WOMEN AT RISK: THE HIGH-RISK PREGNANCY

Maternal-Fetal Medicine Practice & Maternal Mortality

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http://www.acadianamfm.com/

Acadiana Maternal-Fetal Medicine A.P.M.C.

DISCLOSURES..

- I disclose that I have a minimal working knowledge of Power Point and IT type of work
- I disclose that this is my first "formal" presentation online
- I disclose that I'm from Franklin and I talk fast
- I have no financial disclosures, however

LEARNING OBJECTIVES / GOALS

- To gain an appreciation of the idea that a patient may walk into a room, a situation, a store, an office.. and what was thought to possibly be a "routine" pregnancy can quickly turn into the "unroutine"

- We are here to talk about *Maternal Mortality* ... Let us not forget the "other" patient.


ADOLPH F. C. CRAMER
DEBORAH K. BLOMME

BASELINE NUMBERS…

- ~ 85% of women will deliver normally in the United States
- ~ 10 – 15% will develop some complication
- ~ 3 – 5 % will need some surgical intervention

- 700 – 900 women in the U.S. die/year – HIGHEST IN THE DEVELOPED WORLD
- American women are more than 3x likely as Canadian women to die
- Some 65,000 nearly die

We are talking about a very small group of people in actual numbers but in reality, each individual… is an individual.

THE PATIENT SAFETY MOVEMENT

- Born from the Annenberg Conference in 1996
- Launched efforts devoted to improving patient safety
  - National Patient Safety Foundation (NPSF)
  - Institute for Healthcare Improvement (IHI)
- Institute of Medicine publication – 2000
  - ~ 44,000 – 98,000 patients die annually from medical errors
- More recent studies suggest that it may be the 3rd leading cause of death in the United States

MORBIDITY, MORTALITY AND THE DEFINITIONS

- Severe maternal morbidity (SMM) – refers to health-impacting and life-threatening events that occur surrounding pregnancy / childbirth
- Pregnancy-related death: death w/in one year of the pregnancy from a pregnancy complication, chain of events initiated by the pregnancy or aggravation (preeclampsia, eclampsia, extreme hypertension..)
- Pregnancy-associated, but not related: death w/in one year from a cause that is not related to pregnancy (car crash etc..)
- Pregnancy associated, unable to be determined: pregnancy associated but unable to be determined (suicide)

DATA, DATA, DATA…

- Purpose: …to propose guidelines for delivering facilities to systematically implement (evidence based) and improve patient care.

- All of the SMM and PAMR are significantly limited by the limited reliable and reproducible means of collecting data and the rarity of many complications
- Autopsies were performed in only 57% of cases in our own review*
- OVER HALF of the cases were missing at least "some" crucial records
- Pregnancy registry…

* Louisiana Maternal Mortality Review Report 2011 – 2016

MATERNAL MORTALITY – WORLDWIDE & US

Worldwide

- Obstetric hemorrhage – 27%
- Hypertensive disorders – 14%
- Pregnancy-related sepsis – 11%
- Abortion – 8%
- Embolism – 3%
- "Other direct" – 10%
  - Complications of labor etc..
- "Other indirect" – 28%
  - Preexisting medical disorders

Say L et al. Lancet Glob Health 2014; 2:e323.

United States

- Cardiovascular conditions – 15%
- Noncardiovascular medical cond – 14%
- Infection – 12%
- Hemorrhage – 11%
- Cardiomyopathy – 10.8%
- Embolism – 9%
- HTN disorders 7%
- CVA – 7%
- Unknown – 6%
- AFE – 5%
- Anesthesia complications – 0.3%

Petersen EE et al. MMWR Morb Mortal Wkly Rep 2019; 68:423

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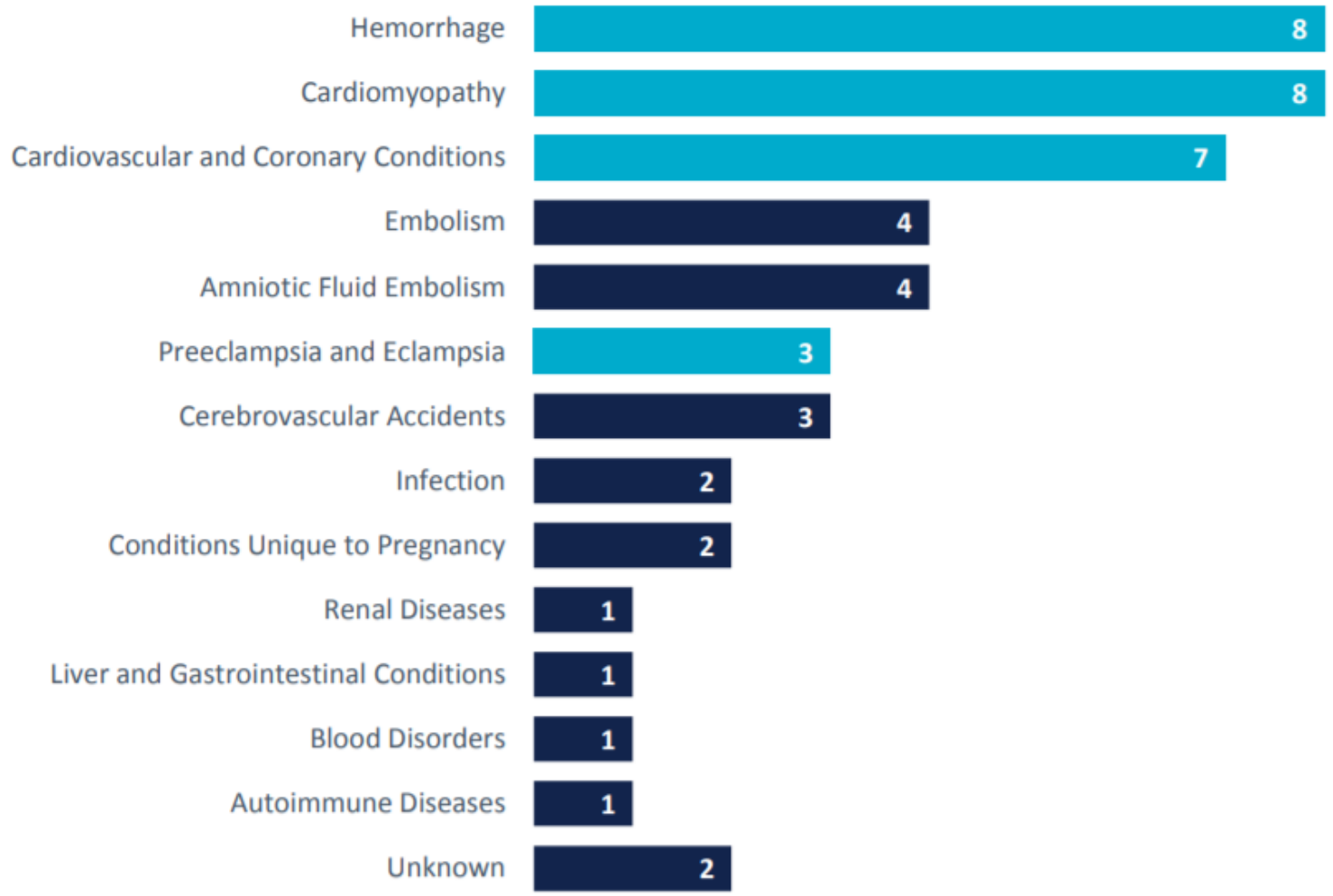
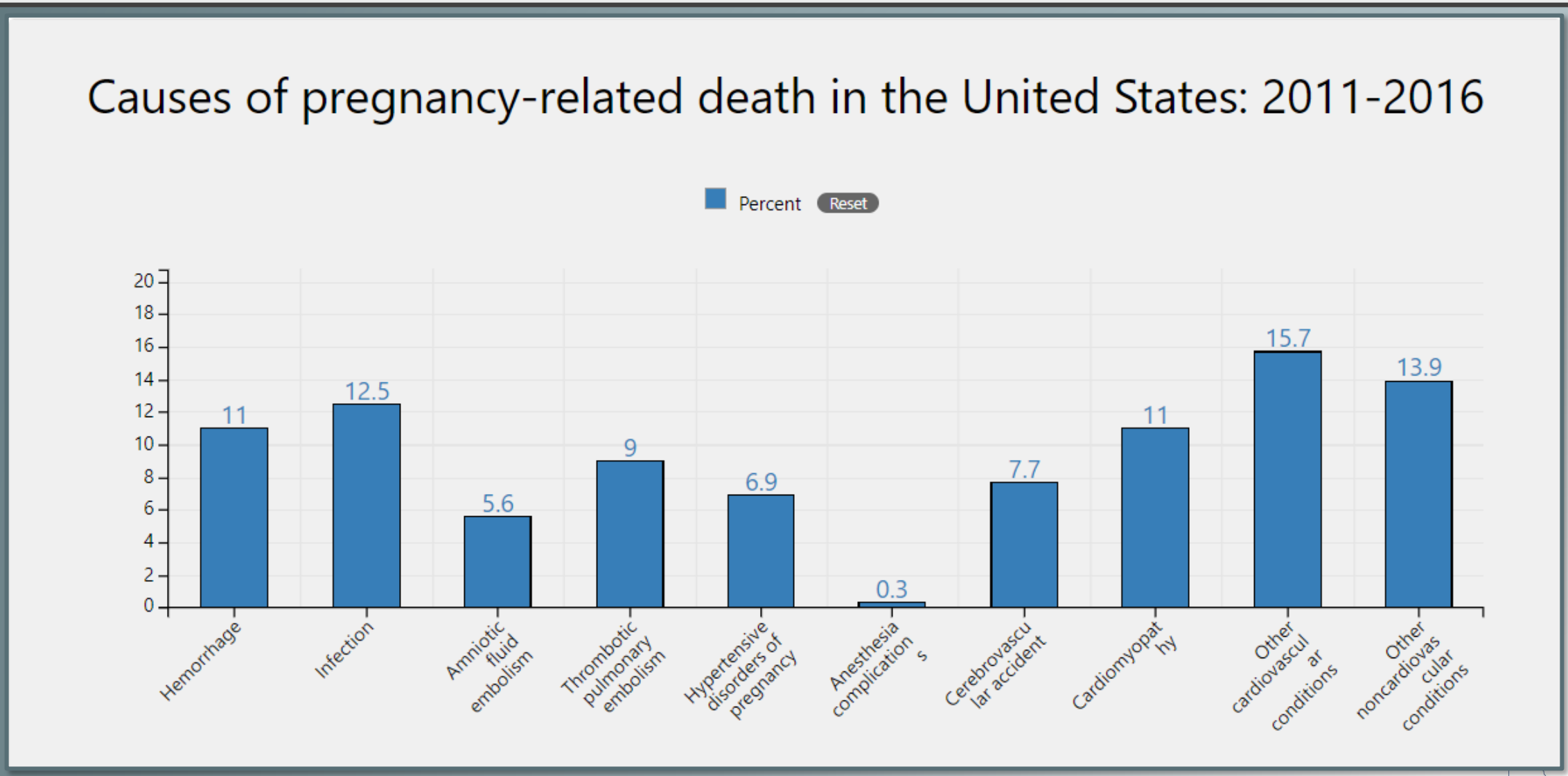
LOUISIANA
2011 – 2016

Causes of Maternal Death

All causes of confirmed pregnancy-related deaths in Louisiana from 2011-2016, by number of deaths.



CAUSES OF PREGNANCY-RELATED DEATH



CDC Data

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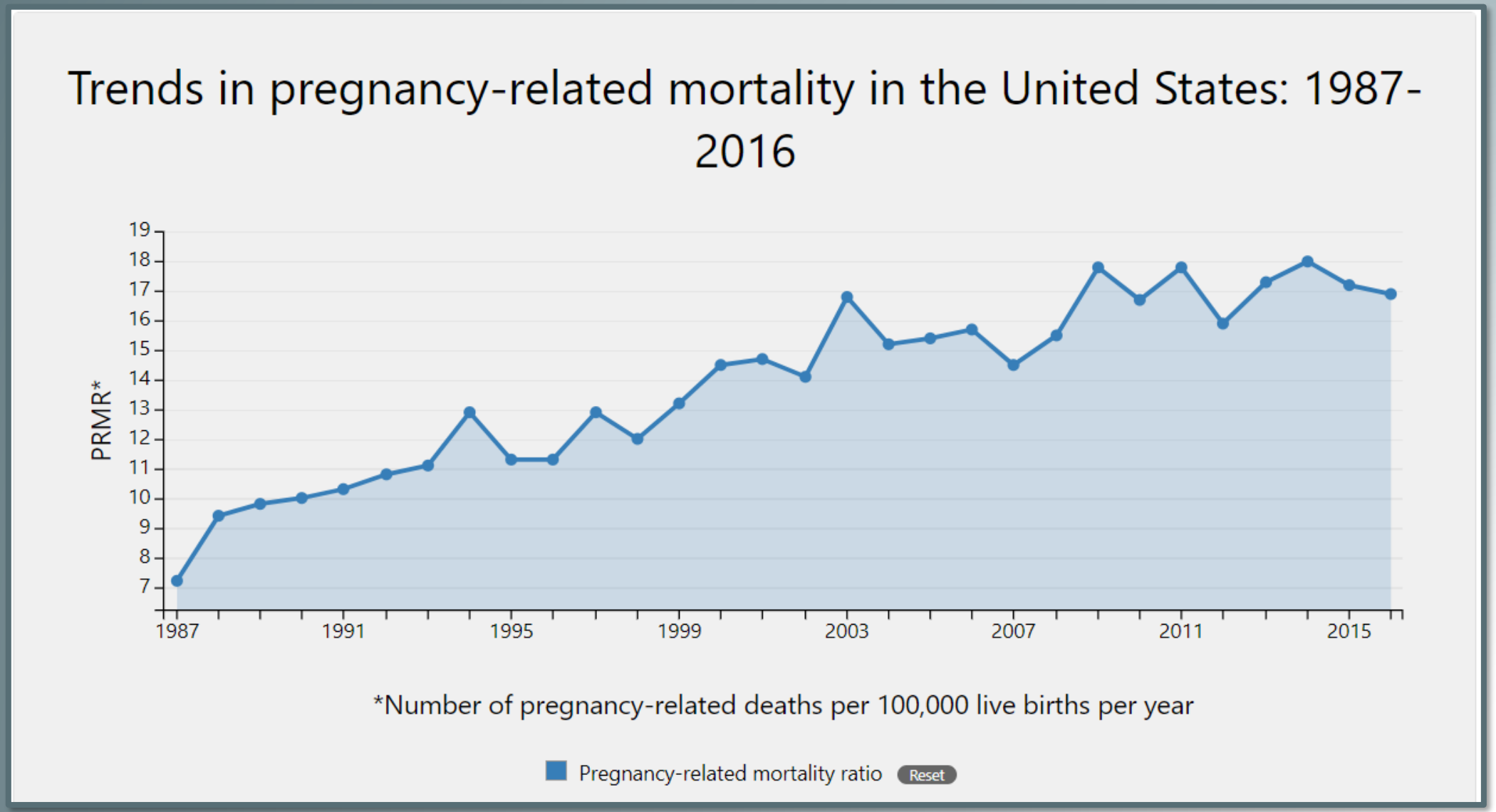
TRENDS IN PREGNANCY RELATED MORTALITY



CDC Data

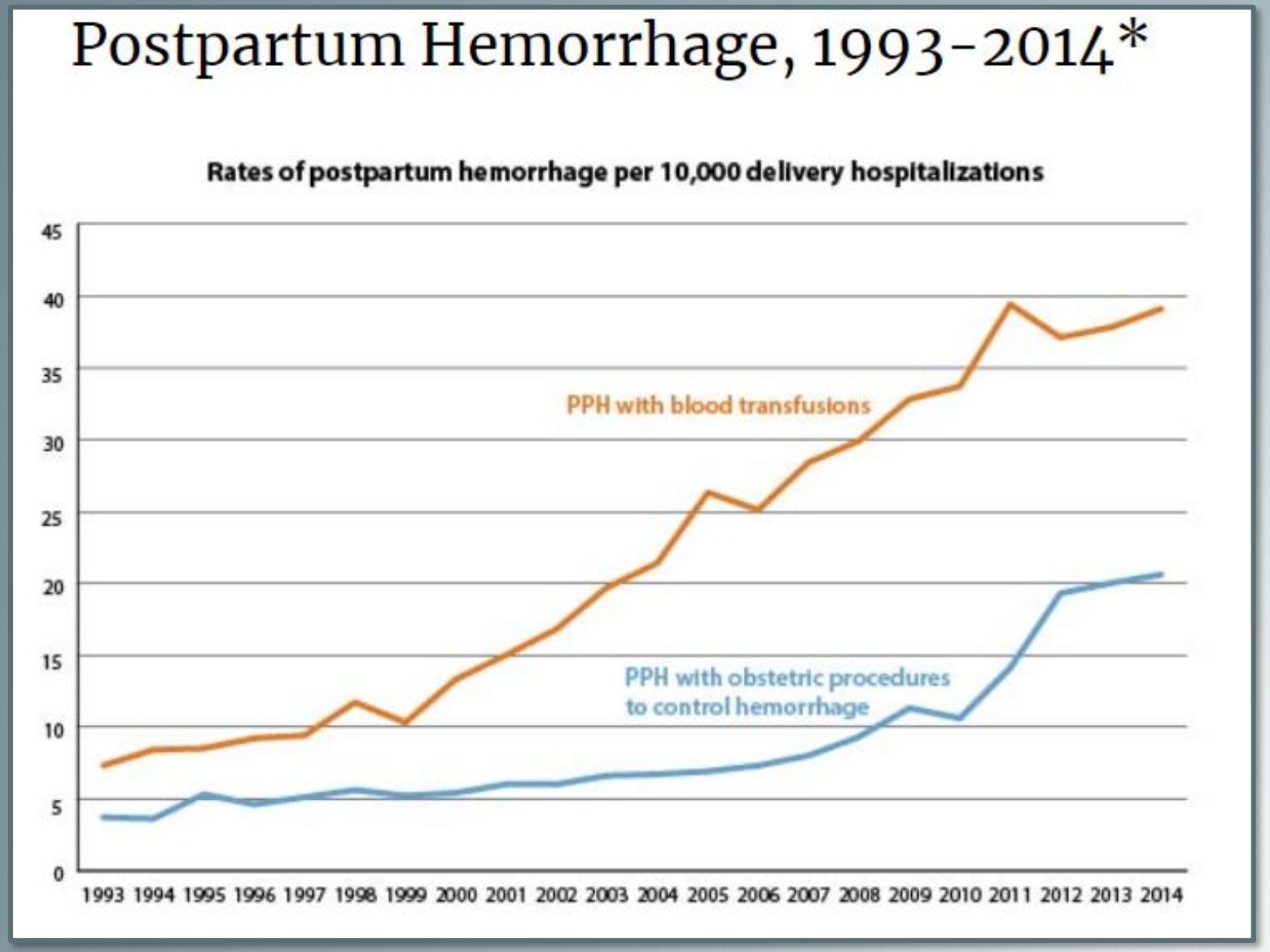
MATERNAL DEATHS/100,000 LIVE BIRTHS IN THE US AND LOUISIANA

Maternal deaths per 100,000 live births in the U.S. and Louisiana

Maternal deaths were identified through vital records data alone, using the WHO definition of maternal death (death during or within 42 days of pregnancy)

SPECIFIC CONDITIONS IN PREGNANCY - MORBIDITY AND MORTALITY

OBSTETRICAL HEMORRHAGE



CDC Data

HEMORRHAGE

- There is approximately 600 ml of blood that goes through the uterus every minute.
- Leading cause of death worldwide in 2014 (27%)
- 1:20 – 1:100 deliveries
- No. 4 in the US (11%) for maternal death
- Increasing in frequency – increase in cesarean deliveries
- Antepartum hemorrhage
- Postpartum hemorrhage

Petersen EE et al. MMWR Morb Mortal Wkly Rep 2019; 68:423

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OBSTETRICAL HEMORRHAGE- ANTEPARTUM

- First Trimester Bleeding
  - Pregnancy loss / threatened spontaneous abortion / "implantation"
  - Cervical pathology
  - Vaginal trauma
  - Ectopic pregnancy

HEMORRHAGE – ECTOPIC PREGNANCY

- Risk factors
  - Previous ectopic
  - Prior fallopian tube surgery
  - Previous pelvic or abdominal surgery
  - Previous STI's / PID
  - Endometriosis
  - Cigarette smoking
  - Age > 35
  - History of infertility
  - ART (IVF)
- Treatment
  - Medical – methotrexate
  - Surgical intervention

OBSTETRICAL HEMORRHAGE – ANTEPARTUM

- Second trimester bleeding / Third
  - Bloody show
  - Vasa previa
  - Other (polyps, trophoblastic disease, non-tubal ectopics, trauma)
  - **Placenta previa**
  - **Abruption**
  - **Uterine rupture**

POSTPARTUM HEMORRHAGE

- Obstetrical emergency
- Definitions have varied by time and by source making investigation/research difficult
- Incidence of ~ 1 – 3% of deliveries
- May be divided into "early" or "late" (aka "delayed", "secondary")
- ACOG revision 2017 – "... or bleeding associated w/ signs/sx of hypovolemia w/in 24hrs of birth
- Main causes:
  - Uterine Atony
  - Trauma
  - Coagulopathy

POSTPARTUM HEMORRHAGE DEFINITIONS

Organization	Definition of PPH
World Health Organization[1]	▪ Blood loss ≥500 mL within 24 hours after birth. ▪ Severe PPH: Blood loss ≥1000 mL within the same time frame.
American College of Obstetricians and Gynecologists[2]	▪ Cumulative blood loss ≥1000 mL or blood loss accompanied by signs or symptoms of hypovolemia within 24 hours after the birth process (includes intrapartum loss) regardless of route of delivery.
Royal College of Obstetricians and Gynaecologists[3] 2017	▪ Minor PPH (500 to 1000 mL) and major PPH (>1000 mL). Subdivisions of major PPH include moderate (1001 to 2000 mL) or severe (>2000 mL).
International expert panel[4]	▪ Active bleeding >1000 mL within the 24 hours following birth that continues despite the use of initial measures, including first-line uterotonic agents and uterine massage.
Society of Obstetricians and Gynaecologists of Canada[5]	▪ Any amount of bleeding that threatens the patient's hemodynamic stability.
California Maternal Quality Care Collaborative[6]	▪ Stage 0: Every woman in labor/giving birth. ▪ Stage 1: Blood loss >500 mL after vaginal or >1000 mL after cesarean delivery; or change in vital signs >15% or heart rate ≥110 beats/minute, blood pressure ≤85/45 mmHg, O_2 saturation <95%. ▪ Stage 2: Continued bleeding with total blood loss <1500 mL. ▪ Stage 3: Total blood loss >1500 mL or >2 units packed red cells transfused; or unstable vital signs; or suspicion of disseminated intravascular coagulation.

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POSTPARTUM HEMORRHAGE – CAUSES / RISK FACTORS

- Abnormal placentation
- Placental abruption
- Hypertensive disorders
- IUFD
- Induction of labor
- Prolonged 1st or 2nd stage
- Retained placenta / membranes
- Morbidly adherent placenta
- Lacerations
- Instrumental delivery
- LGA (> 4,000 g)

Sheiner E et al. J Matern Fetal Neonatal Med 2005; 18:149.

Mhyre JM et al. Obstet Gynecol 2013; 122:1288.

POSTPARTUM HEMORRHAGE – LATE / DELAYED

- Generally defined as significant uterine bleeding b/w 24hrs – 12 weeks post
- Occurs in 0.2 – 2.5% of post partum in high-income countries
- Most common causes:
  - Retained product of conception
  - Infection
  - Subinvolution of the placental bed

HEMORRHAGE – GENERAL PRINCIPLES OF MANAGEMENT

- Goals
  - Restore / Maintain adequate circulatory volume to prevent hypoperfusion
  - Reverse / Prevent coagulopathy
  - Eliminate the cause of the PPH
- Quantify blood loss
- Timely diagnosis
- Teamwork
- Monitoring

NPMS Bundle for Hemorrhage

- Readiness
- Recognition
- Response & reporting
- Systems learning

The risk of recurrence can be ~ 18% dependent upon the etiology

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REDUCING MATERNAL MORTALITY : OBSTETRIC HEMORRHAGE

- Assessment all women to be delivered for risk of postpartum hemorrhage
- Every obstetrical unit needs a hemorrhage–response protocol
  - Member should train as a team and frequently
- All providers on every level must be able to identify and respond to clinical triggers
- Uterotonics, intrauterine balloons, uterine compression sutures and skills should be available to all maternity providers
- Women with a suspected morbidly adherent placenta should deliver at a center capable of massive transfusion protocols, rapid cesarean delivery availability and experience.

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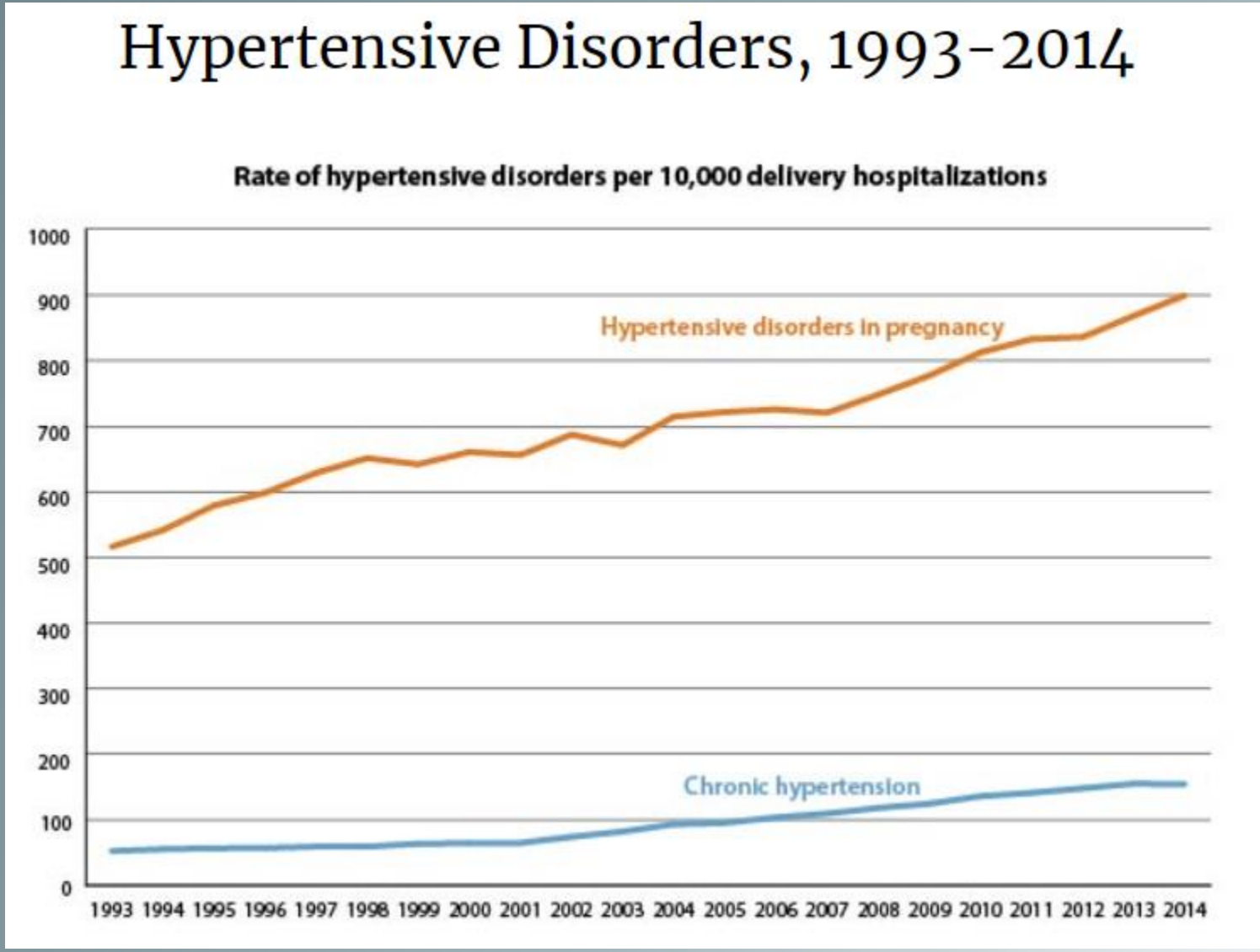
HYPERTENSION



CDC Data

HYPERTENSION

- Second leading cause of maternal death worldwide by the WHO 2014
- 33% of all adults ≥ 20y/o have CHTN as of 2016
- Number 7 in a US report from 13 MMR (7%)
- Perinatal mortality is 3 – 4x
- Comes in four forms:
  - 1. Chronic hypertension
  - 2. Gestational hypertension
    - Mild / Severe
  - 3. Preeclampsia/Eclampsia
    - HELLP
  - 4. Superimposed preeclampsia

MMWR Morb Mortal Wkly Rep. 2019;68(18):423

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HYPERTENSION – COMPLICATIONS

- Abruption
- Fetal growth restriction
- IUFD (fetal death)
- Oligohydramnios (low fluid)
- Prematurity
- Pulmonary edema
- Retinopathy
- Cerebral hemorrhage – largest contributor to mortality

HELLP… A SPECIAL KIND OF SICK

- Increased risk of maternal death – 1%
- Substantial increase in the perinatal morbidity / mortality – (7-20%)
- Increased risk of preterm birth (70%)
- Specific risks to the patient with HELLP
  - Pulmonary edema (8%)
  - ARF (3%)
  - DIC (15%)
  - Abruption (9%)
  - Liver hemorrhage / failure (1%)
  - Subsequent CVD

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CMQCC
California Maternal Quality Care Collaborative

FOR FAMILIES | CMQCC Accounts Login | Contact Us

ABOUT CMQCC | MATERNAL DATA CENTER | QI INITIATIVES | RESEARCH | RESOURCES & TOOLKITS

TOOLKITS

Cardiovascular Disease Toolkit

Preeclampsia Toolkit

The primary aim of *Improving Health Care Response to Preeclampsia: A California Toolkit to*

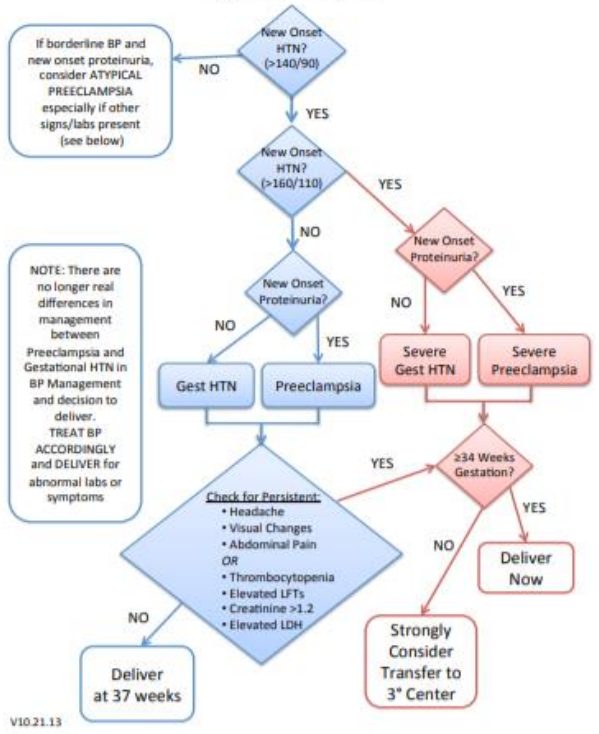
Preeclampsia Practice Update

CMQCC CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE | California Department of PublicHealth

CMQCC PREECLAMPSIA TOOLKIT
PREECLAMPSIA CARE GUIDELINES
CDPH-MCAH Approved: 12/20/13

SUSPECTED PREECLAMPSIA ALGORITHM

Suspected Preeclampsia Flowchart
Diagnosis and Management



CMQCC CALIFORNIA MATERNAL QUALITY CARE COLLABORATIVE | California Department of PublicHealth

CMQCC PREECLAMPSIA TOOLKIT
PREECLAMPSIA CARE GUIDELINES
CDPH-MCAH Approved: 12/20/13

Preeclampsia Early Recognition Tool (PERT)

ASSESS	NORMAL (GREEN)	WORRISOME (YELLOW)	SEVERE (RED)
Awareness	Alert/oriented	•Agitated/confused •Drowsy •Difficulty speaking	•Unresponsive
Headache	None	•Mild headache •Nausea, vomiting	•Unrelieved headache
Vision	None	•Blurred or impaired	•Temporary blindness
Systolic BP (mm HG)	100-139	140-159	≥160
Diastolic BP (mm HG)	50-89	90-105	≥105
HR	61-110	111-129	≥130
Respiration	11-24	25-30	<10 or >30
SOB	Absent	Present	Present
O2 Sat (%)	≥95	91-94	≤90
Pain: Abdomen or Chest	None	•Nausea, vomiting •Chest pain •Abdominal pain	•Nausea, vomiting •Chest pain •Abdominal pain
Fetal Signs	•Category I •Reactive NST	•Category II •IUGR •Non-reactive NST	•Category III
Urine Output (ml/hr)	≥50	30-49	≤30 (in 2 hrs)
Proteinuria (Level of proteinuria is not an accurate predictor of pregnancy outcome)	Trace	•≥ +1** •≥300mg/24 hours	
Platelets	>100	50-100	<50
AST/ALT	<70	>70	>70
Creatinine	≤0.8	0.9-1.1	≥1.2
Magnesium Sulfate Toxicity	•DTR +1 •Respiration 16-20	•Depression of patellar reflexes	•Respiration <12

GREEN = NORMAL
Proceed with protocol

YELLOW = WORRISOME
Increase assessment frequency

# Triggers	TO DO
1	•Notify provider
≥2	•Notify charge RN •In-person evaluation •Order labs/tests •Anesthesia consult •Consider magnesium sulfate •Supplemental oxygen

**Physician should be made aware of worsening or new-onset proteinuria

RED = SEVERE

Trigger: 1 of any type listed below	TO DO
1 of any type	• Immediate evaluation • Transfer to higher acuity level • 1:1 staff ratio
Awareness Headache Visual	• Consider Neurology consult • CT Scan • R/O SAH/intracranial hemorrhage
BP	• Labetalol/hydralazine in 30 min • In-person evaluation • Magnesium sulfate loading or maintenance infusion
Chest Pain	• Consider CT angiogram
Respiration SOB O2 SAT	• O2 at 10 L per rebreather mask • R/O pulmonary edema • Chest x-ray

11.8.13.v1

https://www.cmqcc.org/resources-tool-kits/toolkits/preeclampsia-toolkit

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LDH – OPH – Bureau of Family Health

Louisiana Perinatal Quality Collaborative (LaPQC): Reducing Maternal Morbidity

What is LaPQC?

The Louisiana Perinatal Quality Collaborative (LaPQC) is an initiative of the Louisiana Commission on Perinatal Care and Prevention of Infant Mortality. LaPQC is a voluntary network of perinatal care providers, public health professionals and patient and community advocates who work to advance equity and improve outcomes for women, families, and newborns in Louisiana.

The first initiative of the LaPQC is the *Reducing Maternal Morbidity Initiative*. The goal of this initiative is to achieve a 20% reduction in severe maternal morbidity among pregnant and postpartum women who experience hemorrhage or severe hypertension/preeclampsia in LaPQC participating birthing facilities in 12 months, and to narrow the Black-White disparity in this outcome in 12 months.

What does the LaPQC do?

The LaPQC provides support to hospitals for continuous quality improvement on perinatal outcomes. It works to:

- Facilitate collaborative learning opportunities through Learning Sessions and monthly calls
- Identify and share best practices
- Facilitate mentorship between hospitals
- Provide teams with a data portal to allow for real-time evaluation to guide decision-making
- Provide subject-matter experts who are brought on as Faculty
- Coordinate a guiding Advisory Committee
- Ensure Louisiana's work is connected to national initiatives

LaPQC@la.gov
Amy.Ladley@la.gov

REDUCING MATERNAL MORTALITY : PREECLAMPSIA

- Aggressively treat both systolic and diastolic hypertension
- Protocols for the use of IV antihypertensives for severe range blood pressure should be used widely on L&D and in the ER
- Laboratory evaluation should be completed for all women who present in the 3rd trimester with new onset hypertension OR RECENTLY POSTPARTUM
- Magnesium sulfate should be used to reduce the risk of eclampsia in women with hypertension and severe features
- Women with preeclampsia with severe features who are expectedly managed should be admitted to a hospital

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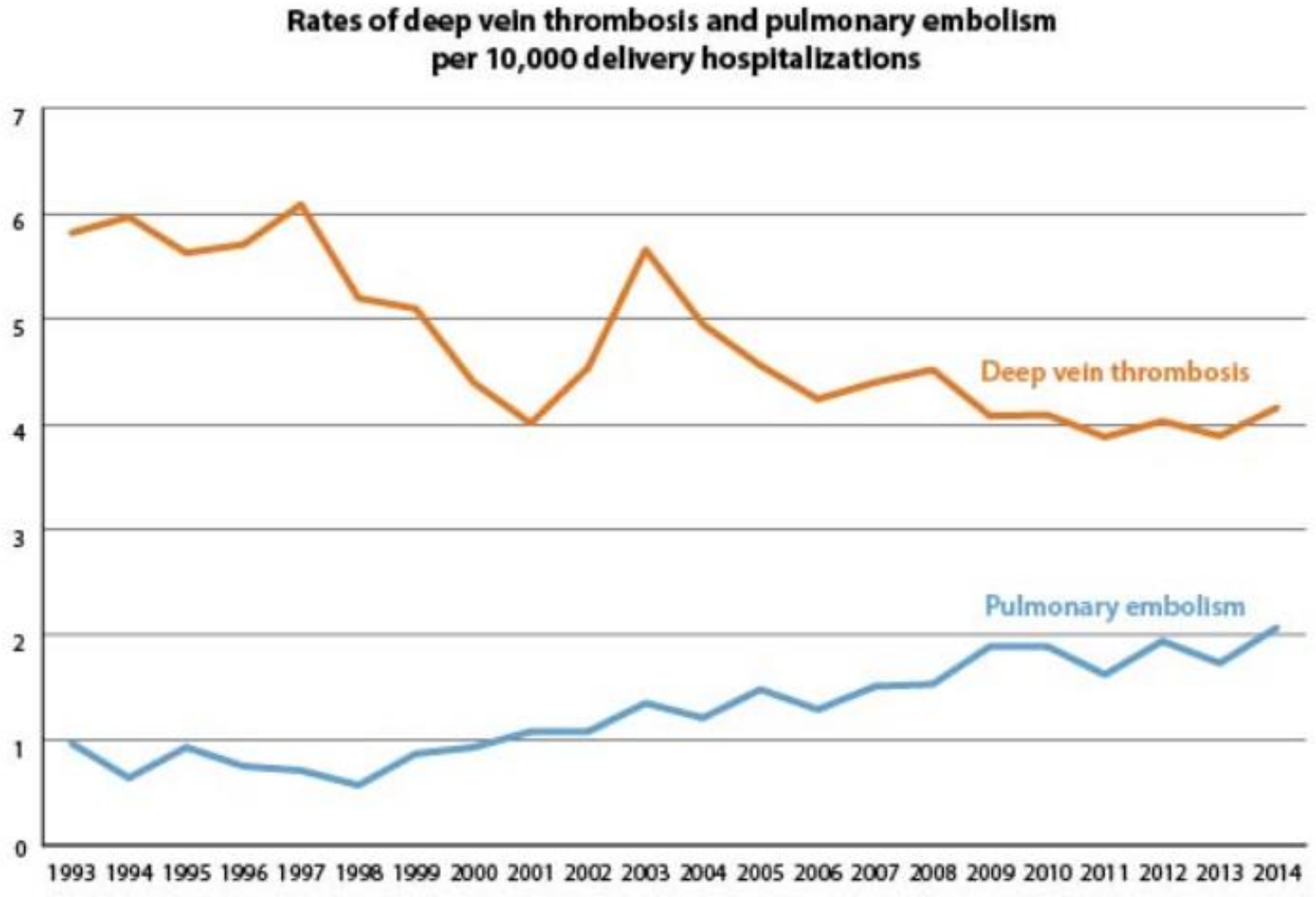
HYPERTENSION – GOALS WORTH REPEATING

- Guide, educate, and support providers, staff, hospitals and all involved with a ***culture of awareness*** and recommend best practices for prevention and response
- Timely recognition and an organized and swift response to hypertensive disorders surrounding pregnancy

THROMBOEMBOLISM



CDC Data

VENOUS THROMBOEMBOLISM

- DVT – condition when a blood clot forms in a "deep vein".
- Typically develop in the lower leg, thigh, or pelvis
- Potential for pulmonary embolus (PE)
- Pregnancy /surrounding postpartum period are well established risk factors
  - as much as 50 x risk of nonpregnant women
- Incidence 1:500 – 1:2,000
- PE is the 7th leading cause of maternal mortality
- Accounts for 9% of maternal deaths
- Conflicting reports of current trends*,**

*Heit JA, Kobbervig CE, James AH, et al. Trends in the incidence of venous thromboembolism during pregnancy or postpartum: a 30-year population-based study. Ann Intern Med 2005; 143:697.

**Ghaji N, Boulet SL, Tepper N, Hooper WC. Trends in venous thromboembolism among pregnancy-related hospitalizations, United States, 1994-2009. Am J Obstet Gynecol 2013; 209:433.e1.

VENOUS THROMBOSIS RISK FACTORS

Antepartum

- Multiples
- Inflammatory bowel disease
- UTI
- Diabetes
- Hospitalization (>3d)
- BMI
- Increased maternal age

Postpartum

- C/S (esp emergent)
- Comorbidities
- AMA
- EGA < 36 weeks
- Obstetric hemorrhage
- Smoking
- Pre-eclampsia
- Infection
- Stillbirth

ROOM FOR IMPROVEMENT IN THE US

- United Kingdom's push for lowering rate of VTE
- Achieved ~ 50% reduction from baseline of the previous 6 years
  - Better risk assessment
  - Wider use of prophylaxis
- Current UK rate is ~ 0.8 / 100,000 vs US 1.5 / 100,000
- Now most US hospitals now follow prophylaxis recommendations by The Joint Commission and ACOG

REDUCING MATERNAL MORTALITY : VENOUS THROMBOEMBOLISM

- Evaluate all women for risk of venous thromboembolism
- Use sequential compression devices during and after all cesarean deliveries
- Use pharmacologic prophylaxis in women with a personal history
- Consider pharmacologic thromboprophylaxis for patients with other high risk conditions (obesity, thrombophilias, nephrotic proteinuria level, blood transfusion, surgical procedures, AMA)
- Consider pulmonary embolus in the differential diagnosis of sudden onset SOB, chest pain, tachypnea, hypoxia and/or tachycardia... and promptly

CONGENITAL / ACQUIRED HEART DISEASE

CARDIOVASCULAR DISEASE IN PREGNANCY

- In the US, cardiovascular disease is the leading cause of death in the pregnant and postpartum woman
- Constitutes 26.5% of U.S. pregnancy-related deaths
- It affects ~ 1-4% of nearly 4 million pregnancies in the U.S. every year
- Can be classified as "congenital" or "acquired"
- Increasing in incidence
  - 6.4 ⟶ 9.0 /10,000 delivery hospitalizations from 2000 – 2010
  - 97% seem to be related to acquired heart disease
- Higher rates of morbidity & mortality in nonwhite, lower-income women

Creanga AA et al. Obstet Gynecol 2017;130:366–73.

CARDIOVASCULAR DISEASE IN PREGNANCY

- Most common presentations
  - Heart failure
  - Myocardial infarction
  - Arrhythmia
  - Aortic dissection
- Diagnosis can be challenging because of the overlap of symptoms
- Estimated that ¼ or more of maternal deaths in the US could be prevented
- UK report in 2015 on maternal mortality:
  - 50% were associated with substandard health care
  - ½ of those were considered "avoidable"

Hameed et al. Am J Obstet Gynecol 2015;213:379.e1–10A
Kuklina E et al. BJOG 2011;118:345–52

MATERNAL CARDIOVASCULAR DISEASE – RISK FACTORS

- Non-Hispanic black race
- Older age (>40)
- Hypertensive disorders
  - Preeclampsia spectrum
- Chronic disease
  - CHTN
  - Pregestational diabetes
- Obstructive sleep apnea
- History of preterm birth
- Family history
- Exposure to cardiotoxic drugs
- Obesity

COMMON SIGNS & SYMPTOMS VS ABNORMAL

	ROUTINE CARE	CAUTION*†	STOP†‡
	Reassurance	Nonemergent Evaluation	Prompt Evaluation Pregnancy Heart Team
History of CVD	None	None	Yes
Self-reported symptoms	None or mild	Yes	Yes
Shortness of breath	No interference with activities of daily living; with heavy exertion only	With moderate exertion, new-onset asthma, persistent cough, or moderate or severe OSA§	At rest; paroxysmal nocturnal dyspnea or orthopnea; bilateral chest infiltrates on CXR or refractory pneumonia
Chest pain	Reflux related that resolves with treatment	Atypical	At rest or with minimal exertion
Palpitations	Few seconds, self-limited	Brief, self-limited episodes; no lightheadedness or syncope	Associated with near syncope
Syncope	Dizziness only with prolonged standing or dehydration	Vasovagal	Exertional or unprovoked
Fatigue	Mild	Mild or moderate	Extreme
Vital signs	Normal		
HR (beats per minute)	<90	90–119	≥120
Systolic BP (mm Hg)	120–139	140–159	≥160 (or symptomatic low BP)
RR (per minute)	12–15	16–25	≥25
Oxygen saturation	>97%	95–97%	<95% (unless chronic)
Physical examination	Normal		
JVP	Not visible	Not visible	Visible >2 cm above clavicle
Heart	S3, barely audible soft systolic murmur	S3, systolic murmur	Loud systolic murmur, diastolic murmur, S4
Lungs	Clear	Clear	Wheezing, crackles, effusion
Edema	Mild	Moderate	Marked

Thomas S. Heart 2016;1021:1410-7

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WHO PREGNANCY RISK CLASSIFICATION

Modified WHO Pregnancy Risk Classification (Risk of Pregnancy by medical condition) Suggested follow-up*	Specific Cardiac Lesions	Pregnancy Care Delivery Location

mWHO Risk Class I
No detectable increased risk of maternal mortality and no or mild increase in morbidity
(2–5% risk of maternal cardiac event rate)
Follow-up: Cardiology evaluation once or twice during pregnancy
	• Uncomplicated, small, or mild
	  ○ Pulmonary stenosis
	  ○ Patient ductus arteriosus
	  ○ Mitral valve prolapse
	• Successfully repaired simple lesions (atrial or ventricular septal defect, patent ductus arteriosus, anomalous pulmonary venous drainage)
	• Atrial or ventricular ectopic beats, isolated
		• Prepregnancy/pregnancy counseling
		• Care at local hospital
		• Delivery at local hospital*

mWHO Risk Class II Small increased risk of maternal mortality or moderate increase in morbidity (6–10% maternal cardiac event rate) Follow-up: Cardiology, every trimester	• Unoperated atrial or ventricular septal defect • Repaired Tetralogy of Fallot or aortic coarctation • Most arrhythmias (supraventricular arrhythmias) • Turner syndrome without congenital cardiac disease	• Prepregnancy/pregnancy counseling • Pregnancy Heart Team* consultation/ counseling • Care at local hospital • Delivery at local hospital*

WHO – CLASS II(CONT) & III

mWHO Risk Classes II and III Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity (11–19% maternal cardiac event rate) Follow-up: Cardiology, every trimester	• Mild left ventricular impairment (EF >45%) • Hypertrophic cardiomyopathy • Native or bioprosthetic valve disease not considered mWHO Risk Class I or IV (mild mitral stenosis, moderate aortic stenosis) • Marfan or other HTAD syndrome without aortic dilation • Aorta <45 mm in bicuspid aortic valve pathology • Repaired coarctation without residua (non-Turner) • Atrioventricular septal defect	• Prepregnancy/pregnancy counseling • Pregnancy heart team* consultation/ counseling • Care at an appropriate level hospital (critical members of the Pregnancy Heart Team* available depending on cardiac disease) • Delivery at an appropriate level hospital*†
Pre-mWHO Risk Class III Significantly increased risk of maternal mortality or severe morbidity (20–27% maternal cardiac event rate) Follow-up: Cardiology, every 1–2 months	• Moderate left ventricular impairment (EF 30–45%) • Previous peripartum cardiomyopathy without any residual left ventricular impairment • Mechanical valve • Systemic right ventricle with good or mildly decreased ventricular function • Uncomplicated Fontan circulation, • Unrepaired cyanotic heart disease • Other complex heart disease • Moderate mitral stenosis • Severe asymptomatic aortic stenosis • Moderate aortic dilation (40–45 mm in Marfan syndrome or other HTAD; 45–50 mm in bicuspid aortic valve; Turner syndrome ASI 20–25 mm/m^2; Tetralogy of Fallot <50 mm) • Ventricular tachycardia	• Prepregnancy/pregnancy counseling • Pregnancy Heart Team* consultation/ counseling • Care at an appropriate level hospital† • Delivery at an appropriate level hospital*†

RISK CLASS IV

mWHO Risk Class IV

Pregnancy contraindicated

Discuss induced abortion

Extremely high risk of maternal mortality or severe morbidity

(>27% maternal cardiac event rate)

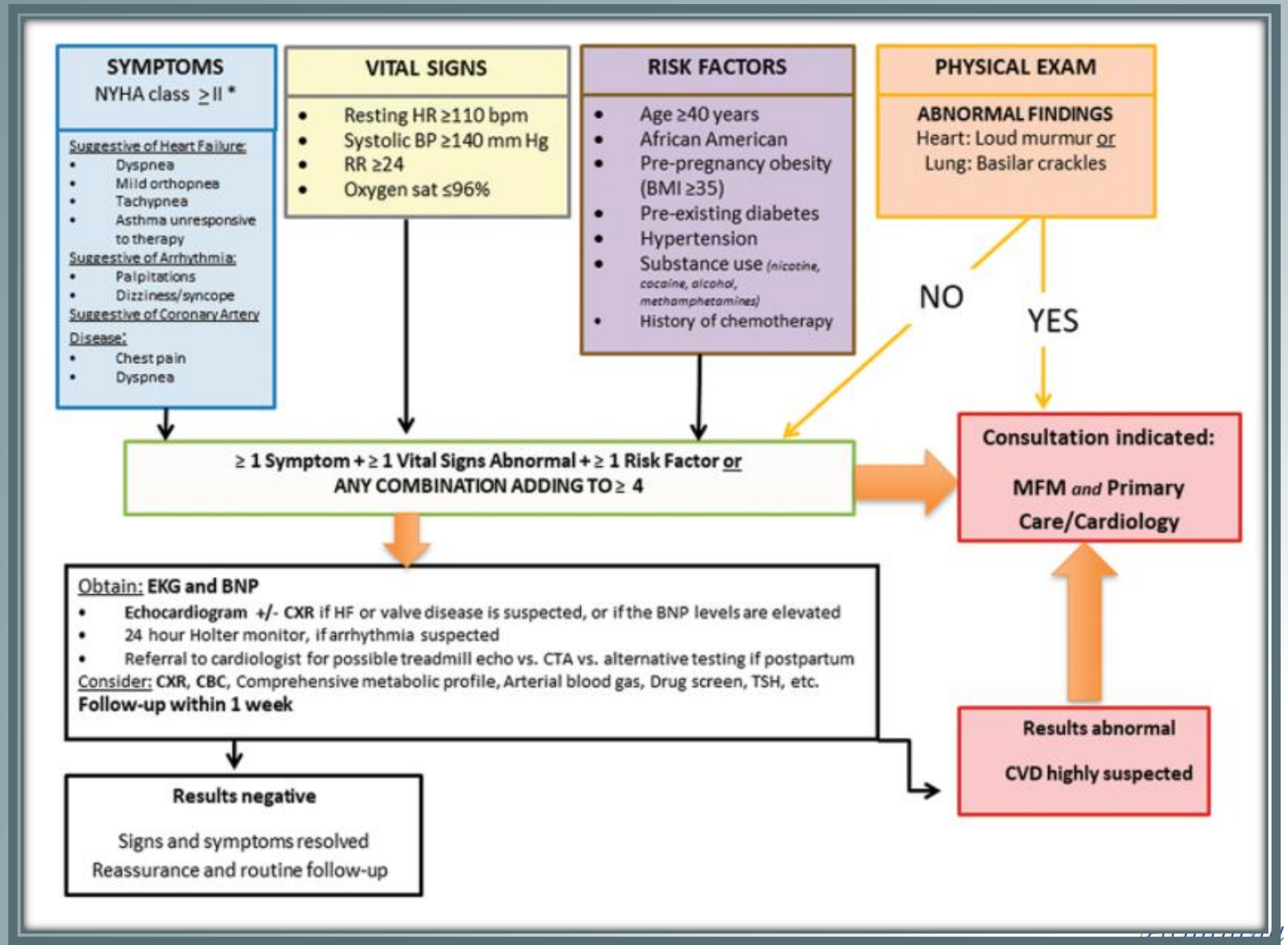
Follow-up: Cardiology follow-up every month (minimum)

- Pulmonary arterial hypertension
- Severe systemic ventricular dysfunction (EF <30%, NYHA III-IV)
- Previous peripartum cardiomyopathy with any residual left ventricular dysfunction
- Severe mitral stenosis
- Severe symptomatic aortic stenosis
- Systemic right ventricle with moderate to severely decreased ventricular function
- Severe aortic dilation (>45 mm in Marfan syndrome or other HTAD; >50 mm in bicuspid aortic valve; Turner syndrome ASI >25 mm/m^2; Tetralogy of Fallot >50 mm)
- Vascular Ehlers-Danlos
- Severe (re)coarctation
- Fontan circulation with any complication

- Pregnancy Heart Team* consultation/ counseling
- Care at an appropriate level hospital† (critical members of the Pregnancy Heart Team* available depending on cardiac disease)
- Delivery at an appropriate level hospital*‡

CALIFORNIA 2019

- California Improving Health Care Response to Cardiovascular Disease in Pregnancy & Postpartum
- Could have identified 88% of patient prior to maternal deaths



Wolfe DS et al. Am J Obstet Gynecol 2019;220(2):167.e1–167

CLINICAL CONSIDERATIONS

- Preconceptual counseling / risk assessment
- Detailed history
- Proper referrals
  - Cardiology
  - MFM
  - Anesthesia
- Patient education

REDUCING MATERNAL MORTALITY : CARDIOVASCULAR DISEASE

- Symptoms such as severe dyspnea, orthopnea or syncope warrant further evaluation
- Women who present late in pregnancy or recently postpartum with pulmonary edema or other evidence of volume overload of unknown etiology should have an echocardiogram
- All women with known underlying cardiac disease should be co-managed with an MFM and cardiologist
- Women with WHO Class IV should be counseled that pregnancy is contraindicated ..even discussions at regular gyn visits
- Careful delivery planning for women with cardiac disease is required in a multidisciplinary collaboration

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AMNIOTIC FLUID EMBOLISM

AMNIOTIC FLUID EMBOLISM (AFE)

- Rare and often catastrophic condition of pregnancy
- Diagnosis of exclusion and clinical findings
- Characterized by sudden cardiovascular collapse, severe respirator difficulty, hypoxia and/or seizures. DIC typically follows these symptoms
- Generally arises during labor or shortly thereafter
- Occurs ~ 1.9 – 6.1 cases / 100,000 deliveries
- One of the leading causes of maternal mortality
- Pathogenesis is unclear with many hypotheses

AMNIOTIC FLUID EMBOLISM – RISK FACTORS

- Cesarean delivery
- Instrumental delivery
- Placental abnormalities
  - Previa
  - Abruption
  - Accreta
- Preeclampsia / eclampsia

AFE – SYMPTOMS AND LOOK-ALIKES

- Aura – 1/3 sense doom, chills, n/v, agitation, anxiety
- Sudden cardiorespiratory failure
- Hemorrhage / DIC
- Tonic-clonic seizure

- Hemorrhage secondary to atony
- Thromboembolism
- Anesthetic accident
- MI
- Septic shock

MANAGEMENT / OUTCOME

- Supportive care and monitoring
- ICU and ruling out other causes / narrow diagnosis

  Vasopressors IVF

  Blood products Arterial access
- Mortality rate is ~ 15 – 40% (overall acceptable number is ~ 20%)
- 85% patients with significant neurologic injury
- 20 – 60% neonatal mortality and ~ Only 50% of survivors are neurologically "intact"
- Recurrence is unknown

REDUCING MATERNAL MORTALITY : AMNIOTIC FLUID EMBOLISM

- Consider amniotic fluid embolism in the differential diagnosis
- Initiate aggressive and immediate cardiopulmonary support
- Initiate massive transfusion protocol early - emphasis on large quantities of coagulation factors
- If AFE occurs during pregnancy with a viable fetus, expedited delivery
- Immediately involve staff from anesthesia, obstetricians (other help), critical care

Mortality can occur even in **BEST cases that are **optimally** managed*

INFECTION / SEPSIS

INFECTION / SEPSIS

- "Infection" can come in many forms during pregnancy
- Depending upon the infection, mother and fetus may be affected
- Sepsis is one of the leading causes of mortality in an ICU
  - Accounts for ~ 12% of maternal deaths in the North America
    - Mostly due to multi-organ dysfunction

INFECTION / SEPSIS

- The obstetric patient is particularly vulnerable...
  - Decrease immune system
  - Opportunities for viral reactivation and/or bacteremia
    - Pyelonephritis
    - Intra-amniotic infection
    - Endometritis
    - Wound infections

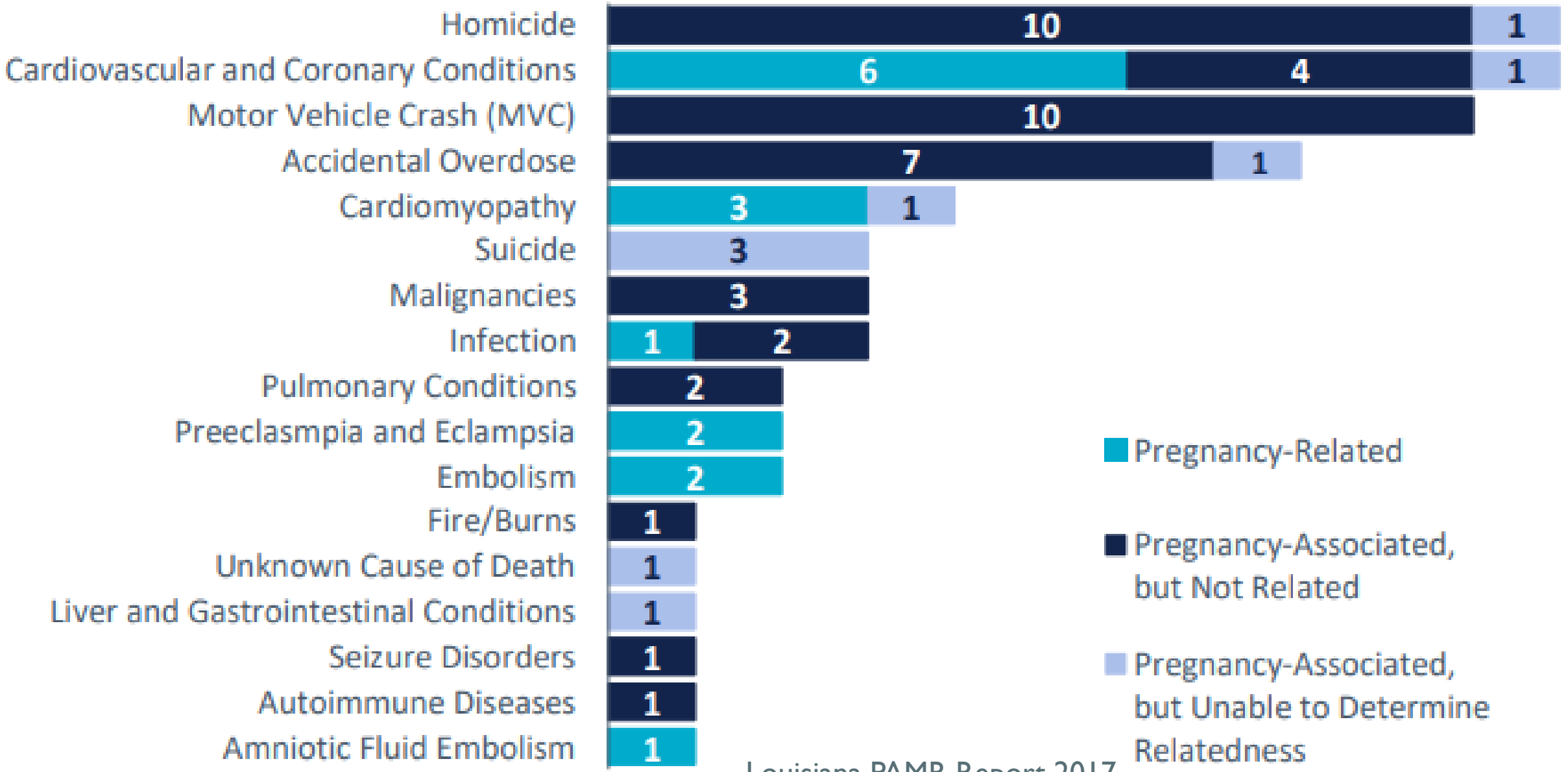
REDUCING MATERNAL MORTALITY : SEPSIS

- Pregnant and postpartum women with an infection should be evaluated for sepsis
- All provider/medical staff must be able to identify and respond to clinical triggers demonstrating risk of progression to septic shock
- Culture should be collected to identify the organizing responsible for the infection*
- Supportive care (pressors, intubation etc.) is critical when needed

SUICIDE AND HOMICIDE

Causes of Death

As determined by the PAMR Committee



SUICIDE / HOMICIDE

- Older studies likely underestimate the contribution of suicide and homicide
- National data lacking because of death not historically reported to the CDC
- There is now a more accurate standardized classification with the new CDC collection tool (MMRIA).
- Intimate partner violence - 54% of cases

SUICIDE / HOMICIDE DEMOGRAPHICS

- Pregnancy associated suicide
  - Older (>30 years)
  - White or Native American
  - employed
- Suicide victims associated with substance use
  - Younger victims
  - Single
  - Unemployed

SUICIDE DEATHS IN COLORADO

- 17% had a known substance use disorder
- 54% had a prior psychiatric diagnosis, predominantly depression
- Psychopharmacotherapy was discontinued and almost 50% - patient or provider
- Most cases, these were medications that were considered "safe in pregnancy"
  - Lack of understanding of the risk of the medication
  - Lack of understanding of the risk of discontinuation
- Counsel on Patient Safety and Women's Healthcare – 2016 bundle

REDUCING MATERNAL MORTALITY: SUICIDE AND HOMICIDE

- Screening pregnant women for mental health disorders and referral to treatment when identified
- Allowing for access to the proper treatment for the patient
- Discuss the risk and benefits of cessation of medications, particularly those of mental health disorders – education

REDUCING MATERNAL MORTALITY: SUICIDE AND HOMICIDE

- Screen pregnant women for intimate – partner violence and provide resources if identified
- Resources available and readily known to healthcare providers
- Screen pregnant women for substance use disorders and refer to treatment
- Resources for treatment of substance use disorders in pregnant women

“...too much plane for one man to fly”

WHAT CAN BE DONE?

- Use of safety bundles and check list
- Checklists in Obstetrics
  - Oxytocin
- Safety personnel / Committee
- Event reporting tools
- Hospitalists
- Team training and simulation

THE NEAR MISS

WHO MATERNAL NEAR-MISS CRITERIA

Clinical criteria	Laboratory-based criteria	Management-based criteria
▪ Acute cyanosis ▪ Gasping* ▪ Respiratory rate >40 or <6/min ▪ Shock ¶ ▪ Oliguria nonresponsive to fluids or diuretics Δ ▪ Clotting failure ◇ ▪ Loss of consciousness lasting ≥12 hours § ▪ Loss of consciousness AND absence of pulse/heart beat ▪ Stroke ¥ ▪ Uncontrollable fit/total paralysis ‡ ▪ Jaundice in the presence of preeclampsia †	▪ Oxygen saturation <90% for ≥60 minutes ▪ PaO_2/FiO_2 <200 mmHg ▪ Creatinine ≥300 micromol/L or ≥3.5 mg/dL ▪ Bilirubin >100 micromol/L or >6.0 mg/dL ▪ pH <7.1 ▪ Lactate >5 ▪ Acute thrombocytopenia (<50,000 platelets) ▪ Loss of consciousness AND the presence of glucose and ketoacids in urine	▪ Use of continuous vasoactive drugs** ▪ Hysterectomy following infection or hemorrhage ▪ Transfusion of ≥5 units red cell transfusion ▪ Intubation and ventilation for ≥60 minutes not related to anesthesia ▪ Dialysis for acute renal failure ▪ CPR

The WHO maternal near-miss criteria: A woman presenting with any of the life-threatening conditions listed in the table and surviving a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy should be considered as a maternal near-miss case.

CPR: cardiopulmonary resuscitation; IV: intravenous.
* Gasping is a terminal respiratory pattern, and the breath is convulsively and audibly caught.
¶ Shock is a persistent severe hypotension, defined as a systolic blood pressure <90 mmHg for ≥60 minutes with a pulse rate of at least 120 despite aggressive fluid replacement (>2 L).
Δ Oliguria is defined as a urinary output <30 mL/hour for 4 hours or <400 mL/24 hours.
◇ Clotting failure can be assessed by the bedside clotting test or absence of clotting from the IV site after 7 to 10 minutes.
§ Loss of consciousness is a profound alteration of mental state that involves complete or near complete lack of responsiveness to external stimuli. It is defined as a Coma Glasgow Scale <10 (moderate or severe coma).
¥ Stroke is a neurologic deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours.
‡ Condition in which the brain is in a state of continuous seizure.
† Preeclampsia is defined as the presence of hypertension associated with proteinuria. Hypertension is defined as a blood pressure of at least 140 mmHg (systolic) or at least 90 mmHg (diastolic) on at least 2 occasions and at least 4 to 6 hours apart after the 20th week of gestation in women known to be normotensive beforehand. Proteinuria is defined as excretion of 300 mg or more of protein every 24 hours. If 24-hour urine samples are not available, proteinuria is defined as a protein concentration of 300 mg/L or more (≥1+ on dipstick) in at least 2 random urine samples taken at least 4 to 6 hours apart.
** For instance, continuous use of any dose of dopamine, epinephrine, or norepinephrine.

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"OPPORTUNITIES"

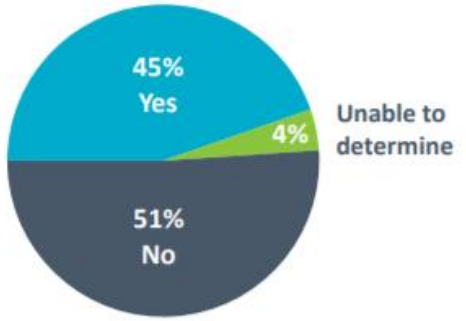
- Review committees crucial
- Louisiana & National findings continue to confirm that leading causes of death are PREVENTABLE

Preventability & Chance to Alter Outcomes
Among confirmed pregnancy-related deaths

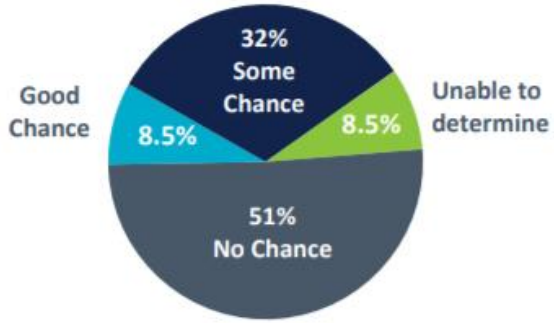
Almost half of confirmed pregnancy-related deaths were thought to be preventable by the review committee.

The committee reviewed all confirmed pregnancy-related deaths and used the Maternal Mortality Review Committee Decisions Form (see Appendix G) to determine their preventability and the chance to alter the outcome of each case. A death was considered preventable if the committee determined that there was at least some chance of the death being averted by one or more reasonable changes to patient, family, provider, facility, system, and/or community factors.

Preventability



Chance to Alter Outcome



National Findings

Based on data from review committees in 9 other states and cities:[8]

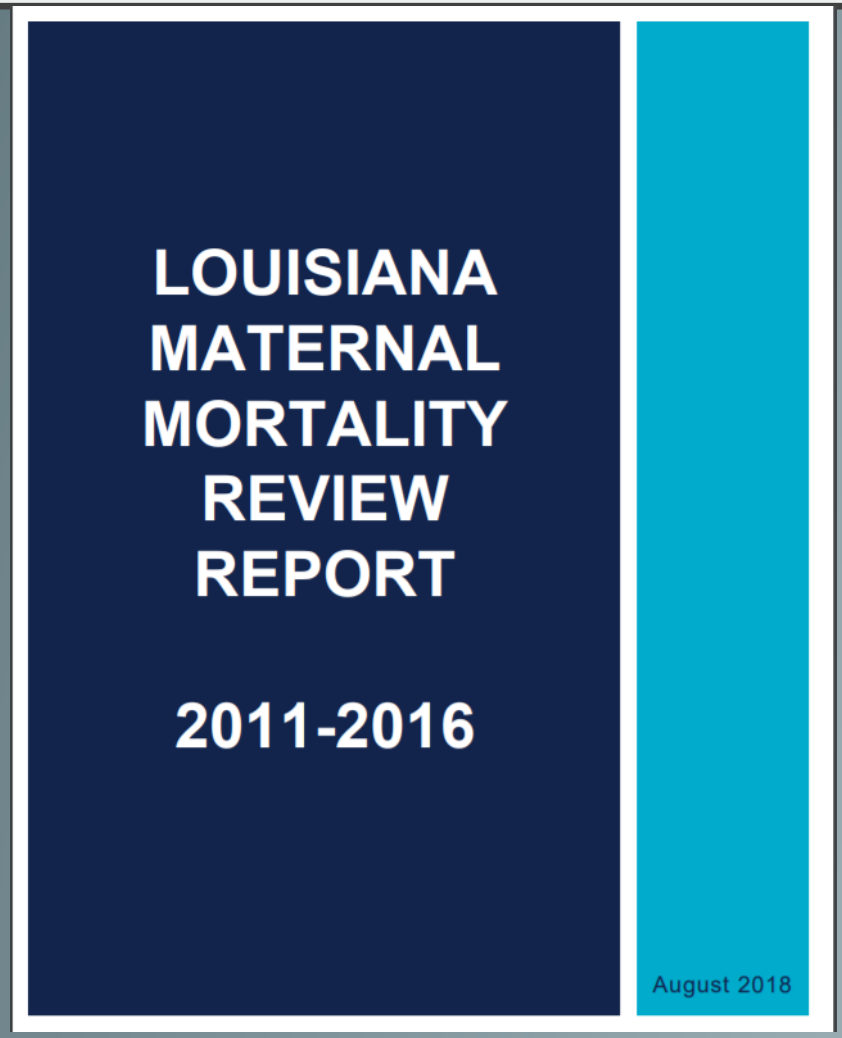
- **70%** of deaths due to **hemorrhage** were thought to be **preventable**.
- **68.2%** of deaths due to **cardiovascular/coronary conditions** were thought to be **preventable**.
- **66%** of deaths **occurring within 42 days of pregnancy** were thought to be **preventable**.

Louisiana Findings

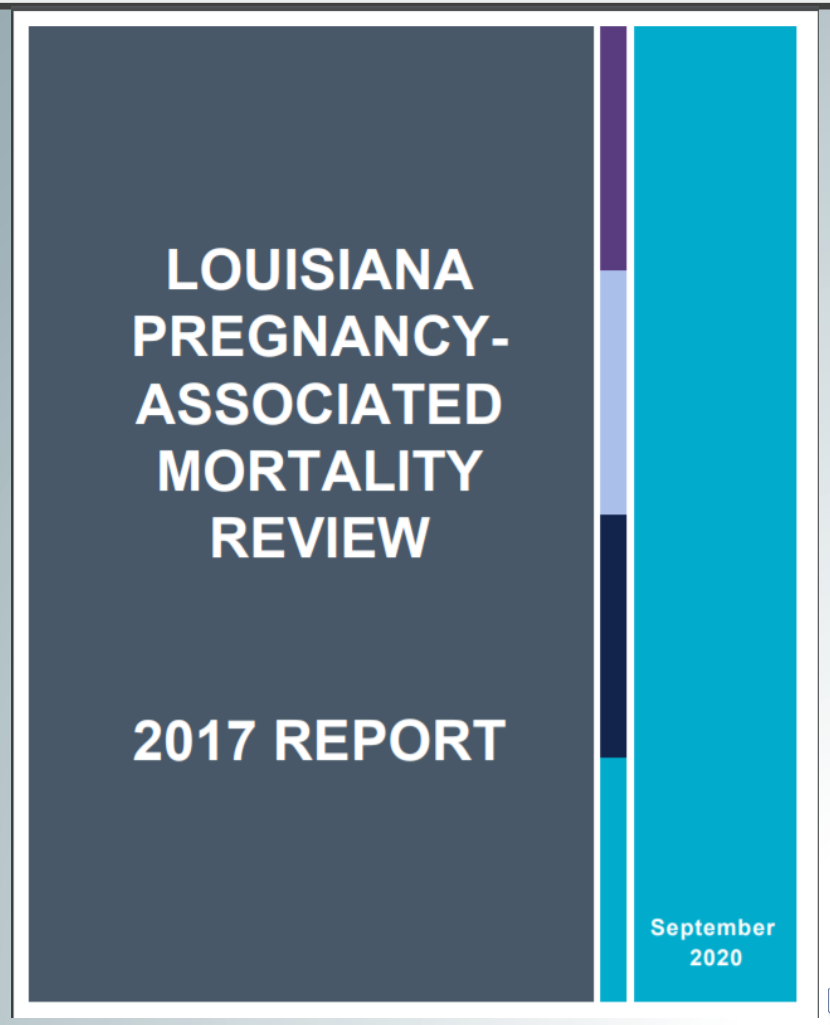
- **62.5%** of **hemorrhage** deaths were deemed **preventable**.
- **62.5%** of **cardiomyopathy** deaths were deemed **preventable**.
- **40%** of deaths due to **cardiovascular/coronary conditions** were deemed **preventable**.

7 out of 8 deaths due to embolism, including thromboembolism and amniotic fluid embolism, were deemed **not preventable**.

LOUISIANA MATERNAL MORTALITY REVIEW REPORT



LOUISIANA PREGNANCY-ASSOCIATED MORTALITY REVIEW



IN CONCLUSION… CHANGE YOUR CULTURE

- Be **Ready** for an event
- **Recognize** warning signs & symptoms & risk factors
- **Respond** to those findings
- **Report** and **Revaluate**
  - **Train**
  - **Train**
  - **Train**

THE END