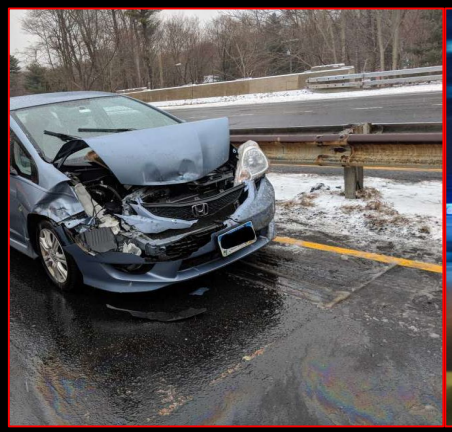
# Trauma in Pregnancy

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# Disclosure Statement of Financial Interest

- I do not have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

# Overview

- Describe epidemiology and types of trauma in pregnancy
- Describe pregnancy-driven changes in trauma patients
- Discuss abruption as key to most outcomes
- Optimize your roles as:
  - consultant to major trauma
  - director of minor trauma in pregnancy
- Make you an educator of:
  - ED/others about care of pregnant women with trauma
  - patients re correct seat belt use

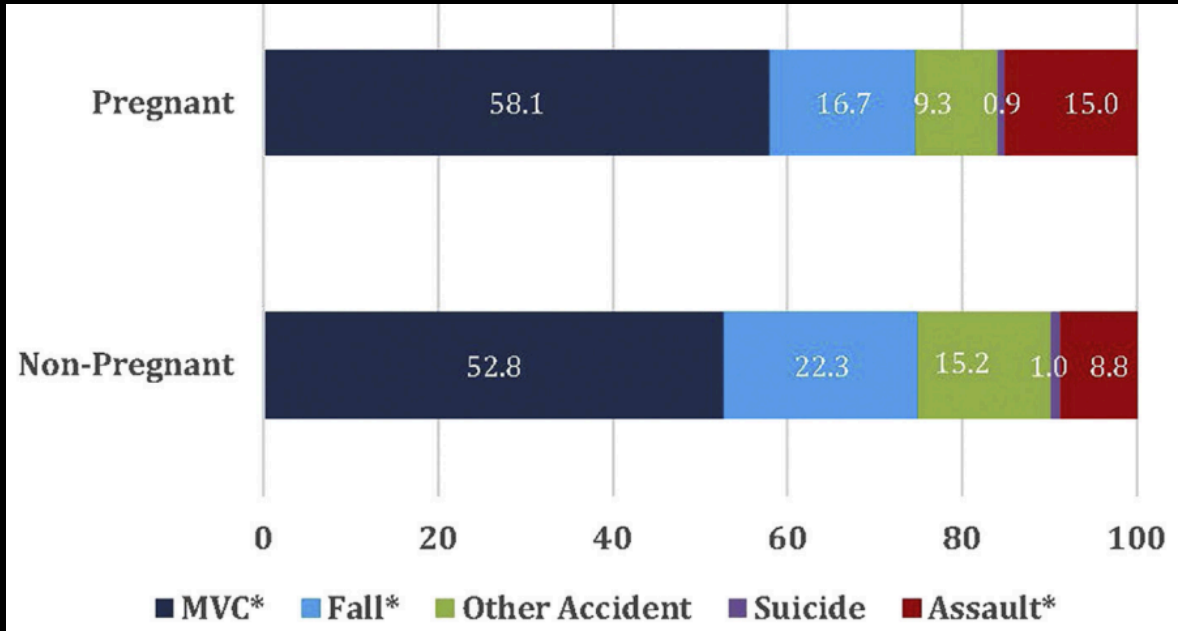
# What's the big deal?

- #1 killer (non-obstetric) of reproductive-age women, U.S
- #1 killer (non-obstetric) of pregnant women and fetuses
- 1 in 12 pregnancies
- Women are twice as likely to die from trauma if pregnant
- Approximately 20% of pregnant women with trauma deliver during trauma admission

# Causes of trauma

In pregnancy:

- Less falls
- More MVC
- More violent assaults




Causes of trauma among pregnant (upper) and nonpregnant (lower) women and girls of reproductive age presenting to any Pennsylvania trauma center from 2005 through 2015. *Statistically significantly different pregnant and nonpregnant women when 2-sided $\chi^2$ test was performed, at level of $P < .001$.

*MVC*, motor vehicle collision.

*Deshpande et al. Pregnant* trauma *victims experience higher mortality. Am J Obstet Gynecol 2017.*

# Pregnancy-driven challenges

- Difficult airway
- Physiologic changes: vitals more difficult to interpret
- Younger population; hemorrhagic shock may show late
- Distorted anatomy altering surgical possibilities
- Two patients
- Also:
  - Limited experience in EDs
  - Limited professional guidelines

# 28 yo G1 driving on I-15 to SLC

# How can we help in major trauma?

- "What would you do if she weren't pregnant?  Do that."
- Estimate gestational age. Umbilicus:  ~20 weeks
- Uterine displacement (18-20 weeks)
-

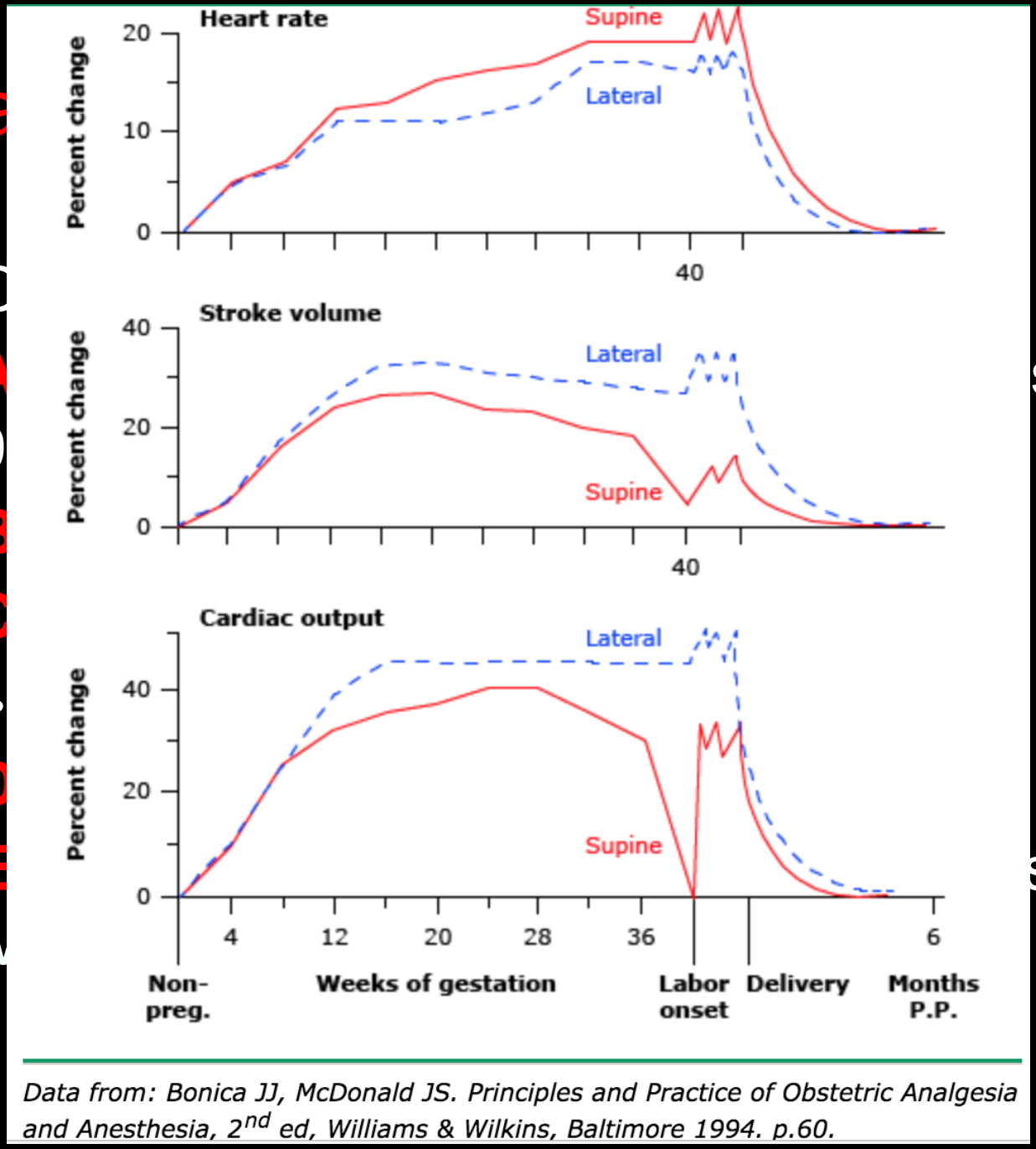
-

# Major trauma

- Same approach as if were not pregnant
- Primary survey:
  - identify and treat life-threatening injuries
  - few minutes
  - stabilize mother first
- Secondary survey
  - fetal assessment
  - vaginal exam

# Prima

- ABC
  - **A** s >
    9
  - **B**
  - **C**
    -
  - **D** (ISS)
  - **E** s for
    w




*Data from: Bonica JJ, McDonald JS. Principles and Practice of Obstetric Analgesia and Anesthesia, 2nd ed, Williams & Wilkins, Baltimore 1994. p.60.*

# Secondary survey

- After initial stabilization, assess pregnancy
  - Vaginal exam (if no previa): dilation, bleeding, ROM?
  - Assess fetus: non-stress test, toco, ultrasound
  - Other radiologic exams

- Pearl
  - Reactive NST suggests good maternal perfusion

# Injury Severity Score; ISS

| Region | Injury Description | AIS | Square Top Three |
|---|---|---|---|
| Head & Neck | Cerebral Contusion | 3 | 9 |
| Face | No Injury | 0 | |
| Chest | Flail Chest | 4 | 16 |
| Abdomen | Minor Contusion of Liver<br>Complex Rupture Spleen | 2<br>5 | 25 |
| Extremity | Fractured femur | 3 | |
| External | No Injury | 0 | |
| | | Injury Severity Score: | 50 |

| AIS Score | Injury |
|---|---|
| 1 | Minor |
| 2 | Moderate |
| 3 | Serious |
| 4 | Severe |
| 5 | Critical |
| 6 | Survivable |

| ISS | |
|---|---|
| 1-8 | Minor |
| 9-15 | Moderate |
| 16-24 | Serious |
| 25-49 | Severe |
| 50-74 | Critical |
| 75 | Maximum |

ISS = sum of 3 highest$^2$AIS
$= a^2 + b^2 + c^2$

- Standardizes trauma severity, predicts outcome: morbidity, mortality, hospitalization
- Not reliable in pregnancy
- Calculated from injury scores (1-6; minor to unsurvivable) of 6 body regions: worst 3 scores squared and added
- ISS > 15 defines major trauma

# Injury Severity Score (ISS) in pregnancy

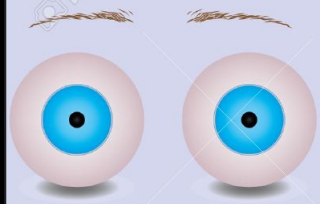
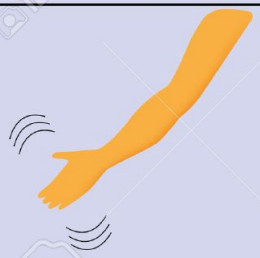
- Poor predictor of adverse maternal or fetal outcome (abruption, preterm labor, preterm birth, fetal death)

  Schiff MA et al., 2005

- High ISS: bad
- Low ISS score does not rule out maternal/fetal morbidity or prolonged hospitalization

# Glasgow Coma Scale (GCS)

- Communicates level of consciousness in acute brain injury
- Initial decision making, trends in responsiveness
- Eye movements, verbal response, motor activity
- Score: 3 (worst) to 15 (best)

| Behaviour | Response |
|---|---|
|  Eye Opening Response | 4. Spontaneously<br>3. To speech<br>2. To pain<br>1. No response |
|  Verbal Response | 5. Oriented to time, person and place<br>4. Confused<br>3. Inappropriate words<br>2. Incomprehensible sounds<br>1. No response |
|  Motor Response | 6. Obeys command<br>5. Moves to localised pain<br>4. Flex to withdraw from pain<br>3. Abnormal flexion<br>2. Abnormal extension<br>1. No response |

# Possible consequences of impact injury

- Placental abruption: cause of >50% of fetal losses, maternal morbidity
- Uterine rupture, direct fetal injury
- PTL, PPROM, non-reassuring fetal status, SAB, IUFD
- Bladder: displaced upward and vulnerable

# Intubation/anesthetic concerns

- Intubation
  - more difficult and more likely to fail
  - often need smaller ET tube
  - aspiration risk increases
- May require more medications for induction of anesthesia

# 28 yo G1, unknown gestational age, s/p MVC

- Alert, speaking, cooperative; C-spine collar
- BP 110/70, P105, RR 20, T98, O2 sat 98% RA
- Uterine lateral tilt
- Left wrist and ankle swelling, erythema
- Fundus 2 cm above umbilicus
- IV started
- Cervix closed (u/s: no previa)

- Labs?

# 28 yo G1, unknown gestational age, s/p MVC

- CBC, coagulation panel/fibrinogen, type and screen, toxicology screen

- Rh positive.  Kleihauer-Betke?
  - Typically quantifies Rh-immune globulin needed
  - Positive >0.01 ml fetal blood in maternal circulation
  - Trauma, regardless of Rh-status: positive KB confers 20.8-fold increase in PTL
    - Meunch et al., J Trauma, 11/2004

- Ultrasound? X-rays?
  - Placental location, gestational age, abruption
  - Fractures

# Radiation in pregnancy?

- **No single radiologic study threatens fetal well-being**
  - None > 5 rads (x-ray, CT scan, MRI)
    - Hall EJ. Scientific view of low-level radiation risks. Radiographics 1991;11:509–18
- Fetal exposure:
  - Typical abdominal or pelvic CT: 2-5 rads
  - Mammography: 1 rad
  - Chest CT or CT pulmonary angiography: 0.15 rad
  - CXR PA/lateral: 0.01 rad

# How are we doing in pregnancy?

Among women with severe trauma in pregnancy at a major obstetric trauma center, Melbourne Australia:

- only 19% received recommended radiologic evaluation
  - Plain x-rays are often used to avoid CT
    - Shakerian et al., J Trauma Acute Care Surg, 2015

No single radiologic study exceeds the maximal recommended fetal exposure to radiation

# 21 yo G1 ~22 weeks s/p MVC

- C-spine, wrist, ankle xrays: no fractures
- Ultrasound ~22 weeks, fundal placenta, no signs of abruption or subchorionic hematoma, normal AFV, no anomalies
- Normal fibrinogen, KB negative
- Fetal Doppler: FHR 150s

# 21 yo G1 ~22 weeks s/p MVC

- Discharged hospital day 5
- Growth ultrasounds? EFM?
- Increased LBW, preterm birth after trauma
- PPROM, delivery, 35 weeks

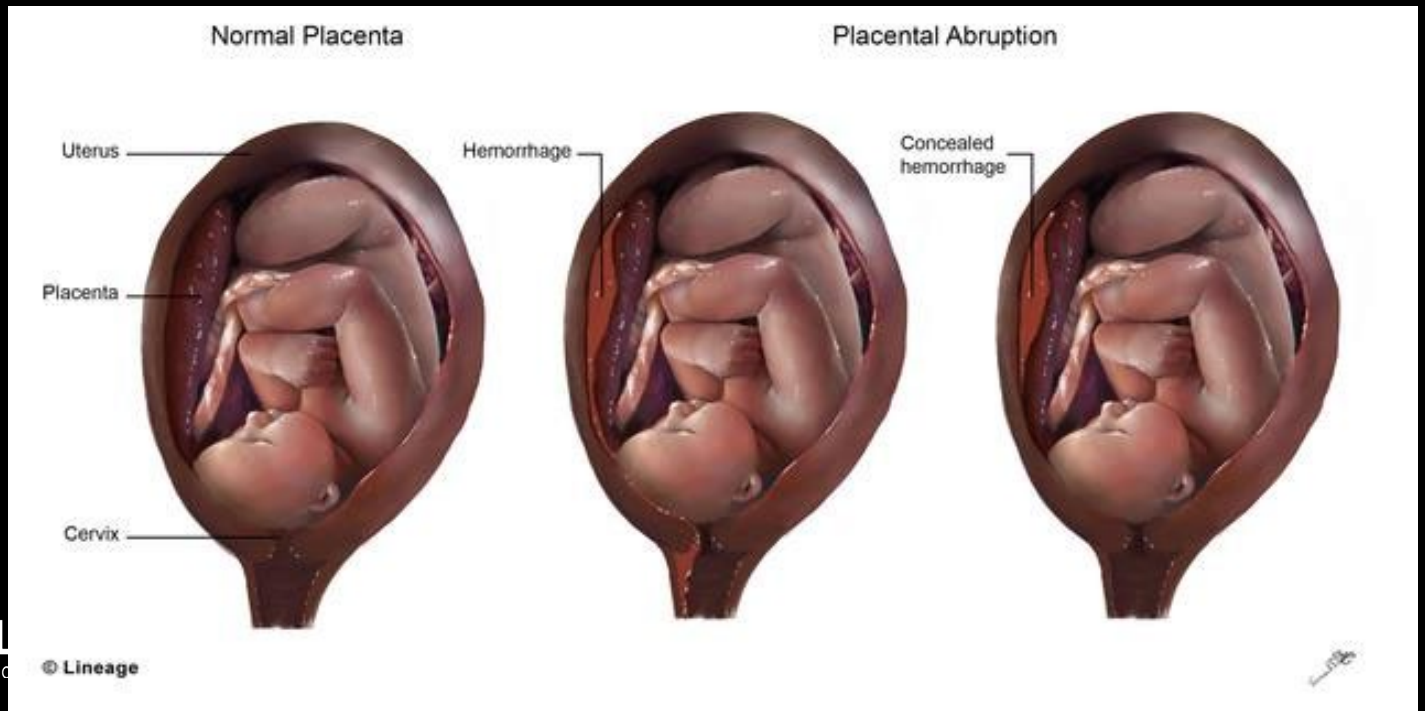
# Incidence of placental abruption

- Major trauma: up to 50% (especially >16 weeks)
- Assaults (5%)
- Falls (3%)

- Minor trauma:  2-4%

# Why abruption happens?

- Amniotic fluid is not compressible
- Elastic myometrium vs. inelastic placenta
  - Shearing or blunt injury
- Immediate or delayed



# Placental abruption diagnosis

- Clinical: bleeding, contractions, pain, rigid uterus, non-reassuring FHR, or asymptomatic
- Abnormal labs: fibrinogen, platelets
- Ultrasound?
  - 75% abruptions not seen
  - subchorionic hematoma is suggestive

# 22 yo G2P1 28 Wks playing in the park

- BP 100/60, P82, RR 16, T 98.2, O2 sat 99% RA
- Appears comfortable, no abdominal erythema, abrasions or visible trauma
- Reactive NST; contractions q7-8 minutes
- CBC, coags, fibrinogen normal; Rh positive
- KB positive
- What is her risk of abruption?

# Minor Trauma

- 2% abruption overall
- Contractions <q10 minutes: up to 20% risk of abruption
- EFM is more sensitive for detecting abruption than ultrasound, KB, or physical exam

- How long should you monitor her?

# Fetal monitoring: how long?

- Generally 2-6 hours if minor injury, normal FHR tracing
  - No validated time minimum
  - Most abruptions diagnosed 2-6 hours after injury
- EFM has good negative predictive value
  - Abruption is unlikely if no contractions, normal FHR pattern

# When to extend EFM?

- Consider continuous EFM 24-48 hours if:
  - contractions q10 minutes
  - uterine tenderness, cervical dilation, vaginal bleeding, abdominal bruising, category II FHR pattern
  - multiple or severe maternal injuries
  - hemodynamically unstable mother
  - abnormal laboratory studies (KB, fibrinogen)
  - abnormal imaging studies

- **Contractions q7-8 minutes,** KB positive
- 4 hours later: cervical change from closed to 1 cm dilation
- Ongoing contractions without cervical change; admitted
- 4 days post-trauma:
  - Contractions q2 minutes
  - Recurrent late decelerations
  - Cesarean for non-reassuring fetal status
  - Apgars 7/9; cord pH 7.10
  - Placenta: small abruption

# Minor Trauma

- 90% of trauma in pregnancy
- 2% risk of abruption

# Penetrating uterine trauma

- Most gunshot wounds (73%); stabbings (23%), shotgun wounds (4%)
- Uterus protects bowel and great vessels
  - Maternal mortality is decreased vs. non-pregnant abdominal trauma
- Fetal injury and mortality is high (73%)
  - Death: 71% of gunshot wounds, 43% of stabbings

# Burns in pregnancy

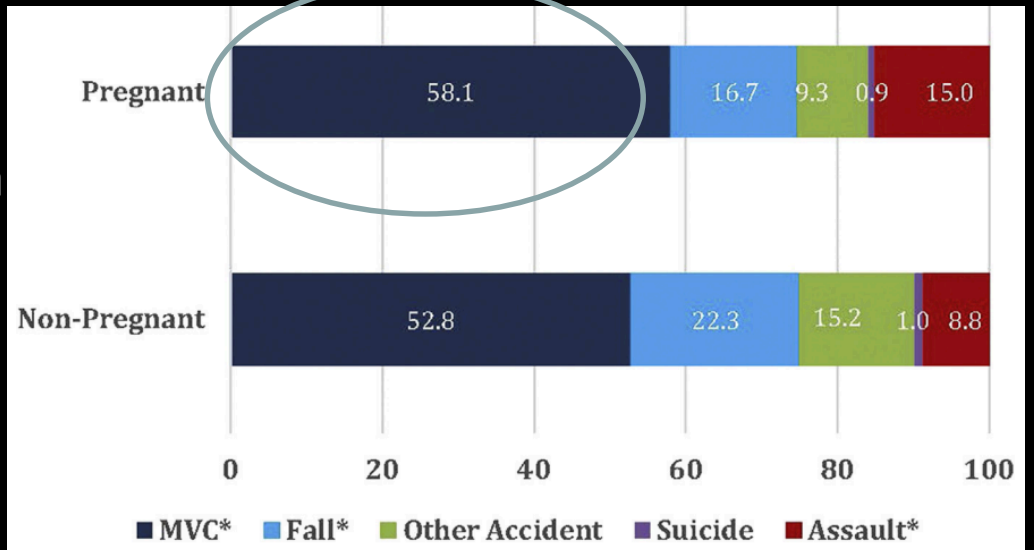
- High risk for sepsis, venous thrombosis
- Burns >40% body surface area (BSA) increase the risk for maternal and neonatal mortality
- If third trimester and >50% BSA burned, deliver

# Immunizations

- Anti-D immune globulin
  - Rh negative:
  - Kleihauer-Betke to quantify dose
- Tetanus vaccine. Administer if:
  - Dirty wound:
    - If <3 doses or unknown (add tetanus immune globulin)
    - If ≥3 doses but >5 years since last dose
  - Clean wound:
    - ≥3 doses but >10 years since last dose
    - <3 doses or unknown vaccination

# Motor vehicle injuries

- The leading cause of
  - non-obstetric maternal death
  - traumatic fetal death
- 1-3% of live born infants are exposed
- Seat belt use reduces adverse maternal and fetal outcomes

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**https://www.cdc.gov/prams/pdf/snapshot-report/motorvehicleinjuries.pdf**

# Prevention: correct seat belt use

- 50% fetal losses preventable by correct seat belt use
- ACOG: counsel during prenatal care about proper seat belt use
  - CDC: only 53% are counseled
- Shoulder belt mid-clavical, between breasts
- Lap belt below abdominal dome
- Do not turn off airbags
- Abdomen 10” from airbag

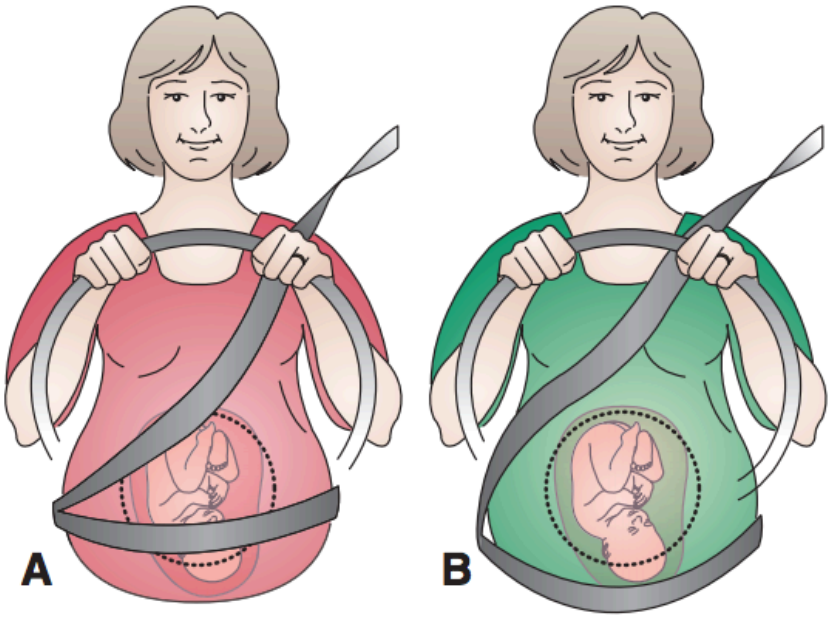


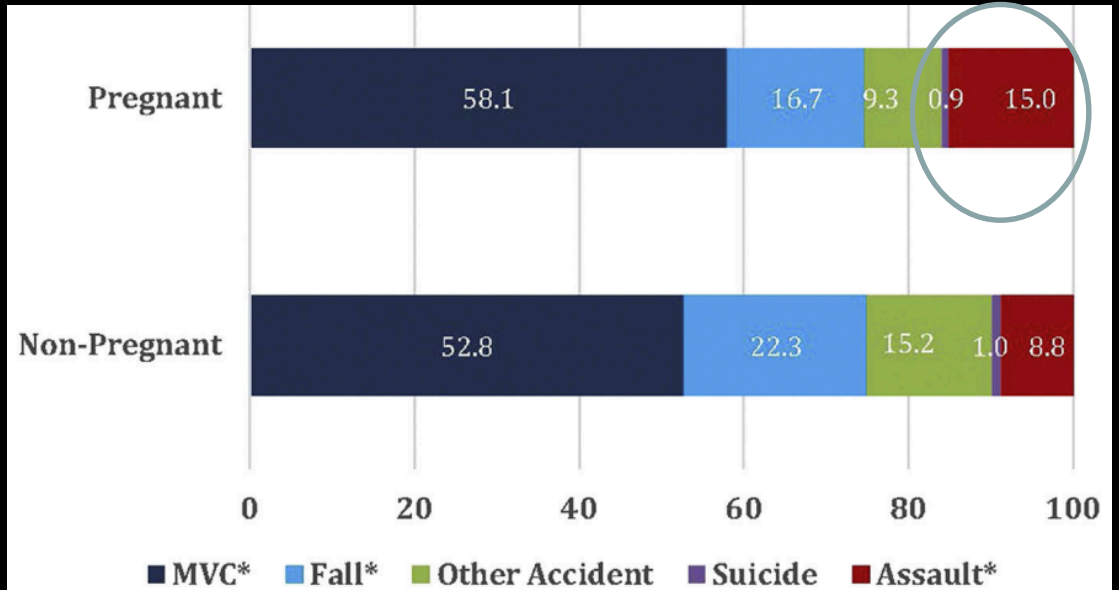

**Fig. 4.** **A.** Improper use of lap seatbelt in pregnancy showing placement across the abdominal dome. **B.** Proper use of lap seatbelt appropriately placed below the abdominal dome. Illustration: John Yanson.

*Brown. Trauma in Pregnancy. Obstet Gynecol 2009.*

Klinich KD, AJOG 2008
https://www.cdc.gov/prams/pdf/snapshot-report/motorvehicleinjuries.pdf

# Domestic Violence

- Evaluate for domestic violence

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# Perimortem Cesarean

- If the uterus is at or above the umbilicus
- Cardiopulmonary resuscitation
  - Left uterine displacement
- If delivery is thought to benefit mother
- “Five minute rule”:
  - Initiate delivery within 4 minutes
  - Deliver by 5 minutes
- Faster, better outcomes with simulation, not transporting patient

**Figure 2.** . Left uterine displacement with 2-handed technique.

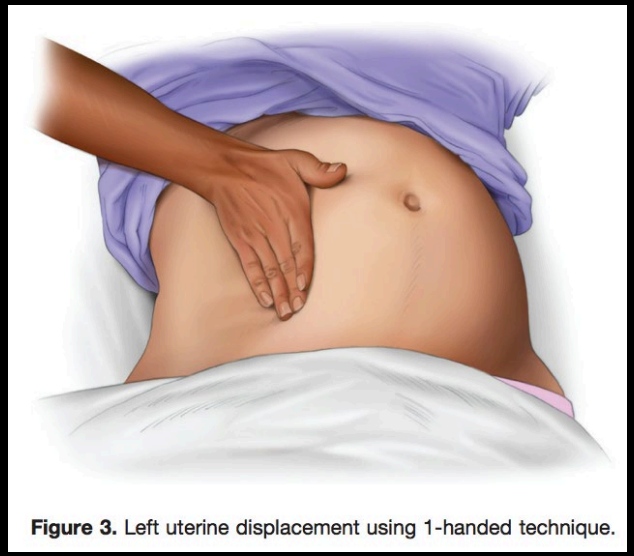

**Figure 3.** Left uterine displacement using 1-handed technique.

# Thank you