Patient Simulation Case

I. Title: Organophosphate Poisoning Simulation

II. Target Audiences: Pre-clerkship medical students, nursing students

III. Learning Objectives or Assessment Objectives:

A. Primary
   1. Recognize the symptoms and signs of organophosphate poisoning in a simulated patient.
   2. Use medical terminology to describe symptoms and physical findings.
   3. Describe the effects of parasympathetic nervous system stimulation by organophosphates as manifested in the following organ systems: Cardiovascular, Respiratory, Visual, Gastrointestinal, Neurologic, Genitourinary, and Dermatologic.
   4. Explain the pharmacologic mechanisms of atropine and pralidoxime in the treatment of organophosphate poisoning.

B. Secondary
   1. Demonstrate basic teamwork skills.
   2. Recognize hypoxia from clinical signs and/or abnormal pulse oximetry reading.
   3. Treat hypoxia with oxygen and assisted bag/mask ventilation as needed.
   4. Discuss the importance of patient decontamination and provider protection when caring for patients with organophosphate poisoning.

C. Critical actions checklist
   1. Assign roles to group member upon entering room.
   2. Use appropriate personal protective gear.
   3. Remove patient's contaminated clothes.
   4. Check the patient's ABC’s (Airway, Breathing, Circulation) and address immediate concerns.
   5. Call for consultation if drug dosage is not known.
   6. Treat with atropine, pralidoxime (atropine, Mark-1 kits and/or DuoDote).

IV. Environment:

A. Lab Set Up
   1. Simulated emergency department with in-room video and audio capture.

B. Mannequin Set-Up
   1. Preferred mannequin: Laerdal SimMan 3G
   2. Fluids tank filled
   3. Put detergent in mouth port for foaming
   4. Patient sitting reclined on stretcher
   5. Undressed except for pants
6. Pants have oily stains on legs, slit in back for easy removal
7. Wet spot on front of pants (urinary incontinence)
8. Diarrheal stool in pants (stains)
9. Face wet (Use spray bottle if mannequin does not have diaphoresis feature.)
10. Partially filled emesis basin at patient’s side (emesis can be replicated using a latency prop from a costume store, or with a can of chunky soup)
11. Cardiac monitor leads in place
12. BP cuff on arm
13. Pulse oximetry probe on finger
14. Vital signs monitor: turned on
15. No IV line in place

C. Props
1. Spray bottle with water
2. Clipboard with “chart”
3. Gloves
4. Gowns (4)
5. Masks (4)
6. Plastic bag (for clothing)
7. Bar of soap
8. Towels
9. External, support monitor (or iPad): turned on
10. Videos loaded (Paramedic report, Frothing mouth, Poisoned paramedic)
11. Scrub top and name tag for nurse
12. Phones (2)
13. System for communication from computer operator to nurse/actor
14. Printed picture of Malathion label (See image in appendix 1)
15. Optional: small, sealed vial of Malathion.

Note: if using a simulator without fluid capabilities, then the following workarounds could be used:

- Diaphoresis can be simulated by spraying water on the mannequin’s face and clothing prior to the start of the scenario.
- Urinary incontinence can be simulated by pouring a small amount of water on the pants. (Simulating the odor of fecal incontinence can be accomplished with a soiled baby diaper, but it is not recommended.)
- Frothy saliva can be created with a soapy solution applied around the mouth.

D. Distractors
1. Paramedic vomits and collapses due to secondary exposure to Malathion.
2. Students can call pharmacist for drug dose recommendations.

V. Actors:
A. **Roles:** voice of patient (Mr. Boyd), voice of pharmacist, voice of paramedic, and nurse in simulation suite. All actor scripts are provided in Appendix 2.

B. **Who may play them:** Faculty, resident, or simulation technician plays voice of patient, pharmacist, and paramedic. Nurse: nursing student or actor plays role of nurse in the simulation room.

C. **Action Role:** Students may choose to “call” the pharmacist for drug recommendations; near end of the script, the nurse receives word that the paramedic has vomited and collapsed at the triage desk.

**VI. Case Narrative:**

Orientation to the Event (This information is presented to the students prior to the start of the simulation.)

- **Logistics:**
  - 15-minute orientation
  - 15-minute simulation
  - 75-minute group discussion
- Event will be video-recorded.
- Rules of confidentiality & professionalism apply.
- Setting: an Emergency Department resuscitation room
- Patient: SimMan 3G (full set of features that you are familiar with.) The patient will interact with you, unless he is unconscious
- One actor (nurse) in each room will assist you; interact with this person as you would a real nurse. You can talk with a pharmacist by phone, if you like.
- You will work in teams of 4-6 students per patient.
- You decide on team assignments, but at least one person should take notes (i.e. create a medical record) for the discussion.
- Stay in your roles. Save your questions for the discussion session. We won’t interrupt the simulation unless your safety is at risk.
- Keep in mind the time limitation. We will end the scenario at 15 minutes, whether you finish early or don’t complete everything you want to do. You may run out of time if you pursue non-essential tasks or fail to allocate your resources wisely.
- This is an emergency case. It's fast-paced. Problems can develop rapidly.
- Enjoy the experience.

A. **Scenario Background Given to Participants (specify if given freely or must be asked for)**

1. **Chief complaint, triage note, medic report** – in patient chart, nurse will read this when the students enter the room.
2. **Past medical history** – not in chart, students can ask patient.
3. **Meds and allergies** – not in chart, students can ask patient.
4. **Family/social history** – not in chart, students can ask patient.
B. Scenario conditions initially:
   1. **History**: The patient is a 40-year-old adult male with complaints of dimmed vision, watery eyes, shortness of breath, nausea, vomiting, diarrhea, and sweating. He is able to answer questions during the first 5 minutes of the scenario. Only if questioned about recent activities, the patient admits to spraying crops in his field with a pesticide called Malathion. The patient is undressed except for soiled pants that he is still wearing. The nurse will not remove the pants unless requested to do so.

   2. **Patient initial exam** - Initial vital signs are: BP 100/70, P 50, R 25, T 99.0°F, and O₂ saturation 90%. On examination, the patient has diaphoresis, constricted pupils, profuse salivation, bronchospasm, hyperactive bowel sounds, muscle twitching, and evidence of urinary and fecal incontinence. If the team does not obtain the history of the exposure, the paramedic who brought the patient will call with the information 11 minutes into the scenario. Soon after the examination is completed (or at t=10 mins), the patient vomits and becomes confused; a one-minute seizure is an optional event. The patient begins frothing at the mouth and is increasingly hypoxic. He can no longer answer questions at this point.

   3. **Patient physiology** – the patient is exhibiting all of the classic signs of cholinergic toxicity; see list of symptoms in “patient initial exam” above.

C. Scenario branch points:
   1. **Changes in patient’s condition** – the patient deteriorates during the simulation (dyspnea, seizure, low oxygen saturation, loss of consciousness) until the appropriate drugs are administered.
   2. **Responses to treatment** – Once 6 mg of atropine is administered, the patient improves with the treatment.
   3. **Directions scenario can take** – Patient will deteriorate further, seize, and become unconscious unless the correct dose of atropine is administered. A large dose of atropine is required, so if the learners do not administer a sufficient amount, the patient will not improve.

VII. Instructors Notes:

A. **Tips to keep scenario flowing**: Keep the timeline and transition points in front of computer operators and instructors in the control room and the nurse actor so everyone knows exactly when to transition during the scenario. Perform equipment checks before the scenario begins.
   a. Equipment Checks:
      • Check flow of fluids from all ports.
      • Check urination flow.
      • Check voice of mannequin.
      • Check overhead paging.
      • Check “phone” system.
      • Check communication systems.
B. **Tips to direct actors:** Have actors study the script and timeline; the nurse/actor should wear an earpiece that allows the instructor/computer operator to communicate instructions in real time.

C. **Scenario programming:**

1. Optimal management path – Follow the provided scripts in appendix 2; Follow “Computer Operator Instructions” in appendix 3.

Simulation Team Roles:
A. Instructor – student orientation, scenario management, communication with nurse actor in simulation room, voice of pharmacist, and discussion facilitator.
   1. Provide the nurse with directions when unanticipated questions are asked and actions are taken.
   2. Play the roles of the paramedic providing a phone report and the pharmacist answering questions by phone. Options: allow the computer operator to play one of the roles, or pre-record the communication and play the video clip during the simulation.
   3. Bookmark the recording for playback during the discussion.
   4. Stop the simulation at 15 minutes.
   5. **Timing:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mins</td>
<td>Nurse gives initial presentation report; start scenario immediately after nurse report.</td>
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<tr>
<td>5 mins</td>
<td>Nurse reveals oily residue on clothes &amp; remarks on pungent odor. Patient shows worsening signs.</td>
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<tr>
<td>10 mins</td>
<td>Show frothing mouth image or video (if mannequin fails to froth.)</td>
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<tr>
<td>10 mins</td>
<td>Patient seizes automatically for 1 minute.</td>
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<tr>
<td>11 mins</td>
<td>Provide ‘Paramedic report’ by phone.</td>
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<tr>
<td>12 mins</td>
<td>Nurse cues atropine treatment, if not done.</td>
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<tr>
<td>14 mins</td>
<td>Remind nurse to report the poisoned paramedic to the team.</td>
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<tr>
<td>15 mins</td>
<td>Nurse states that ICU team will assume care; end scenario.</td>
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</tbody>
</table>

B. **Actor - emergency nurse in simulation room**

General purpose during scenario:
1. Do not provide any information or cues except as scripted.
2. Do not suggest any history or physical examination. Step back and let the team evaluate the patient.
3. If physical findings are unclear because of simulation artifact, you may describe what you see, if asked.
4. You do not have any more information about the patient’s circumstances prior to his arrival.
5. Do not speak for the patient.
6. Get any equipment or medications requested by the team.
7. Attach oxygen tubing, turn it on, apply a face mask, turn on suction, remove the patient’s pants, start an IV line, deliver drugs in doses specified by the team, and provide anything they need, but ONLY if requested.
8. Read the script away from the bedside to start the scenario.
9. No medical consultants are available. A pharmacist is available for advice.
10. If you are unclear about how to respond to a question or a request, signal the Control Room by putting your elbow in your hand, and tap the side of your head with your finger. The instructor will give you directions through the earpiece.
11. Optional action: open a small vial of Malathion and allow the students to smell the odor briefly, and then recap the tube. Handle the tube of Malathion carefully.

C. Actor – patient voice from control room

D. Simulation Technicians - Computer Operator

VIII. Debriefing Plan

A. Method of debriefing – Group discussion with whiteboard and markers. At least one clinician and one basic science faculty member should be present for the debriefing session.

Stages:
1. Reactions phase: allow participants chance to discuss feelings about the case, decompress from the stressful event, and if desired, briefly discuss one issue that was memorable, and explain why.

2. Analysis phase: Review the medical facts of the case: review the presenting signs and symptoms the patient, discuss the physiology of the autonomic nervous system and how organophosphate poisoning produced the signs and symptoms of each organ system, and discuss the diagnosis and treatment regimens.

3. Summary Phase: participants can review the lessons they have learned in the simulation and discussion session, allowing for formative assessment.

B. Actual debriefing materials – A whiteboard and markers can be used to list the patient’s signs and symptoms, which provide discussion points throughout the remainder of the discussion session. If the scenarios are recorded, actual footage from the simulation can be used to reinforce concepts or help learners to recall events.

C. Rules for the debriefing - The facilitator must guide the discussion rather than lead it; encourage participation from everyone; limit interruptions by others when someone is speaking; ensure a confidential and safe environment; and allow time for participants’ responses.

D. Questions to facilitate the debriefing:

*Debriefing Outline (Questions and Answers): 15 Questions, 75 minutes.*
1. Do you have any general comments about this simulation exercise before we explore specifics of the case?

2. List essential demographic data about this patient:
   - Gender: Male
   - Age: 40 years
   - Weight: 80 kg
   - Occupation: farm worker

3. List the symptoms that you elicited from this patient:
   - Runny nose
   - Dimmed vision
   - Headache
   - Nausea
   - Abdominal cramps
   - Vomiting
   - Diarrhea
   - Muscle twitching
   - Generalized weakness

4. List the signs (physical findings) that you observed in this patient, from head-to-toe:

<table>
<thead>
<tr>
<th>Vital signs:</th>
<th>Blood pressure: 100/70 mmHg (hypotension). Decreased to 80/50</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pulse: 50/min → 40/min (bradycardia)</td>
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<tr>
<td></td>
<td>Respiratory rate: 25/min (tachypnea)</td>
</tr>
<tr>
<td></td>
<td>Temperature: 99.5°F</td>
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<tr>
<td>General appearance:</td>
<td>Dyspnea (short of breath)</td>
</tr>
<tr>
<td>Head:</td>
<td>Normal</td>
</tr>
<tr>
<td>Eyes:</td>
<td>Miosis (pupils constricted bilaterally)*</td>
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<tr>
<td></td>
<td>Pupils minimally reactive to light</td>
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<tr>
<td></td>
<td>Profuse lacrimation (tearing)</td>
</tr>
<tr>
<td>Ears:</td>
<td>Normal</td>
</tr>
<tr>
<td>Nose:</td>
<td>Rhinorrhea (runny nose)</td>
</tr>
<tr>
<td>Mouth &amp; Throat:</td>
<td>Hypersalivation (drooling)</td>
</tr>
<tr>
<td>Neck:</td>
<td>Normal</td>
</tr>
<tr>
<td>Chest:</td>
<td>Normal</td>
</tr>
<tr>
<td>Lungs (auscultation):</td>
<td>Breath sounds equal on both sides</td>
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<tr>
<td></td>
<td>Wheezes &amp; rales (crackles) bilaterally</td>
</tr>
<tr>
<td>Heart (auscultation):</td>
<td>Bradycardia (slow heart rate)</td>
</tr>
<tr>
<td></td>
<td>Regular heart rhythm (no skipped beats)</td>
</tr>
</tbody>
</table>
Abdomen/rectal: Hyperactive bowel sounds (noisy on auscultation)
Not tender to palpation (touch)
Fecal incontinence (lost control of bowels & soiled self)

Genitalia: Urinary incontinence (lost control of bladder & urinated in clothing)

Extremities/Musculoskeletal: Fasciculations (twitching muscles)*

Vascular: Decreased strength of pulses

Skin: Profuse diaphoresis (sweating)
Normal color and temperature

Mental status: Initially - awake but confused, anxious, restlessness
Later - unresponsive due to intermittent seizures (convulsions)

Neurologic: Motor function symmetrical, but generalized weakness (moves all 4 extremities with decreased strength)
Tremors

Monitors: Oxygen saturation = 90 → 84%
Cardiac monitor = slow rate, 50 → 40 (sinus bradycardia)

*Reliable signs of organophosphate toxicity.

5. How would you describe the characteristic odor of Malathion that was on the patient’s clothing?
   • Garlic-like odor

6. Explain each finding (symptom or sign) on the basis of what you know about the effects of organophosphates on the autonomic nervous system and organ systems.

<table>
<thead>
<tr>
<th>ACUTE FINDINGS</th>
<th>PHYSIOLOGIC EXPLANATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotension, bradycardia &amp; decreased pulses</td>
<td>Ach binds to M2 receptors on the sinoatrial node and reduces heart rate (bradycardia).</td>
</tr>
<tr>
<td></td>
<td>Ach binds to M2 receptors on atrial myocardiocytes and reduces stroke volume via decreased contractility (inotropy).</td>
</tr>
<tr>
<td></td>
<td>Together, these actions reduce cardiac output, which decreases blood pressure (hypotension) and pulse.</td>
</tr>
<tr>
<td>Low oxygen saturation, tachypnea, dyspnea, wheezes &amp; rales</td>
<td>Ach binds to M3 receptors on the smooth muscle cells of the airways and causes constriction, producing dyspnea, wheezing &amp; rales. This leads to low oxygen saturation.</td>
</tr>
<tr>
<td>Hypersalivation</td>
<td>Ach binds to M3 receptors on the salivary glands and increases K+ and water secretion, which increases salivation.</td>
</tr>
<tr>
<td>Miosis &amp; dimmed vision</td>
<td>Ach binds to M3 receptors on the iris sphincter muscle, causing constriction, which reduces the diameter of the pupil (constriction).</td>
</tr>
<tr>
<td>Lacrimation &amp; rhinorrhea</td>
<td>Ach binds M3 receptors in the tear ducts and nasal cavity glands, causing increased production of tears and nasal secretions</td>
</tr>
<tr>
<td>Syndrome</td>
<td>Mechanism</td>
</tr>
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<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Nausea, vomiting</td>
<td>Ach binds to cholinergic receptors in the central and peripheral nervous system to cause nausea and vomiting.</td>
</tr>
<tr>
<td>Hyperactive bowel sounds</td>
<td>Ach binds to M1 &amp; M3 receptors in the smooth muscle tissue of the GI system to increase GI motility (and bowel sounds). This can cause diarrhea.</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>Ach binds to M3 receptors on the urinary sphincter, which relaxes the sphincter to eliminate urine.</td>
</tr>
<tr>
<td>Fasciculations</td>
<td>Ach binds to N receptors on skeletal muscle. This stimulates the muscle, which causes fasciculations and tremors.</td>
</tr>
<tr>
<td>Diaphoresis</td>
<td>ACh binds to M receptors on the sweat glands and increases general secretions, which is an increase in sweat production. Sweating is mediated by the sympathetic nervous system, but it utilizes ACh at the target organ.</td>
</tr>
<tr>
<td>Confusion &amp; seizure</td>
<td>The cause of neurologic symptoms is not well understood. There are both nicotinic and muscarinic receptors in the brain. Neuro symptoms can range from mild to severe (confusion to seizures). Most symptoms are due to activation of the PNS.</td>
</tr>
</tbody>
</table>

Note: A toxidrome is a collection of symptoms and signs characteristic of a poisoning.

7. List the treatment you gave and all responses to treatment:

A. Check airway, breathing, & circulation.
B. Suction airway secretions until medications take effect.
C. Deliver oxygen through non-rebreather mask:
   a. Slight but inadequate improvement in oxygen saturation.
D. Oxygen delivery by bag-mask ventilation:
   a. Temporary improvement to ~90%
E. Atropine:
   a. <6 mg or <3 Mark-1 kit (or <3 DuoDote kits) = No improvement
   b. >6 mg or ≥3 Mark-1 kits or <3 DuoDote kits:
      ▪ Heart rate increases to 70/minute
      ▪ Blood pressure increases to 90/60
      ▪ Patient becomes more awake
      ▪ Secretions (tears & salivation) decrease
      ▪ Vomiting stops
      ▪ Lungs: wheezes and rales resolve
      ▪ Sweating decreases
F. Pralidoxime 1 gram over 30 minutes = Muscle weakness/paralysis resolves.

Note: A Mark-1 Kit contains atropine (2 mg) and pralidoxime (600 mg) in two separate auto injectors that work similarly to an Epi-Pen. In patients with severe respiratory symptoms and/or seizures, you should administer three of these kits immediately.

Duodote contains 2.1 mg of atropine and 600 mg of pralidoxime in a single autoinjector.
8. Explain how atropine reversed (or could have reversed) the effects of the organophosphate.

- Atropine is an anticholinergic drug that blocks acetylcholine from binding to peripheral and central cholinergic receptors, reversing the parasympathetic stimulation.

- Atropine does not reverse the muscarinic (somatic) effects of organophosphates, so the patient may be at risk of respiratory failure (from respiratory muscle weakness) even if secretions have dried up.

9. The usual dose of atropine for cardiac problems in an adult is 0.5-1.0 mg. How much atropine should you give in this situation?

- Enough to 1) dry up secretions in the lung and improve oxygen saturation in the blood (as measured by pulse oximetry); 2) provide adequate heart rate and blood pressure to reverse shock (e.g. Systolic BP > 90 mm Hg, heart rate > 80/min.)

- For severe cases, start with 1-3 mg and double the dose every 5 minutes until the response is achieved. It may take many vials of atropine. (e.g. 40 mg for a moderate poisoning is a common dose.)

- A constant infusion of 10-20% of the loading dose (usually a maximum of 2 mg/hour) is then given.

10. Why is pralidoxime (2-PAM) used as an antidote in these poisonings?

- Pralidoxime (2-PAM) should be given in any patient who requires atropine for treatment.

- Pralidoxime works by reversibly binding to the acetyl cholinesterase enzyme, thereby competing with the organophosphate binding.

- Unlike organophosphates, pralidoxime does not inactivate the enzyme, and so it can still function.

- Without pralidoxime treatment, the organophosphate can permanently inactivate acetyl cholinesterase.

11. What happened to the paramedic at the end of the scenario and why?

- Developed poisoning from handling clothing that was soiled with the organophosphate pesticide, through skin absorption and inhaling malathion fumes that were “off gassing” from the patient’s clothing and skin.

12. Considering how you managed this patient, are you and your healthcare team at risk for poisoning?
• Yes, if personal protective clothing is not worn. Organophosphates are highly toxic in very small amounts by absorption through skin or inhalation. For chemical warfare agents, as little as 0.0001 mg/m³ and for insecticides 100 mg/m³ can pose an immediate danger to life and health (IDLH).

13. What can you do to prevent this problem?

• By decontamination: removing the patient’s clothes and washing him thoroughly from head-to-toe with soap (e.g. dishwashing liquid) and warm water to reduce further poisoning of the patient and the chance that a provider will be poisoned through contact with the organophosphate.

• By wearing clothing impervious to organophosphates. This would include a disposable Tychem® full body suit and neoprene or nitrile gloves and boots. Regular clothing does not offer any protection against organophosphates. Nor do latex gloves, which the organophosphate can simply pass through to the wearer’s skin.)

• By using Powered Air Purifying Respirators (PAPR) to prevent inhalation of any fumes from his skin, or what is referred to as “off-gassing”.

14. What could you or a public agency do to prevent this from happening to other farmworkers?

• Report this event to the Public Health Department.

• Health Department might recommend the use of personal protective equipment while handling or applying pesticides, transportation of pesticides in a separate trailer behind the farm truck, and construction of separate storage areas for herbicides, insecticides and fungicides.

• A separate wash site could be constructed for use at the end of the workday.

15. In what other situation could you see this type of poisoning?

• Chemical warfare agents, i.e. nerve agent attack by terrorist group

IX. Pilot Testing and Revisions:

A. Numbers of participants
Two groups of five M3 medical students participated in the pilot test of the simulation.

Three instructors ran the simulation. One person served as the nurse actor, one provided the voice of the patient, pharmacist, and paramedic, and one simulation technician operated the computer. Two clinicians and one basic science faculty member guided the discussion session.
B. Performance expectations, anticipated management mistakes

This simulation was used for M1 students. The students had a few introductory lectures on the autonomic nervous system and autonomic drugs prior to the simulation event. This was crucial for the students to be able to recognize the autonomic signs and symptoms the simulated patient was exhibiting, and know what to use for treatment. This prior knowledge allowed the students to demonstrate competence in learning objectives 1, 3, and 4.

1. Recognize the symptoms and signs of organophosphate poisoning in a simulated patient.

3. Describe the effects of parasympathetic nervous system stimulation by organophosphates as manifested in the following organ systems: Cardiovascular, Respiratory, Visual, Gastrointestinal, Neurologic, Genitourinary, and Dermatologic.

4. Explain the pharmacologic mechanisms of atropine and pralidoxime in the treatment of organophosphate poisoning.

In addition, all of the students had previously completed a Medical First Responders course, which utilized high-fidelity simulators. Due to this training, the students were familiar with basic medical terminology, teamwork as medical professionals, basic first response care, the high-fidelity simulators, and the use of personal protective equipment. These skills allowed the students to demonstrate competence in learning objectives 2, 5, 6, 7, and 8.

2. Use medical terminology to describe symptoms and physical findings.

5. Demonstrate basic teamwork skills.

6. Recognize hypoxia from clinical signs and/or abnormal pulse oximetry reading.

7. Treat hypoxia with oxygen and assisted bag/mask ventilation as needed.

8. Discuss the importance of patient decontamination and provider protection when caring for patients with organophosphate poisoning.

Upon entering the simulation room, the participants should assign roles to each member of the group, recognize the toxidrome of cholinergic toxicity, put on personal protective equipment and remove the contaminated clothing from the patient, recognize the patients respiratory failure based on clinical signs and oxygen saturation measurements, provide basic ventilatory support with bag mask ventilation, call the pharmacist for advice on drug doses as needed, and ask the nurse to administer the drugs.
The most common problem during the simulation involved communication between the nurse and the control room. It is important for the nurse to clearly repeat what medications are administered so the instructors in the control room can initiate the correct responses in the simulated patient.

In addition, none of the student groups used the personal protective equipment, which was addressed in the debriefing.

Also, some of the groups did not call the pharmacist for a consult, which led to those groups not giving a high enough dose of the drugs to resolve the patients symptoms before the simulation ended. This was also discussed in the debriefing, and we may advise the nurse to prompt the students to call the pharmacist in future simulation events, when necessary.

C. Evaluation forms for participants:

<table>
<thead>
<tr>
<th>Evaluation of the Simulation Session:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the scale below, please indicate how much this case simulation added to your knowledge and skills in each of the following areas. For each item, place a check in the box under the appropriate number.</td>
</tr>
<tr>
<td>1 = I gained nothing</td>
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<tr>
<td>2 = I gained a little</td>
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<tr>
<td>3 = I gained somewhat</td>
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<tr>
<td>4 = I gained a lot</td>
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<tr>
<td>5 = I gained a great deal</td>
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</tbody>
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<thead>
<tr>
<th>Area</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Collecting information from a patient history and physical examination during an emergency</td>
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<tr>
<td>Learning new medical terminology</td>
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<tr>
<td>Recognizing hypoxia from symptoms, signs, and monitors</td>
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<tr>
<td>Instituting patient decontamination measures and protection of healthcare personnel when treating surface poisons</td>
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<tr>
<td>Recognizing how organophosphate poisoning affects the autonomic nervous system</td>
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<tr>
<td>Comprehending the pharmacology of the antidotes to this poison</td>
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<td>Integrating basic science knowledge into a clinical setting</td>
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1. How did this experience compare with other teaching/learning that you have encountered?

2. How can the sessions be improved?
**Evaluation of the Discussion (Debriefing) Session:**

Use the scale below to rate the Discussion Session. For each item, place a check in the box under the appropriate number.

1 = Strongly disagree  
2 = Disagree  
3 = Agree  
4 = Strongly agree  

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<tr>
<td>The scenario was both interesting and instructive.</td>
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<td>The facilitators encouraged all members of the group to participate in the discussion.</td>
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<td>The facilitators asked questions that were related to material learned during the simulation.</td>
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<td>The facilitators guided, but did not lead, the group’s exploration of the case during the discussion.</td>
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<td>The facilitators helped the learners to correlate the basic sciences with the clinical features of the case.</td>
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1. Please provide written comments below on how the Discussion Session could be improved:

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**X. Authors and their affiliations**

**Maria Sheakley, PhD**  
Associate Professor, Physiology  
Department of Biomedical Sciences  
WMU Homer Stryker School of Medicine  
300 Portage Street  
Kalamazoo, MI 49008

**Richard Lammers, MD, FACEP**  
Professor, Emergency Medicine  
Assistant Dean for Simulation  
Department of Emergency Medicine  
WMU Homer Stryker School of Medicine  
300 Portage Street  
Kalamazoo, MI 49008

**John D. Hoyle Jr., MD FACEP, FAAP**  
Professor, Emergency Medicine  
Professor, Pediatric and Adolescent Medicine
Appendix 1 – Malathion image

Image was “obtained by the paramedics at the scene”, to be shown to students during simulation approximately 11 minutes after the start of the scenario, during the paramedic report.

Photo taken by Dr. Richard Lammers, co-author
Appendix 2 – Actor Scripts

Organophosphate Poisoning Scenario: Nurse’s Instructions

Setting:  Emergency Department exam room
Clothing:  Scrubs, nametag

Nurse’s Script, Part 1

Introduction:  (inside the room but away from the bedside)

• “I’m (first name), the nurse working with your team today.”

• “You must be new to this Emergency Department. I’ll find any equipment or medications you need. Just tell me what you want.”

• “I have a patient I’d like you to see.”

• “Here is the chart. You can start taking notes.”

Initial report:

• “The paramedics brought this man from work. He just arrived. They’ll be back in a few minutes.”

• “The patient is a 40-year old man who told me that he’s sweaty, short of breath, nauseated, vomiting, and weak.”

• “I connected him to the cardiac monitor. His vital signs are on the screen already—pulse, blood pressure, respiratory rate, temperature, and oxygen saturation. The patient’s vital signs during transport to the hospital were the same as they are here.”

• “His lungs sound like asthma to me, but it’s probably another case of the flu.”

• “You can go see him now.”

Lead the team to the bedside.
Organophosphate Poisoning Scenario: Nurse’s Script, Part 2

Scenario Progression:

Provide the following information at the appropriate time:

Time = 5 minutes
“Besides the diarrhea, his pants smell strange. Take a whiff of this…what do you think it smells like?” (Nurse lets students smell malathion).

Patient comments to nurse about eyes:
“I don’t see anything in your eyes, sir. Maybe you got some chemical in them.” (Interact with patient in order to get team to do the same.)

Seizing: (time=10 mins)
• “That looks like a seizure to me.”

• “I’ve also seen the muscles in his arms and legs twitch, but not like a seizure.”

Time=11 minutes
“The paramedic who brought this patient wants to give you a report.”
[Hand a phone to the team, and then show the Malathion image]

Time = 12 minutes, and no treatment given:
• “I’ve seen something like this once before. The doctors gave atropine when the pulse was this slow. Do you want me to give some atropine?”
**Treatment:**

• “I have atropine here. *(Show the vial/Mark I kit/Duodote.)* How much do you want me to give? Would you like to give it?”

• “I can give one of these syringes to start with.”

• “It doesn’t look like the atropine did much (<4 mg). Do you want me to give some more?”

• “You could talk to the pharmacist and ask for advice. I’ll put the call on the loudspeaker.”

**Time=14 minutes**

“Did you hear? The paramedic who brought this patient to us just vomited and collapsed at the triage desk. I think you’re going to have to see him next.”

**Time=15 minutes**

“The ICU team has arrived and they will assume care for the patient now”.
Organophosphate Poisoning Scenario: Pharmacist’s Script

If called:

• “Hello, I’m the pharmacist on duty today. How can I help you?”

• Listen to report, or ask for symptoms and signs.

• “Tell me what the patient’s symptoms are. What are the physical findings?”

• If the students use non-standard terms to describe symptoms and signs, correct them with a statement such as: “Oh, do you mean ___?”

• “Well, this sounds like a cholinergic syndrome. Why don’t you try more atropine and pralidoxime? I’ll send up 600 mg of pralidoxime.”

• “I’ve seen doctors give several ampules of atropine before the patient got better.”
Organophosphate Poisoning Scenario: Paramedic’s Script

Deliver message by phone.

Time=11 minutes

- “Doctors, I’m the paramedic that brought your patient. I don’t know if you heard, but we picked up the patient at his farm in the rural part of the county.”

- “He was spraying his crops with some pesticide. I think he inhaled a little bit too much of that stuff. Had it all over his clothes, too.”

- “I’m going to put his stuff in a bag and bring it in to you.”

- “I’m sending a picture of the chemical he was spraying.”

[Nurse shows Malathion picture.]

- “His vital signs were stable during transport, except his pulse was around 50 per minute. His lungs were clear.

- He didn’t require any treatment according to our protocols.

- If there’s nothing else, I’m going back into service.”
Organophosphate Poisoning Scenario: Patient’s Script

*Communicative ONLY during the first 10 minutes of the scenario.*

**Chief complaint**
“I feel sick, like I have the flu.”

**History of Present Illness (stated breathlessly)**
“I was working outside when I started to get sick. First, it was a headache, watery eyes, and runny nose—like my allergies, but worse. When I felt weak, I figured I was coming down with the flu. Then came the nausea and cramps. I started vomiting and had diarrhea—couldn’t even get to the house in time. So, I thought, it must be something I ate. The weakness got worse, I felt my vision dim and muscles twitch. Then I couldn’t breathe, so I stopped working and called the ambulance. This is just what happened to my cousin who died of pneumonia.”

**History:** Respond with following only if asked:

- **Name:** Mr. Boyd
- “I was spraying my crops out in the field today.”
- “I got sick about 3 hours after I started spraying.”
- “I was using Malathion.”

**Review of Symptoms:** Symptoms present
Runny nose
Dimmed vision
Headache
Nausea
Abdominal cramps
Vomiting
Diarrhea
“Twitchy”
Generalized weakness
All other symptoms negative
Past Medical & Surgical History
Gender: Male
Age: 40 years
Weight: 80 kg
No medical illnesses
No prior surgery

Social History
Occupation: farmer
Smoking history: ½ pack of cigarettes per day for 15 years

Family History
Negative

Conversation with nurse
Time = 3 mins
“Nurse, my eyes keep watering. Do I have something in them? Maybe I’m allergic to something.”

Time = 5 mins
“Nurse, I can’t breathe.”

Time = 8 mins (dyspneic and confused)
“What am I doing here? I need to get back to work. Don’t take my tractor.”

Time = after ≥ 6 mg of atropine (correct treatment)
“Uhhhh. What happened to me? My mouth is dry.”
Appendix 3 – Computer Operator Instructions

Organophosphate Poisoning Scenario:

**Phase 1: Initial Presentation**
t=0 mins
Initial Vital Signs
HR: 50
Syst BP: 100/75
RR: 25
Cardiac rhythm: Sinus bradycardia
Lung sounds: Bilateral rales, wheezes
O₂ sat: 90%
Verbal: answers questions through computer operator voice
Motion: none
Pupils: constricted bilaterally
Secretions: tears, salivation, sweating: on

Apply oxygen ➔ Menu
‘Oxygen’
(Raises O₂ sat 2% for 3 mins)

**Phase 2: Worsening signs**
t=5 mins
Automatic Trend: “Deterioration” starts at t=2 mins
HR: ➔ 40 (-10)
Syst BP: ➔ 80/50 (-20/20)
O₂ sat: ➔ 84% (-6)
Voice: intermittent vomiting
Voice: audible wheezes (recording played intermittently)
Brief twitches are fasciculations

**Phase 3: Seizure; uncommunicative**
t=10 mins
Automatic Trend: (over 1 minute)
O₂ sat: ➔ (-4% for 2 mins)
R: ➔ 15
Movement: seizure, continuous for 60 seconds

Phone call: paramedic report

Bag/mask ventilation ➔ Menu
‘BVM ventilation’
(Raises O$_2$ sat 2% for 5 mins)

Suction mouth → Menu ‘Suction mouth’

(Lowers O$_2$ sat 2% then raises 4%, then returns to baseline, in 1.5 mins)

**Phase 4: Treatment and improvement**

*t=*any time atropine is given

Give 6-10 mg atropine IV or IM → Menu ‘atropine 6 or more mg’

(Partially reverses all abnormalities)

HR: 80
Syst BP: 115/75
RR: 20
Cardiac rhythm: Sinus rhythm
Lung sounds: Bilateral rales off; wheezes off
O$_2$ sat: 94%
Verbal: no response
Motion: none
Pupils: mid-position bilaterally
Secretions: tears, salivation, sweating: off

**Phase 5: Poisoned paramedic**

*t=*14 mins
Nurse report of poisoned paramedic

End Scenario
*t=*15 mins

- Responses in gray are programmed and occur automatically.
- **Menu items** must be manually selected in the menu to trigger programmed responses.
Appendix 4 - Programming Files
Organophosphate Poisoning handlers.hne

Oxygen

Patient response

Start Trend: Oxygen (Start: 0 min)

Click to add patient response

BVM ventilation

Patient response

Start Trend: BVM (Start: 0 min)

Click to add patient response

Suction mouth

Patient response

Start Trend: Suction mouth (Start: 0 min)

Click to add patient response
Appendix 5 – References


8. You Tube video on use of Mark I kit: https://www.youtube.com/watch?v=COhxEKr0SiA

9. You Tube video of chemical warfare attack victims in Syria: https://www.youtube.com/watch?v=hmZvbO6wGn0

10. CDC report of health care workers poisoned when caring for a patient with organophosphate poisoning. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4951a2.htm