MICHAEL & SUSAN DELL
CENTER *for* HEALTHY LIVING

Healthy children in a healthy world.

We advance health and healthy living for children and families through cutting-edge research, innovative community-based programs, and dissemination of evidence-based practices.

STRATEGIC PLAN GOALS

Funding for this webinar provided by:

Michael & Susan Dell FOUNDATION

UTHealth Houston School of Public Health | Michael & Susan Dell Center for Healthy Living

Center Resources

WEBSITE
msdcenter.org

WEBINARS
go.uth.edu/webinars

NEWSLETTER
bit.ly/MSDCenterNewsletter

EXPERT BLOGS
go.uth.edu/CenterBlogs

SOCIAL MEDIA
@msdcenter

RESEARCH AND RESOURCE STATION
go.uth.edu/CenterResources

TX CHILD HEALTH STATUS REPORTS AND TOOLKITS
go.uth.edu/TexasChildHealth

VISIT OUR WEBSITE

UTHealth Houston School of Public Health

Michael & Susan Dell Center for Healthy Living

Maternal Early Warning Systems

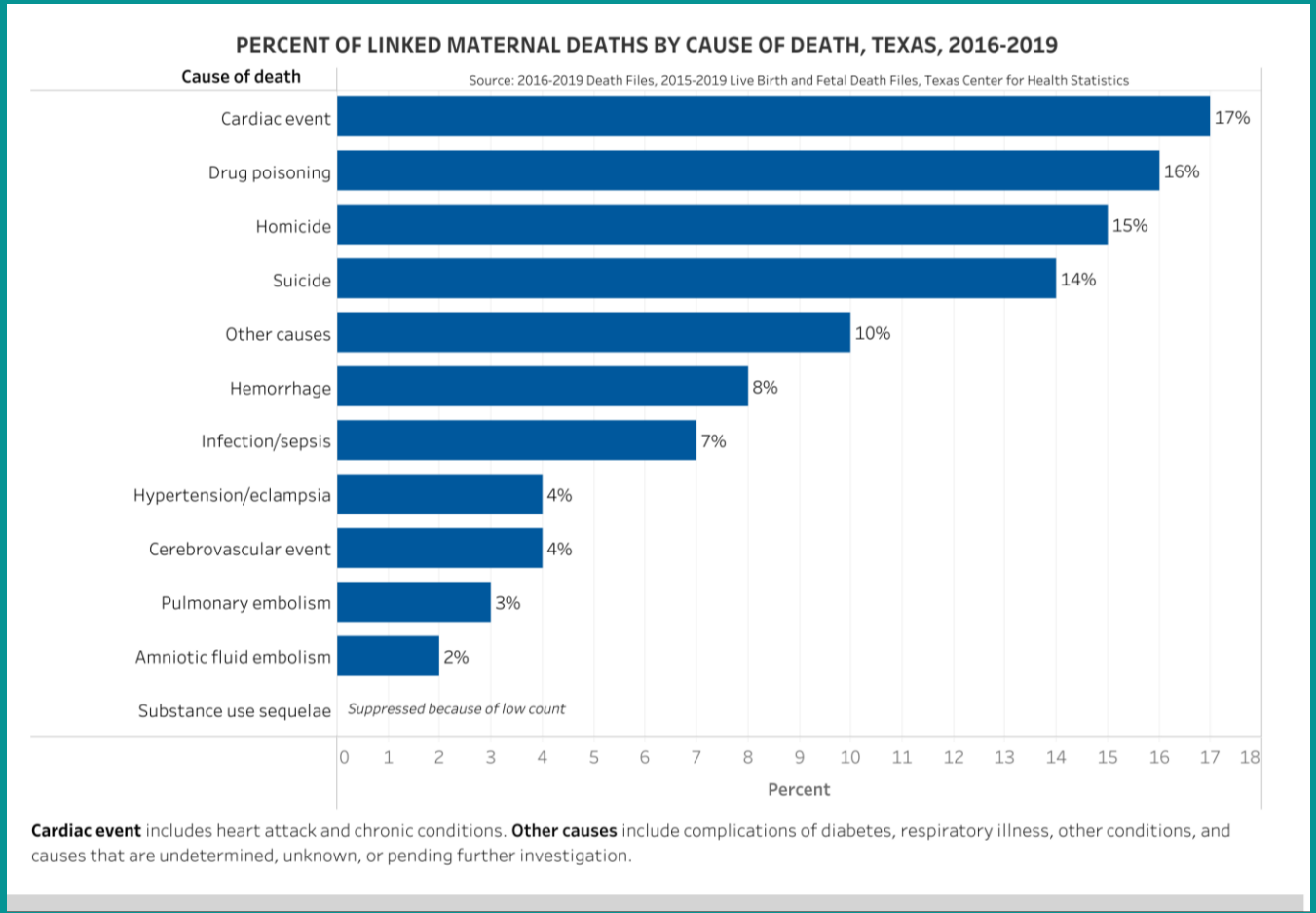
Carey Eppes MD MPH
Texas Collaborative for Healthy Mothers and Babies

Acknowledgement: Christina Davidson, Nagla Elerian, Divya Patel and Amanda Wagner

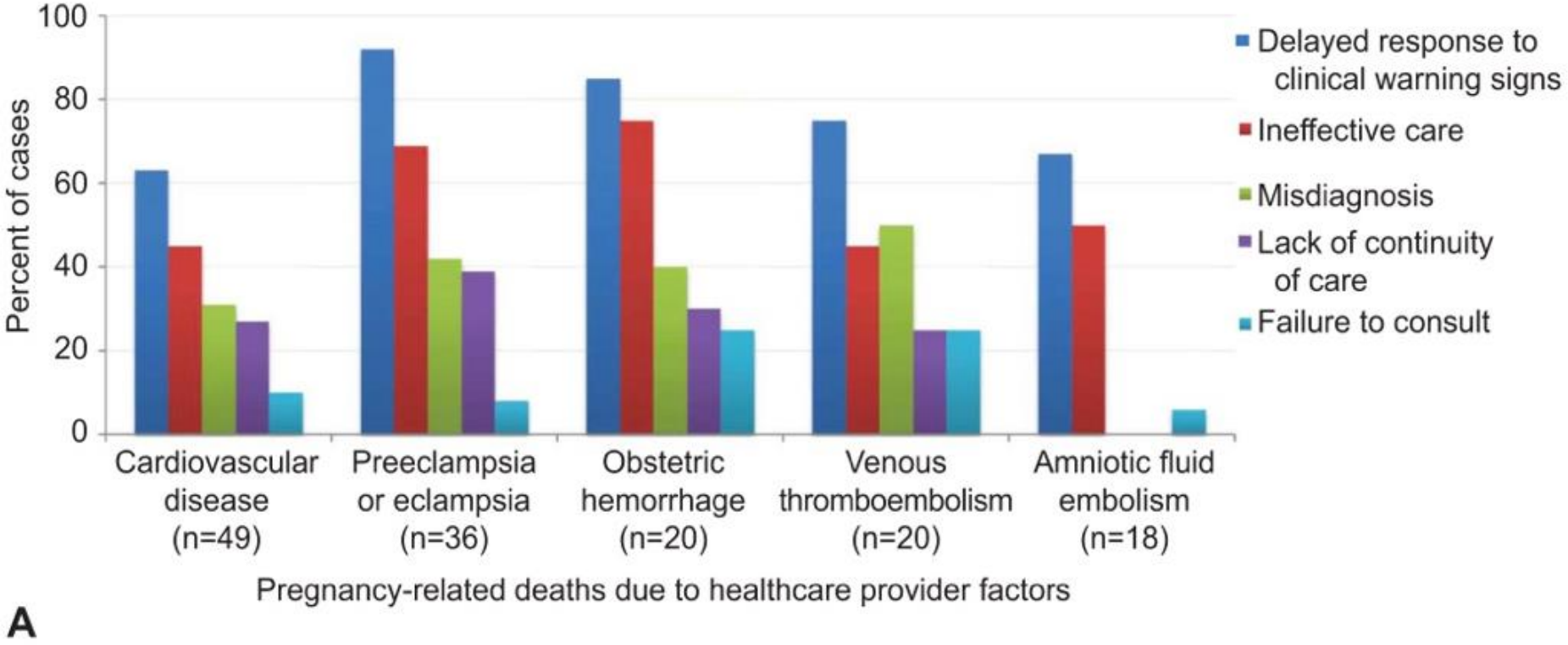
Objectives

- Review of maternal mortality & morbidity in Texas
- Discuss evidence supporting MEWS
- Illustrate parallels in the AIM Bundles and MEWS
- Highlight essential components to MEWS
- Address challenges with MEWS in Texas Hospitals
- Discuss how to conduct a MEWS QI Project
- Compare options for integrating MEWS into the EHR

MATERNAL
MORTALITY
SEVERE ACUTE
MATERNAL
MORBIDITY



Source: Texas Health Data. https://healthdata.dshs.texas.gov/dashboard/maternal-and-child-health/maternal-health/maternal-health



Main et al. Pregnancy-related mortality in California. Obstet Gynecol 2015

Maternal Early Warning Systems

Delays in recognition, diagnosis, and treatment precede majority of deaths from hemorrhage, hypertension, infection, venous thrombosis

Early signs of life-threatening illness are difficult to recognize in obstetric patients because they have substantial physiologic reserve to compensate

Early warning systems proposed to facilitate timely recognition, diagnosis, and treatment for women developing critical illness

Maternal Early Warning Systems

- System of escalation and response based on maternal vital signs
- Developed to facilitate timely recognition, diagnosis, and treatment for women developing critical illness

Table 1. The Maternal Early Warning Criteria

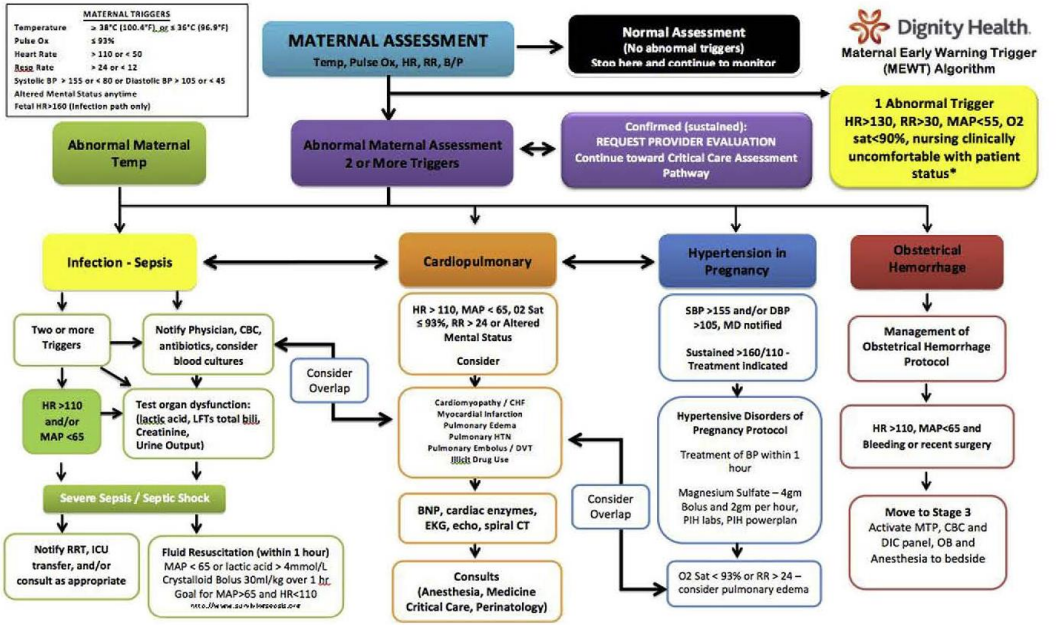
Systolic BP (mm Hg)	<90 or >160
Diastolic BP (mm Hg)	>100
Heart rate (beats per min)	<50 or >120
Respiratory rate (breaths per min)	<10 or >30
Oxygen saturation on room air, at sea level, %	<95
Oliguria, mL/hr for ≥2 hours	<35
Maternal agitation, confusion, or unresponsiveness; Patient with preeclampsia reporting a non-remitting headache or shortness of breath	

BP, blood pressure.

These triggers cannot address every possible clinical scenario that could be faced by an obstetric clinician and must not replace clinical judgment. As a core safety principle, bedside nurses should always feel comfortable to escalate their concerns at any point.

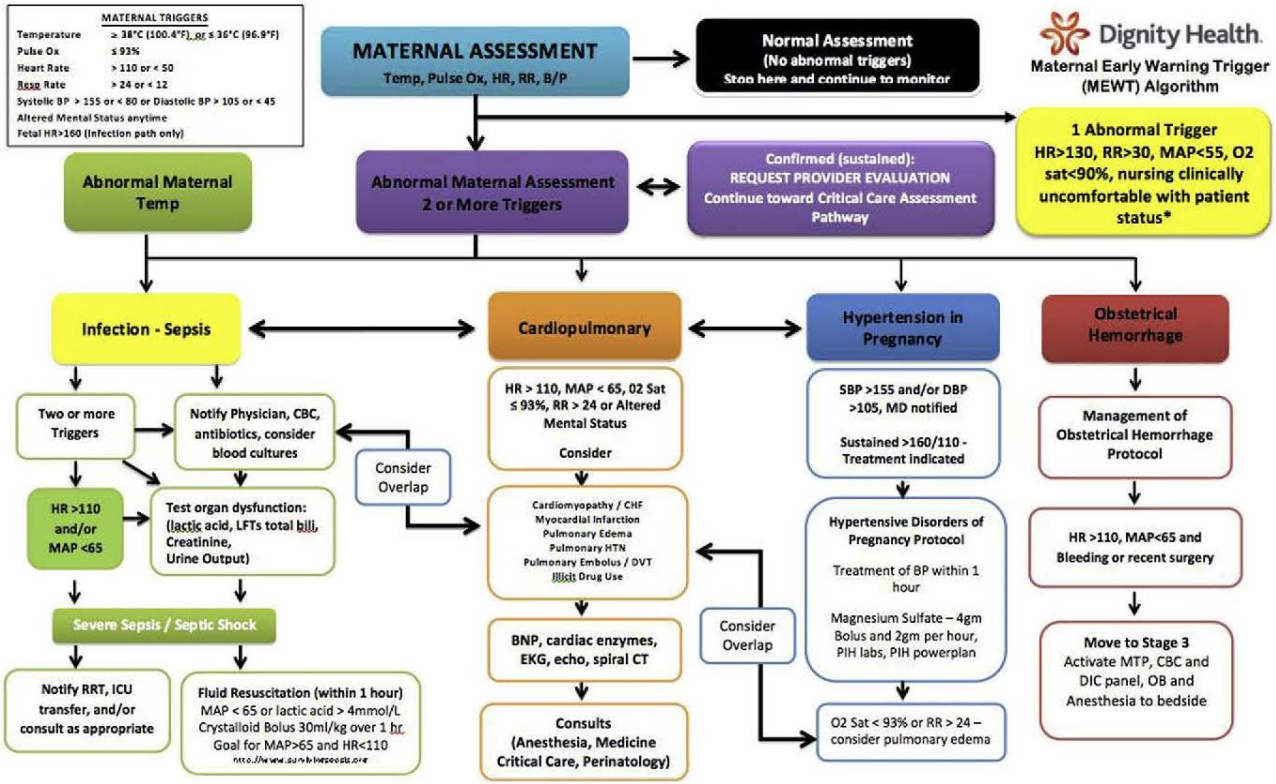
FIGURE

Flow diagram for maternal early warning trigger (MEWT) tool



FIGURE

Flow diagram for maternal early warning trigger (MEWT) tool



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.

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.

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.

Table 2 Description of morbidity events among 79 cases

Morbidity event defined by CDC ICD-10 Criteria[19]	*n* (%)
1. Blood transfusion	62 (78.5)
2. Pulmonary edema	12 (15.2)
3. Hysterectomy	11 (13.9)
4. Adult respiratory distress syndrome	8 (10.1)
5. Disseminated intravascular coagulation	7 (8.9)
6. Acute renal failure	7 (8.9)
7. Eclampsia	5 (6.3)
8. Sepsis	4 (5.1)
9. Internal injuries of the thorax, abdomen, pelvis	4 (5.1)
10. Cardiac monitoring	3 (3.8)
11. Shock	1 (1.3)
12. Myocardial infarction	1 (1.3)
13. Cardiac arrest	1 (1.3)
Additional morbidity data collected during chart review[a]	
14. Obstetric hemorrhage with ≥4 units packed red blood cells transfused	21 (26.6)
15. Prolonged postpartum length of stay (≥4 days vaginal delivery or ≥6 days cesarean delivery)	12 (15.2)
16. Preeclampsia with difficult to control severe hypertension	10 (12.7)
17. ICU admission (unplanned)	9 (11.4)
18. Maternal mortality	1 (1.3)

Table 3 Validity of trigger alert(s) *prior to the morbidity* to identify patients who experience a severe morbidity event overall and after restriction of case group by defined criteria a, b, and c

	Sensitivity (95% CI)	Specificity (95% CI)	LR± Sensitivity/ (1- Specificity)	LR− (1- Sensitivity)/ Specificity
Overall[a]	$p < 0.001$[b]	$p < 0.001$		
MEOWS	67.1% (55.6, 77.3)	51.2% (42.1, 60.3)	1.38 (1.08, 1.74)	0.64 (0.45, 0.92)
MERC	67.1% (55.6, 77.3)	60.2% (51.0, 68.9)	1.68 (1.29, 2.20)	0.55 (0.39, 0.77)
MEWS	19.0% (11.0, 29.4)	93.5% (87.6, 97.2)	2.92 (1.30, 6.56)	0.87 (0.77, 0.97)
MEWT	40.5% (29.6, 52.2)	88.6% (81.6, 93.6)	3.56 (2.03, 6.24)	0.67 (0.55, 0.81)
(a) Excluded 25 cases coded "Emergency without warning"[c]	$p < 0.001$	Same as overall		
MEOWS	74.1% (60.4, 85.0)		1.52 (1.19, 1.93)	0.51 (0.31, 0.82)
MERC	74.1% (60.4, 85.0)		1.86 (1.42, 2.43)	0.43 (0.27, 0.69)
MEWS	22.2% (12.0, 35.6)		3.42 (1.48, 7.88)	0.83 (0.72, 0.97)
MEWT	44.4% (30.9, 58.6)		3.90 (2.19, 6.95)	0.63 (0.49, 0.80)
(b) Excluded 52 cases where transfusion delay < = 12 hour	$p < 0.001$	Same as overall		
MEOWS	88.9% (70.8, 97.7)		1.82 (1.46, 2.28)	0.22 (0.07, 0.64)
MERC	96.3% (81.0, 99.9)		2.42 (1.92, 3.04)	0.06 (0.01, 0.42)
MEWS	22.2% (8.6, 42.3)		3.42 (1.29, 9.04)	0.83 (0.68, 1.02)
MEWT	59.3% (38.8, 77.6)		5.21 (2.90, 9.34)	0.46 (0.29, 0.73)

Blumenthal EA, Hooshvar N, McQuade M, McNulty J. A Validation Study of Maternal Early Warning Systems: A Retrospective Cohort Study. Am J Perinatol. 2019 Sep;36(11):1106-1114. doi: 10.1055/s-0039-1681097. Epub 2019 Mar 11.

Table 2. Outcomes assessed by the EWS effectiveness studies (n = 6).

	Outcome measures						
Publication	Morbidity	ICU admission	Maternal Death	Vital sign recording	Time lag*	Preop stabilization**	Referral rate#
Austin DM et al., 2013	✓						
Maguire PJ et al., 2015				✓	✓		
Maguire PJ et al., 2016		✓					
Shields E L et al. 2016	✓	✓					
Sheikh S et al., 2017		✓	✓				✓
Merriel A et al., 2017						✓	

*Time lag: time interval between trigger and review.

**Preop stabilization: clinical actions taken to optimize patients undergoing a caesarean section.

Referral rate: rate of referral of sick patients to a higher level of care, including critical/intensive care

- MEWS identified had very high median sensitivity—89% and specificity—85%
- MEWS had low median positive predictive values—41% for predicting morbidity or ICU admission.
- MEWS had a high accuracy in predicting death (AUROC >0.80) among critically ill obstetric patients.

Umar A, Ameh CA, Muriithi F, Mathai M (2019) Early warning systems in obstetrics: A systematic literature review. PLoS ONE 14(5): e0217864. https://doi.org/10.1371/journal. pone.0217864

“The pursuit of safety is not so much about preventing isolated failures, either human or technical, as about making the system as robust as is practicable in the face of its human and operational hazards.” – Reason 2000

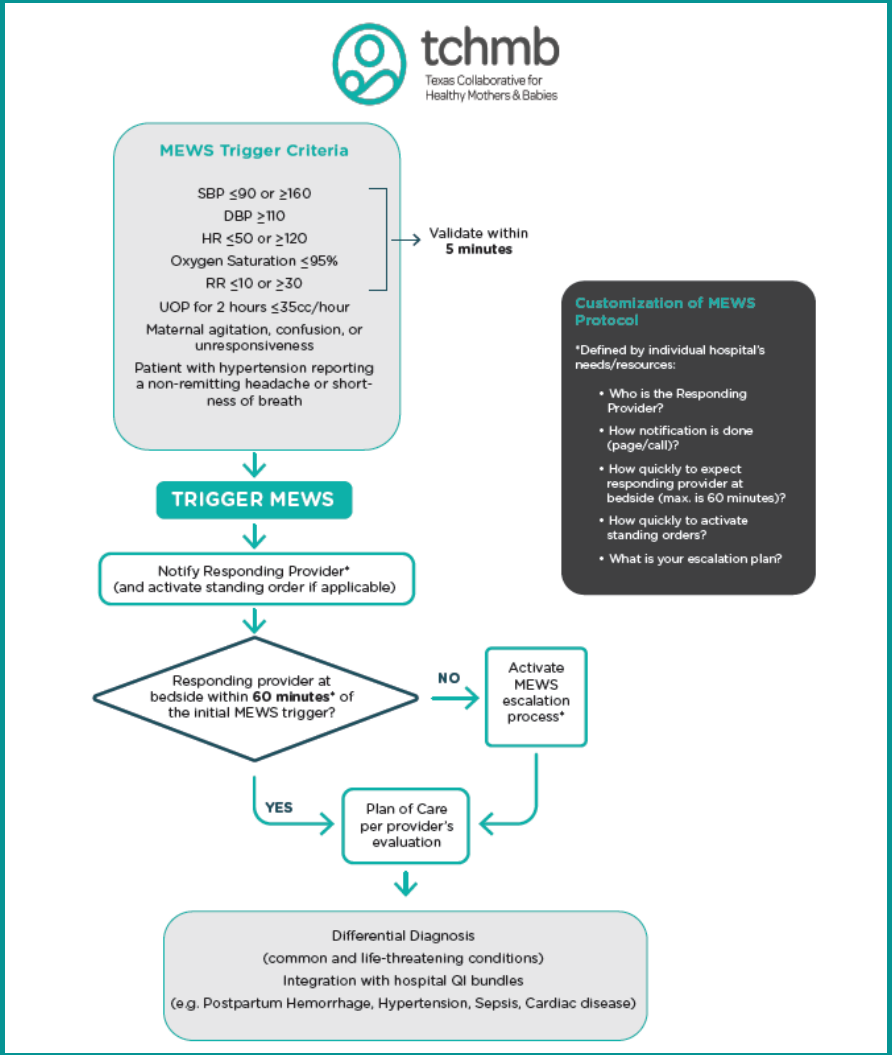
Essential Components of MEWS

- Early Warning Criteria
  - Defined abnormal parameters
- Prompt Reporting
  - Effective Notification and Escalation Policy
- Bedside Evaluation
  - Standardized communication and documentation

Essential Components of MEWS

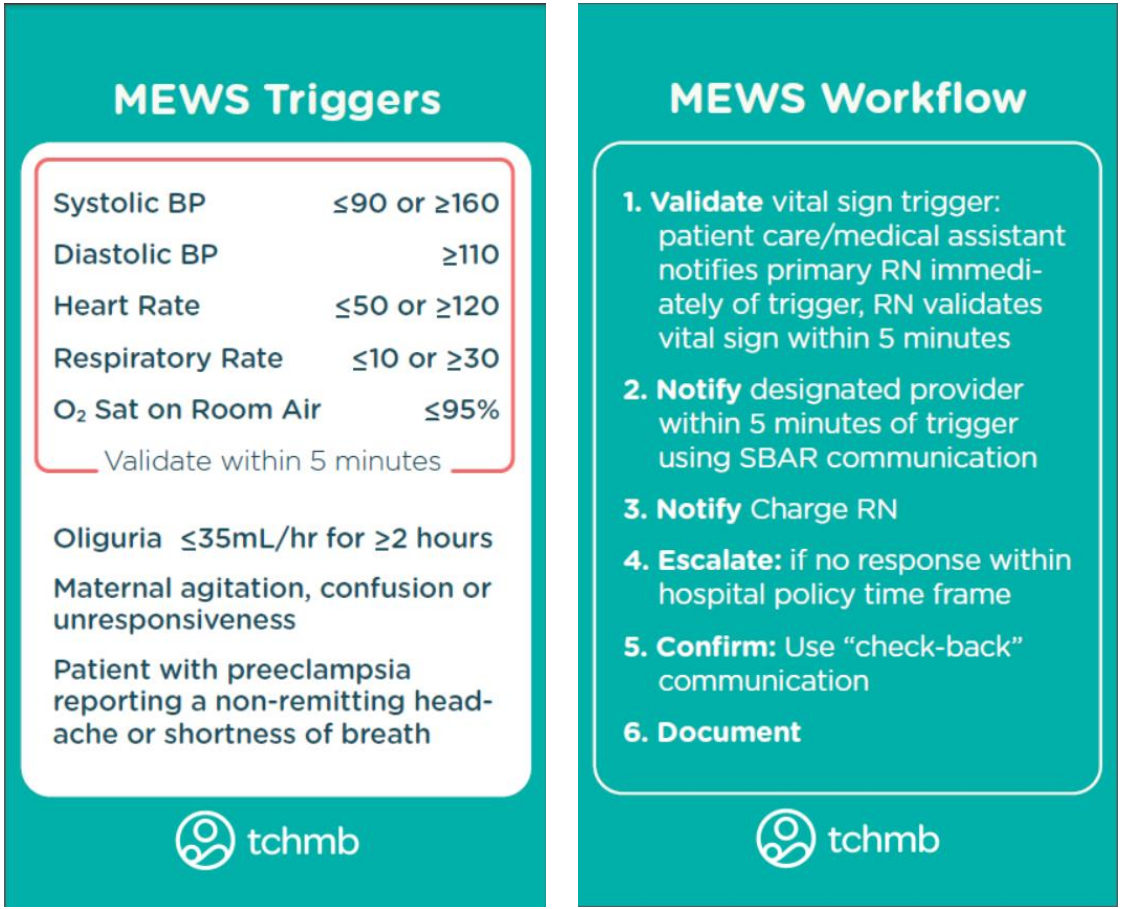
Early Warning Criteria

Maternal Early Warning System Protocol



tchmb

MEWS Badge Buddy



tchmb

AIM

ALLIANCE FOR INNOVATION ON MATERNAL HEALTH

Maternal Early Warning System Implementation Resource Kit

tchmb

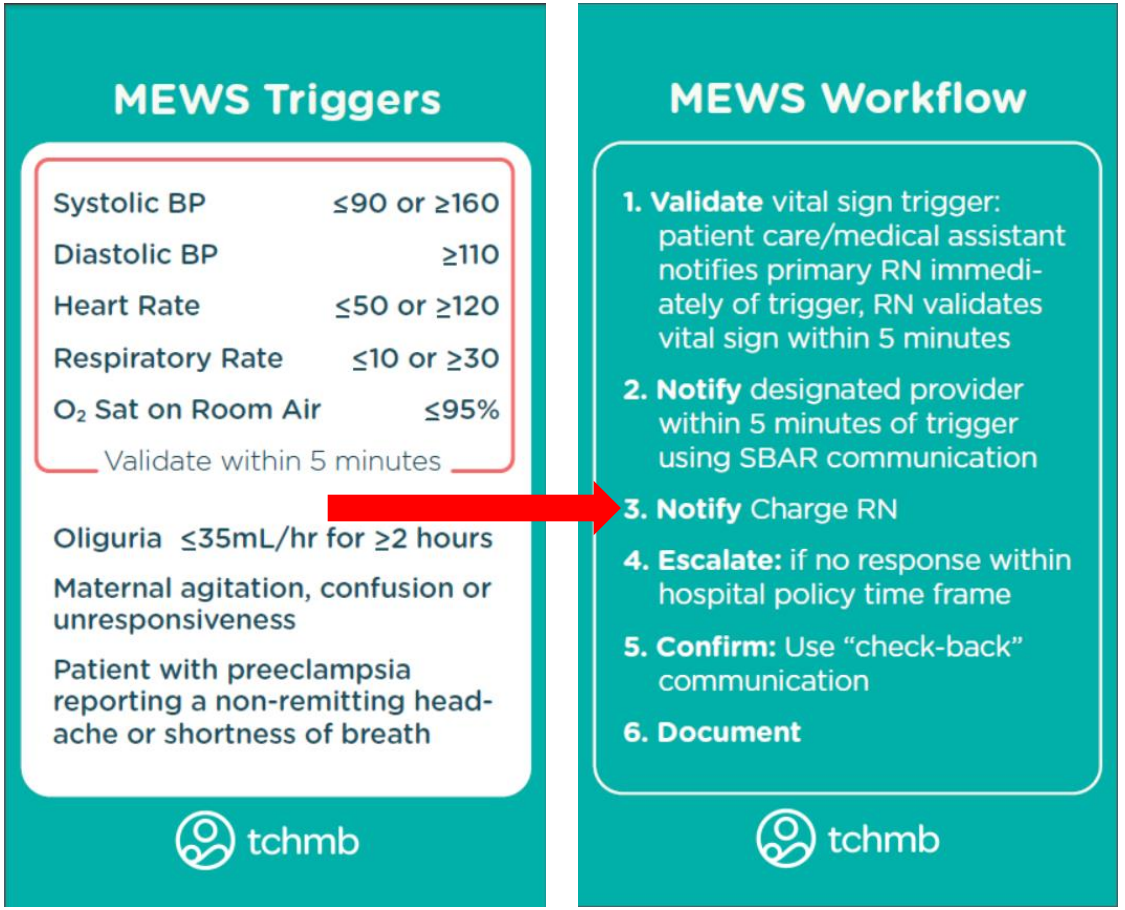
Resource Kit Key

Examples indicated by this symbol are models of programs, agreements, protocols, and checklists that can be reviewed and adapted to needs and clinical settings.

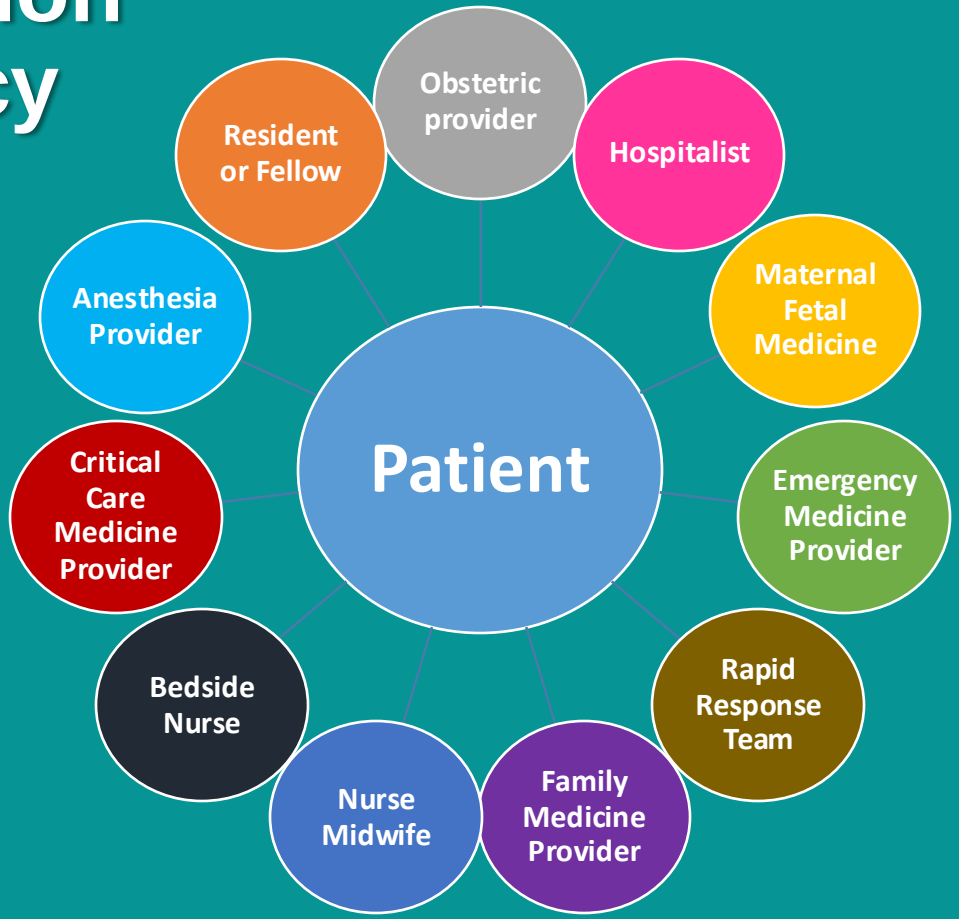
Resources indicated by this symbol are materials that are ready for immediate use by providers, facilities, and health systems.

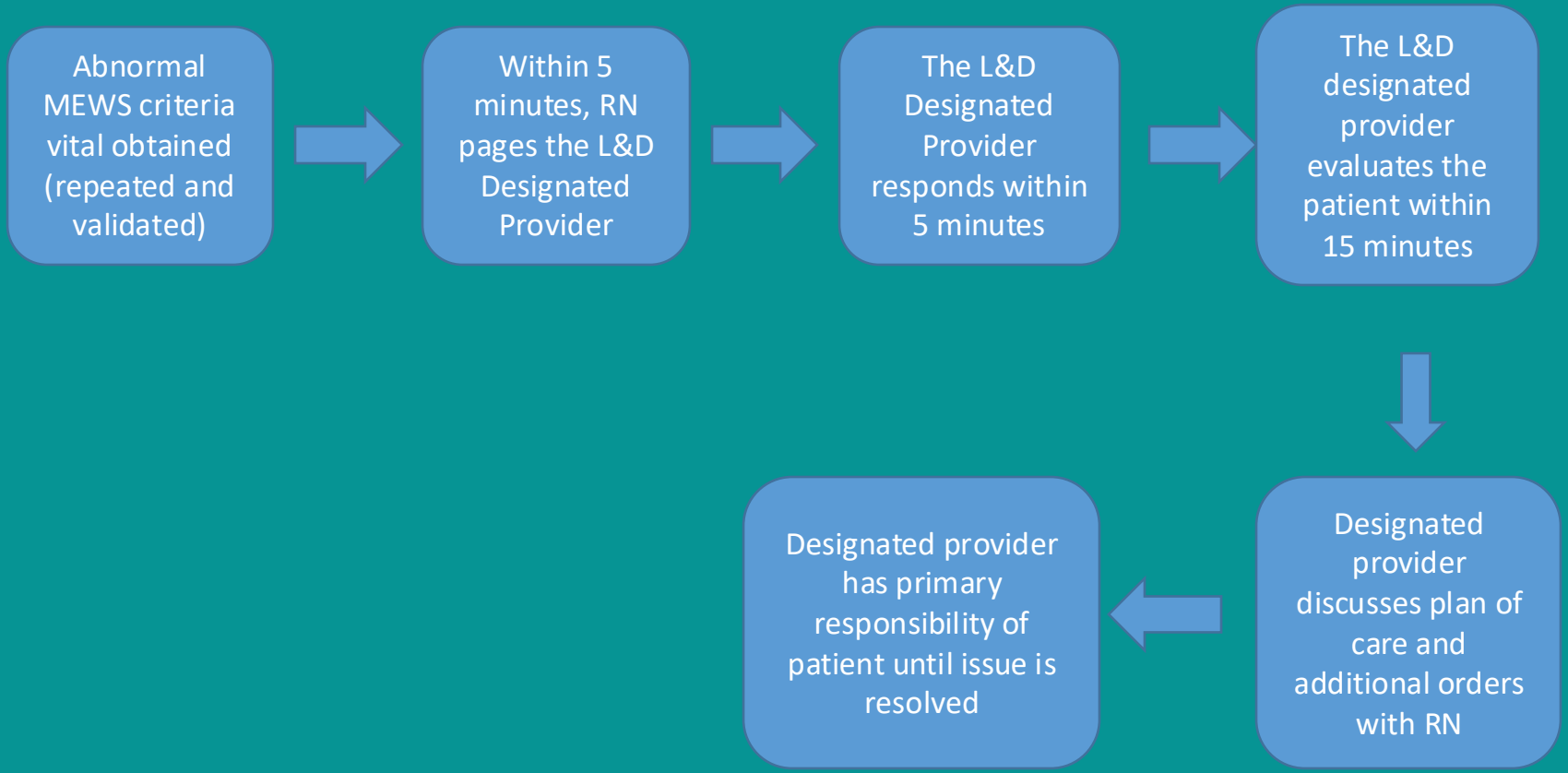
Essential Components of MEWS Prompt Reporting

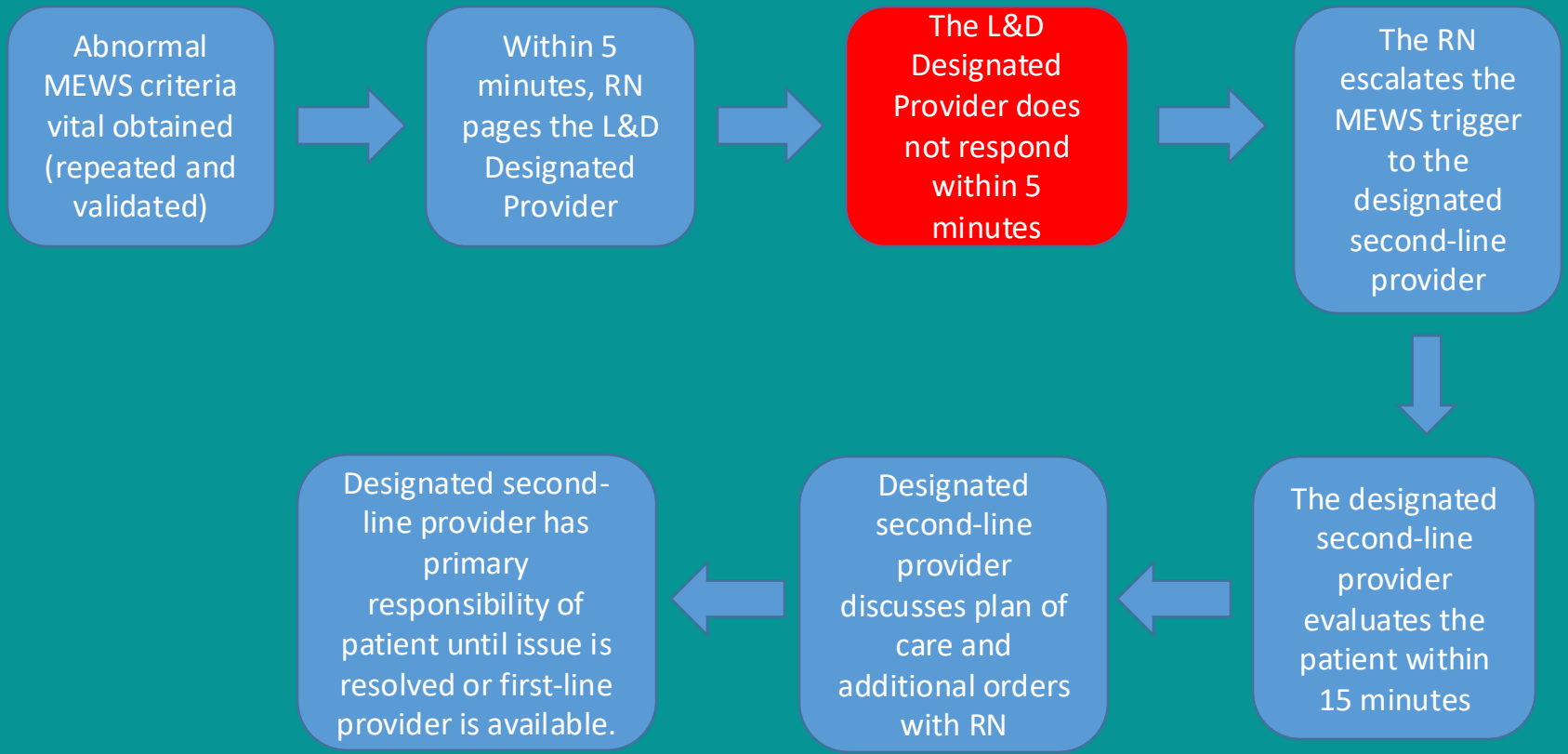
MEWS Badge Buddy



Effective Notification & Escalation Policy




Abnormal MEWS criteria vital obtained (repeated and validated)
Within 5 minutes, RN pages the L&D Designated Provider
The L&D Designated Provider responds within 5 minutes
The L&D designated provider evaluates the patient within 15 minutes
Designated provider discusses plan of care and additional orders with RN
Designated provider has primary responsibility of patient until issue is resolved


Abnormal MEWS criteria vital obtained (repeated and validated)
Within 5 minutes, RN pages the L&D Designated Provider
The L&D Designated Provider does not respond within 5 minutes
The RN escalates the MEWS trigger to the designated second-line provider
The designated second-line provider evaluates the patient within 15 minutes
Designated second-line provider discusses plan of care and additional orders with RN
Designated second-line provider has primary responsibility of patient until issue is resolved or first-line provider is available.

Essential Components of MEWS
Bedside Evaluation and Communication

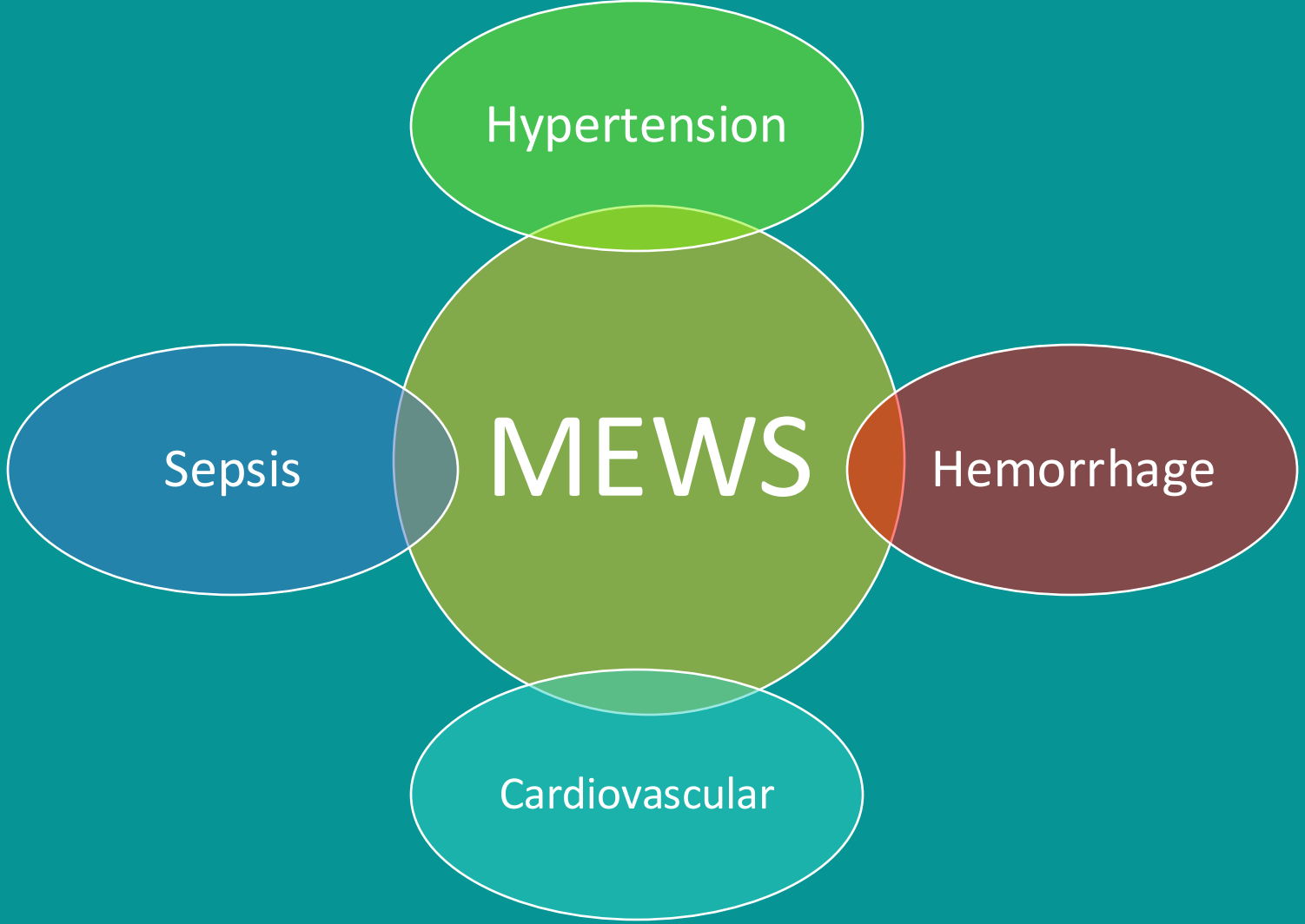
Bedside Evaluation

- Initiate resuscitative and diagnostic interventions
- Consider appropriate differential until diagnosis is confirmed or criteria resolves
- MEWS does not replace obstetric emergency systems
  - If bedside evaluation concerning for critical illness, activate Obstetric emergency response teams, rapid response teams
- Establish chain of command to escalate clinical care concerns

MEWS Triggers and Common Diagnoses

Hypertension SBP >160	Hypotension SBP <90	Tachycardia HR >120	Bradycardia
• Chronic hypertension • Preeclampsia • Sympathomimetic medications	• Dehydration • Hypovolemia from hemorrhage • Regional anesthesia • Medications side effect • Sepsis • Vasovagal reaction • Cardiogenic shock	• Sepsis • Hypovolemia from hemorrhage • Medication side effect • Anxiety • Hyperthyroidism • Tachyarrhythmia	• Vasovagal reaction • Medication side effect • Bradyarrhythmia

Mhyre J, et al. Obstet Gynecol 2014;124:782–6


Hypertension
Sepsis
MEWS
Hemorrhage
Cardiovascular

Communication

- Clinician to primary nurse
- Primary nurse to charge nurse
- Clinician to patient's obstetric provider

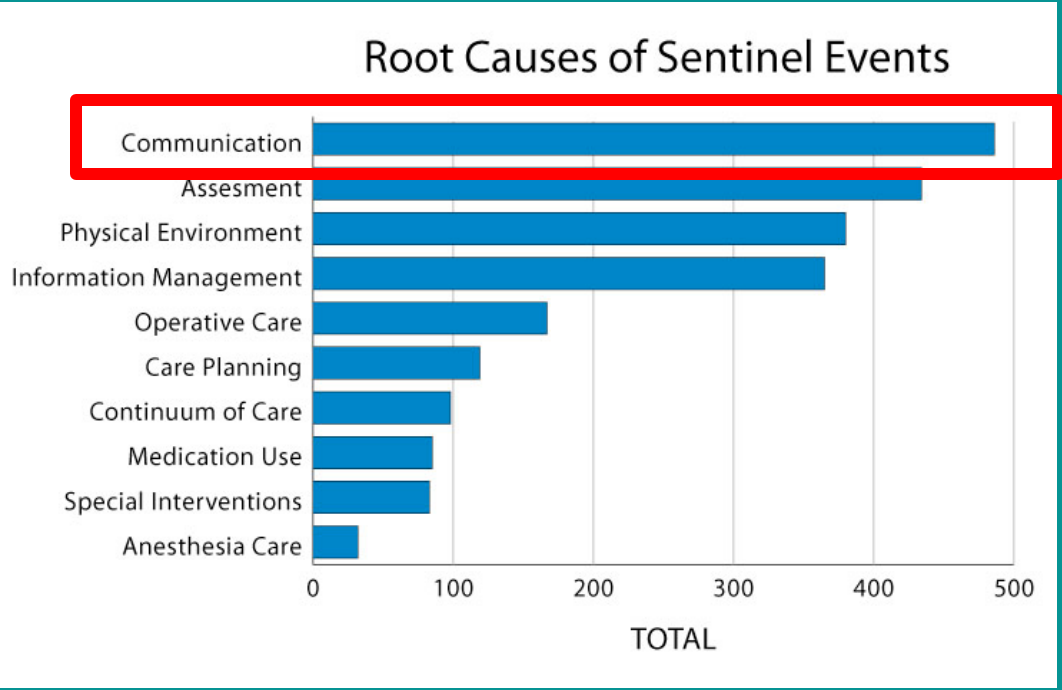
Communication

Failures in communication are the most common root cause for near misses and adverse events in the medical domain

Tue, Mar 22, 2011 Week: 3

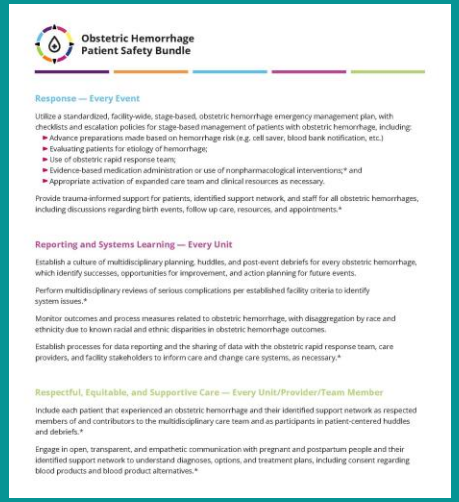
Photo Credit: https://www.slideshare.net/Drachsler/the-handover-project-improving-the-continuity-of-patient-care-through-identification-and-implementation-of-novel-patient-handoff-processes-in-europe

Communication Failures



Joint Commission. (2011). Sentinel Event Statistics Data - Root Causes by Event Type (2004 - Third Quarter 2011)
Rosenbluth G, West DC. Better Handoffs and Safer Care: Preliminary Results of the I-PASS Study. UCSF. Available at: http://meded.ucsf.edu/sites/meded.ucsf.edu/files/documents/graduate-medical-education/rosenbluthipass.pdf. Accessed Feb. 27, 2017.

Establish a culture of multidisciplinary briefs, huddles and debriefs



Obstetric Hemorrhage Patient Safety Bundle

Response — Every Event

Utilize a standardized, facility-wide, stage-based, obstetric hemorrhage emergency management plan, with checklists and escalation policies for stage-based management of patients with obstetric hemorrhage, including:

- Advance preparations made based on hemorrhage risk (e.g. cell saver, blood bank notification, etc.)
- Evaluating patients for etiology of hemorrhage;
- Use of obstetric rapid response team;
- Evidence-based medication administration or use of nonpharmacological interventions;* and
- Appropriate activation of expanded care team and clinical resources as necessary.

Provide trauma-informed support for patients, identified support network, and staff for all obstetric hemorrhages, including discussions regarding birth events, follow up care, resources, and appointments.*

Reporting and Systems Learning — Every Unit

Establish a culture of multidisciplinary planning, huddles, and post-event debriefs for every obstetric hemorrhage, which identify successes, opportunities for improvement, and action planning for future events.

Perform multidisciplinary reviews of serious complications per established facility criteria to identify system issues.*

Monitor outcomes and process measures related to obstetric hemorrhage, with disaggregation by race and ethnicity due to known racial and ethnic disparities in obstetric hemorrhage outcomes.

Establish processes for data reporting and the sharing of data with the obstetric rapid response team, care providers, and facility stakeholders to inform care and change care systems, as necessary.*

Respectful, Equitable, and Supportive Care — Every Unit/Provider/Team Member

Include each patient that experienced an obstetric hemorrhage and their identified support network as respected members of and contributors to the multidisciplinary care team and as participants in patient-centered huddles and debriefs.*

Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network to understand diagnoses, options, and treatment plans, including consent regarding blood products and blood product alternatives.*

Cardiac Conditions in Obstetric Care

Response — Every Event

Facility-wide standard protocols with checklists and escalation policies for management of **cardiac symptoms**.

Facility-wide standard protocols with checklists and escalation policies for management of people with **known or suspected cardiac conditions**.

Coordinate transitions of care including the discharge from the birthing facility to home and transition from postpartum care to ongoing primary and specialty care.

Offer reproductive life planning discussions and resources, including access to a full range of contraceptive options in accordance with safe therapeutic regimens. *

Provide patient education focused on general life-threatening postpartum complications and early warning signs, including instructions of who to notify if they have concerns, and time and date of a scheduled postpartum visit.

Reporting and Systems Learning — Every Unit

For pregnant and postpartum people at high risk for a cardiac event, establish a culture of multidisciplinary planning, admission huddles and post-event debriefs.

Perform multidisciplinary reviews of serious complications (e.g. ICU admissions for other than observation) to identify systems issues.

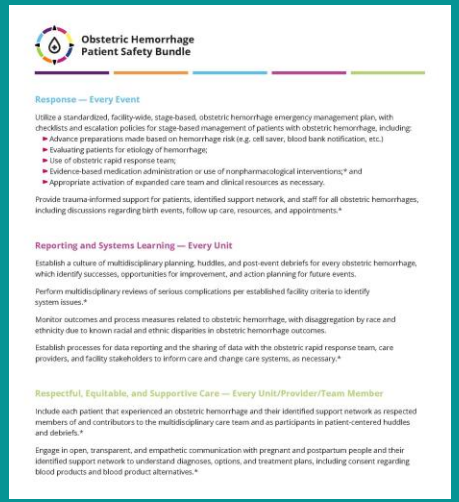
Monitor outcomes and process data related to cardiac conditions, with disaggregation by race and ethnicity due to known disparities in rates of cardiac conditions experienced by Black and Indigenous pregnant and postpartum people.

Respectful, Equitable, and Supportive Care — Every Unit/Provider/Team Member

Screen for structural and social drivers of health that might impact clinical recommendations or treatment plans and provide linkage to resources that align with the pregnant or postpartum person's health literacy, cultural needs, and language proficiency.

Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network to understand diagnoses, options, and treatment plans.

Include each pregnant or postpartum person and their identified support network as respected members of and contributors to the multidisciplinary care team.*



Obstetric Hemorrhage Patient Safety Bundle

Response — Every Event

Utilize a standardized, facility-wide, stage-based, obstetric hemorrhage emergency management plan, with checklists and escalation policies for stage-based management of patients with obstetric hemorrhage, including:

- Advance preparations made based on hemorrhage risk (e.g. cell saver, blood bank notification, etc.)
- Evaluating patients for etiology of hemorrhage;
- Use of obstetric rapid response team;
- Evidence-based medication administration or use of nonpharmacological interventions;* and
- Appropriate activation of expanded care team and clinical resources as necessary.

Provide trauma-informed support for patients, identified support network, and staff for all obstetric hemorrhages, including discussions regarding birth events, follow up care, resources, and appointments.*

Reporting and Systems Learning — Every Unit

Establish a culture of multidisciplinary planning, huddles, and post-event debriefs for every obstetric hemorrhage, which identify successes, opportunities for improvement, and action planning for future events.

Perform multidisciplinary reviews of serious complications per established facility criteria to identify system issues.*

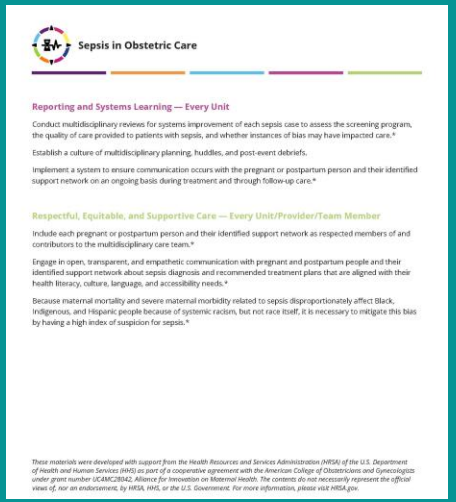
Monitor outcomes and process measures related to obstetric hemorrhage, with disaggregation by race and ethnicity due to known racial and ethnic disparities in obstetric hemorrhage outcomes.

Establish processes for data reporting and the sharing of data with the obstetric rapid response team, care providers, and facility stakeholders to inform care and change care systems, as necessary.*

Respectful, Equitable, and Supportive Care — Every Unit/Provider/Team Member

Include each patient that experienced an obstetric hemorrhage and their identified support network as respected members of and contributors to the multidisciplinary care team and as participants in patient-centered huddles and debriefs.*

Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network to understand diagnoses, options, and treatment plans, including consent regarding blood products and blood product alternatives.*



Sepsis in Obstetric Care

Reporting and Systems Learning — Every Unit

Conduct multidisciplinary reviews for systems improvement of each sepsis case to assess the screening program, the quality of care provided to patients with sepsis, and whether instances of bias may have impacted care.*

Establish a culture of multidisciplinary planning, huddles, and post-event debriefs.

Implement a system to ensure communication occurs with the pregnant or postpartum person and their identified support network on an ongoing basis during treatment and through follow-up care.*

Respectful, Equitable, and Supportive Care — Every Unit/Provider/Team Member

Include each pregnant or postpartum person and their identified support network as respected members of and contributors to the multidisciplinary care team.*

Engage in open, transparent, and empathetic communication with pregnant and postpartum people and their identified support network about sepsis diagnosis and recommended treatment plans that are aligned with their health literacy, culture, language, and accessibility needs.*

Because maternal mortality and severe maternal morbidity related to sepsis disproportionately affect Black, Indigenous, and Hispanic people because of systemic racism, but not race itself, it is necessary to mitigate this bias by having a high index of suspicion for sepsis.*

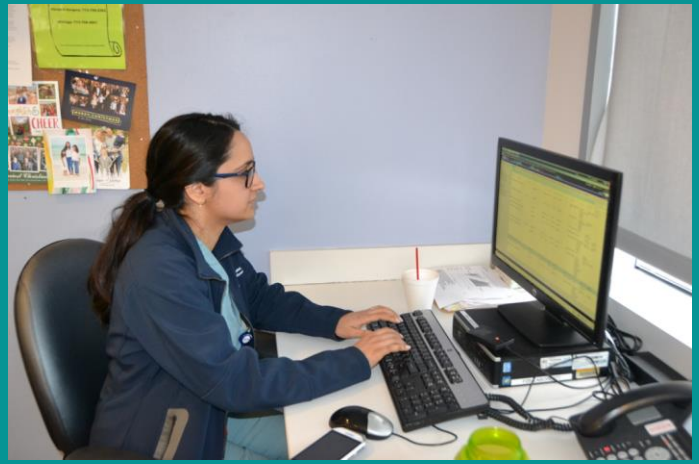
These materials were developed with support from the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) as part of a cooperative agreement with the American College of Obstetricians and Gynecologists under grant number UC4MC28042. Alliance for Innovation on Maternal Health. The contents do not necessarily represent the official views of, nor an endorsement, by HRSA, HHS, or the U.S. Government. For more information, please visit HRSA.gov.

Somewhere in Houston….

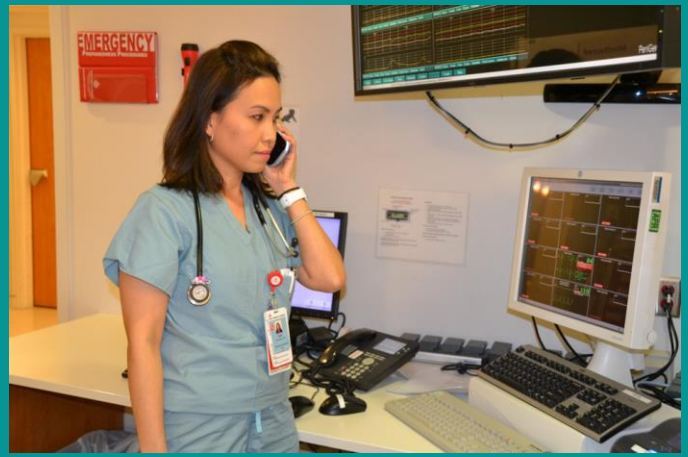
0800: Patient Care Assistant (PCA) checking vital signs on Mother Baby Unit

- Blood pressure: 165/103

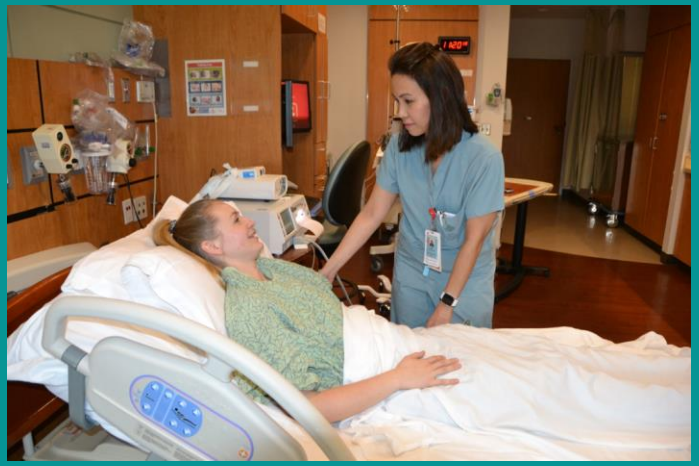
0845: PCA documents blood pressure of 165/103 in electronic health record (EHR)



0850: Primary provider logs in to EHR and is given a Best Practice Alert for severe hypertension (165/103)



0900: Primary provider calls RN and requests validation of vital signs



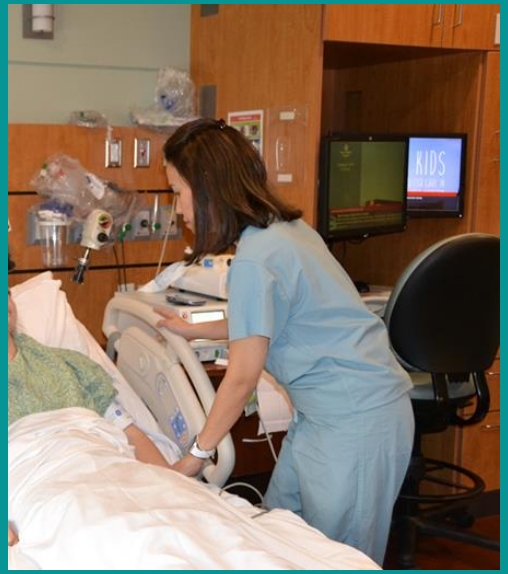
0915: RN assesses patient and re-checks vital signs

0920: RN calls primary provider back to inform of BP 170/106 and new onset headache

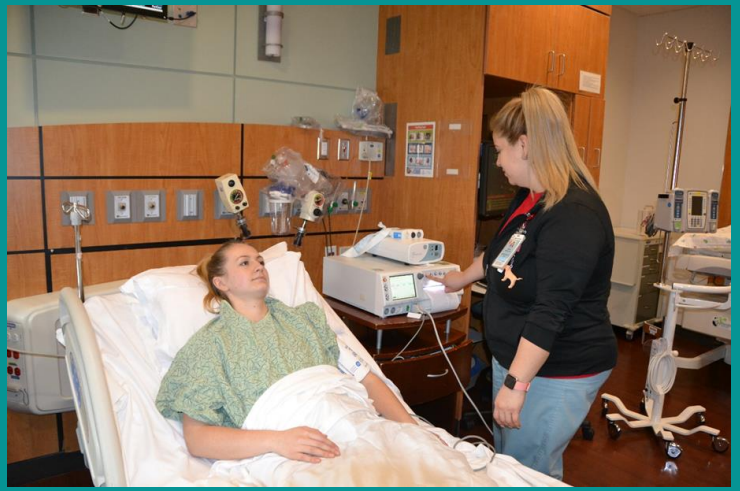
- **No orders received**

1000: Primary provider at bedside

- **Headache 7/10, new onset visual disturbances**
- **Primary provider orders:**
  - ✓ **Preeclampsia labs**
  - ✓ **Nifedipine 10mg PO now for BP**
  - ✓ **Tylenol 650 mg PO now for headache**
  - ✓ **Vital signs q 15 minutes until severe hypertension resolution**
  - ✓ **Transfer to higher level of care for Magnesium Sulfate administration**



1015: RN administers antihypertensive and tylenol



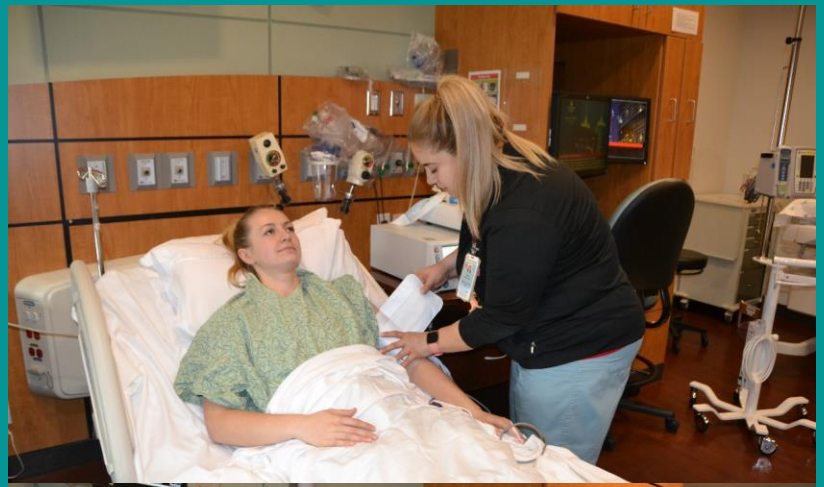
PCA takes vital signs Q 15 minutes after medication administration

- **1045: BP 155/89**

SUMMARY

- Time of initial severe hypertension trigger: 0800
- Time of provider to bedside: 1000
- Amount of time from severe hypertension to treatment: 135 minutes
- Amount of time to resolution of severe hypertension trigger: 165 minutes

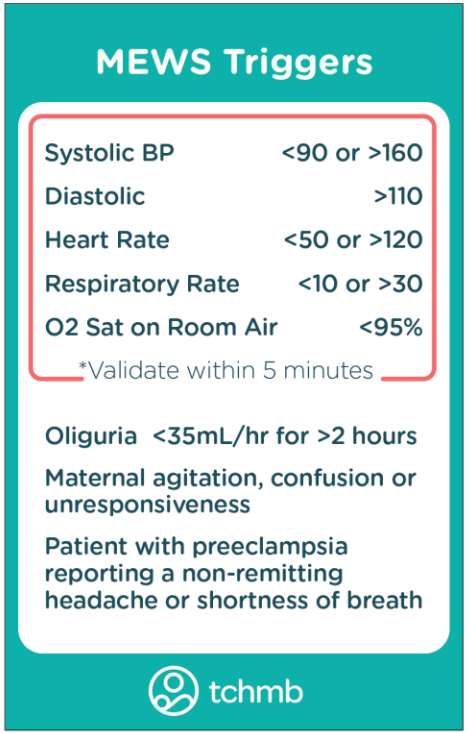
Somewhere else in Houston……

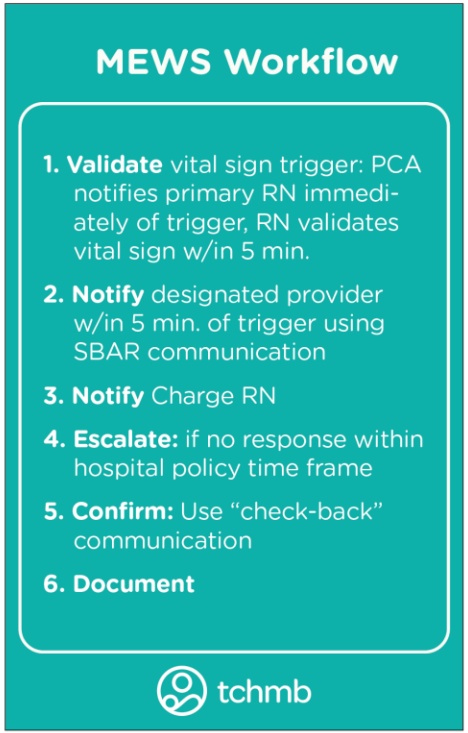


0800: PCA checking vital signs and validating

- **Blood pressure: 165/103**

Validate vital signs within 5 minutes





PCA immediately notifies RN of MEWS trigger vital sign

0805: RN evaluates patient and validates vital signs

0807: RN calls responding provider

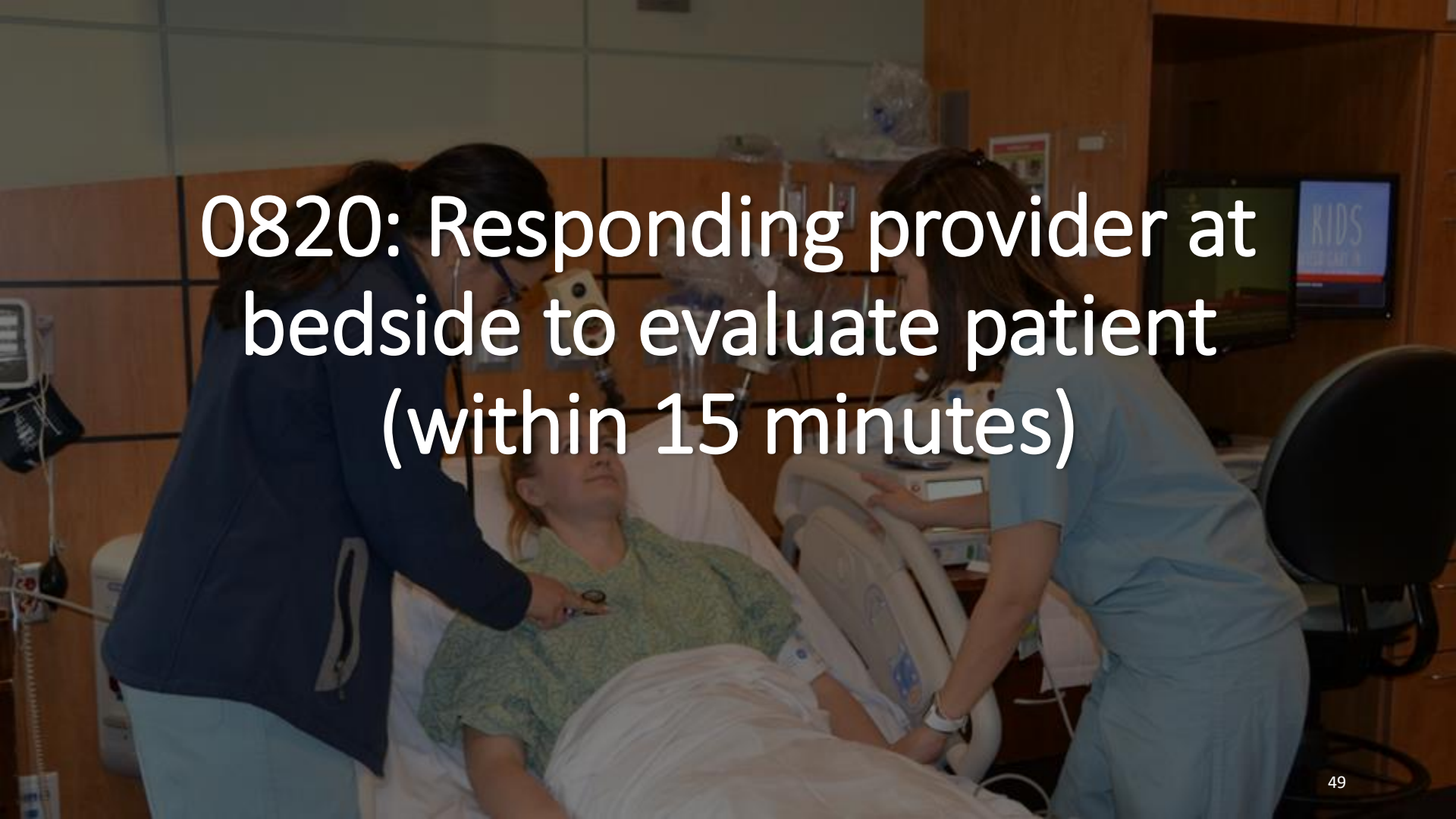
S: Hi Dr. Jones. This is Lisa calling to report that Ms. Smith had a MEWS trigger with a blood pressure of **165/103**. Her other vital signs are normal: HR 89, RR 17, SP02 99%.

B: She was admitted earlier today with elevated blood pressure and a headache to evaluate for preeclampsia. She is 35 year old G4P3 at 32 weeks gestation.

A: Her headache remains 5/10; she denies visual changes and her DTRs are 2+.

R: The patient needs a provider assessment now. I will see you at the bedside within 15 minutes for an evaluation.

0810: Bedside RN notifies Charge RN of MEWS activation



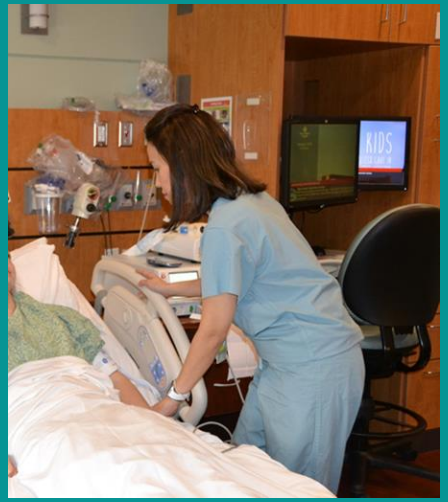
0820: Responding provider at bedside to evaluate patient (within 15 minutes)

Responding provider will:

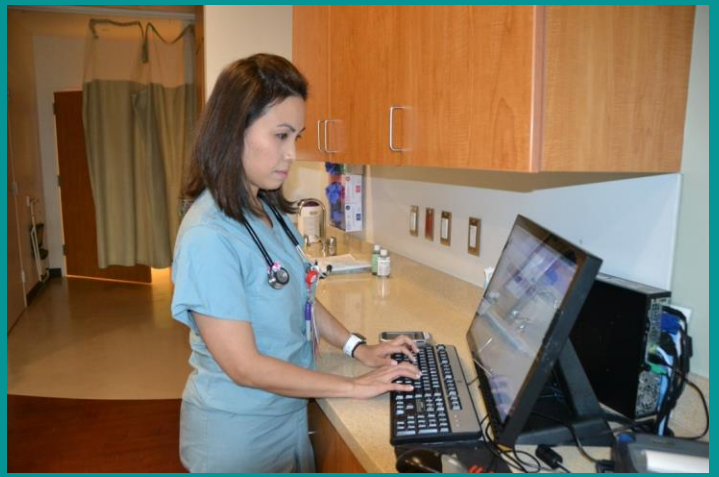
- Assume patient care responsibility until MEWS is resolved or patient is handed off to another provider
- Report findings to patient's primary provider

0822: Responding provider and RN discuss differential diagnosis, planned frequency of monitoring & re-evaluation, work up, plan of care (including orders)

***Check-Back communication: Use closed-loop communication to ensure that information conveyed by the sender is understood by the receiver as intended.**



0828: RN administers antihypertensive



0840: RN documents MEWS trigger and events in EHR

0843: PCA takes vital signs Q 15 minutes after medication administration

0858: B/P 155/89

SUMMARY

- **Time of initial MEWS trigger: 0800**
- **Time of provider to bedside: 0820**
- **Amount of time from severe hypertension to treatment: 28 minutes**
- **Amount of time to resolution of MEWS trigger: 58 minutes**

Goal: Treat severe hypertension within 60 minutes

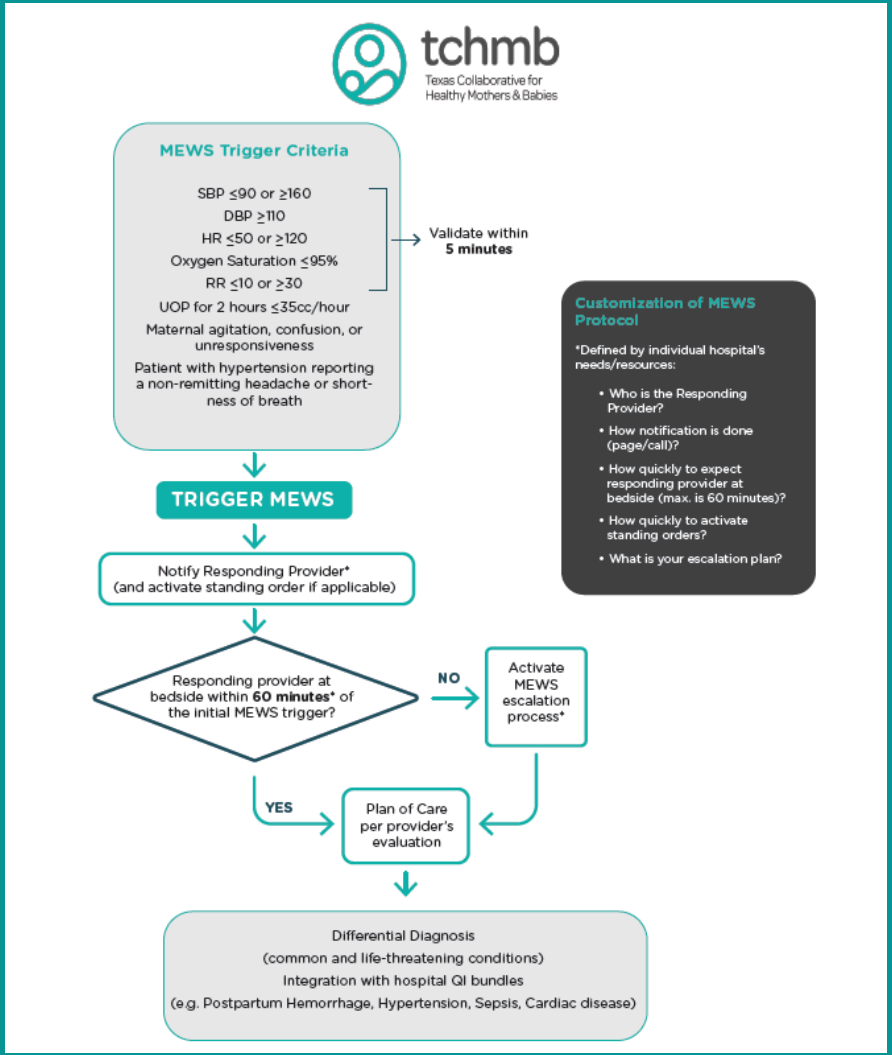
Scenario 1

- PCA takes VS and enters into EHR; same process regardless of VS value
- **Recognition** of severe HTN occurs via BPA after logging into EHR
- VS validation occurred 75 min after severe-range BP reading
- **Response**: Provider-to-bedside time = 120 min
- Time-to-treatment = 135 min
- Time-to-trigger resolution = 165 min

Scenario 2

- PCA takes VS and immediately notifies RN if MEWS trigger
- **Recognition** of VS abnormality occurs via MEWS trigger communicated directly to provider from RN using SBAR
- VS validation occurred immediately after severe-range BP
- **Response**: Provider-to-bedside time = 20 min
- Time-to-treatment = 28 min
- Time-to-trigger resolution = 58 min

Maternal Early Warning System Protocol

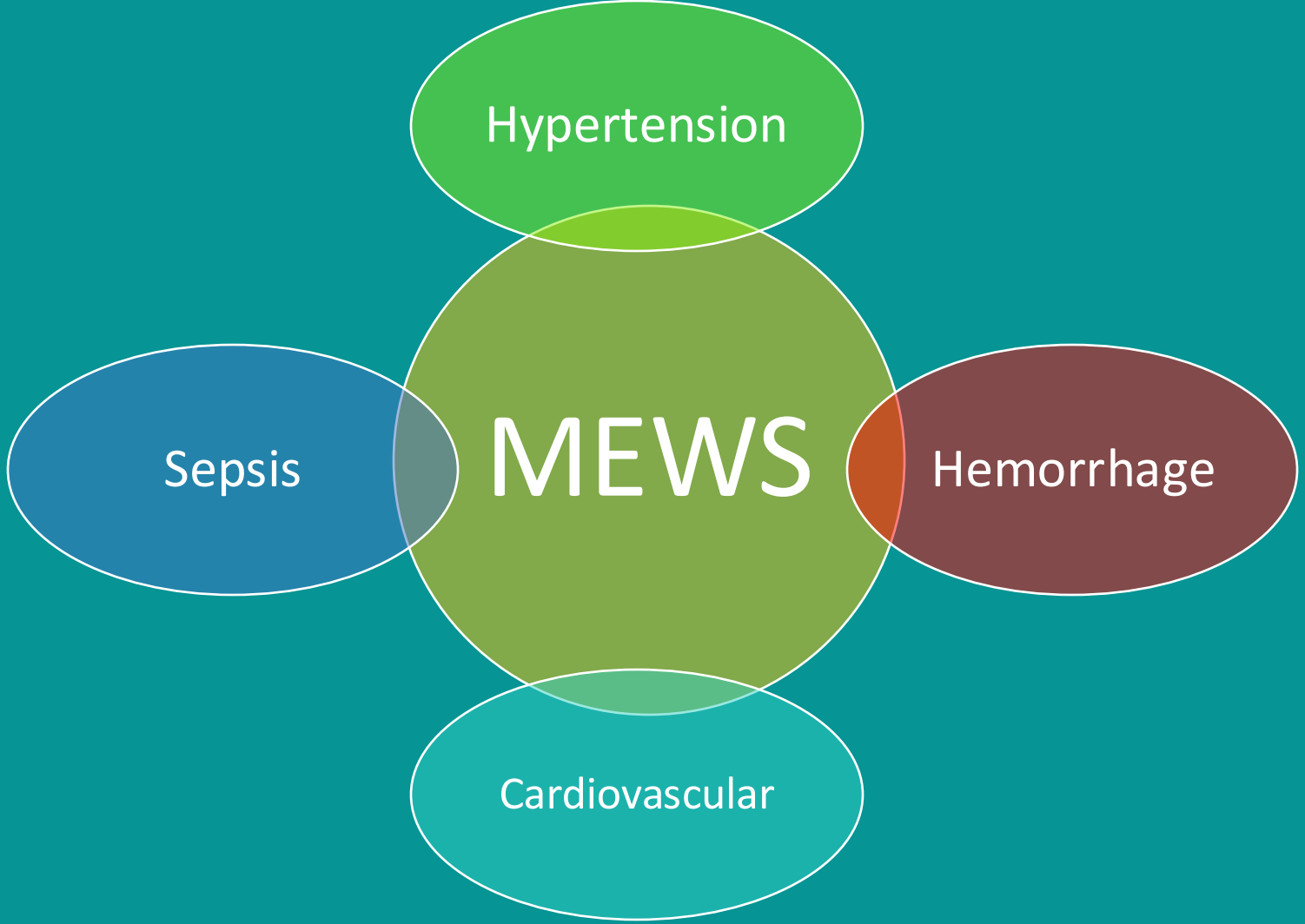


tchmb

MEWS Triggers and Common Diagnoses

Hypertension SBP >160	Hypotension SBP <90	Tachycardia HR >120	Bradycardia
• Chronic hypertension • Preeclampsia • Sympathomimetic medications	• Dehydration • Hypovolemia from hemorrhage • Regional anesthesia • Medications side effect • Sepsis • Vasovagal reaction • Cardiogenic shock	• Sepsis • Hypovolemia from hemorrhage • Medication side effect • Anxiety • Hyperthyroidism • Tachyarrhythmia	• Vasovagal reaction • Medication side effect • Bradyarrhythmia

Mhyre J, et al. Obstet Gynecol 2014;124:782–6


Hypertension
Sepsis
MEWS
Hemorrhage
Cardiovascular

How Does MEWS Align with Texas' Efforts for Improved Maternal Outcomes?

Maternal Levels of Care

- All levels required to have written guidelines or protocols for conditions that place pregnant/postpartum patient at risk for morbidity and/or mortality, including promoting prevention, early identification, early diagnosis, therapy, stabilization, and transfer. The guidelines or protocols must address a minimum of:
  - Massive hemorrhage and transfusion
  - Obstetrical hemorrhage
  - Hypertensive disorders in pregnancy
  - Sepsis and/or systemic infection
  - Venous thromboembolism
  - Shoulder dystocia
  - Behavioral health disorders

Severe Hypertension in Pregnancy Patient Safety Bundle

Readiness — Every Care Setting

Develop processes for management of pregnant and postpartum patients with severe hypertension, including:

- A standard protocol for maternal early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (including order sets and algorithms)
- A process for the timely triage and evaluation of pregnant and postpartum patients with severe hypertension or related symptoms
- A system plan for escalation, obtaining appropriate consultation, and maternal transfer as needed

Ensure rapid access to medications used for severe hypertension/eclampsia with a brief guide for administration and dosage in all areas where patients may be treated.

Conduct interprofessional and interdepartmental team-based drills with timely debriefs that include the use of simulated patients.

Develop and maintain a set of referral resources and communication pathways between obstetric providers, community-based organizations, and state and public health agencies to enhance services and supports for pregnant and postpartum families.

Develop trauma-informed protocols and provider education to address health care team member biases to enhance equitable care.

Recognition & Prevention — Every Patient

Assess and document if a patient presenting is pregnant or has been pregnant within the past year in all care settings.

Ensure accurate measurement and assessment of blood pressure for every pregnant and postpartum patient.

Screen for structural and social drivers of health that might impact clinical recommendations or treatment plans and provide linkage to resources that align with the pregnant or postpartum person's health literacy, cultural needs, and language proficiency.

Provide ongoing education to all patients on the signs and symptoms of hypertension and preeclampsia and empower them to seek care.

Provide ongoing education to all health care team members on the recognition of signs, symptoms, and treatment of hypertension.

Obstetric Hemorrhage Patient Safety Bundle

Readiness — Every Unit/Team

Develop processes for the management of patients with obstetric hemorrhage, including:

- A designated rapid response team co-led by nursing, obstetrics, and anesthesia with membership appropriate to the facility's Level of Maternal Care;*
- A standardized, facility-wide, stage-based obstetric hemorrhage emergency management plan with checklists and escalation policy;*
- Emergency release and massive transfusion protocols to ensure immediate access to blood products;*
- A protocol, including education and consent practices, to collaborate with patients who decline blood products, but may accept alternative approaches;* and
- Review of policies to identify and address organizational root causes of racial and ethnic disparities in outcomes related to the diagnosis, management, and surveillance of obstetric hemorrhage.

Maintain a hemorrhage cart or equivalent with supplies, checklists, and instruction cards for devices or procedures where antepartum, laboring, and postpartum patients are located.*

Ensure immediate access to first- and second-line hemorrhage medications in a kit or equivalent per the unit's obstetric hemorrhage emergency management plan.*

Conduct interprofessional and interdepartmental team-based drills with timely debriefs that include the use of simulated patients.*

Recognition & Prevention — Every Patient

Assess and communicate hemorrhage risk to all team members as clinical conditions change or high-risk conditions are identified; at a minimum, on admission to labor and delivery, during the peripartum period, and on transition to postpartum care.*

Measure and communicate cumulative blood loss to all team members, using quantitative approaches.*

Actively manage the third stage of labor per department-wide protocols.

Provide ongoing education to all patients on obstetric hemorrhage risk and causes, early warning signs, and risk for postpartum complications.*

*See **Obstetric Hemorrhage Element Implementation Details**

Sepsis in Obstetric Care

For the purpose of this Bundle, sepsis in obstetric care refers to the World Health Organization definition for maternal sepsis as a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or the postpartum period (up to 42 days). Such conditions include infections that are related to delivery and other types of infections that occur during pregnancy or the postpartum period.

Readiness — Every Unit

Establish inter- and intradepartmental protocols and policies for the care of patients experiencing obstetric sepsis or suspected sepsis.*

Provide multidisciplinary education on obstetric sepsis to all clinicians and staff that provide care to pregnant and postpartum people, including in non-labor & delivery settings such as emergency departments, intensive care units, and outpatient clinics.*

Utilize evidence-based criteria for sepsis assessment for all pregnant and postpartum patients, in all units, including obstetric-specific criteria, when appropriate.*

Create a culture that utilizes non-hierarchical communication so that all team members, including the patient, feel empowered to speak up about a concern and know that their input is valued by the entire care team.*

Recognition & Prevention — Every Patient

Implement evidence-based measures to prevent infection.*

Recognize and treat infection early to prevent progression to sepsis.*

Consider sepsis on the differential diagnosis of a person with deteriorating status, even in the absence of fever.*

In all care environments, assess and document if a patient presenting is pregnant or has been pregnant within the past year.*

Provide patient education focused on general life-threatening pregnancy and postpartum complications and early warning signs, including sepsis signs and symptoms other than fever, and instructions for who to notify| with concerns.*

Response — Every Event

Initiate facility-wide standard protocols and policies for assessment, treatment, and escalation of care for people with suspected or confirmed obstetric sepsis.*

Initiate facility-wide standard protocols and policies for post-stabilization management of people with sepsis.*

Engage in team communication among units involved in the care coordination for patients with sepsis to understand diagnoses, treatment plans, and follow-up care.*

Facilitate comprehensive post-sepsis care, including screening and proper referrals for post-sepsis syndrome.*

*See **Sepsis in Obstetric Care Element Implementation Details**

Challenges with MEWS in Texas Hospitals

- Integration with the electronic health record
- Tracking of obstetrical outcomes
- Simulation based education and training for MEWS
- Escalation using the chain of command

MEWS Implementation

Readiness: Every Unit

- Establish a multidisciplinary team of champions
- Select MEWS criteria
- Create a process map of *current* and *desired* practice from vital sign to provider notification
- Develop a MEWS protocol
- Educate unit on MEWS triggers and protocol
- Select data metrics to track implementation process and effectiveness

Readiness

Identify Strengths and Weaknesses for MEWS Implementation

When preparing to implement change in systems, identification of strengths and weaknesses in current processes, which may be accomplished through a gap analysis or readiness assessment, supports success. The following gap analysis tool was developed to support a unit or facility-based quality improvement (QI) team in the process of implementing MEWS.

While using this tool, it is recommended to consider the process currently in use in a unit and facility to recognize and report abnormal signs and symptoms. These questions may be answered even if there is not currently a formal MEWS in place.

Consider practices across the continuum of care, for instance in obstetric triage, antepartum, Labor & Delivery, and Postpartum units; if practices are inconsistent between units, specify which unit the answer is referencing.

MEWS-Readiness Assessment

Requirements Every Unit	Consistently In Place	Partially or Inconsistently in Place Ineffective	Not In Place	Comments
Establish a multidisciplinary team of champions				
Identification of trigger that will warrant response				
Oxygen saturation				
Temperature				
Systolic blood pressure				
Diastolic blood pressure				
Heart rate				
Respiration rate				
Urine output				
Mean arterial pressure				
Establish a MEWS notification system				
Establish a MEWS escalation process				

To improve this component, consider creating an action plan for any requirement that is not currently in place and consistently executed.

Examples

Introduction to MEWS Webinar: Webinar presentation slide set developed by TCHMB to introduce the concept of MEWS.

Maternal Early Warning System: Alternate organizational readiness to change assessment pdf tool developed by the Texas perinatal quality collaborative (PQC), TCHMB, for all facilities to use in assessing readiness to implement MEWS.

Resources

Maternity Watch Program: Early Warning Trigger Tool Guide: Implementation guide pdf developed by the Washington Hospital Association to support hospital initiation of Maternal Early Warning Trigger tool.

Maternal Early Warning Criteria: a proposal from the national partnership for maternal safety. 2014 Obstetrics and Gynecology article discussing origin, intent, and initial development of MEWS.

Implementing Obstetric Early Warning Systems: 2018 American Journal of Perinatology Reports article discussing early warning implementation across a broad range of hospital settings.

Recognition and Prevention

Standard protocol for nurse notification of MEWS triggers (e.g., patient care assistant [PCA] notifies RN of MEWS-trigger vital sign immediately)

Develop a standard protocol for validation of MEWS triggers (e.g., PCA and/or nurse validates MEWS-trigger vital sign within 5 minutes)

Develop a standard protocol for provider notification of MEWS triggers (e.g., nurse notifies provider of MEWS trigger within 5 minutes of validation)

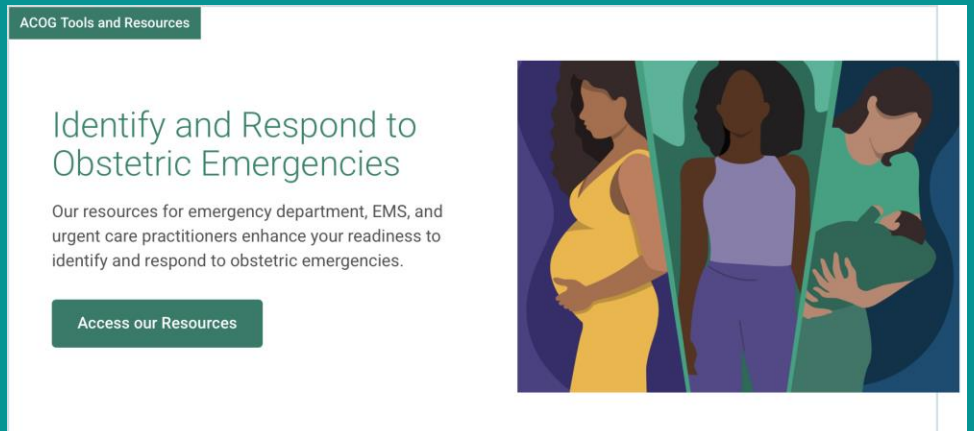
A team working to determine processes to implement MEWS should, at minimum, ascertain:

- Identified maternal patient populations for application (e.g., gestational parameters, locations of care)
- Vital sign and symptoms parameters that trigger provider notification
- Identified responding provider
- Notification processes (e.g., text alert, paging, calling)
- Maximum expected provider response time from initial call and arrival to bedside if applicable
- Timeline for activation of standing orders
- Standardized escalation plan

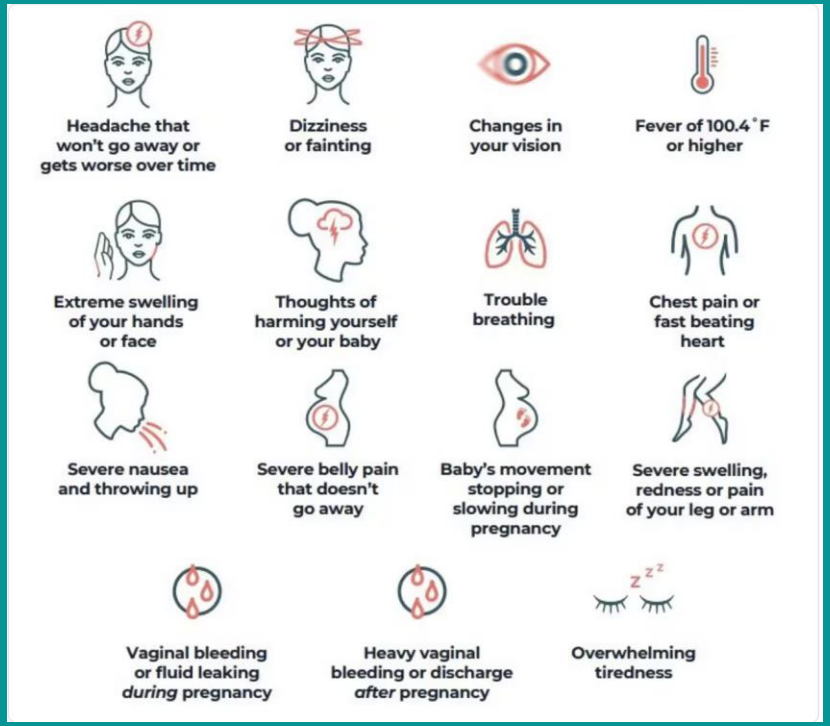
Recognition and Prevention

- Screen for current or recent pregnancy in all care settings

- Train health care professionals and staff to recognize obstetric emergencies using MEWS



Recognition and Prevention



MEWS triggers and times

MEWS Vital sign and time

Location of patient

Time and person who is notified

Time at Bedside

Time vital sign is not in MEWS range

Response

Script for communication between RN and MEWS responder

Escalation process

Develop a standard protocol for provider notification of MEWS triggers (e.g., nurse notifies provider of MEWS trigger within 5 minutes of validation)

Electronic Health Record Integration

- Addition of MEWS triggers, monitoring and reporting protocols into existing order sets
- MEWS alert integration into electronic health record
- Development of smart text for documentation

Electronic Health Record Integration

Example of Integration

tchmb

Alert: MEWS Trigger
Criteria: HR 124
Activate MEWS

MEWS Flowsheet	
MEWS Trigger	
MEWS Trigger Time	
MEWS notification Provider	
MEWS Notification time	
Provider at Bedside	
Intervention	

Order Set for MEWS with concern for PPH:

- ❑ Place peripheral IV
- ❑ Bolus 500 cc lactate ringers
- ❑ CBC
- ❑ INR, PT, PTT
- ❑ Fibrinogen
- ❑ Thromboelastogram
- ❑ Crossmatch XX units
- ❑ Transfuse XX units of XX
- ❑ Vitals signs q5 min for XX time

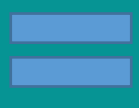
REPORTING/SYSTEMS LEARNING

Every Unit

Perform briefs, huddles and debriefs surrounding MEWS triggers

Establish a system of documenting MEWS notification, response, patients triggering MEWS and auditing for activations

Monitor data metrics at a defined interval (at least monthly)



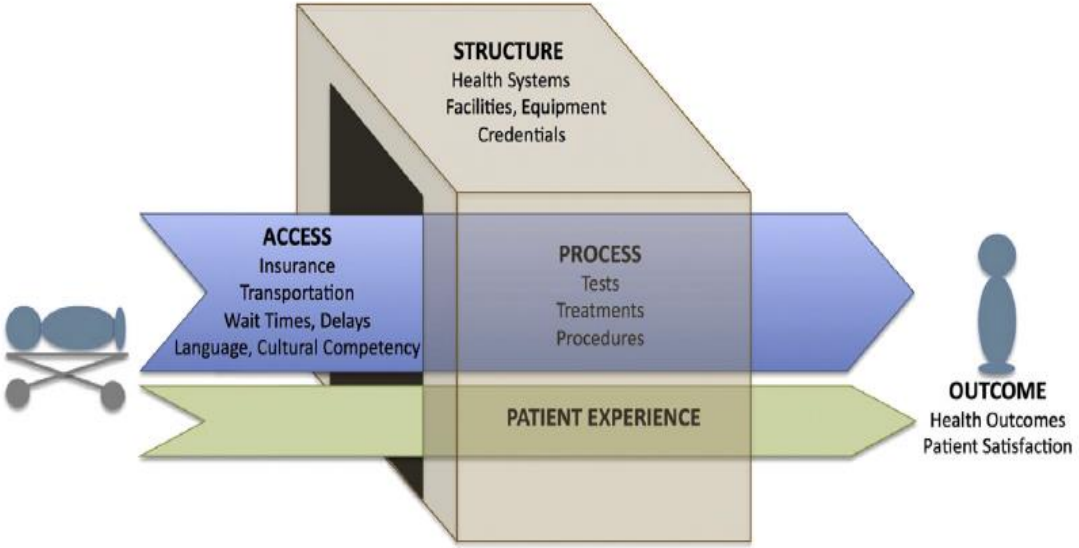
Protocol

Implementation

Outcome

Quality Measures

FIGURE
Five components of health care quality



Agency for Healthcare Research and Quality 5 domains of quality.

SMFM. Measuring quality of care in obstetrics. Am J Obstet Gynecol 2016.

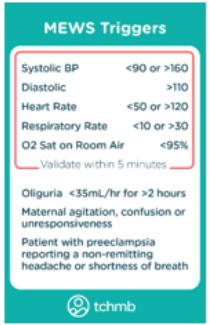
MEWS RN Documentation/Auditing

MEWS Event Documentation Tool

Patient name: _____ Date of admission: _____

Patient MRN: _____ Date of discharge: _____

Patient location: _____



1. Answer the following questions based on the above MEWS trigger criteria:
   - ❑ Patient DID NOT screen positive (based on your internal MEWS criteria and policy) for any trigger during the admission: **STOP HERE**
   - ❑ Patient DID screen positive (Based on your internal MEWS criteria and policy) on any criteria: **CONTINUE**

2. Check the criteria below that screened positive (if multiple MEWS criteria were triggered simultaneously, check all that apply):

	Low SBP Trigger		Low HR Trigger		Urine Output Trigger
	High SBP Trigger		High HR Trigger		Maternal agitation, confusion or unresponsiveness
	High DBP Trigger		Low RR Trigger		Patient with preeclampsia reporting a non-remitting headache or SOB
	O_2 sat Trigger		High RR Trigger		Other:

3. Date of initial trigger: _____
4. Time of initial trigger: _____
5. Time of provider notification: _____
6. Name of provider who was notified: _____
7. Time of provider at bedside: _____
8. Name of provider who came to bedside: _____
9. Time of return of abnormal vital sign to non-trigger range: _____
10. If the time period in which the provider was at the bedside is >60 minutes, what was the reason for delay?
    - ❑ The patient care/medical assistant did not notify the RN of the MEWS trigger
    - ❑ The RN did not notify the responding provider of the MEWS trigger
    - ❑ The responding provider could not be reached, and the RN failed to activate the escalation process
    - ❑ The responding provider could not come to the bedside, and the RN failed to activate the escalation process
    - ❑ The responding provider gave verbal orders over the phone instead of coming to the bedside
    - ❑ Other: _____
11. Was the patient transferred to a higher level of care?
    - ❑ Yes, to ICU
    - ❑ Yes, to Labor & Delivery
    - ❑ Yes, to a different facility
    - ❑ No
    - ❑ Unable to determine
12. Did the patient receive ≥ 4 units of PRBCs during intra- or postpartum?
    - ❑ Yes
    - ❑ No

The following questions are for the purposes of a retrospective chart review.

13. Did the nurse document the MEWS trigger in the EHR?
    - ❑ Yes
    - ❑ No
    - ❑ Unable to determine
14. Did the nurse document the notification to the provider in the EHR?
    - ❑ Yes
    - ❑ No
    - ❑ Unable to determine
15. Did the nurse document the time of the provider at bedside in the EHR?
    - ❑ Yes
    - ❑ No
    - ❑ Unable to determine
16. Did the provider document the MEWS encounter in the EHR?
    - ❑ Yes
    - ❑ No
    - ❑ Unable to determine

MEWS Measures and Data Source Information			
Measure Type	**Tracking Frequency**	**Measure Titles**	**Data Source**
MEWS Process Measure	Monthly	Cumulative proportion of OB providers^ who have completed education program on MEWS protocol	Self-reported
		Cumulative proportion of OB nurses who have completed education program on MEWS	Self-reported
		% of patients that triggers the MEWS protocol (monthly)	Numerator: Medical record, e.g., TCHMB MEWS event tracking tool (chart review/EMR); Denominator: Delivery logbook / DRG codes / Joint Commission measure
		% of patients that should have triggered the MEWS protocol but did not (monthly)	Numerator: Medical record, e.g., TCHMB MEWS event tracking tool (chart review/EMR); Denominator: Delivery logbook / DRG codes / Joint Commission measure
MEWS Structural Measures	Monthly	Presence of a MEWS protocol or policy (yes/no)	Self-reported
		MEWS triggers included in hand-off reports (yes/no)	Self-reported
MEWS Outcome Measures	Monthly	Time from abnormal vital sign to provider at bedside/activation of standing order set (monthly)	Medical record, e.g., TCHMB MEWS event tracking tool (chart review/EMR)
		Time from abnormal vital sign to return to non-trigger range (monthly)	Medical record, e.g., TCHMB MEWS event tracking tool (chart review/EMR)
		% Transfusion of $\geq$ 4 units of PRBCs	Incident report from hospital / Blood bank / Transfusion log book / Transfusions with validation from hospital lab / TCHMB MEWS event tracking tool
		% Intensive care unit admission	Incident report from hospital / TCHMB MEWS event tracking tool / Billing revenue code data

*All numerator cases are those from among the denominator

^OB providers includes obstetricians, MFM physicians, midwives, family medicine physicians, and any other provider working with obstetrical patients

Respectful and Equitable Care

Recognize Patients and Their Support Networks as True Experts

Provide Patient Urgent Warning Signs

Table 1. Examples of Patient Education Materials for Urgent Signs and Symptoms During Pregnancy and Postpartum

Patient Education Material	Costs Associated with Use	Available in Languages Other in English
CDC HEAR HER Campaign	No	Yes
AWHONN POST-BIRTH Warning Signs	Yes	Yes
Urgent Maternal Warning Signs	No	Yes

Examples

AIM Urgent Maternal Warning Signs: materials developed to provide patient facing education information in a low literacy format and variety of languages. Materials include templates for posters, cards, badge buddies, and ability to request additional language translation.

Centers for Disease Control and Prevention (CDC)'s Hear Her Campaign: a campaign developed to support identification of urgent signs and symptoms in pregnancy and postpartum and the need to seek care. Includes healthcare professional-facing materials, including posters and palm cards, underlying the importance of asking patients about current or recent pregnancy.

Reproductive Health National Training Center's Recognize Postpartum Warning Signs Poster: a non-obstetric healthcare professional-facing poster developed as a visual aid for clinicians and unlicensed ancillary team members on urgent maternal warning signs to be aware of in the postpartum period.

Thank you

- Ben Taub and Texas Children's Pavilion for Women Hospital teams
- Christina Davidson, Amanda Wagner, Divya Patel, Nagla Elerian, Leah
- MEWS Reinforcement Cohort Hospitals

Questions?

Please post your questions in the chat for the audience Q&A session

UTHealth Houston School of Public Health | Michael & Susan Dell Center for Healthy Living

Thank you for attending!

Please scan the QR code below to view more webinars from the Michael & Susan Dell Center for Healthy Living

UTHealth Houston School of Public Health | Michael & Susan Dell Center for Healthy Living