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Authors

Claudius, Ilene
Montero, Sandra
Hardasmalani, Madhu
[et al.](#)

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SIMULATION

Pediatric Sepsis Case Scenario

Ilene Claudius, MD*, Sandra Montero, RN*, Madhu Hardasmalani, MD^, Kellyn Pak, RN* and Y. Liza Kearn, MD^

*Los Angeles County + University of Southern California Medical Center, Department of Emergency Medicine, Los Angeles, CA

^University of Southern California Keck School of Medicine, Department of Emergency Medicine, Los Angeles, CA

Correspondence should be addressed to Ilene Claudius, MD at iaclaudius@gmail.com

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ABSTRACT:

Audience: This scenario was used to educate emergency nurses on pediatric sepsis. However, it could be applied to physician or advanced practice provider trainees as well or for simulations run for team communication.

Introduction: Pediatric sepsis is a low-frequency, high impact condition. Nurses and physicians do not see it often, but must recognize and treat children with sepsis efficiently when they present. This makes pediatric sepsis education particularly amenable to simulation scenarios.

Objectives: At the end of the simulation, the learner will acquire enduring knowledge regarding recognition and treatment of pediatric sepsis.

Method: This session is taught using high-fidelity simulation coupled with a lecture on pediatric sepsis. Following the intervention, nurses were given a quiz on sepsis recognition and management. This quiz was repeated at 6-12 months to assess retention.

Topics: Simulation, pediatrics, pediatric sepsis, management.





USER GUIDE

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Learner Audience:

Medical students, interns, junior residents, senior residents, nursing

Time Required for Implementation:

Instructor Preparation: 30 minutes
Time for lecture: 30 minutes
Time for case: 10 minutes
Time for debriefing: 10 minutes

Recommended Number of Learners per Instructor/case:

4

Topics:

Simulation, pediatrics, pediatric sepsis, management.

Objectives:

By the end of this simulation, learners will be able to:

1. Recognize and manage pediatric sepsis
2. Maintain a score on post-test following simulation intervention to post-test 6-12 months later.

- There were no reading assignments because a lecture was provided. If participants cannot attend lecture due to time-constraints, then review of the lecture material is recommended. Reading the Surviving Sepsis Campaign guidelines is recommended (reference below).

Associated content:

- Associated Sepsis Quiz

Results and tips for successful implementation:

- This was tested on emergency department nurses in early 2016. There were 44 participants total, with a score of 80% following the intervention. The scores on a delayed test taken 6-12 months later averaged 87% correct, increasing rather than decaying over time. Participants ranked the experience 4.9 out of a possible 5 for "I enjoyed the simulation experience" and "Simulation is a better learning method as compared with lectures." We did not make any modifications.

References/suggestions for further reading:

1. Dellinger RP et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock. *Intensive Care Med.* 2013;39(2):165-228. doi: 10.1097/CCM.0b013e31827e83af

Linked objectives and methods:

Pediatric sepsis is a high impact but low frequency condition. The main goal would be improved identification and early treatment of pediatric sepsis in the emergency department following an intervention; however, this would be difficult to test. Therefore, the immediate goal is to acquire and maintain knowledge related to recognition and management, taught through an illustrative simulation case.

Recommended pre-reading for instructor:

- It would be useful to review the pediatric portion of the Surviving Sepsis Campaign guidelines¹ as well as the attached lecture.

Learner responsible content (optional):

Claudius I, et al. Pediatric Sepsis Case Scenario for Nursing Simulation. *JETem* 2017. 2(2): S22-42.
<https://doi.org/10.21980/J8MK5X>





INSTRUCTOR MATERIALS

Case Title: Pediatric Sepsis Case Scenario for Nursing Simulation

Case Description & Diagnosis (short synopsis): 4-year old Ryan is brought into ED with sepsis. The goal is early recognition and treatment.

Equipment or Props Needed:

- High-fidelity simulation mannequin
- Angiocaths = 24g, 22g, 20g, 18g
- O₂ = nasal Cannula / face mask / non-rebreather mask
- Monitor
- Pulse oximetry
- Ambu bag
- Broselow equipment
- Normal saline
- Medications: ceftriaxone, vancomycin, dopamine, D25W/D50

Confederates needed:

Triage nurse, primary nurse, charge nurse, 1-2 additional nurses, physician

Stimulus Inventory:

None

Background and brief information: Mother carries child into community hospital.

Initial presentation

- Mom gives the following history: Vomiting x 5 days, fever 102.0F x 2 days. Talking about “crazy stuff” (If asked – the color of emesis is clear, calling father his brother)
- Mother states – “My child was seen here last night and was sent home with Tylenol. Doctor said it was a virus.”
- Has not been eating or drinking today
- Patient states his head and tummy hurt and he is crying
- No diarrhea, rash, or cough
- Cousin sick with cough and runny nose at home
- Past medical history: Had ankle surgery 2 years ago
- Immunizations up-to-date



INSTRUCTOR MATERIALS

- No allergies
- Pediatric Assessment Triangle (PAT)
 - Appearance = Lethargic
 - Work of Breathing = Rapid and shallow
 - Circulation to skin = Pale
- Vital Signs:
 - HR – 170/min
 - RR – 30/min
 - Temp – 35.3 C oral
 - BP – 90/50
 - Pulse Ox – 94% RA
- Weight: 16kg
- Assessment: Neck supple, Lungs clear to auscultation, alert, not oriented to place. States he's at home when asked where he is. Abdomen soft with mild tenderness. Cap refill >3sec. Dry mucous membranes. Skin cool and dry.

How the scenario unfolds:

1. Child should be triaged as an emergency screening index (ESI) 2. If triaged as a 3-5, then child should decompensate in triage.
2. Child should be placed on monitor and oxygen. If not, facilitator should prompt.
3. IV started and 20mL/kg NS or LR bolus should be infused quickly. If not given by pressure bag or push-pull method, patient should decompensate quickly.
4. In spite of bolus, child becomes increasingly lethargic with SBP = 70 mmHg and capillary refill >4 seconds.
5. Bolus repeated, antibiotics given, without improvement.
6. Child requires dopamine or epinephrine (cold shock).
7. Serious consideration should be given to evaluation for possible intubation, though not mandatory.

Critical Actions:

1. Correct ESI score given (ESI 2)
2. Placed in room immediately
3. Primary nurse assigned
4. Provider informed
5. Oxygen started
6. Continuous monitoring initiated with pulse oximetry



INSTRUCTOR MATERIALS

7. IV access x 2
8. Use of IO if peripheral access is unattainable
9. Blood Cultures/VBG/POC glucose
10. Normal saline bolus = 20mL/kg intravenous (IV) or intraosseous (IO) delivered rapidly (pressure bag or push-pull)
11. Anchor antibiotic started within 1 hour
12. Ongoing vital signs and reassessments
13. Pressor support if nonresponsive to fluids
14. Secure airway
15. Pediatric intensive care unit (PICU) called



INSTRUCTOR MATERIALS

Case title: Pediatric Sepsis Case Scenario for Nursing Simulation

Chief Complaint: 4-year-old previously healthy child with vomiting x 5 days, fever 102.0F x 2 days. Talking about “crazy stuff.” Seen last night and sent home with Tylenol and diagnosis of viral syndrome.

Vitals: Heart rate (HR) 176 Blood pressure (BP) 89/49 Respiratory rate (RR) 32
Temperature (T) 35.3°C Oxygen saturation (O₂Sat) 94% on room air (RA), 96% if oxygen initiated

General Appearance: Ill-appearing, crying.

Primary Survey:

- **Airway:** Patent
- **Breathing:** Rapid and shallow
- **Circulation:** Pale and mottled

History:

- **History of present illness:** 4-year old previously healthy child with vomiting x 5 days, fever 102.0F x 2 days. Talking about “crazy stuff.” Seen last night and sent home with Tylenol and diagnosis of viral syndrome. If asked, emesis is clear and child complains of abdominal pain. ROS negative for diarrhea, rash, cough if asked.
- **Past medical history:** None, immunizations up-to-date
- **Past surgical history:** Ankle surgery 2 years ago
- **Patient’s medications:** Tylenol as needed
- **Allergies:** No known drug allergies
- **Social history:** Lives with both parents
- **Family history:** Cousin at home with runny nose and cough

Secondary Survey/Physical Examination:

- **General appearance:** Ill, pale, shallow breathing, crying
- **Weight:** 16 kg
- **Head, eyes, ears, nose throat (HEENT):**
 - **Head:** Atraumatic
 - **Eyes:** within normal limits
 - **Ears:** TMs clear



INSTRUCTOR MATERIALS

- **Nose:** Friable mucosa with nasal congestion
- **Throat:** Mild erythema, no exudate
- **Neck:** supple
- **Heart:** tachycardia with regular rate and rhythm, no murmurs
- **Lungs:** clear to auscultation bilaterally
- **Abdominal/GI:** Soft, non-peritoneal but mild diffuse tenderness to palpation
- **Genitourinary:** deferred
- **Rectal:** deferred
- **Extremities:** Cold with capillary refill 3-4 seconds
- **Back:** non-tender
- **Neuro:** Moves all 4 extremities in grossly non-focal manner, poorly cooperative with further neurologic exam, not oriented to place (states that he is at home)
- **Skin:** No rash
- **Lymph:** No lymphadenopathy
- **Psych:** Patient confused



OPERATOR MATERIALS

SIMULATION EVENTS TABLE:

Minute (state)	Participant action/ trigger	Patient status (simulator response) & operator prompts	Monitor display (vital signs)
0:00 (Baseline)	Triage	If assigned ESI 2, patient remains stable and is brought into room If assigned ESI 3,4, or 5, patient remains in triage and decompensates with decrease in BP to 60/30	T 35.3 HR 176 BP 89/49 RR 32/m O2 94% RA
2:00	Placed in room on monitor and oxygen started	If monitored, no change If not monitored, child decompensates silently and is discovered in asystole If oxygen not started, saturation declines to 88%	T 35.3 HR 170 BP 90/50 RR 30/m O2 96% 2L
3:00	IV started Labs drawn NS or LR bolus at 20 mL/kg given rapidly (push or pressure bag)	If performed correctly, patient still declines with lethargy, CR >4 seconds and BP 70/palp If steps not taken or bolus placed on pump, greater decompensation to BP 60/30	T 35.3 HR 196 BP 70/P RR 30/m O2 96% 2L
6:00	Repeat bolus	If not performed, please prompt by asking if patient needs more fluids	T 35.3 HR 196 BP 70/P RR 30/m O2 96% 2L
8:00	Call for pressers (dopamine or epinephrine preferred)	If performed correctly, BP improves to 90/50 but mental status remains poor; patient is obtunded If not performed, patient goes into PEA	T 35.3 HR 176 BP 90/50 RR 30/m O2 90% on NRB
10:00	Suggest intubation for airway protection	If performed, saturations improve If not suggested, patient vomits with potential aspiration	T 35.3 HR 176 BP 90/50 RR 30/m O2 98%
(Case Completion)	Antibiotics given (ceftriaxone first, then vancomycin), consider intubation, PICU admission	If not mentioned, prompt by asking if patient needs antibiotics, what should be given and which is the anchor to be given first	T 35.3 HR 176 BP 90/50 RR 30/m O2 96% 2L



OPERATOR MATERIALS

Diagnosis:

Septic Shock

Disposition:

Pediatric Intensive Care Unit



DEBRIEFING AND EVALUATION PEARLS

Pediatric Sepsis Case Scenario for Nursing Simulation

Pearls:

1. Pediatric sepsis can be difficult to recognize. Hypotension is a late finding; thus, altered mental status, tachycardia, and poor capillary refill should be taken seriously.
2. Rapid fluid administration is recommended for patients in septic shock, particularly in high-resource nations. In pediatric patients, this can rarely be accomplished by gravity or a standard IV pump. Using a syringe to manually push in a bolus or a pressure bag will yield a more appropriate rate of infusion.
3. While other forms of access, like IO lines, can be considered, access can be an issue in pediatric patients. If antibiotics cannot be administered simultaneously, a rapidly infused, broad-spectrum antibiotic should be given first and quickly.

Other debriefing points:

1. If the triage designation given was not ESI 2 (provided the center uses ESI triage), the reason should be explored. In this case, both the altered mental status and the danger zone vital signs should have prompted an ESI 2.
2. As the patient decompensates, he becomes hypotensive. For a pre-pubescent child, the lowest acceptable systolic blood pressure (2 standard deviations below the mean) is $70+(2)(\text{age in years})$. In this case, a systolic blood pressure below 74 should have been very concerning.

Wrap Up: Administer quiz (attached) and go over with providers

¹ Dellinger RP et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock. *Intensive Care Med.* 2013;39(2):165-228.



SIMULATION ASSESSMENT

Pediatric Sepsis Case Scenario for Nursing Simulation

Learner: _____

Assessment Timeline

This timeline is to help observers assess their learners. It allows observer to make notes on when learners performed various tasks, which can help guide debriefing discussion.

Critical Actions

1. Correct ESI score given (ESI 2)
2. Placed in room immediately
3. Primary Nurse assigned
4. Provider informed
5. Oxygen started
6. Continuous monitoring initiated with pulse oximetry
7. IV access x 2
8. Use of IO if peripheral access is unattainable
9. Blood Cultures/VBG/POC glucose
10. Normal saline bolus = 20mL/kg IV/IO rapidly
11. Anchor antibiotic started within 1 hour
12. Ongoing vital signs and reassessments
13. Pressor support if nonresponsive to fluids
14. Secure airway
15. PICU called

0:00



SIMULATION ASSESSMENT

Pediatric Sepsis Case Scenario for Nursing Simulation

Learner: _____

Critical Actions:

- Correct ESI score given (ESI 2)
- Placed in room immediately
- Primary Nurse assigned
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- Normal saline bolus = 20mL/kg IV/IO rapidly
- Anchor antibiotic started within 1 hour
- Ongoing vital signs and reassessments
- Pressor support if nonresponsive to fluids
- Secure airway
- PICU called

Summative and formative comments:

Milestones assessment:

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
1	Emergency Stabilization (PC1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Recognizes abnormal vital signs	<input type="checkbox"/> Recognizes an unstable patient, requiring intervention Performs primary assessment Discerns data to formulate a diagnostic impression/plan	<input type="checkbox"/> Manages and prioritizes critical actions in a critically ill patient Reassesses after implementing a stabilizing intervention





SIMULATION ASSESSMENT

Pediatric Sepsis Case Scenario for Nursing Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
2	Performance of focused history and physical (PC2)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Performs a reliable, comprehensive history and physical exam	<input type="checkbox"/> Performs and communicates a focused history and physical exam based on chief complaint and urgent issues	<input type="checkbox"/> Prioritizes essential components of history and physical exam given dynamic circumstances
3	Diagnostic studies (PC3)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Determines the necessity of diagnostic studies	<input type="checkbox"/> Orders appropriate diagnostic studies. Performs appropriate bedside diagnostic studies/procedures	<input type="checkbox"/> Prioritizes essential testing Interprets results of diagnostic studies Reviews risks, benefits, contraindications, and alternatives to a diagnostic study or procedure
4	Diagnosis (PC4)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Considers a list of potential diagnoses	<input type="checkbox"/> Considers an appropriate list of potential diagnosis May or may not make correct diagnosis	<input type="checkbox"/> Makes the appropriate diagnosis Considers other potential diagnoses, avoiding premature closure
5	Pharmacotherapy (PC5)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Asks patient for drug allergies	<input type="checkbox"/> Selects an medication for therapeutic intervention, consider potential adverse effects	<input type="checkbox"/> Selects the most appropriate medication and understands mechanism of action, effect, and potential side effects Considers and recognizes drug-drug interactions



SIMULATION ASSESSMENT

Pediatric Sepsis Case Scenario for Nursing Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
6	Observation and reassessment (PC6)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Reevaluates patient at least one time during case	<input type="checkbox"/> Reevaluates patient after most therapeutic interventions	<input type="checkbox"/> Consistently evaluates the effectiveness of therapies at appropriate intervals
7	Disposition (PC7)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Appropriately selects whether to admit or discharge the patient	<input type="checkbox"/> Appropriately selects whether to admit or discharge Involves the expertise of some of the appropriate specialists	<input type="checkbox"/> Educates the patient appropriately about their disposition Assigns patient to an appropriate level of care (ICU/Tele/Floor) Involves expertise of all appropriate specialists
9	General Approach to Procedures (PC9)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Identifies pertinent anatomy and physiology for a procedure Uses appropriate Universal Precautions	<input type="checkbox"/> Obtains informed consent Knows indications, contraindications, anatomic landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	<input type="checkbox"/> Determines a back-up strategy if initial attempts are unsuccessful Correctly interprets results of diagnostic procedure
20	Professional Values (PROF1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Demonstrates caring, honest behavior	<input type="checkbox"/> Exhibits compassion, respect, sensitivity and responsiveness	<input type="checkbox"/> Develops alternative care plans when patients' personal beliefs and decisions preclude standard care



SIMULATION ASSESSMENT

Pediatric Sepsis Case Scenario for Nursing Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
22	Patient centered communication (ICS1)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Establishes rapport and demonstrates empathy to patient (and family) Listens effectively	<input type="checkbox"/> Elicits patient's reason for seeking health care	<input type="checkbox"/> Manages patient expectations in a manner that minimizes potential for stress, conflict, and misunderstanding. Effectively communicates with vulnerable populations, (at risk patients and families)
23	Team management (ICS2)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Recognizes other members of the patient care team during case (nurse, techs)	<input type="checkbox"/> Communicates pertinent information to other healthcare colleagues	<input type="checkbox"/> Communicates a clear, succinct, and appropriate handoff with specialists and other colleagues Communicates effectively with ancillary staff



LEARNER MATERIALS

Pediatric Sepsis Simulation Quiz

Name: _____ Employee # _____

Date: _____ Test Score: _____

1. Which of the following is not part of the elements that define SIRS?
 - a. Heart rate elevated for age
 - b. Pain level > 5/10
 - c. Respiratory rate elevated for age or PaCO₂ <32
 - d. Temp <36 or >38 C° (< 96.8 or > 100.4 F°)
 - e. WBC >12,000, < 4,000 or > 10% bands

2. Criteria not included in the definition of systemic inflammatory response syndrome (SIRS) in children, are:
 - a. Pyrexia
 - b. Hypothermia
 - c. Leukopenia
 - d. A confirmed bacterial infection
 - e. Tachycardia

3. What would be initiated in the pediatric triage on a patient with SIRS and a suspected source of infection?
 - a. ESI of 2
 - b. Placed in an available room to initiate sepsis work-up
 - c. Notify Attending immediately
 - d. All the above

4. What's the minimum fluid bolus a 14 Kg patient should receive within the first 5 minutes of a sepsis workup:
 - a. 140 ml over 30 minutes
 - b. 840 ml slow IV drip
 - c. 280 ml IV push
 - d. 1 liter set to infuse at 999 ml over an hour



LEARNER MATERIALS

5. If antibiotics are ordered as follows:
“Vancomycin 140mg IVPB and Ceftriaxone 700 mg IVPB”
in what order should the antibiotics be administered?
- Whichever one appears at the top of the order box
 - It doesn't matter
 - Whichever bag is found first in the Pyxis
 - Ceftriaxone 700 mg IVPB then Vancomycin 140 mg IVPB
 - Vancomycin 140 mg IVPB then Ceftriaxone 700 mg IVPB
6. Which is a late finding in septic shock in children?
- Decreased urine output
 - Increased cardiac output
 - Decreased blood pressure
 - Focal lung infiltrate
7. Which of the following skin examination findings is generally **not** associated with sepsis?
- Pyogenic granuloma
 - Ecthyma gangrenosum
 - Purpura fulminans
 - Petechiae
8. One characteristic of organ dysfunction is:
- Anuria
 - Metabolic acidosis
 - Gradual and subtle changes in mental status
 - A ratio of arterial oxygen tension to fraction of inspired oxygen of 380 or more
9. The common manifestations of sepsis are seen in all of the following organ systems, EXCEPT:
- Skeletal
 - Pulmonary
 - Cardiovascular
 - Central nervous system



LEARNER MATERIALS

10. Altered mental status is a common manifestation of sepsis. An early sign of this change may be:

- a. Irritability
- b. Polyneuropathy
- c. Focal manifestations
- d. Low oxygen saturation

11. What drugs are the first choices to restore blood pressure and perfusion in the patient with sepsis and cold shock?

- a. Dobutamine or vasopressin
- b. Epinephrine or dopamine
- c. Phenylephrine or epinephrine
- d. Chlorpromazine or pseudoephedrine

12. Sepsis/Meningitis Signs and Symptoms in Neonates include:

- a. seizures
- b. feeding intolerance
- c. retractions
- d. all of the above

13. Sepsis/Meningitis Signs and Symptoms in Children include:

- a. loss of appetite or emesis
- b. muscle and joint pain
- c. Kernig sign, Brudzinski sign
- d. all of the above

14. Complication(s) associated with sepsis:

- a. persistent hypotension
- b. disseminated intravascular coagulation
- c. acute respiratory distress syndrome
- d. acute renal failure
- e. all of the above



INSTRUCTOR MATERIALS

Pediatric Sepsis Simulation Quiz – Key *Correct answers noted in bold and italics*

1. Which of the following is not part of the elements that define SIRS?
 - a. Heart rate elevated for age
 - b. *Pain level > 5/10***
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INSTRUCTOR MATERIALS

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INSTRUCTOR MATERIALS

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- b. Polyneuropathy
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- a. persistent hypotension
- b. disseminated intravascular coagulation
- c. acute respiratory distress syndrome
- d. acute renal failure
- e. **all of the above**