MORE COMPLICATED THAN  
YOU THINK



# MATERNAL MORTALITY – WHY SHOULD WE CARE?

# A PRICE TOO HIGH TO BEAR: THE COSTS OF MATERNAL MORTALITY TO FAMILIES AND COMMUNITIES

- A mother's death begins a chain of disruption, economic loss, and pain that, far too often, leads to the death of her baby, loss of educational and life opportunities for her surviving children, and a deepening cycle of poverty for her family.



# CARING ON A GLOBAL SCALE

## Millennial Development Goals

	<b>Goal 1: Eradicate Extreme Hunger and Poverty</b>
	<b>Goal 2: Achieve Universal Primary Education</b>
	<b>Goal 3: Promote Gender Equality and Empower Women</b>
	<b>Goal 4: Reduce Child Mortality</b>
	<b>Goal 5: Improve Maternal Health</b>
	<b>Goal 6: Combat HIV/AIDS, Malaria and other diseases</b>
	<b>Goal 7: Ensure Environmental Sustainability</b>
	<b>Goal 8: Develop a Global Partnership for Development</b>

## Sustainable Development Goals

**Sustainable Development Goals**

TRANSFORMING OUR WORLD:  
THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

	<b>1 NO POVERTY</b>		<b>2 ZERO HUNGER</b>		<b>3 GOOD HEALTH AND WELL-BEING</b>		<b>4 QUALITY EDUCATION</b>		<b>5 GENDER EQUALITY</b>		
	<b>6 CLEAN WATER AND SANITATION</b>		<b>7 AFFORDABLE AND CLEAN ENERGY</b>		<b>8 DECENT WORK AND ECONOMIC GROWTH</b>		<b>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</b>		<b>10 REDUCED INEQUALITIES</b>		<b>11 SUSTAINABLE CITIES AND COMMUNITIES</b>
	<b>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</b>		<b>13 CLIMATE ACTION</b>		<b>14 LIFE BELOW WATER</b>		<b>15 LIFE ON LAND</b>		<b>16 PEACE, JUSTICE AND STRONG INSTITUTIONS</b>		<b>17 PARTNERSHIPS FOR THE GOALS</b>



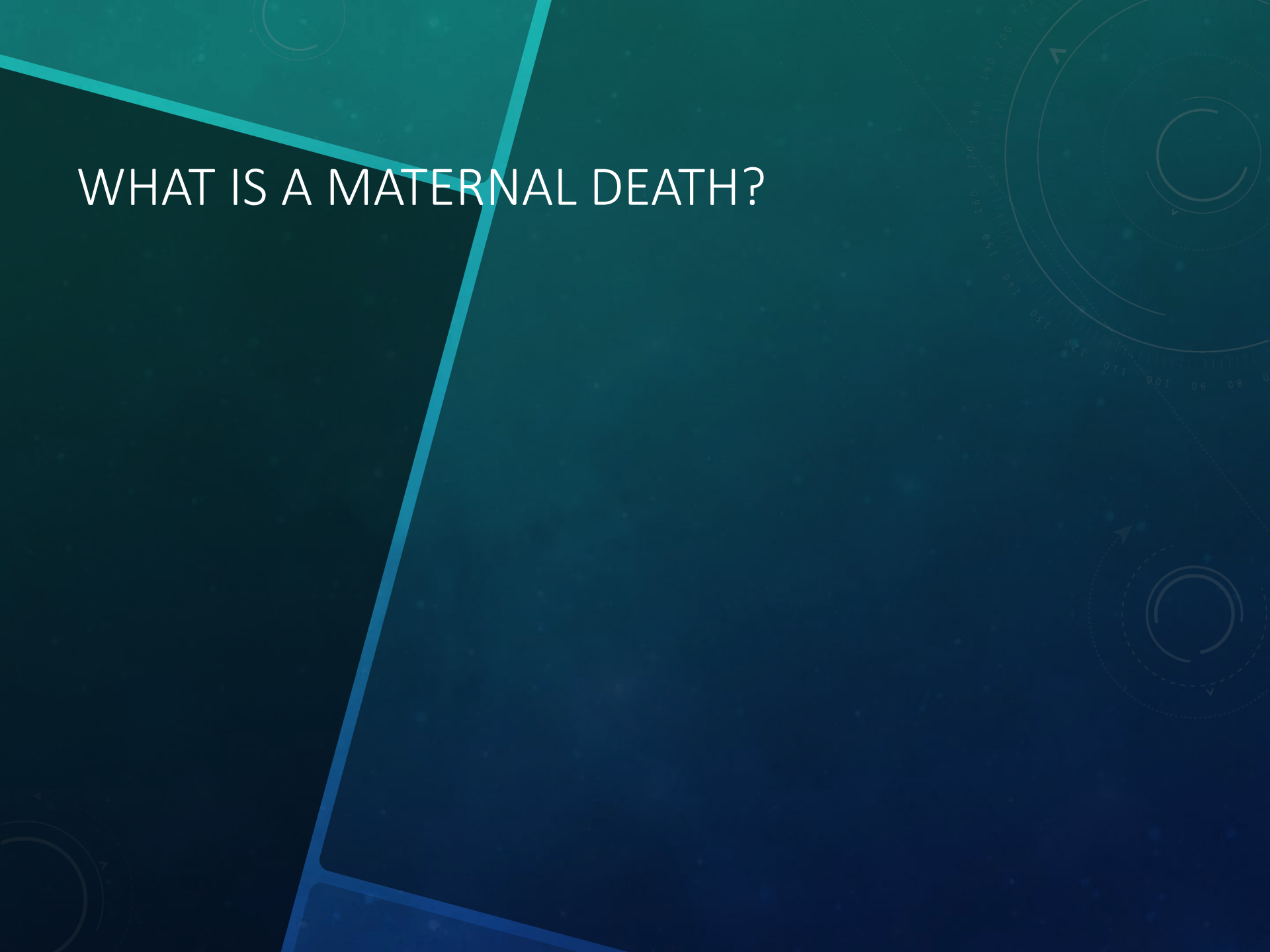
# LOOKING AT PREGNANCY-RELATED HEALTH



# WHAT METRIC/INDICATOR IS USED TO DISCUSS MATERNAL MORTALITY?

- AMDs (Absolute Maternal Deaths)?
- MMR (Maternal Mortality Ratio)?
- MMR (Maternal Mortality Rate)?
- PRDR (Pregnancy Related Death Ratio)?

# WHAT IS A MATERNAL DEATH?



# HOW DO WE DEFINE AND MEASURE MATERNAL MORTALITY?

- What is a maternal death?
  - Within 42 days of delivery/termination
  - Any cause related to or aggravated by pregnancy
  - Does not include accidental or incidental causes
- Pregnancy-related death
  - The death of a woman while pregnant or within 42 days of termination of pregnancy,
  - **irrespective of the cause of death**
- Late maternal death
  - death of a woman from direct or indirect causes more than 42 days but less than one year after termination of pregnancy

## UTAH DEFINITION

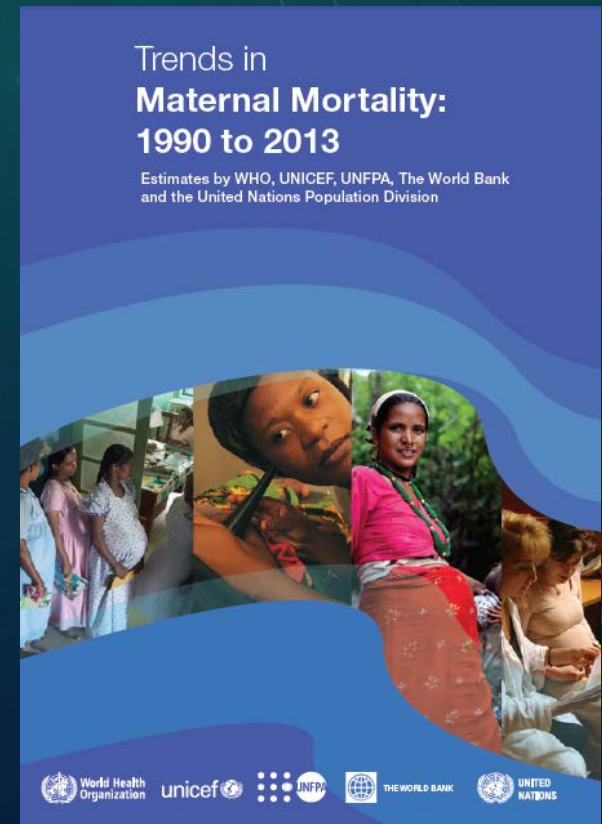
- the number of women who have died within 12 months of completion of a pregnancy
- cause of **death** is due to pregnancy or pregnancy-related causes
- per 100,000 live births.



# TRENDS IN MATERNAL MORTALITY

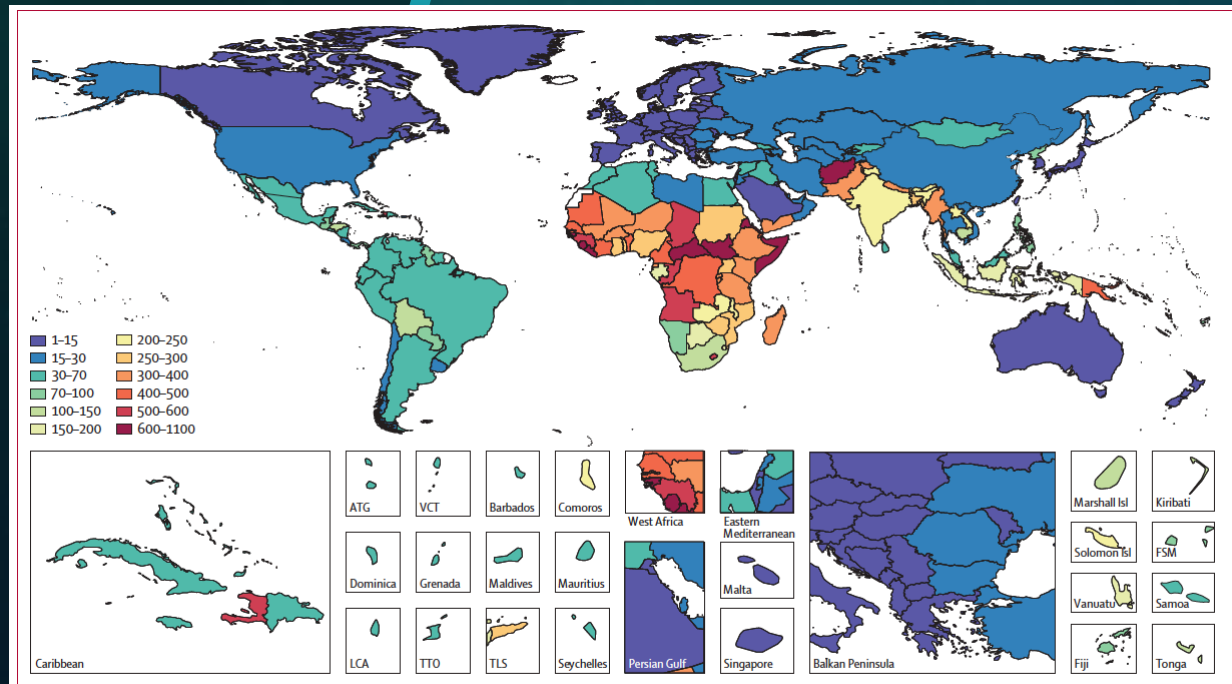
# TRENDS IN MATERNAL MORTALITY: 1990-2013

- An estimated 289,000 women died in 2013, a 45% reduction from the 523,000 that died in 1990
- 11 countries with high levels of maternal mortality in 1990 *estimated to have achieved MDG 5 target of maternal mortality*
- Progress not been balanced globally: 10 countries account for 60% of the global maternal death burden





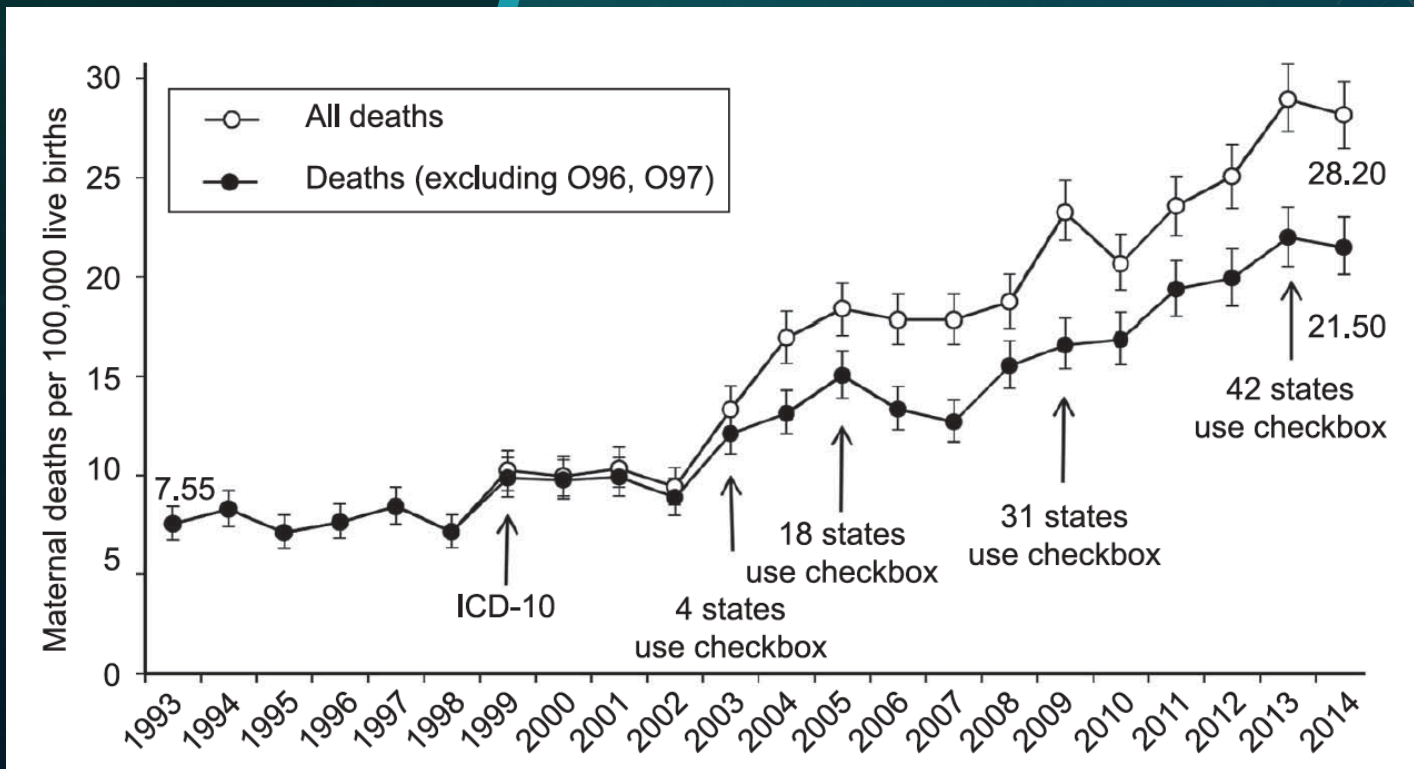
# TRENDS IN MATERNAL MORTALITY: GLOBAL PERSPECTIVE



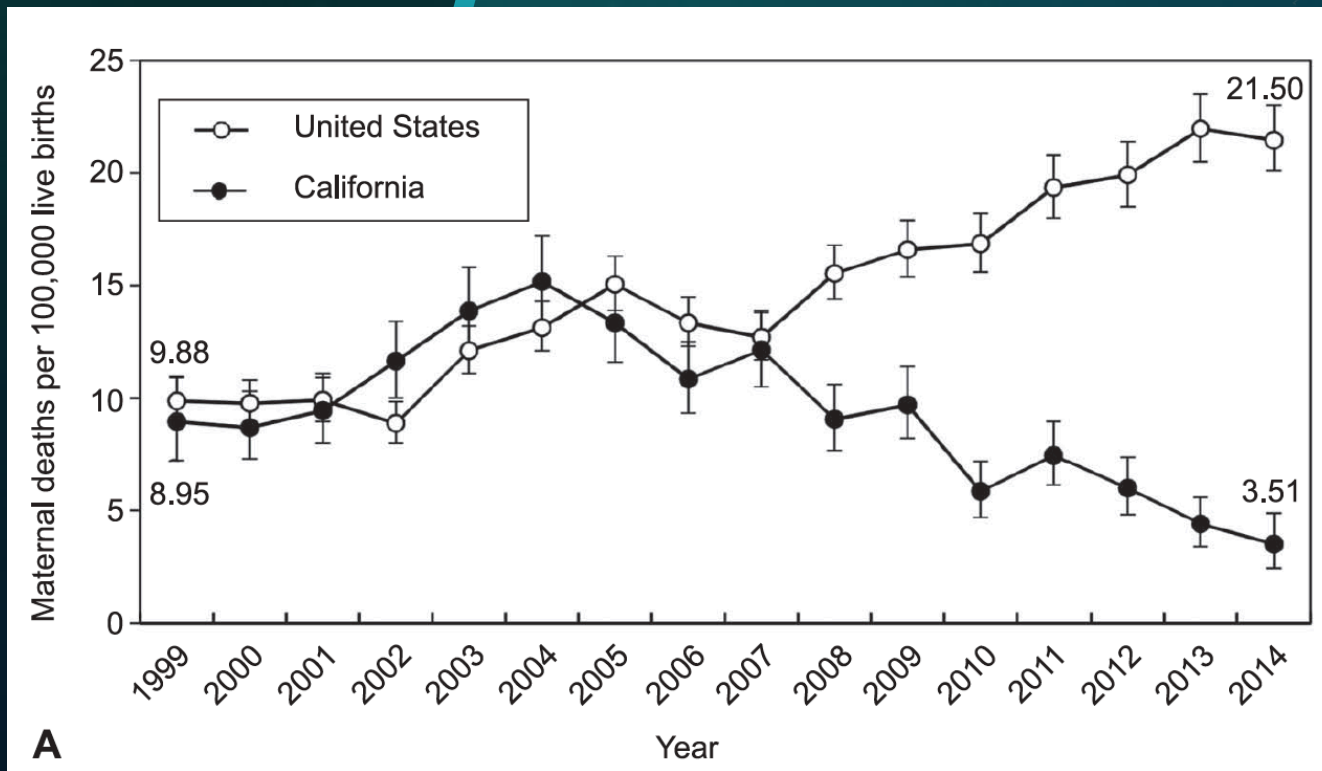
**Figure 4: Maternal mortality ratio (MMR; number of deaths per 100 000 livebirths) for countries and territories, 2015**

The map is colour-coded according to the national MMR in the year 2015. Lowest MMR is shown in purple and highest in dark red. Inset images help to show smaller countries. ATG=Antigua, VCT=Saint Vincent and the Grenadines, Isl=Islands, FSM=Federated States of Micronesia, LCA=Saint Lucia, TTO=Trinidad and Tobago, TLS=Timor-Leste.

# TRENDS IN MATERNAL MORTALITY: USA



# TRENDS IN MATERNAL MORTALITY: US REGIONAL VARIATION



# WHY ARE WE DOING WORSE?

- Better assessment
  - Changes in coding system
  - Changes in definition
  - Changes in collection
- Less healthy population
- More women entering reproductive years who would have died before (congenital heart disease)

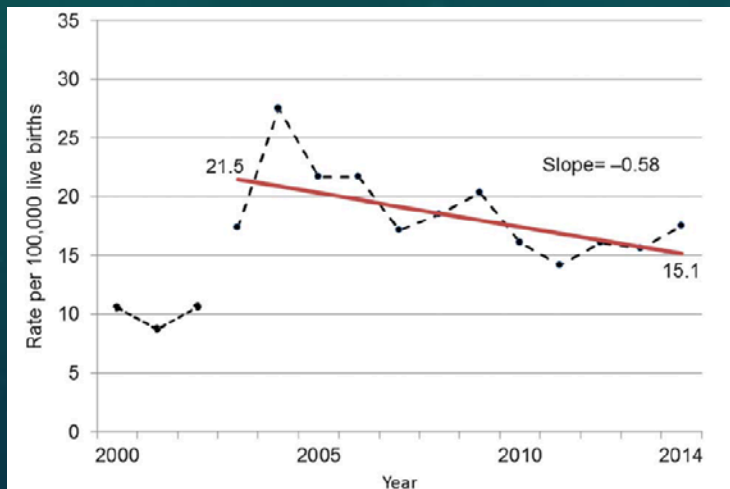
**Table 1. State Death Certificate Revision Dates and Pregnancy Question Types, 2014**

State	Unrevised		Revision Date*	Analysis Group†
	Pregnancy Question?	Pregnant Within Last		
Alabama	Yes	42 d	Not revised	4
Alaska	No		2014	3
Arizona	No		2010	1
Arkansas	No		2008	1
California	No		2003	Separate
Colorado	No		Not revised	3
Connecticut	No		2005	1
Delaware	No		2007	1
Florida	Yes	3 mo	2005	2
Georgia	No		2008	1
Hawaii	No		2014	3
Idaho	No		2003	1
Illinois	Yes	3 mo	2008	2
Indiana	Yes	90 d	2008	2
Iowa	Yes	12 mo	2011	2
Kansas	No		2005	1
Kentucky	Yes	12 mo	July 2010	2
Louisiana	Yes	12 mo	July 2012	2
Maine	No		Rolling 2010	1
Maryland	Yes	42 d	Not revised	4
Massachusetts	No		September 2014	3
Michigan	No		2004	1
Minnesota	Yes	12 mo	March 2011	2
Mississippi	Yes	90 d	2012	2
Missouri	Yes	90 d	2010	2
Montana	No		2003	1
Nebraska	Yes	3 mo	2005	2
Nevada	No		2008	1
New Hampshire	No		April 2004	1
New Jersey	Yes	90 d	2004	2
New Mexico	Yes	6 wk	2006	4
New York City	Yes	12 mo	2003	2
New York State	Yes	6 mo	2003	2
North Carolina	No		2014	3
North Dakota	Yes	18 mo	2008	2
Ohio	No		2007	1
Oklahoma	No		2004	1
Oregon	No		2006	1
Pennsylvania	No		2012	1
Rhode Island	No		2006	1
South Carolina	No		2005	1
South Dakota	No		2004	1
Tennessee	No		2012	1
Texas	Yes	12 mo	2006	*
Utah	No		2005	1
Vermont	No		July 2008	1
Virginia	Yes	3 mo	October 2014	3
Washington	No		2004	1
Washington, DC	No		Mid-2005	1
West Virginia	No		Not revised	3
Wisconsin	No		September 2013	3
Wyoming	No		2004	1

All states adopted the U.S. standard question when revised except for California, which adopted a question on pregnancy within the past 1 year.

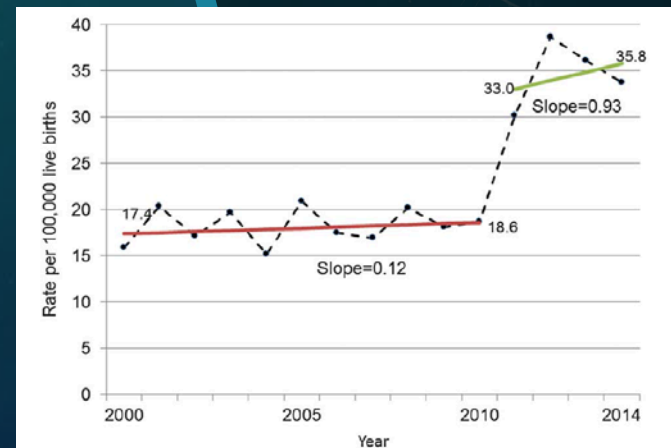


# CALIFORNIA VERSUS TEXAS



**Fig. 5.** Unadjusted combined maternal and late maternal mortality rates, California, 2000–2014. Includes pregnancy-related deaths occurring within 1 year of pregnancy. California revised their death certificate in 2003 to a non-standard question that asks about deaths within 1 year of pregnancy. Before 2003, California did not have a pregnancy question on their death certificate.

MacDorman. *U.S. Maternal Mortality Trends. Obstet Gynecol* 2016.



**Fig. 4.** Adjusted maternal mortality rates, Texas, 2000–2014. Texas revised to the U.S. standard pregnancy question in 2006. The unrevised question asked about pregnancies within the past 12 months.

MacDorman. *U.S. Maternal Mortality Trends. Obstet Gynecol* 2016.



# WHY ARE TEXAS AND CALIFORNIA SO DIFFERENT?

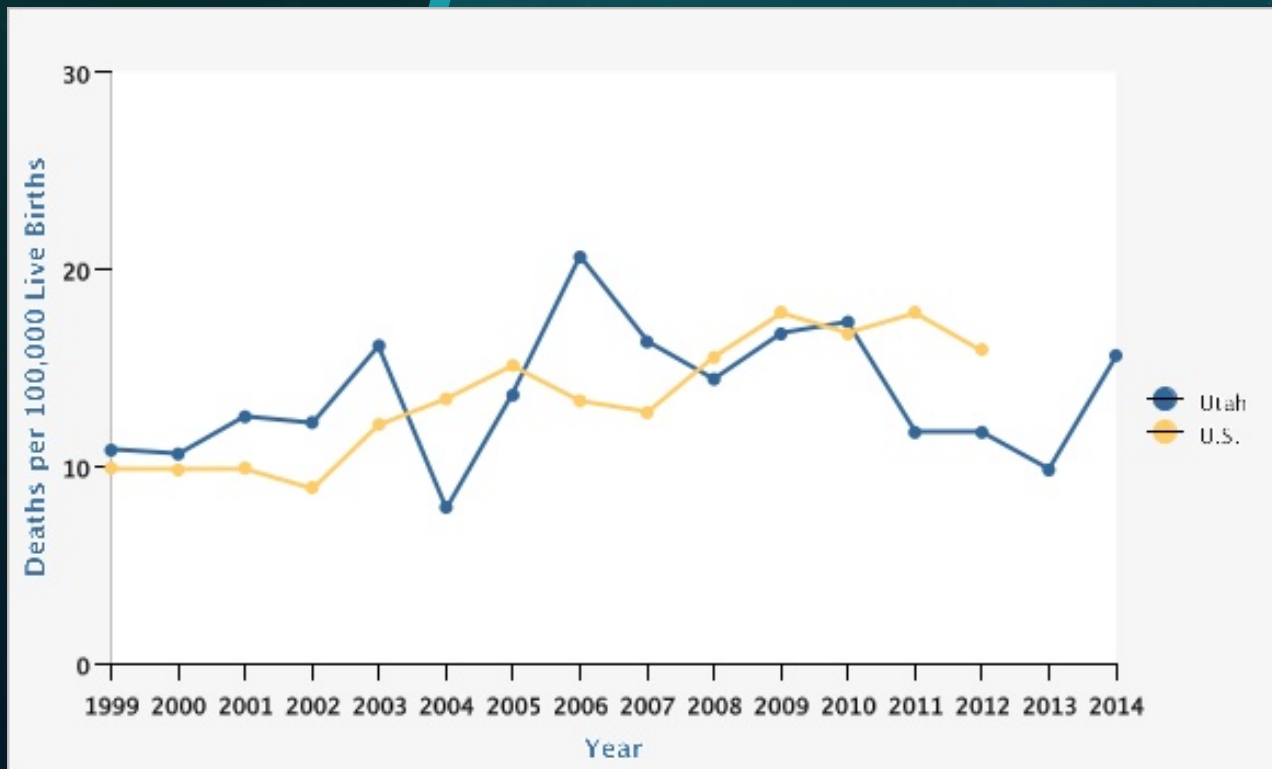
## California

- Statewide pregnancy-associated mortality review
- Contracting with the California Maternal Quality Care Collaborative to investigate primary causes of maternal death
  - evidence-based tool kits to address two of the most common, preventable contributors to maternal death (obstetric hemorrhage and preeclampsia)
  - Implementation of quality improvement initiatives throughout the state

## Texas

- some changes in the provision of women's health services in Texas from 2011 to 2015

# TRENDS IN MATERNAL MORTALITY: UTAH



# WHY IS MATERNAL MORTALITY GETTING BETTER?

- We made it a priority
- Improved access to care
- Training/Education of providers
- Increased provision to emergency obstetric care
- Focus on warning systems



# WHY DO “OBSTETRIC” WOMEN DIE?

IT'S ABOUT QUANTITY AND QUALITY...AND IT'S  
COMPLICATED

OR THINK ABOUT IT FROM THE  
OPPOSITE...WHAT DO “OBSTETRIC”  
WOMEN NOT DIE FROM?

# SO MANY REASONS...

- Underlying medical conditions
  - Worsen in pregnancy
  - Complicate pregnancy
- Physiologic changes in pregnancy
- Pathologies of pregnancy
- Mental changes in pregnancy

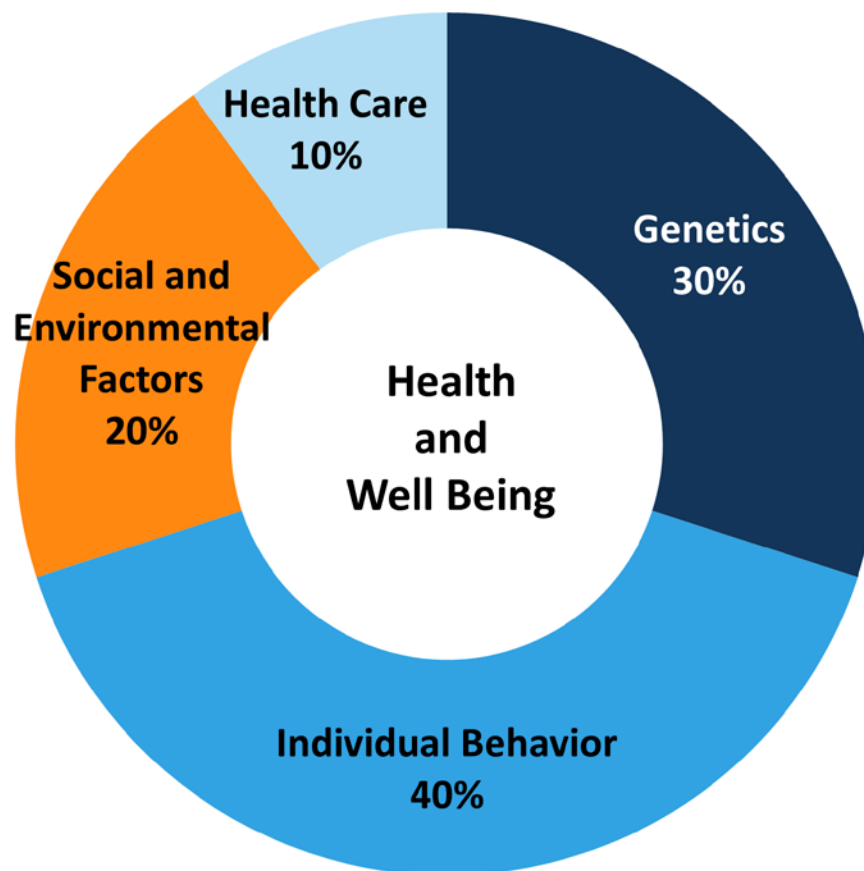


## ...AND MORE

- Three Delays:
  - Delay in decision to seek care
  - Delay in reaching care
  - Delay in receiving adequate health care
- A 4<sup>th</sup> delay
  - Delay in the community in recognizing its responsibility for and commitment to women in need of health care
- Other delays?
  - Delay in preventing pregnancy?

Figure 1

# Impact of Different Factors on Risk of Premature Death



SOURCE: Schroeder, SA. (2007). We Can Do Better — Improving the Health of the American People. *NEJM*. 357:1221-8.

# ACTUALLY THESE ARE ALL RELATED...





BUT REALLY...WHY  
DO WOMEN DIE?

# CAUSE OF DEATH: SIMPLEST WAY TO THINK ABOUT IT

- DIRECT versus INDIRECT

Table 1

Groups of underlying causes of death during pregnancy, childbirth and the puerperium in mutually exclusive, totally inclusive groups <sup>3</sup>

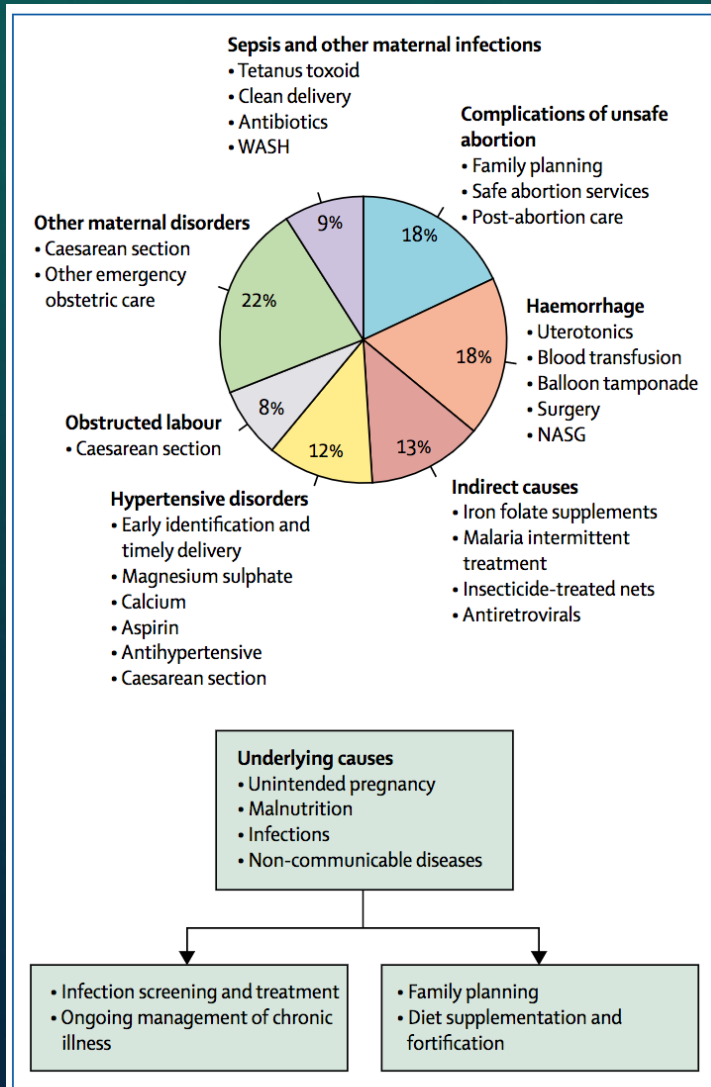
Type	Group name/number	EXAMPLES of potential causes of death
Maternal death: direct	1. Pregnancies with abortive outcome	Abortion, miscarriage, ectopic pregnancy and other conditions leading to maternal death and a pregnancy with abortive outcome
Maternal death: direct	2. Hypertensive disorders in pregnancy, childbirth, and the puerperium	Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium
Maternal death: direct	3. Obstetric haemorrhage	Obstetric diseases or conditions directly associated with haemorrhage
Maternal death: direct	4. Pregnancy-related infection	Pregnancy-related, infection-based diseases or conditions
Maternal death: direct	5. Other obstetric complications	All other direct obstetric conditions not included in groups to 1–4
Maternal death: direct	6. Unanticipated complications of management	Severe adverse effects and other unanticipated complications of medical and surgical care during pregnancy, childbirth or the puerperium
Maternal death: indirect	7. Non-obstetric complications	Non-obstetric conditions <ul style="list-style-type: none"> <li>• Cardiac disease (including pre-existing hypertension)</li> <li>• Endocrine conditions</li> <li>• Gastrointestinal tract conditions</li> <li>• Central nervous system conditions</li> <li>• Respiratory conditions</li> <li>• Genitourinary conditions</li> <li>• Autoimmune disorders</li> <li>• Skeletal diseases</li> <li>• Psychiatric disorders</li> <li>• Neoplasms</li> <li>• Infections that are not a direct result of pregnancy</li> </ul>
Maternal death: unspecified	8. Unknown/undetermined	Maternal death during pregnancy, childbirth and the puerperium where the underlying cause is unknown or was not determined
Death during pregnancy, childbirth and the puerperium	9. Coincidental causes	Death during pregnancy, childbirth and the puerperium due to external causes

# CAUSES OF DEATH: ICD-MM

## A CODIFIED WAY TO DESCRIBE DEATH



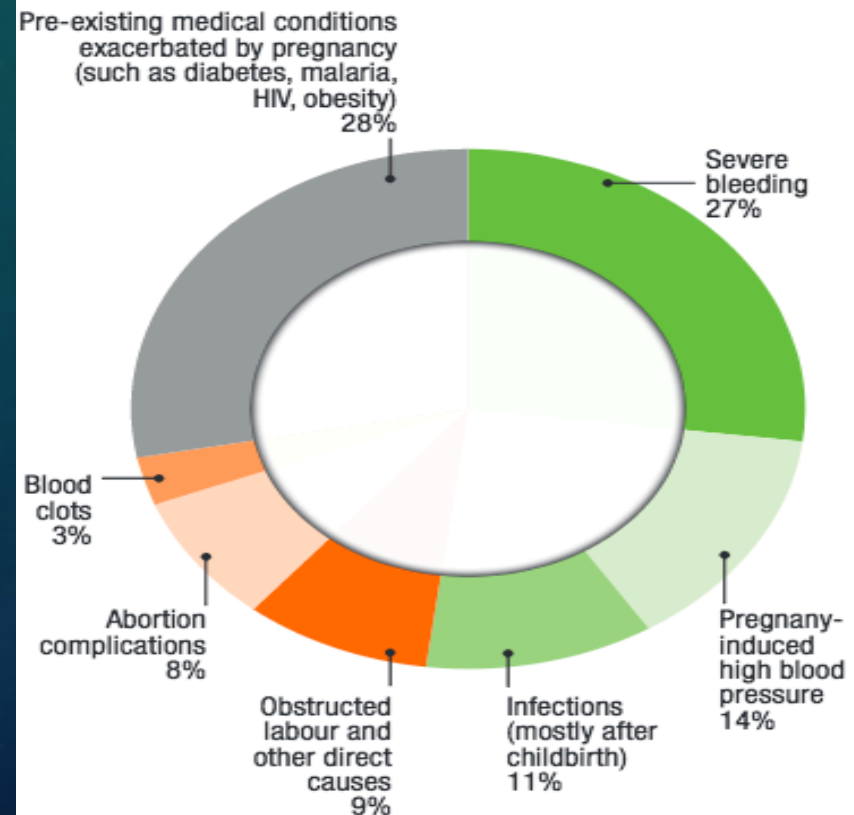
# MANY WAYS TO DIE...



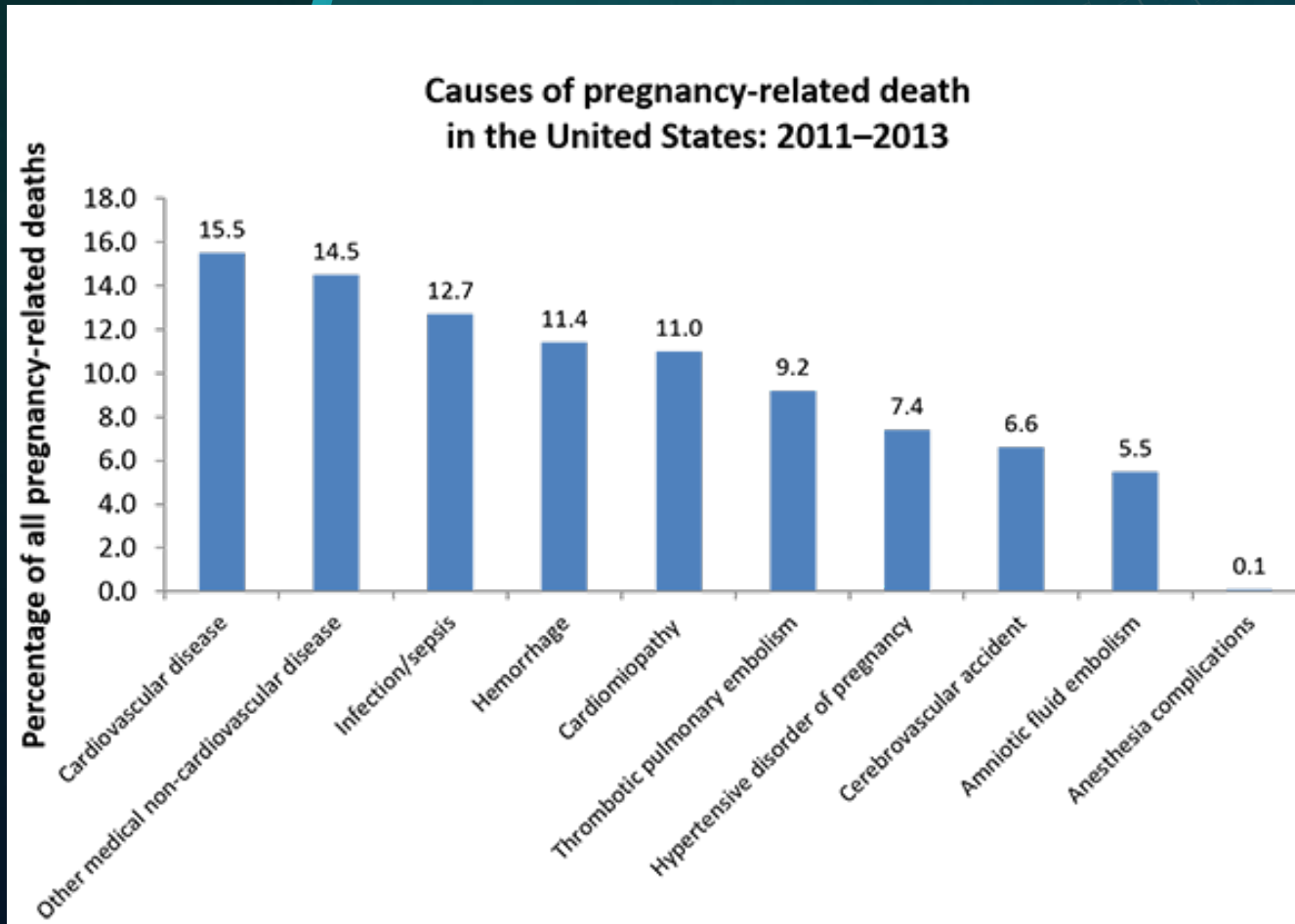
**Figure 1: Main causes of maternal death and key interventions (2013)**

Percentages refer to the proportion of all maternal deaths attributed to the specified cause. (WASH=water, sanitation, and hygiene. NASG=non-pneumatic anti-shock garment.) Source: *Series Papers Maternal Health 1 and 6*

**Figure A.1.1.**  
**Global estimates for causes of maternal mortality 2003–2009**

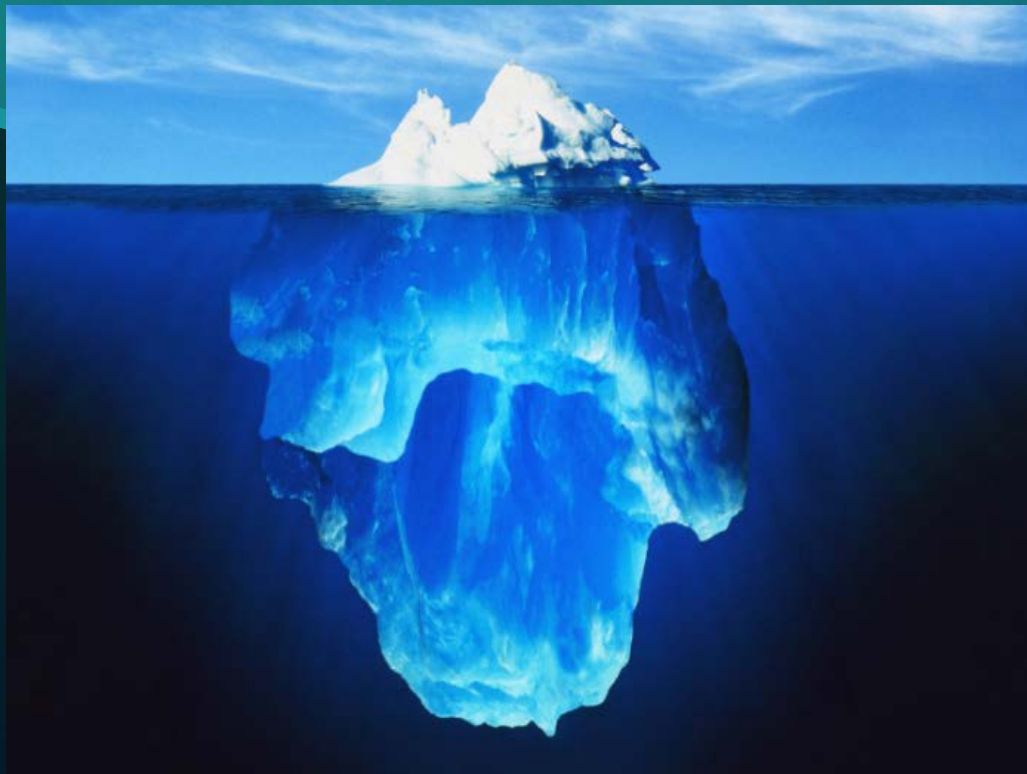


# WHY DO WOMEN IN THE USA DIE?

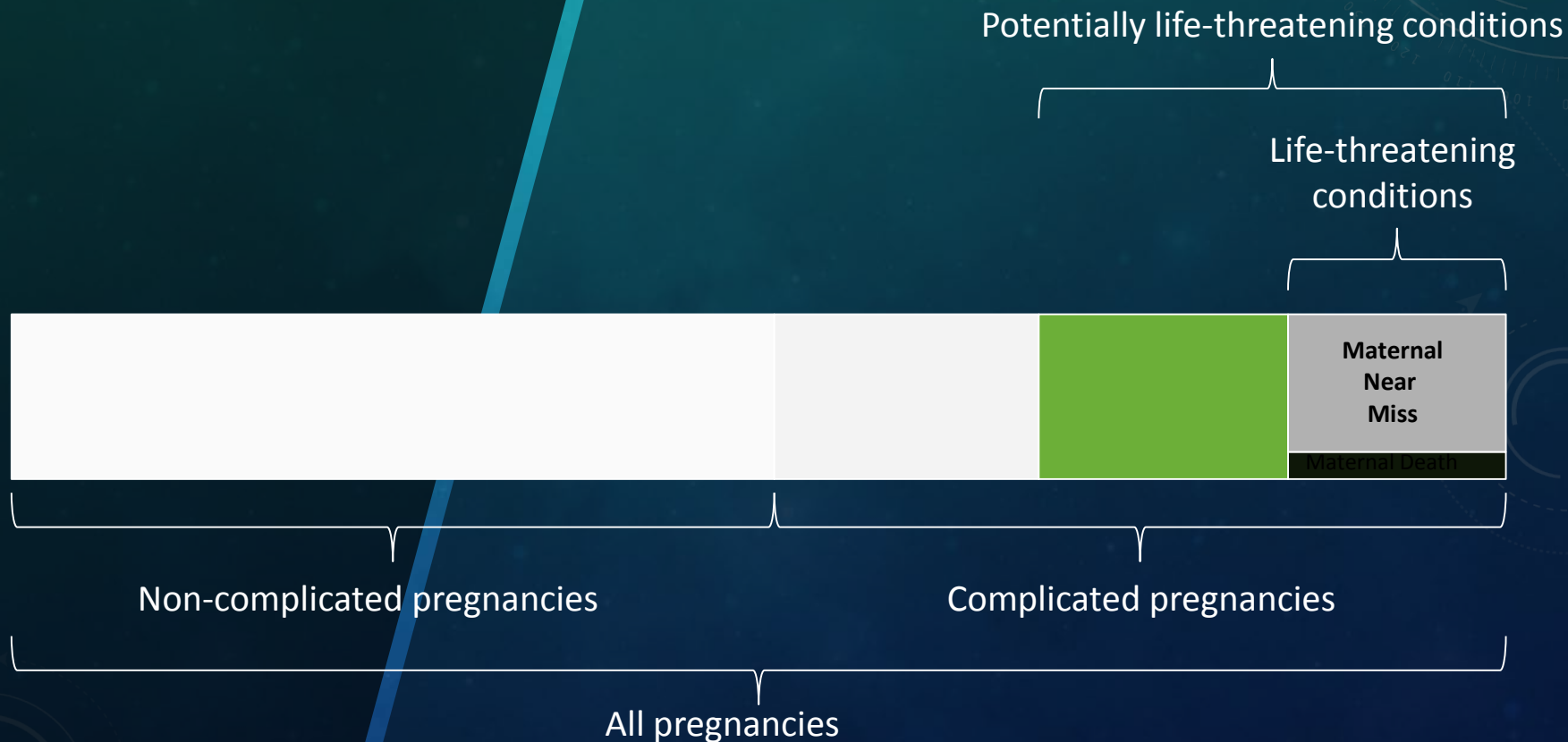


# WHY DO WOMEN IN UTAH DIE?

- Hemorrhage
- Sepsis
- Embolism
  - Pulmonary Embolism
  - Amniotic Fluid Embolism
- Cardiomyopathy



# THE SPECTRUM OF MATERNAL MORBIDITY: FROM NON-COMPLICATED PREGNANCIES TO MATERNAL DEATHS



# TAKE AWAYS

- Maternal mortality remains an issue
- Quality improvement efforts are helping to decrease maternal mortality
- Medical conditions brought into pregnancy are an increasingly important cause of maternal deaths, particularly cardiovascular deaths – preconception counseling becomes really important



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# MAHALO!





QUESTIONS?