

# PEDIATRIC ASTHMA

LIVE FAMILY MEMBER REQUIRED

Estimated Time: 60 minutes • Debriefing Time: 40 minutes



Scan to Begin



Patient Name: Patrick A. Armstrong

## SCENARIO OVERVIEW

Patrick A. Armstrong is a 16-year-old male patient who was brought to the emergency department today by his friend's dad with a severe exacerbation of his known asthma. Students receive report that the patient received 3 nebulizers from EMS en route and was intubated upon arrival to the ER about 30 minutes ago. While students are performing a ventilator check, labs and imaging result. Students will need to withdraw the ETT 2-3 cm and adjust ventilator setting per the provided protocol. As students are performing these tasks, the patient's dad arrives (as a video on the iPad). Student must provide comfort and explain the situation to the dad. In addition, an ICU bed opens up, so students will need to provide hand-off report to the ICU RT. This scenario revolves around managing a patient during an acute exacerbation of asthma, managing a mechanical ventilation protocol, and communication with both a frantic family member and the ICU RT.

This is Level 4C: This simulation requires a "Live Family Member" to play the patient's parent.

## LEARNING OBJECTIVES

1. Obtain vital signs and interpret for a pediatric patient
2. Perform a focused respiratory assessment
3. Recognize and respond to abnormal findings
4. Evaluate objective and subjective data
5. Implement and follow evidence-based standards and protocols
6. Safely manage artificial airway and mechanical ventilation
7. Demonstrate appropriate communication
8. Document accurately

## CURRICULUM MAPPING

### WTCS RESPIRATORY THERAPY PROGRAM OUTCOMES

- Apply respiratory therapy concepts to patient care situations
- Demonstrate technical proficiency required to fulfill the role of a respiratory therapist
- Practice respiratory therapy according to established professional and ethical standards

### RESPIRATORY AND CIRCULATORY PHYSIOLOGY

- Apply principles of gas transport
- Apply principles of ventilatory mechanics
- Interpret blood gas data
- Assess fluid and electrolyte balance

### RESPIRATORY DISEASE

- Evaluate radiologic images of the chest
- Analyze signs, symptoms, etiology, pathogenesis and treatment for obstructive lung disorders

## RESPIRATORY PHARMACOLOGY

- Examine the pharmacodynamics of bronchodilators
- Examine the pharmacodynamics of anti-inflammatories, steroidal and non-steroidal
- Examine the pharmacodynamics of anesthetics, muscle blockers, analgesics, sedatives, hypnotics, and tranquilizers

## RESPIRATORY SURVEY

- Perform pulse oximetry
- Adapt communication strategies to a diverse patient population
- Review the medical record utilizing medical record keeping and charting methods consistent with hospital policy and procedures
- Utilize infection control principles
- Evaluate patient data
- Perform a respiratory assessment
- Perform a basic cardiovascular assessment
- Obtain vital signs

## RESPIRATORY THERAPEUTICS 1

- Evaluate oxygenation
- Assess the need for medical gas therapy
- Assess patient for humidity therapy
- Demonstrate the use of humidity equipment

## RESPIRATORY NEONATAL/PEDIATRICS

- Differentiate cardiopulmonary diseases/disorders of the neonatal/pediatric patient
- Apply principles of mechanical ventilation and airway management for the neonatal/pediatric patient

## RESPIRATORY AIRWAY MANAGEMENT

- Apply airway equipment appropriate for patient situation
- Demonstrate the skill of secretion removal

## RESPIRATORY LIFE SUPPORT

- Operate various ventilators
- Evaluate patient response to mechanical ventilation
- Correlate mechanical ventilation to various disease states

## RESPIRATORY CLINICAL COMPETENCIES

- Apply standard precautions
- Assess vital signs
- Perform pulse oximetry
- Perform chart review
- Demonstrate cylinder safety
- Administer humidity therapy
- Perform a pulmonary exam
- Perform open suctioning
- Perform closed suctioning
- Perform cuff pressure
- Check a ventilator

## SIMULATION LEARNING ENVIRONMENT & SET-UP

### ENVIRONMENT

Inside room: Patient in bed, intubated and on mechanical ventilator, HOB at 15 degrees

Inside or outside room: Hand sanitizer and/or sink

Outside room: Computer or form(s) for documentation

### PATIENT PROFILE

Name: Patrick A. Armstrong

Admitting Diagnosis: shortness of breath (R06.02)

DOB: 11/16/20XX

Medical History: asthma, unspecified (493.90)

Age: 16

MR#: 1116

Allergies: NKDA

Gender: Male

Surgical History: None

Height: 177.5 cm (5 ft 11 in)

Ethnicity: African American

Weight: 109 kg (240 lbs)

Spiritual Practice: Unknown

Code Status: Full Code

Primary Language: English

### EQUIPMENT/SUPPLIES/SETTINGS

#### Patient

- In patient gown
- No moulage
- #8 ETT in place, secured with a tube holder on the right, 22 at the teeth
- Mechanical ventilator running: Volume-based Mode, Rate = 18, Vt = 500, PEEP = 10, O2 = 100%
- Bandage on right wrist from an ABG drawn
- ID band present with QR code
- Wrist restraints applied

- IV in right hand – with the following running:
  - Ketamine IV infusion, 60 mcg/kg/min

### **Monitor Settings**

- On cardiac monitor with pulse oximetry
- Simulator vitals: HR 116, RR 18, BP 110/74, Temp 37.2, O2 Sat 95%
- Simulator settings: paralyzed (so the ventilator works better) and eyes closed

### **Supplies**

- General
  - Respiratory Equipment
    - Ambu bag and mask at bedside
    - Nebulizer set up at bedside
    - Equipment to measure cuff pressures
    - Equipment to suction (either open or closed)
    - Humidification for the ventilator (HME or wet)
- Medications (realistic labels are available by scanning the QR code)
  - Albuterol – unit dose

## QR CODES

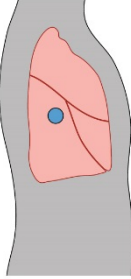
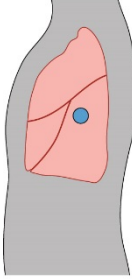


<p>START</p> 	<p>PATIENT</p> 	<p>REPORT</p> 	<p>PATIENT ID</p> 
<p>IV SITE</p> 	<p>ALBUTEROL</p> 		

## CHEST QR CODES

Cut along the dotted lines. Fold along the solid line to create a bi-fold of the diagram and QR code.

			
ANTERIOR 2	ANTERIOR 3	ANTERIOR 6	ANTERIOR 7
			
			
POSTERIOR 0	POSTERIOR 1	POSTERIOR 4	POSTERIOR 5
			



	
<b>RIGHT AXILLARY 1</b>	<b>LEFT AXILLARY 1</b>
	

# TEACHING PLAN

## PREBRIEF

The facilitator should lead this portion of the simulation. The following steps will guide you through Prebrief.

- Scan the **QR Code: “Scan to Begin”** while students are in Prebrief.
- “Meet Your Patient” (on iPad) and explain how the iPad works in the simulated learning environment including:
  - Explain how to use the iPad scanner and QR codes. Remind students that there are multiple QR codes in the simulation, but they should only scan them if they think it will provide data necessary for their assessment and evaluation of the patient.
  - For some scenarios, it may be helpful to tell students where the QR code are located. For others, you may want students to “find” the QR codes during their assessments. This is your choice.
  - Describe how a QR code sound will work in the scenario. For the most authentic sound experience, student should use ear buds or the ARISE “stethoscope” for all QR codes with the following symbol: 📻. Example: **QR Code: Chest Anterior 1 📻**
  - As the facilitator, you should be aware that throughout the simulation some QR codes are necessary to the programming of the iPad content. Directions for which QR codes are required (to be scanned) in each state are listed under each state of the documentation below. The QR codes are also in **BOLD** type.
  - Level Up tab – This tab “tells” the content in the iPad to change to what is needed for the next state of a simulation. It is used a few times in this scenario after the provider is notified to display new orders (those just given over the phone) and lab results, etc...
  - Medication QR Codes – The student(s) must scan **QR Code: Patient ID** prior to scanning any medication. That scan is valid for 2 minutes and then it “times out.” The student(s) will need to scan **QR Code: Patient ID** again to give more medications.
  - MAR Hyperlinks – On the MAR all medications are underlined and hyperlinked to DailyMed, which is a medication reference housed by the

National Library of Medicine. Students can click on these links during the simulation for up-to-date medication content, labels, and package insert information.

- Discuss the simulation “Learning Objective(s)” (on iPad) as well as any other Prebrief materials
- Get “Report” on iPad
  - Possible Facilitator Questions
    - What are your priorities for this patient?
    - How will you modify your approach for a pediatric patient?
- View “Patient” video on iPad
  - Facilitator Note
    - This is a video of the patient prior to intubation.
  - Possible Facilitator Questions:
    - What physical signs indicate that Patrick is in respiratory distress?
    - What subjective and objective data is needed to determine whether or not Patrick requires intubation?
    - What strategies could you employ when you assess and evaluate Patrick?
- Advance to the “Patient Profile” screen (on iPad). This will act as a simulated patient chart.
- Students can view the tabbed content on the iPad (see below) prior to entering the patient’s room and throughout the simulation as needed.
  - You should give student some time (5-10 minutes) to review this content now, prior to entering the patient’s room.

## H&amp;P

No reports available.

## ORDERS

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

## Provider Orders

Date	Time	Order
Today	30 minutes	Rapid Sequence Intubation
	ago	Vent settings and management: per Adult Mechanical Ventilation Protocol
		Albuterol nebulizer, 2.5 mg, STAT – then Q2 and Q1 prn for shortness of breath and/or wheezing
		Methylprednisolone IV, 1 mg/kg (max 125 mg), STAT
		Magnesium sulfate IV, 75 mg/kg (max of 2.5 g), STAT
		Ketamine IV infusion, 60 mcg/kg/min
		Cardiopulmonary monitoring – call if HR >120 and/or systolic BP <90 or >150
		Portable CXR, STAT – post intubation
		Pulmonology Consult, STAT
		Serum electrolytes and blood glucose, STAT
		Transfer to ICU when bed available
		----- James Emerson, M.D.

MAR

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

## Medication Administration Record

Scheduled		
Albuterol nebulizer – 2.5 mg, Every 2 hours	<b>Due Today</b>	<b>Last Given</b>
	0900	Today – 15 minutes ago
Continuous Infusion		
Ketamine IV infusion, 60 mcg/kg/min	<b>Started</b>	
	Today – 15 minutes ago	
PRN		
Albuterol nebulizer, 2.5 mg, Every 1 hour prn for shortness of breath and/or wheezing	<b>Last Given</b>	
Discontinued		
Albuterol nebulizer, 2.5 mg, STAT	Discontinued	Last Given
	Today – 15 minutes ago	Today – 15 minutes ago
Magnesium sulfate IV, 75 mg/kg (max 2.5 g), STAT	Discontinued	Last Given
	Today – 15 minutes ago	Today – 15 minutes ago
Methylprednisolone IV, 1 mg/kg (max 125 mg), STAT	Discontinued	Last Given
	Today – 15 minutes ago	Today – 15 minutes ago

## DAILY RECORD

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

## Daily Record

Vitals	Admission	Today – 30 minutes ago	[time]	[time]	[time]
Pulse	122	116			
Resp. Rate	42	18			
BP Systolic	146	108			
BP Diastolic	94	72			
Temp (°C)	37.3	37.2			
O2 Saturation (%)	91	95			
Applied Oxygen	100% NRB	100% vent			
Pain	Not assessed	Unable to assess			

## VITALS

The iPad shows the “enterable” vitals screen.

## VENTILATOR FLOWSHEET

The iPad shows the “enterable” ventilator flowsheet. See Appendix A.

## PROGRESS NOTES

No reports available.

## LABS-DIAGNOSTICS

No reports available.

## IMAGING

---

No reports available.

## PROTOCOL

---

The iPad displays the “Adult Mechanical Ventilation” protocol. See Appendix B.

Note: In the “Guidelines” of the protocol, exclusion criteria include patients less than 16 years old.

## LEVEL 1

---

When the Level 1 tab is tapped, the iPad reads, “The iPad is at Level 1.”

## SCANNER

---

Use this to scan available QR Codes.

## EXIT

---

The iPad reads, “Are you sure you want to exit? All data will be lost.”

- If “No” is selected, the iPad will return to the tabbed content.
- If “Yes” is selected, the iPad will let the student(s) exit and prompt them to complete an embedded 3-5 minute survey.

## STATE 1

# PATIENT ASSESSMENT & VENTILATOR CHECK

- Patient Overview
  - The patient is in bed, HOB @ 15°. He is on a ventilator (see settings, tube placement, etc... above). Students should assess the patient and document a ventilator check.
  - Facilitator Note
    - Ten minutes after the student scans any **QR Code: Chest** 📱, the iPad will alert students with a “dinging sound” and display a plaque that reads, “Labs and imaging have resulted.”
    - After student’s view both the labs and imaging, a plaque automatically appears on the iPad that reads, “New orders received.”
- Expected Student Behaviors
  - Perform appropriate hand hygiene and infection control
  - Introduce themselves and verify the patient (can scan **QR Code: Patient ID**)
  - Obtain vital signs and interpret for a pediatric patient
    - This patient would have vitals similar to an adult of his size.
  - Perform a focused respiratory assessment
    - Inspection – Students will not find any abnormalities. (May scan **QR Code: IV**)
    - Palpation – Students will not find any abnormalities.
    - Percussion – All areas have hyperresonant tones.
    - Auscultation – Scan **QR Code: Chest** 📱
      - There are ten QR codes to apply to the chest – see above Chest QR Code chart for locations



- Student will hear diffuse I & E wheezes in all lung fields. However, anterior and posterior upper lobes have much louder wheezes than all other lung fields.
- Optional: Students may want to administer a prn Albuterol nebulizer (**QR Code: Albuterol**). However, it is ordered every 1-hour prn and the MAR reads that it was last given 15 minutes ago.
- Perform Ventilator check
  - Students should document the ventilator check on the provided Ventilator Flowsheet. See Appendix A.
  - Students should perform all appropriate math calculations and document findings on the provided Ventilator Flowsheet.
- Perform Suctioning
  - Students may suction the patient as part of this assessment. Open or closed suction can be done at the discretion of the facilitator.
- Recognize and respond to abnormal findings
  - Labs and Imaging will result ten minutes after the student scans any **QR Code: Chest** 📱.
  - Students should view and interpret the resulted labs and imaging.
- Technician Prompts
  - None
- Possible Facilitator Questions
  - Analyze the vital signs: are they within normal limits for his age?
  - Analyze the findings from your physical assessment: do you have any concerns?
  - Analyze your finding from the ventilator check: do you have any concerns?
- Tabbed iPad Prompts & Content

## LABS-DIAGNOSTICS

## Arterial Blood Gas (ABG)

	Today – 30 minutes ago	Units	Reference Range
pH	7.31		7.35-7.45
PaCO <sub>2</sub>	52	mmHg	35-45
PaO <sub>2</sub>	68	mmHg	80-100
HCO <sub>3</sub>	26	mmol/L	22-26
Base Excess	-2	mmol/L	0+/-3
SaO <sub>2</sub>	94	%	
Site = ® Radial	Modified Allen's test = √		% O <sub>2</sub> = 100

## Blood Glucose

	Today – 30 minutes ago	Units	Reference Range
Glucose	73	mg/dL	Fasting 70-150

## Serum Electrolytes

	Today – 30 minutes ago	Units	Reference Range
Sodium	142	mEq/L	135-145
Potassium	3.8	mEq/L	3.5-5.3
Calcium	5.1	mEq/L	4.5-5.8
Magnesium	1.8	mEq/L	1.3-2.5
Phosphate	2.1	mEq/L	1.4-2.7
Chloride	100	mEq/L	98-108

## IMAGING

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

**DESCRIPTION:** Portable x-ray post-intubation for asthma exacerbation.

**EXAM:** Portable AP chest

**REASON FOR EXAM:** Intubation

**COMPARISON EXAM:** None

**TECHNIQUE:** 1.5 mAS @ 125 kvp

**DISCUSSION:** The heart and vasculature are normal. Trachea is midline with the endotracheal tube positioned 1 cm above the carina. All visualized bony structures are unremarkable. Costophrenic angles are clear with some mild to moderate flattening of the diaphragm noted. Lung tissue is remarkable for mild to moderate hyperinflation. No infiltrates or atelectasis.

**IMPRESSION:** Endotracheal tube is located 1 cm above the carina. Flattened diaphragm and hyperinflation consistent with obstructive lung disorder. Clinical correlation suggested.

## LEVEL 1 / 2

- When the Level 1 tab is tapped, the iPad reads, “The iPad is at Level 1.”
- After the student(s) views both the labs and imaging reports, the Level 1 tab will automatically change to a Level 2 tab (students are not prompted about this).
- When the Level 2 tab is tapped, the iPad reads, “The iPad is at Level 2.”

## STATE 2

# NEW ORDERS & PARENT ARRIVES

- Patient Overview
  - New orders are received to move back the ETT by 2-3 cm and adjust the vent settings per protocol. Students will need to make vent changes based on the ABG results and according to the included “Adult Mechanical Ventilator” protocol.
  - Facilitator Note:
    - 5-10 minutes after the iPad changes from State 1 to State 2, the patient’s parent should arrive. See technician prompts below.
- Expected Student Behaviors
  - Evaluate subjective and objective data
    - Both Imaging and Labs have resulted at the beginning of this state.
  - Implement new orders
    - Withdraw ETT
    - Adjust ventilator settings per the included protocol. See Appendix B.
  - Reassess Patient
    - Bilateral breath sounds have not changed.
    - Optional: Students may want to administer a prn Albuterol nebulizer (**QR Code: Albuterol**). However, it is ordered every 1-hour prn and the MAR reads that it was last given 45 minutes ago.
  - Demonstrate appropriate communication to an upset family member
    - Student should comfort the parent and explain the ventilator in lay term.
    - Students may ask for the RN and/or MD to help explain the patient condition.
- Technician Prompts
  - The patient’s parent can be played by the technician, facilitator or another student.

- This “actor” should be upset and almost frantic by the situation. There may be tears. The actor is surprised by the ETT and ventilator. In addition, the actor is afraid to touch Patrick.
  - Parent responses can include:
    - “Oh my god!!! What happened? What are all these tubes! What is that machine? I’m so confused... he was fine this morning!”
    - “How did this happen? Is it contagious?”
    - “Why are his hands tied down?”
    - “Is he having any pain?”
    - “Why won’t he wake up?”
    - “Is he gonna die?” (with tears)
    - “How long will he be like this?”
    - “Can I hold his hand?”
    - Questions about the ventilator can include:
      - “How does that machine work?”
      - “Is it hurting him?”
      - “What is that tube for (pointing to the ETT)?”
    - After the phone call about transferring him to ICU, questions can include:
      - “Can I come with you to the ICU?”
      - “I don’t want to leave him here. Will the ICU let me stay with him?”
- Technician should call the students informing them that an ICU bed is available and that the ICU RT needs them to call and give hand-off report.
  - This should occur after the students comfort the parent and explain the ventilator.
- Possible Facilitator Questions
  - Analyze the lab and imaging results: do you have any concerns?
  - How will you adjust the ventilator settings per the included protocol?

- What are the documentation requirements at this time?
- How will you address concerns of Patrick's father?
- Tabbed iPad Prompts & Content

## ORDERS

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>178</i>	<i>109</i>

### Provider Orders

Date	Time	Order
Today	45 minutes	Rapid Sequence Intubation
	ago	Vent settings and management: per Adult Mechanical Ventilation Protocol
		Albuterol nebulizer, 2.5 mg, STAT – then Q2 and Q1 prn for shortness of breath and/or wheezing
		Methylprednisolone IV, 1 mg/kg (max 125 mg), STAT
		Magnesium sulfate IV, 75 mg/kg (max of 2.5 g), STAT
		Ketamine IV infusion, 60 mcg/kg/min
		Cardiopulmonary monitoring – call if HR >120 and/or systolic BP <90 or >150
		Portable CXR, STAT – post intubation
		Pulmonology Consult, STAT
		Serum electrolytes and blood glucose, STAT
		Transfer to ICU when bed available
		----- James Emerson, M.D.
Today	now	Pull ETT out 2-3 cm, STAT
		Repeat portable chest x-ray, in AM
		RT to adjust ventilator settings per Adult Mechanical Ventilation Protocol
		----- James Emerson, M.D.

MAR

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

## Medication Administration Record

<b>Scheduled</b>		
Albuterol nebulizer – 2.5 mg, Every 2 hours	<b>Due Today</b>	<b>Last Given</b>
	0900	Today – 45 minutes ago
<b>Continuous Infusion</b>		
Ketamine IV infusion, 60 mcg/kg/min	<b>Started</b>	
	Today – 45 minutes ago	
<b>PRN</b>		
Albuterol nebulizer, 2.5 mg, Every 1 hour prn for shortness of breath and/or wheezing	<b>Last Given</b>	
<b>Discontinued</b>		
Albuterol nebulizer, 2.5 mg, STAT	Discontinued	Last Given
	Today – 45 minutes ago	Today – 45 minutes ago
Magnesium sulfate IV, 75 mg/kg (max 2.5 g), STAT	Discontinued	Last Given
	Today – 45 minutes ago	Today – 45 minutes ago
Methylprednisolone IV, 1 mg/kg (max 125 mg), STAT	Discontinued	Last Given
	Today – 45 minutes ago	Today – 45 minutes ago

**LEVEL 2/3**

---

- When the Level 2 tab is tapped, the iPad reads, “The iPad is at Level 2.”
- Ten minutes after the Orders tab is viewed, the Level 2 tab will automatically change to a Level 3 tab (students are not prompted about this).
- When the Level 3 tab is tapped, the iPad reads, “The iPad is at Level 3.”



## STATE 3

# TRANSFER PREPARATION & HAND-OFF REPORT

- Patient Overview
  - At the beginning of this State, the parent steps out to call family members and let them know what has happened.
  - The students will call the ICU RT and give hand-off report and assure a ventilator is set up in the ICU or that someone will help transport the ventilator the patient is currently on. In addition, the student can help ready the patient for transport.
- Expected Student Behaviors
  - Provide hand-off report
  - Ready the patient for transfer
    - Students should assure O2 tank is on the bed and full, ambu bag attached to O2 tank, ambu mask is with them for the transport in case of accidental extubation, etc.
  - Optional: Students want to administer a prn Albuterol nebulizer (**QR Code: Albuterol**). The MAR reads that it was last given 70 minutes ago.
- Technician Prompts
  - The RT can be played by the technician or facilitator via phone.
    - Assure hand-off report is complete and accurate.
    - Ask questions as appropriate for the report given.
- Possible Facilitator Questions
  - How will you address hand-off report to the ICU RT?
  - How will you prepare the patient for transfer to the ICU?
- Tabbed iPad Prompts & Content

MAR

<b>Patient Name</b>	<b>DOB</b>	<b>MR#</b>
<i>Patrick A. Armstrong</i>	<i>11/16/20XX</i>	<i>1116</i>
<b>Allergies</b>	<b>Height (cm)</b>	<b>Admission Weight (kg)</b>
<i>NKDA</i>	<i>177.5</i>	<i>109</i>

## Medication Administration Record

Scheduled		
Albuterol nebulizer – 2.5 mg, Every 2 hours	<b>Due Today</b>	<b>Last Given</b>
	0900	Today – 70 minutes ago
Continuous Infusion		
Ketamine IV infusion, 60 mcg/kg/min	<b>Started</b>	
	Today – 70 minutes ago	
PRN		
Albuterol nebulizer, 2.5 mg, Every 1 hour prn for shortness of breath and/or wheezing	<b>Last Given</b>	
Discontinued		
Albuterol nebulizer, 2.5 mg, STAT	Discontinued	Last Given
	Today – 70 minutes ago	Today – 70 minutes ago
Magnesium sulfate IV, 75 mg/kg (max 2.5 g), STAT	Discontinued	Last Given
	Today – 70 minutes ago	Today – 70 minutes ago
Methylprednisolone IV, 1 mg/kg (max 125 mg), STAT	Discontinued	Last Given
	Today – 70 minutes ago	Today – 70 minutes ago

**LEVEL 3/ EXIT**

- When the Level 3 tab is tapped, the iPad reads, “The iPad is at Level 3.”
- Five minutes after the iPad changes from State 2 to State 3, the Level 3 tab will automatically disappear (students are not prompted about this).
- When the Exit tab is tapped, the iPad reads, “Scenario objectives have been met. Are you sure you want to exit the game?”
  - If “No” is selected, the iPad will return to the tabbed content.
  - If “Yes” is selected, the iPad will let the student(s) exit and prompt them to complete an embedded 3-5 minute survey.

**DEBRIEF**

Nothing needed from the iPad.

**QUESTIONS**

1. How did you feel this scenario went?
2. What were the main issues you had to deal with when caring for Patrick?
3. Review understanding of learning objective: Obtain vital signs and interpret for a pediatric patient.
  - a. What vital signs are within normal range for a 16-year-old male?
  - b. Interpret Patrick's vital signs: Were they in range? What could be affecting Patrick's vital signs?
4. Review understanding of learning objective: Perform a focused respiratory assessment.
  - a. What concerns did you find during your initial assessment and evaluation?
  - b. How would your assessment of Patrick compare to what you would expect of an asthmatic patient?
  - c. Did you alter your assessment for this pediatric patient? Why or why not?
  - d. How did your assessment change as a result of the ETT and mechanical ventilator?
5. Review understanding of learning objective: Recognize and respond to abnormal findings.
  - a. What abnormal findings did you find in the vital signs and/or physical assessment? How did you respond to these findings?
6. Review understanding of learning objective: Evaluate objective and subjective data.
  - a. Describe the conclusions you made given the available subjective and objective data.
  - b. Are there any other pieces of data you wish you had?
  - c. Did you agree with the new provider orders? Why or why not?
7. Review understanding of learning objective: Implement and follow to evidence-based standards and protocols.
  - a. Why is it important to follow evidence-based standards?

- b. How do protocols affect a respiratory therapist?
  - c. Are there any other ICU protocols you would be expected to know and/or follow as a respiratory therapist? (Hint: vent bundle, sedation, etc...)
8. Review understanding of learning objective: Safely manage artificial airway and mechanical ventilation.
- a. Did you have any concerns related to the patient's airway?
  - b. What issues did you look for when assessing the patient's artificial airway?
  - c. Did you have any concerns related to the ventilator and/or ventilator settings?
  - d. What issues did you look for when completing your assessment of the mechanical ventilator (ventilator check)?
  - e. How would you address any concerns you found related to either the patient's artificial airway and/or mechanical ventilator/settings?
9. Review understanding of learning objective: Demonstrate appropriate communication
- a. How did you modify your communication techniques for this patient?
  - b. Describe how you provide hand-off communication to the ICU RT.
  - c. How did you comfort and provide communication to Patrick's dad?
  - d. If you could "do over" your communication, how would you change your communication with Patrick or the provider?
10. Review understanding of learning objective: Document accurately.
- a. What is important to document in your assessments and interventions?
11. Summary/Take Away Points
- a. "Today you cared for a mechanically ventilated pediatric patient who was experiencing a severe exacerbation of his known asthma. What is one thing you learned from participating in this scenario that you will take with you into your respiratory therapy practice?" (Each student must share something different from what the others' share.)

Note: Debriefing technique is based on INASCL Standard for Debriefing and NLN Theory Based Debriefing by Dreifuerst.

## SURVEY

Print this page and provide to students.

Students, please complete a brief (2-3 minute) survey regarding your experience with this ARISE simulation. There are two options:

**1. Use QR Code: Survey**

- a. Note: You will need to download a QR code reader/scanner onto your own device (smartphone or tablet). There are multiple free scanner apps available for both Android and Apple devices from the app store.
- b. This QR code will not work in the ARIS app.



**2. Copy and paste the following survey link into your browser:**

- a. [https://ircvtc.co1.qualtrics.com/SE/?SID=SV\\_6Mwfv98ShBfRnBX](https://ircvtc.co1.qualtrics.com/SE/?SID=SV_6Mwfv98ShBfRnBX)

**APPENDIX A**

This is the “enterable” ventilator flowsheet included in this program. Note the “Dropdown Menu” options students have when documenting their ventilator assessment.

<b>Patient Name</b>	
<i>John Smith</i>	D 8
<b>Allergies</b>	H 1
<i>Peanuts</i>	

## Respiratory Therapy – Ventilator Care Flowsheet

\* Blank field = not assessed \*

Patient Assessment	[time]	[time]	[time]	[time]
Heart Rate				
Respiratory Rate				
BP Systolic				
BP Diastolic				
Temp (°C)				
O2 Saturation (%)				
Level of Consciousness	Dropdown Menu 1. Alert 2. Confused 3. Drowsy 4. Lethargic 5. Obtunded 6. Comatose 7. Sedated 8. Paralyzed			
Color	Dropdown Menu 1. Normal for skin tone 2. Pale 3. Flushed 4. Red 5. Yellowish 6. Orangey 7. Bluish			

	8. Other – see progress note			
Lung Sounds – RUL	<p>Dropdown Menu</p> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Diminished</li> <li>3. Crackles</li> <li>4. Course crackles</li> <li>5. Fine crackles</li> <li>6. Wheezes</li> <li>7. Inspiratory wheezes</li> <li>8. Expiratory Wheezes</li> <li>9. Stridor</li> <li>10. Rub</li> <li>11. Bronchial</li> <li>12. Gurgles</li> <li>13. Absent</li> </ol>			
Lung Sounds – RML	<p>Dropdown Menu</p> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Diminished</li> <li>3. Crackles</li> <li>4. Course crackles</li> <li>5. Fine crackles</li> <li>6. Wheezes</li> <li>7. Inspiratory wheezes</li> <li>8. Expiratory Wheezes</li> <li>9. Stridor</li> <li>10. Rub</li> <li>11. Bronchial</li> <li>12. Gurgles</li> <li>13. Absent</li> </ol>			



Lung Sounds – RLL	<b>Dropdown Menu</b> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Diminished</li> <li>3. Crackles</li> <li>4. Course crackles</li> <li>5. Fine crackles</li> <li>6. Wheezes</li> <li>7. Inspiratory wheezes</li> <li>8. Expiratory Wheezes</li> <li>9. Stridor</li> <li>10. Rub</li> <li>11. Bronchial</li> <li>12. Gurgles</li> <li>13. Absent</li> </ol>			
Lung Sounds – LUL	<b>Dropdown Menu</b> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Diminished</li> <li>3. Crackles</li> <li>4. Course crackles</li> <li>5. Fine crackles</li> <li>6. Wheezes</li> <li>7. Inspiratory wheezes</li> <li>8. Expiratory Wheezes</li> <li>9. Stridor</li> <li>10. Rub</li> <li>11. Bronchial</li> <li>12. Gurgles</li> <li>13. Absent</li> </ol>			
Lung Sounds – LLL	<b>Dropdown Menu</b> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. Diminished</li> </ol>			

	<ol style="list-style-type: none"> <li>3. Crackles</li> <li>4. Course crackles</li> <li>5. Fine crackles</li> <li>6. Wheezes</li> <li>7. Inspiratory wheezes</li> <li>8. Expiratory Wheezes</li> <li>9. Stridor</li> <li>10. Rub</li> <li>11. Bronchial</li> <li>12. Gurgles</li> <li>13. Absent</li> </ol>			
--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--	--	--

Airway Assessment	[time]	[time]	[time]	[time]
Airway/Mask Type	Dropdown Menu <ol style="list-style-type: none"> <li>1. Endotracheal Tube</li> <li>2. Tracheostomy Tube</li> <li>3. Full Face Mask</li> <li>4. Nasal Mask</li> <li>5. Total Face Mask</li> </ol>			
Airway/Mask Size	Dropdown Menu <ol style="list-style-type: none"> <li>1. 2.5</li> <li>2. 3.0</li> <li>3. 3.5</li> <li>4. 4.0</li> <li>5. 4.5</li> <li>6. 5.0</li> <li>7. 5.5</li> <li>8. 6.0</li> <li>9. 6.5</li> <li>10. 7.0</li> <li>11. 7.5</li> <li>12. 8.0</li> <li>13. 8.5</li> <li>14. 9.0</li> <li>15. 9.5</li> </ol>			

	16. 10.0 17. Extra Small 18. Small 19. Medium 20. Large 21. Extra Large			
ETT Location	Dropdown Menu 1. Right 2. Left 3. Center			
ETT Relocated (✓)	(✓) or (Contraindicated)			
Secure & Patent (✓)	(✓)			
Cuff Pressure (cmH2O)	Dropdown Menu 1. Minimal Leak 2. Minimal Occluding Volume 3. Range: 0.0-60.0			
Oral Care Completed (✓)	(✓) or (Contraindicated)			
Oral Secretions	Dropdown Menu Amount 1. Copious 2. Large 3. Moderate 4. Small 5. Scant 6. None  Consistency 1. Thick 2. Thin 3. Normal 4. Frothy  Color 1. Clear			

	<ol style="list-style-type: none"> <li>2. White</li> <li>3. Cream</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Tan</li> <li>7. Red</li> <li>8. Pink</li> <li>9. Brown</li> <li>10. Gray</li> <li>11. Black</li> </ol>
<b>Tracheal Secretions</b>	<b>Dropdown Menu</b> <b>Amount</b> <ol style="list-style-type: none"> <li>1. Copious</li> <li>2. Large</li> <li>3. Moderate</li> <li>4. Small</li> <li>5. Scant</li> <li>6. None</li> </ol> <b>Consistency</b> <ol style="list-style-type: none"> <li>1. Thick</li> <li>2. Thin</li> <li>3. Normal</li> <li>4. Frothy</li> </ol> <b>Color</b> <ol style="list-style-type: none"> <li>1. Clear</li> <li>2. White</li> <li>3. Cream</li> <li>4. Yellow</li> <li>5. Green</li> <li>6. Tan</li> <li>7. Red</li> <li>8. Pink</li> <li>9. Brown</li> <li>10. Gray</li> <li>11. Black</li> </ol>

Ventilator Bundle	[time]	[time]	[time]	[time]
HOB > 30°	(✓) or (Contraindicated)			
Daily Sedation Vacation	(✓) or (Contraindicated)			
Assess Weaning Readiness	(✓) or (Contraindicated)			
PUD Prophylaxis	(✓) or (Contraindicated)			
DVT Prophylaxis	(✓) or (Contraindicated)			

Ventilator Assessment	[time]	[time]	[time]	[time]
Vent/BiPAP	Dropdown Menu 1. Vent 2. BiPAP			
Mode	Dropdown Menu 1. Volume Control 2. Pressure Control 3. SIMV 4. SIMV with PS 5. CPAP with PS 6. CPAP 7. BiLevel 8. APRV 9. Spontaneous 10. Spontaneous-timed			
Set Rate	Range: 0-80			
Total Rate	Range: 0-80			
Set V <sub>T</sub> (ml)	Range: 0-2000			
Expiratory V <sub>T</sub> (ml)	Range: 0-2000			

Spontaneous V <sub>T</sub> (ml)	Range: 0-2000			
Exhaled Ve (lpm)	Range: 0.0-50.0			
Set PS or PC (cmH <sub>2</sub> O)	Range: 0-40			
O <sub>2</sub> (%)	Range: 0-100			
Set IPAP	Range: 0-50			
Set PEEP (cmH <sub>2</sub> O)	Range: 0.0-40.0			
Total PEEP (cmH <sub>2</sub> O)	Range: 0.0-40.0			
PIP (cmH <sub>2</sub> O)	Range: 0.0-80.0			
Plateau (cmH <sub>2</sub> O)	Range: 0.0-80.0			
MAP (cmH <sub>2</sub> O)	Range: 0.0-80.0			
C <sub>L</sub> -Static (ml/cmH <sub>2</sub> O)	Range: 0.0-150.0			
C <sub>L</sub> -Dynamic (ml/cmH <sub>2</sub> O)	Range: 0.0-150.0			
Raw (cm H <sub>2</sub> O/L/sec)	Range: 0.0-50.0			
Peak Flow (lpm)	Range: 0-200			
Waveform	Dropdown Menu 1. Square 2. Descending 3. Ascending 4. Sine 5. Ramp			
Inspiratory Time	Range: 0.0-5.0			
I:E Ratio (of set rate)	Range: 3.0:1 - 1:15			
Sensitivity	Dropdown Menu 1. -0.5 cmH <sub>2</sub> O 2. -1.0 cmH <sub>2</sub> O 3. -1.5 cmH <sub>2</sub> O 4. -2.0 cmH <sub>2</sub> O 5. -2.5 cmH <sub>2</sub> O 6. -3.0 cmH <sub>2</sub> O 7. -3.5 cm H <sub>2</sub> O 8. -4.0 cmH <sub>2</sub> O 9. -4.5 cmH <sub>2</sub> O 10. -5.0 cm H <sub>2</sub> O 11. 1 lpm 12. 2 lpm			

	13. 3 lpm 14. 4 lpm 15. 5 lpm 16. Other – see progress note			
All Alarms On & Set (✓)	(✓)			
Bag/Mask @ bedside (✓)	(✓)			

## APPENDIX B

# ADULT MECHANICAL VENTILATION

## 1. POLICY

- a. The Respiratory Therapist and MD will determine mechanical ventilations settings based on each patient's ideal body weight, physical condition, and clinical condition. Clinical data will be used to determine appropriate changes to mechanical ventilation settings.

## 2. PURPOSE

- a. The purpose of this policy is to provide a safe and efficient mechanical ventilator setup, management and weaning.

## 3. SCOPE

- a. These mechanical ventilation policies support an interprofessional approach to mechanical ventilation.

## 4. GUIDELINES

- a. Ordering Adult Mechanical Ventilation protocols for intubated patients
  - i. The protocols will be initiated by physician order.
  - ii. Any order not covered by the protocols should be written in the physician's order sheet.
  - iii. The attending physician may discontinue the Adult Mechanical Ventilation protocols at any time.
  - iv. Any patient that meets the Adult Mechanical Ventilation protocols exclusion criteria will not be managed using the protocol.
    - 1) Exclusion criteria includes:
      - a) Patient less than 16 years old
      - b) A physician order that varies from the Adult Mechanical Ventilation protocols and does not permit adjustment of ventilator parameters based on those protocols.



## ADULT MECHANICAL VENTILATION SETUP PROTOCOL

### 1. INITIAL PARAMETERS & GOALS

- a. Volume Ventilation is generally used for the majority of patients, but Pressure Ventilation should be considered if peak pressures are  $> 40$  cm H<sub>2</sub>O, or if plateau pressures rise  $> 30$  cm H<sub>2</sub>O.
- b. The initial Volume Ventilation settings will be determined based upon the patient's Ideal Body Weight (IBW) and immediate clinical needs.
  - i. Tidal Volume ( $V_T$ ): set between 6-8 mL/Kg IBW while maintaining plateau pressure  $< 30$  cm H<sub>2</sub>O. Consult physician if unable to maintain these parameters.
    - 1) IBW Calculation
      - a) Males (kg) =  $105 + 5 (\text{height in inches} - 60) \div 2.2$
      - b) Females (kg) =  $106 + 6 (\text{height in inches} - 60) \div 2.2$
  - v. Rate (f): set between 10 to 16 breaths/minute.
  - vi. F<sub>I</sub>O<sub>2</sub>: set between 0.4 to 1
  - ii. PEEP: Set initial PEEP at 5 cm H<sub>2</sub>O, unless otherwise indicated. Higher levels may be required with acute lung injury (ALI) or acute respiratory distress syndrome (ARDS). See ALI/ARDS Protocol.
  - iii. I:E Ratio: Adjust to achieve an I:E ratio greater than 1:2 – 1:3 unless otherwise indicated to provide optimum mean airway pressure, lung filling, lung emptying (minimizing airtrapping/Auto-PEEP), and patient/ventilator synchrony.
- b. Obtain an ABG within 30 – 45 minutes from the start of mechanical ventilation and adjust above settings per Adult Mechanical Ventilation Management Protocol.

## ADULT MECHANICAL VENTILATION MANAGEMENT PROTOCOL

### 1. INITIAL VENTILATOR & PATIENT ASSESSMENT GUIDELINES

- a. Initial ventilator and patient assessment will be performed within 15 - 45 minutes from setup.

- c. Assessment will include evaluation of the patient's general appearance, breath sounds, ventilating pressures and volumes, SpO<sub>2</sub>, ABGs, HR, BP, ETCO (if available) and other hemodynamic data (if available).
- d. Adjust ventilator settings to achieve and maintain acceptable ABG's according to the ventilator management guidelines.

## 5. VENTILATOR MANAGEMENT GUIDELINES

- a. Subsequent ventilator and patient assessments will be performed and documented at least every four hours.
- b. For a pH < 7.30, evaluate to determine if the cause is respiratory.
  - i. If appropriate, increase rate to a maximum of 26 breaths/min until pH is > 7.30.
  - ii. If further adjustment is needed, incrementally increase VT until peak pressure = 40 cm H<sub>2</sub>O or plateau pressure = 30 cm H<sub>2</sub>O.
  - iii. If adjustments are unable to achieve and maintain desired pH within the maximum parameters, consult physician and consider allowing permissive hypercapnia.
- c. For a pH > 7.45, evaluate to determine if the cause is respiratory.
  - i. If appropriate, reduce rate to a minimum of 8 breaths/minute or until pH is < 7.45.
  - ii. After rate is decreased to 8 breaths/minute, if pH is still > 7.45, reduce volume to a minimum of 4 mL/kg IBW.
- d. PaO<sub>2</sub> or SpO<sub>2</sub> should be maintained based on the oxygenation goal: Keep PaO<sub>2</sub> 55-80 mmHg or SpO<sub>2</sub> 88-95%
  - i. Adjustments can be made on SpO<sub>2</sub> alone, but if ABG is available, it will supersede the SpO<sub>2</sub>.
  - ii. Minimum PEEP = 5 cmH<sub>2</sub>O
  - iii. Do not go above 12 cmH<sub>2</sub>O PEEP without consulting the physician
  - iv. Hemoglobin should be checked to ensure the absence of anemia.
  - v. Hemodynamic data should be checked to ensure adequate perfusion.
  - vi. Consult pulmonologist and consider the ARDS/ALI protocol if:
    - 1) PaO<sub>2</sub>/FiO<sub>2</sub> ratio is < 300 or

- 2) Settings of  $F_{I}O_2 = 0.5$  and  $PEEP = 12$  cm H<sub>2</sub>O are insufficient to maintain appropriate
  - e. Insert A-Line if patient requires, or is anticipated to require, more than one ABG per day.
  - f. Change from a Heat Moisture Exchange (HME) unit to a heated-wire circuit within 48 to 72 hours of the initiation of mechanical ventilation.

## CREDITS

---

Medication information from National Library of Medicine: Daily Med at

<http://dailymed.nlm.nih.gov/dailymed/>

Pictures from Shutterstock.com

Sound from freesound: Ding by Aiwaha at <http://freesound.org/people/Aiwaha/sounds/196106/>

Sound from freesound: Doorknock.ogg by appdoc at <http://freesound.org/people/appdoc/>

Wheeze lung sound from Wikipedia at <https://en.wikipedia.org/wiki/Wheeze>

## STORYLINE REFERENCES

American Academy of Allergy, Asthma & Immunology. (2017). Peak flow meter. Retrieved from <https://www.aaaai.org/conditions-and-treatments/library/at-a-glance/peak-flow-meter>

American Association for Clinical Chemistry. (2001-2017). CO2. *Lab Tests Online*. Retrieved from <https://labtestsonline.org/understanding/analytes/co2/refrange/>

American Lung Association. (2017). *Measuring your peak flow rate*. Retrieved from <http://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/living-with-asthma/managing-asthma/measuring-your-peak-flow-rate.html>

Camargo, C., Rachelefsky, G., & Schatz, Michael. (2009). Managing asthma exacerbations in the emergency department: Summary of the national asthma education and prevention program expert panel report 3 guidelines for the management of asthma exacerbations. *Proceeding of the American Thoracic Society*, 6 (4). Retrieved from [http://www.atsjournals.org/doi/full/10.1513/pats.P09ST2#.V3\\_w-032apo](http://www.atsjournals.org/doi/full/10.1513/pats.P09ST2#.V3_w-032apo)

Center for Disease Control and Prevention (2000). Clinical Growth Charts: Boys Stature for age and Weight for age Growth Chart. Retrieved from [http://www.cdc.gov/growthcharts/clinical\\_charts.htm](http://www.cdc.gov/growthcharts/clinical_charts.htm)

Dickens, G., McCoy, R., WQest, R., Stapczynski, J., & Clifton, G. (1994). Effect of nebulized albuterol on serum potassium and cardiac rhythm in patients with asthma or chronic obstructive pulmonary disease. *Pharmacotherapy*, 14(6), 729-33. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/7885977>

Gorelick, M., Stevens, M., Schultz, T., & Scribano, P. (2004). Performance of a novel clinical score, the pediatric asthma severity score (PASS), in the evaluation of acute asthma. *Academic Emergency Medicine*, 11 (1), 10-18. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1197/j.aem.2003.07.015/abstract>

- Global Initiative for Asthma. (2016). *2016 Pocket guide for asthma management and prevention*. Retrieved from <http://ginasthma.org/2016-pocket-guide-for-asthma-management-and-prevention/>
- Heart ® Continuous Nebulizers. (2016). Retrieved from <http://westmedinc.com/heart/>
- HOPE™ Nebulizer – Aerosol Therapy for Adult and Pediatric Patients (2010-2017). Retrieved from <http://bandb-medical.com/hope-nebulizer/>
- Howell, J. (2016). Acute severe asthma exacerbations in children: Endotracheal intubation and mechanical ventilation. *UpToDate Literature Review*. Retrieved from <https://www.uptodate.com/contents/acute-severe-asthma-exacerbations-in-children-endotracheal-intubation-and-mechanical-ventilation>
- Howell, J. (2016). Acute severe asthma exacerbations in children: Intensive care unit management. *UpToDate Literature Review*. Retrieved from <https://www.uptodate.com/contents/acute-severe-asthma-exacerbations-in-children-intensive-care-unit-management>
- Joint Commission (2016). Children’s Asthma Care. Downloaded from [https://www.jointcommission.org/childrens\\_asthma\\_care/](https://www.jointcommission.org/childrens_asthma_care/).
- Labson, M. (2013). *SBAR – A powerful tool to help improve communications*. Retrieved from [https://www.jointcommission.org/at\\_home\\_with\\_the\\_joint\\_commission/sbar\\_%e2%80%93\\_a\\_powerful\\_tool\\_to\\_help\\_improve\\_communication/](https://www.jointcommission.org/at_home_with_the_joint_commission/sbar_%e2%80%93_a_powerful_tool_to_help_improve_communication/)
- Medscape. (2017). *Peak expiratory flow prediction*. Retrieved from <http://reference.medscape.com/calculator/peak-expiratory-flow>
- Moses, S. (2017). *Status asthmaticus*. Retrieved from <http://www.fpnotebook.com/Lung/Asthma/StsAsthmtcs.htm>

National Heart, Lung and Blood Institute. (2007). Asthma action plan. Retrieved from <https://www.nhlbi.nih.gov/health/resources/lung/asthma-action-plan>

National Heart, Lung and Blood Institute. (2007). *National asthma education and prevention program: Expert panel report 3: Guidelines for the diagnosis and management of asthma*. Retrieved from <https://www.nhlbi.nih.gov/health-pro/guidelines/current/asthma-guidelines>

National Heart, Lung and Blood Institute. (2012). *Asthma care quick reference: Diagnosing and managing asthma*. Retrieved from <https://www.nhlbi.nih.gov/health-pro/guidelines/current/asthma-guidelines/quick-reference>

National Institute for Occupational Safety and Health: Respiratory Health Division. (2015). Spirometry – Reference value calculator. Retrieved from <https://www.cdc.gov/niosh/topics/spirometry/refcalculator.html>

Nievas, I. F. F., & Anand, K. J. S. (2013). Severe acute asthma exacerbation in children: A stepwise approach for escalating therapy in a pediatric intensive care unit. *The Journal of Pediatric Pharmacology and Therapeutics*, 18(2), 88–104. <http://doi.org/10.5863/1551-6776-18.2.88>

Quality Measures Summary. (2015). Retrieved from [https://www.cdc.gov/asthma/pdfs/quality\\_measures\\_summary\\_3\\_18\\_15.pdf](https://www.cdc.gov/asthma/pdfs/quality_measures_summary_3_18_15.pdf)

Peak Flow Meter. (2017). Retrieved from <https://www.childrensmn.org/educationmaterials/childrensmn/article/15556/peak-flow-meter/>

Saaddeh, C. (2016). Status asthmaticus. Retrieved from <http://emedicine.medscape.com/article/2129484-overview#a1>

Sawicki, G., & Haver, K. (2016). Acute asthma exacerbations in children: Home/office management and severity assessment. *UpToDate Literature Review*. Retrieved from <https://www.uptodate.com/contents/acute-asthma-exacerbations-in-children-home-office-management-and-severity-assessment>

Scarfone, R. (2016). Acute asthma exacerbations in children: Emergency department management. *UpToDate Literature Review*. Retrieved from [https://www.uptodate.com/contents/acute-severe-asthma-exacerbations-in-children-intensive-care-unit-management?source=search\\_result&search=severe%20asthma%20exacerbation%20in%20children&selectedTitle=1~150](https://www.uptodate.com/contents/acute-severe-asthma-exacerbations-in-children-intensive-care-unit-management?source=search_result&search=severe%20asthma%20exacerbation%20in%20children&selectedTitle=1~150)



This work by the Wisconsin Technical College System TAACCCT IV Consortium is licensed under a [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/).

Third party marks and brands are the property of their respective holders. Please respect the copyright and terms of use on any webpage links that may be included in this document.

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This is an equal opportunity program. Assistive technologies are available upon request and include Voice/TTY (771 or 800-947-6644).