

# Guidelines for the Diagnosis and Management of Pediatric Acute Asthma Exacerbation

## Clinical Practice Guideline MedStar Health

*“These guidelines are provided to assist physicians and other clinicians in making decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient’s primary care provider-in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of publication but should be used with the clear understanding that continued research may result in new knowledge and recommendations”.*

MedStar Pediatrics and MedStar Family Choice accept and endorse the clinical guidelines set forth by the Nation Heart Lung and Blood Institute Guidelines for the Diagnosis and Management of Asthma (**EPR-3**) & Focused Updates 2020, and the Global Initiative for Asthma (GINA).

The complete online versions of the guidelines are available at:

<https://www.nhlbi.nih.gov/health-topics/guidelines-for-diagnosis-management-of-asthma>

Focused updated 2020

<https://www.nhlbi.nih.gov/health-topics/asthma-management-guidelines-2020-updates>

<https://ginasthma.org/wp-content/uploads/2022/07/GINA-Main-Report-2022-FINAL-22-07-01-WMS.pdf>

The guideline below is a summary of the above guidelines adapted for our Outpatient and Urgent Care settings for acute asthma exacerbation. For chronic management of asthma, see the [MedStar Ambulatory Guidelines](#) page and open “Peds Guidelines for the Diagnosis and Management of Asthma in Children and Adolescents.”

## Diagnosis

Asthma exacerbations are acute or subacute episodes of progressively worsening shortness of breath, cough, wheezing, and/or chest tightness. Exacerbations are characterized by decreases in expiratory airflow that can be measured by spirometry or peak expiratory flow (PEF). These objective measures, in conjunction with physical findings, more reliably indicate the severity of an exacerbation than does the severity of symptoms alone. In general, mild exacerbations may be managed “at home” (i.e., outside the health care system), whereas serious exacerbations require an office visit, an unscheduled urgent care visit, an ED visit, possibly leading to a hospital admission.

## **Diagnostic Considerations**

1. Assess the severity of the exacerbation, as indicated by the findings listed in the table below.
2. Determine red flags that would put patient at higher risk as listed here:
  - a. History of severe, life threatening asthma requiring intubation.
  - b. Hospitalization, ICU admission, or recent ED visit for asthma
  - c. Currently using or have recently stopped using oral steroids
  - d. Overuse of short acting beta agonists (SABAs) especially more than one canister per month, or more than 4 days per week.
  - e. Non-adherence with inhaled corticosteroids (ICS), controller medications and asthma action plan.
  - f. History of anaphylaxis.
  - g. Co-morbid conditions such as pulmonary infections, or chronic disease such as other pulmonary disease, diabetes, or cardiac conditions.
3. Pulse oximetry may be useful for assessing the initial severity; a repeated measure of pulse oximetry of < 92% after 1 hour of albuterol is predictive of the need for further medical care.
4. Assess overall patient status, including level of alertness, fluid status, presence of cyanosis, respiratory distress, and wheezing. Wheezing can be an unreliable indicator of obstruction if there is poor aeration with little or no air movement.
5. Children who have severe asthma symptoms after 1-2 hours of initial treatment and who continue to meet the criteria for a moderate or severe exacerbation require transfer to the ED.
6. Rule out possible complications such as pneumonia, pneumothorax, or pneumomediastinum.
7. Rule out upper airway obstruction from foreign bodies, epiglottitis, organic diseases of the larynx, vocal cord dysfunction, and extrinsic and intrinsic tracheal obstruction.
8. Chest radiography is not recommended for routine assessment but should be obtained for patients suspected of a complicating cardiopulmonary process.
9. Antibiotics not recommended for routine management of asthma but appropriate when signs of symptoms of pneumonia or other co-morbid bacterial infections.

	Signs and Symptoms	PEF, SaO <sub>2</sub>	Clinical Course
Mild	Dyspnea only with activity, end expiratory wheezes, intermittent cough	PEF ≥70% predicted SaO <sub>2</sub> >95%	<ul style="list-style-type: none"> <li>• Usually cared for at home</li> <li>• Prompt relief with SABA or ICS/Formoterol</li> </ul>
Moderate	Dyspnea limits activity, accessory muscle use/ retractions common, expiratory wheezes, tachycardia, persistent cough, abdominal breathing	PEF 40-69% predicted SaO <sub>2</sub> 93-95%	<ul style="list-style-type: none"> <li>• Requires office or ED visit</li> <li>• Relief from 1-2 hours SABA</li> <li>• Oral corticosteroids</li> </ul>
Severe	Dyspnea at rest, accessory muscle use/retractions, nasal flaring, inspiratory and expiratory wheezes, tachycardia, persistent cough, abdominal breathing/ paradoxical breathing	PEF <40% predicted SaO <sub>2</sub> <93%	<ul style="list-style-type: none"> <li>• Requires ED visit</li> <li>• Partial relief from SABA</li> <li>• Oral corticosteroids</li> <li>• Adjunctive therapies</li> </ul>
Life Threatening	Too dyspneic to speak, perspiring, drowsy, grunting, absence of wheeze, tachycardia/bradycardia, cough may be absent	PEF <25% predicted SaO <sub>2</sub> <90%	<ul style="list-style-type: none"> <li>• Requires ED/Hospitalization</li> <li>• Minimal relief from SABA</li> <li>• IV corticosteroids</li> <li>• Adjunctive therapies</li> </ul>
Key: PEF, peak expiratory flow; ED, emergency department; SABA, short acting beta <sub>2</sub> -agonist; ICS, inhaled corticosteroid; LABA, long acting beta <sub>2</sub> -agonist; SaO <sub>2</sub> , oxygen saturation Normal respiratory rate per minute: 0-6 months:30-60, 6-12 months: 24-30, 1-5 years: 20-30, > 6 years: 12-20			

## Treatment

### Goals of treatment

- I. Reversal of airflow obstruction (SABA +/- steroids)
  - II. Correct hypoxemia
  - III. Reduce risk of relapse by starting or increasing controller medication
1. Rapid reversal of airflow obstruction by repetitive administration of a short-acting beta agonist (SABA) (Albuterol) in a continuous or repeated treatment. Systemic corticosteroids (Prednisolone or Prednisone 2mg/kg up to a maximum of 60mg/dose) should be added for children with mild exacerbations who fail to respond to the first hour of treatment with a SABA. For patients who have moderate to severe exacerbations, systemic corticosteroids should be administered immediately.
  2. Nebulized ipratropium has been shown to reduce the risk of hospitalization, not reverse obstruction. Ipratropium should be given early when patients present with moderate to severe asthma exacerbations.
  3. For severely ill patients with poor aeration, administer subcutaneous or intramuscular epinephrine concurrent with nebulized albuterol/ipratropium therapy.
  4. Activate EMS for emergency transfer to the ED for severe exacerbations and place these patients on continuous monitor if available with frequent reassessment.
  5. Goal oxygen saturation is  $\geq 92\%$ . Correct hypoxemia ( $\text{SaO}_2 \leq 92\%$ ) with supplemental oxygen to keep  $\text{SaO}_2 > 95\%$ . Nebulized medications should be delivered with oxygen in hypoxemic patients. A patient requiring supplement oxygen should be transferred to the ED by EMS.
  6. **Monitor closely for respiratory depression after initiating treatment:**
    - a. **Red flags for respiratory failure:**
      - Paradoxical breathing
      - drowsy/lethargic
      - Poor air movement
      - Bradycardia
      - Oxygen saturation less than 90 percent

### Reassessment

Every 10 to 20 minutes, patients should be reassessed for response to treatment and repeat vital signs. Children with moderate exacerbations are typically given up to three doses of SABA/ ipratropium over one hour and reassessed after each dose. This should include physical examination and repeat measurement of  $\text{SaO}_2$ . Serial lung function measures using either FEV1 or PEF are useful for children 5 years of age or older.

### **Indications for Emergency Department Transfer**

1. Children with severe exacerbations.
2. Children with SaO<sub>2</sub> ≤92% that does not resolve with albuterol and unable to remove from supplemental Oxygen delivery.
3. Children with persistent exacerbation symptoms after three SABA/ipratropium treatments and oral steroids.

### **Discharge**

Provide patients with the following:

1. Necessary medications and education using teach-back with demonstration on effective use of medications, inhaler with spacer use, and when to return to see a medical provider.
  - a. Refilling or starting controlled medicine if needed
  - b. Oral Systemic steroids if needed (5-day course)
  - c. Recommend follow up with PCP in 1-2 days
  - d. Review discharge medications.
2. Instruction in an asthma discharge plan for recognizing and managing relapse of the exacerbation.

### **Criteria for Discharge**

1. Discharge is appropriate if FEV<sub>1</sub> or PEF has returned to ≥70 % of predicted or personal best and symptoms are minimal or absent for at least one hour after the most recent albuterol dose.
2. Patients who have a rapid response should be observed for 30–60 minutes after the most recent dose of bronchodilator to ensure their stability of response before discharge to home.

### **Discharge Medications**

1. Prescribe sufficient medications for the patient to continue treatment after discharge at least until follow-up is scheduled.
2. Patients given oral systemic corticosteroids should continue oral systemic corticosteroids for a total of 5 days. For more complicated asthmatics, oral systemic steroids may be provided as a burst for up to 10 days without a need to taper the dose. If more than 10 days

of treatment with oral systemic steroids is required, the dose should be tapered before stopping.

3. Start an ICS at discharge for patients with asthma who have a severe exacerbation, 2 prior courses of oral steroids in the last year, require frequent albuterol use, or are limiting their activity due to asthma symptoms. When initialing or refilling a controller, prescribe a one-month supply. Patients already taking ICS therapy should continue it following discharge.
4. Review discharge medications and provide patient education on correct use of inhaler and spacer/holding chamber. Patients under 6 years age or unable to use a spacer without a mask should be provided a spacer with a mask. [If able, provide Patient Instructions: MedConnect EMR ‘How to Use a Metered Dose Inhaler’]
5. Ensure that the patient has the resources to fill prescriptions not provided on-site, spacers and nebulizers require a prescription to be filled, and some insurers will only fill at a durable medical equipment supplier.

### **Follow-up Care and Home Care**

1. Emphasize the need for continual, regular care in an outpatient setting, and refer the patient for a follow-up asthma care appointment with the primary care provider. This appointment should be prior to stopping oral steroids. If appropriate, consider referral to an asthma management education program.
2. If an asthma specialist seems appropriate, encourage patient to discuss this with their primary care provider.
3. Consider issuing a peak flow meter and giving appropriate education on how to measure and record PEF to patients who have difficulty perceiving airflow obstruction or symptoms of worsening asthma.
4. Give the patient an asthma discharge plan with instruction for medications prescribed and for increasing medications or seeking medical care should symptoms worsen. A sample asthma discharge plan is shown below, and is available at this link:  
<https://www.ncbi.nlm.nih.gov/books/ NBK7228/figure/A2678/>

## Medications for Asthma Exacerbation in Urgent Care or Office Setting

Medication  How Supplied	Pediatric Dose	Comments
<b>Inhaled Short-Acting Beta2-Agonists (SABA)</b>		
<b>Albuterol</b> Nebulizer solution, Inhalation Generic: Most common concentration used: <b>2.5 mg/3mL Albuterol 0.083%</b>	<b>0-4 yrs.: 2.5mg/dose</b> <b>5+yrs: 2.5mg-5mg /dose</b> every 20 minutes for 3 doses Repeat if necessary. Consider transfer by EMS to ED if not responding after 1 hour of treatment.  Use 2.5 mg neb every 4 hours as needed for home use.	May mix with ipratropium nebulizer solution for initial treatment in office to decrease risk of hospitalization.
Albuterol inhaler (90 mcg/puff) Proair (Red) Proventil (Yellow), Ventolin (Blue)  Generic MDI available	4-8 puffs, 1 minute apart every 20 minutes for 3 doses. Repeat if necessary.  Consider transfer by EMS to ED if not responding after 1 hour of treatment.  Use 2 puffs with spacer every 4 hours as needed for home use.	<b>Use spacer;</b> add mask in children <6 years or unable to use spacer adequately.  In mild-to-moderate exacerbations, MDI plus spacer is as effective as nebulized therapy with appropriate administration technique and spacer use.
<b>Levalbuterol</b> (Xopenex) Nebulization solution, Inhalation: Most common concentration used is <b>1.25 mg/3 mL</b>	1.25mg -2.5mg every 20 minutes for 3 doses. Repeat if necessary.  Consider transfer by EMS to ED if not responding after 1 hour of treatment.  Use 1.25 mg neb every 4 hours for home use.	Levalbuterol administered in one-half the mg dose of albuterol provides comparable efficacy and safety. Has not been evaluated by continuous nebulization.
<b>Levalbuterol</b> (Xopenex) MDI, Inhalation: 45 mcg/actuation  Generic MDI available	4-8 inhalations with spacer every 20 minutes for 3 doses. Repeat if necessary.  Consider transfer by EMS to ED if not responding after 1 hour of treatment.  Use 2 puffs with spacer every 4 hours as needed for home use.	<b>Use spacer;</b> add mask in children <6 years or unable to use spacer adequately.

**Systemic (Injected)Beta2- Agonists**
**Epinephrine for asthma attack**

Epinephrine Injection [1 mg/mL ]	0.01 mg/kg up to 0.3-0.5 mg every 20 minutes for 3 doses SC	
-------------------------------------	--	--

**Ipratropium (Anticholinergic)**

Ipratropium Nebulizer solution: (with or without preservative) 0.02% [0.25 mg/ mL]	0.25 – 0.5 mg every 20 minutes for 3 doses, then as needed	Do not use before or in place of albuterol. May mix in same nebulizer with albuterol. Should be used for moderate or severe exacerbations to reduce risk of hospitalization. <b>Do not continue ipratropium at home for asthma.</b>
---	---	---

<b>Ipratropium / albuterol (Duoneb)</b> Nebulization Solution: Ipratropium bromide 0.5mg and albuterol 2.5mg per 3 mL	<b>Infants and Children:</b> 1.5-3ml every 20 minutes for 3 doses, then as needed <b>Adolescent:</b> 3mL every 20 minutes for 3 doses, then as needed up to 3 hours	May be used for up to 3 hours in the initial management of severe exacerbations.
--	--	---

**Systemic Corticosteroids**

prednisone 5mg= prednisolone 5 mg= methylprednisolone 4 mg;  
however same dosing recommended for all 3 agents for simplicity per NHLBI guidelines

<b>Prednisone</b> 2.5mg, 5mg, 10mg, 20mg tablets.	<b>Oral:</b> 2mg/kg/day up to maximum of 60mg/day	GINA guidelines recommend max dose of 40 mg per day. NHLBI recommends 40 to 60 mg max. Minimal added benefit when going from 40 mg to 60 mg in clinical trials.
<b>Prednisolone:</b> <b>Solution:</b> 3mg/ mL (15mg/5ml) <b>Tablet:</b> 5mg <b>Disintegrated Tablet:</b> 10mg, 15mg, 30mg		

<b>Methylprednisolone</b>  <b>Tablet:</b> 2 mg, 4 mg, 8 mg, 16 mg,32mg <b>Injection IM:</b> Intramuscular as acetate 40 mg/mL	<b>Oral:</b> 1-2mg/kg/day in 1 or 2 divided doses up to maximum daily dose of 60mg/day  <b>IM: ≤4 years:</b> IM: 7.5mg/kg as one-time dose; maximum dose:240mg <b>≥5years:</b> IM: 7.5mg/kg as one- time dose, maximum dose:240mg	
---	---	--

<b>Dexamethasone</b> <b>Liquid:</b> 0.1mg/1 mL 1mg/1 mL <b>Tablet:</b> 0.5mg, 0.75mg, 1mg, 1.5mg, 2 mg, 4 mg, 6mg	Infants, Children, and Adolescents: Oral, IM, IV: 0.6mg/kg once daily as a single dose or once daily for 2 days; maximum dose: 16mg/ dose	Duration > 2days is not recommended due to increased risk of metabolic effects.
---	--	--

## PATIENT DISCHARGE INSTRUCTIONS FOR ASTHMA EXACERBATION:

### **YOUR MEDICINE FOR THIS ASTHMA ATTACK IS:**

Medicine	Amount	How to use medicine
Prednisone/prednisolone		__ a day for __ days. Take the entire prescription, even when you start to feel better
Inhaled albuterol with spacer		__ puffs with spacer every __ hours if you have cough, wheeze, or trouble breathing, for __ days

### **YOUR DAILY MEDICINE FOR LONG-TERM CONTROL AND PREVENTING ATTACKS IS:**

Medicine	Amount	How to use medicine
Inhaled steroids		__ puffs __ times a day

### **YOUR QUICK-RELIEF MEDICINE WHEN YOU HAVE SYMPTOMS IS:**

Medicine	Amount	How to use medicine
Inhaled albuterol with spacer		__ puffs with spacer every __ hours

### **ASK YOURSELF 2-3 TIMES A DAY, EVERY DAY, FOR AT LEAST A WEEK:**

**“How good is my asthma compared to when I left the hospital?”**

<b>If you feel much better:</b> <ul style="list-style-type: none"> <li>Take your daily long-term control medicine.</li> </ul>	<b>If you feel better, but still need your quick-relief inhaler often:</b> <ul style="list-style-type: none"> <li>Take your daily long-term control medicine</li> <li>See your doctor as soon as possible</li> </ul>	<b>If you feel about the same:</b> <ul style="list-style-type: none"> <li>Use your quick-relief inhaler</li> <li>Take your daily long-term control medicine</li> <li>See your doctor as soon as possible—don't delay.</li> </ul>	<b>If you feel worse:</b> <ul style="list-style-type: none"> <li>Use your quick-relief inhaler</li> <li>Take your daily long-term control medicine</li> <li>Immediately go to the emergency department or call 911.</li> </ul>
---	--	--	--

**References:**

1. Nation Heart Lung and Blood Institute (NHLBI) 2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Coordinating Committee Expert Panel Working Group.  
<https://www.nhlbi.nih.gov/healthtopics/all-publications-and-resources/2020-focused-updates-asthma-managementguidelines>
2. Global Initiative for Asthma: 2020 update.  
[https://ginasthma.org/wp-content/uploads/2020/06/GINA-2020-report\\_20\\_06\\_04-1wms.pdf](https://ginasthma.org/wp-content/uploads/2020/06/GINA-2020-report_20_06_04-1wms.pdf)
3. UpToDate, 2021:Acute asthma exacerbations in children younger than 12: Home/office management and severity assessment.  
[https://www.uptodate.com/contents/acute-asthma-exacerbations-in-children-younger-than-12-years-home-office-management-and-severity-assessment?search=asthma%20managemetrn%20exacerbation%20children&source=search\\_result&selectedTitle=4~150&usage\\_type=default&display\\_rank=4](https://www.uptodate.com/contents/acute-asthma-exacerbations-in-children-younger-than-12-years-home-office-management-and-severity-assessment?search=asthma%20managemetrn%20exacerbation%20children&source=search_result&selectedTitle=4~150&usage_type=default&display_rank=4)

<p><i>Initial Approval Date and Reviews:</i>                  April 2017 by Ambulatory Best Practice Committee</p>	<p><i>Most Recent Revision and Approval Date:</i> April 2023</p>	<p><i>Next Scheduled Review Date:</i>                  April 2025 Ambulatory Best Practice                  Condition: Pediatric Acute Asthma Treatment</p>
--	--	---