Goals of Asthma Treatment

Patients will:

- Be free from troublesome symptoms day and night, including sleeping through the night.
- Have the best possible lung function.
- Be able to participate fully in any activities of their choice.
- Not miss work or school because of asthma symptoms.
- Need fewer or no urgent care visits or hospitalizations for asthma.
- Use medications to control asthma with as few side effects as possible.
- Be satisfied with their asthma care.

It is also important to determine the patient’s personal treatment goals and preferences for treatment. Ask how asthma interferes with the patient’s life (e.g., inability to sleep through the night, play a sport), and incorporate the responses into personal treatment goals. Involve the patient in decision-making about treatment.
Based on the opinion of the Expert Panel, referral for consultation or care to a specialist in asthma care is recommended when:

- Patient has had a life-threatening asthma exacerbation.
- Patient is not meeting the goals of asthma therapy after 3-6 months of treatment, or is unresponsive to therapy.
- Signs and symptoms are atypical, or there are problems in differential diagnosis.
- Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, VCD, GERD, COPD).
- Additional diagnostic testing is indicated (e.g., allergy skin testing, pulmonary function studies, provocative challenge, bronchoscopy).
- Patient requires additional education and guidance on complications of therapy, problems with adherence, or allergen avoidance.
- Patient is being considered for immunotherapy.
- Patient requires step 4 care or higher (step 3 for children 0-4 years of age). Consider referral if patient requires step 3 care (step 2 for children 0-4 years of age).
- Patient has required more than two bursts of oral corticosteroids in 1 year or has an exacerbation requiring hospitalization.
- Patient requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma.

An asthma specialist is usually a fellowship-trained allergist or pulmonologist or, occasionally, a physician with expertise in asthma management developed through training and experience.

Patients with significant psychiatric, psychosocial, or family problems that interfere with their asthma therapy should be referred to an appropriate mental health professional for counseling or treatment.
Differential Diagnosis for Asthma

**Infants and Children**

**Upper airway diseases**
- Allergic rhinitis and sinusitis

**Obstruction involving large airways**
- Foreign body in trachea or bronchus
- Vocal cord dysfunction
- Vascular ring or laryngeal web
- Laryngotracheomalacia, tracheal stenosis, or bronchostenosis
- Enlarged lymph nodes or tumor

**Obstructions involving small airways**
- Viral bronchiolitis or obliterative bronchiolitis
- Cystic fibrosis
- Bronchopulmonary dysplasia
- Heart disease

**Other Causes**
- Recurrent cough not due to asthma
- Aspiration from swallowing mechanism dysfunction or gastroesophageal reflux

**Adults**
- Chronic Obstructive Pulmonary Disease (COPD) (e.g., chronic bronchitis or emphysema)
- Congestive heart failure
- Pulmonary embolism
- Laryngeal dysfunction
- Mechanical obstruction of the airways (benign and malignant tumors)
- Pulmonary infiltration with eosinophilia
- Cough secondary to drugs [angiotensin-converting enzyme (ACE) inhibitors]
- Vocal cord dysfunction (VCD)
Level of severity is determined by both impairment and risk. Assess impairment domain by patient's/caregiver's recall of the previous 2-4 weeks and spirometry (if ≥ 5yrs of age). Severity may be assigned to the most severe category in which any feature occurs.

Risk factors for developing persistent asthma among infants and young children who had four or more episodes of wheezing in the past year that lasted more than (1) one day and affected sleep: either (1) one of the following: parental history of asthma, a physician diagnosis of atopic dermatitis, or evidence of sensitization to aeroallergens, or (2) two of the following: evidence of sensitization to foods, >4 percent peripheral blood eosinophilia, or wheezing apart from colds.

At present, there are inadequate data to correspond frequency of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients ≥5yrs of age who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.

1 Short-acting inhaled beta2-agonist.
2 Does not include SABA for prevention of exercise-induced bronchospasm.
The stepwise approach is meant to assist, not replace, clinical decision-making required to meet individual needs. Steps 2-4: Consider subcutaneous allergen immunotherapy for patients ≥5yrs of age with persistent allergic asthma. The stepwise approach is meant to assist, not replace, clinical decision-making required to meet individual needs.

Key: Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy. ICS = inhaled corticosteroid; OCS = oral systemic corticosteroids; LABA = inhaled long-acting beta2-agonist; LTRA = leukotriene receptor antagonist; SABA = inhaled short-acting beta2-agonist
### Classifying Asthma Severity ≥12 years (The Chronic Disease)

<table>
<thead>
<tr>
<th>Components of Severity*</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment</td>
<td></td>
<td>Mild</td>
</tr>
<tr>
<td>Daytime symptoms</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
<td>3-4x/month</td>
</tr>
<tr>
<td>SABA¹ use for symptom control ²</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week but not daily</td>
</tr>
<tr>
<td>Activity limits</td>
<td>None</td>
<td>Minor limitation</td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal FEV₁ between exacerbations FEV₁≥80% FEV₁/FVC=normal</td>
<td>FEV₁&gt;80% FEV₁/FVC=normal</td>
</tr>
</tbody>
</table>

| Risk                    |              | Relative annual risk of exacerbations may be related to FEV₁ |
|                        |              | 0-1/yr | ≥2 exacerbations in the past year requiring oral corticosteroids† |

* Level of severity is determined by assessment of both impairment and risk. Assess impairment domain by patient's/caregiver's recall of previous 2-4 weeks and spirometry. Severity may be assigned to the most severe category in which any feature occurs.

† At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.

¹ Short-acting inhaled beta₂-agonist

² Does not include SABA for prevention of exercise-induced bronchospasm
Stepwise Approach to Management ≥12 years

**Step 1**
*Preferred:* Low-Dose ICS  
*Alternative:* Cromolyn, LTRA, Nedocromil, or Theophylline

**Step 2**
*Preferred:* Low-Dose ICS + LABA  
*Alternative:* Low-Dose ICS + either LTRA, Theophylline, or Zileuton

**Step 3**
*Preferred:* Medium-Dose ICS + LABA  
*Alternative:* Medium-Dose ICS + either LTRA, Theophylline, or Zileuton

**Step 4**
*Preferred:* High-Dose ICS + LABA  
And  
Consider Omalizumab for patients who have allergies

**Step 5**
*Preferred:* High-Dose ICS + LABA + Oral Systemic Corticosteroid  
And  
Consider Omalizumab for patients who have allergies

**Step 6**
*Preferred:* High-Dose ICS + LABA + Oral Systemic Corticosteroid  
And  
Consider Omalizumab for patients who have allergies

**Step Up** if needed  
(first, check adherence, inhaler technique, environmental control, and co-morbid conditions)

**Step down if possible**  
(and asthma is well controlled at least 3 months)

Recommend Consult

Classifying Asthma Severity ≥12 years (The Chronic Disease) / Stepwise Approach to Management ≥12 years

- If alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up.
- In Step 6, before oral systemic corticosteroids are introduced, a trial of high-dose ICS + LABA + either LTRA, theophylline, or zileuton may be considered, although this approach has not been studied in clinical trials.
- Immunotherapy for steps 2-4 based on evidence may be most helpful for those with house dust mite, animal dander or pollen allergy; evidence is weak or lacking for molds and cockroaches.

Key: **Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy.**  
ICS = inhaled corticosteroid; LABA = inhaled long-acting beta₂-agonist; LTRA = leukotriene receptor antagonist; OCS = oral corticosteroid; SABA = inhaled short-acting beta₂-agonist

Once the patient has achieved control, classify based on the amount of therapy required to maintain control.  
**Steps 2-4:** Consider subcutaneous allergen immunotherapy for patients who have persistent allergic asthma.

The stepwise approach is meant to assist, not replace, clinical decision-making required to meet individual needs.
### Components of Control

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Classification of Asthma Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td></td>
<td>≤2 days/week but not more than once on each day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤1x/ month</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Activity limits</td>
<td>None</td>
</tr>
<tr>
<td>Validated questionnaire: ACT* (4-11yrs)</td>
<td>≥20</td>
</tr>
<tr>
<td>Lung function</td>
<td>FEV₁ or PEF&gt;80% FEV₁/FVC&gt;80%</td>
</tr>
<tr>
<td>Risk</td>
<td>OCS use</td>
</tr>
</tbody>
</table>

#### Recommended Action for Treatment

- **Well Controlled**
  - Maintain current step
  - Regular follow-up every 1-6 months
  - Consider step down if well controlled for at least 3 months

- **Not Well Controlled**
  - Step up (1 step); and
  - Re-evaluate in 2-6 weeks
  - For side effects, consider alternative treatment options

- **Very Poorly Controlled**
  - Consider short course of oral systemic corticosteroids
  - Step up (1-2 steps); and
  - Re-evaluate in 2 weeks
  - For side effects, consider alternative treatment options

- **If no clear benefit in 4-6 weeks, consider alternative diagnoses or adjusting therapy**

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The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient’s/caregiver’s recall of previous 2-4 weeks and by spirometry or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether patient’s asthma is better or worse since the last visit.

* NHLBI ([www.nhlbi.nih.gov](http://www.nhlbi.nih.gov)) recommendations separate age groups for nighttime symptoms. Age groups have been combined for ease of application.

** ACT = Asthma Control Test (recommended by MaineHealth AH! Asthma Health Program for children 4-11yrs).
# Determining Asthma Control ≥12 years

## Components of Control

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime symptoms</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
<td>Throughout the day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
<td>1-3 x/week</td>
<td>≥4x/week</td>
</tr>
<tr>
<td>Short-acting beta2-agonist use (not prevention of EIB)</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Activity limits</td>
<td>None</td>
<td>Some limitation</td>
<td>Extremely limited</td>
</tr>
<tr>
<td>Lung function</td>
<td>FEV₁ or PEF&gt;80%</td>
<td>FEV₁ or PEF=60-80%</td>
<td>FEV₁ or PEF&lt;60%</td>
</tr>
<tr>
<td>Validated questionnaire: ACT</td>
<td>≥20</td>
<td>16-19</td>
<td>≤15</td>
</tr>
</tbody>
</table>

## Risk

<table>
<thead>
<tr>
<th>Exacerbations</th>
<th>0-1/year</th>
<th>≥2/year</th>
</tr>
</thead>
</table>

## Recommended Action for Treatment

- Maintain current step
- Regular follow-up every 1-6 months to maintain control
- Consider step down if well controlled for at least 3 months
- Step up (1 step); and
- Re-evaluate in 2-6 weeks
- For side effects, consider alternative treatment options
- Consider short course of oral systemic corticosteroids
- Step up 1-2 steps, and
- Re-evaluate in 2 weeks
- For side effects, consider alternative treatment options

The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's/caregiver's recall of previous 2-4 weeks and by spirometry or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether patient’s asthma is better or worse since the last visit.

Key: FEV₁ = forced expiratory volume in 1 second; PEF = peak flow; ACT = Asthma Control Test (recommended by MaineHealth AH! Asthma Health Program); EIB = exercise-induced bronchospasm; OCS = oral corticosteroid.
<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosage Form</th>
<th>Adult Dose</th>
<th>Child Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systemic Corticosteroids</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylprednisolone (Medrol)</td>
<td>2, 4, 8, 16, 32mg tablets</td>
<td>7.5-60mg daily in a single dose in a.m.</td>
<td>0.25-2mg/kg daily in a single dose in a.m.</td>
<td></td>
</tr>
<tr>
<td>Prednisolone (Prednisolone, Pediapred, Orapred)</td>
<td>5mg tablets, 5mg/5cc, 15mg/5cc, 10 &amp; 15mg oral dissolving tablets</td>
<td>or qod as needed for control</td>
<td>or qod as needed for control</td>
<td></td>
</tr>
<tr>
<td>Prednisone (Deltasone)</td>
<td>1, 2.5, 5, 10, 20mg tablets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leukotriene Modifiers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montelukast (Singulair)</td>
<td>4mg oral granules, 4 or 5mg chewable tablet, 10mg tablet</td>
<td>10mg qhs</td>
<td>4mg qhs (6 mos-5yrs) 5mg qhs (6-14yrs) 10mg qhs (&gt;14yrs)</td>
<td>Monitor for signs and symptoms of hepatic dysfunction</td>
</tr>
<tr>
<td>Zafirlukast (Accolate)</td>
<td>10 or 20mg tablet</td>
<td>20mg tablet bid</td>
<td>7-11 yrs: 10mg tablet bid</td>
<td>For zileuton, monitor hepatic enzymes (ALT)</td>
</tr>
<tr>
<td>5-Lipoxygenase Inhibitor: Zileuton (Zyflo)</td>
<td>600mg tablet</td>
<td>2,400mg daily (divided bid if sustained release tablet)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Combination Medication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluticasone/Salmeterol (Advair)</td>
<td>DPI 100mcg/50mcg, 250mcg/50mcg, 500mcg/50mcg</td>
<td>1 inhalation bid; dose depends on asthma severity</td>
<td>5-11yrs: 100mcg/50mcg, 1 inhalation bid</td>
<td>100/50 DPI or 45/21 HFA for patients not controlled on low- to medium-dose ICS 250/50 DPI or 115/21 HFA for patients not controlled on medium- to high-dose ICS</td>
</tr>
<tr>
<td></td>
<td>HFA 45mcg/21mcg, 115mcg/21mcg, 230mcg/21mcg</td>
<td>2 inhalations bid; dose depends on asthma severity</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Budesonide/Formoterol (Symbicort) HFA MDI</td>
<td>80mcg/4.5mcg, 160mcg/4.5mcg</td>
<td>2 inhalations bid; dose depends on asthma severity</td>
<td>N/A</td>
<td>80/4.5 for patients who have asthma not controlled on low- to medium-dose ICS 160/4.5 for patients who have asthma not controlled on medium- to high-dose ICS</td>
</tr>
<tr>
<td><strong>Inhaled Long-Acting Beta --Agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmeterol (Serevent)</td>
<td>DPI 50mcg/puff</td>
<td>1 blister q 12 hours</td>
<td>N/A</td>
<td>Should not be used for acute symptom relief or exacerbations. Use only with inhaled corticosteroids (ICS).</td>
</tr>
<tr>
<td>Formoterol (Foradil)</td>
<td>DPI 12mcg/single-use capsule</td>
<td>1 capsule q 12 hours</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Cromolyn</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cromolyn (Intal)</td>
<td>MDI 1mg/puff Nebulizer 20mg/ampule</td>
<td>2 puffs tid-qid 1 ampule tid-qid</td>
<td>2 puffs tid-qid (children ≥5yrs) 1 ampule tid-qid (children ≥2yrs)</td>
<td>May be used as exercise pre-treatment.</td>
</tr>
<tr>
<td><strong>Methylyxanthines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theophylline (Theo-Dur, Uniphyl)</td>
<td>Liquid, sustained-release tablets, and capsules</td>
<td>Starting dose 10mg/kg/day up to 800mg/day</td>
<td>Starting dose 10mg/kg/day; usual max=16kg/mg/day, (formula to calculate max dose if &lt;1 year of age: 0.2 x (age in weeks) +5=mg/kg/day)</td>
<td>Serum monitoring is important (serum concentration of 5-15mcg/mL at steady state).</td>
</tr>
<tr>
<td>Drug</td>
<td>Low Daily Dose</td>
<td>Medium Daily Dose</td>
<td>High Daily Dose</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0-4yrs</td>
<td>5-11yrs</td>
<td>≥12yrs and Adult</td>
<td>0-4yrs</td>
</tr>
<tr>
<td>Beclomethasone (QVAR) HFA: 40 or 80mcg puff</td>
<td>NA</td>
<td>80-160mcg</td>
<td>80-240mcg</td>
<td>NA</td>
</tr>
<tr>
<td>Budesonide (Pulmicort Flexhaler) DPI: 90 or 180mcg/inhalation</td>
<td>NA</td>
<td>180-400mcg</td>
<td>180-600mcg</td>
<td>NA</td>
</tr>
<tr>
<td>Budesonide Inhalation Suspension for Nebulization (Pulmicort Respules)</td>
<td>0.25-0.5mg</td>
<td>0.5mg</td>
<td>NA</td>
<td>&gt;0.5-1.0mg</td>
</tr>
<tr>
<td>Ciclesonide (Alvesco) HFA* 80 mcg/ 160mcg/ inhalation</td>
<td>NA</td>
<td>NA</td>
<td>160-320 mcg</td>
<td>NA</td>
</tr>
<tr>
<td>Flunisolide (Aerobid) 250mcg/puff</td>
<td>NA</td>
<td>500-750mcg</td>
<td>500-1,000mcg</td>
<td>NA</td>
</tr>
<tr>
<td>Fluticasone (Flovent) HFA: 44, 110, or 220mcg/puff DPI: 50mcg/inhalation</td>
<td>88-176mcg</td>
<td>88-176mcg</td>
<td>88-264mcg</td>
<td>&gt;176-352mcg</td>
</tr>
<tr>
<td>Mometasone (Asmanex) DPI: 110, 220mcg/inhalation</td>
<td>NA</td>
<td>100-200mcg</td>
<td>100-300mcg</td>
<td>NA</td>
</tr>
<tr>
<td>Triamcinolone acetonide (Azmacort) 100mcg/puff</td>
<td>NA</td>
<td>300-600mcg</td>
<td>300-750mcg</td>
<td>NA</td>
</tr>
</tbody>
</table>

Key: DPI = dry powder inhaler; HFA = hydrofluoroalkane; MDI = metered-dose inhaler; NA = not available (either not approved, no data available, or safety and efficacy not established for this age group)

*Dosing recommendations are estimated based on FDA package insert. No direct comparisons were available at time of publication.
<table>
<thead>
<tr>
<th>Medications</th>
<th>Dosage Form</th>
<th>Adult Dose (≥12 years)</th>
<th>Child Dose (0-11 years)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhaled Short-Acting Beta-2-Agonists (SABA)</strong>(^1,2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Albuterol (ProAir/Ventolin/Proventil) HFA</strong></td>
<td>90mcg/puff, 200 puffs</td>
<td>2 puffs q 4-6hrs prn or 10-15min before exercise</td>
<td>2 puffs q 4-6hrs prn</td>
<td></td>
</tr>
<tr>
<td><strong>Pirbuterol (Maxair) CFC</strong></td>
<td>200mcg/puff, 400 puffs</td>
<td></td>
<td>Safety and efficacy not established for children &lt;12yrs</td>
<td></td>
</tr>
<tr>
<td><strong>Levalbuterol (Xopenex) HFA</strong></td>
<td>45mcg/puff, 200 puffs</td>
<td>2 puffs q 4-6hrs prn</td>
<td>5-11yrs: 2 puffs q 4-6hrs prn</td>
<td></td>
</tr>
<tr>
<td><strong>Albuterol</strong></td>
<td>Nebulizer Solution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.63mg/3mL</td>
<td>2.5-5mg</td>
<td>0-4 yrs: 0.63-2.5mg q 8hrs prn</td>
<td>1 Regular use exceeding 2 days/week for symptom control (not prevention of EIB) indicates the need for additional long-term control therapy.</td>
</tr>
<tr>
<td></td>
<td>1.25mg/3mL</td>
<td>q 4-8hrs prn</td>
<td>5-11 yrs: 1.25-5mg q 4-8hrs prn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5mg/3mL</td>
<td></td>
<td>0.31-0.63mg q 4-6hrs prn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5mg/mL (0.5%)</td>
<td></td>
<td>0.625-1.25mg q 8hrs prn</td>
<td></td>
</tr>
<tr>
<td><strong>Levalbuterol (Xopenex)</strong></td>
<td>Nebulizer Solution</td>
<td>0.63mg-1.25mg q 8hrs prn</td>
<td>0-4 yrs: 0.31-0.63mg q 4-6hrs prn</td>
<td>2 For an exacerbation at home, up to 2 treatments 20 minutes apart of MDI (2-6 puffs) or nebulizer may be used, and if good response, continued q 4hrs as needed for 24-48hrs. If incomplete response, contact doctor.</td>
</tr>
<tr>
<td></td>
<td>0.31mg/3mL</td>
<td></td>
<td>5-11yrs: 0.31-0.63mg q 4-6hrs prn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.63mg/3mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25mg/0.5mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25mg/3mL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Anticholinergics</strong>(^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ipratropium (Atrovent)</strong></td>
<td>Nebulizer Solution</td>
<td>0.25mg q 6hrs</td>
<td>NA</td>
<td>3 Evidence is lacking for anticholinergics producing added benefit in long-term therapy.</td>
</tr>
<tr>
<td><strong>Ipratropium with albuterol (Duoneb)</strong></td>
<td>Nebulizer Solution</td>
<td>3mL q 4-6hrs</td>
<td>NA</td>
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<tr>
<td></td>
<td>0.5mg/3mL ipratropium bromide and 2.5mg/3mL albuterol</td>
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<tr>
<td><strong>Systemic Corticosteroids</strong>(^4)</td>
<td></td>
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<tr>
<td><strong>Prednisolone</strong></td>
<td>10 &amp; 15mg oral dissolving tabs (Orapred ODT) 5mg/5cc (Pediapred, Prelone) 15mg/5cc (Prelone, Orapred)</td>
<td>Short course: 40-60mg/day as single or 2 divided doses for 3-10 days</td>
<td>Short course: 1-2mg/kg/day max 60 mg/kg/day for 3-10 days</td>
<td>4 The burst should be continued until patient achieves 80% PEF personal best or symptoms resolve; usually 3-10 days, may be longer. May consider tapering for patients requiring &gt;6 days of therapy.</td>
</tr>
<tr>
<td><strong>Prednisone</strong></td>
<td>1, 2.5, 5, 10, 20, 50mg tabs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Methylprednisolone acetate</strong>(^5)</td>
<td>Repository Injection</td>
<td>240mg IM once</td>
<td>0-4yrs: 7.5 mg/kg IM once</td>
<td>5 May be used in place of a short burst of oral corticosteroids in patients who are vomiting or if adherence is a problem.</td>
</tr>
<tr>
<td></td>
<td>40mg/mL</td>
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<td>5-11yrs: 240 mg IM once</td>
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<tr>
<td></td>
<td>80mg/mL</td>
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</tbody>
</table>
Emergency Treatment for Acute Exacerbations - Mild

Assess patient. Obtain temperature, pulse, respiration, weight, height; obtain FEV₁/PEF if ≥5 years old (as appropriate)

- Patient is alert and oriented, speaks in sentences, is dyspneic only with activity, may have slight expiratory wheezing, and is tachypneic; and/or,
- FEV₁/peak flow ≥70% of predicted or personal best
- Oxygen saturation >95% (test not usually necessary)

These patients rarely require inpatient treatment for asthma (i.e. hospitalization). When classifying severity, consider therapy received prior to acute visit and response to initial treatments.

Administer inhaled albuterol 2.5mg at 20 minute intervals via nebulizer or albuterol MDI, 2-8 puffs with valved holding chamber (spacer). Up to 3 treatments via nebulizer or MDI may be given. If using a Breath Actuated Nebulizer (BAN), only one treatment may be needed.

Check pulse, respiration, chest exam, FEV₁ or peak flow 20 minutes after inhaled treatment completed.

If patient does not improve

If patient improves and:
- Response sustained 60 minutes after last treatment
- No wheeze, no shortness of breath
- Normal physical exam

Consider treating any co-morbidities (e.g., otitis media, sinusitis, allergic rhinitis, gastroesophageal reflux (GER))

- Discharge patient to home on inhaled albuterol q 4-6hrs for 24-48hrs and then q 4-6hrs prn or as directed by healthcare provider.
- If the patient has recently been on oral steroids, consider treatment with oral steroids (up to 1-2 mg/kg/day, maximum dose 60mg in children, 80mg in adults).
- Consider initiating inhaled corticosteroids (if persistent asthma).
- Follow-up by phone or office visit with primary care provider within 1-5 days.

Follow guideline for moderate exacerbation

Patient education to be initiated prior to discharge. Begin education with emphasis on:
- Basic facts about asthma
- Roles of medications
- Skills using inhalers, peak flow meters, and spacer devices
- Environmental control measures
- Action plans – home and school

If patient is in a smoking environment, encourage tobacco treatment program at 1-800-207-1230, The Maine Tobacco Helpline.

Consider referral to a certified asthma educator for on-going patient education. In Portland, call 207-662-3325.
Emergency Treatment for Acute Exacerbations - Moderate

### Assess patient. Obtain temperature, pulse, respiration, weight, height; obtain FEV1/PEF if >5 years old (as appropriate)

- Patient is agitated, not playful, and speaks in phrases. An infant may have a softer, shorter cry and difficulty feeding. Patient is using accessory muscles, may have loud wheezing, and is tachypneic; and/or,
- FEV1/peak flow 40-69% of predicted or personal best
- Oxygen saturation 90-95% (test not usually necessary)

### Administer albuterol 2.5 mg at 20 minute intervals via nebulizer or albuterol MDI, 2 - 8 puffs with valved holding chamber (spacer); may consider adding ipratropium. Up to 3 treatments via nebulizer or MDI may be given over the 1st hour and then spread to every 1-3 hours if improvement is noted. If using a breath actuated nebulizer (BAN), fewer treatments may be needed.

### Corticosteroids (oral prednisone or equivalent) 1-2 mg/kg up to a max of 60 - 80 mg. Consider IV steroids if patient cannot tolerate oral medication.

#### Good Response
- FEV1 or PEF>70%
- Sustained response 60 minutes after treatment
- No dyspnea or oxygen requirement
- Normal exam

Treat co-morbidities (e.g., pneumonia, otitis media, sinusitis, allergic rhinitis, gastroesophageal reflux (GER))

#### Incomplete Response
- FEV1 or PEF 40-69% and/or,
- Mild to moderate symptoms

- Continue treatment with albuterol q 1-3hrs
- Continue systemic corticosteroids (0.5-1mg/kg q 12hrs for the initial 48hrs if hospitalized, then re-evaluate; usual maximum dose=60mg/day in children, 80mg/day in adults)
- Treat co-morbidities
- Consider hospitalization and follow available inpatient guidelines

#### Poor Response
- FEV1 or PEF<40%
- Severe symptoms
- Drowsy, confused

Follow guidelines for severe exacerbation and admit to ICU

**Patient education to be initiated prior to discharge; begin education with emphasis on:**
- Basic facts about asthma
- Roles of medications
- Skills using inhalers, peak flow meters, and spacer devices
- Environmental control measures
- Action plans – home and school

If patient is in smoking environment, encourage tobacco treatment program at 1-800-207-1230, The Maine Tobacco Helpline.

Consider referral to a certified asthma educator for on-going patient education. In Portland, call 207-662-3325.

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Discharge to home:
- Inhaled albuterol q 4-6hrs for 24-48 hrs and then q 4-6hrs pm or as directed by healthcare provider
- Continue controller medications and if not on inhaled corticosteroids (ICS) consider prescribing
- Oral corticosteroids (OCS): up to 1-2mg/kg/day in 1 or 2 divided doses for 3-10 days (maximum=60mg for children, 80mg for adults); consider tapering for patients requiring >6 days of OCS
- Follow-up by phone or office visit with primary provider within 24-48hrs
Emergency Treatment for Acute Exacerbations – Severe

Assess patient. Obtain vital signs, weight, and height (as appropriate) in ED. Consider FEV₁/peak flow if >5 years old. FEV₁/peak flow may be difficult or impossible to measure due to significant dyspnea and cough. Therefore, FEV₁/peak flow may not be appropriate in very severe cases of obvious airway compromise or cyanosis.

- Patient is breathless at rest. Dyspnea interferes with conversation (e.g. speaks in words). An infant will stop feeding. Patient is using accessory muscles, has suprasternal retractions, may or may not have loud wheezing (throughout inhalation and exhalation), and is tachypneic
- FEV₁/peak flow <40% of predicted or personal best
- Oxygen saturation <90%

Administer oxygen to keep saturation >90%.
Administer moderate to high dose albuterol plus ipratropium nebulizer q 20min x 3, or albuterol continuously for 1 hour. BAN (breath actuated nebulizer) is recommended to increase delivery of nebulized medications in severe exacerbations.

Corticosteroids (oral prednisone or equivalent) 1-2mg/kg up to a max of 60-80 mg. Consider IV corticosteroids if patient cannot tolerate oral medication.

Repeat vital signs (pulse and respiratory rate) q 15 minutes. Continuous pulse oximetry.

Good Response
- FEV₁ or PEF>70%
- Sustained response 60mins after treatment
- No dyspnea or oxygen requirement
- Improved physical exam
  - Consider hospitalization
  - Continue oral corticosteroids 0.5-1mg/kg q 12hrs for 3-10 days (max dose=60mg for children, 80mg for adults); consider tapering for patients requiring >6 days of OCS
  - Wean nebulized albuterol to q 3-4hrs
  - Patient education
  - If not on inhaled corticosteroids (ICS), consider initiation of an ICS

Incomplete Response
- FEV₁ or PEF 40-69%
- Mild to moderate symptoms
  - Continue supplemental oxygen
  - Continue treatment with albuterol and ipratropium q 1-3hrs (while in the ED); or continuous albuterol
  - Continue systemic corticosteroids (0.5-1mg/kg q 6-12hrs: usual max dose=60mg/day in children, 80mg/day in adults)
  - Treat co-morbidities
  - Hospitalize and follow available inpatient guidelines

Poor Response
- FEV₁ or PEF <40%
- PCO₂>42mm Hg
- Severe symptoms
- Drowsy, confused
  - Consider hospitalization
  - Intubated or pending intubation
  - pCO₂ greater than 55
  - Requiring more than 50% FiO₂
  - Requiring nebulized therapies more frequently than q 2hrs
  - Altered mental status
  - Acute pneumothorax
  - Use of adjunctive therapies – heliox, terbutaline, magnesium

Admit to ICU – With orders for:
- Supplemental oxygen
- Corticosteroids IV 1 mg/kg q 12 hours
- Consider arterial line for serial ABGs
- Albuterol nebs hourly or continuous at 0.15-0.5mg/kg/hr (maximum of 10-15mg/hr)
- Wean nebulized albuterol to q 3-4hrs
- Consider adjunctive therapies

ICU Admission Criteria
- Intubated or pending intubation
- pCO₂ greater than 55
- Requiring more than 50% FiO₂
- Requiring nebulized therapies more frequently than q 2hrs
- Altered mental status
- Acute pneumothorax
- Use of adjunctive therapies – heliox, terbutaline, magnesium

Emergency Treatment for Acute Exacerbations – Moderate / Severe
MaineHealth, a not-for-profit health system serving the people of southern, western and central Maine, is working with communities and organizations around the state to improve the care of children and adults with asthma through the AH! Asthma Health Program. A key goal of the program is to improve the clinical care of asthma by supporting the consistent use of nationally developed guidelines in the diagnosis and management of asthma.

To support this effort, the AH! Program created this flip chart summarizing current recommendations for asthma care. The AH! Asthma Health Program efforts have been fueled by a multidisciplinary group of clinicians representing nursing, respiratory therapy, public health, primary care physicians, pulmonary and allergy-immunology subspecialists. This chart was adapted from the National Heart, Lung, and Blood Institute (NHLBI) National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, 2007. Some recommendations reflect the local expert opinion of the AH! Asthma Health Program clinicians. We would like to give special thanks to the following people for their efforts in the production of the 2008 version of this flip chart: Dr. Barbara Chilmonczyk (Allergist/Immunologist); Dr. Jennifer Jewell (Hospitalist); Rhonda Vosmus, RRT; Donna Levi, M.S.; and Joel Richard.

These guidelines were developed for healthcare professionals who provide asthma care to patients. They are intended as a guide for care, but are not intended to replace providers' clinical judgment or to establish a single protocol. Some clinical problems may not be adequately addressed by these guidelines. As always, clinicians are urged to document management strategies. For questions or more information, please contact the AH! Asthma Health Program Manager at tel. 207-541-7566. These guidelines are also available on the web at www.mainehealth.org/AH.