The Maternal Early Warning Criteria
A Proposal From the National Partnership for Maternal Safety

Jill M. Mhyre, MD, Robyn D’Oria, MA, RN, APN, Afshan B. Hameed, MD, Justin R. Lappin, MD, Sharon L. Holley, CNM, DNP, Stephen K. Hunter, MD, PhD, Robin L. Jones, MD, Jeffrey C. King, MD, and Mary E. D’Alton, MD

Case reviews of maternal death have revealed a concerning pattern of delay in recognition of hemorrhage, hypertensive crisis, sepsis, venous thromboembolism, and heart failure. Early-warning systems have been proposed to facilitate timely recognition, diagnosis, and treatment for women developing critical illness. A multidisciplinary working group convened by the National Partnership for Maternal Safety used a consensus-based approach to define the Maternal Early Warning Criteria, a list of abnormal parameters that indicate the need for urgent bedside evaluation by a clinician with the capacity to escalate care as necessary in order to pursue diagnostic and therapeutic interventions. This commentary reviews the evidence supporting the use of early-warning systems and describes the Maternal Early Warning Criteria, along with considerations for local implementation.

(J Obstet Gynaecol 2014;24:782–86)
DOI: 10.1097/AOG.0000000000000489

The Maternal Early Warning Criteria
Proposal from the National Partnership for Maternal Safety

Jill M. Mhyre, Robyn D’Oria, Afshan B. Hameed, Justin R. Lappin, Sharon L. Holley, Stephen K. Hunter, Robin L. Jones, Jeffrey C. King, and Mary E. D’Alton

ABSTRACT
Case reviews of maternal death have revealed a concerning pattern of delay in recognition of hemorrhage, hypertensive crisis, sepsis, venous thromboembolism, and heart failure. Early-warning systems have been proposed to facilitate timely recognition, diagnosis, and treatment for women developing critical illness. A multidisciplinary working group convened by the National Partnership for Maternal Safety used a consensus-based approach to define the Maternal Early Warning Criteria, a list of abnormal parameters that indicate the need for urgent bedside evaluation by a clinician with the capacity to escalate care as necessary in order to pursue diagnostic and therapeutic interventions. This commentary reviews the evidence supporting the use of early-warning systems, describes the Maternal Early Warning Criteria, and provides considerations for local implementation.


Article referenced
The Joint Commission
Sentinel Event Alert

- Existing Joint Commission requirements:
  - Have a process for recognizing and responding as soon as a patient’s condition appears to be worsening.
  - Develop written criteria describing early warning signs of a change or deterioration in a patient’s condition and when to seek further assistance.
  - Based on the hospital’s early warning criteria, have staff seek additional assistance when they have concerns about a patient’s condition.
What are Maternal Early Warning Signs?

• National Partnership for Maternal Safety field tested recommendations for triggers related to pregnant or postpartum women’s status
• Requires prompt bedside evaluation
Learning from Review

• Hemorrhage death
  – 93% of deaths were potentially preventable
  – Lack of appropriate attention to clinical signs of hemorrhage
  – Failure to restore blood volume, to act decisively with life-saving interventions

• Severe hypertension
  – 60% of deaths were potentially preventable
  – Failure to control blood pressure, to recognize HELLP syndrome, to diagnosis and treat pulmonary edema
Monitoring our patients

Monitoring forms the cornerstone of timely diagnosis and treatment.
# Maternal Early Warning Criteria

## The Maternal Early Warning Criteria

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure (mm Hg)</td>
<td>&lt;90 or &gt;160</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mm Hg)</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Heart rate (beats per minute)</td>
<td>&lt;50 or &gt;120</td>
</tr>
<tr>
<td>Respiratory rate (breaths per min)</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>Oxygen saturation on room air, at sea level %</td>
<td>&lt;95</td>
</tr>
<tr>
<td>Oliguria, mL/hr for ≥2 hrs</td>
<td>&lt;35</td>
</tr>
<tr>
<td>Maternal agitation, confusion, or unresponsiveness</td>
<td></td>
</tr>
<tr>
<td>Woman with preeclampsia reporting a non-remitting headache or shortness of breath</td>
<td></td>
</tr>
</tbody>
</table>
• It is important to verify isolated abnormal measurements – particularly for:
  – Blood pressure
  – Heart rate
  – Respiratory rate
  – Oxygen saturation
While awaiting the arrival of the evaluation clinician, the bedside nurse should follow basic resuscitation principles to ensure patient safety:

- IV access
- Increased vital signs
- Left uterine displacement (if still pregnant)
- Supplemental oxygen
What to do ... what to do

• Appropriate standing orders should be in place to allow the bedside nurse to administer these resuscitative measures
## Differential Diagnosis

### Blood Pressure

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Common Diagnoses</th>
<th>Rare But Life-Threatening Diagnoses</th>
</tr>
</thead>
</table>
| Blood pressure > 160 systolic or > 100 diastolic | • Chronic hypertension  
• Preeclampsia  
• Sympathomimetic medications | • Illicit substance abuse  
• Endocrine disorders  
• Hypoventilation |
| Blood pressure < 90 systolic   | • Dehydration  
• Supine hypotension syndrome  
• Regional anesthesia side effect  
• Hemorrhage  
• Medication side effects  
• Vasovagal reaction | • Sepsis  
• Cardiac  
• Thromboembolism  
• Concealed hemorrhage  
• Amniotic fluid embolism  
• Anaphylaxis  
• Diabetic ketoacidosis  
• Drug toxicity  
• High spinal or epidural block  
• Tension pneumothorax  
• Vascular emergency |
## Differential Diagnosis
### Respiratory

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Common Diagnoses</th>
<th>Rare But Life-Threatening Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate &gt; 30</td>
<td>• Hypoxia</td>
<td>• Cardiac</td>
</tr>
<tr>
<td></td>
<td>• Hemorrhage</td>
<td>• Thromboembolism</td>
</tr>
<tr>
<td></td>
<td>• Infection</td>
<td>• Aspiration</td>
</tr>
<tr>
<td></td>
<td>• Anxiety/Panic attack/exertion</td>
<td>• Metabolic acidosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Concealed hemorrhage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Amniotic fluid embolism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stroke</td>
</tr>
<tr>
<td>Respiratory rate &lt; 10</td>
<td>• Medication toxicity</td>
<td>• Airway obstruction</td>
</tr>
<tr>
<td></td>
<td>• Obstructive sleep apnea</td>
<td>• Asthma with respiratory failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High spinal or epidural block</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cerebrovascular accident</td>
</tr>
<tr>
<td>Measurement</td>
<td>Common Diagnoses</td>
<td>Rare But Life-Threatening Diagnoses</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Oxygen saturation &lt;95% or increasing oxygen requirements to maintain oxygen saturation &gt;= 95%</td>
<td>• Atelectasis</td>
<td>• Airway obstruction</td>
</tr>
<tr>
<td></td>
<td>• Bronchospasm</td>
<td>• Pulmonary edema</td>
</tr>
<tr>
<td></td>
<td>• Hemorrhage</td>
<td>• Thromboembolic disease</td>
</tr>
<tr>
<td></td>
<td>• Hypoventilation</td>
<td>• Cardiac disease</td>
</tr>
<tr>
<td></td>
<td>• Infection</td>
<td>• Concealed hemorrhage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Amniotic fluid embolism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Anaphylaxis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Aspiration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Acute chest syndrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pneumothorax</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Venous air embolism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Blood product reaction</td>
</tr>
</tbody>
</table>
## Differential Diagnosis

### Mental Status

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Common Diagnoses</th>
<th>Rare But Life-Threatening Diagnoses</th>
</tr>
</thead>
</table>
| Maternal confusion, agitation, or unresponsiveness | • Hypoxemia  
• Hemorrhage/hypotension  
• Illicit substances  
• Seizure/postictal/PRES  
• Psychosis is a diagnosis of exclusion | • Diabetic ketoacidosis  
• Sepsis  
• Concealed hemorrhage  
• Thromboembolic disease  
• Amniotic fluid embolism  
• Anesthesia complications  
• Cardiomyopathy  
• Cerebrovascular accident  
• Increased intracranial pressure  
• Electrolyte abnormality  
• Hyperthyroidism/thyroid storm  
• Medication toxicity |
## Differential Diagnosis
### Heart Rate

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Common Diagnoses</th>
<th>Rare But Life-Threatening Diagnoses</th>
</tr>
</thead>
</table>
| Heart rate < 50 | • Vasovagal reaction  
• Medication side effects  
• Hypertension | • Heart block from cardiac disease  
• Hypoventilation or hypoxemia  
• Electrolyte disturbance  
• Medication toxicity  
• Stroke/increased intracranial pressure  
• High spinal or epidural block |
EFFECTIVE ESCALATION PROCESS
Escalation

- An abnormal parameter requires:
  - Prompt reporting to a physician or other qualified clinician
  - Prompt bedside evaluation by a physician or other qualified clinical provider with the ability to initiate emergency diagnostic and therapeutic interventions as needed
Importance of bedside evaluation

- Maternal mortality reviews have illustrated the hazards of phone based management in women developing critical illness.
- Specific expectations for response times should be established at a local level based on available resources.
How will this look for you?

- Each facility will need to define:
  - Who to notify
  - How to notify them
  - When and how to activate the clinical chain of command in order to ensure an appropriate response
Key points – takeaway points

• Delays in diagnosis contribute to a large portion of preventable maternal deaths
• Maternal early warning criteria can identify potentially critically ill patients and establish standards for prompt evaluation and close follow up
• Local implementation is dependent on hospital type, provider staffing, and patient population
Available Resources

• CMQCC Maternal Early Warning System information sheet

• Safety Action Series on MEWS