Maternal 911 in Action: Cardiomyopathy

Traditional patient safety approaches, known as Safety-I, are reactive and focus on identifying and mitigating contributing factors after adverse events have occurred. This approach views safety as the condition whereas few things go wrong as possible, using tools like root cause analysis and risk assessments to prevent future incidents. While Safety-I is effective in evaluating failures and minimizing adverse events, it fails to consider the many factors that contribute to everyday successes in healthcare, which are often just as critical to ensuring patient safety in dynamic and complex environments. [1,2]

In contrast, the Safety-II framework takes a proactive, system-wide approach to patient safety by focusing on understanding and learning from everyday successes rather than just failures. Safety-II emphasizes the importance of adaptability and resilience, recognizing that safety is not only the absence of adverse events but also the presence of actions that go right. By studying what works well and how healthcare professionals effectively adapt to varying conditions, Safety-II aims to replicate and strengthen these successful processes to ensure optimal outcomes, even in unpredictable circumstances. [1,2]

1. Venkatesan C, Helak K, Sousane Z, et al. Application of Safety-II Principles. PSNet [internet]. Rockville (MD): Agency for Healthcare Research and Quality, US Department of Health and Human Services. 2024.
2. Safety-I and Safety-II: The Past and Future of Safety Management. Hollnagel E. Aldershot, Hampshire, England: Ashgate; 2014. ISBN: 9781472423085.

Is Something About to Happen?

The objective of Maternal 911 in Action is to put real-life events into practice with the management of each step prior to an actual event. This is not a test of individuals. This is an opportunity to strengthen the process, to identify and fix gaps within the unit and to improve teamwork, communication and overall reliability.

Every healthcare scenario aims to be as realistic as possible ideally involving the members of the team that would be present during an actual event. Even consider involving another colleague to simulate a family member.

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A 911 in Action drill should be practiced in a room consistent with where an actual event would occur. This will make the drill efficient in helping participants familiarize themselves with the room set-up, equipment location, and medication available helping participants to identify improvements in their location for faster retrieval in a real event.

911 in Action is to be as hands-on as possible.

Following the practice event, the team should discuss what went well, what could be improved, what needs to be changed regarding equipment, supply location, and questions answered so each member has a clear understanding of the event and management.

Maternal 911 in Action Steps to Preparedness

1. Please have conversations with your risk team to have non-discoverable status; this may ensure that protected documents and items cannot be used in a court of law during a malpractice suit.
   - This process is best determined by the hospital attorney or the Risk Management Department and needs to be in place before simulation occurs**.**
   - Simulations and findings may also be considered a quality improvement project and be protected in the same manner other such projects are.
   - Once a process is determined, simulation instructors need to be familiar with how to protect simulations and findings along with consequences of not following the process.
   - Instructors are responsible for explaining what non-discoverable status is to trainees, ensure all in simulation follow the process and understand the consequences violating the process.
2. Simulations are a safe place to learn; therefore, confidentiality is a key part of training.
   - Everyone attending the simulation training must sign a confidentiality form stating they will not discuss the events of the scenario and debriefing (obtain from legal/risk).
   - Whether mistakes are made, or performance is excellent, each trainee needs to understand that anyone at the session from instructors to other trainees to observers will not discuss their performance outside of the training session.
   - Issues that are uncovered for quality improvement will be described, but not attributed or linked with any specific individual.
3. The drill should be as realistic as possible:
   - Mannequins or individuals may be used.
   - Equipment and supplies should be available.
   - Even consider having a colleague simulate a family member.
4. Drills should meet department or unit needs and practices using current evidence-based practice.
5. Those who attend should be the team members who would provide care during an actual event.
6. Explanation of the process should be understood prior to initiation of the action:
   - Provide a case scenario.
   - Participants understand their role is to respond as would be done during an actual event.
   - Individuals should know that the patient's outcome will be based upon their actions.
7. The trainer will provide scenario outcomes in events as participants work through the drill and redirect as appropriate.
8. All procedure performances will be demonstrated through discussion, so the team will be aware of the time and supplies needed for successful completion.
9. Following the event, the team will discuss the process:
   - Debriefing provides a powerful and essential structure for maintaining learning capacity.
   - The team can evaluate what worked well and identify needed improvements.
   - This may include adding or removing equipment, supplies, and medication, etc.
10. Repeating the drill may be necessary until all members are functioning proficiently within their scope of practice.
11. The trainer will have the participant(s) go through the drill until they are competent in the topic and health care delivery.

Maternal 911 and Maternal 911 in Action contains information designed as an educational resource to aid practitioners in providing obstetric care and the use of this information is voluntary. This information should not be considered as inclusive of all proper treatments or methods of care or as a statement of the standard of care. It is not intended to substitute for the individual's independent professional judgement. Maternal 911 reviews the publication regularly, but all course material may not reflect the most recent evidence.

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Data from completing the modules may be used in research and publications with privacy maintained.

Maternal 911 in Action

Case Scenario to Post

Cardiomyopathy

Gia is a 32-year-old, now para 1 who develops symptoms of breathlessness on the fourth day after an elective cesarean for a breech fetal lie. She has had mild asthma since her teen years which has typically been controlled with an albuterol inhaler, used as needed. She was discharged home on day two.

She calls EMS for help. EMS arrives to find her having to take a breath after every third word with definite air-hunger. Pulse oximeter is 94% on room air with respiratory rate (RR) of 24/min. Heart rate (HR) is 109bpm with blood pressure (BP) of 95/60. Temperature is 98.9 degrees Fahrenheit.

Trainer's Form

Maternal 911 in Action Case Scenario

Cardiomyopathy

Supplies:

- Printed cases (with answers) for the trainer or save a tree and use a laptop or I-pad
- Have consents for participants to sign regarding confidentiality (from legal/risk)
- Simulation Based Training Analysis Template (page 13) for your documentation
- Consent for all participants to sign regarding confidentiality (from legal/risk)
- Please have the QR code available (page 14) for participants to complete survey once simulation complete

Announce: The objective of the 911 in Action is to put real-life events into practice with the management of each step prior to an actual event. This is not a test of individuals. This is an opportunity to strengthen the process, to identify and fix gaps within the unit and to improve teamwork, communication, and overall reliability.

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She calls EMS for help. EMS arrives to find her having to take a breath after every third word with definite air-hunger. Pulse oximeter is 94% on room air with respiratory rate (RR) of 24/min. Heart rate (HR) is 109bpm with blood pressure (BP) of 95/60. Temperature is 98.9 degrees Fahrenheit. She arrives to your unit.

Family member: "Please help her. She has asthma attacks, but never like this before."

Ask the following paragraphs from the left column, more prompts in right column.

911 in Action	Discussion
Ask for initial assessment questions 1. When did the breathing difficulty start? 2. How long have you been coughing? 3. What else should we know about you? 4. Do you have asthma?	Shortness of breath (SOB) started a few hours ago and is worse when lying flat or walking. The cough started a week ago but is just a "tickly" cough. For the last few weeks, she states she has just been tired and breathless, but thought it was from having the baby. Again, only able to speak 2-3words then has to breath. Asthma has been well controlled for years.
What exam would you perform?	Exam: airway is clear, two to three-word dyspnea continues, bilateral lung bases with fine inspiratory crackles, trachea is midline. No audible wheezing. Pulse is adequate. Third heart sound is audible. Mild bilateral ankle edema. Abdomen is soft, uterus is small and non-tender below the umbilicus.
The Jugular venous pressure (JVP) is elevated at 5cm. What do you know about JVP? The JVP has a double pulsation whereas the carotid has single. Assess with her head turned to the left at 45 degrees. Here is a link to learn how to assess jugular venous pressure (JVP).	Measure the JVP by assessing the vertical distance between the sternal angle and the top of the pulsation point of the internal jugular vein (IJV) (in healthy individuals, this should be no greater than 3cm). It raises above 3cm with right heart failure. The JPV has a double pulsation whereas the carotid has single. Assess with her head turned to the left at 45 degrees.
What actions to you take next?	Remember the CAB's (circulation, airway, breathing) and apply oxygen via non-rebreathing mask and establish IV access.

What do you consider in the differential diagnosis? (see Table at the end)	Heart failure Pre-eclampsia Infective Pulmonary embolism (PE) Atelectasis Autoimmune disease

Gia is very distressed and struggling to breath and becoming drowsy.

Family member: "Can you get her to the help right now?"

911 in Action	**Discussion**
On exam, florid pulmonary edema is present with marked fine inspiratory crackles throughout. JVP is elevated and third heart sound is noted.	If available, trial of CPAP would be appropriate.
If the team recognizes and treats heart failure, then the ICU team in called to assist in her treatment.	If heart failure is not recognized, the patient goes into full cardiorespiratory arrest with unsuccessful resuscitation. The simulation ends.

Heart Failure is recognized.

911 in Action	**Discussion**	
ECG, ABG's and blood work are obtained. What blood work would be important? What else may be consider?	CBC, CRP, BMP, coagulation, CXR	
Results	Results ABG: pH 735 p02 9 kPa PCO2 4.2 kPa BE -4mmol/L Lactate 0.9mmol/L	Vitals RR 40 SpO2 88 on 15L O2 HR 125 bpm BP 75/50 Temp 98.1

Who would you consult?	Obstetrician Anesthesia Cardiology/Hospitalist
CXR – radiology tech declines to do the CXR because the patient may need TPA.	How do you handle this situation? What is the facility policy to escalate up the chain of command?

Gia is now very distressed and sitting at the edge of the bed, very short of breath with productive pink frothy sputum.

911 in Action	**Discussion**
Reexamination reveals widespread course inspiratory crackles and persistent cough, tachycardia is present, JVP continues to be elevated, and third heart sound continues to be audible.	What do you suspect now? Pulmonary edema Consider a stat dose of what med? Lasix 40mg IV.
The labs have returned and show: The BNP is a key factor to the diagnosis of cardiomyopathy.	WBC 15 Platelets 255 Sodium 142 Potassium 4.5 Urea 3.8 Creatinine 50 CRP 30 **BNP 8235** Clotting studies normal
What is your next action with this information?	Cardiology in to see this patient and orders an urgent echocardiogram.
Would an urgent echo be performed at your facility, or would she need to be transferred?	The echocardiogram shows dilated left ventricular (LVEDd 6.1cm) with severe global impairment of systolic function (LVEF 25%).
At this point a request is placed to transfer her to a tertiary care intensive care unit.	

Gia is becoming more distressed and struggling to breath. She is becoming more obtunded.

Cardiogenic shock is recognized. The cardiologist begins inotropic/vasopressor therapy, an arterial line and starts CPAP. They are prepared to intubate Gia if these measures do not improve her symptoms. Below is a review of Peripartum Cardiomyopathy.

Here is a link to learn how to assess jugular venous pressure (JVP) if this needs to be reviewed.

Peripartum Cardiomyopathy (PPCM)

1. Would this be easy to manage for your team?

2. Peripartum Cardiomyopathy

    a. Typically presents during the first week postpartum with dyspnea
    b. Subtle preceding symptoms may be mistakenly attributed to normal symptoms:
        i. Fatigue
        ii. Cough
        iii. Edema
        iv. Abdominal discomfort

3. PPCM is a diagnosis of exclusion defined as an "idiopathic cardiomyopathy presenting with heart failure secondary to left ventricular systolic dysfunction towards the end of pregnancy or in the months following delivery where no other cause is found."

    a. The clinical course of PPCM is highly variable, ranging from mild reversible cardiac dysfunction to rapidly progressive end-stage heart failure.

    b. Since the clinical course is so variable it is imperative for clinicians involved with the management of pregnant women to have knowledge of the presentation and management of PPCM.

4. Risk factors

    a. Maternal age with 50% of PPCM cases occurring in women over 30 years of age.
    b. African- American race
    c. Hypertension
    d. Anemia
    e. Multiparty
    f. Multiple gestation
    g. Autoimmune disease
    h. History of PPCM with prior pregnancy

5. Initial treatment of PPCM is based on key elements

    a. Optimize cardiac preload
        i. Correction of volume status
            1. IV fluids/blood in hypovolemic patients but use with caution if any concern for pulmonary edema.
            2. Diuretics in fluid overload
        ii. Vasodilator therapy (nitrates, hydralazine) should be initiated where the systolic BP is ≥ 110mmHg

    b. Optimize oxygenation
        i. Start with non-rebreather mask and then titrate to aim for saturation > 95%
        ii. With respiratory distress secondary to pulmonary edema, CPAP should be initiated
        iii. Invasively ventilate if her condition deteriorates or her status fails to improve

    c. Restoration of hemodynamics
        i. When cardiogenic shock occurs, inotropes or vasopressor therapy should be initiated.

6. Summary
    a. Breathlessness has various causes; the team needs to be alert to the possibility of PPCM.
    b. PPCM is rare, but potentially life-threatening obstetric emergency.
    c. Early recognition with prompt multidisciplinary management is essential to reduce maternal morbidity and mortality. The lab to determine BNP will help determine PPCM. Remember to draw the BNP in a woman with peri-partum shortness of breath.
    d. Keeping a low threshold to escalate to intensive care is imperative.

References:

Bauersachs, J., Arrigo, M., Hilfiker-Kleiner, D., et al (2016) Current management of patients with severe acute peripartum cardiomyopathy: practical guidance from the Heart Failure Association of the European Society of Cardiology Study Group on peripartum cardiomyopathy. European Journal of Heart Failure, 18(9), 1096-1105

Kolte, D., Khera, S., Aronow, W.S., et al. (2014). Temporal trends in incidence and outcomes of peripartum cardiomyopathy in the United States: a nationwide population-based study. Journal of the American Heart Association, 3(3), e001056.

Sliwa, K., Hilfiker-Kleiner, D., Petrie, M.C., et al. (2014) Current state of knowledge on the etiology, diagnosis, management and therapy of peripartum cardiomyopathy: a position statement from the Heart Failure Association of the European Society of Cardiology Working Group on peripartum cardiomyopathy. European Journal of Heart Failure, 12(8), 767-778.

After the Maternal 911 in Action drill:

1. What will occur next?
2. Discuss the importance of documenting.
3. Discussion with the patient and/or her family.
4. Documentation of the event.

After the Maternal 911 in Action drill, trainer leads team through the debriefing process:

1. What went well for the team?
2. What did we learn through this drill?
3. What would we do differently in a real-life situation?
4. Did we have any issues; equipment, processes, communication, understanding?
5. Who is going to follow-up to resolve the problems and/or contact those who need to assist in making changes?
6. What time frame will be allowed for completion of this project?
7. How will changes be communicated to the team?

	Heart Failure	**Acute Coronary Syndrome**	**Pulmonary Embolus**	**Myocarditis**
Presentation	Insidious (could be acute) Dyspnea	Acute chest pain	Acute chest pain	Subacute Recent infection
Signs	Hypotension Tachycardia Tachypnea Elevated JVP Inspiratory crackles S3	Normal (with uncomplicated cases)	Tachypnea Hypoxia	Fever Tachycardia S3
ECG	Rarely normal Nonspecific repolarization abnormalities	ST elevation/depression T-wave inversion LBBB/RBBB	Sinus tachycardia S1Q3T3 RBBB T-wave changes V1-3	T-wave changes LBBB Conduction abnormalities
CXR	Pulmonary congestion Cardiomegaly Pleural effusion	Normal	Normal	Normal
Labs	Elevated BNP	Elevated troponin	Elevated D-dimer (BNP and troponin may be elevated)	Elevated troponin BNP may or may not be elevated
Echocardiography	Global LV systolic impairment LVEF < 45% LV may be dilated or normal in size	Regional LV systolic impairment (can be normal)	RV impairment (can be normal)	Global LV systolic impairment
Other	Cardiovascular magnetic resonance (cardiac MRI)	Coronary angiography Cardiac MRI	CTPA/VQ scan	Cardiac MRI

MATERNAL911

SIMULATION-BASED TRAINING ANALYSIS TEMPLATE

Topic of SBT:

Date(s) of training:

Number of trainees: *This section can be broken down by discipline or job title if this is relevant to the findings*

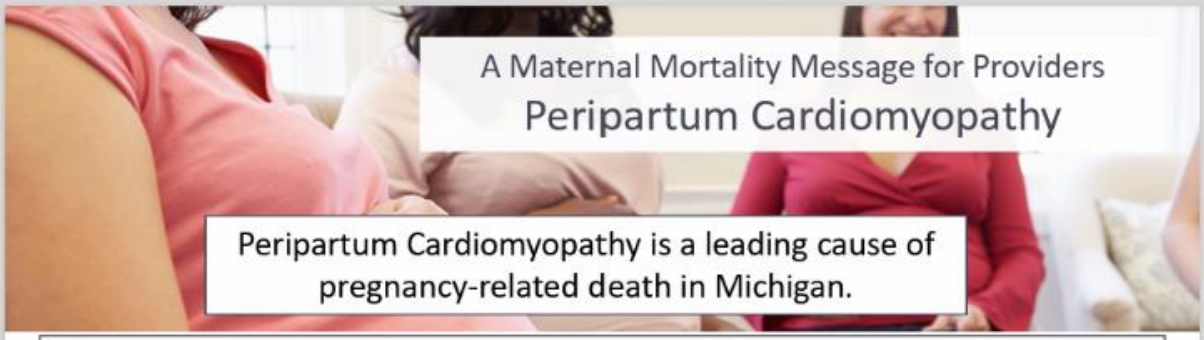
1. METRICS

METRIC	FINDING	COMMENTS
(Example) Time Anesthesiologist called to time in room	(Example) 6 minutes	(Example) Anesthesiologist needs pager that works in the OR to decrease response time to OB

2. SYSTEMS ISSUES AND PROCESSES UNCOVERED

ISSUE OR PROCESS	REPORTED TO	SUGGESTION FOR IMPROVEMENT
(Example) Instrument labeled incorrectly	(Example) Unit manager and sterile supply dept	(Example) Inform OB surgical staff of incorrect label, have 2 sets in case one is incorrect

To help the Maternal 911 team improve simulations please have your team scan the QR code to complete a post simulation survey.



A Maternal Mortality Message for Providers

Peripartum Cardiomyopathy

Peripartum Cardiomyopathy is a leading cause of pregnancy-related death in Michigan.

Michigan Data:

- In 2017, there were 167 inpatient hospitalizations with a peripartum cardiomyopathy diagnosis code, giving a rate of 14.1 peripartum cardiomyopathy diagnoses per 10,000 inpatient hospitalizations with obstetric codes present.
  - Black women experience a 5.1 times higher rate of peripartum cardiomyopathy diagnoses as compared to White women.
- During 2012-2016, peripartum cardiomyopathy was a leading cause of pregnancy-related deaths, causing 15.3 percent of those deaths.
  - 50 percent of pregnancy-related cardiomyopathy deaths were determined to be preventable.

Recognition

- ✓ Symptoms
  - ✓ Include dyspnea, lower extremity edema, orthopnea, cough, fatigue, heart palpitations/tachycardia, neck vein distention, fluid retention, exercise intolerance, arrhythmias, paroxysmal nocturnal dyspnea, chest pain, weakness
- ✓ Diagnostic testing
  - ✓ Serum blood tests (blood count, creatinine, urea, electrolytes, cardiac enzymes, **B-type natriuretic peptide (BNP),** liver functions, TSH), chest x-ray, EKG, **echocardiogram**

Response

- ✓ Diagnostic criteria
  - ✓ Development in the last month of pregnancy or within five months postpartum
  - ✓ No other identifiable cause for the heart failure
  - ✓ Ejection fraction <45%
- ✓ Treatment
  - ✓ Consultation with cardiologists, obstetricians, and perinatologists
- ✓ Future pregnancy planning
  - ✓ Contraception and counseling regarding future pregnancies

Data Sources:
Michigan Department of Health and Human Services, Michigan Resident Inpatient Files created by the Division for Vital Records and Health Statistics, using data from the Michigan Inpatient Database obtained with permission from the Michigan Health and Hospital Association Service Corporation (MHASC), 2017.
Michigan Department of Health and Human Services, Michigan Maternal Mortality Surveillance Program, 2012-2016.
Reference:
Johnson-Coyle, L, et al. Peripartum Cardiomyopathy: Review and Practice Guidelines. *Am J Critical Care. (2012)* 21 (2): 89-98.

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