

A decorative graphic on the left side of the slide consisting of a 2x2 grid of squares. The top-left square is white, the top-right is dark green, the bottom-left is orange, and the bottom-right is a light brownish-grey.

Maternal Mortality

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Disclosures

Commercial Interest	Relationship	Role
BioIncept, LLC	Grant Stock option	Principal Investigator Scientific Advisory Board
CSL Behring	Grant	Principal Investigator
GestVision	Grant	Principal Investigator
NovoNordisk	Consultant	Consultant
Progenity	Grant	Principal Investigator
rEVO Biologics	Grant, COA Support	Principal Investigator

NIH/NIAID, MJP

Objectives

At the end of this presentation, the participant will be able to:

- 1) Describe the causes of maternal mortality and offer a strategy designed to prevent its occurrence.
- 2) Describe the association between common pregnancy complications and maternal morbidity.
- 3) Describe the existing disparity in pregnancy outcome, severe maternal morbidity and mortality.

Women and coronary heart disease: a century after Herrick: understudied, underdiagnosed, and undertreated

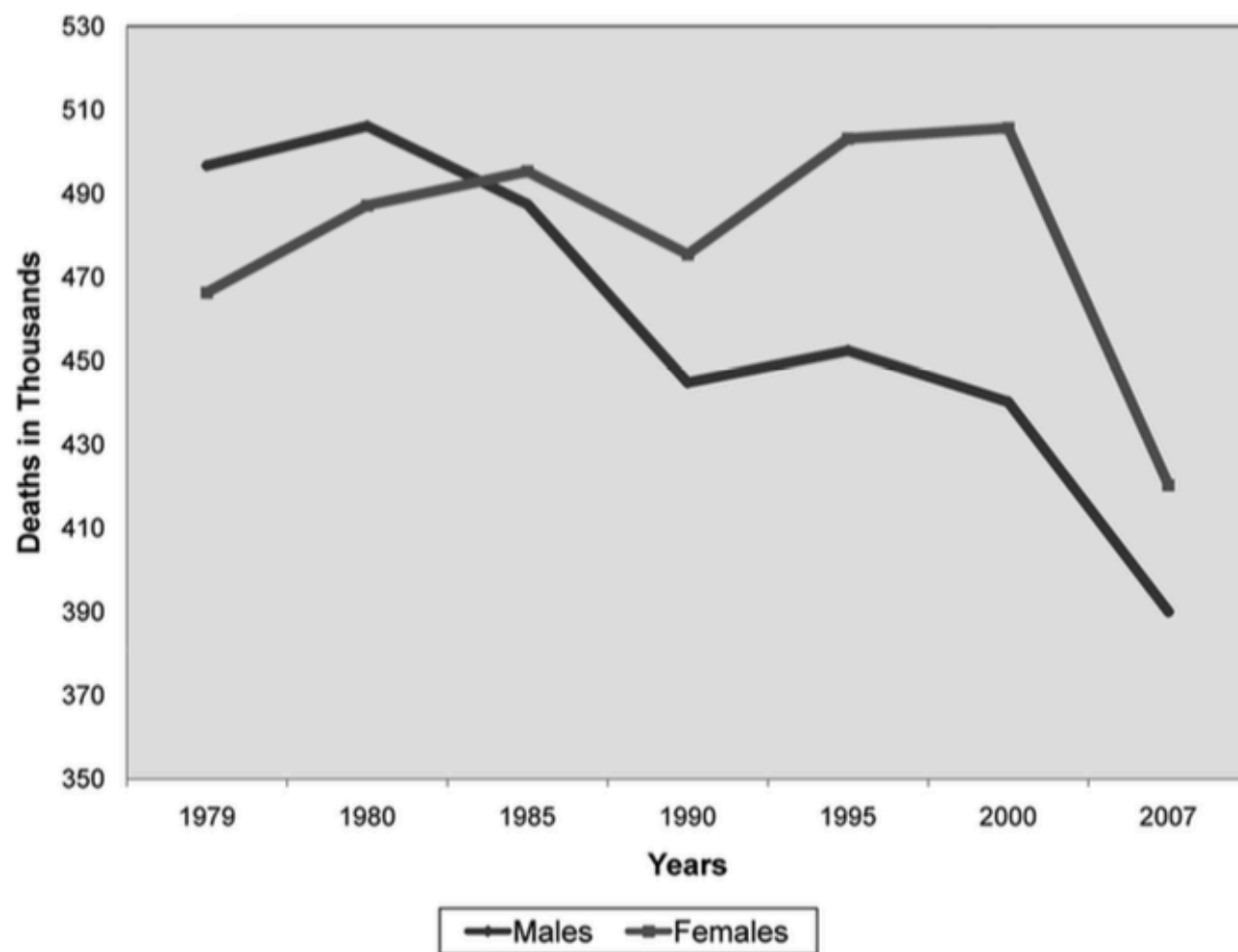


Figure. Cardiovascular disease mortality trends for males and females (United States: 1979–2007). The overall comparability for cardiovascular disease between the *International Classification of Diseases, 9th Revision* (1979–1998) is 0.9962. No comparability ratios were applied. Source: National Center for Health Statistics, Heart Disease and Stroke Statistics–2011 Update.⁵

US · Published July 18, 2013 · Last Update September 18, 2015

Pregnant former Olympian collapses and dies in Connecticut, doctors save baby

By | Associated Press



FILE: Meskerem Legesse competes in the Women's 1500 meter run at the Millrose Games at New York's Madison Square Garden. (REUTERS)

HARTFORD, Conn. – A former Olympic and professional runner from Ethiopia who was eight months pregnant died after collapsing at a Connecticut restaurant, but doctors were able to save her baby, her friends said Wednesday.

Maternal Death

Quick Facts

- 2015 305,000 maternal deaths globally
- Global maternal mortality ratio: 216 maternal deaths per 100,000 live births
- World Health Organization goal: reduce global maternity ratio to 70 maternal deaths per 100,000 live births by 2030.
- USA has highest maternal mortality ratio than any other developed country & rate is rising.

Maternal Death

PAST: Top 3 causes of maternal mortality (USA)

- a) Hemorrhage
- b) Hypertensive disease
- c) Thrombosis

PRESENT

- 1) *Cardiovascular disease (15.5%),*
- 2) *Other medical non-cardiovascular disease (14.5%)*
- 3) *Infection/sepsis (12.7%).*
- 4) *Hemorrhage (11.4%)*

Maternal Mortality in the Twenty First Century
Ozimek JA, Kilpatrick SJ. Obstet Gynecol Clin N Am 45 (2018) 175- 186

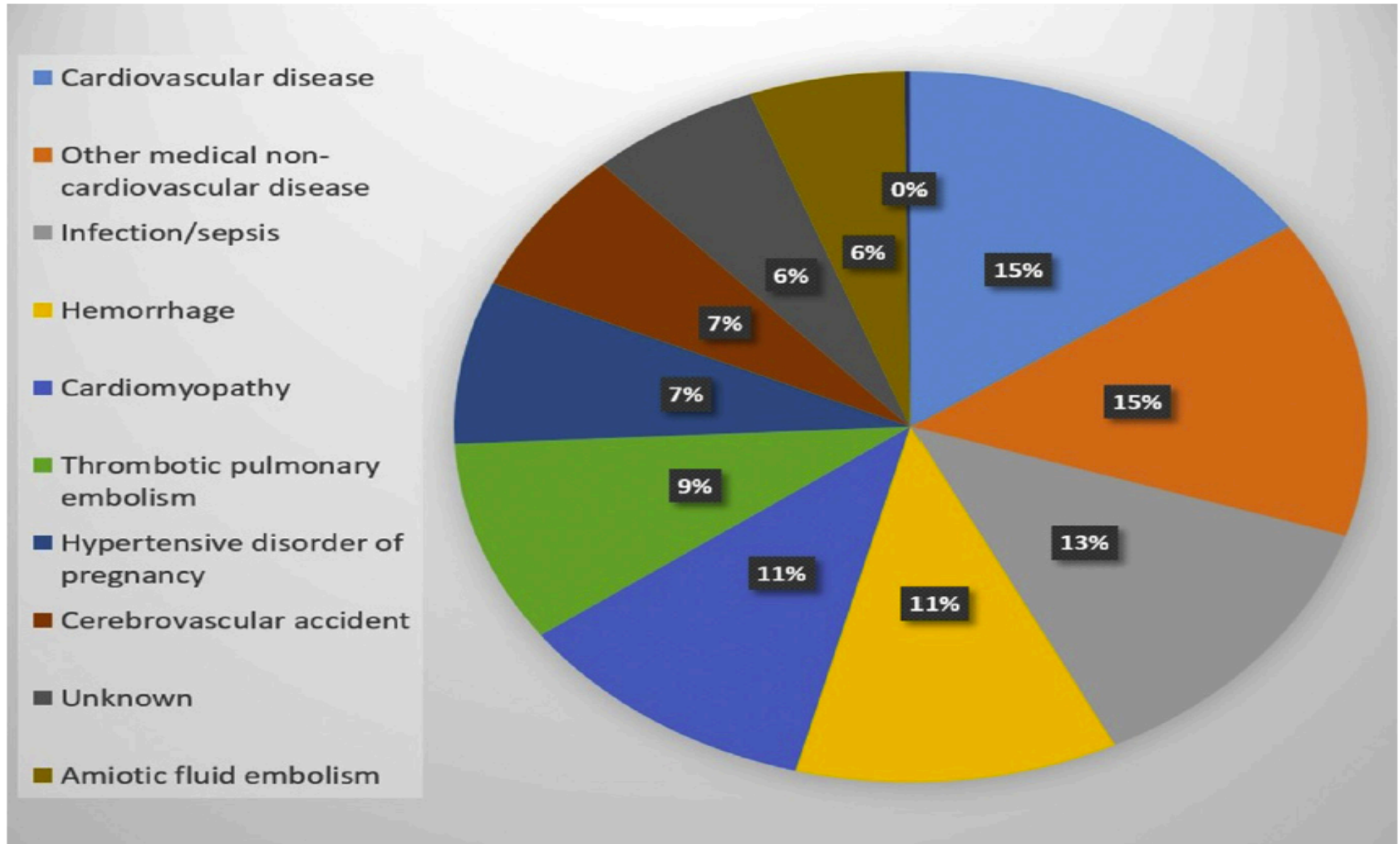


Fig. 1. Causes of pregnancy-related death in the United States: 2011 to 2013. (Data from Centers for Disease Control and Prevention (CDC). Pregnancy mortality surveillance system. Available at: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>.)

Terms

- **Pregnancy-Related Death** (Centers for Disease Control and Prevention **[CDC]**): the death of a woman while pregnant or within 1 year of pregnancy termination, regardless of the duration or site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.
- **Pregnancy-Related Death (WHO)**: the death of a woman while pregnant or with 42 days of termination of pregnancy, irrespective of the cause of death.
- **Maternal Death (WHO)**: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy or its management but not from accidental or incidental causes.

Terms

- **Pregnancy-Related Mortality Ratio (CDC):** an estimate of the number of pregnancy-related deaths for every 100,000 live births. The CDC reports that there were 17.3 pregnancy-related deaths per 100,000 live births in the United States in 2014.
- **Maternal Mortality Ratio (WHO):** the number of maternal deaths per 100,000 live births. The WHO reports that the maternal mortality ratio in the United States was 14 deaths per 100,000 live births in 2015.
- The MMR is the most commonly used measure of maternal mortality.
- USA: the MMR had been steadily decreasing until reaching its nadir in 1987 at 6.6.
- After 1987, the MMR remained fairly stable at between 7 and 8 maternal deaths/ 100,000 live births until 1999 when the MMR began to steadily increase, resulting in the most recent report of 14 deaths/100,000 live births in 2015.

Historical Perspective- early mid 20th Century

- Corresponding 90% decline in maternal mortality
 - Medical advances: antibiotics, oxytocin, improved blood transfusion technique, better management of hypertensive disorders of pregnancy
- 71% decline in maternal mortality over a 10 year period from 1939-1948.
- 1950-1973: 89% decrease in septic abortion, partially due to legalization of abortion starting in some states in 1967, then all states in '73.

Historical Perspective

- MMR varied greatly by region ranging
 - 12 deaths per 100,000 LB in developed regions
 - 546 deaths per 100,000 LB in sub-Saharan Africa
 - 1100 deaths per 100,000 LB in Sierra Leone.

Historical Perspective

- MMR trend fell short of the United Nations Millennium Development Goal of a reduction of 75% in the MMR between 1990 and 2015.
- The World Health Organization (WHO) has presented new Sustainable Development Goals with the objective of reducing the global MMR to less than 70 deaths per 100,000 live births from 2015 to 2030.

To achieve goal, countries will need to:

- decrease their MMR at an annual rate of reduction of at least 7.5%.
- Reasons for positive trend in lowering MMR over past 25 yrs:
 - **Decrease in total fertility rate,**
 - **Increased maternal education,**
 - **increased access to skilled birth attendants**

Historical Perspective

- Possibly some increase in MMR in USA is secondary to improvements in methods for identification of pregnancy-related deaths and changes in coding and classification of maternal deaths.
- Other factors that contribute to the increasing rate of maternal mortality include:
 - **Increasing maternal age**
 - **Increasing maternal BMI**
 - **Increased incidence of medical comorbidities**

Centers for Disease Control and Prevention National Center for Health Statistics database (CDC WONDER)-

Authors concluded the following were significantly associated with increased MMR:

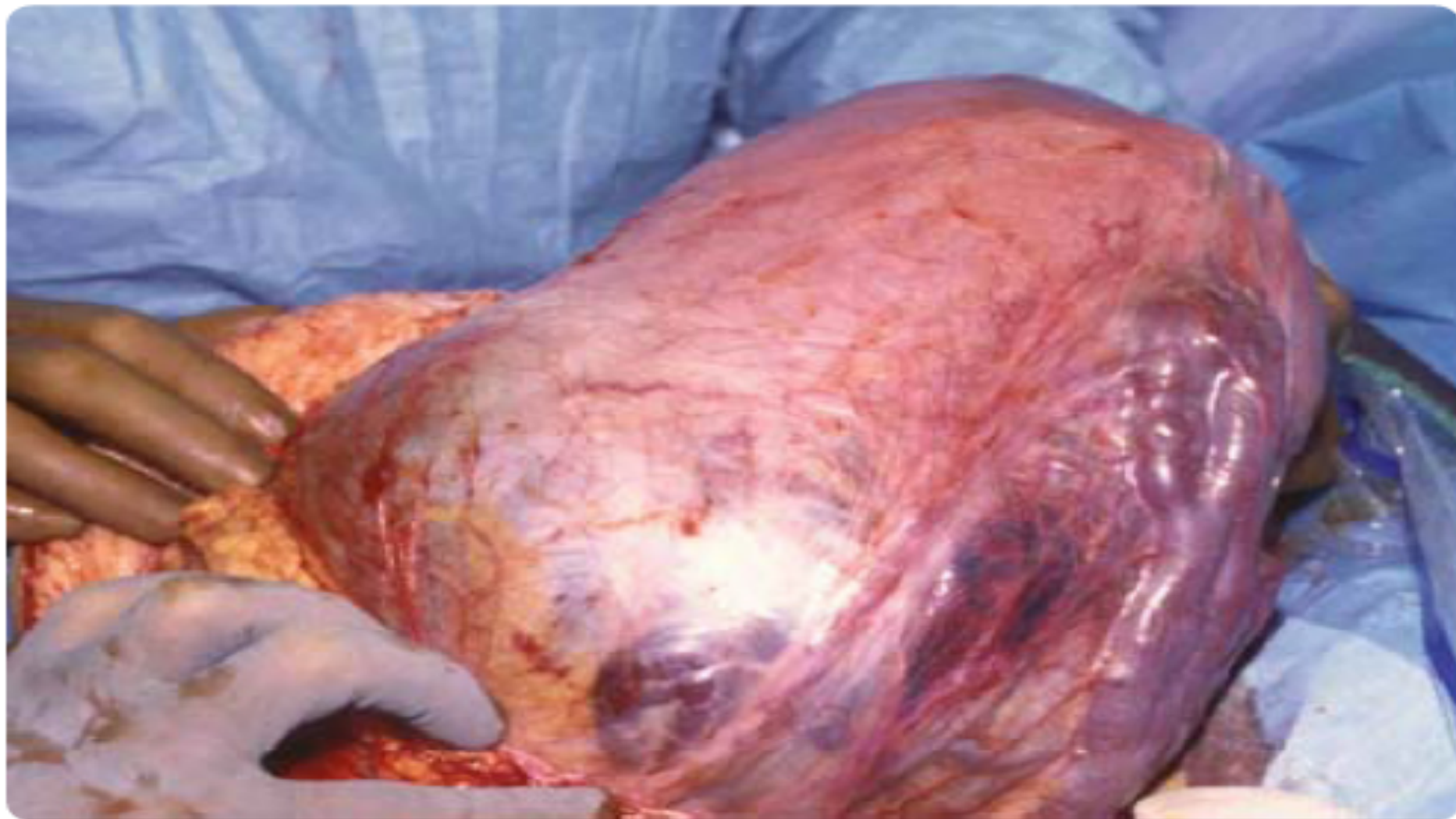
- 1) Cesarean deliveries
- 2) Unintended births
- 3) Unmarried status
- 4) Four or less prenatal visits

Moaddab A, Dildy GA, Brown HL, et al. Health care disparity and state-specific pregnancy-related mortality in the United States, 2005-2014. *Obstet Gynecol* 2016;128(4):869–75.

Ozimek JA, Kilpatrick SJ. Maternal Mortality in the Twenty First Century. *Obstet Gynecol Clin N Am* 45 (2018) 175- 186

FIGURE 2

Placenta percreta with bladder invasion at cesarean delivery



Lower uterine segment is bulbous with areas of hemorrhage beneath visceral peritoneum and prominent distended vessels. Fundal and posterior hysterotomy was performed to avoid disruption of placenta before hysterectomy was completed.

Reprinted with permission of Wolters Kluwer Health.

SMFM. Placenta accreta. *Am J Obstet Gynecol* 2010.

Placenta Accreta

- Reported incidence of abnormal placental attachment has increased from 0.8 per 1000 births (1980s) to 3 per 1000 births in the last decade.
- The increasing rate has been attributed to increases in:
 - Cesarean rate
 - advanced maternal age
 - other prior uterine surgery or curettage
 - irradiation
 - ablation
 - hypertensive disorders of pregnancy
 - maternal smoking

Placenta Accreta Consequences

- Associated maternal mortality: 5.6%*
- Associated morbidities include:
 - Damage to surrounding organs
 - Blood loss anemia
 - Amniotic fluid embolism
 - Coagulopathy
 - Transfusion associated reactions and lung injury
 - Thromboembolism
 - Infection
 - End organ failure

READINESS

Every unit

- Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compressions stitches
- Immediate access to hemorrhage medications (kit or equivalent)
- Establish a response team - who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
- Establish massive and emergency release transfusion protocols (type-O negative/uncrossmatched)
- Unit education on protocols, unit-based drills (with post-drill debriefs)

RECOGNITION & PREVENTION

Every patient

- Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
- Measurement of cumulative blood loss (formal, as quantitative as possible)
- Active management of the 3rd stage of labor (department-wide protocol)

RESPONSE

Every hemorrhage

- Unit-standard, stage-based, obstetric hemorrhage emergency management plan with checklists
- Support program for patients, families, and staff for all significant hemorrhages

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and process metrics in perinatal quality improvement (QI) committee

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women's Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women's Health Care is a broad consortium of organizations across the spectrum of women's health for the promotion of safe health care for every woman.

May 2015

For more information visit the Council's website at www.safehealthcareforeverywoman.org

Racial Disparity

- Teenaged black women were 1.4 times more likely to die than their white counterparts.
- Black women aged 20 to 24 years were 2.8 times more likely to die.
- Black women in all other age groups were more than 4 times more likely to die from pregnancy-related complications.
- Pregnancy-related mortality ratio for black women aged 40 or older in approached 150 maternal deaths per 100,000 LB versus approaching 40 deaths per 100,000 LB among white women in the same age group.
- Black women who died of pregnancy-related complications were younger, less educated, more likely to be unmarried, more likely to be late to prenatal care, and more likely to die of ectopic pregnancy–related complications than white women.
- Variation in MMR was most closely associated with social factors, such as unintended pregnancy, unmarried status, & non-Hispanic black race.

Deshpande NA, Kucirka LM, Smith RN, et al. Pregnant trauma victims experience nearly 2-fold higher mortality compared to their nonpregnant counterparts. Am J Obstet Gynecol 2017;217(5):590.e1–9.

Trauma

- Affects 1 in 12 pregnant women & is the leading non-obstetric cause of death among reproductive-aged women in USA.
- Excluded from WHO and CDC maternal mortality reports, and not well defined.
- Pregnant women were more likely to experience violent trauma.
- Were 1.6 times more likely to die.
- Were more likely to be dead on arrival to hospital or to die during their hospital course compared with nonpregnant women.

>1100 trauma events in pregnant women vs 43,600 events in nonpregnant women

HIV Disease

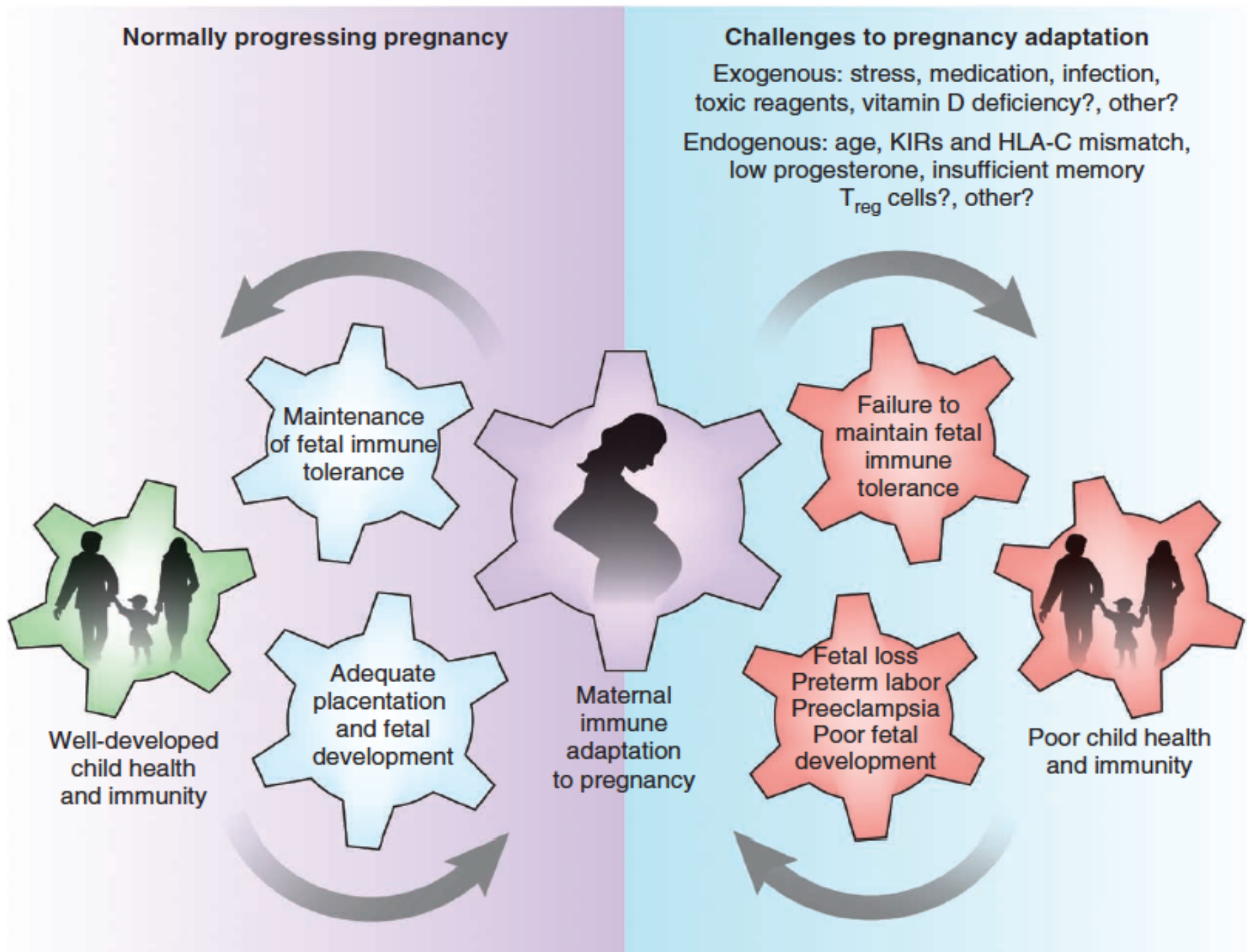
- HIV/AIDS is among the top ten leading cause of death for Non-Hispanic Black women 15–64 years of age & for Hispanic women 15–54 years of age.
- Black women account for 67% of HIV infections in the U.S., and Latina women account for 17%.
- Highest MR (per 100,000 population) for African American females (25.7), more than 21 times as high as the rate of death for Whites (1.2)

Preventability

- 40% of pregnancy-related deaths were potentially preventable and that preventability varied by cause.
- 93% of hemorrhage-related deaths, 60% of hypertension-related deaths, 43% of infection-related deaths, and 40% of cardiovascular-related deaths were potentially preventable.
- Improved quality of medical care was the leading factor that could have led to prevention.

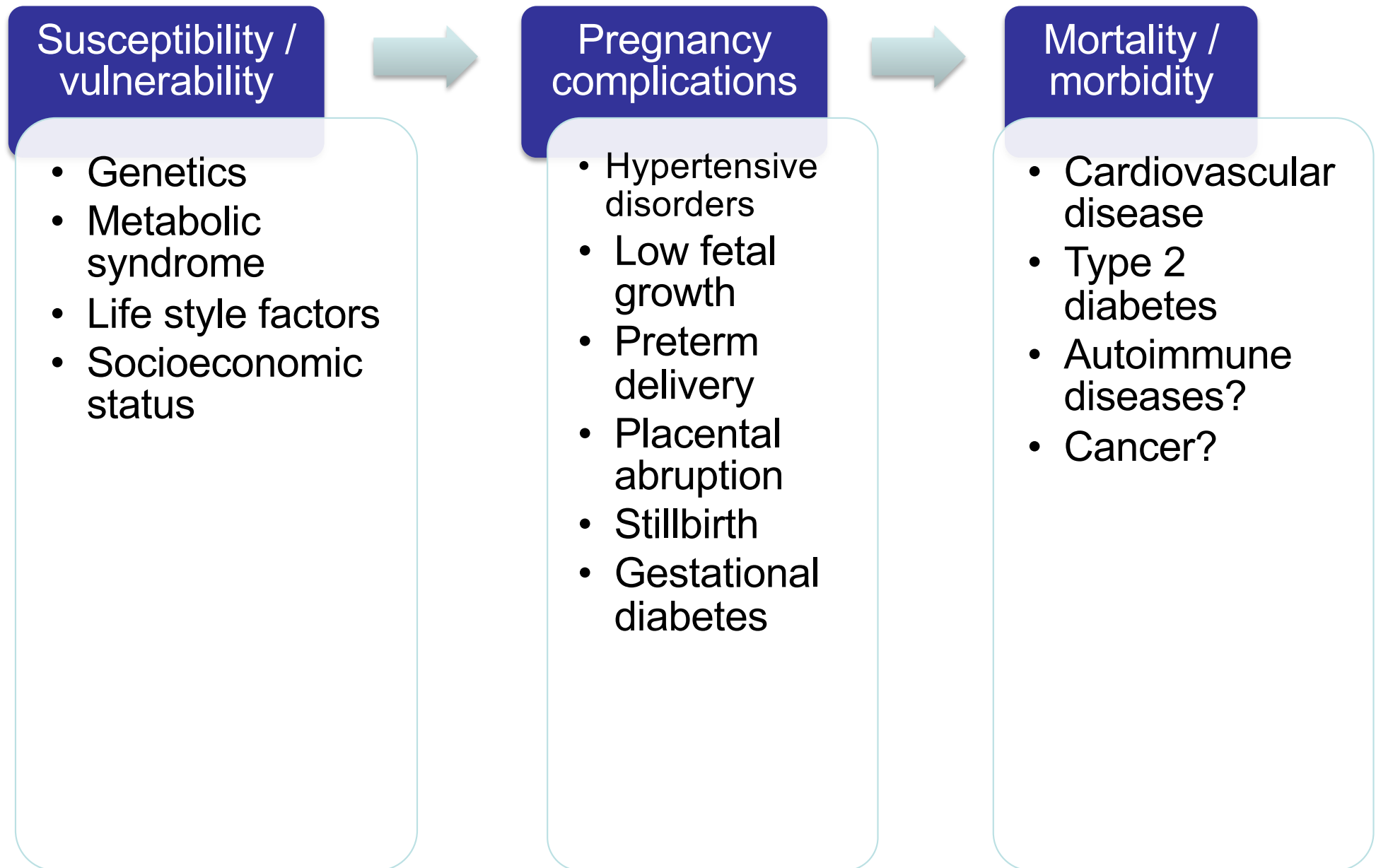
Severe Maternal Morbidity

- Severe maternal morbidity is increasing in the USA.
- 50,000 women per year with an occurrence of 0.5% to 1.3% of pregnancies in the USA.
- 2 screening criteria: pregnant or postpartum patients who have been admitted to the intensive care unit and/or have received 4 units of packed red blood cells because of their high sensitivity and specificity for identification of cases of severe maternal morbidity.



Arck PC, Hecher K. Fetomaternal immune cross-talk and its consequences for maternal and offspring's health. Nat Med. 2013 May;19(5):548-56. doi: 10.1038/nm.3160. Epub 2013 May 7. Review. PMID: 23652115

Pregnancy as the stress test of life



Pregnancy Complications

USA: Overall 4,000,000 Births Per Year

1) Maternal Thromboembolism: 1 in 1,600 pregnancies

2) Preterm (< 37 w) Delivery Rate (USA): 9.85% pregnancies

3) Placenta Mediated Complications: 8% pregnancies:

- Preeclampsia, early onset <36 wks
- Abruptio (decidual hemorrhage)
- Intrauterine growth restriction (<5th percentile)
- Late fetal loss (≥ 20 wks)
- Early fetal loss (>9 wks)

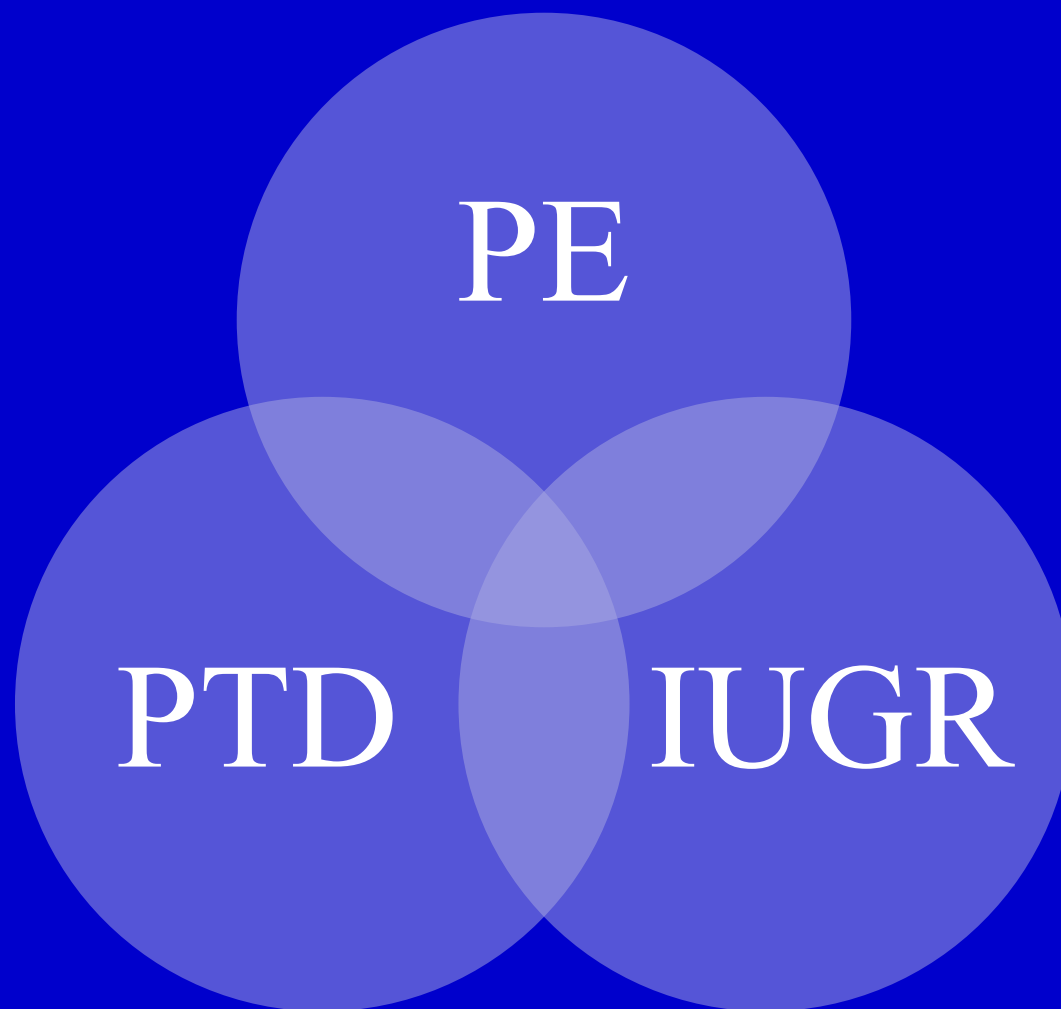


Frequency 1 in 5 pregnancies

Bourjeily G, Paidas MJ, Khalil H, Rosene-Montella K, Rodger M. Lancet. 2010 Feb 6;375(9713):500-12.

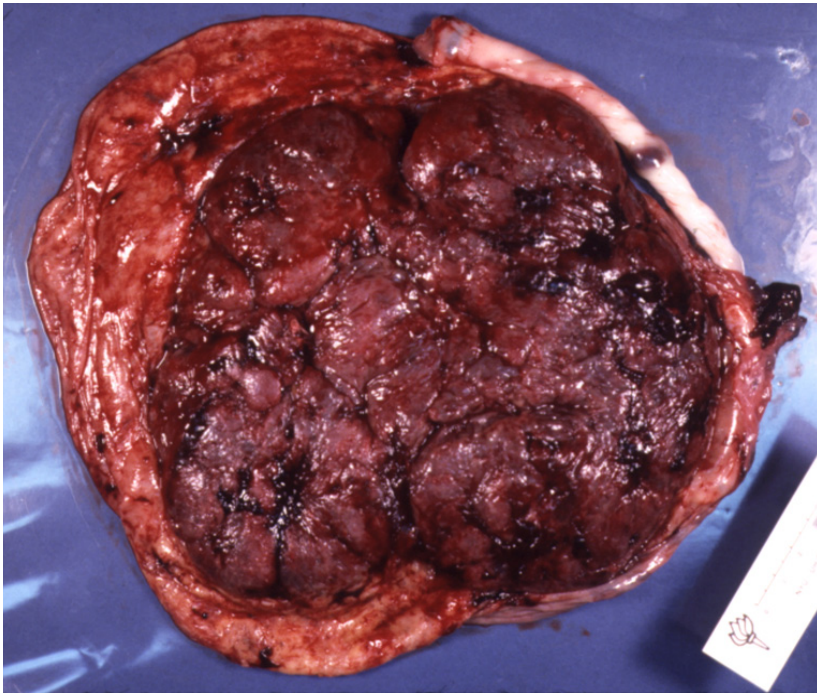
Duhl AJ, Paidas MJ, et al. AJOG. 2007;197(5):457.e1-e21

Placenta Mediated Complications (PMC)



Ananth, Obstet Gynecol, 2007;
Ness and Sibai, AJOG 2006

Placental Pathology



Normal placenta



**Infarction and fibrosis in
PE and IUGR**

Preeclampsia & IUGR Involves Shallow Extravillous Trophoblast Invasion

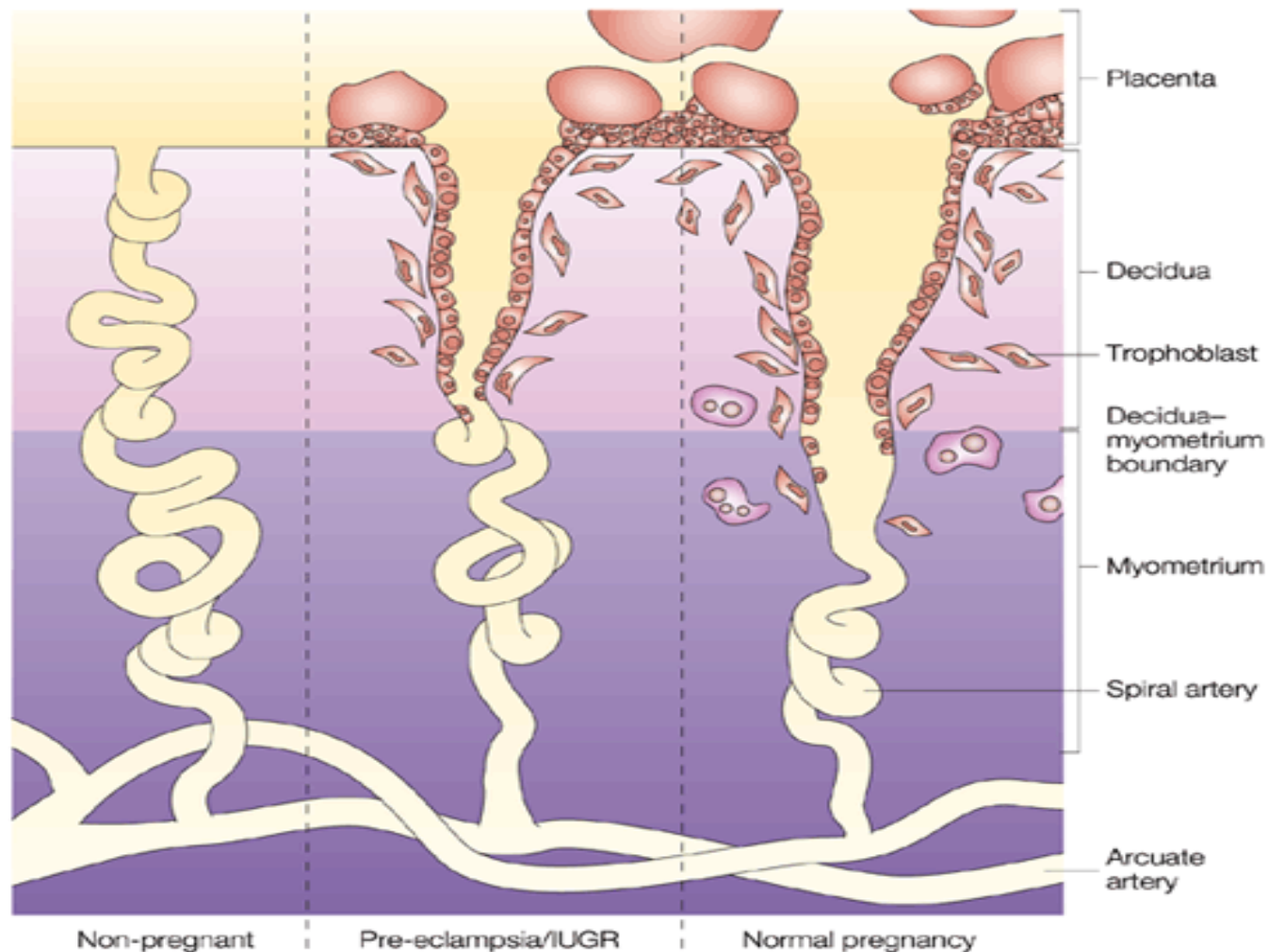
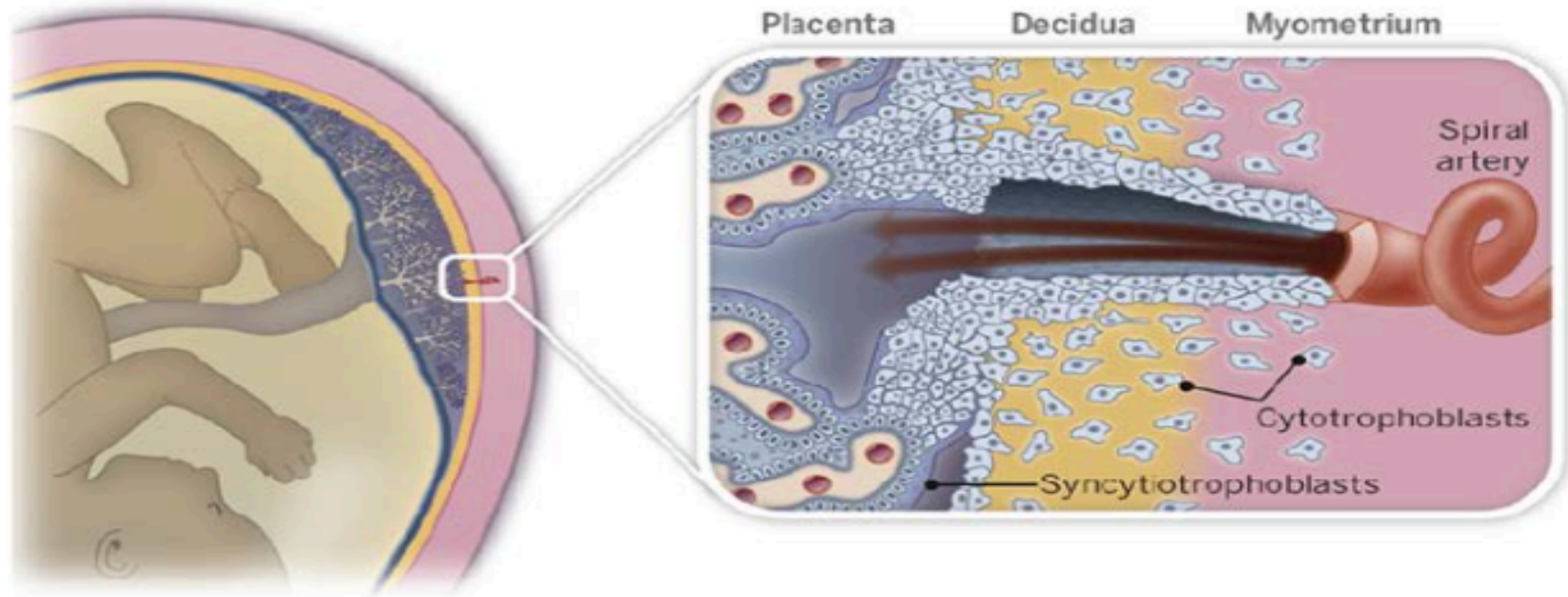


FIGURE 1

A schematic drawing of the maternal-fetal interface in human pregnancy



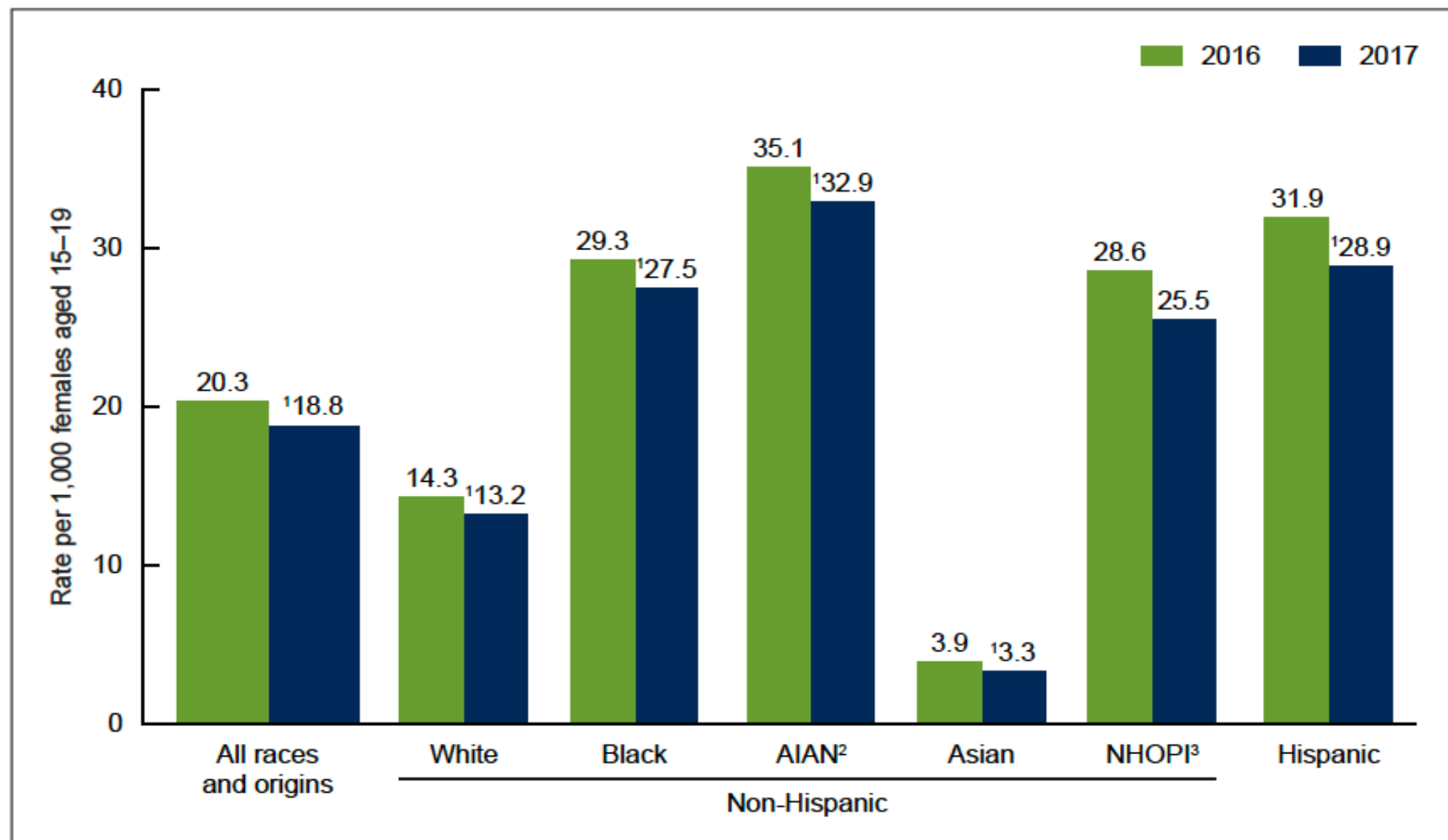
Mononuclear placental cytotrophoblasts invade the uterine wall and its resident vasculature (*right panel*). During this process, they transform spiral arteries into wide-bore vessels that perfuse the placenta. Its tree-like chorionic villi are covered by multinucleated syncytiotrophoblasts, which transport a variety of substances to and from the fetus, enabling normal fetal growth.

Reprinted with permission from Romero et al.²¹

Ilekis. Potential placental molecular therapeutic targets. *Am J Obstet Gynecol* 2016.

Ilekis JV, Tsilou E, Fisher S, Abrahams VM, Soares MJ, Cross JC, Zamudio S, Illsley NP, Myatt L, Colvis C, Costantine MM, Haas DM, Sadovsky Y, Weiner C, Rytting E, Bidwell G. Placental origins of adverse pregnancy outcomes: potential molecular targets: an Executive Workshop Summary of the Eunice Kennedy Shriver National Institute of Child Health and Human Development. *Am J Obstet Gynecol*. 2016 Jul;215(1 Suppl):S1-S46. PMID: 26972897

Figure 2. Birth rates for females aged 15–19, by race and Hispanic origin of mother: United States, 2016 and 2017



¹Significant decline from 2016 ($p < 0.05$).

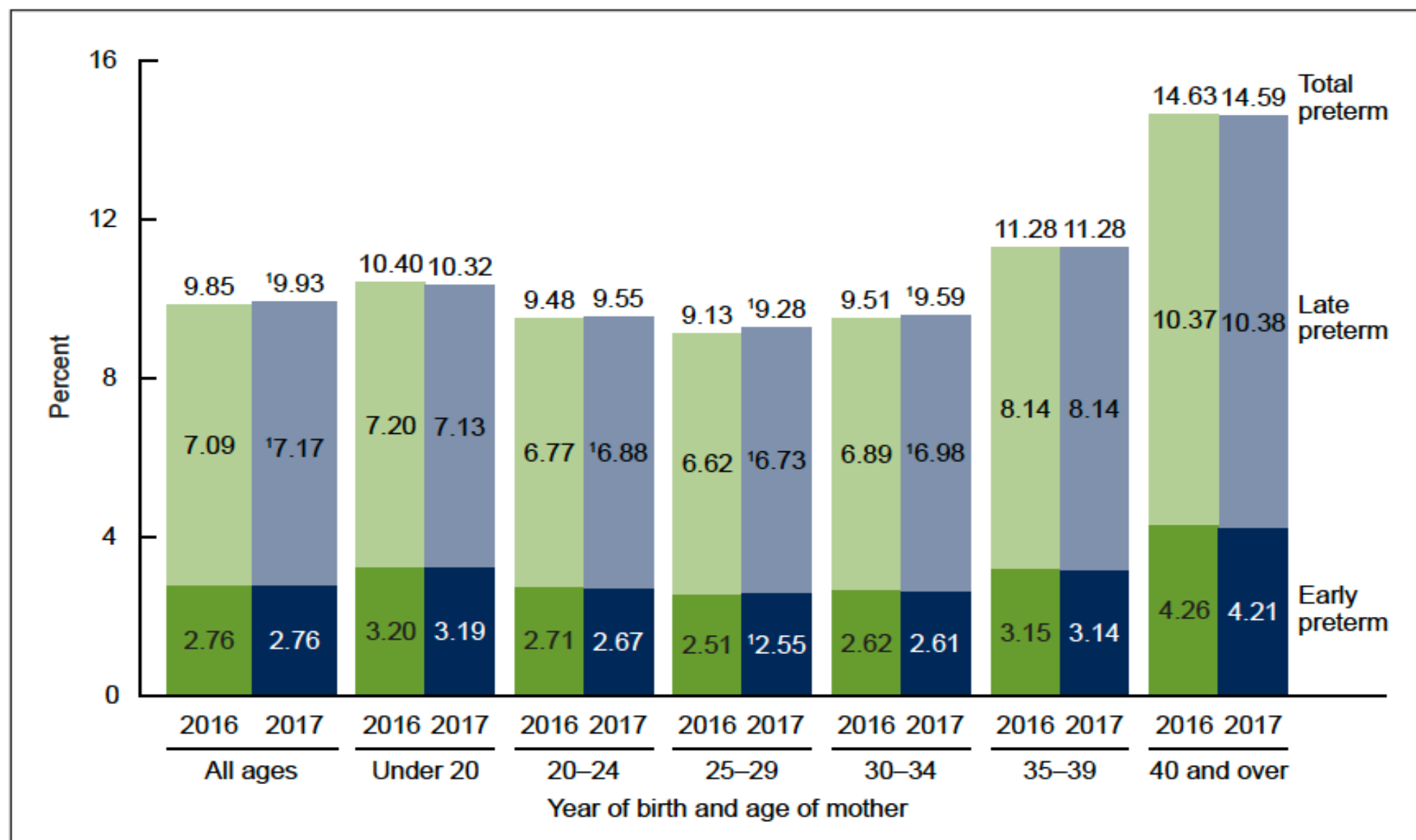
²AIAN is American Indian or Alaska Native.

³NHOP is Native Hawaiian or Other Pacific Islander.

NOTES: Race groups are single race. Access data table for Figure 2 at: https://www.cdc.gov/nchs/data/databriefs/db318_table.pdf#2.

SOURCE: NCHS, National Vital Statistics System, Natality.

Figure 4. Preterm birth rates, by age of mother: United States, 2016 and 2017



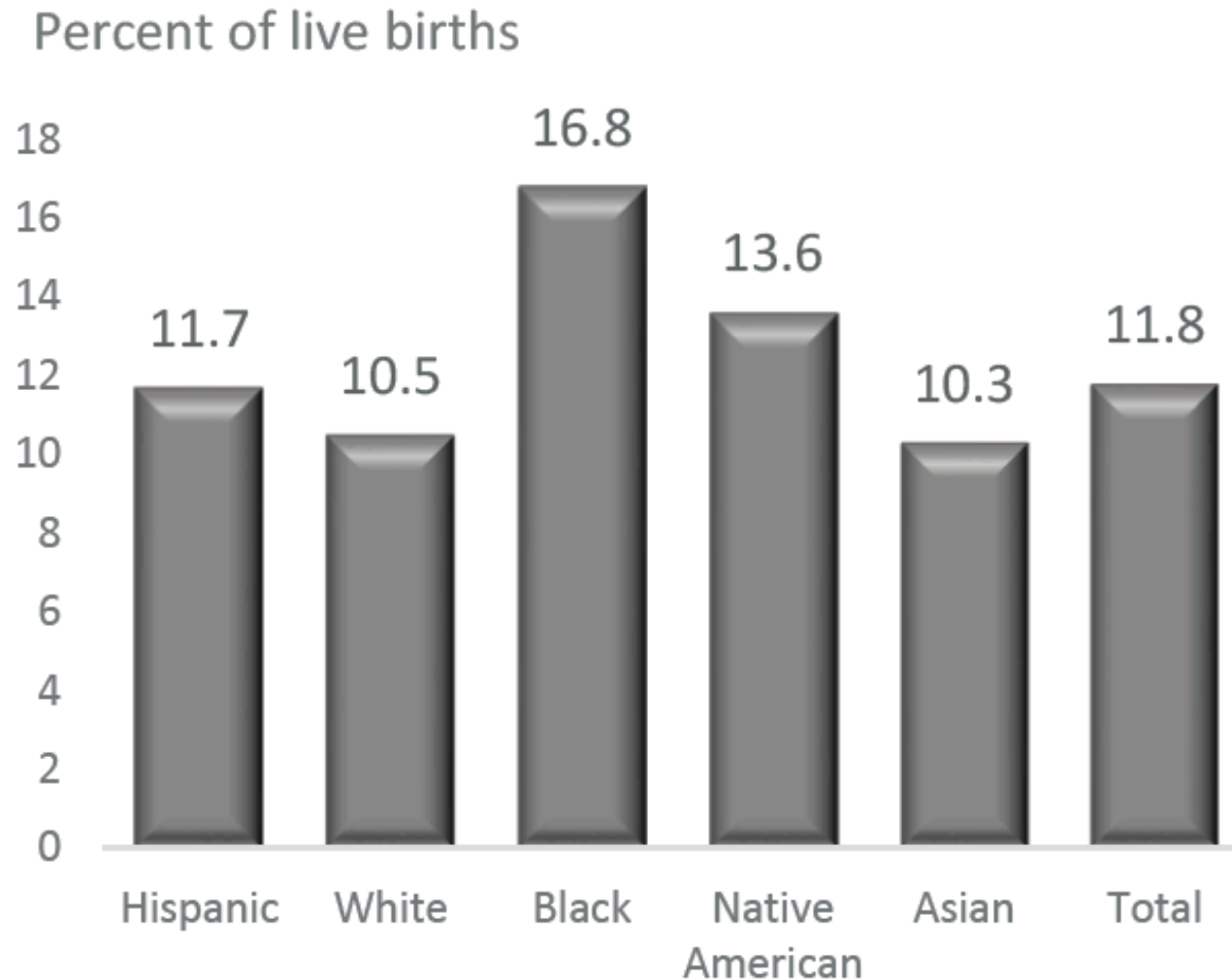
¹Significant increase from 2016 ($p < 0.05$).

NOTE: Figures may not equal totals due to rounding. Preterm is less than 37 completed weeks of gestation, early preterm is less than 34 weeks, and late preterm is 34 to 36 weeks. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db318_table.pdf#4.

SOURCE: NCHS, National Vital Statistics System, Natality.

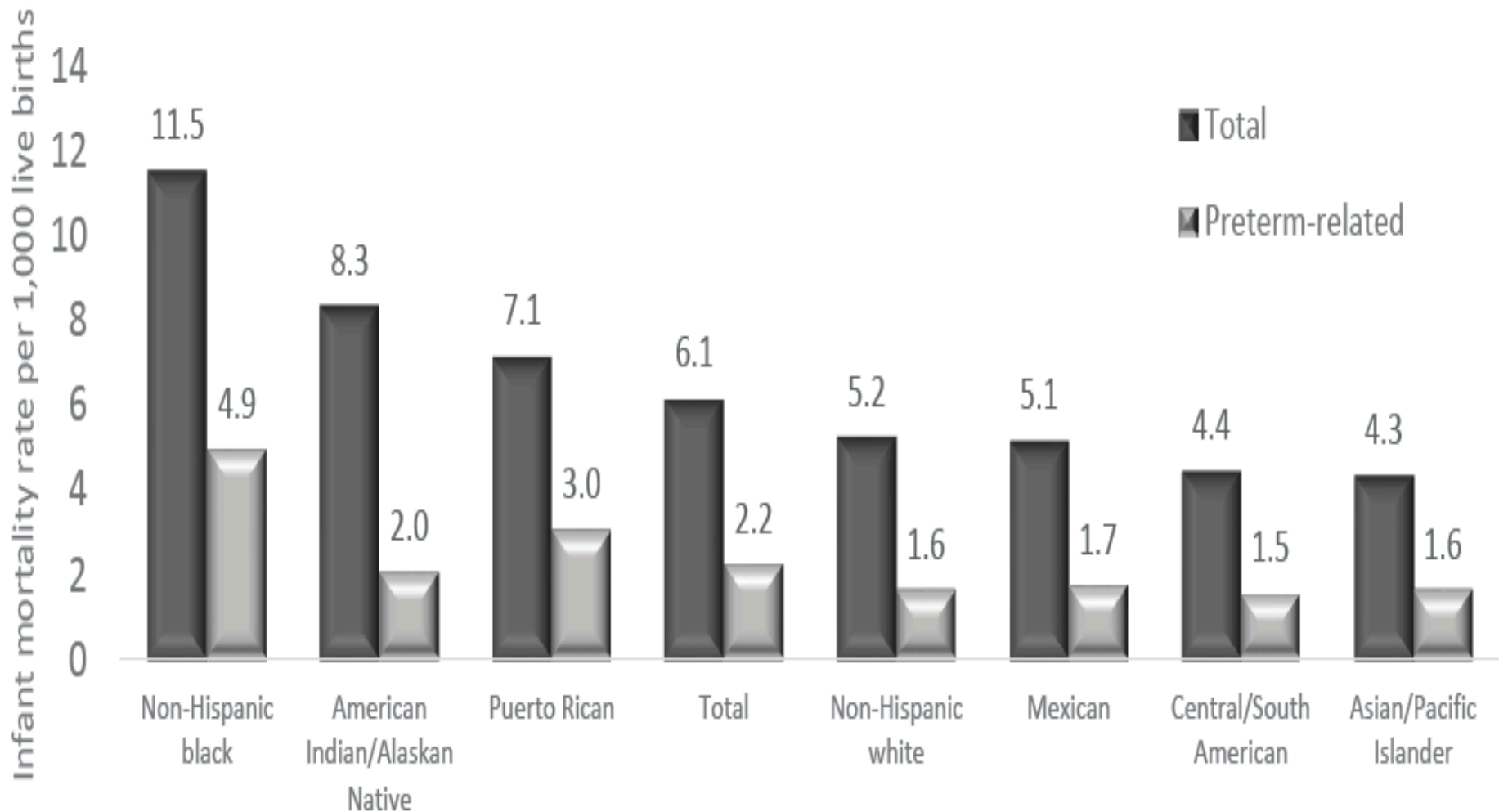
March of Dimes 2015

Figure 1: Preterm Birth Rate by Mother's Race/Ethnicity, United States, 2010-2012 Average⁴



March of Dimes 2015

Figure 2: Total and Preterm-related Infant Mortality by Mother's Race/Ethnicity, United States, 2010.⁵



Recurring Pregnancy Complications

Women delivering spontaneously preterm, having preeclampsia or having SGA offspring have an increased risk of recurrence of the same pregnancy complication or are susceptible for other pregnancy complications.

Danish Registry Studies

- Registry-based follow-up (*Central Person Registry & National Patient Registry*)
- Population: women given birth in Denmark
 - First singleton pregnancy
 - Second singleton pregnancy
- Exposure: Hypertensive pregnancy disorders
- Endpoints: HTN, thromboembolism, and type 2 diabetes
- Ascertainment by specific ICD-8, ICD-10 codes
- Cox proportional hazard models
- *Danish National Birth Cohort 1996-2002 (100,000 women recruited; maternal- child paired blood stored)*

Population

Follow up: Median 14.6y (interquartile range 12.4-17.5)
Accruing 11,600,945 person-years

Singleton deliveries during 1978-2007
(1,795,806 deliveries of 965,475
women)



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graph TD; A["Singleton deliveries during 1978-2007  
(1,795,806 deliveries of 965,475  
women)"] --> B["First delivery (n=796,915)"]; B --> C["Women aged 15 to 50 years  
(n=796,915)"]; C --> D["No prior cardiovascular diseases,  
thromboembolism or DM, or deceased or  
emigrated within 3 months (n=782,287)"];
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First delivery (n=796,915)

Women aged 15 to 50 years
(n=796,915)

No prior cardiovascular diseases,
thromboembolism or DM, or deceased or
emigrated within 3 months (n=782,287)

Subsequent hypertension

Follow up: Median 14.6y (interquartile range 12.4-17.5)

Accruing 11,600,945 person-years

Complication	Rate	HR	CI	p
No hypertensive disorder	13.5	1	(reference)	
Gestational hypertension	82.7	5.72	(5.28-6.20)	<0.001
Mild preeclampsia	52.2	4.00	(3.80-4.21)	<0.001
Severe preeclampsia	92.4	6.73	(6.04-7.49)	<0.001

Lykke JA, Langhoff-Roos, Sibai BM, Funai E, Triche EW, Paidas MJ. Hypertensive pregnancy disorders and subsequent cardiovascular morbidity and type 2 diabetes mellitus in the mother. Hypertension. 2009 Jun;53(6):944-51.

Preterm Delivery: Subsequent hypertension

Combination	Rate	HR	CI	p
No PTD in either pregnancy	16.8	1	(reference)	
PTD in first pregnancy	22.6	1.22	(1.10-1.35)	< .001
PTD in second pregnancy	28.2	1.20	(1.07-1.35)	0.002
PTD in both pregnancies	32.3	1.39	(1.14-1.70)	0.001

Lykke JA, Paidas MJ, Damm P, Triche EW, Kuczynski E, Langhoff-Roos J. Preterm delivery and risk of subsequent cardiovascular morbidity and type-II diabetes in the mother. BJOG. 2010 Feb;117(3):274-81.

Subsequent thromboembolism following placenta mediated complications Danish Registries

Follow up: median 14.6 y

Accruing 11,600,945 person-year

Combination	Rate	HR	CI	p
No complications	3.1	1	(reference)	
Preeclampsia	5.0	1.61	(1.39-1.87)	<0.001
Preeclampsia + PTD	4.9	1.62	(0.99-2.65)	0.054
Preeclampsia + SGA	8.5	2.74	(1.93-3.88)	<0.001
Preeclampsia + PTD + SGA	7.9	2.57	(1.72-3.84)	<0.001

Lykke JA, Langhoff-Roos, Sibai BM, Funai E, Triche EW, Paidas MJ. Hypertensive pregnancy disorders and subsequent cardiovascular morbidity and type 2 diabetes mellitus in the mother. Hypertension. 2009 Jun;53(6):944-51.

Acta Obstet Gynecol Scand. 2012 Sep;91(9):1053-60.
 J Thromb Haemost. 2012 Jul;10(7):1320-5.
 Acta Obstet Gynecol Scand. 2012 Apr;91(4):503-10
 Paediatr Perinat Epidemiol 2010; Jul 1;24(4): 323-30.

BJOG. 2010 Feb;117(3):274-81.
 Obstet Gynecol. 2009 Jun;113(6):1217-24.
 Hypertension. 2009 Jun;53(6):944-51.
 Semin. Perinatol 2007 Aug;31(4) 219-22

Other Adverse Outcomes

- Ischemic Heart Disease
 - Severe Preeclampsia 2.11 (1.76-2.52)
 - Mild Preeclampsia 1.76 (1.61-1.92)
 - Gestational Hypertension 1.67 (1.41-1.97)
- Stroke
 - Severe Preeclampsia 1.61 (1.35-1.93)
 - Mild Preeclampsia 1.44 (1.32-1.59)
 - Gestational Hypertension 1.68 (1.42-1.97)

Subsequent type 2 diabetes

Complication	Rate	HR	CI	p
No hypertensive disorder	5.1	1	(reference)	
Gestational hypertension	18.0	3.12	(2.63-3.70)	<0.001
Mild preeclampsia	17.9	3.53	(3.23-3.85)	<0.001
Severe preeclampsia	19.6	3.68	(3.04-4.46)	<0.001

Lykke JA, Langhoff-Roos, Sibai BM, Funai E, Triche EW, Paidas MJ. Hypertensive pregnancy disorders and subsequent cardiovascular morbidity and type 2 diabetes mellitus in the mother. Hypertension. 2009 Jun;53(6):944-51.

doi: 10.1111/j.1365-3016.2010.01120.x

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Mortality of mothers from cardiovascular and non-cardiovascular causes following pregnancy complications in first delivery

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^aDepartment of Obstetrics and Gynaecology, Roskilde Hospital, Roskilde, and ^bDepartment of Obstetrics, Rigshospitalet, Copenhagen, Denmark,

^cYale Women and Children's Center for Blood Disorders, Department of Obstetrics, Gynecology, and Reproductive Sciences, Yale University

School of Medicine, New Haven, CT, and ^dDepartment of Community Health, Section of Epidemiology, Brown University School of Medicine, Providence, RI, USA

Death from cardiovascular causes

Complication	Rate	HR	CI	p
Preterm delivery	2.0	1.98	(1.64-2.40)	<0.001
Small-for-gestational-age	2.7	2.56	(2.19-3.00)	<0.001
Gestational hypertension	2.9	2.47	(1.74-3.52)	<0.001
Mild preeclampsia	2.2	1.99	(1.61-2.47)	
Severe preeclampsia	2.6	2.89	(1.93-4.33)	
Placental abruption	1.5	1.23	(0.78-1.93)	0.37
Stillbirth	2.2	1.80	(1.06-3.01)	0.029

Rate is number of events pr. 10,000 person-years; HR denotes hazard ratio.

Adjusted for maternal age, year of delivery, and all of the above complications.

Death from non-cardiovascular causes

Combination	Rate	HR	CI	p
Preterm delivery only	6.4	1.39	(1.23–1.58)	<0.001
Small-for-gestational-age	8.1	1.65	(1.50–1.82)	<0.001
Preterm + SGA	10.4	1.93	(1.55–2.41)	<0.001
Severe preeclampsia	4.1	0.89	(0.76–1.04)	0.14
Preeclampsia + PTD	4.3	1.03	(0.61–1.74)	0.91
Preeclampsia + SGA	6.6	1.35	(0.91–2.00)	0.13
Preeclampsia + PTD + SGA	6.5	1.43	(0.92–2.22)	0.11

Lykke JA, Jens Langhoff-Ross J, Lockwood CJ, Triche EW, Paidas MJ. Maternal mortality from cardiovascular and non-cardiovascular causes following pregnancy complications in first delivery. *Paediatr Perinat Epidemiol* 2010; Jul 1;24(4): 323-30.

Death from all causes

Complication	Rate	HR	CI	p
Preterm delivery	11.7	1.66	(1.53-1.79)	<0.001
Small-for-gestational-age	14.2	1.91	(1.79-2.04)	<0.001
Gestational hypertension	10.3	1.23	(1.03-1.48)	0.001
Mild preeclampsia	8.7	1.11	(1.00-1.23)	
Severe preeclampsia	9.2	1.38	(1.11-1.71)	
Placental abruption	11.4	1.41	(1.20-1.67)	<0.001
Stillbirth	15.6	1.83	(1.50-2.23)	<0.001

number of events pr. 10,000 person-years; HR denotes hazard ratio.

Adjusted for maternal age, year of delivery, and all of the above complications.

Maternal Consequences of Hypertensive Disorders

Hypertensive pregnancy disorders are strongly associated with subsequent hypertension, thromboembolism, & T2 diabetes (metabolic syndrome).

Lykke JA, Langhoff-Roos, Sibai BM, Funai E, Triche EW, Paidas MJ. Hypertensive pregnancy disorders and subsequent cardiovascular morbidity and type 2 diabetes mellitus in the mother. Hypertension. 2009 Jun;53(6):944-51.

Maternal Consequences of Preterm Delivery

PTD is associated with subsequent cardiovascular morbidity & overt T2 diabetes; a lower gestational age & recurrence of PTD augments these associations.

Lykke JA, Paidas MJ, Damm P, Triche EW, Kuczynski E, Langhoff-Roos J. Preterm delivery and risk of subsequent cardiovascular morbidity and type-II diabetes in the mother. BJOG. 2010 Feb;117(3):274-81.

Effectiveness-based guidelines for the prevention of cardiovascular disease in women--2011 update: a guideline from the American Heart Association.

Classification of CVD Risk in Women

Risk Status	Criteria
High Risk (≥ 1 HR States)	CHD, CVD, PAD, AAA, ED or CKD, DM, 10 yr predicted CVD risk $\geq 10\%$
At Risk (≥ 1 major RF)	Cig, SBP ≥ 120 , DBP ≥ 80 or treated HTN, Tchol ≥ 120 , HDL-C <50 , Txed for dyslipidemia, Obesity (central), Poor diet, physical inactivity, F hx premature CHD in 1 st deg rel in men <55 or women <65 ; metabolic syn, advanced subclin atherosclerosis, poor exercise capacity on treadmill or abnl HR recovery, systemic autoimmune collagen vascular dis, Hx Preeclampsia, gestational diabetes, or pregnancy induced hypertension

Pregnancy Complications and Cardiovascular Disease Death 50-Year Follow-Up of the Child Health and Development Studies Pregnancy Cohort

Table 2. Associations of Paired Pregnancy Complications With CVD Risk

Combinations of pregnancy complications*	HR	95% CI	
		Lower	Upper
SGA + preterm delivery	2.6	1.06	6.20
Gestational hypertension + hemoglobin decline	2.8	1.15	6.92
Preeclampsia† + SGA‡	3.7	1.12	12.10
Preterm delivery (weeks 35–36) + hemorrhage	3.9	1.63	9.56
SGA + preexisting hypertension	4.8	1.78	12.91
Gestational hypertension + preterm delivery‡	5.0	2.64	9.60
Preeclampsia† + preexisting hypertension	5.6	2.09	15.18
Preterm delivery + preexisting hypertension	7.1	3.49	14.55

Strategies for ongoing reduction of global maternal mortality (WHO Sustainable Development Goals) include:

- a human rights–based approach to maternal and newborn health, which includes eliminating inequities that lead to disparities in access, quality, and outcomes of care within and between countries.
- There is a need for improvements in care, including sexual and reproductive health, family planning, and newborn and child survival.

Howell EA. Reducing Disparities in Severe Maternal Morbidity and Mortality. Clinical Obstetrics and Gynecology 2018; vol 61 (2): 387- 399

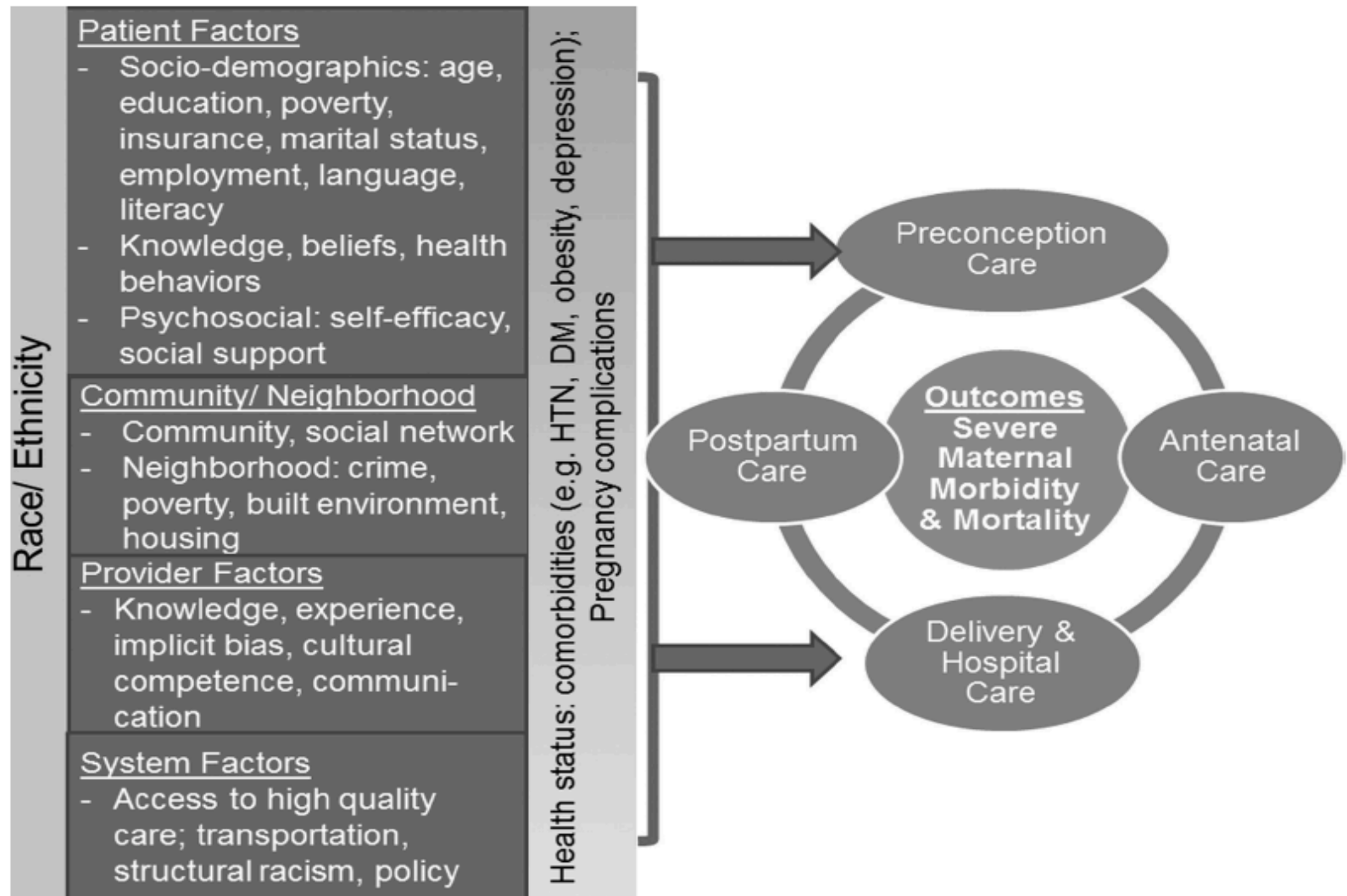


FIGURE 1. Conceptual model. DM indicates diabetes; HTN, hypertension.



SMFM Special Report: Putting the “M” back in MFM: Reducing racial and ethnic disparities in maternal morbidity and mortality: A call to action

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Racial and ethnic disparities in maternal morbidity and mortality rates are an important public health problem in the United States. Because racial and ethnic minorities are expected to comprise more than one-half of the US population by 2050, this issue needs to be addressed urgently. Research suggests that the drivers of health disparities occur at 3 levels: patient, provider, and system. Although we have recognized this issue and identified elements that contribute to it, knowledge must be converted into action to address it. In addition, despite available funding and databases, research directed towards understanding and reducing these disparities is lacking. This document summarizes findings of a workshop convened at the 2016 Society for Maternal-Fetal Medicine’s 36th Annual Pregnancy meeting in Atlanta, GA, to review and make recommendations about immediate actions in clinical care and research that will serve to reduce racial and ethnic disparities in maternal morbidity and mortality rates in the United States.

Key words: barrier, care, research gap, SMFM

TABLE 1
Summary of recommendations to improve clinical care

Recommendations	Rationale	Description
For providers		
Use available preventive therapies for high-risk women.	Prevention strategies in high-risk women can lead to an improvement in healthcare costs and care outcomes. ⁶⁷	Prescribe low-dose aspirin to prevent preeclampsia according to US Preventive Services Task Force guidelines.
Assess baseline end-organ damage among high-risk women.	Black women are more likely to have end-organ damage for any given duration of hypertension. ²⁵	Consider an algorithm for high-risk women who may benefit from a maternal echocardiogram, renal function evaluation, and sleep apnea screening either before or early in pregnancy.
Follow existing clinical guidelines.	Specific societies may have recommendations for the management of medical conditions; only 10–40% of women with hypertension or diabetes mellitus will see a primary care provider within 1 year after delivery. ⁶⁸	Follow existing evidence-based guidelines (American Heart Association guidelines for treatment of hypertension; National Institute for Health and Care Excellence guideline key recommendations for a 6- to 8-week postpartum consultation). ^{29,69}
For healthcare systems		
Provide supportive services that facilitate access to care.	Improved access to care is associated with significant increases in usage, preventive care, healthcare quality, and self-reported health, in addition to reductions in emergency department use. ⁷⁰	Incorporate standardized, culturally appropriate patient education materials that illustrate the link between pregnancy complications and future health.
		Provide transportation vouchers and translation services.
		Provide remote visits and home visits when possible. Consider using community-based initiatives to enhance prenatal and postnatal care.
For hospital systems		
Improve the quality of the care provided.	Black women are more likely to deliver at hospitals that serve a predominately black population and have high rates of morbidity. ²⁶	Incorporate recommended care bundles that are related specifically to hypertension, venous thromboembolism prevention, and postpartum hemorrhage.
		Partner with lower resource hospitals to help improve healthcare quality.
Implement maternal morbidity and mortality reviews.	Mortality reviews can help identify areas of substandard care that need improvement. ⁷¹	Undertake a systematic, multidisciplinary review of all cases of death and severe morbidity. ⁷²
		Establish a mechanism to disseminate knowledge gained from those reviews.

THANK YOU



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