APPROACHING THE EDGE:
Maternal Early Warning System
Disclosures

• I have no relevant financial relationships to disclose or conflicts of interest to resolve.

• I will not discuss any unapproved or off label, experimental or investigational use of a product, drug, or device.
APPROACHING THE EDGE: MATERNAL MORBIDITY AND MORTALITY

• What is an early warning system?
• Why is one needed?
• How does an effective early warning system differ for obstetric patients?
CA VS USA MATERNAL MORTALITY

[Graph showing maternal mortality rates in California and the United States from 1999 to 2013, with California's rate in blue and the United States' rate in red.]
CA DISPARITY: BLACK WOMEN

[Graph showing maternal mortality disparity between White, Non-Hispanic and African-American, Non-Hispanic populations from 1999-2013.]
• Maternal mortality: tip of the iceberg

• Severe morbidity/near miss: 50-100 fold more common than death
• Review of annual deliveries from 16 hospitals over one year (almost 70,000 total deliveries) 2012-2013

• Potential cases identified from procedure and diagnosis codes (external data set from the CMDC) plus ICU admission and blood bank records (internal data sets from participating hospitals)

• **True** SMM rate based on individual chart review of all potential cases using a clinician defined gold standard.

Main E et al Am J Obstet Gynecol 2016; 214:643 e1-10
SMM BY “GOLD STANDARD” EXAMPLES

- Transfusion $\geq 4$ units PRBC
- Transfusion $\geq 2$ units plus any additional procedure
  - UAE, Bakri balloon, B Lynch sutures
- Any unplanned hysterectomy
- Eclampsia
- Severe HTN requiring multiple doses of parenteral meds
- Severe pre eclampsia with liver hematoma
- Diagnosis of ATN or need for dialysis
- Creatinine $>2$ with no prior renal disease
- VTE
- Need for intubation
- Pre existing cardiac disease requiring ICU admission for treatment
- Bowel or bladder injury (more than serosal tear)
SM I N C A L I F O R N I A D E L I V E R I E S

- True SMM Rate was approximately 0.7% of all deliveries (700/100,000)

- Wide range between hospitals (approximately 0.3 - 0.9%)

- Higher levels at larger more tertiary hospitals and lowest levels at small hospitals

- Most true SMM was related to hemorrhage and pre eclampsia

- More than 2/3 of ICU admissions with true SMM were due to hemorrhage and pre eclampsia
WHICH MEANS?

• US: 4 million deliveries/year, SMM of 129/10,000?
• US: 52,000 woman/year with SMM (2009)
• CA: 3,500 woman/year with SMM (chart review 2012) up to 6,500 woman (ICD10 coding 2009 data)
PREVENTABILITY?
CA MATERNAL DEATHS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Good-to-strong chance</th>
<th>Some chance</th>
<th>No chance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease (n=48)</td>
<td>29</td>
<td>63</td>
<td>8</td>
</tr>
<tr>
<td>Preeclampsia or eclampsia† (n=35)</td>
<td>60</td>
<td>40</td>
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<tr>
<td>Obstetric hemorrhage† (n=20)</td>
<td>70</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Venous thromboembolism (n=20)</td>
<td>50</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Amniotic fluid embolism‡ (n=18)</td>
<td>83</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Other (n=64)</td>
<td>39</td>
<td>39</td>
<td>22</td>
</tr>
<tr>
<td>All deaths (n=205)</td>
<td>41</td>
<td>48</td>
<td>11</td>
</tr>
</tbody>
</table>

Main E et al. Obstet Gynecol 2015;125:938-47
WHY DO WE NEED AN EARLY WARNING SYSTEM?

• Delays in recognition, diagnosis and treatment proceed the majority of deaths from hemorrhage, hypertension, venous thromboembolism

• Early signs of life-threatening illness can be difficult to recognize
  • Critical illness is relatively rare
  • Normal pregnancy and childbirth can generate significant changes in maternal vital signs
  • Healthy women have substantial physiologic reserve to compensate for pathologic derangements.
EARLY WARNING SYSTEM: PREMISE?

- Early warning system (EWS), Modified early warning system (MEWS), Pediatric early warning system (PEWS)

- Most adverse events usually proceeded by early warning signs of clinical instability

- Early signs often *subtle changes in multiple parameters* rather than a dramatic change in a single isolated value

- However, hospital rapid response team (RRT) usually called due to a severe change in a *single* vital sign
EARLY WARNING SYSTEM: PREMISE?

• Premise
  • Detect deterioration by a combination of less dramatic changes in vital signs, which would provide an opportunity for earlier assessment and better outcomes
  • Aggregate-weighted scoring system: Presumed to be more sensitive

• The ongoing assessment of a patient with the intention of detecting abnormality and triggering a response if an abnormality is detected

• Effective warning systems include clear expectations for
  • Observation
  • Predefined criteria for an abnormality
  • Protocol to trigger a response if an abnormality is detected.
EWS, MEWS, PEWS have been shown to predict:

- Hospital mortality
- ICU admission within 72 hours
- Cardiac arrest
- Need for a Rapid response team (RRT) call within 72 hours
- Overall quality of data is limited however
EWS AND PATIENT OUTCOME

• Systematic review, Resuscitation, 2014
• Aim: Evaluate impact of use of an EWS on patient outcomes
• Seven studies included
• Trials evaluated outcomes before and after implementation of EWS, with a total of 486,237 patients
• 5 UK, 1 Belgium, 1 Italy
• Meta analysis not possible due to heterogeneity
• “Narrative analysis” performed

DESCRIBED OUTCOMES

• Patient Outcomes:
  • Mortality
  • ICU Mortality
  • Serious adverse events
  • Cardiopulmonary arrests

• System Outcomes:
  • Compliance with documentation of vital signs
OVERVIEW

• Mortality: 2/6 studies had significant reductions of in hospital mortality, 4/6 showed non-significant reduction of in hospital mortality
• ICU Mortality: 1 study showed non significant reduction
• Serious adverse events: 1 study showed non significant reduction
• Cardiac arrest: 1 study demonstrated statistical increased risk, 1 study showed statistically decreased risk

• Documentation of appropriate physiologic vital signs: 2/2 studies showed increased compliance
• Concluded: Most studies showed improved clinical outcomes but heterogenous and lack of power for many important outcomes, generalizability a question
MEWS AND ACTIVATION OF A RAPID RESPONSE TEAM

• AIM: To study the impact of standardized MEWS (modified early warning score) on activation of the rapid response system at a Netherlands hospital.

• Randomized to standardized calculation of MEWS 3x/day or “as indicated” MEWS, from vital signs performed by RNs.

• Outcomes: degree of delay in physician notification and activation of RRT with elevated MEWS.

• Process measures: degree of implementation and compliance with monitoring standards.

• General wards in 1000 bed hospital randomized to
  • MEWS calculated minimum 3x/day
  • MEWS calculated “as indicated”
  • Stratified by medical or surgical ward
  • MEWS contained 9 component parameters.

MEWS calculated by RN

- MEWS < 3
  - Call MD with SBAR
  - MD: Evaluate within 30 minutes
    - MD: Activate RRT
    - Medical intervention and reassess within 60 minutes
    - If no effect of therapy: MD activate RRT

- MEWS \( \geq 3 \)
  - MD doesn’t comply with time or protocol: RN activates RRT
SYSTEM PROCESS

**Control wards ("as needed")**:
- MEWS calculation/score determined for 2% of all measurements
- MEWS calculation was indicated in 41% of all measurements but calculated in fact in only 4% of measurements
- A critical MEWS was noted on 1% of measurements however a critical MEWS actually occurred for 7% of measurements (retrospectively identified)

**Study/protocolized wards**:
- MEWS calculation was performed in 70% of all measurements
- Compliance with VS measurement 3x/day was achieved for 68% of patient days
- A critical MEWS was noted for 9% of measurements however a critical MEWS actually occurred for 11% of measurements (retrospectively identified) due to calculation errors

RRT ACTIVATION OVER 3 MONTHS

• Study group
  • N = 373 patients
  • RRT activation 62 cases
  • Incidence increased from 11.8/1000 to 19.6/1000 over study period
  • Need for ICU admission for RRT patients decreased from 67% to 26%

• Control group
  • N = 432 patients
  • RRT activation 22 patients
  • Incidence decreased from 8.0/1000 to 6.5/1000
  • Need for ICU admission for RRT patients unchanged from 58% to 50%

• No difference in APACHE IV scores between groups of patients needing ICU admission

• Increased delay time in activation of RRT in control group versus study group once elevated MEWS occurred (both prospectively and retrospectively)
EWS IN OBSTETRICS?

• MEOWS, MEWT
  • Modified Early Obstetric Warning System
  • Maternal Early Warning Trigger

• 2003 – 2005 Saving Mothers’ Lives (UK) recommended implementation of MEOWS and a chart for bedside scoring of vital signs

• Recommends bedside physician assessment if one severely abnormal vital sign (red) or two moderately abnormal vital signs (yellow)

• MEOWS added to a list of auditable maternal safety standards in the UK
EWS TO PREDICT MATERNAL MORTALITY

- Analysis of physiologic data collected from OB patients admitted to ICU for critical care in UK from 1995-2008.
- Most extreme VS in first 24 hours of the ICU admission
  - Intensive Care National Audit and Research Center (ICNARC) dataset
  - OB Admissions: 4440
  - 0.7% of all admissions and 6.2% of all female admissions age 16-50 years of age
  - ICU mortality of OB admissions was 1.7% (1:60) vs 13% for non OB ICU admissions
- Scoring system highly accurate when applied to a second data set of OB ICU patients, but complexity precluded routine use.
- Simplified clinical score demonstrated comparable accuracy to existing scoring system

Table 4: New clinical obstetric early warning score. Score created by combining the statistical score derived using logistic regression analysis and clinical judgement.

<table>
<thead>
<tr>
<th>Score</th>
<th>Systolic blood pressure (mmHg)</th>
<th>Diastolic blood pressure (mmHg)</th>
<th>Respiratory rate (min⁻¹)</th>
<th>Heart rate (min⁻¹)</th>
<th>% O₂ required to maintain SpO₂ ≥ 96%</th>
<th>Temperature (°C)</th>
<th>Conscious level</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>&lt; 80</td>
<td>80–89</td>
<td>&lt; 10</td>
<td>&lt; 60</td>
<td>Room air</td>
<td>&lt; 34.0</td>
<td>Alert*</td>
</tr>
<tr>
<td>2</td>
<td>90–139</td>
<td>90–99</td>
<td>10–17</td>
<td>60–110</td>
<td>24–39%</td>
<td>34.0–35.0</td>
<td>Not alert†</td>
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<tr>
<td>1</td>
<td>140–149</td>
<td>100–109</td>
<td>18–24</td>
<td>111–149</td>
<td>≥ 40%</td>
<td>35.1–37.9</td>
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<tr>
<td>0</td>
<td>150–159</td>
<td>≥ 110</td>
<td>25–29</td>
<td>≥ 150</td>
<td></td>
<td>38.0–38.9</td>
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<tr>
<td>1</td>
<td>≥ 160</td>
<td></td>
<td>≥ 30</td>
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</tbody>
</table>

Urine output, pain score, F₁O₂ and S_pO₂ recorded elsewhere on chart. Alert*, alert and orientated, equivalent to Glasgow Coma Score (GCS) 15 and A on Alert/Voice/Pain/Unresponsive (AVPU) scale; Not alert†, GCS 3–14 or V, P, U on AVPU scale.
ROC's FOR MATERNAL MORTALITY

Dotted line: Statistical OEWS
Solid line: Simplified clinical OEWS
Dashed line: Simplified clinical OEWS without RR
Blue line: NEWS
Red line: MEOWS
Green line: CEMACH OEWS
EWS TO PREDICT MATERNAL MORTALITY

- Use of Clinical OEWS as described by Carle et al in Anaesthesia 2013
- AIM: Apply OEWS in a different population of women
  - Classified as to ICU admission for “direct” obstetric reasons (76% of admissions) or “indirect” admissions (non obstetric conditions, 25% of admissions)
  - 29 maternal deaths, 4.1% of ICU admissions, MMR of 57/100,000 births
- Assessed probability of death related to OEWS
ROCs for Maternal Mortality

Dotted line: Direct OB diagnosis admissions

Solid line: Indirect diagnosis admissions
<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
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<tbody>
<tr>
<td></td>
<td>&gt;30</td>
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<tr>
<td>Resp:</td>
<td>11-20</td>
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<td>5-10</td>
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<td>Sat:</td>
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<td>&lt;95%</td>
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<td>Admin O2 (L/min):</td>
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<td>Heart Rate:</td>
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<td>Systolic blood pressure:</td>
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<td>190</td>
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<td>Diastolic blood pressure:</td>
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<tr>
<td></td>
<td>60</td>
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<td>50</td>
</tr>
</tbody>
</table>

Contact doctor for early intervention if patient triggers one red or two yellow scores at any one time.
MEOWS EVALUATION

- Prospective evaluation of 676 obstetric patients
- Incidence of serious morbidity in population was 13%
  - 30% met criteria for an evaluation
  - Of these, 43% had some form of significant morbidity
  - Sensitivity of 89%
  - Specificity of 79%
  - PPV 39%, NPV 98%
- Required nurse to document, calculate and interpret the scores
- Led to discretionary use of the tool, limiting its significance
- Excessive alarms: desensitization and lack of clinician response
- Local cultures:
  - Nurses disbelieved the physiologic significance of the parameter
  - Nurses faced hierarchical barriers to requesting evaluation of the patient

• Prospective observational evaluation of 1,065 women during delivery admission and up to 6 weeks postpartum if in hospital
• No specific intervention
• Triggers using CEMACH/MEOWs definitions
• 284 women “triggered” (26.6%)
  • 153 met criteria of obstetric morbidity
• 24 women did not trigger but had morbidity
NATIONAL PARTNERSHIP FOR MATERNAL SAFETY

Recommended a Maternal Early Warning Criteria
Single parameter risk assessment
Favored simplicity and specificity
COMMUNICATION STRATEGY

CRITICAL

• **Who** to notify?
• **How** to notify them?
• **When** and how to activate the clinical chain of command in order to ensure an appropriate response

• Barriers to prompt notification need to be addressed
  • Fear of offending or disturbing more senior personnel
  • Nurses are rewarded rather than punished or ignored when they call for bedside evaluation, regardless of the clinical outcome

• Strong organization leadership may be needed to establish normative expectations for prompt bedside evaluation

## Single Clinical Trigger: Early Warning System

<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>
• Important to verify isolated abnormal values, especially BP, HR, RR, O2 sat

• Urgent bedside evaluation by the clinician if any one value persists for more than one measurement, or recurs more than once, or if present with additional abnormal parameters

• Specific process to request bedside evaluation should be established at a local level

MEWTS: “PERSISTENCE” OF VITAL SIGN ABNORMALITIES

- Retrospective case-control study
- **Cases:** Obstetric patients admitted to the ICU of seven pilot hospital from within the hospital antepartum, intrapartum or postpartum areas
  - Excluded direct admissions from the ED or transfer from other facilities
- **Controls:** patients admitted to maternity units with normal delivery outcome
- Vital signs assessed, multiple different “MEWTS” assessed retrospectively
- Early interventions noted if any

ASSESSMENT METS

- HR < 50 or HR > 110
- RR < 10 or RR > 24
- Temp < 36°C or Temp > 38°C (aural or oral)
- MAP < 65
- O2 sat < 94%
- AMS: Altered mental state
  - Confusion, agitation, persistent intensifying pain, non-responsive
“EARLY INTERVENTION AT TIME OF EVALUATION”

- Blood transfusion
- Treatment of severe hypertension
- Initiation of antibiotics within an hour of sepsis diagnosis
- Oxygen supplementation
- Call for provider bedside assessment
## Comparison of two or more extant and two or more persistent MEWTs.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>ICU group (n = 50)</th>
<th>Control group (n = 50)</th>
<th>Odds ratio (95% CI)</th>
<th>P value</th>
<th>Predictive value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥2 MEWTs</td>
<td>36 (72)</td>
<td>10 (20)</td>
<td>10.3 (4.0–26.0)</td>
<td>&lt;0.001</td>
<td>72 (57–83)</td>
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<td></td>
<td>80 (66–90)</td>
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<td>78 (63–89)</td>
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<td></td>
<td>74 (60–85)</td>
</tr>
<tr>
<td>≥2 persistent MEWTs&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36 (72)</td>
<td>2 (4)</td>
<td>61.7 (13.2–288.0)</td>
<td>&lt;0.001</td>
<td>72 (57–83)</td>
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<td>96 (85–99)</td>
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<td></td>
<td>95 (81–99)</td>
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<td>77 (65–87)</td>
</tr>
</tbody>
</table>

At least 30 minutes
MEWTS

- False positive rate of \( \geq 2 \) MEWTS 20%
- False positive rate of \( \geq 2 \) MEWTS for at least 30 minutes 4%

- 42% of patients with two or more MEWTs were NOT recognized by the staff as having deteriorating clinical status before the decision for ICU transfer.
- 62% of patients (31/50), earlier intervention might have lessened the maternal morbidity
- Similar to a previous study in which ICU admission could have been avoided in 48% of cases if early intervention had been performed

IMPLEMENTATION: MATERNAL EARLY WARNING TRIGGER (MEWT) TOOL

• Can SMM be reduced with implementation of a clinical pathway-specific MEWT tool?

• Pilot project
  • 6 of 29 hospitals within a large system

• Positive trigger
  • Sustained for >20 minutes
  • Severe trigger (single abnormal value above a “severe” threshold)
  • Non severe trigger (required 2 abnormal values)

Shields L et al. Use of Maternal Early Warning Trigger tool reduces maternal morbidity. AJOG;2016
MEWT IMPLEMENTATION STUDY

• MEWT Tool addressed the 4 most common areas of SMM
  • Sepsis, cardiopulmonary dysfunction, pre eclampsia/HTN, hemorrhage
• Recommended management/assessment was provided for each area

• Two time periods:
  • 24 month baseline
  • 13 month MEWT study period

• Control population from non-MEWT sites during same baseline and study periods
• **One severe trigger**

• Sustained > 20 minutes
  • HR >130
  • RR >30
  • MAP < 55
    • \((DBP \times 2) + SBP/3\)
  • O2 Sat <90%
  • Nursing clinically uncomfortable with patient status
TRIGGERS

• **Less severe trigger: 2 or more**
  • Sustained > 20 minutes
    • Temp >100.4 or <96.9
    • Pulse ox <94%
    • HR >110 or 50
    • RR >24 or <12
    • SBP >155 or <80 OR DBP >105 or <45
    • Altered mental status anytime
MEWT TOOL:
LINKED TO SUGGESTED EVALUATIONS

- **Sepsis**
  - Test organ dysfunction (lactic acid, LFTs, total bilirubin, creatinine, urine output)
  - CBC, consider blood cultures, antibiotics
  - Fluid resuscitation (within 1 hour)

- **Cardiopulmonary Dysfunction**
  - Consider DDX: cardiomyopathy, CHF, MI, PE, Pulmonary HTN, Pulmonary Edema, Illicit drug use
  - BNP, cardiac enzymes, EKG, echo, spiral CT

- **HTN/Pre E**
  - Treatment of BP within 1 hour, magnesium, labs, consider pulmonary edema if RR>24 or O2 sat <94%

- **OB Hemorrhage**
  - Hemorrhage protocol
GOAL OF MEWT TRIGGER EVALUATION RECOMMENDATIONS

• Expedite treatment for suspected sepsis
• Provide basic recommendations for evaluation of patients who likely had cardiovascular dysfunction
• Ensure early treatment of critically elevated BP
• Remind that other CV disorders may be present when BP and additional triggers were present
• Alert all providers that individuals with abnormal bleeding and symptoms/vital sign abnormalities should be escalated to stage 3 of the hemorrhage protocol
M E W T T O O L I M P L E M E N T A T I O N

• MEWT screening occurred in 11,399 patients
  • Hospital delivery volumes ranged from 860-3000/year
  • Screening occurred in 93.4% of the patients delivering

• Screen positive rate 2.3% (260/11,399 mothers)

• MD intervention within <60 minutes in 82.3%
  • Occurred in <30 minutes in 71.9%

• MD followed recommended clinical pathway in 83.1%
MEWT TRIGGERS

• Single severe triggers:
  • Most common: HR >130 (0.6% of patients)
  • Second most common: nursing uncomfortable (0.1%)

• Less severe triggers
  • Most common HR >110 (1.5%), temp >100.4 (1.5%), RR >24 or <10 (0.15%)
TABLE 1
Percentage of Maternal Early Warning Trigger positive results of each clinical pathway and intensive care unit admission

<table>
<thead>
<tr>
<th>Clinical pathway</th>
<th>Screened positive (n = 260)</th>
<th>ICU admissions (n = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>71.4%</td>
<td>38%</td>
</tr>
<tr>
<td>Cardiopulmonary</td>
<td>3.1%</td>
<td>6%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>14.6%</td>
<td>15%</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>7.7%</td>
<td>31%</td>
</tr>
<tr>
<td>Multiple pathways</td>
<td>2.3%</td>
<td></td>
</tr>
<tr>
<td>Pathways follow correctly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician intervention time points, &lt;30 and &lt;60 min</td>
<td>71.9% and 83.1%</td>
<td></td>
</tr>
</tbody>
</table>

ICU, intensive care unit.
MEWT TOOL AND ICU ADMISSION

- Of the screened population, MEWT tool for cases of ICU admission
  - Sensitivity 96%
  - Specificity 99%
  - PPV 12%
  - NPV 99.9%
PRIMARY OUTCOMES

- CDC Defined Severe Maternal Morbidity
  - Combination of ICD 9/10 procedure and diagnosis codes during delivery hospitalization
- Composite Maternal Morbidity
  - At least one of: CDC Defined SMM, ICU admission, hemorrhage > 500 cc (vaginal) or >1000 (CS) without transfusion, or need for D & C
## Pre and Post MEWT Time Periods: Pilot vs Routine Care Hospitals

<table>
<thead>
<tr>
<th></th>
<th>Pilot (Intervention) Group</th>
<th>Control (NO Intervention Group)</th>
<th>Postpilot vs Postnonpilot P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-MEWT</td>
<td>Post-MEWT</td>
<td>Trend</td>
</tr>
<tr>
<td>Deliveries</td>
<td>24221</td>
<td>12611</td>
<td></td>
</tr>
<tr>
<td>CDC-SMM</td>
<td>2.0%</td>
<td>1.6%</td>
<td>↓</td>
</tr>
<tr>
<td>Composite morbidity</td>
<td>5.9%</td>
<td>5.1%</td>
<td>↓</td>
</tr>
<tr>
<td>Eclampsia/1000(^a)</td>
<td>2.0</td>
<td>0.4</td>
<td>↓</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>2.9%</td>
<td>2.7%</td>
<td>↓</td>
</tr>
<tr>
<td>Transfusion</td>
<td>0.7%</td>
<td>0.6%</td>
<td>↓</td>
</tr>
<tr>
<td>D&amp;C/1000(^a)</td>
<td>4.1</td>
<td>3.0</td>
<td>↓</td>
</tr>
<tr>
<td>Hysterectomy/1000(^a)</td>
<td>0.94</td>
<td>0.63</td>
<td>↓</td>
</tr>
<tr>
<td>Sepsis/1000(^a)</td>
<td>0.78</td>
<td>1.3</td>
<td>↑</td>
</tr>
</tbody>
</table>
STUDY CONCLUSIONS: USE OF A MEWT TOOL

• Significantly reduced maternal morbidity
• When linked to suggested management algorithms resulted in high compliance with appropriate evaluation
• Resulted in a screen positive rate of 2.3%
  • 1:8 patients with a positive screen required ICU admission
• Was successful at hospitals with a wide range of delivery volumes
  • Suggests could be successful at the majority of delivery hospitals in the US
• The sepsis component was the most common trigger and had a fairly low PPV of only 7%
  • Probably requires further modification
DELIVERY HOSPITAL VOLUME IN CA: 2013, 254 HOSPITALS

Annual Births

- 32% <1000/yr
- 27% 1000-2000/yr
- 19% 2000-3000/yr
- 15% 3000-5000/yr
- 4% >5000/yr
MEWS IN THE UK: CURRENT STATUS

• 2013 survey sent to all UK lead anaesthesiologists (205)
  • Survey response 63%, n = 130
  • 33 from tertiary units 97 from district general hospitals

• Follow-up of same study done in 2007
  • 100% had a MEWS in place, with 90% having a written policy
    • Only 19% in 2007

• 91% believed MEWS was useful

• 45% used the Confidential Enquiry recommended MEOWS and 50% used a modification of the MEOWS (single parameter system)

MEWS: IF NOT NOW, WHEN?

- Well correlated with maternal mortality
- Use shown to decrease severe maternal morbidity
- Given consistent findings that cases of morbidity are associated with delay in recognition of maternal deterioration, it is time to institute in our facilities
- Single parameter systems less sensitive but simpler to institute
- Not enough to have a trigger; needs to be linked to a system for escalation of care and concrete recommendations for doing so
- Barriers include lack of belief in physiologic significance of vital sign derangement and hierarchical barriers in requesting medical evaluation. Need normative expectation for escalation of care
- Strong organizational leadership will likely be required to establish normative expectations for prompt bedside evaluation
STAY AWAY FROM THE EDGE!