

JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Asthma Clinical Pathway



JOHNS HOPKINS
All Children's Hospital



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This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patient based on the patient's individualized circumstances and the practitioner's professional judgment.

Johns Hopkins All Children's Hospital
Asthma Clinical Pathway

Rationale

This clinical pathway was developed by a group including Emergency Medicine, Hospitalists, Intensivists, Pulmonologists, Nursing, Respiratory Therapy and Pharmacy to standardize the treatment of patients presenting with acute asthma exacerbations in Emergency Center and the inpatient setting. This clinical pathway addresses the following questions or processes:

1. Standardization to the approach and treatment of acute exacerbation of asthma
2. Decrease routine use of unnecessary diagnostic testing and unnecessary interventions
3. Reinforce the use of asthma score to guide care
4. Provide guidance for patients/families on asthma, discharge instructions and home care
5. Follow current national and international guidelines for asthma care

Background

Asthma is a common chronic pediatric disorder of the airways that is complex and characterized by variable and recurring symptoms, airflow obstruction, bronchial hyperresponsiveness, and an underlying inflammation. The interaction of these features of asthma determines the clinical manifestations and severity of asthma and the response to treatment. Central to the various phenotypic patterns of asthma is the presence of underlying airway inflammation, which is variable and has distinct but overlapping patterns that reflect different aspects of the disease, such as intermittent versus persistent or acute versus chronic manifestations. Acute symptoms of asthma usually arise from bronchospasm and require and respond to bronchodilator therapy. Acute and chronic inflammation can affect not only the airway caliber and airflow but also underlying bronchial hyperresponsiveness, which enhances susceptibility to bronchospasm (Cohn et al. 2004).

Pediatric Asthma Score (PAS): Is an assessment tool using a point system that is used to determine the appropriate severity measurement of the patient. The points are added together and the greater the number, the more frequent the bronchodilator treatments. See attached asthma score guideline.

Always assess airway, breathing and circulation prior to assessing PAS. The PAS was not developed for use on unstable patients and emergent intervention must not be withheld to determine the score.

Diagnosis

To establish a diagnosis of asthma, the clinician should determine that symptoms of recurrent episodes of airflow obstruction or airway hyperresponsiveness are present; airflow obstruction is at least partially reversible; and alternative diagnoses are excluded. (NAEPP 2007)

The presence of multiple key indicators increases the probability of asthma.

- 1) Wheezing—high-pitched whistling sounds when breathing out—especially in children.
 - a. A lack of wheezing and a normal chest examination do not exclude asthma.
- 2) History of any of the following:
 - a. Cough (worse particularly at night)
 - b. Recurrent wheeze
 - c. Recurrent difficulty in breathing
 - d. Recurrent chest tightness
- 3) Symptoms occur or worsen in the presence of:
 - a. Exercise
 - b. Viral infection
 - c. Inhalant allergens (e.g., animals with fur or hair, house-dust mites, mold, pollen)
 - d. Irritants (tobacco or wood smoke, airborne chemicals)
 - e. Changes in weather
 - f. Strong emotional expression (laughing or crying hard)
 - g. Stress
 - h. Menstrual cycles
- 4) Symptoms occur or worsen at night, awakening the patient
- 5) Spirometry may be utilized to establish diagnosis, but not required

Clinical Management Introduction

Management of asthma is reflected by the Asthma Pathway developed by Johns Hopkins All Children's multidisciplinary group with portions adapted from the Johns Hopkins Hospital Asthma Management Pathway along with The National Heart Lung and Blood Institute's National Asthma Education and Prevention Program.

The provider will diagnose and assess asthma severity based on the history and physical examination. The patient should be assessed for risk factors such as allergies, eczema and close family members who have asthma. Classification of baseline asthma severity or assessment of asthma control can be determined by analysis of daytime symptoms, nighttime symptoms, short-acting beta2-agonist (SABA) use, interference with normal activity, lung function, and asthma exacerbations requiring oral systemic corticosteroids. The severity of current illness can be assessed by lung function measures (for ages ≥ 5 years), physical examination, and signs and symptoms.

If the patient is over the age of 2 years, respiratory rate, breath sounds, wheezing, accessory muscle use, and oxygen requirement should be assessed using the Pediatric Asthma Score (PAS). If the patient's oxygen saturation is above 90% on room air, continuous pulse oximetry should not be performed. Relieve hypoxemia with supplemental oxygen to keep the oxygen saturation above 90%. Airflow obstruction should be relieved with bronchodilators either by

repetitive or continuous administration. The addition of inhaled ipratropium bromide is acceptable in severe exacerbations. Airway inflammation should be reduced with systemic corticosteroids for moderate to severe exacerbations. Consider adjunctive treatments in severe exacerbations unresponsive to treatment.

Patient should be admitted if there is an oxygen requirement, continued respiratory distress requiring further medication administration and/or unable to tolerate po. Once admission has been accepted by inpatient team, respiratory treatments should continue in the EC based on PAS severity score until patient transfer has occurred. Respiratory therapy (RT) will be called when the patient arrives to the unit. They will score the patient using the PAS scoring tool. RT will score the patient before and after each SABA administration and communicate any change in status to the provider.

The provider will complete admission and asthma orders according to the asthma severity score guidelines and designated order sets.

Asthma Scoring

Table 3: Pediatric Asthma Scoring System

Characteristic	Score 1	Score 2	Score 3
Respiratory Rate (assessed over 60 seconds)	< 2 years = < 40 2-3 years = 34 or less 4-5 years = 30 or less 6-12 years = 26 or less > 12 years = 23 or less	< 2 years = 40-60 2-3 years = 35-39 4-5 years = 31-35 6-12 years = 27-30 > 12 years = 24-27	< 2 year = > 60 2-3 years = 40 or greater 4-5 years = 36 or greater 6-12 years = 31 or greater > 12 years = 28 or greater
Breath Sounds / Dyspnea	Good aeration Breath sounds bilaterally throughout Speaks in full sentences = good	Fair aeration Breath sounds half way up and bilateral Speaks in partial sentences = Fair	Poor aeration Diminished bilaterally or absent Speaks in single words/short phrases/grunting = poor
Wheezing	No wheezing or minimal expiratory wheezing	Diffuse expiratory wheezing	Inspiratory and expiratory wheezing
Accessory Muscle Use (nasal flaring, intercostal, substernal, supraclavicular)	Zero to one site	Two sites	Three or more sites
Oxygen Measurement (using at least two minutes of continuous pulse oximetry measurement)	>95% on room air	90-95% on room air	<90% on room air OR currently requiring supplemental oxygen or continuous albuterol

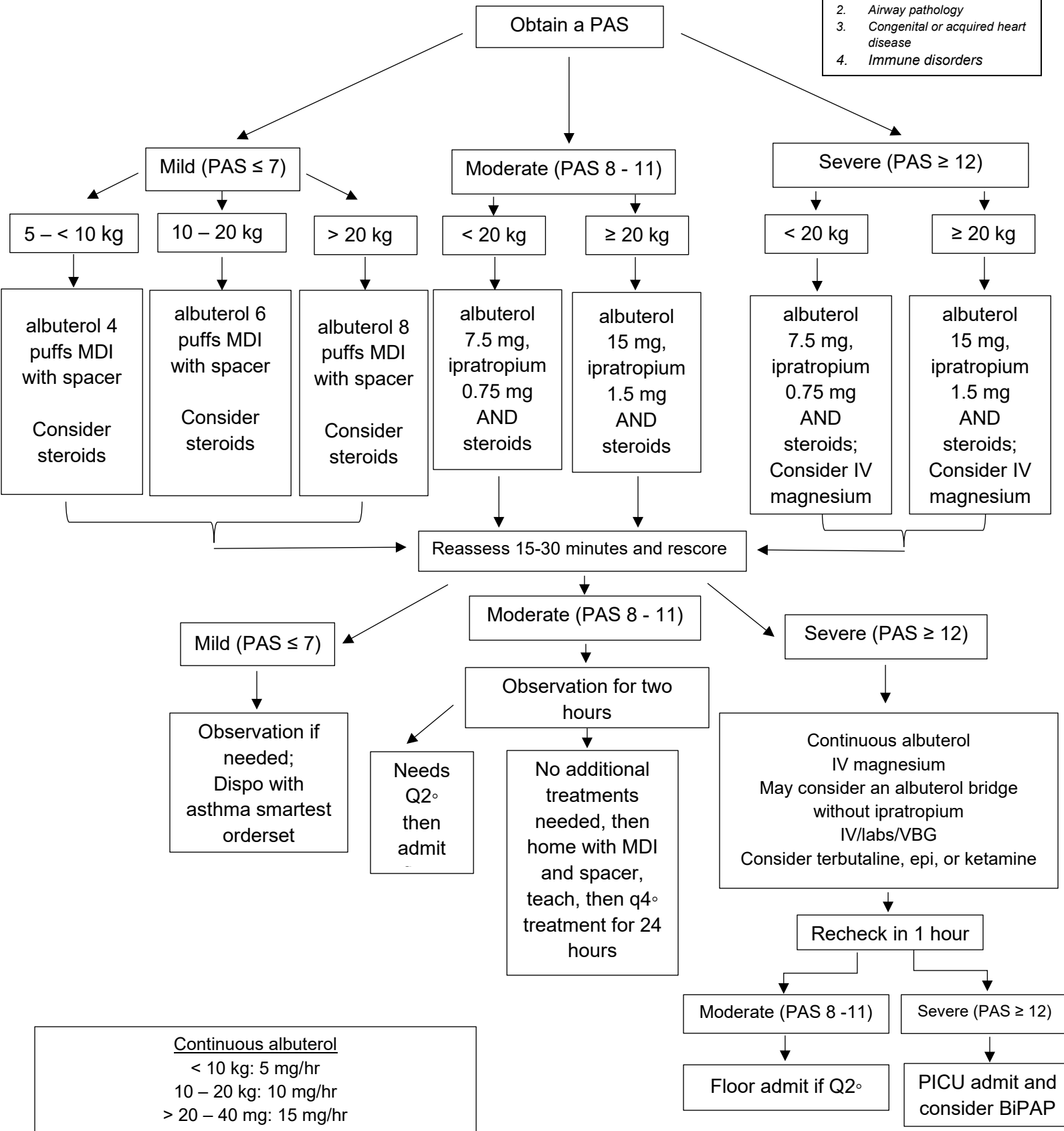
* Reference: Kelly CS, Andersen CL, Pestian JP, Wenger AD, Finch AB, Strobe GL, Luckstead EF. Improved outcomes for hospitalized asthmatic children using a clinical pathway. Ann Allergy Asthma Immunol. 2000; 84(5):509-16.

Table 4: Pediatric Asthma Score (PAS) Definitions

Pediatric Asthma Score (PAS)	A respiratory scoring tool which consists of 5 elements that make up the respiratory assessment of the patient in distress. The higher the score, the more distress the patient is in. (See Table 1)
Mild Asthma	PAS of ≤ 7
Moderate Asthma	PAS of 8-11
Severe Asthma	PAS of ≥ 12

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Emergency Center Clinical Pathway

- Inclusion Criteria:**
1. ≥ 2 years old
 2. Dx of asthma or RAD
 3. Suffering exacerbation of asthma/RAD
- Exclusion Criteria**
1. Chronic respiratory illness
 2. Airway pathology
 3. Congenital or acquired heart disease
 4. Immune disorders



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PICU Clinical Pathway

Continuous albuterol
 < 10 kg: 5 mg/hr
 10 - 20 kg: 10 mg/hr
 > 20 - 40 kg: 15 mg/hr
 > 40 kg **OR**
 > 20 kg in severe
 distress: 20 mg/hr

ipratropium
 < 12 years: 0.25 mg
 ≥ 12 years: 0.5 mg

Nebulization of continuous albuterol through a high flow nasal cannula circuit (or through a mask over the cannula) with flows greater than 5 L/min may result in suboptimal albuterol deposition in the lungs.

Inpatient ICU Admission
 Utilize the JHACH PICU Asthma Order Sets

Moving air on exam, able to speak phrases, and mild work of breathing

YES

NO

Continue with current albuterol dosing, steroids, supplemental oxygen as needed.

Obtunded, combative, rising CO₂, poor respiratory effort, or significant hypoxia despite oxygen

Improving within 30-60 minutes and maintains normal mental status, FiO₂ < 0.5

YES

NO

YES

NO

Add continuous albuterol if not already receiving, consider titrating dose or add ipratropium and/ or magnesium sulfate

- Obtain blood gas, place T_cCO₂ Monitor
- **Consider trial of adjunctive interventions:**
- Respiratory interventions:
 - **Heliox** (via Mask or HFNC)
 - **BiPAP** (if ≥ 5 yo)
 - **HFNC** (if < 5 yo and unable to tolerate BiPAP)
- Pharmacologic interventions/infusions:
 - terbutaline
 - aminophylline
 - EPINEPHrine
 - ketamine

Improving within 30-60 minutes

Improving within 30-60 minutes

YES

NO

NO

YES

Continue albuterol and wean when able

Escalate on PICU pathway

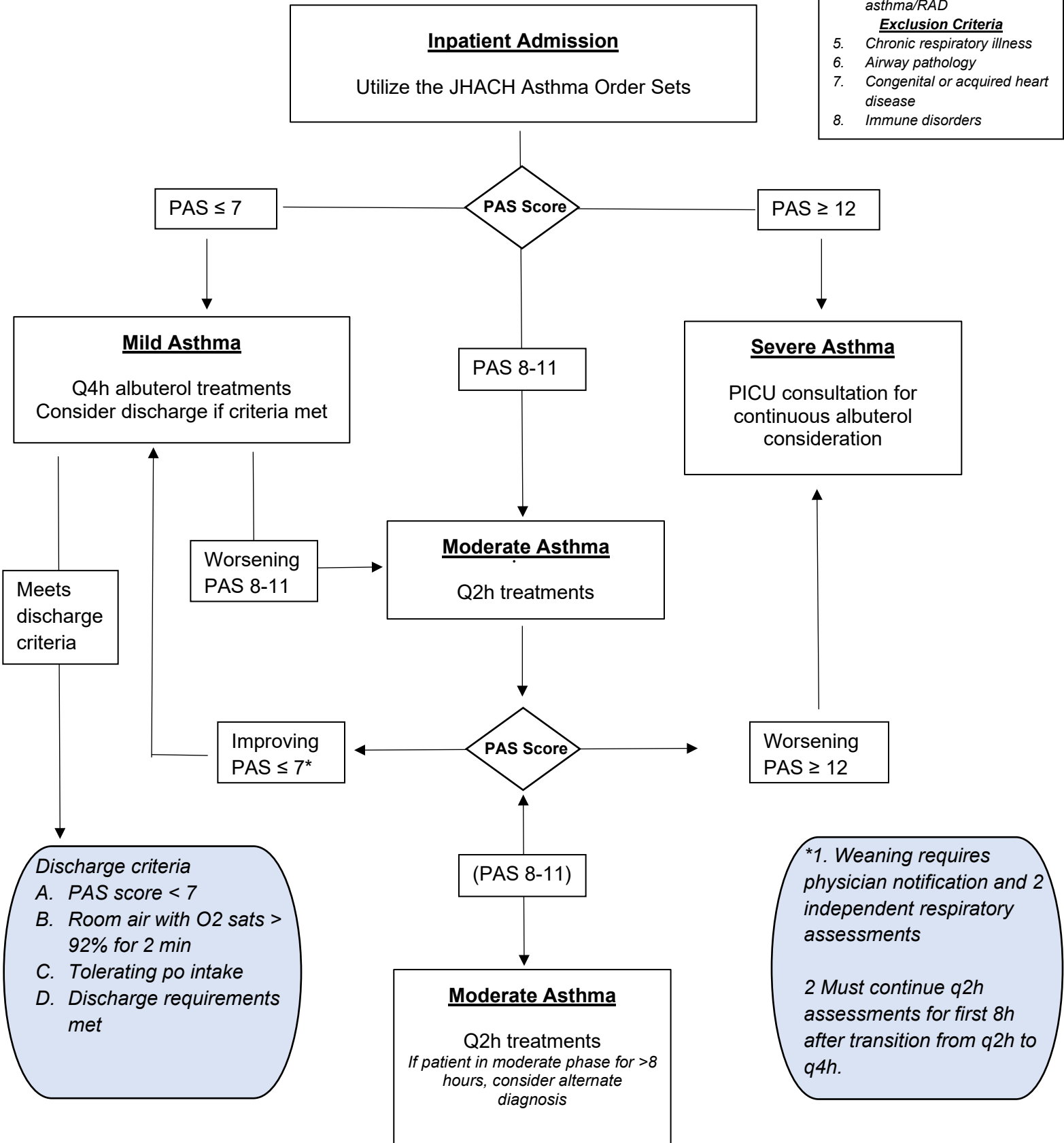
- Prepare for intubation
- Consider concurrent ketamine, Heliox, and/or isoflurane
- Consultation with ECLS team

- Continue to titrate NIPPV and medications as needed
- Wean when able

Transfer to floor when able to tolerate q 2 treatments

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Inpatient Clinical Pathway

- Inclusion Criteria:**
4. ≥ 2 years old
 5. Dx of asthma or RAD
 6. Suffering exacerbation of asthma/RAD
- Exclusion Criteria**
5. Chronic respiratory illness
 6. Airway pathology
 7. Congenital or acquired heart disease
 8. Immune disorders



Asthma Management

A. Indications For Use

- a. Inclusion Criteria
 - i. ≥ 2 years old
 - ii. Diagnosis of asthma or reactive airway disease (RAD)
 - iii. Suffering an acute exacerbation of asthma/RAD
- b. Exclusion Criteria: Patients with one or more of the following:
 - i. Chronic respiratory illness, such as cystic fibrosis, bronchopulmonary dysplasia, or chronic lung disease (ventilator-dependent)
 - ii. Airway pathology, such as vocal cord disorders, tracheomalacia, bronchomalacia or tracheostomy dependent.
 - iii. Congenital or acquired heart disease
 - iv. Immune disorders (For example: CGD, CVID, SCID, AIDS, Immunocompromised oncology patient)
- c. Caution:
 - i. Children with a co-morbid diagnosis of pneumonia and asthma that qualify for entry into the protocol should be carefully followed for non-bronchodilator responsive wheezing.
 - ii. Patients with a positive COVID-19 diagnosis should be monitored for delayed symptoms and should be managed according to institutional COVID-19 protocols.

B. Responsibility

- a. Physician (Resident/Attending)
 - i. Enters admission orders into EPIC
 1. Utilize asthma order sets as indicated
 - ii. Enters orders for:
 1. Initiation and discontinuation of intermittent respiratory treatments
 - a. q2h and q4h treatments
 - iii. Discontinues the pathway if appropriate
- b. Respiratory Therapy (RT)
 - i. Performs respiratory assessments, completes Pediatric Asthma Score (PAS) and documents in the respiratory flow sheet
 - ii. Administers bronchodilator therapies
 - iii. Communicates with nursing and physician any changes in patient status
 - iv. Informs nursing and/or physician if additional respiratory assessment required
- c. Nursing
 - i. Performs vital sign assessment at indicated intervals
 - ii. Notifies physician and/or RT if any changes in condition
 - iii. Performs independent respiratory assessments, completes Pediatric Asthma Score (PAS) and documents in the respiratory flow sheet when indicated per protocol.

C. Procedure

- a. Initial Emergency Center treatment
 - i. Interventions

1. Intermittent and continuous respiratory treatments will be administered by Respiratory Therapy
- ii. Initial treatments
 1. Mild Asthma (PAS \leq 7)
 - a. 5 - 10 kg: 4 puffs MDI
 - b. 10 - 20 kg: 6 puffs MDI
 - c. > 20 kg: 8 puffs MDI
 - d. Consider enteral steroids
 2. Moderate Asthma (PAS 8-11)
 - a. < 20 kg: 7.5 mg albuterol with 0.75mg ipratropium
 - b. \geq 20 kg: 15 mg albuterol with 1.5mg ipratropium
 - c. Give enteral steroid
 3. Severe Asthma (PAS \geq 12)
 - a. < 20 kg: 7.5 mg albuterol with 0.75mg ipratropium
 - b. \geq 20 kg: 15 mg albuterol with 1.5mg ipratropium
 - c. Give IV steroid
 - d. Consider magnesium sulfate IV
- iii. Subsequent treatments (Emergency Center, ICU, Inpatient)
 1. Mild Asthma (q4h treatments)
 - a. Preferred (MDI with appropriately sized spacer)
 - i. < 20 kg: 4 puffs q4h
 - ii. \geq 20 kg: 4 puffs q4h
 - b. Nebulized (Not tolerating MDI)
 - i. < 20 kg: 2.5 mg q4h
 - ii. \geq 20 kg: 5 mg q4h
 - c. Consider enteral steroids or continue if previously administered
 - d. Note: RT Protocolized wean may result in simultaneous wean of dose and frequency (e.g. 8 puffs q2h to 4 puffs q4h). Consider sequential wean of frequency then dose if concerned for failure.
 2. Moderate Asthma (q2h treatments)
 - a. Preferred (MDI with appropriately sized spacer)
 - i. < 20 kg: 4 puffs q2h
 - ii. \geq 20 kg: 8 puffs q2h
 - b. Nebulized (Not tolerating MDI)
 - i. < 20 kg: 2.5 mg q2h
 - ii. \geq 20 kg: 5 mg q2h
 - c. Continue enteral steroids
 - d. Patient in moderate phase (PAS 8-11) for 8h or more, please consider alternative diagnosis.
 3. Severe Asthma (EC and ICU care)
 - a. Any patient receiving continuous nebulized therapy must be treated in the EC or ICU setting.
 - b. Initiate continuous albuterol

- c. Consider bridging albuterol treatment until continuous albuterol arrives
 - i. < 20 kg: 7.5 mg albuterol
 - ii. ≥ 20 kg: 15 mg albuterol
- d. Continue IV steroids
- e. Consider magnesium sulfate if not previously given
- f. Consider additional interventions if indicated
 - i. terbutaline
 - ii. aminophylline
 - iii. EPINEPHrine IM
 - iv. ketamine
 - v. Heliox
 - vi. BiPAP or high-flow nasal canula
 - vii. Lab work and imaging
 - viii. IV fluids
 - ix. Escalation of ventilatory support based on hospital protocols and availability of equipment

D. Pharmacology

- a. dexAMETHasone
 - i. Enteral dexamethasone
 - 1. See Table 1 for enteral standardized dosing
 - ii. IV/IM dose: 0.6 mg/kg/dose once (max: 16 mg/dose)

Table 1: Dexamethasone Weight-Based Dosing (Enteral)

Weight	Dose
6 - 8 kg	4 mg once
> 8 - 12 kg	6 mg once
> 12 - 16 kg	8 mg once
> 16 - 25 kg	12 mg once
> 25 kg	16 mg once

- b. predniSONE/prednisoLONE
 - i. 2 mg/kg/day once daily or divided BID (max: 60 - 80 mg/DAY) for 5 days
- c. methylPREDNISolone
 - i. 2 mg/kg/dose (max: 125 mg) IV once followed by 1 mg/kg/dose (max: 60 mg/dose) Q6h
- d. albuterol/ipratropium
 - i. See Table 2

Table 2: Albuterol and Ipratropium Weight-based Dosing EC Setting

Medication	5 - 10 kg	> 10 - 20 kg	> 20 kg
albuterol HFA	4 puffs	6 puffs	8 puffs
	< 10 kg	10 - 20 kg	> 20 kg
albuterol nebulizer	2.5 mg	3.75 mg	5 mg
	< 20 kg		≥ 20 kg

albuterol nebulizer	7.5 mg**	15 mg**
ipratropium	0.75 mg**	1.5 mg**

**note, this is a "triple" meaning the patient is getting 3 doses of each neb to equal the desired dose; ex. albuterol 2.5 mg x 3 doses to equal 7.5 mg for patients < 20 kg

- ii. For continuous albuterol:
 1. Non-vented: for patients NOT requiring ventilation or on heated high flow nasal cannula
 2. Vented: For in-line use with vented or heated high flow nasal cannula
 3. Dosing:
 - a. < 10 kg: 5 mg/hr
 - b. 10 – 20 kg: 10 mg/hr
 - c. > 20 – 40 mg: 15 mg/hr
 - d. > 40 kg OR > 20 kg and severe distress: 20 mg/hr
- iii. ipratropium
 1. < 12 years old: 0.25 mg q4h
 2. ≥ 12 years old: 0.5 mg q4h
- e. magnesium sulfate IV
 - i. 50 - 75 mg/kg/dose (max: 2000 mg) administer over 20 minutes
 - ii. Dosing given over 20 minutes may need EC or ICU level monitoring
- f. EPINEPHrine IM
 - i. < 10 kg: 0.01 mg/kg/dose IM
 - ii. 10 - < 30 kg: 0.15 mg IM
 - iii. ≥ 30 kg: 0.3 mg IM
- g. terbutaline
 - i. Subcutaneous: 0.01 mg/kg/dose (max 0.25 mg)
 - ii. Loading dose before infusion: 0.01 mg/kg/dose
 - iii. Infusion starting dose: 0.4 mcg/kg/min
 - iv. Monitoring:
 1. Troponins Q6h
 2. EKG daily
- h. aminophylline
 - i. Loading dose: 6 mg/kg/dose IV once
 - ii. Refer to Lexicomp for age-specific infusion dosing
 - iii. Monitor theophylline levels (send out)
 1. May obtain post-loading dose level 30 – 60 minutes after loading dose is complete
 2. May obtain steady state levels 12 - 24 hours after initiation of infusion
 3. Adjust infusion rate based on goal of 10 – 15 mcg/mL; below are Lexicomp recommendations:
 4. <9.9 mcg/mL: If tolerated, but symptoms remain, increase dose by ~25%. Recheck serum theophylline concentrations.
 5. 10 to 14.9 mcg/mL: Maintain dosage if tolerated and symptoms controlled. Recheck serum concentrations at 24-hour intervals. If

symptoms not controlled, consider additional medications for management.

6. 15 to 19.9 mcg/mL: Consider 10% dose reduction to improve safety margin even if dose is tolerated.
7. 20 to 24.9 mcg/mL: Decrease dose by ~25%. Recheck serum concentrations.
8. 25 to 30 mcg/mL: Stop infusion for 12 hours (ages 1 month to <16 years) or 24 hours (ages ≥16 years) and decrease subsequent doses by at least 25%. Recheck serum concentrations.
9. >30 mcg/mL: Stop dosing and treat overdose; if resumed, decrease subsequent doses by at least 50%. Recheck serum concentrations.

i. ketamine

- i. Refer to Lexicomp for specific dosing

E. Inpatient Assessments

- a. Transition from ICU to Med/Surg floor
 - i. Patient must be tolerating q2h or q4h treatments with PAS scores ≤ 11.
 - ii. Transferring physician determines that patient meets criteria for step down to general inpatient care on Med/Surg floor.
 - iii. Accepting physician has been notified and agrees with transfer.
 - iv. Physician to be notified by nursing upon arrival to floor.
- b. Assessing readiness to transition from q2h to q4h treatments
 - i. If RT believes that patient is ready to be transitioned from q2h to q4h treatments, they will notify Nursing to complete an independent PAS assessment.
 - ii. If the independent RT and Nursing PAS assessments correlate exactly, the physician will be notified that the patient is ready to transition to q4h treatments.
 1. If Nursing is unavailable to complete the required second independent PAS assessment, then the Resident or Attending Physician should be contacted to perform an independent PAS score.
 - iii. If there are any discrepancies between either independent PAS assessment, the patient will not be weaned until a Physician (Resident and/or Attending) evaluates the patient.
- c. Criteria for adjusting frequency of albuterol treatments
 - i. Wean frequency from q2h to q4h treatments
 1. If the patient has received two q2h treatments, the RT and Nursing PAS assessment correlate exactly, AND meet any of the following criteria, notify authorized physician that the patient is ready to transition to q4h treatments and obtain orders:
 - a. PAS improves (score decreases) by 2 or more and PAS is less than 12
 - b. PAS is 7 or less
 - c. PAS has not improved (score has not decreased) by at least 2 (but not getting worse) AND patient has been receiving respiratory treatments at q2h for at least 12 hours.

2. For the first 8 hours (2 subsequent q4h treatments) after transitioning from q2h treatments to q4h treatments, patient will continue to be evaluated every 2 hours.
 - a. PAS score will be performed by RT at each evaluation.
 - b. If RT is unable to evaluate at the 2 hour time period then PAS assessment to be performed by Nursing. If neither is available, then resident/attending to be contacted.
 - i. If PAS score is 8-11 then patient is to remain at q2h treatments until score is ≤ 7 .
 - c. If the 2 hour PAS assessment was performed by someone other than RT and patient requires a treatment, then RT to be contacted immediately
- ii. Maintain frequency (q2h treatments)
 1. If patient meets ALL the following criteria, the patient is not ready for transition and no changes are needed:
 - a. PAS less than 12
 - b. No decrease in PAS by at least 2
 - c. Patient has received q2h treatments for less than 12 hours
- iii. Intensification of respiratory treatments
 1. If the patient meets ANY of the following criteria, contact the authorized physician as soon as possible.
 - a. PAS worsens (score increases) by 2 or more and PAS is more than 7.
 - b. PAS is 12 or more
 - c. PAS worsens (score increases) by more than 2 within 2 hours after transition to lower frequency of respiratory treatments
 - d. If PAS score is ≥ 12 and patient requires consideration of continuous albuterol treatments then call a Rapid Response for critical care evaluation.

F. Discharge

- a. Discharging from the EC
 - i. Patient may be discharged from the EC if oxygen saturations are stable above 92% for > 2 minutes, tolerating po and no respiratory distress. Patient must also be at least 2 hours from triple nebulizer treatment and have no need for further EC treatments.
 - ii. The patient should be discharged with medication and patient education:
 1. Medications: SABA, oral systemic corticosteroids; consider starting inhaled corticosteroid (ICS)
 - a. MDI may be sent home with patient from EC per Medication Administration policy PAT051.
 - b. Send prescriptions to the JHACH outpatient pharmacy to be picked up prior to discharge unless home pharmacy is preferred by patient or parent

- iii. Referral for follow-up care. High risk patients should be referred to Pulmonology.
 - 1. High risk examples include: history of life threatening or severe asthma, poorly controlled asthma on appropriate treatment, concern for underlying conditions that would make treating asthma difficult.
- iv. Utilize asthma smart set order
- v. Review of inhaler technique and, whenever possible, environmental control measures
- vi. Social work consult if there are social concerns that would make it more likely to return to the ED or worsen patient's asthma
- vii. Referral for parent or patient for tobacco cessation if they smoke or vaping cessation if abuse is suspected
- b. Discharging the patient from hospital
 - i. If the patient has received two q4h treatments, and patient meets ALL of the following criteria, RT or nursing to notify the authorized physician that the patient is ready for discharge and request assessment from the physician to confirm patient meets discharge criteria:
 - 1. PAS score < 7
 - 2. Oxygen saturation on room air > 92% using at least 2 minutes of continuous pulse oximetry measurement
 - a. May be done with routine vitals check.
 - b. Do not routinely place on continuous pulse oximeter unless otherwise indicated
 - 3. Patient is tolerating po intake
 - 4. Social concerns (if applicable) have been addressed
- c. Additional discharge considerations
 - i. Authorized physician on the patient's care team must evaluate the patient for discharge readiness criteria
 - ii. The patient is maintaining adequate respiratory status on therapies that are prescribed for home use.
 - iii. Patient education, review of environmental control measures, and inhaled medication administration training is completed.
 - iv. Asthma action plan is printed and provided to the patient and/or family.
 - v. Arrangements for any medications or equipment required for home therapies are complete.
 - 1. Send prescriptions to the JHACH outpatient pharmacy to be picked up prior to discharge unless home pharmacy is preferred by patient or parent
 - vi. Follow-up care is arranged, coordinating with primary care provider or asthma care specialist
 - 1. High risk patients should be referred to Pulmonology for outpatient care
 - a. High risk examples include: history of life threatening or severe asthma, poorly controlled asthma on appropriate treatment,

concern for underlying conditions that would make treating asthma difficult.

vii. Social Considerations:

1. Social work consult if there are social concerns that would make it more likely to return to the ED or worsen patient's asthma
2. Referral and/or education provided for parent or patient for tobacco cessation if they smoke or for vaping cessation if abuse suspected or confirmed.

G. Patient Class and Documentation Recommendations:

a. Patient Class:

- i. If your patient is admitted to the ICU, please admit to inpatient status
- ii. If your patient is referred for hospitalization on a med/surg floor, please begin in observation status

b. Documentation:

- i. It is important to document if your patient has clinically significant **tachycardia** associated with their condition. If you feel the tachycardia is secondary to albuterol use, it is important to document that (ex. tachycardia secondary to albuterol administration).
- ii. It is important to document if your patient has any **electrolyte abnormalities**, especially if it is related to their treatment. Please be sure to link the medication you feel is causing the abnormality (ex. hypokalemia secondary to albuterol administration).
- iii. If you feel the patient's condition is also related to their underlying **chronic lung disease of prematurity** (or bronchopulmonary dysplasia), it is important to document that.
- iv. It is important to document if your patient is on chronic steroids, immunomodulators, or has an underlying condition that causes them to be **immunosuppressed**.
- v. It is important to document if your patient has **status asthmaticus**. Status asthmaticus (vs. asthma exacerbation) is considered when a patient's symptoms have worsened or failed to respond to adequate standard therapy and they require hospitalization due to respiratory failure or impending respiratory failure.
- vi. It is important to document if the patient has acute or acute on chronic **respiratory failure**.

Figure 1: Acute Respiratory Failure Indicators

Acute Respiratory Failure Indicators

Term Newborn/Neonate	
Symptoms	<ul style="list-style-type: none"> Tachypnea or lowered respiratory rate (>60 or <30 breaths per min.) Dyspnea, increased work of breathing, stridor, cyanosis, retractions-suprasternal, intercostal, or subcostal, head bobbing, grunting, nasal flaring, apnea Hemodynamic instability
Lab Values/ O2 Levels	<ul style="list-style-type: none"> PaO2<60 mmHg or SPO2 <91% on Room Air (RA) PaO2/FiO2 <300 pH <7.35 from an arterial sample pH <7.3 from a venous sample
Intervention	<ul style="list-style-type: none"> Mechanical Ventilator, BiPAP, CPAP or NPPC Oxygen delivered via HFNC or Non-rebreather mask Nasal Cannula delivering at least 0.5L to 2L/min or 30% face mask provided Any amount of high flow nasal cannula (Vapotherm/HHFNC)
Infant	
Symptoms	<ul style="list-style-type: none"> Tachypnea or lowered respiratory rate (>60 or <20 breaths per min.) Dyspnea, increased work of breathing, stridor, cyanosis, retractions-suprasternal, intercostal, or subcostal, head bobbing, grunting, nasal flaring, apnea Hemodynamic instability
Lab Values/ O2 Levels	<ul style="list-style-type: none"> PaO2<60 mmHg or SPO2 <91% on Room Air (RA) PaO2/FiO2 <300 pH <7.35 from an arterial sample pH <7.3 from a venous sample
Intervention	<ul style="list-style-type: none"> Mechanical Ventilator, BiPAP, CPAP or NPPC Oxygen delivered via HFNC or Non-rebreather mask Nasal Cannula delivering at least 0.5L to 2L/min or 30% face mask provided Any amount of high flow nasal cannula (Vapotherm/HHFNC)
Toddler (Ages 12 months–4 years old)	
Symptoms	<ul style="list-style-type: none"> Tachypnea or lowered respiratory rate (>50 or <20 breaths per min.) Dyspnea, increased work of breathing, stridor, cyanosis, retractions: suprasternal, intercostal, or subcostal, head bobbing, grunting, nasal flaring, apnea Hemodynamic instability
Lab Values/ O2 Levels	<ul style="list-style-type: none"> PaO2<60 mmHg or SPO2 <91% on Room Air (RA) or dependence on at least 2L of O2 PaO2/FiO2 <300 pH <7.35 from an arterial sample pH <7.3 from a venous sample
Intervention	<ul style="list-style-type: none"> Mechanical Ventilator, BiPAP, or CPAP Oxygen delivered via HFNC or Non-rebreather mask Nasal Cannula delivering at least 2L/min or 28% FiO2 via face mask provided.

Acute Respiratory Failure Indicators

School Age (Ages 5 to 12 years old)	
Symptoms	<ul style="list-style-type: none"> Tachypnea or lowered respiratory rate (>30 or <16 breaths per minute) Dyspnea, increased work of breathing, stridor, cyanosis, retractions: suprasternal, intercostal, or subcostal, nasal flaring, unable to speak in full sentences Hemodynamic instability
Lab Values/ O2 Levels	<ul style="list-style-type: none"> PaO2<60 mmHg or dependence on at least 3L of O2 through nasal cannula (approx. 32% FiO2) or SpO2 <91% on Room Air (RA) PaO2/FiO2 <300 pH <7.35 from an arterial sample pH <7.3 from a venous sample
Intervention	<ul style="list-style-type: none"> Mechanical Ventilator, BiPAP, or CPAP Oxygen delivered via HFNC or Non-rebreather mask Nasal Cannula delivering at least 3L/min or 32% FiO2 via face mask provided
Teen (Ages 13 to 18, if >18 see adult guideline)	
Symptoms	<ul style="list-style-type: none"> Tachypnea or lowered respiratory rate (>24 or <10 breaths per minute) Dyspnea, increased work of breathing, nasal flaring, anxiety Hemodynamic instability
Lab Values/ O2 Levels	<ul style="list-style-type: none"> PaO2<60 mmHg or dependence on at least 4L of O2 through nasal cannula (approx. 36% FiO2) or SpO2 <91% on Room Air (RA) PaO2/FiO2 <300 pH <7.35 from an arterial sample pH <7.3 from a venous sample
Intervention	<ul style="list-style-type: none"> Mechanical Ventilator, BiPAP or CPAP Oxygen delivered via HFNC or Non-rebreather mask Nasal Cannula delivering at least 4L/min or 36% FiO2, via face mask

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Outcome Measures:

- Length of hospital stay
- Length of PICU stay
- Length of EC stay prior to discharge or admission
- Time to first treatment if PAS > 7
- Time to continuous albuterol if needed
- Discharged with home controller medications
- Frequency of EC visits
- 72 hour returns to EC
- Readmissions
- Chest x-ray utilization
- Increase in albuterol frequency after weaning

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Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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