Obstetric Hemorrhage

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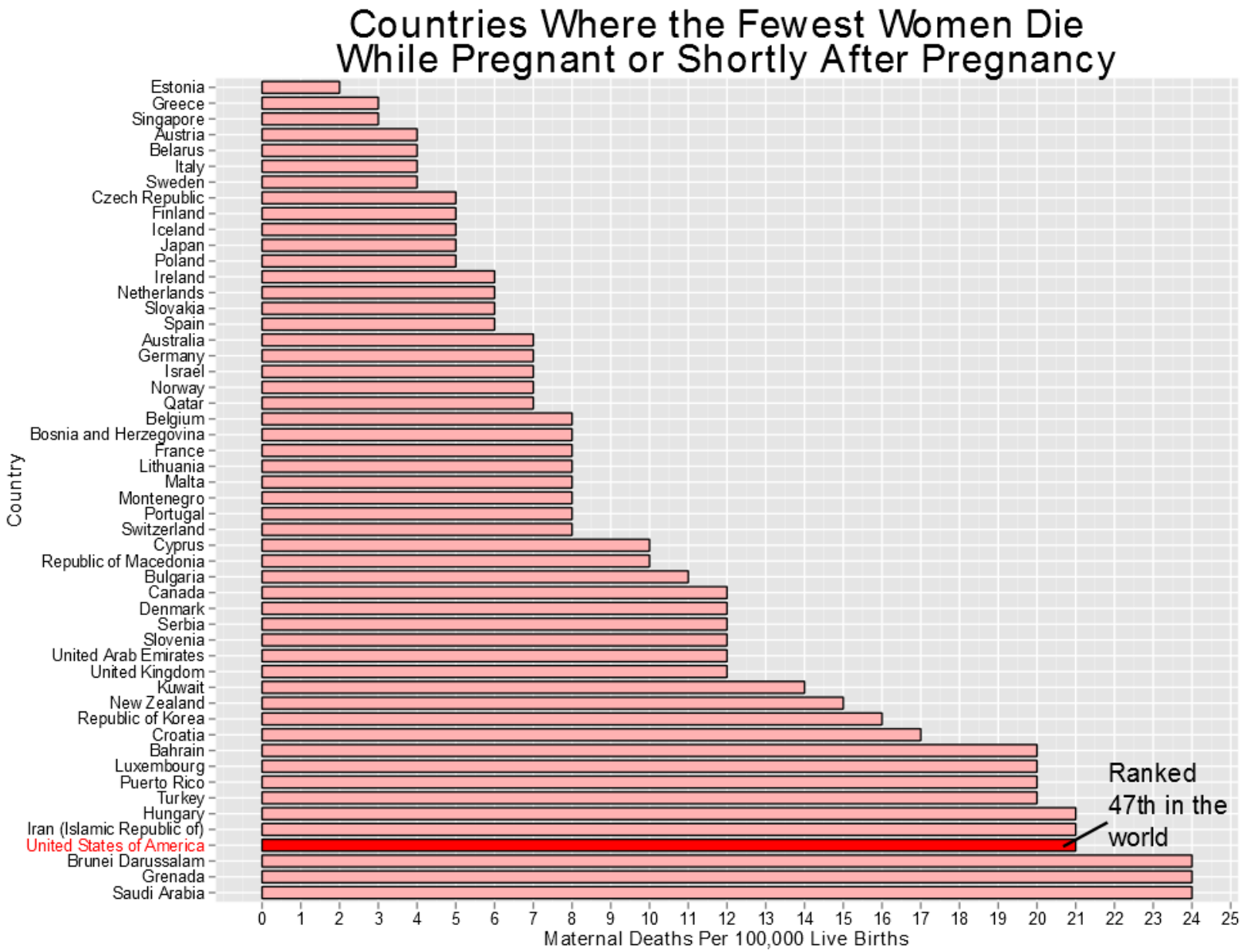
Obstetric Hemorrhage

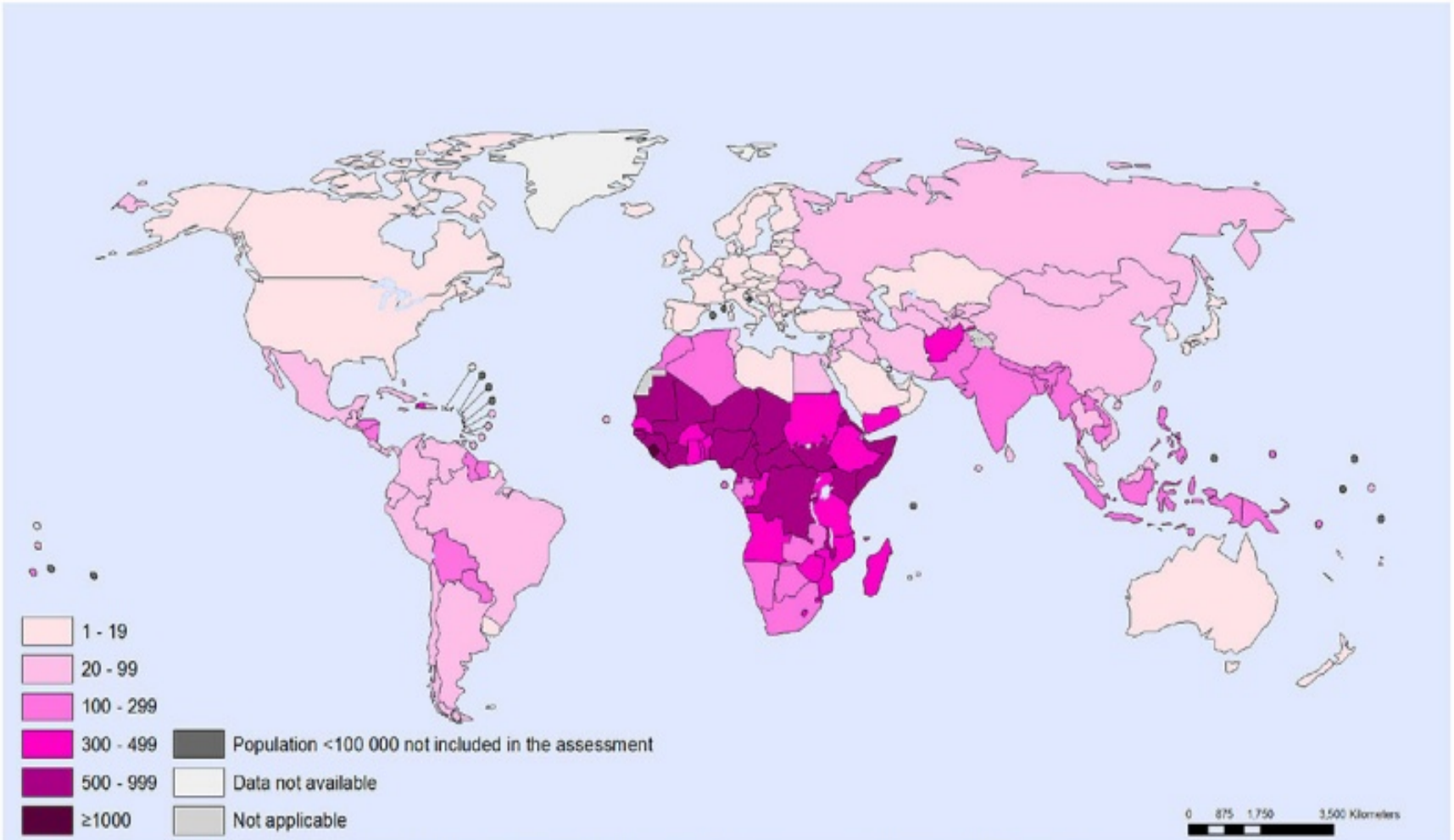
- USA Mortality estimate : Two to three women die every day or have obstetric complications. Every 10 minutes a woman in the United States almost dies of pregnancy-related complications. 125,000 women a year are affected.
- 50% of these have been determined to be preventable.
- African American women have 3-4 times more deaths than women of all other racial/ethnic groups.
- **Postpartum hemorrhage is a leading cause affecting 2.9%.**
- In 1998-1999 compared to 2008-2009 there was a 75% increase in the number of women who suffered serious injuries while giving birth.
- The US is one of the only countries where maternal deaths and injuries have increased.



Data Source: Trends in Maternal Mortality: 1990-2010. WHO/UNICEF/UNFPA/WB

Developing countries

Maternal mortality ratio (per 100 000 live births), 2015



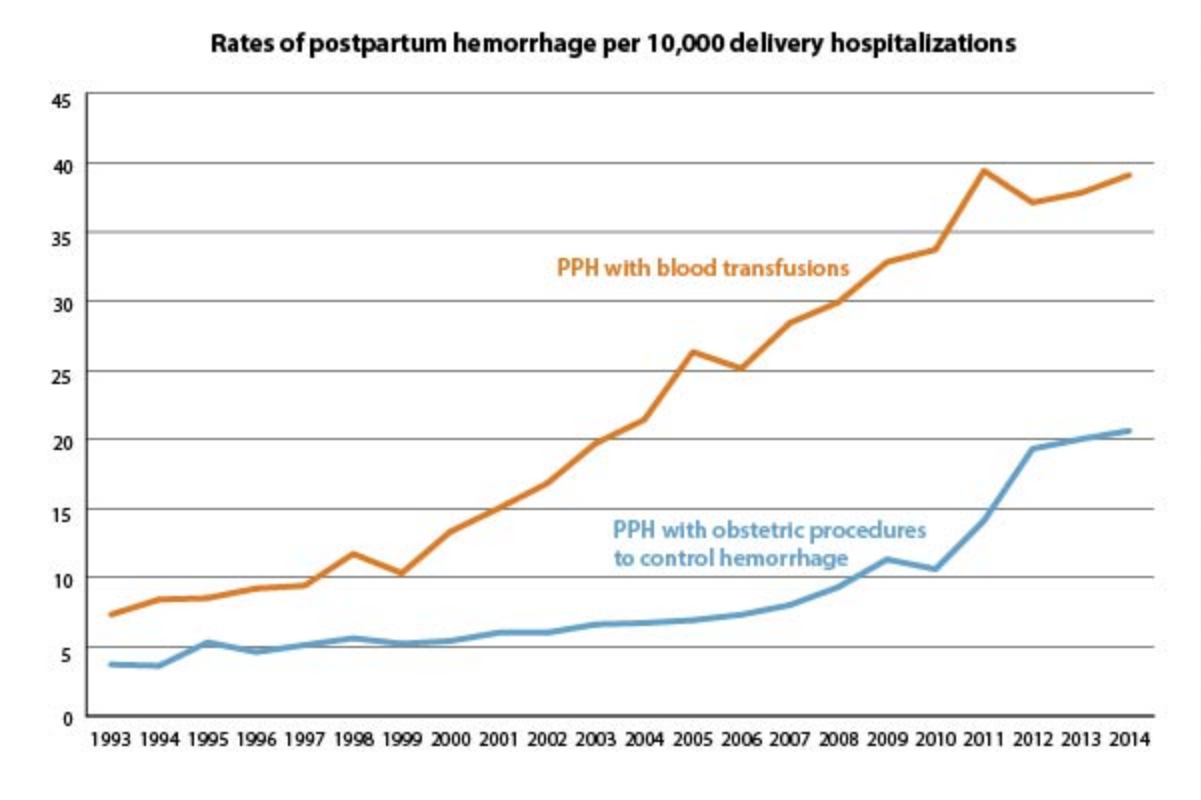
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

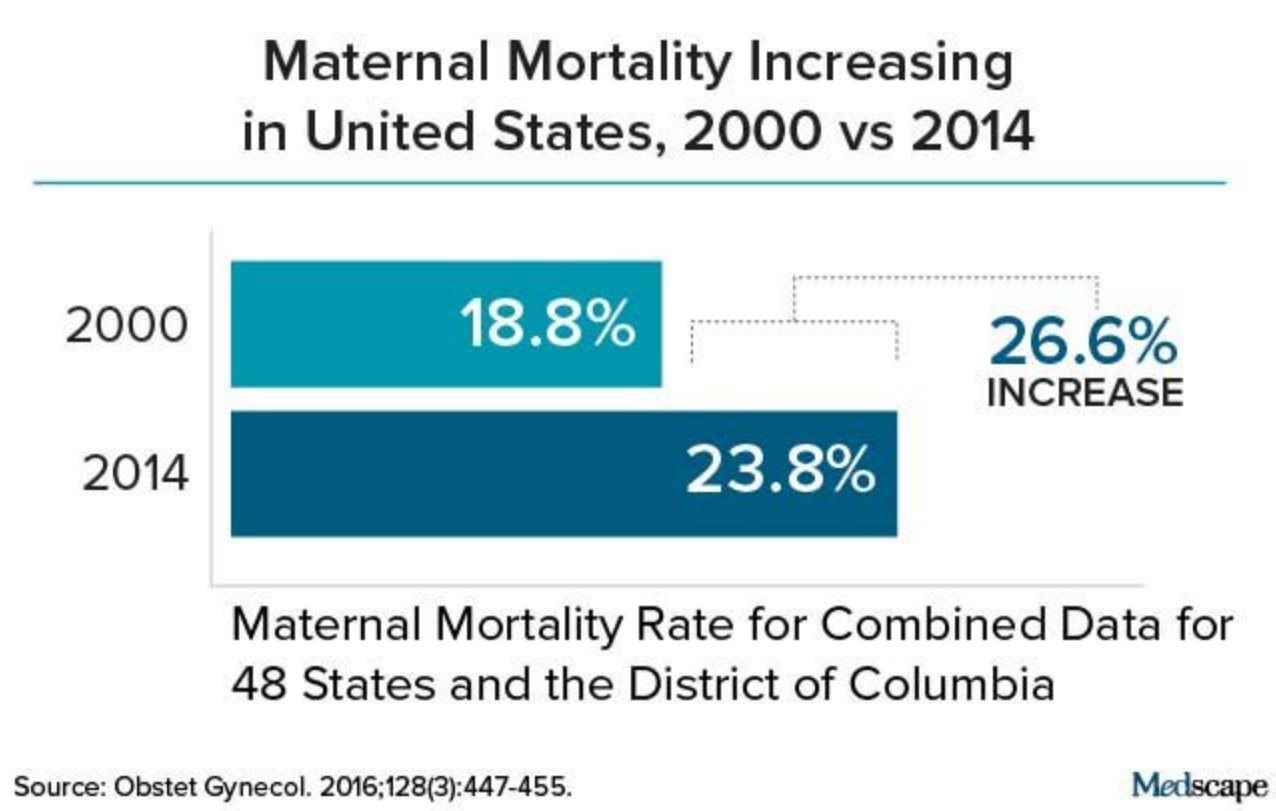
Data Source: World Health Organization
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

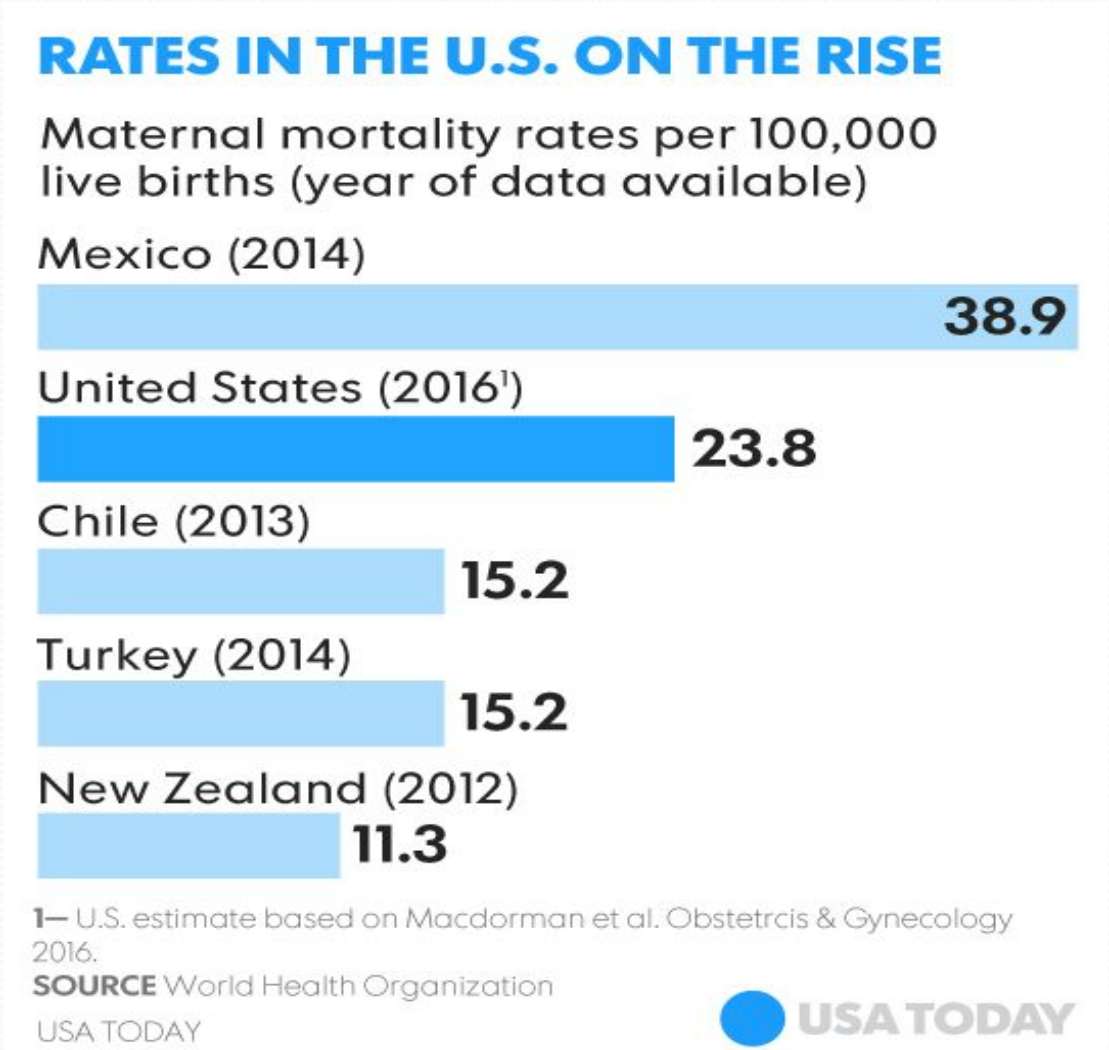
World Health Organization

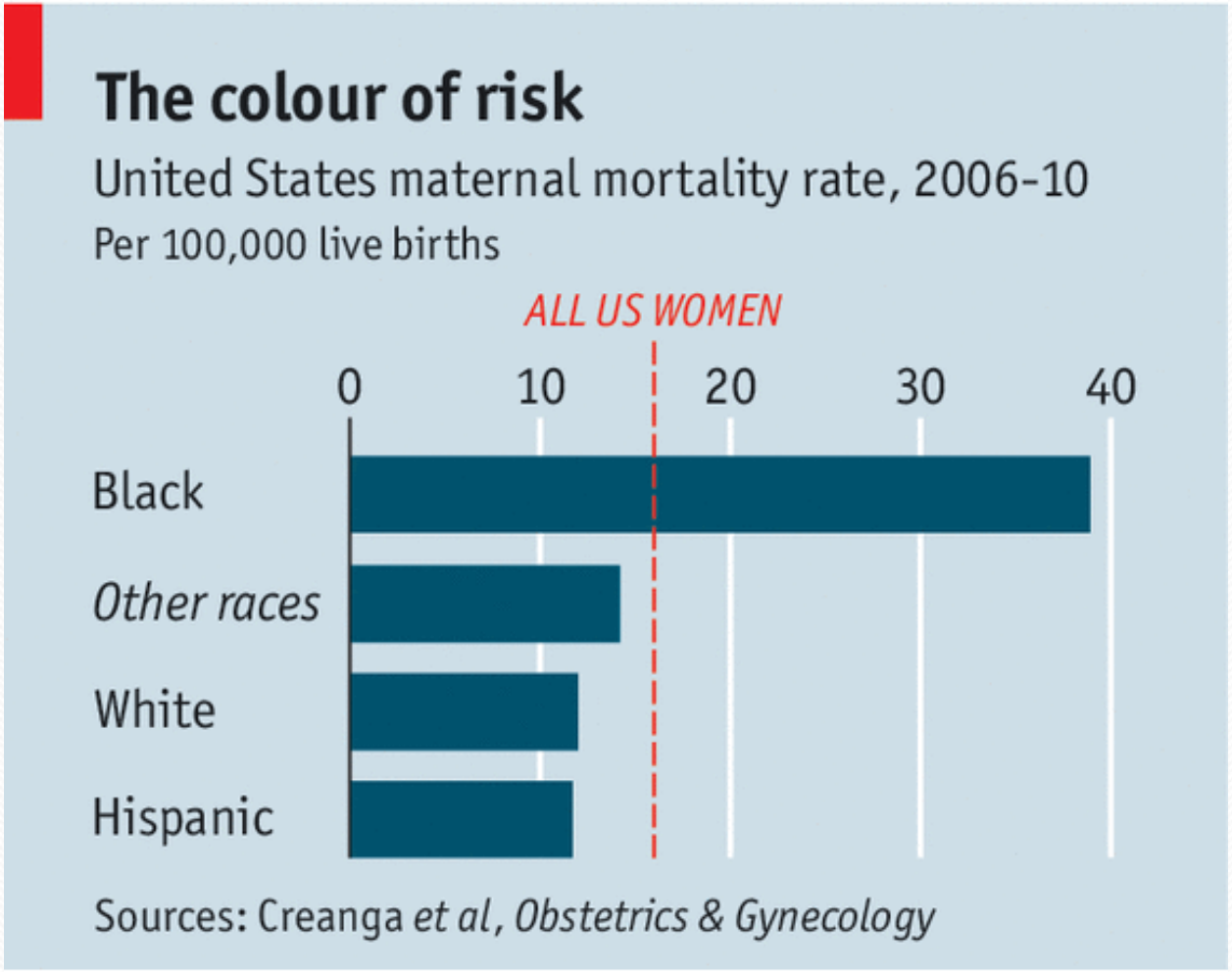
Source - WHO Trends in Maternal Mortality 1990 to 2015

- The rate of PPH with procedures to control hemorrhage increased from 4.3 in 1993 to 21.2 in 2014, with sharper increases in later years. The rate of PPH with blood transfusions also increased noticeably over time, from 7.9 in 1993 to 39.7 in 2014.




Maternal Mortality Increasing
in United States, 2000 vs 2014
2000
18.8%
2014
23.8%
26.6%
INCREASE
Maternal Mortality Rate for Combined Data for
48 States and the District of Columbia
Source: Obstet Gynecol. 2016;128(3):447-455.
Medscape


RATES IN THE U.S. ON THE RISE
Maternal mortality rates per 100,000 live births (year of data available)
Mexico (2014)
38.9
United States (2016[1])
23.8
Chile (2013)
15.2
Turkey (2014)
15.2
New Zealand (2012)
11.3
1— U.S. estimate based on Macdorman et al. Obstetrcis & Gynecology 2016.
SOURCE World Health Organization
USA TODAY
USA TODAY

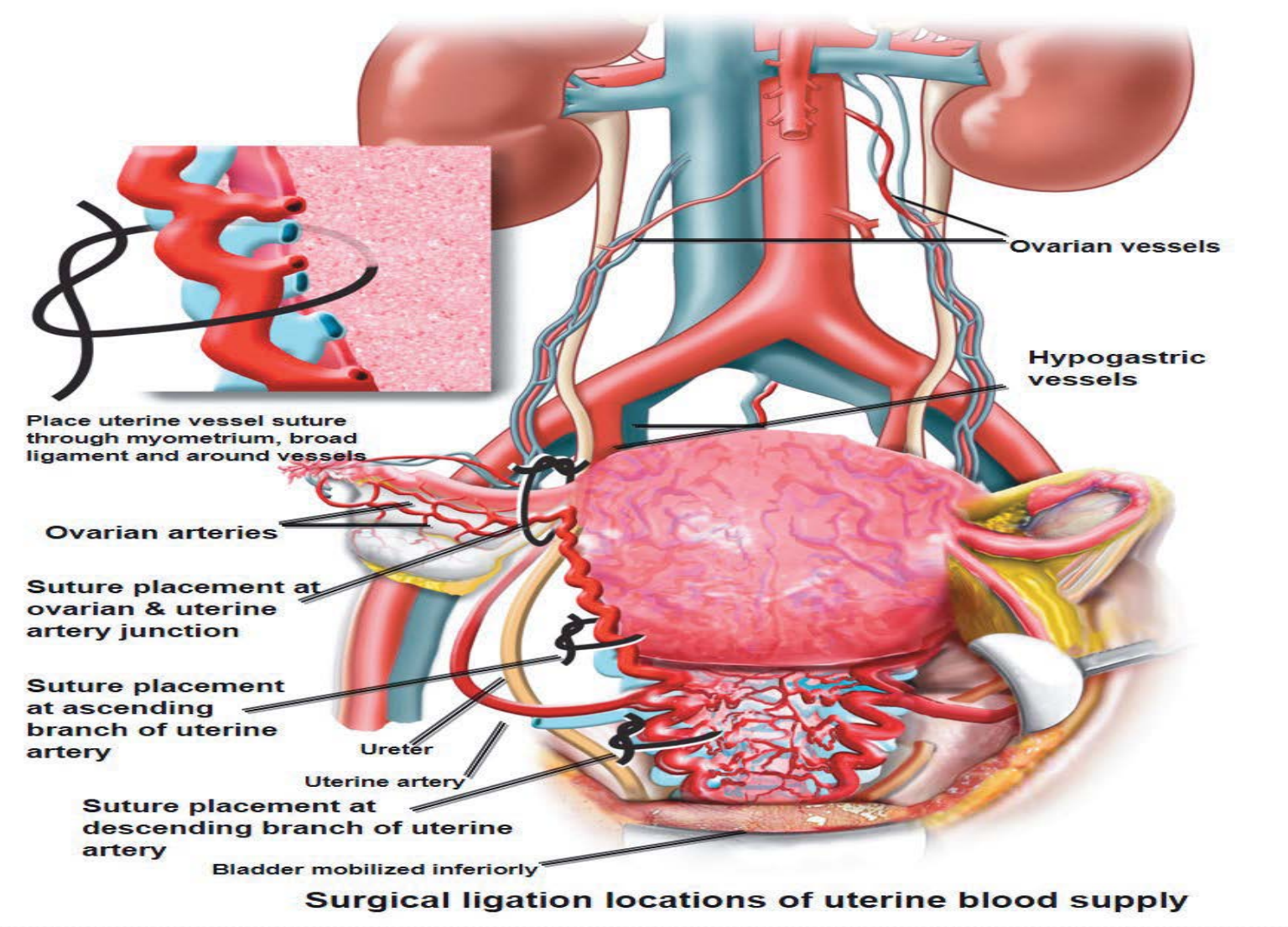

The colour of risk
United States maternal mortality rate, 2006-10
Per 100,000 live births
ALL US WOMEN
0
10
20
30
40
Black
Other races
White
Hispanic
Sources: Creanga et al, Obstetrics & Gynecology
Economist.com

Etiology

Etiology

- **The 4Ts**
- Tone : Atonic uterus , 70%
- Trauma : Lacerations, hematomas, inversion, rupture , 20%
- Tissue : Retained tissue, invasive placenta, 10%
- Thrombin Coagulopathies : 1%

Uterine circulation



Surgical ligation locations of uterine blood supply

Obstetric Hemorrhage : Etiology

- Low Risk
- Medium Risk
- High Risk

Low risk

- First or early second trimester D&C without history of bleeding (scheduled)
- Cerclage
- Vaginal Birth
  - No previous uterine incision
  - No history of bleeding problems
  - No history of PP hemorrhage
  - Four or less previous vaginal births
  - Singleton pregnancy

Medium Risk

- Prior cesarean, uterine surgery, multiple laparotomies
- Multiple gestation
- >4 prior births
- **Prior obstetric hemorrhage (VWF)**
- Large myomas
- EFW >4000 g
- **Obesity (BMI >40)**
- Hematocrit <30% & other risk
- **Peripartum**

  Chorioamnionitis

  Prolonged oxytocin >24 hours

  Prolonged 2nd stage

  Magnesium sulfate

High Risk

- Placenta previa/ accreta/ percreta
- Platelet count < 70,000
- Active Bleeding
- Known coagulopathy
- **Two or more medium risk factors.**
- **Peripartum**
- New Active Bleeding
- Two or more medium admission or intrapartum risk factors

Risk Assessment: Antepartum Abnormal Placentation

- Placenta accreta : Deliver 34 0/7-35 6/7 wks
- Placenta previa : Deliver 36 0/7-37 6/7 wks
- Prior classical cesarean : Deliver 36 0/7-37 6/7wks
- Prior myomectomy : Deliver 37 0/7-38 6/7 wks
- If extensive: Deliver 36-37wks

Risk Assessment: Prenatal

- Suspected previa/accreta/increta/percreta
- Pre-pregnancy BMI >50
- Clinically significant bleeding disorder
- Other significant medical/surgical risk *(consider patients who decline transfusion)*
- **Transfer to appropriate level of care for delivery** *

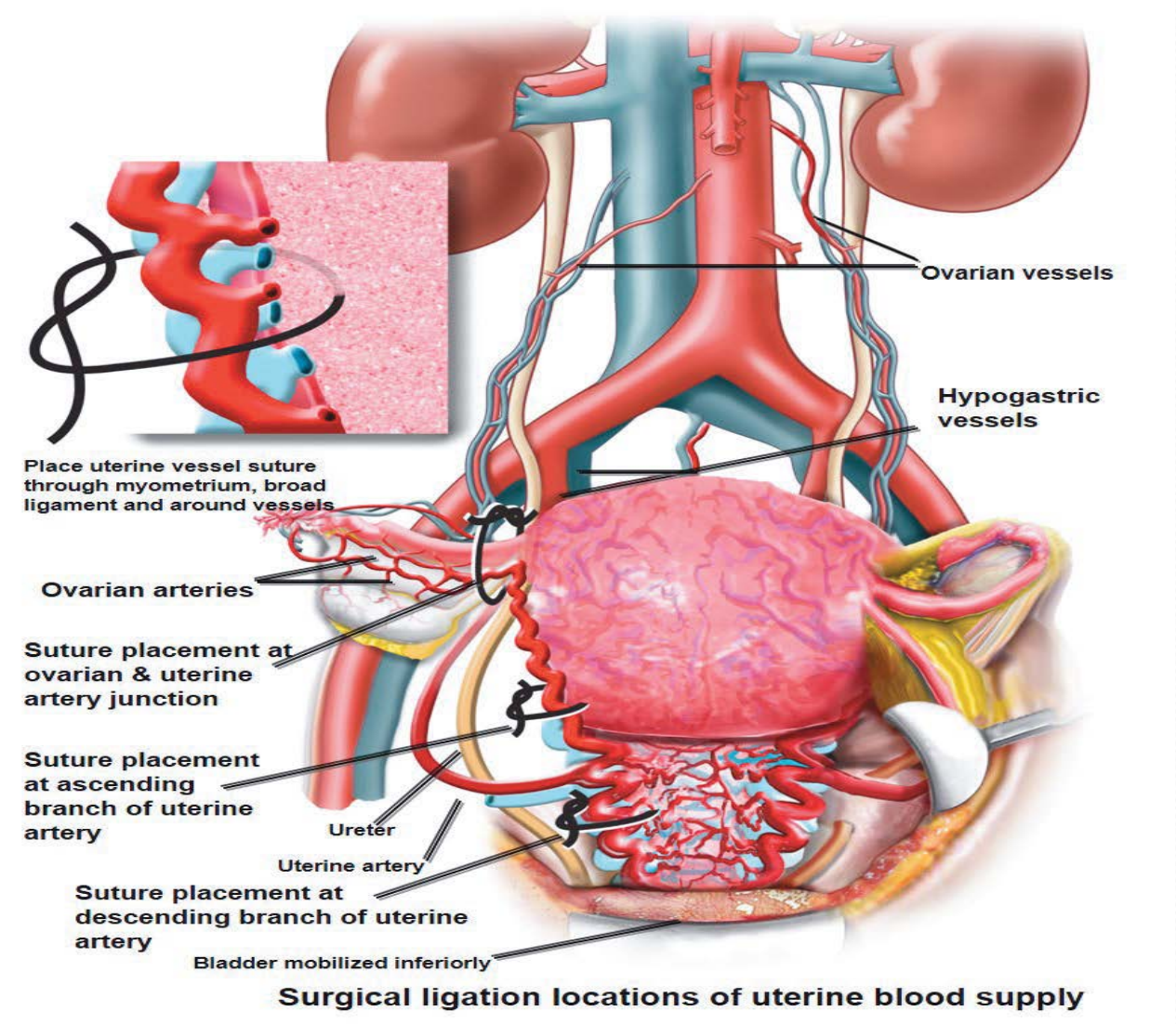
Risk Assessment: Placenta Accreta Management

- For one or more prior cesareans, placental location should be documented prior to scheduled delivery.
  - Imaging studies : Transvaginal sonogram.
  - Care at appropriate center (Accreta team).

Physiology

- Anatomy
- Coagulation cascade Pathways

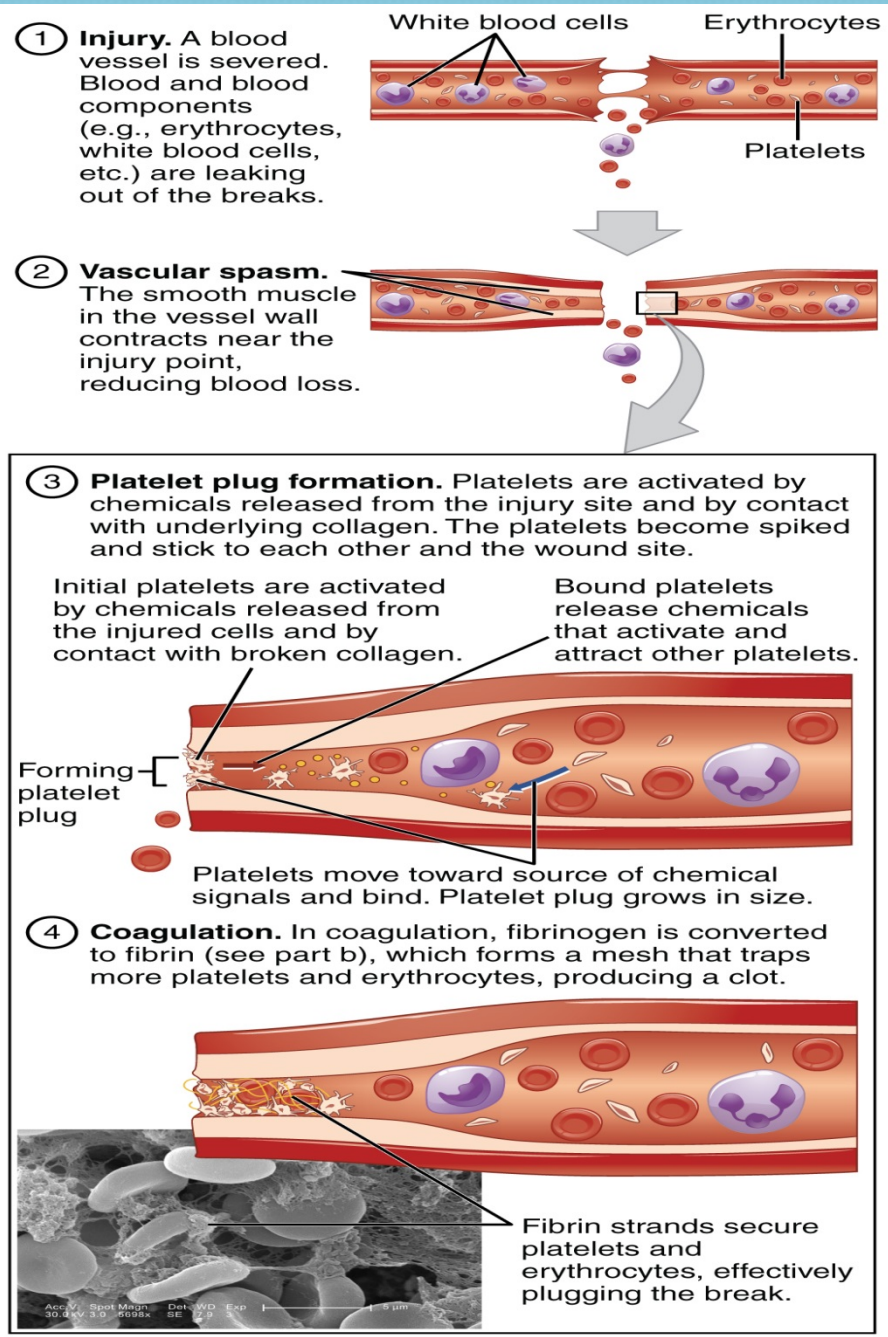
Uterine circulation



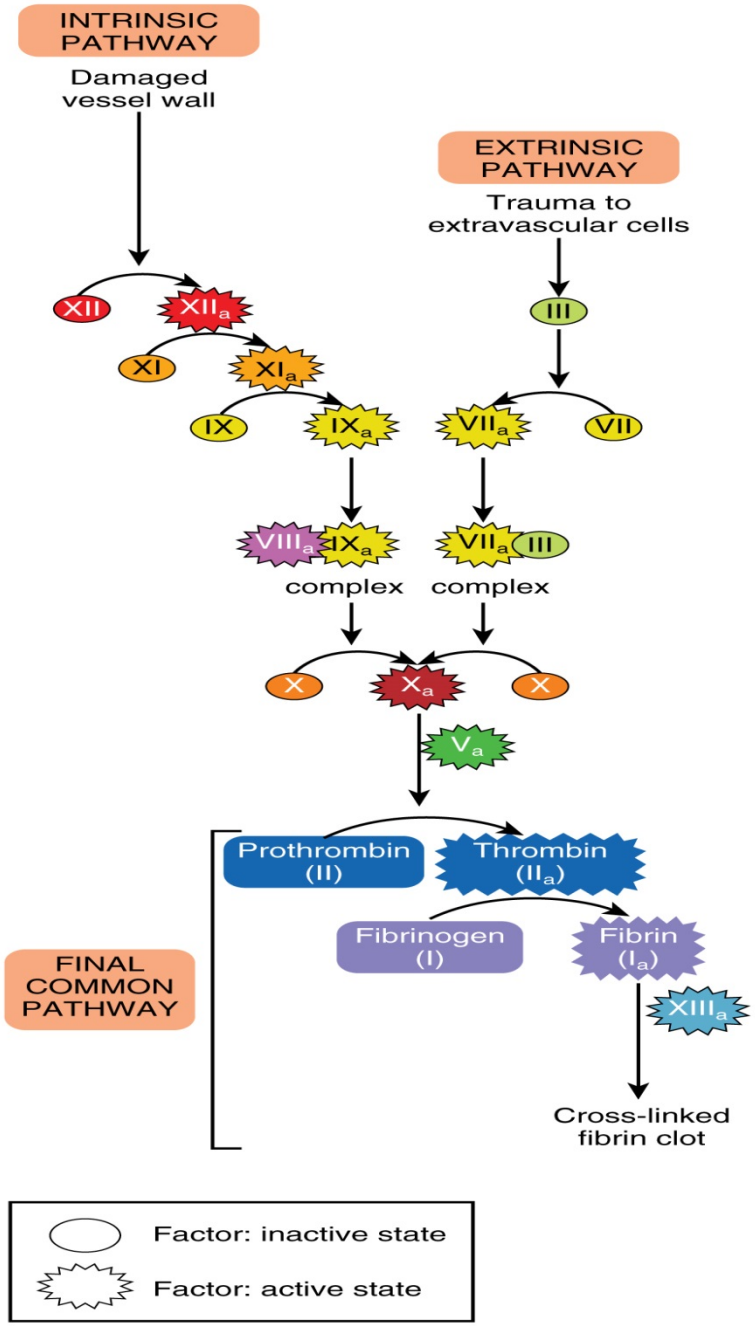
Surgical ligation locations of uterine blood supply

Coagulation

- Multi-step chain reaction cascade. Each step produces a new protein which acts as an enzyme, or catalyst, for the next step.
- Three pathways—the extrinsic pathway, the intrinsic pathway, and the common pathway.
- The **extrinsic pathway (Tissue factor)** is triggered by a chemical called tissue factor that is released by damaged cells. It is initiated by a factor outside the blood vessels.
- The i**ntrinsic pathway** (**Contact Activation**) is triggered by blood coming into contact with collagen fibers in the broken wall of a blood vessel.
- Both pathways eventually produce a prothrombin activator. The prothrombin activator triggers the **common pathway** in which prothrombin becomes thrombin followed by the conversion of fibrinogen to fibrin.
- All of the mentioned risk factors are potential triggers for these pathways to be activated : i.e. Chorioamnionitis

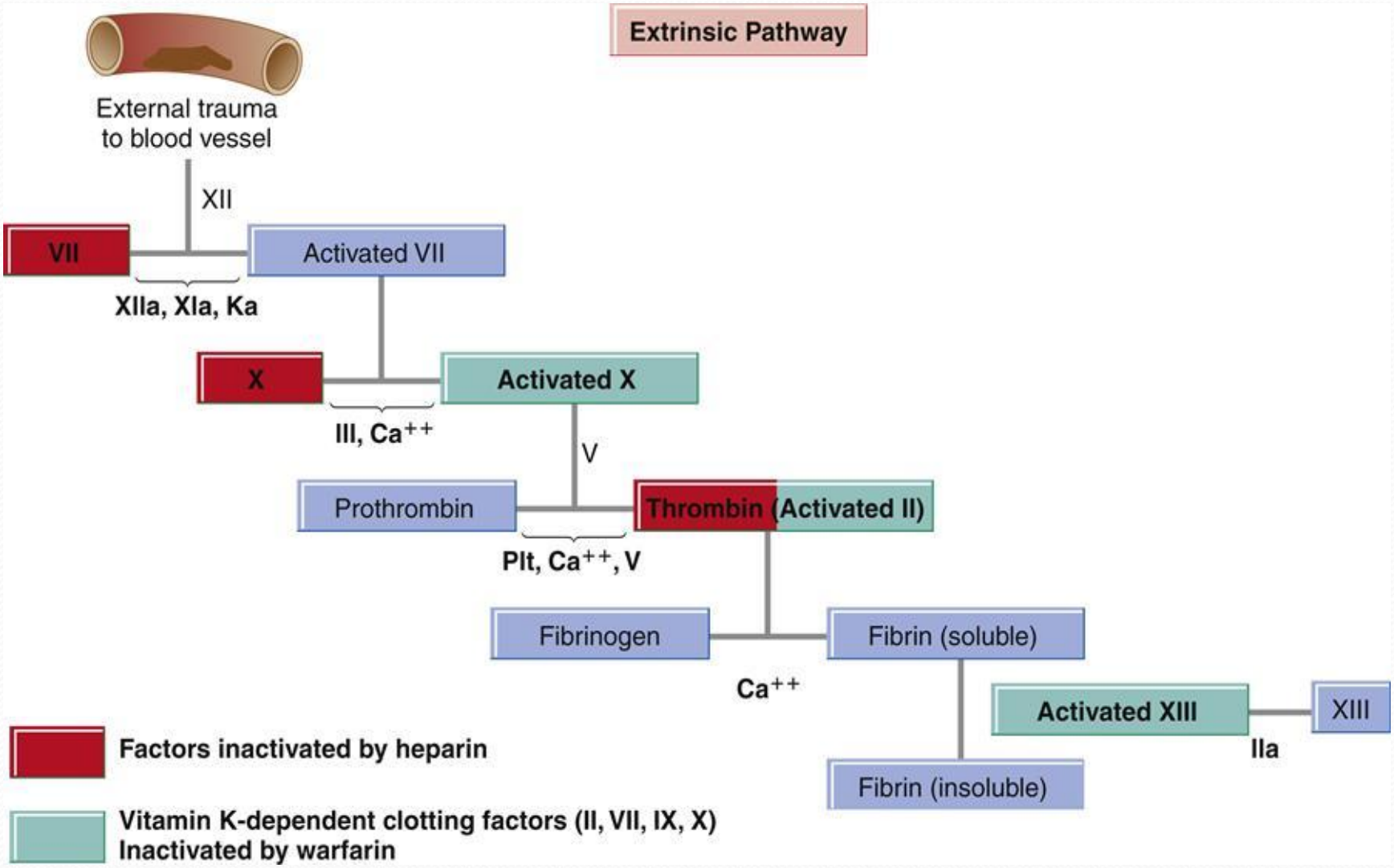


(a) The general steps of clotting



(b) Fibrin synthesis cascade

Coagulation Cascade



When to evaluate?
What to evaluate?

Primary postpartum hemorrhage

- Occurs within the first 24 hours after birth.
- Etiology : uterine atony, lacerations, retained placenta, abnormally adherent placenta (accreta), defects of coagulation (disseminated intravascular coagulation), and uterine inversion.

Secondary postpartum hemorrhage

- Occurs more than 24 hours and up to 12 weeks after delivery.
- Etiology :
  Subinvolution of the placental site
  Retained products of conception
  Endometritis , Chorioamnionitis
  Inherited coagulation defects (i.e. : VWD)

When to evaluate ?

- Vaginal Delivery : bleeding in the immediate postpartum period exceeds 500 mL
- Cesarean Delivery : excess of 1000ml.
- What to assess?
- Start with your physical exam : uterus, cervix, vagina, vulva, and perineum
- Consider **physiological dilutional anemia in pregnancy** Waiting for a 10% decrease in hematocrit can be misleading. It is probably greater.
- Clinical symptoms and signs ie: tachycardia and hypotension may be delayed until about 25% (1500ml)

What else?

- Large blood loss will include depletion of coagulation factors resulting in consumptive or disseminated intravascular coagulopathy. i.e.: Trauma
- DIC (may result from excessive blood loss)
- Thrombocytopenia
- Placental abruption
- ITP
- TTP
- Pre-eclampsia including ***H***emolysis ***EL*** ***L***ow ***P***latelets Syndrome
- Anticardiolipin/Antiphospholipid Syndrome
- Malignancy, substance use (etoh)

What to Evaluate ?

- Mental Status
- Vital Signs including BP, Pulse and O_2 saturation
- Intake: Blood Products and Fluids
- Output: Urine and Blood Loss
- Hemoglobin and Hematocrit
- Assess uterine tone and vaginal bleeding

Obstetric Hemorrhage: Key Elements

- **Obstetric Hemorrhage: Key Elements**
  - RECOGNITION & PREVENTION (every patient)
  - Risk assessment
  - Universal active management of 3rd stage of labor

  - READINESS (every unit) Blood bank (massive transfusion protocol)
  - Cart & medication kit
  - Hemorrhage team with education & drills for all stakeholders

- RESPONSE (every hemorrhage)
- Checklist
- Support for patients/families/staff for all significant hemorrhages
- REPORTING / SYSTEMS LEARNING (every unit)
- Culture of huddles & debrief
- Multidisciplinary review of serious hemorrhages
- Monitor outcomes & processes metrics

Team Work

The Designated Team :

Ob / L/D team, On Call MFM, On Call Gyn Onc/ Trauma

Mobilize additional team members as necessary (Blood bank, courier, ICU / PACU for postoperative care)

General or Trauma surgery

Anesthesia

Interventional radiology.

Assessing degree of Hemorrhage

- Use to **quantify** (measure)not qualify (think it could be)
- Volume of blood already lost *(estimated blood loss)*
- Rate of bleeding *(at the time of evaluation)*
  - Consequences of blood loss: Hemodynamic abnormalities ***(blood pressure, pulse, urinary output)***
  - Hemoglobin/Hematocrit abnormalities
  - Metabolic abnormalities *(pH, base deficit, lactic acid)*
  - Coagulation abnormalities *(PT, PTT, INR, fibrinogen, platelets)*
  - Patient's clinical status *(anxious, confused, lethargic)*

Hemorrhage Checklist

- **Call for assistance**
  - Response team to the bedside (10 Team) Delivering attending MD/CNM
  - Primary RN
  - Anesthesiologist
- Huddle: appoint leader, recorder/time keeper, nursing roles
- Identify hemorrhage stage Document EBL and interventions
- Timekeeper will call out at 5 minute intervals

Blood Bank: Massive Transfusion Protocol

- **ANTICIPATE ONGOING MASSIVE BLOOD NEEDS**
- OBTAIN MASSIVE TRANSFUSION PACK
- consider using coolers
- administer as needed in the following ratio 6:4:1
  - 6 units PRBCs
  - 4 units FFP
  - 1 apheresis pack of platelets

- INITIAL LAB RESULTS
  - Normal anticipate ongoing bleeding repeat massive transfusion pack bleeding controlled deactivate MTP
  - Abnormal repeat massive transfusion pack repeat labs consider cryoprecipitate and consultation for alternative coagulation agents (Prothrombin Complex Concentrate [PCC], recombinant Factor VIIa, tranexamic acid)

Massive Transfusion Protocol (MTP)

- **Blood Bank:**
- **Massive Transfusion Protocol** (MTP)
- In order to provide safe obstetric care, institutions MUST:
- Have a minimum of 4 units of O-negative PRBCs
- Have the ability to obtain 6 units PRBCs & 4 units FFP (compatible or type specific) for a bleeding patient
- Have a mechanism in place to obtain platelets & additional products in a timely fashion

Blood Bank: Massive Transfusion Protocol

- I. PATIENT CURRENTLY BLEEDING & AT RISK FOR UNCONTROLLABLE BLEEDING
- 1. Activate MTP – call (add number) and say *"activate massive transfusion protocol"*
- 2. Nursing/Anesthesia draw stat labs
  - a.Type & crossmatch
  - b.Hemoglobin and platelet count, PT(INR)/PTT, fibrinogen, and ABG *(as needed)*
  - II. IMMEDIATE NEED FOR TRANSFUSION

- *(type and crossmatch not yet available)*
- Give 2-4 units O-negative PRBCs

- ("OB EMERGENCY RELEASE")

Blood Bank: Massive Transfusion Protocol

- *Important protocol items to be determined at each institution are:*
- How to activate MTP
- Blood bank number & location; notify as soon as possible
- Emergency release protocol that both blood bank staff and ordering parties *(MD/RN/CNM)* understand
- How will blood be brought to L&D?
- How will additional blood products/platelets be obtained?
- Mechanism for obtaining serial labs, such as with each transfusion pack, to ensure transfusion targets achieved

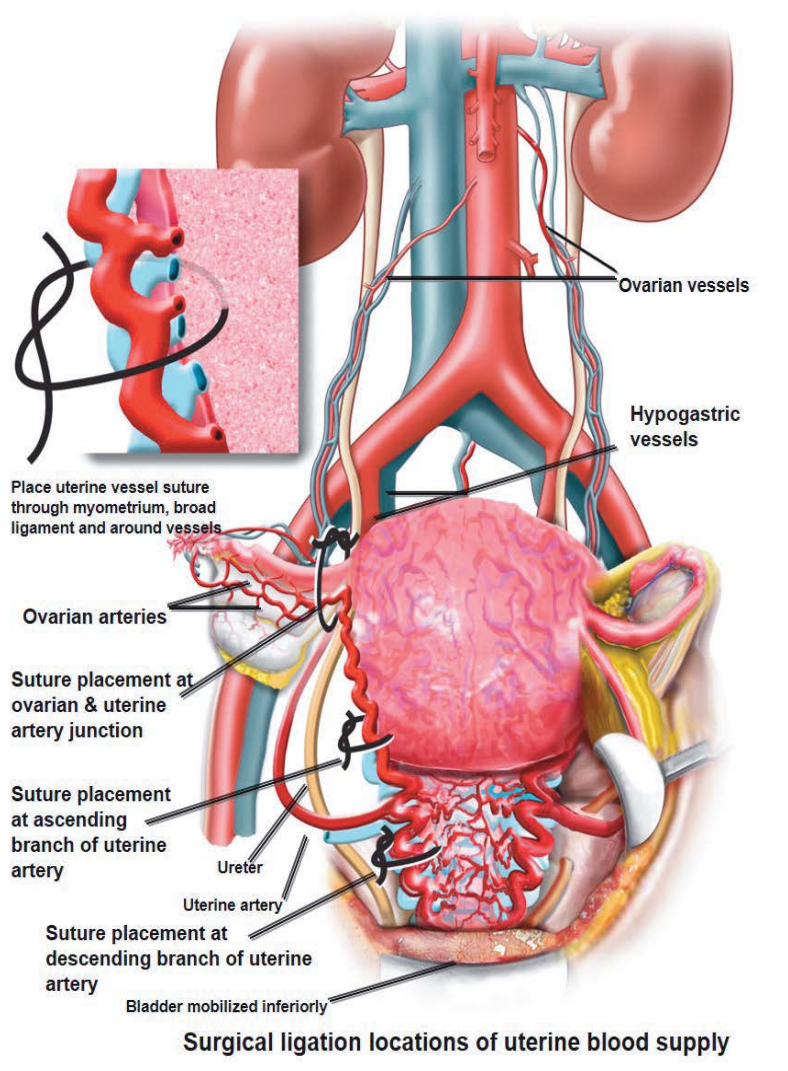
Blood Bank: Massive Transfusion Protocol

- *In order to provide safe obstetric care institutions must:*
  - Have a functioning Massive Transfusion Protocol (MTP)
  - Have a functioning **Emergency Release Protocol** (a minimum of 4 units of O-negative/uncross matched PRBCs)
  - Have the ability to obtain 6 units PRBCs and 4 units FFP *(compatible or type specific)* for a bleeding patient
  - Have a mechanism in place to obtain platelets and additional products in a **timely** fashion

Obstetric Hemorrhage

Recommended Instruments Checklist

- **Hemorrhage Cart**
- **VAGINAL :** Vaginal retractors; long weighted speculum
- Long instruments (needle holder, scissors, Kelly clamps, sponge forceps)
- Intrauterine balloon
- Banjo curette
- Bright task light
- Procedural instructions (balloon)
- **CESAREAN/LAPAROTOMY** Hysterectomy tray
- #1 chromic or plain catgut suture
- Reloadable straight needle for B-Lynch sutures
- Intrauterine balloon
- Procedural instructions (balloon, B-Lynch, arterial ligations)



Checklist : STAGE 1

- Blood loss >500 mL vaginal OR blood loss >1000 mL cesarean WITH NORMAL VITAL SIGNS and LAB VALUES
- Record VS, O2 saturation every 5 minutes
- Record cumulative blood loss
- Insert Foley catheter
- IV access: at least 16 gauge if possible
- Increase intravenous fluid (crystalloid: estimated blood loss in 2:1 ratio without oxytocin)
- Fundal massage
- Determine and treat etiology (4 Ts -*Tone, Trauma, Tissue, Thrombin)*
- Blood bank: Type & crossmatch 2 units PRBCs

Checklist: STAGE 1
Medications

- Oxytocin (Pitocin) : 40-80 international units/liter intravenously or the equivalent
  Avoid undiluted IV infusion, causes hypotension
- Methylergonovine (Methergine) : 0.2 milligrams intramuscularly
- (may be repeated every 2-4 hours)
  Avoid in hypertension, Reynaud's
- 15-methyl PGF2α (Hemabate, Carboprost) : 250 micrograms intramuscularly
  may repeat every 15 minutes, maximum 8 doses
  Avoid in asthma, hepatic, renal, cardiovascular disease
  Risk of diarrhea, fever, tachycardia
- Misoprostol (Cytotec) : 800-1000 micrograms rectally

Checklist: STAGE 2

- **Continued bleeding EBL up to 1500 mL OR any patient requiring ≥2 uterotonics WITH NORMAL VITAL SIGNS and LAB VALUES**
- 2nd IV access (16 gauge if possible)
- STAT labs, with coags & fibrinogen
- Warming blanket
- For uterine atony : Consider intrauterine balloon or surgical interventions
- Blood bank: *DO NOT wait for labs. Transfuse per clinical signs/symptoms.*
- Notify of OB hemorrhage (MTNP), bring 2 units PRBCs to bedside, thaw 2 units FFP
- Medications: Continue medications from Stage 1
- Consider moving patient to OR *(better exposure, potential D&C)*
- Mobilize additional team members as necessary

Checklist: STAGE 3

- **Continued bleeding with EBL >1500 mL OR >2 units PRBCs given OR Patient at risk for occult bleeding (post-cesarean, coagulopathy) OR Any patient with abnormal vital signs/labs/oliguria**
- **Outline management plan**
- Serial re-evaluation and Communicate with hemorrhage team
- **Replacement** RBC-FFP-Platelets in a 6:4:1 ratio (trigger Massive Transfer Protocol - MTP) If coagulopathic, add cryopreciptate. Consider consultation for alternative agents
- **If unclear, identify etiology for bleeding**
  Rule out lacerations : physical exam
  Coagulopathy (labs) : Consider Internal Medicine / Hematology consult
  Occult bleeding (imaging)
- **Hemostasis** Initiate immediately, interventions based on etiology. If poor response, adopt additional measures**.**
  Notify Interventional Radiology

Checklist: STAGE 4

- **Cardiovascular (CV) Collapse (Rapid Response)**
  - For patients with cardiovascular collapse in setting of massive hemorrhage: Profound hypovolemic shock (blood loss not replaced)
  - AFE (sudden CV collapse followed by heavy uterine bleeding from uterine relaxation and associated coagulopathy)

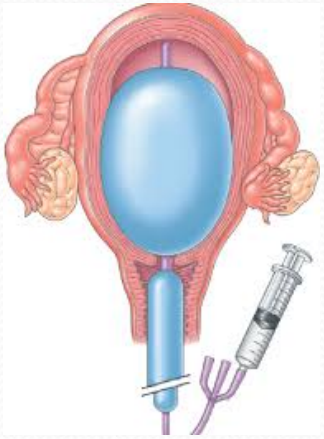
- In these situations, immediate surgical intervention to ensure hemostasis **(hysterectomy)** is suggested.
- This should take place with simultaneous aggressive blood and factor replacement and medical interventions regardless of patient's coagulation status.
- Expeditious hemostasis is the only step that will maximize survival rates for these critical patients.

Universal Active Management
3rd Stage of Labor

- Oxytocin : 10-20 units/1000 milliliters vs. 10 units intramuscularly
- Titrate to uterine tone

Intrauterine Balloon Technique

- **Intrauterine Balloon Technique**
- Transabdominal placement (via incision) — late after incision is closed
- Connect to fluid collection bag to monitor hemostasis
- Continuous monitoring of vital signs and signs of increased bleeding
- May need to flush clots with sterile isotonic saline
- Maximum time balloon can remain in place is 24 hours
  - To deflate: Remove tension from shaft
  - Remove packing
  - Aspirate fluid
  - Remove catheters gently



Uterine Atony

- **Intrauterine Balloon Technique**
  - Insert under ultrasound guidance
  - Inflate to 500 cc with sterile water or NaCl
  - Use vaginal packing (iodoform or antibiotic soaked gauze) to maintain correct placement and maximize tamponade
  - Gentle traction — secure to patient's leg or attach weight <than 500 g

Active management
Code Noelle/Massive Transfusion Protocol

- **Recommended Instruments**
- **Medication Kit** (*for rapid access to medications)*
- Oxytocin (Pitocin)
  - 20 units/liter 1 bag
- Oxytocin (Pitocin)
  - 10 units 2 vials
- 15-methyl PGF2α (Hemabate)
- 250 micrograms/milliliters 1 ampule *
- Misoprostol (Cytotec)
- 200 microgram tablets 5 tabs
- Methylergonovine (Methergine)
- 0.2 milligrams/milliliters 1 ampule *
- * ***Needs refrigeration***

Surgical Management

- Uterine curettage
- Placental bed suture
- Uterine artery ligation
- Utero-ovarian ligation
- Repair uterine rupture
- B-Lynch suture, multiple square sutures
- Hysterectomy
- *B-Lynch suture Hayman uterine compression suture Surgical ligation locations of uterine blood supply*

Tranexamic acid

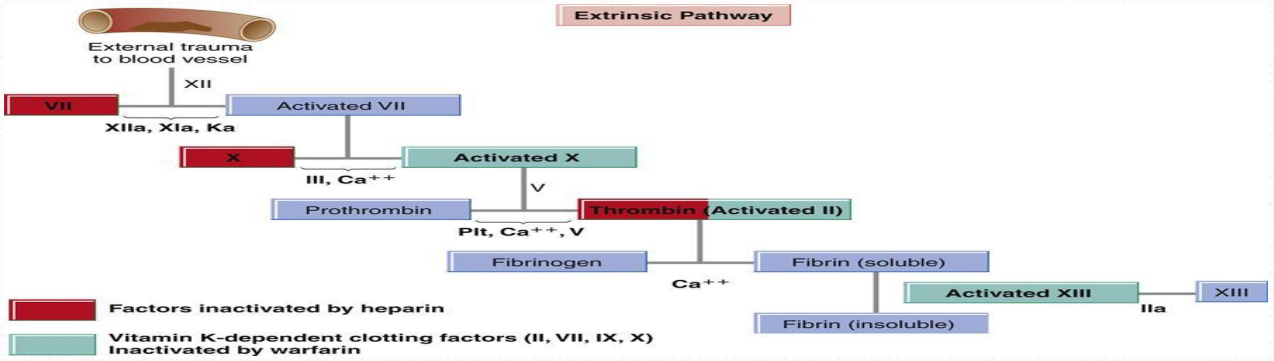
- Placental Separation should be fatal – we survive because
  1. Strong myometrial contractions
  2.Increased platelet activity
  3.Massive release of coagulant factors
  4.Fibrinolytic activity increases
- Oxytocin administration enhances the first mechanism, TXA administration might be able to counter the latter and thus facilitate the hemostatic process.

Tranexamic acid : Category B

- **Brand Names:** US Cyklokapron; Lysteda , Canada Cyklokapron
- Antifibrinolytic , Antihemophilic , Hemostatic Agent; Lysine Analog
- **Biological half-life**: 3.1 h
- **Routes of administration**: oral, injection
- **Post-operative bleeding associated with cervical conization (prevention/reduction) (off-label use):**
- IV/Oral: Intra- and postoperative regimen: 1 g IV infusion during procedure followed by oral therapy 1 g 3 times daily for 14 days, beginning the day after procedure (Grunsdell 1984).
- Oral: Postoperative regimen: 1500 mg every 8 hours beginning the evening following the procedure and continuing for 12 days (Rybo 1972).

Tranexamic acid : Mechanism of action

- Tranexamic acid (TXA) is a potent **antifibrinolytic agent** that exerts its effect by blocking lysine binding sites on plasminogen molecules and has the potential to enhance the effectiveness of the patient's own hemostatic mechanisms. Consequently, **clot breakdown (fibrinolysis) is inhibited and bleeding is reduced**
- Forms a **reversible** complex that displaces plasminogen from fibrin resulting in inhibition of fibrinolysis and proteolytic activity of plasmin
- With reduction in plasmin activity, tranexamic acid also reduces activation of complement and consumption of C1 esterase inhibitor (C1-INH), thereby decreasing inflammation associated with hereditary angioedema.



Tranexamic acid

- **Postpartum hemorrhage (off-label use):** IV: 1,000 mg over 10 minutes given within 3 hours of vaginal or operative delivery. if bleeding continues after 30 minutes or stops and restarts within 24 hours after the first dose, a second dose of 1,000 mg may be given (WOMAN Trial Collaborators 2017).
- ***Off-label uses:***
- **Elective cesarean section, blood loss reduction (off-label use):** IV: 1,000 mg over 5 minutes at least 10 minutes prior to skin incision (Gungorduk 2011)

Tranexamic acid

- **Pregnancy Implications** : Adverse events have not been observed in animal reproduction studies. **Tranexamic acid crosses the placenta and concentrations within cord blood are similar to maternal concentrations.**
- Evaluated for the treatment of postpartum hemorrhage
  (Ducloy-Bouthors 2011; Gungorduk 2011; WOMAN Trial Collaborators 2017).
  Significant reduction in risk of death due to bleeding when treatment was started within 3 hours of vaginal or cesarean birth (WOMAN Trial Collaborators 2017).
- Oral tranexamic acid (Lysteda) is not indicated for use in pregnant women.
- **Breast-Feeding Considerations : present in breast milk. Concentrations are approximately 1/100th of the maximum maternal serum concentration. Breastfeeding is not recommended by the manufacturer**.
- **Monitoring Parameters** : Ophthalmic examination (visual acuity, color vision, eye-ground, and visual fields) at baseline and regular intervals if used in extended treatment (several days)
- signs/symptoms of hypersensitivity reactions, seizures, thrombotic events, and ureteral obstruction

Concerns related to adverse effects

- **CNS depression**: may impair physical or mental abilities; cautioned about performing tasks which require mental alertness
- **Hypersensitivity reactions**: Severe hypersensitivity reactions, including anaphylaxis / anaphylactoid reaction have been reported.
- **Ocular effects**: Visual defects (eg, color vision change, visual loss) and retinal venous and arterial occlusions. Discontinue treatment if ocular changes occur; prompt ophthalmic examination should be performed by an ophthalmologist. Use of the injection is contraindicated in patients with acquired defective color vision. Ligneous conjunctivitis has been reported with the oral formulation, but resolved upon discontinuation of therapy.
- **Seizure:** Seizures have been reported with use; most often with intraoperative use (eg, open chamber cardiac surgery) and in older patients (Murkin 2010). The mechanism by which tranexamic acid use results in seizures may be secondary to neuronal gamma aminobutyric acid (GABA) inhibition.
- **Thrombotic events: Venous and arterial thrombosis or thromboembolism**, including central retinal artery/vein obstruction, has been reported. Use the injection with caution in patients with thromboembolic disease; **oral formulation is contraindicated in patients with a history of or active thromboembolic disease or with an intrinsic risk of thromboembolic events (eg, thrombogenic valvular disease, thrombogenic cardiac rhythm disease, hypercoagulopathy).** Concomitant use with certain procoagulant agents (eg, anti-inhibitor coagulant complex/factor IX complex concentrates, oral tretinoin, hormonal contraceptives) may further increase the risk of thrombosis; concurrent use with either the oral or injectable formulation may be contraindicated, not recommended, or to be used with caution.
- **Ureteral obstruction:** Use the injection with caution in patients with upper urinary tract bleeding, ureteral obstruction due to clot formation has been reported.

Tranexamic acid
Disease related complications of thrombosis.

- **Disseminated intravascular coagulation (DIC)**: Use with extreme caution in patients with DIC requiring antifibrinolytic therapy
- **Renal impairment**: Use with caution in patients with renal impairment; dosage modification necessary.
- **Subarachnoid hemorrhage**: Use oral formulation with caution in patients with subarachnoid hemorrhage; cerebral edema and infarction may occur. Use of the injection is contraindicated.
- **Vascular disease**: Use with caution in patients with uncorrected cardiovascular or cerebrovascular disease due to the complications of thrombosis.
- ***Concurrent drug therapy issues:***
- Drug-drug interactions: Potentially significant interactions may exist, requiring dose or frequency adjustment, additional monitoring, and/or selection of alternative therapy. Consult drug interactions database for more detailed information.

Tranexamic acid

- **Metabolism/Transport Effects** : None known.
- **Drug Interactions**
- Anti-inhibitor Coagulant Complex (Human): Antifibrinolytic Agents may enhance the thrombogenic effect of Anti-inhibitor Coagulant Complex (Human). *Risk X: Avoid combination*
- Estrogen Derivatives (**Contraceptive**): May enhance the thrombogenic effect of Tranexamic Acid. *Risk X: Avoid combination*
- Progestins (Contraceptive): May enhance the thrombogenic effect of Tranexamic Acid. *Risk X: Avoid combination*
- Tretinoin (Systemic): May enhance the thrombogenic effect of Antifibrinolytic Agents. *Risk C: Monitor therapy*

Tranexamic acid

Inhibition of fibrinolysis - potential risk of thrombosis, especially with previous history of thrombosis

Pregnancy is a hypercoagulable condition

Systematic review of randomized controlled trials of elective surgical patients cited above (129 randomized controlled trials including 10 488 randomized participants, 5484 of them allocated to TXA) showed no significant increases in the incidence of myocardial infarction, stroke, deep vein thrombosis, or pulmonary embolism

CRASH-2 trial of TXA in bleeding trauma patients showed a statistically significant reduction in global mortality with no increase in thromboembolic events

Code Noelle
Massive Transfusion Protocol

- **Hemorrhage Response Team**
  - *Drills and education for teams are critical.*
    - Surgical/Critical Care support Gyn Oncology, Maternal-Fetal Medicine, General Ob-Gyn, Critical Care, General Surgery, Urology, Vascular, Trauma
  - Anesthesia support (2nd / 3rd person)
  - Nursing support (additional staff)
  - Administrative (blood bank and laboratory staff, logistical support)

Checklists

- Texas Children's Hospital flowchart
- American College of Obstetricians and Gynecologists four-stage system for classifying PPH, checklist, list of appropriate interventions at each stage
- California Maternal Quality care Collaborative.

Hemorrhage Flow Sheet

- *Diagnosis of hemorrhage first made*
- *Date: Time:*
- **EVALUATION:**
- Cumulative blood loss
- Symptoms (cold, clammy, dizzy, lightheaded, mental status)
- Blood pressure
- Pulse
- Oxygen saturation
- Imaging: Sonogram/CT Scan
- Urine output
- **REPLACEMENTS:**
- Fluids (crystalloid)
- RBC
- FFP
- Platelets
- Fibrinogen
- Cryoprecipitate

Hemorrhage Flow Sheet

- **MEDS GIVEN:**
- Oxytocin (Pitocin)
- Methylergonovine (Methergine)
- 15-methyl PGF2α (Hemabate, Carboprost)
- Misoprostol (Cytotec)
- Pressor agents

- **LABS:**
- Hct/Hb
- PT/PTT/INR
- Platelets
- Fibrinogen
- pH
- Lactate
- Base deficit

Hemorrhage Flow Sheet

- **INTERVENTION:**
- D&C
- Intrauterine balloon
- B-Lynch
- Uterine artery ligation
- Hysterectomy
- **CONSULTS/ESCALATION:**
- Specialty

Obstetric Hemorrhage Flow Sheet

- **Date:**
- Time

Group	Description	time	time	time	time	time	time	time
	Hour:Minute (oo:oo)	:	:	:	:	:	:	:
	Evaluation	:	:	:				
	Cumulative blood loss							
	Symptoms (cold, clammy, dizzy, lightheaded, mental status)							
	Blood pressure							
	Pulse							
	Oxygen saturation							
	Imaging: Sonogram/CT Scan							
	Urine output							
	Replacement							
	Fluids (crystalloid)							
	PRBC							
	FFP							
	Platelets							
	Fibrinogen							
	Cryoprecipitate							

Checklist: Post-Hemorrhage Management

- Clinical considerations (including disposition of patient)
  - Debrief
  - Document after team debrief
- Discuss with patient
- Discuss with family members

Quality Control

- **Reporting / Systems Learning**
- Establish a culture of huddles for high-risk patients and post-event debriefs
- Conduct a multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and processes metrics

Posted contact numbers

- **Important Phone Numbers**
  - Rapid Response Team
  - Blood Bank
  - Anesthesia
  - Interventional Radiology
  - Senior Surgeon
  - ICU:
  - Director of obstetric Service

Conclusion

- Early opportunities exist to assess risk, anticipate, and plan in advance of an obstetric hemorrhage.
- Multidisciplinary coordination and preparation, (blood bank) is crucial in order to provide safe obstetrical care.
- A standardized approach to obstetric hemorrhage includes
  - clearly defined plan
  - staged checklist of appropriate actions in an emergency situation

Pop Quiz

- Can you name two medium or high risk factors for hemorrhage ?
- What is the dose for tranexamic acid ?
- What are the words you have to say aloud to activate your hemorrhage protocol?

- Thank you all!

- Questions?