

AIM

To reduce the number of PCEMS calls where norepinephrine is inappropriately used by 20% within 6 months of implementing a new educational program.

BACKGROUND

Hypotensive shock can be caused by conditions such as trauma, myocardial infarction, and sepsis. Treatment is usually in the form of a vasopressor such as epinephrine or norepinephrine. Last year, Pitt County Emergency Medical Services (PCEMS) changed their standard hypotensive shock and sepsis treatment from epinephrine to norepinephrine. Since this change PCEMS personnel have received feedback from physicians that they are overusing norepinephrine.

METHODS

A combination of Plan-Do-Study-Act cycles and Six Sigma methods will be used to define, plan, implement, and measure change. Run charts will be used to visualize changes over the short and long term.

CURRENT PROTOCOL

Hypotension / Shock

History

- Blood loss - vaginal or gastrointestinal bleeding, AAA, ectopic
- Fluid loss - vomiting, diarrhea, fever
- Infection
- Cardiac ischemia (MI, CHF)
- Medications
- Allergic reaction
- Pregnancy
- History of poor oral intake

Signs and Symptoms

- Restlessness, confusion
- Weakness, dizziness
- Weak, rapid pulse
- Pale, cool, clammy skin
- Delayed capillary refill
- Hypotension
- Coffee-ground emesis
- Tarry stools

Differential

- Ectopic pregnancy
- Dysrhythmias
- Pulmonary embolus
- Tension pneumothorax
- Medication effect / overdose
- Vasovagal
- Physiologic (pregnancy)
- Sepsis

Procedures:

- Blood Glucose Analysis Procedure
- 12 Lead ECG Procedure
- IV or IO Protocol UP 6
- Cardiac Monitor
- Airway Protocol(s) if indicated
- Diabetic Protocol AM 2 if indicated

Flowchart:

History and Exam Suggest Type of Shock

- Cardiogenic:** Chest Pain, Cardiac and STEMI Protocol AC 4 Appropriate Cardiac Protocol(s) if indicated
- Hypovolemic:** Allergy Protocol AM 1 if indicated, Suspected Sepsis Protocol UP 15 if indicated, Multiple Trauma Protocol TB 6 if indicated
- Distributive:** Isotonic Fluid Saline Bolus 500 mL IV Repeat to effect SBP > 90 2 L Maximum
- Obstructive:** Chest Decompression- Needle Procedure if indicated

Final Step: Norepinephrine 1 - 30 mcg/min IV/IO MAP > 70

Notify Destination or Contact Medical Control

AM 5

Hypotension / Shock

Min 4 mg (4 ml) of Norepinephrine in 250 ml D5W or NS → concentration of 16 mcg/ml

mg/min	gtt/min	mg/hr	gtt/hr
1	1.5	90	135
2	3.0	180	270
3	4.5	270	405
4	6.0	360	540
5	7.5	450	675
6	9.0	540	810
7	10.5	630	945
8	12.0	720	1080
9	13.5	810	1215
10	15.0	900	1350

Adverse/Side Effects:

Systemic: Ischemic injury due to potent vasoconstrictor action and tissue hypoxia.

Cardiovascular: Hypertensive, arrhythmias as a reflex result of a rise in blood pressure, arrhythmias, tachycardia

Neurologic: Anxiety, transient headache

Respiratory: Respiratory difficulty

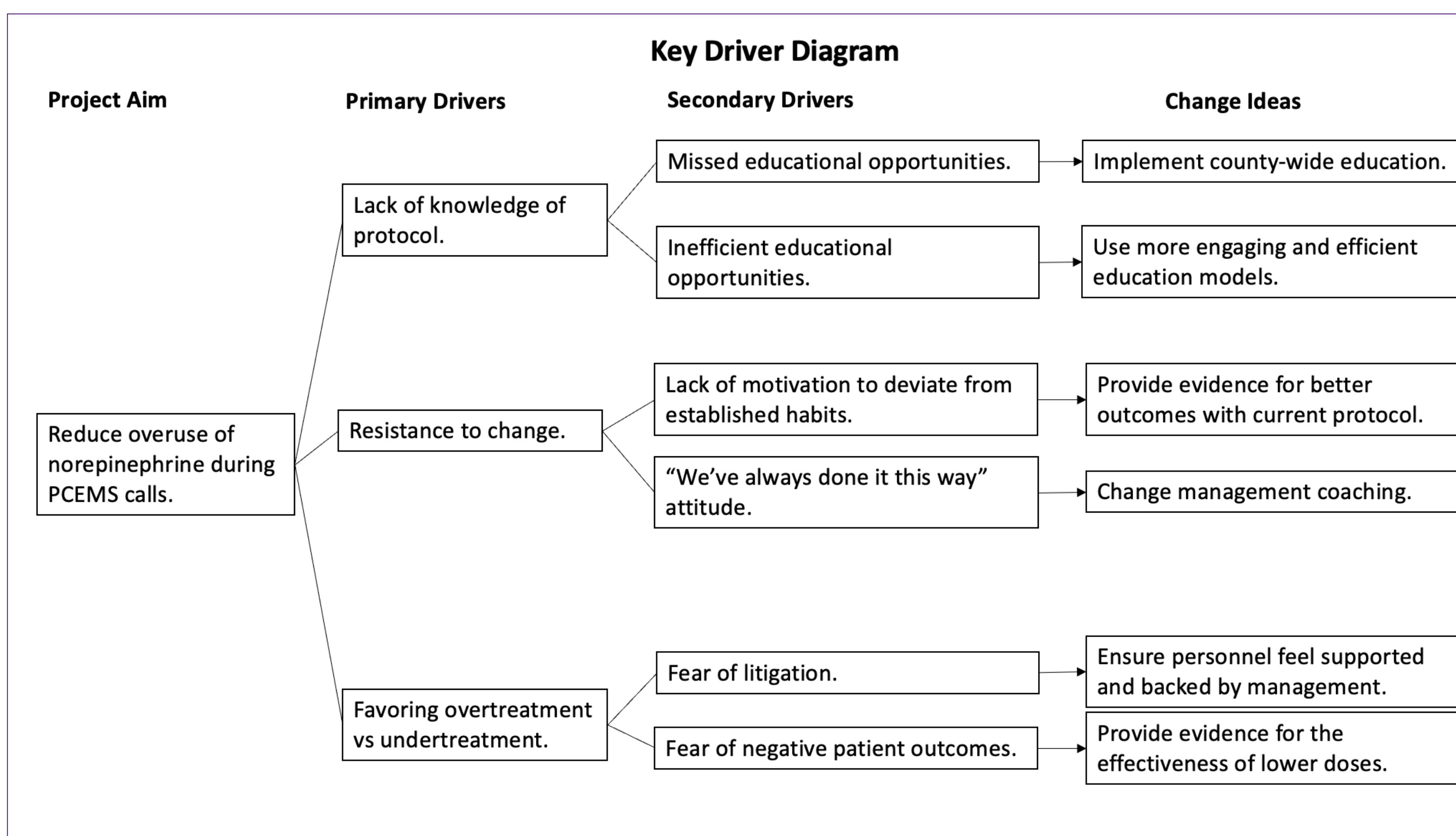
Metabolic/Endocrine: Extravasation necrosis at injection site; Gangrene of extremities has been rarely reported. Overdoses or conventional doses in hypersensitive persons (e.g., hyperthyroid patients) cause severe hypertension with violent headache, photophobia, dilating retrosternal pain, panic, intense sweating, and vomiting.

Pearls:

- Recommended Exam:** Mental Status, Skin, Heart, Lungs, Abdomen, Back, Extremities, Neuro
- Hypotension can be defined as a systolic blood pressure of less than 90 or MAP <70. This is not always reliable and should be interpreted in context and patients typical BP if known.
- Shock may be present with a normal blood pressure initially.
- Shock often is present with normal vital signs and may develop insidiously. Tachycardia may be the only manifestation.
- Consider all possible causes of shock and treat per appropriate protocol.
- Hypovolemic Shock:** Hemorrhage, trauma, GI bleeding, ruptured aortic aneurysm or pregnancy-related bleeding.
- Tranexamic Acid (TXA):** Agencies utilizing TXA must submit letters from their receiving trauma centers for approval by the OEMS Medical Director. Receiving trauma centers must agree to continue TXA therapy with repeat dosing. TXA is NOT indicated and should NOT be administered where trauma occurred > 3 hours prior to EMS arrival.
- Cardiogenic Shock:** Heart failure, MI, Cardiomyopathy, Myocardial contusion, Ruptured ventricle / septum / valve / toxins.
- Distributive Shock:** Sepsis / Anaphylactic / Neurogenic Toxins. Hallmark is warm, dry, pink skin with normal capillary refill time and typically alert.
- Obstructive Shock:** Pericardial tamponade, Pulmonary embolus, Tension pneumothorax. Signs may include hypotension with distended neck veins, tachycardia, unilateral decreased breath sounds or muffled heart sounds.
- Acute Adrenal Insufficiency or Congenital Adrenal Hyperplasia:** Body cannot produce enough steroids (glucocorticoids / mineralocorticoids.) May have primary or secondary adrenal disease, congenital adrenal hyperplasia, or more commonly have stopped a steroid like prednisone. Injury or illness may precipitate. Usually hypotensive with nausea, vomiting, dehydration and / or abdominal pain. If suspected Paramedic should give Methylprednisolone 125 mg IM / IV / IO or Dexamethasone 10 mg IM / IV / IO. Use steroid agent specific to your drug list. May administer prescribed steroid carried by patient IM / IV / IO. Patient may have Hydrocortisone (Cortel or Solu-Cortef). Doses: < 1y.o. give 25 mg, 1-12 y.o. give 50 mg, and > 12 y.o. give 100 mg or dose specified by patient's physician.

AM 5

KEY DRIVER DIAGRAM



PLAN

- Review PCEMS calls where norepinephrine has been used since the change in protocol.
- Observe if calls were compliant or non-compliant with the recommended use of norepinephrine.
- Review arrival actions in the emergency department to see if norepinephrine was continued or discontinued and if any other acute interventions were attempted.
- Compare the number of calls with correct norepinephrine use to the number of calls with incorrect norepinephrine use per protocol.
- If norepinephrine is being overused, implement a county-wide education program.
- Continue to measure protocol adherence over 6 months to determine the success or failure of the education program.

CURRENT TEAM

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