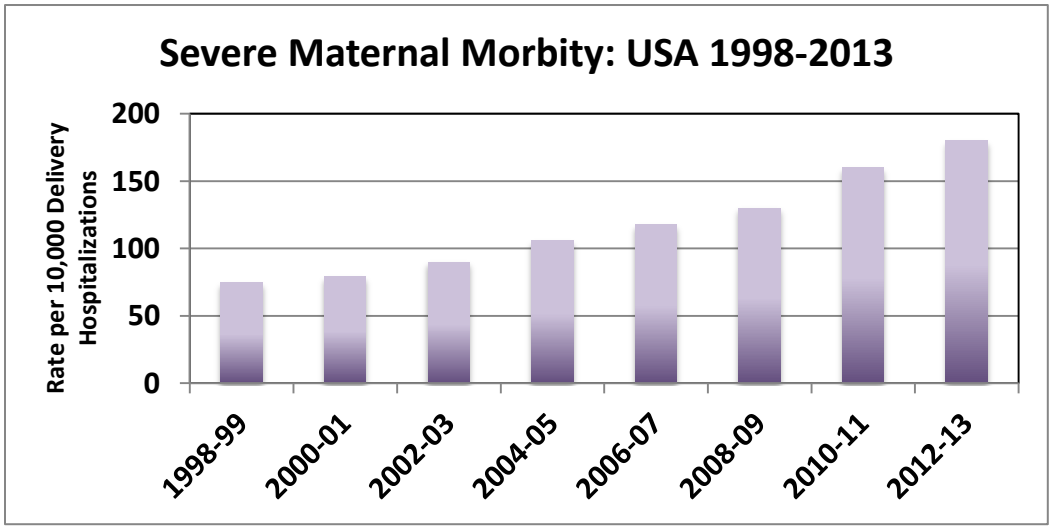
Perinatal Safety
Standardized Practices – White Paper
Maternal Early Warning Trigger (MEWT) System

Purpose

The primary purpose of this White Paper is to highlight the importance of early identification and treatment of maternal early warning triggers in the reduction of maternal morbidity and provide recommendations for implementation of a standardized, evidence-based management process. Every year, the nurses and providers in our maternal child health services at Dignity Health provide care to approximately 60,000 obstetrical patients and newborns. We are committed to partnering with our nurses and providers to provide the best perinatal care possible, including the implementation and adherence to evidence based practices.

Background and Significance

Maternal death and severe maternal mobidity have increased in the past two decades. Early assessment and recognition of maternal early warning triggers is important in providing early intervention and treatment, and consequently improving outcomes.



Data Source: J. Women's Health 2014; 23; 3-9.

In response to these trends, the Joint Commission and others have highlighted the importance of standardized tools aimed at **identifying specific triggers** for responding to changes in the mother's vital signs and clinical condition and **using protocols for responding** to these changes.[1] An internally developed tool was implemented at six (6) facilities and results demonstrated a reduction in severe maternal morbidity, including eclampsia and massive obstetrical hemorrhage.[5]

TABLE 2
Results from pre- and post-Maternal Early Warning Trigger time periods

	Pre-MEWT	Post-MEWT	Trend	*P* value	Prenonpilot	Postnonpilot	Trend	*P* value	Postpilot vs postnonpilot *P* value
Deliveries	24221	12611			95,718	50,641			
CDC-SMM	2.0%	1.6%	↓	<.01	2.4%	2.4%	→	.9	<.01
Composite morbidity	5.9%	5.1%	↓	<.01	6.2%	6.2%	→	.9	<.01
Eclampsia/1000[a]	2.0	0.4	↓	<.01	1.1	1.1	→	.9	.02
Hemorrhage	2.9%	2.7%	↓	.1	3.2%	3.3%	↑	.5	<.01
Transfusion	0.7%	0.6%	↓	.5	0.7%	0.8%	↑	.01	.04
D&C/1000[a]	4.1	3.0	↓	.1	3.0	3.8	↑	.02	.2
Hysterectomy/1000[a]	0.94	0.63	↓	.3	0.95	0.95	↑	.9	.2
Sepsis/1000[a]	0.78	1.3	↑	.14	0.26	0.42	↑	.1	

CDC, Centers for Disease Control and Prevention; *D&C*, dilation and curettage; *MEWT*, Maternal Early Warning Trigger tool; *SMM*, severe maternal morbidity.

[a] Rate given per 1000 deliveries.

Shields et al. Maternal trigger tool and severe maternal morbidity. Am J Obstet Gynecol 2016.

Recommendations

Early Identification

- Implementation of a standardized tool to identify maternal triggers
- Sucessful management requires correctly identifying patients who may have signs of clinical deterioration, providing standardized treatement in response to specified triggers for one of four common pathways: Infection/Sepsis, Cardiopulmonary Dysfunction, Hypertension in Pregnancy and Obstetrical Hemorrhage
- Abnormal vitals signs require **validation** and should be repeated within 15 minutes to confirm.
- Validated abnormal vitals signs are considered **sustained** when there are consecutive abnormal values at least 15 minutes apart. The presence of sustained triggers should be used in the Maternal Early Warning Trigger system guidelines.
- Provider notification with the identification of A) a single Severe Maternal Trigger or B) at least 2 ore more Maternal Triggers.
    - **Severe Maternal Triggers:**
        - Heart Rate > 130
        - Respiratory Rate > 30
        - Mean Arterial Pressure (MAP) < 55
        - pO2 Saturation < 90%
        - Systolic BP ≥ 160
        - Diastolic BP ≥ 110
        - Nurse clinically uncomfortable with patient status
    - **Maternal Triggers:**
        - Temperature ≥ 38°C (100.4°F) or ≤ 36°C (96.9°F)
        - pO2 Saturation ≤ 93%
        - Heart Rate > 110 or < 50
        - Respiratory Rate > 24 or < 12
        - Systolic BP > 155 or < 80
        - Diastolic BP > 105 or < 45
        - Altered Mental Status
        - Fetal HR > 160 (infection pathway only)

Four Pathways - Additional Evaluation and Treatment Guidelines

Infection / Sepsis

2 or more triggers including Abnormal Maternal Temperature

Refer to system Sepsis Identification and Management guidelines.
Notify provider and consider the following:

- Initial CBC and blood cultures.
- Consider antibiotics, if appropriate.
- If Maternal HR > 110 and/or MAP < 65:
    - Additional labwork to include lactic acid, liver function tests, total bili, creatinine
    - Measure urine output

  Consider Severe Sepsis / Septic Shock
    - If lactic acid > 4 mmol/L and/or MAP < 65
    - Notify Rapid Response
    - Consider transfer to ICU and/or consult
    - Fluid resuscitation (within 1 hour) with 30ml/kg crystalloid
    - Goal for MAP > 65 and HR < 100
- Consider overlap with Cardiopulmonary Dysfunction pathway

Cardiopulmonary Dysfuntion

HR > 110, MAP < 65, O2 Sat ≤ 93%, RR > 24 or alterned mental status

Notify provider and consider the following:

- Consider underlying causes:
    - Cardiomyopathy / CHF
    - Myocardial Infarction
    - Pulmonary Edema
    - Pulmonary Hypertension
    - Pulmonary Embolus / DVT
    - Ellicit Drug Use
- Consider additional consults:
    - Anesthesia
    - Medicine
    - Critical Care
    - Perinatology
- Consider overlap with Infection / Sepsis or Hypertension in Pregnancy pathways

Hypertension in Pregnancy

SBP > 155 and/or DBP > 105 – notify provider SBP > 160 and/or DBP > 110 – treatment indicated

Refer to system “Hypertensive Disorders of Pregnancy” guidelines (2014).
Notify provider and consider the following:

- If SBP > 160 and/or DBP > 110 or severe features (headache, visual disturbances, epigastric pain, etc):
    - Administration of IV antihypertensives
    - Magnesium sulfate 4gm bolus and 2gm / hour
    - Labwork: CBC, liver function tests, creatinine
    - Measure urine output
- If O2 Sat , 93% or RR > 24, consider pulmonary edema

- Consider overlap with Cardiopulmonary Dysfunction pathway

Obstetrical Hemorrhage

HR > 110, MAP < 65 and Bleeding or Recent Surgery

Refer to system "Management of Obstetrical Hemorrhage" guidelines (2012).
Notify provider and consider the following:

- Activate Massive Transfusion Protocol, as defined in Stage 3 hemorrhage guidelines:
  - Labwork: CBC, DIC panel
  - OB and Anesthesia providers to bedside

Integration of Maternal Early Warning System with the Electonic Health Record

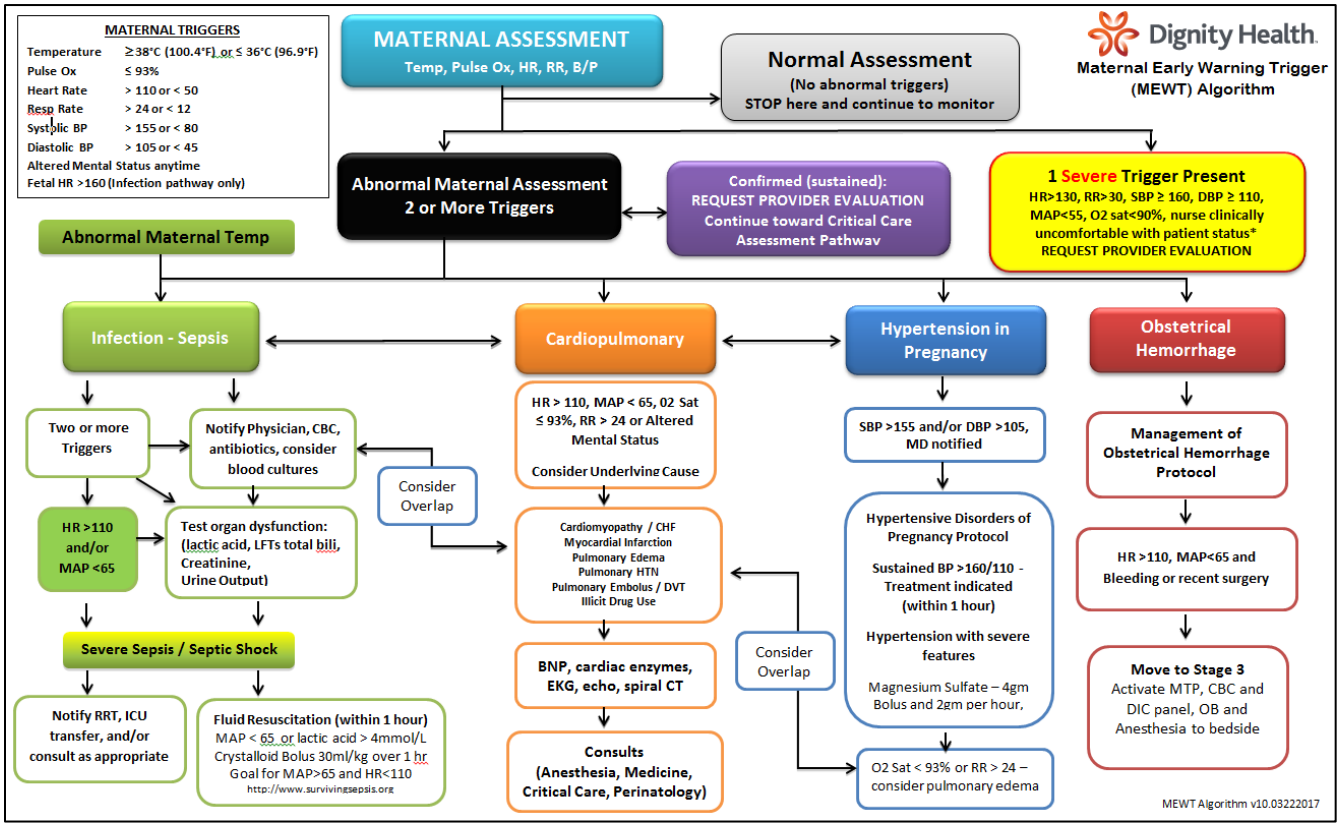
- The Maternal Early Warning Triggers have been used to elicit a "discern alert" to nursing staff when there is documentation of one (1) sustained Severe Trigger or two (2) sustained Maternal Triggers as defined above.
- These alerts should prompt the nurse to notify the provider, consider further evaluation and intervention (as described above), and monitor the patient closely.
- Cerner "discern alerts" will include the specific triggers and identified pathway for consideration. Staff and providers should consider the patient presentation and other assessment elements when deciding on a plan of care.
- Key reminders for ensuring alerts function as designed:
  - Early identification of potential maternal deterioration is critical. Therefore, nursing documentation of vital signs and assessment parameters should be complete as close to "real time" as possible.
  - The alerts reside in Cerner Powerchart Maternity and will not activate until the nurse is logged into the record.
  - The alerts will not activate in FetaLink, the fetal surveillance system.

Quality Improvement and Data Collection

- The Maternal Early Warning Trigger system has been designed to reduce maternal morbidity by early identification and a standardized and timely response.
- Hospital-level measures to consider for ongoing quality improvement include:
  - Process measures:
    - Compliance with evidence-based practice bundles (sepsis, hypertension in pregnancy, obstetrical hemorrhage)
    - Timeliness of provider notification
  - Outcome measures:
    - Several Maternal Morbidity rate
    - Maternal Admission to ICU
    - Rate of eclampsia, obstetrical massive transfusions (4 or more unitls of pRBC's), severe sepsis/septic shock

Note: obstetrical complications may require large numbers of patients observed to show improvement, therefore it is recommended that hospital-based measures be used to monitor same hospital comparisons over time to support the change process.

Maternal Early Warning Trigger (MEWT) Algorithm



bili, bilirubin; BNP, brain natriuretic peptide; BP, blood pressure; CBC; complete blood count; CT; computerized tomography; DBP, diastolic blood pressure; DIC, disseminated intravascular coagulation laboratory results; EKG, electrocardiogram; gm, grams; Hr, hour; HR, heart rate; ICU, intensive care unit; LFTs, liver function testing; MAP, mean arterial pressure; MTP, maternal transfusion protocol; OB, obstetrician; O2 Sat, oxygen saturation; PIH, preeclampsia laboratory assessment; Powerplan, electronic medical record preeclampsia order set; Pulse Ox, pulse oximetry; RR, respiratory rate; RRT, rapid response team; SBP, systolic blood pressure; Temp, temperature.

Resources for Implementation

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2. Hedriana HL, et al, Baseline assessment of a hospital-specific early warning trigger system for reducing maternal morbidity, Int J Gynecol Obstet (2015)
3. Maurice L. Druzin, MD; Laurence E. Shields, MD; Nancy L. Peterson, RNC, PNNP, MSN; Valerie Cape, BSBA (2013). *Preeclampsia Toolkit: Improving Health Care Response to Preeclampsia (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care).* California Department of Public Health; Maternal, Child and Adolescent Health Division; Published by the California Maternal Quality Care Collaborative.
4. *The California Pregnancy-Associated Mortality Review* (2011). Report from 2002 and 2003 Maternal Death Reviews: California Department of Public Health, Maternal Child and Adolescent Health Division. Sacramento.
5. Shields LE, Wiesner S, Klein C, et al. Use of Maternal Early Warning Trigger tool reduces maternal morbidity. Am J Obstet Gynecol 2016; 214:527.e1-6.

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