

# Guideline: Pediatric Asthma Management, Inpatient Admission

This Guideline is for use in the inpatient units of Comer Children's Hospital (Comer 3, 4, 5, 6) in the care and management of children  $\geq 2$  years old with asthma exacerbation.

## Definitions:

**Asthma Exacerbation:** Acute episode of progressively worsening shortness of breath, cough, wheezing, and chest tightness, or some combination of these symptoms, characterized by decreases in expiratory airflow.

**Status Asthmaticus:** Acute asthma exacerbation unresponsive to conventional therapy with short-acting bronchodilators.

## Use of Guideline:

This guideline was developed for care of children with asthma admitted into Comer Children's Hospital and is limited to standard care of asthma exacerbation. The supervising attending physician may decide to follow or not follow this guideline. Use of this guideline outside of Comer Children's Hospital is at the discretion of the care provider. This guideline is not intended to substitute for physician evaluation and care of a child with asthma.

## Background and Purpose

*This guideline was developed in consultation with senior and junior physicians, nurse managers, respiratory therapists, and quality improvement officers at Comer Children's Hospital. The guideline aims to:*

- *Provide guidance for evidence-based management or best-practice care of asthma in hospitalized children.*
- *Provide objective measures for communication amongst interdisciplinary providers managing children with asthma exacerbation.*
- *Establish a platform for monitoring quality measures and improving care in children with asthma.*

## Pathway Inclusion Criteria

- At least 2 years of age
- Admitted to inpatient unit for difficulty breathing +/- coughing, wheeze, or loss of respiratory sounds on auscultation
- Has either a prior diagnosis of asthma, or history taken from parent or chart is strongly suggestive of asthma (recurrent wheeze, persistent cough, or recurrent cough improved by albuterol)
- Unlikely to have the following differential diagnoses:
  - + Foreign body aspiration
  - + *Primary* cause of respiratory distress is bacterial pneumonia (based on CBC, diff, culture, exam; see Pneumonia Guidelines)
  - + Anaphylaxis
  - + Acute cardiac disease (pericardial effusion, pericarditis, myocarditis, etc.)
- No history of the following (exclusion criteria):
  - + Cardiac lesion with potential to cause cyanosis, dyspnea, or distress
  - + Other chronic respiratory disease including but not limited to cystic fibrosis, interstitial lung disease, restrictive lung disease, neuromuscular disease. If child is <5yo with strong history of chronic lung disease of prematurity/BPD, use clinical judgment.
  - + Sickle cell anemia or HbgSC disease

# PAS: Modified and amended Pediatric Asthma Score

PAS is used to communicate patient's respiratory status when being treated for asthma exacerbation. Score reflects degree to which patient is supported by the respiratory intervention at that time.

Score	1	2	3
Respiratory Rate			
Age 2-3	<34	35-39	>40
Age 4-5	<30	31-35	>36
Age 6-12	<26	27-30	>31
Age >12	<23	24-27	>28
O2 saturation*	>95% on room air	90-95% room air	<90% on room air
<i>PICU</i>	<i>On LFNC &lt;4L</i>	<i>On HFNC &gt;4L</i>	<i>On BiPAP</i>
<i>Floor</i>		>95% on O2	<95% on O2
Auscultation	Normal to mild expiratory wheeze	Expiratory wheeze	Inspiratory and expiratory wheeze or diminished
Retractions	None or intercostal	Intercostal and substernal	Intercostal, substernal, supraclavicular
Dyspnea	Speaks in sentences, coos and babbles	Speaks in partial sentences, short cries	Speak in single words Grunts

Total Score 5-15

\*Room air score preferred, if safe for patient to be checked on room air. If patient not safe to be removed from O2, adjust score as listed.

## Triage Uses for PAS

Triage and first assessment: measure PAS prior to any hospital intervention for indication of first needed intervention. For further guidance, refer to Comer Asthma ED Guidelines.

PAS before albuterol and 15-30 min after albuterol: "pre-post" assessment to check for immediate albuterol response. Decrease by 2 or more is positive response.

## Pathway Uses for PAS

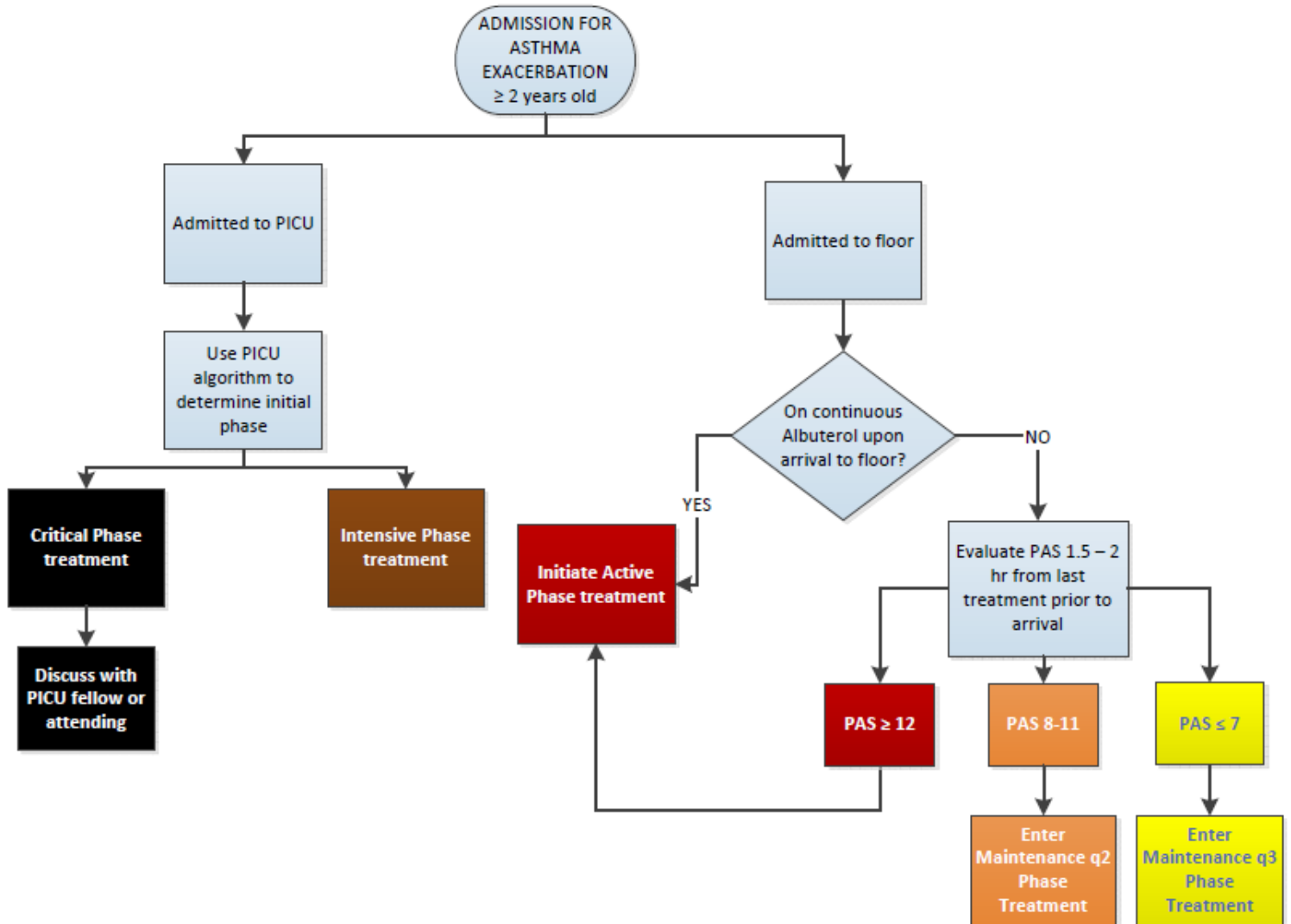
Scheduled PAS during continuous IV or respiratory therapy (albuterol neb, IV drip): measure every 1-2 hours to monitor child's progress on this therapy.

Scheduled PAS measured during intermittent therapy (albuterol "q2"- "q3"- "q4"): measure at the end of the observation interval (every 2-4 hours) but prior to giving the next albuterol dose. This monitors stability on therapy or readiness to wean.

Ad hoc PAS: measure any time if patient is in distress to assess the child's need for increased therapy

# Pathway 1: Admission Pathway

This pathway provides guidance to the admitting clinician for assessment of the initial phase of asthma care.



# Admission Assessment and Orders

## History

### Exacerbation Information:

- Time of onset of symptoms/triggers
- Severity compared with past exacerbations
- Treatments offered, response

Admitting residents: use  
.AsthmaHPI (dot phrase) in  
admission H&P

### Asthma history:

- Age of diagnosis/symptom onset and classification of asthma severity
- Current outpatient medications – document prior to admission medications including doses and frequency, if known, in PTA medication tab
- Current compliance with daily medications and spacer, if prescribed MDI
- One-year history of asthma related urgent visits (PCP), ED visits, hospitalizations and number of steroid courses in last 6 months and last 12 months.
- Lifetime history of PICU admissions, BiPAP and intubations. In older children, delineate ICU stays in toddlerhood vs in grade school and above. In children with severity variations over time, specify frequency in last 1-3 years.
- Asthma control (frequency of daytime symptoms including exercise tolerance, frequency of nighttime symptoms, frequency of use of albuterol)
- Previous complications of ICS

### Risks:

- Known triggers (perennial, seasonal, indoor, outdoor, viral)
- Exposure to animal dander, tobacco smoke, other smoke, pollen or trees, dust or dustmites, mold or mildew, roaches or mice, other triggers

### Related history:

- History of disease-modifying respiratory and chest illness and disease e.g. obstructive sleep apnea, scoliosis, reflux
- History of atopy and family history of atopy or asthma
- Birth history, particularly prematurity or O2 requirements after birth.

### Asthma-Specific Physical Exam

Vital signs including at least one SpO2 on room air (may be triage SpO2)

Neuro: Level of alertness and engagement

CV: Hydration status, perfusion, cardiac exam

Skin/MSK: Cyanosis, pallor, signs of clubbing; neck and chest wall palpation for subcutaneous emphysema

Resp: Detailed respiratory exam (rate, WOB, breath sounds, adventitial noises, symmetry vs asymmetry); current degree of airway obstruction

### Administering Supportive Oxygenation:

In all phases, deliver supplemental O2 as needed to maintain FiO2  $\geq$  90%.

### Requesting Appropriate Pulmonary Care:

It is recommended at Comer that all patients admitted for asthma are seen by a member of the Pediatric Pulmonary service during their inpatient care or by an asthma specialist in hospital follow up. A consult or referral order must be placed on each admitted patient.

## Asthma Specific Investigations

For the general care of asthma exacerbation, no labs or images are necessary. Investigations may be warranted in certain circumstances; common considerations are listed.

### Chest X-ray (PA/Lateral):

- Increased O2 requirements
- Failure to respond to treatment (48h)
- Sudden or unexplained escalation of care
- Asymmetric physical exam
- Admission (to PICU) on positive pressure ventilation
- Subcutaneous emphysema

### RVP

Useful in cases of suspected influenza (high fever and myalgia during circulating season)

### Laboratory investigations

- High grade fever, chills, or clinical signs of SIRS, pneumonia, or sepsis
- Other systemic illness, acute or chronic, raising concern for intervention
- Difficulty in clinically assessing oxygenation and ventilation (consider arterial blood gas measurements)

## Pathway 2: Phases of Inpatient Asthma Care



# Phases of Asthma Management Checklist

## Critical (PICU)

Phase for most critically ill patients. Medication dosing and frequency should be performed in consultation with PICU attending and fellow. Frequent reassessment by all team members is necessary.

- Appropriate for PICU only, consult PICU Asthma guidelines for “tier 3” management and medication dosing.
- Continuous albuterol nebulization 0.5mg/kg/hr (max 20mg/hr)
- Solumedrol 1mg/kg IV q6
- Interventions may include scheduled Atrovent, Scheduled Magnesium, prn IM epinephrine, infusion of terbutaline, aminophylline or ketamine
- Maintenance IV fluids ; may include potassium chloride, consider 20-40 meq/L
- Hourly PAS is logged on Asthma Score Flowsheet. Even hours performed and logged by RN; odd hours performed and logged by RT.
- Primary diagnosis if this stage is reached is Near-Fatal Asthma

## Intensive (PICU)

Phase for patients requiring positive pressurized airflow or helium. Frequent reassessment by all team members is recommended.

- Appropriate for PICU only; consult additional PICU Asthma guidelines for “tier 1” and “tier 2” management and medication dosing.
- BiPAP  $\leq$  14/7 or TV 6-9ml/kg and/or Heliox 60/40 or 70/30
- Continuous albuterol nebulization between 5-20mg/hr
- Solumedrol 1mg/kg IV q6
- Interventions may include scheduled Atrovent or Magnesium; prn IM Epi
- Maintenance IV fluids ; may include potassium chloride, consider 20-40 meq/L
- Hourly PAS is logged on Asthma Score Flowsheet. Even hours performed and logged by RN; odd hours performed and logged by RT.
- Primary diagnosis is Status Asthmaticus

## Active

Phase for patients requiring continuous albuterol administration through face mask or nasal cannula. Active monitoring by resident team and reassessment throughout the day by all team members is recommended.

- Continuous albuterol neb may be given from 5 - 15mg/hour.
- Solumedrol 0.5mg/kg IV q6h or 1mg/kg q12h. A maximum dose of 60-80mg is generally considered appropriate .
- Intervention may involve heated and humidified O2 4L-6L. This is not available on Comer 6. It is available up to 6L on Comer 5.
- Intervention may involve Atrovent 500mcg every 2 hours by nebulizer.
- Intervention may include Magnesium sulfate 50mg/kg IV. Maximum dose is 2g, and minimum interval between doses is 6 hours. On Comer 5 and 6, this is limited to as needed dosing. In PICU, dosing may be scheduled q6 or as needed.
- On Comer 5/6, PAS is logged on Asthma Score Flowsheet every 2 hours by RT. In PICU, PAS is logged on even hours by RN; odd hours are logged by RT.
- Dextrose-containing IV fluids at maintenance or greater
- NPO (no food or drink by mouth); g-tube feeds at discretion of attending.
- Notification to Primary Care Provider of admission may be done by MD or resident extender.
- Primary diagnosis is Status Asthmaticus

# Phases of Asthma Management Checklist

## Maintenance/ "Q2"

Phase for patients requiring albuterol every two hours. Reassessment throughout the day by all several team members is recommended. Patient education and follow up plans are integrated into care.

- Albuterol q2h by metered dose inhaler and spacer only.
- Prednisone or Prednisolone 2mg/kg qd, max 60mg. If converting from a q12 or q6 IV dose, start next dose at 9am the next day. If continuing from first dose of 2mg/kg, give dose 24 hours after first dose.
- Interventions may include supplemental O2  $\leq$  4L. If available, patient may maintain heated humidified flow  $\leq$ 4L.
- Allow PO diet or g-tube feeds. If weaning from continuous albuterol, nursing to monitor for stability for 1-2 hours prior to eating.
- Discontinue maintenance IV fluids if patient able to maintain adequate fluid intake by PO/GT. May saline lock IV to allow mobility.
- Discontinue any Atrovent nebs and scheduled magnesium orders.
- PAS logged every 2 hours by RT on Asthma Score Flowsheet.
- Initiate asthma education. Residents, nursing, and RT may participate in team-based asthma education as appropriate.
- Prepare for discharge and home care, including notifying parent of possible discharge in 12-24 hours.
- Prepare for outpatient follow up with PCP in one week.
- Prepare for outpatient follow up with an asthma specialist such as Pediatric Pulmonology, Allergist, or other dedicated asthma clinic in 4-8 weeks.
- Primary diagnosis is Status Asthmaticus

## Maintenance / "Q3"

Phase for patients requiring albuterol every three hours. Reassessment throughout the day by select team members is recommended. Recommend preparing for discharge.

- Albuterol q3h by metered dose inhaler and spacer only
- Prednisone or Prednisolone 2mg/kg qd, max 60mg. If continuing from first dose of 2mg/kg, give dose 24 hours after first dose.
- Interventions may include supplemental O2  $\leq$  4L. Patient should be weaned off O2 during phase.
- If off O2, discontinue daytime continuous monitoring using order "Limited Pediatric Continuous Pulse Oximetry."
- Start controller medication for eligible patients. Patients who will receive a change in controller management can be started on new controller. Patients with no change can be started on pre-admission controller. If home medication is not available on formulary, use equivalent on-formulary medication or patient's home medication.
- PAS logged every 3 hours by RT on Asthma Score Flowsheet.
- Teaching of proper inhaler technique conducted by RT. All metered dose inhalers (controllers and rescue) must be taught with a spacer. Mask need is determined by patient age and coordination.
- Discharge preparations include notifying parent of probable discharge in 6-12 hours (if reaching phase after 2pm, assume discharge no sooner than the following morning).
- Complete all follow up and education as listed in Maintenance Q2 Phase. Prepare, print, and review the Asthma Action Plan with the family. Prepare all prescriptions and advise parent on obtaining medications outpatient.
- If this is the most severe phase reached by patient in this admission, the primary diagnosis is asthma exacerbation.

# Phases of Asthma Management Checklist

## Resolution

Phase for patients requiring albuterol every four hours. Patient's exacerbation has resolved at this stage and discharge may be anticipated.

- Albuterol q4h by metered dose inhaler and spacer. Patient may be monitored 4 hours between albuterol doses at least once, without need for intervention, i.e. "Q4 x 1."
- Prednisone or Prednisolone 2mg/kg qd, max 60mg. If continuing from first dose of 2mg/kg, give dose 24 hours after first dose. Total course of steroids is at least 5 days. For steroid courses  $\geq 8$  days due to duration of airflow obstruction, consider a taper.
- Off all oxygen and supportive flow.
- PAS logged every four hours by RT on Asthma Score Flowsheet.
- Ensure patient has received education, appointments, Asthma Action Plan, and prescriptions as listed in the Maintenance phases.
- Discuss continuing management of this exacerbation with parent (i.e. albuterol frequency of Q4 today and home steroid course).
- If inpatient stay was  $>48$  hours, notify the PCP of discharge.
- Notify attending and bedside nurse of plan to discharge.
- If this is the most severe phase reached by patient, the primary diagnosis is asthma exacerbation.

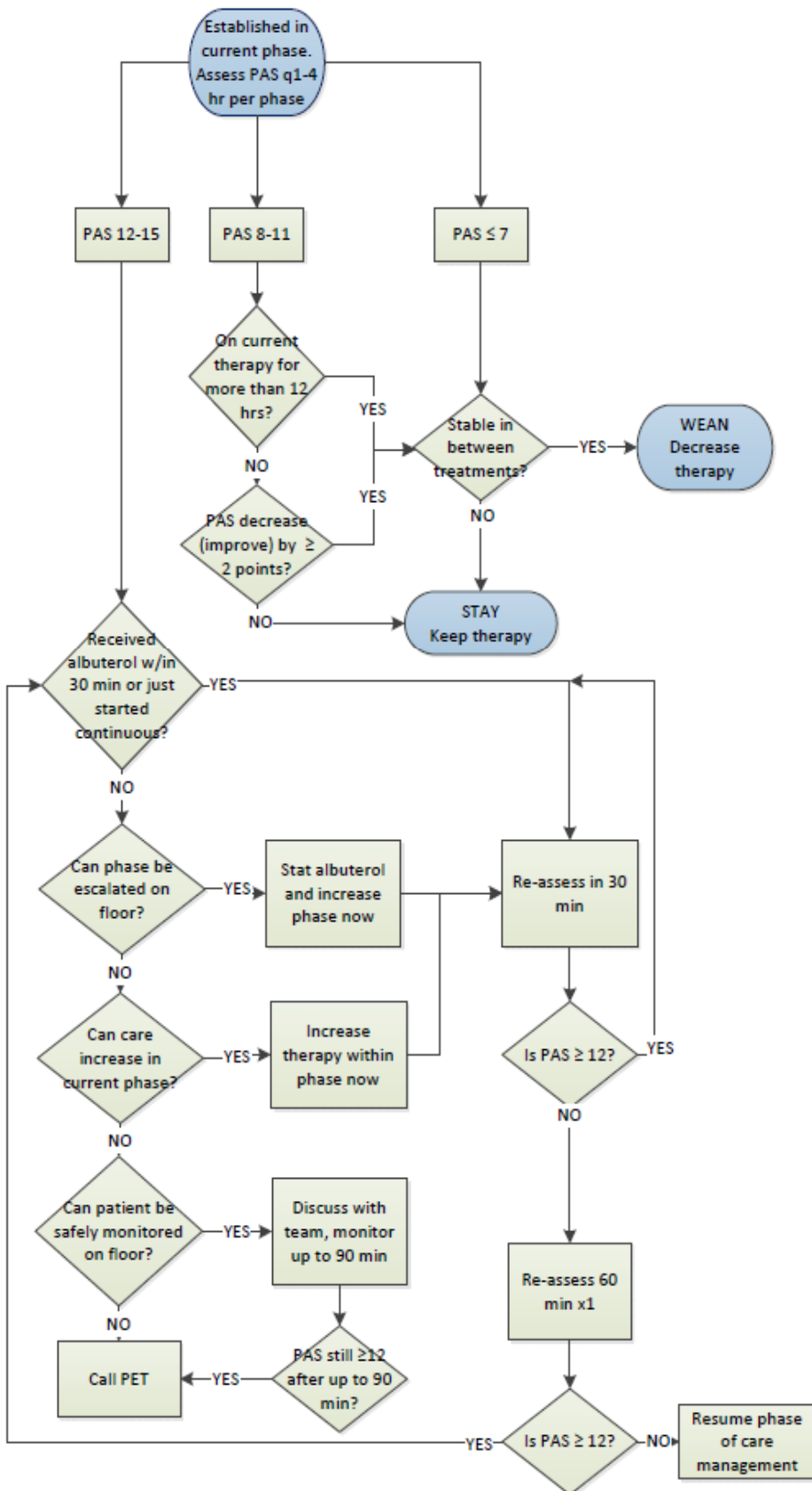
## Discharge criteria

- Respiratory Rate:** Patient meets "1 point" criteria of PAS scoring
- Retractions and Dyspnea:** Patient meets "1 point" criteria of PAS scoring
- Auscultation:** Patient meets "1 point" criteria of PAS scoring, and/or has mild crackles
- SpO<sub>2</sub>:**  $\geq 94\%$  on spot check, off all O<sub>2</sub> for minimum of 4 hours
- Albuterol:** Successfully observed off albuterol for at least 4 hours i.e. "Q4 x 1."
- Education:** Complete Asthma Action Plan printed and reviewed with patient/family
- Family Centrality:** Parent/teen comfortable with home management
- Continuity:** Follow up appointments scheduled by team or patient's family including primary care physician in 1 week and asthma specialist within 4-8 weeks.

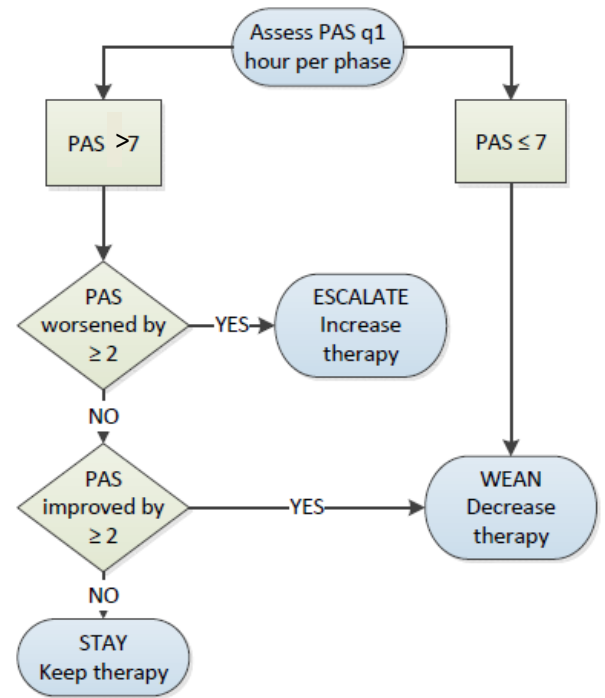


# Pathway 3: Algorithms for Weaning, Maintaining, or Escalating Care

## Comer 5 and 6



## Comer PICU



# References

## **Cross Reference to the Following Hospital Policies: Comer ER Asthma Pathway, Comer PICU Asthma Pathway, PET Policy, and Pneumonia Guidelines**

### **Corresponding order sets:**

- Comer 5/6: IP Pediatric Asthma Admission order set (718) (*revisions pending*)
- PICU: IP Pediatric PICU Asthma Admission order set (3484) (*updated Fall 2015*)

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### **References:**

1. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, Summary Report, National Asthma Education and Prevention Program; National Heart, Lung, and Blood Institute. 2007; 62.
2. Sylvester AM and M George. "Effect of a Clinical Pathway on Length of Stay and Cost of Pediatric Inpatient Asthma Admissions: An Integrative Review." *Clinical Nursing Research*. 2014; 23(4): 384-401.
3. Biondi EA, Gottfried JA et al. "Interobserver reliability of attending physicians and bedside nurses when using an inpatient paediatric respiratory score." *J Clin Nurs*. 2014; 24(9-10): 1320-6.
4. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2014. Available from: [www.ginasthma.org](http://www.ginasthma.org).
5. Dexheimer JW, Borycki EM et al. "A systematic review of the implementation and impact of asthma protocols." *BMC Medical Informatics and Decision Making* 2014, 14:82
6. Nievas IF and KJ Anand. "Severe acute asthma exacerbation in children: a stepwise approach for escalating therapy in a pediatric intensive care unit." *Pediatr Pharmacol Ther*. 2013;18(2):88-104
7. Qureshi F, Pestian J et al. "Effect of Nebulized Ipratropium on the Hospitalization Rates of Children with Asthma." *N Engl J Med* 1998; 339:1030-5.