Obstetric Hemorrhage: 
How Patient Safety Bundles Can Help Improve Outcomes

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• We have no conflicts of interest to disclose relevant to this presentation
Objectives

- Review the epidemiology of obstetric hemorrhage and its impact on maternal morbidity and mortality
- Discuss evidence-based strategies to mitigate the risk associated with obstetric hemorrhage
- Review strategies for readiness and response to unanticipated hemorrhage
Obstetric hemorrhage - Incidence

• Traditional definition: > 500 mL after vaginal birth, >1000 mL after cesarean
• ReVITALize definition: >1000 mL cumulative blood loss within 1st 24 hours after delivery
• Emphasis placed on
  • quantity of blood loss necessary to cause physiologic instability
  • extended period of risk for clinically important bleeding
• Incidence: approximately 4-5% of births
Obstetric hemorrhage - etiologies

- Uterine atony (80% of total)
- Genital tract laceration
- Abnormal placentation
  - Previa
  - Morbidly adherent placenta
- Abruption
- Retained placenta
- Uterine inversion
- Maternal coagulopathy
  - Hereditary
  - Acquired
Obstetric hemorrhage - impact

- Leading direct cause of maternal death worldwide
- Leading cause of severe maternal morbidity in US
- Accounts for 10% of maternal deaths in US
  - Survival from hemorrhage associated with increased rates of:
    - Blood product transfusion
    - Peripartum hysterectomy
    - Critical illness: ARDS, shock, DIC, acute renal failure
Why America’s Black Mothers and Babies Are in a Life-or-Death Crisis

The answer to the disparity in death rates has everything to do with the lived experience of being a black woman in America.

By LINDA VILLAROSA  APRIL 11, 2013
US Pregnancy-Related Death

Pregnancy-Related Mortality in the United States, 2006–2010

Creanga, Andreea A.; Berg, Cynthia J.; Syverson, Carla; Seed, Kristi; Bruce, F. Carol; Callaghan, William M.
Obstetrics & Gynecology 125(1):5-12, January 2015.
doi: 10.1097/AOG.0000000000000564

US: 26/100,000
Other developed countries: 12/100,000
Table 2

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Pregnancy Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live Birth</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>176 (8.8)</td>
</tr>
<tr>
<td>Ruptured ectopic</td>
<td>0</td>
</tr>
<tr>
<td>Uterine rupture or laceration</td>
<td>11</td>
</tr>
<tr>
<td>Abruptio placenta</td>
<td>15</td>
</tr>
<tr>
<td>Placenta previa</td>
<td>5</td>
</tr>
<tr>
<td>Placenta accreta, increta, or percreta</td>
<td>34</td>
</tr>
<tr>
<td>Retained products of conception</td>
<td>4</td>
</tr>
<tr>
<td>Coagulopathy</td>
<td>4</td>
</tr>
<tr>
<td>Atony or other uterine bleeding</td>
<td>49</td>
</tr>
<tr>
<td>Other or unspecified</td>
<td>54</td>
</tr>
<tr>
<td>Embolism</td>
<td>329 (16.4)</td>
</tr>
<tr>
<td>Thrombotic pulmonary embolism</td>
<td>179</td>
</tr>
<tr>
<td>Amniotic pulmonary embolism</td>
<td>145</td>
</tr>
<tr>
<td>Other embolism</td>
<td>5</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>227 (11.3)</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>113</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>98</td>
</tr>
<tr>
<td>Other or unspecified hypertension</td>
<td>16</td>
</tr>
<tr>
<td>Infection</td>
<td>251 (12.5)</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>5</td>
</tr>
<tr>
<td>Genital tract</td>
<td>34</td>
</tr>
<tr>
<td>Sepsis</td>
<td>63</td>
</tr>
<tr>
<td>Other or unspecified infection</td>
<td>149</td>
</tr>
<tr>
<td>Anesthesia complications</td>
<td>13</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>292 (14.6)</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>122 (6.1)</td>
</tr>
<tr>
<td>Cardiovascular conditions</td>
<td>288 (14.4)</td>
</tr>
<tr>
<td>Noncardiovascular conditions</td>
<td>208 (10.4)</td>
</tr>
<tr>
<td>Unknown</td>
<td>97 (4.8)</td>
</tr>
<tr>
<td>Total</td>
<td>2,003 (100.0)</td>
</tr>
</tbody>
</table>

Data are n or n (%).

Creanga, Andreea A.; Berg, Cynthia J.; Syverson, Carla; Seed, Kristi; Bruce, F. Carol; Callaghan, William M.

Obstetrics & Gynecology125(1):5-12, January 2015.

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Fig. 3

Pregnancy-Related Mortality in the United States, 2006–2010

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Mitigating the Risk

- AIM Obstetric Hemorrhage Patient Safety Bundle
- Readiness
- Recognition and Prevention
- Response
- Reporting/Systems Learning
Readiness

- Hemorrhage cart – supplies, checklist, instructions for tamponade balloons and compression stitches
- Hemorrhage medications – kit or equivalent
- Response team [surgical backup, interventional radiology, transfusion medicine]
- Emergency release and massive transfusion protocols
- Unit education, drills, de-briefs
Hemorrhage Cart
# Ordering Blood Products

## 3 Pathways

<table>
<thead>
<tr>
<th>Type</th>
<th>Turnaround Time</th>
<th>Order</th>
<th>Clinical Guidelines</th>
<th>Product</th>
<th>Delivery System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Routine</strong></td>
<td>&lt; 30 minutes if no antibodies</td>
<td>EPIC</td>
<td>✓ HEMODYNAMICALLY STABLE PATIENT</td>
<td>AS ORDERED</td>
<td>TUBE SYSTEM</td>
</tr>
</tbody>
</table>
| **FastBlood** | < 15 minutes | CALL 4-2012 To ACTIVATE FastBlood 4+2 “One and done” → No need to deactivate | ✓ URGENT NEED  
✓ ESTIMATED / PREDICTED ACUTE BLOOD LOSS > 750 mL  
✓ HEART RATE > 100 bpm  
✓ SYSTOLIC BP < 100 mm Hg  
✓ ABC TRAUMA SCORE 0 OR 1 | 4 RBC 2 FFP  NOT RECURRENT ONE AND DONE | ALL IN ONE COOLER  Delivered by Transportation |
| **MTP**       | < 15 minutes to first cooler | CALL 4-2012 To ACTIVATE MTP  
CALL 4-2012 To DEACTIVATE MTP | ✓ EMERGENT NEED  
✓ ESTIMATED / PREDICTED ACUTE BLOOD LOSS > 1500 mL  
✓ HEART RATE > 120 bpm  
✓ SYSTOLIC BP < 90 mm Hg  
✓ ABC TRAUMA SCORE 2 OR GREATER | 1st COOLER  
4 RBC 2 FFP | ALL IN ONE COOLER  Delivered by Transportation |
|               |                  |       | 2nd and SUBSEQUENT COOLERS  
6 RBC 4 FFP 1 PLT 1 CRYO |                       |                  |

**Notes:**
- FastBlood 4+2 uses one and done method where no need to deactivate
- MTP uses different coolers for each type of product
- Cryo is stored frozen, so it must be thawed before it is ready
Tranexamic Acid (WOMAN trial results)

- Anti-fibrinolytic agent utilized in multiple settings (trauma, orthopedics) for prevention and management of blood loss
- Prospective RCT of over 20,000 women
  - Randomized to 1000 mg of TXA given over 10 minutes vs placebo
- Primary outcome was death from all causes OR hysterectomy
  - not reduced by study intervention
- Death caused by hemorrhage was reduced
  - (1.5% TXA vs 1.9% placebo), RR 0.81, [0.65-1.00]
- Death caused by hemorrhage (when TXA was administered within 3 hours of onset of hemorrhage) was reduced
  - (1.2% TXA vs 1.7% placebo), RR 0.69, [0.52-0.91]
Recognition and Prevention

- Assessment of hemorrhage risk
- Measurement of cumulative blood loss
- Active management of 3rd stage of labor
- [Morbidly adherent placenta protocols]
  - Although not part of the AIM bundle, MAP management protocols logically belong here
**Risk screening**

- Screening tools
  - CMQCC
  - AWHONN
- Adopt a screening tool and use it universally
- Identify factors which increase the risk of hemorrhage
- Communicate increased risk of specific patients to all team members
  - Frequent reassessment during labor and post-partum
  - Consider holding standing Safety Rounds at regular intervals
### CMQCC Hemorrhage Risk Assessment

**Table 2. Example of Risk Assessment Tool**

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Singleton pregnancy</td>
<td>Prior cesarean or uterine surgery</td>
<td>Previa, accreta, increta, percreta</td>
</tr>
<tr>
<td>Less than four previous deliveries</td>
<td>More than four previous deliveries</td>
<td>HCT &lt;30</td>
</tr>
<tr>
<td>Unscarred uterus</td>
<td>Multiple gestation</td>
<td>Bleeding at admission</td>
</tr>
<tr>
<td>Absence of postpartum hemorrhage history</td>
<td>Large uterine fibroids</td>
<td>Known coagulation defect</td>
</tr>
<tr>
<td></td>
<td>Chorioamnionitis</td>
<td>History of postpartum hemorrhage</td>
</tr>
<tr>
<td></td>
<td>Magnesium sulfate use</td>
<td>Abnormal vital signs (tachycardia and hypotension)</td>
</tr>
<tr>
<td></td>
<td>Prolonged use of oxytocin</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviation:** HCT, hematocrit.

### AWHONN Hemorrhage Risk Assessment

**Postpartum Hemorrhage (PPH) Risk Assessment Table • 1.0**

**Clinician Guidelines:**
- Each box ☑ represents **ONE** risk factor. Treat patients with 2 or more medium risk factors as high risk.
- Prenatal risk assessment is beyond the scope of this document; however, performing a prenatal hemorrhage risk assessment and planning is highly recommended. Early identification and management preparation for patients with special considerations such as placental previa/accreta, bleeding disorder, or those who decline blood products will assist in better outcomes.

- Adjust blood bank orders based on the patient’s most recent risk category. When a patient is identified as being at high risk for hemorrhage, verify that the blood can be available on the unit within 30 minutes of a medical order.
- Plan appropriately for patient and facility factors that may affect how quickly the blood is delivered to the patient. For example:
  - Patient issues: Pre-existing red cell antibody
  - Facility issues: Any problems at your facility related to the blood supply and obtaining blood

#### Risk Category: Admission

<table>
<thead>
<tr>
<th>Risk Category: Admission</th>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☑ No previous uterine incision</td>
<td>☑ Induction of labor (with oxytocin) or Cervical ripening</td>
<td>☑ Has 2 or More Medium Risk Factors</td>
</tr>
<tr>
<td></td>
<td>☑ Singleton pregnancy</td>
<td>☑ Multiple gestation</td>
<td>☑ Active bleeding more than “bloody show”</td>
</tr>
<tr>
<td></td>
<td>☑ &lt;4 Previous vaginal births</td>
<td>☑ &gt;4 Previous vaginal births</td>
<td>☑ Suspected placenta accreta or percreta</td>
</tr>
<tr>
<td></td>
<td>☑ Prior cesarean birth or prior uterine incision</td>
<td>☑ Placenta previa, low lying placenta</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ No known bleeding disorder</td>
<td>☑ Large uterine fibroids</td>
<td>☑ Known coagulopathy</td>
</tr>
<tr>
<td></td>
<td>☑ No history of PPH</td>
<td>☑ History of one previous PPH</td>
<td>☑ History of more than one previous PPH</td>
</tr>
<tr>
<td></td>
<td>☑ Family history in first degree relatives who experienced PPH (known or unknown etiology with possible coagulopathy)</td>
<td>☑ Hematocrit &lt;30 AND other risk factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ Chorioamnionitis</td>
<td>☑ Platelets &lt;100,000/mm³</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ Fetal demise</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ Estimated fetal weight greater than 4 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ Morbid obesity (body mass index [BMI] &gt;35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☑ Polyhydramnios</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Oklahoma Hemorrhage Risk Assessment: Admission

Evaluate for risk factors on admission, throughout labor, first 24 hours postpartum, and at every hand off.

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ No previous uterine incision</td>
<td>□ Prior cesarean birth or uterine surgery</td>
<td>□ Placenta previa, low lying placenta</td>
</tr>
<tr>
<td>□ Singleton pregnancy</td>
<td>□ Uterine over distention (multiple gestation, polyhydramnios, fetus &gt; 4 kg)</td>
<td>□ Suspected placenta accreta, percreta, or increta</td>
</tr>
<tr>
<td>□ Greater than 4 previous vaginal births</td>
<td>□ Hematocrit less than 30% <strong>AND</strong> other risk factors present</td>
<td></td>
</tr>
<tr>
<td>□ Less than or equal to 4 previous vaginal births</td>
<td>□ Chorioamnionitis</td>
<td>□ Platelets less than 100,000</td>
</tr>
<tr>
<td>□ No known bleeding disorder</td>
<td>□ History of previous PPH</td>
<td>□ Known coagulopathy</td>
</tr>
<tr>
<td>□ No history of PPH</td>
<td>□ Large uterine fibroids or abnormal uterine anatomy</td>
<td>□ Active bleeding-greater than normal show</td>
</tr>
</tbody>
</table>

### Plan of Care

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Type &amp; Screen</td>
<td>• Type &amp; Screen</td>
<td>• Notify OB provider, anesthesia, charge nurse, surgery</td>
</tr>
<tr>
<td>• If prenatal antibody screen positive (except low level anti-D from Rhogam) – Type &amp; Crossmatch 2 units PRBCs</td>
<td>• Review Hemorrhage Protocol</td>
<td>• Type &amp; Crossmatch 2 units PRBCs per order</td>
</tr>
<tr>
<td>• Review Hemorrhage Protocol</td>
<td></td>
<td>• Review Hemorrhage Protocol</td>
</tr>
</tbody>
</table>

### Identify women who may decline transfusion
- Notify OB provider for plan of care
- Early consult with anesthesia
- Review refusal of blood products protocol/consent form

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*VNPC*

Virginia Neonatal Perinatal Collaborative
Oklahoma Hemorrhage Risk Assessment: Post-delivery

Notify care provider of worsening assessment. More than one medium risk factor moves patient into High Risk category. Evaluate for risk factors on admission, throughout labor, first 24 hours postpartum, and at every hand off.

<table>
<thead>
<tr>
<th>Low Risk</th>
<th>Medium Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Retained placenta</td>
<td>☐ Cesarean birth or uterine surgery</td>
<td>☐ Hematocrit less than 30% AND other risk factors present</td>
</tr>
<tr>
<td>☐ Singleton pregnancy</td>
<td>☐ Uterine over distention (multiple gestation, polyhydramnios, fetus &gt; 4 kg)</td>
<td></td>
</tr>
<tr>
<td>☐ No known bleeding disorder</td>
<td>☐ Greater than or equal to 5 vaginal births</td>
<td>☐ Platelets less than 100,000</td>
</tr>
<tr>
<td>☐ No history of PPH</td>
<td>☐ History of previous PPH</td>
<td>☐ Known coagulopathy</td>
</tr>
<tr>
<td>☐ Uncomplicated vaginal delivery</td>
<td>☐ Prolonged oxytocin use</td>
<td>☐ Active bleeding-more than normal lochia</td>
</tr>
<tr>
<td>☐ No genital tract trauma</td>
<td>☐ Prolonged 2nd stage</td>
<td></td>
</tr>
<tr>
<td>☐ Rapid labor</td>
<td>☐ Large uterine fibroids or uterine anomaly</td>
<td></td>
</tr>
<tr>
<td>☐ Magnesium Sulfate treatment</td>
<td>☐ Genital tract trauma</td>
<td></td>
</tr>
</tbody>
</table>

Post Delivery Plan of Care
- Routine recovery
- Ongoing Quantitative Evaluation of Blood Loss

Post Recovery Plan of Care: First 24 hours
- If initial post recovery assessment is Low Risk, reassess every 8 hours or more often as condition necessitates.
- Reassess bleeding and fundus every 4 hours or more often as condition necessitates.
## Admission Risk Assessment & Testing

<table>
<thead>
<tr>
<th>Low (Clot only)</th>
<th>Medium (Type and Screen)</th>
<th>High (Type &amp; Crossmatch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous uterine incision</td>
<td>Prior cesarean birth(s) or uterine surgery</td>
<td>Placenta previa, low lying placenta</td>
</tr>
<tr>
<td>Singleton pregnancy</td>
<td>Multiple gestation</td>
<td>Suspected placenta accreta, percreta, increta</td>
</tr>
<tr>
<td>≤4 previous vaginal births</td>
<td>&gt;4 previous vaginal births</td>
<td>Hematocrit &lt;30 AND other risk factors</td>
</tr>
<tr>
<td>No known bleeding disorder</td>
<td>Chorioamnionitis</td>
<td>Platelets &lt;100,000</td>
</tr>
<tr>
<td>No history of PPH</td>
<td>History of previous PPH</td>
<td>Active bleeding (greater than show) on admit</td>
</tr>
<tr>
<td>Large uterine fibroids</td>
<td>Known coagulopathy</td>
<td></td>
</tr>
</tbody>
</table>

*Pre-transfusion testing strategy should be standardized to facility conditions depending on blood bank resources, speed of testing, and availability of blood products.*
Blood Transfusion Readiness

• Transfusion utilization ~1.6% of births
• Protocol options: universal T&S with crossmatch for high risk patients (highest preparation; most cost); no routine admission testing for any patient (lowest preparation, least cost); intermediate strategies
• Einerson et al (2017): cost-effectiveness analysis showed that universal T&S was not cost-effective in a wide range of scenarios; policy of “hold clot only” with crossmatch for high risk patients was most cost-effective
• Not tested in actual use; hypothetical model; cost-effectiveness was measured against prevention of emergency release blood utilization
• Bottom line – each unit should decide their standard strategy for crossmatching and apply it consistently
Active Management of Third Stage (AMTSL)

- Initiation of oxytocin (IV or IM) immediately upon delivery of the anterior shoulder of the baby, either at the time of vaginal or cesarean birth
- Other components included in research and clinical protocols have included controlled cord traction and vigorous fundal massage
  - Oxytocin is the key element
  - Other components not proven to impact blood loss
- Compatible with delayed cord clamping
Active Management of Third Stage (AMTSL)

- AMTSL leads to reduction in the following outcomes:
  - Risk of blood loss >1000 mL
  - Risk of blood loss >500 mL
  - Post-partum hemoglobin <9 g/L
  - Mean maternal blood loss
  - Maternal transfusion
  - Need for use of uterotonics
Quantified Blood Loss
Quantified Blood Loss

• AWHONN video (basics)
  • https://www.youtube.com/watch?v=F_ac-aCbEn0

• Requires system planning
  • Knowledge of dry weight of commonly used items (lap pads, blue towels, chux)
  • Availability of calibrated drapes and standard work surrounding the documentation
  • Often integrated into EMR
Response

• Standard, stage-based obstetric hemorrhage emergency management plan with checklists
• Support program for patients, families and staff for significant hemorrhages
Hemorrhage Guidelines: Staged Responses

**Pre-Admission:** All patients - Assess Risk

**Stage 0:** All birth - Routine Measures

**Stage 1:** QBL > 500 mL vag or 1000 mL CS or VS unstable with continued bleeding

**Stage 2:** QBL 1000-1500 mL with continued bleeding

**Stage 3:** QBL exceeds 1500 mL

Active Management of Third Stage
CMOQCC OB Hemorrhage Emergency Management Plan

Every hospital will need to customize the protocol—but the point is every hospital needs one.
Reporting/Systems Learning

- Huddles for high risk patients, post-event debriefing to identify successes and opportunities
- Multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and process metrics in perinatal QI committee
Unanticipated hemorrhage

- Drills, team training
- Massive transfusion protocols
- Factor replacement
Selected References

- American College of Obstetricians and Gynecologists, Postpartum Hemorrhage. Practice Bulletin 183, October 2017
- California Maternal Quality Care Collaborative, Planning for and Responding to Obstetric Hemorrhage. March 2015.
Selected References