Introduction

A significant number of the underserved, uninsured, and underinsured population in Nevada seek care in nonprofit health care clinics such as the First Person Care Clinic (FPCC). Despite serving all sectors regardless of their ability to pay, they strive to provide efficient, quality, and affordable healthcare by maintaining continuity of care through a holistic, compassionate, and accessible approach. In addition, they take pride in providing services using evidence-based healthcare.

Services available aim to promote wellness through screening- and identification of chronic-illness, and dental, mental health, and pediatric programs. Providing evidence-based care to treat pediatric asthma patients can properly address the growing needs of the clinic. As a result, this document was created to guide the providers and staff of the First Person Care Clinic in the management of asthma in children age 5 and older.
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Diagnosis of Asthma

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.

Recommended methods to establish diagnosis

- Detailed medical history
- Physical examination
- Spirometry
### Key Symptom Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Presence of multiple key indicators increases the probability of asthma.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheeze</strong></td>
<td>High-pitched whistling when breathing out, especially in children</td>
</tr>
<tr>
<td><strong>History of any of the following:</strong></td>
<td>Cough (worse particularly at night) Recurrent wheeze Recurrent difficulty when breathing Recurrent chest tightness</td>
</tr>
<tr>
<td><strong>Symptoms that occur or worsen in the presence of:</strong></td>
<td>Exercise Viral infection Inhalant allergens Irritants Changes in weather Strong emotional expressions Stress Menstrual Cycles</td>
</tr>
<tr>
<td><strong>Symptoms that:</strong></td>
<td>Occur or worsen at night, awakening the patient</td>
</tr>
</tbody>
</table>
## Physical Examination

<table>
<thead>
<tr>
<th>Physical Assessment</th>
<th>Assessment Finding</th>
</tr>
</thead>
</table>
| **Upper Respiratory Tract** | Increased nasal secretion  
                        Mucosal swelling  
                        Nasal polyp |
| **Chest**              | Sounds of wheezing during normal breathing or prolonged phase of forced exhalation  
                        Hyper-expansion of the thorax  
                        Use of accessory muscles  
                        Appearance of hunched shoulders  
                        Chest deformity |
| **Skin**               | Atopic dermatitis  
                        Eczema |

* Findings may increase the probability of asthma
## Classification of Severity and Initiating Therapy

### Age 5-11

<table>
<thead>
<tr>
<th>Age 5-11</th>
<th>Intermittent</th>
<th>Mild Persistent</th>
<th>Moderate Persistent</th>
<th>Severe Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1 (predicted) or Peak Flow (personal best)</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>60-80%</td>
<td>&lt;60%</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>&gt;85%</td>
<td>&gt;80%</td>
<td>75-80%</td>
<td>&lt;75%</td>
</tr>
<tr>
<td>Recommended Step for Initiating Therapy</td>
<td>Step 1</td>
<td>Step 2</td>
<td>Step 3 Med and consider OCS</td>
<td>Step 3 Med and consider OCS</td>
</tr>
</tbody>
</table>

### Age 12 and Older

<table>
<thead>
<tr>
<th>Age 12+</th>
<th>Intermittent</th>
<th>Mild Persistent</th>
<th>Moderate Persistent</th>
<th>Severe Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal FEV1/FVC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-19 yr</td>
<td>85%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-39 yr</td>
<td>80%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-59 yr</td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-80 yr</td>
<td>70%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV1 (predicted) or Peak Flow (personal best)</td>
<td>&gt;80%</td>
<td>&gt;80%</td>
<td>&gt;60%</td>
<td>&lt;60%</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>Normal</td>
<td>Normal</td>
<td>Reduced 5%</td>
<td>Reduced &gt;5%</td>
</tr>
<tr>
<td>Recommended Step for Initiating Therapy</td>
<td>Step 1</td>
<td>Step 2</td>
<td>Step 3 Med and consider OCS</td>
<td>Step 4 or 5 and consider OCS</td>
</tr>
</tbody>
</table>
## Differential Diagnoses

### Infants and Children

<table>
<thead>
<tr>
<th>Upper airway disease</th>
<th>Allergic rhinitis and sinusitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructions involving large airways</td>
<td>Foreign body in trachea or bronchus; vocal cord dysfunction (VCD); vascular rings or laryngeal webs; laryngotracheomalacia, tracheal stenosis, or bronchostenosis; enlarged lymph nodes</td>
</tr>
<tr>
<td>Obstructions involving small airways</td>
<td>Viral bronchitis or obliterative bronchiolitis; cystic fibrosis; bronchopulmonary dysplasia; heart disease</td>
</tr>
<tr>
<td>Other Causes</td>
<td>Recurrent cough not due to asthma; aspiration from swallowing mechanism dysfunction or gastroesophageal reflux</td>
</tr>
</tbody>
</table>

### Adults

- Chronic obstructive pulmonary disease (COPD)
- Congestive heart failure
- Pulmonary embolism
- Mechanical obstruction of the airways (benign and malignant tumors)
- Pulmonary infiltration with eosinophilia
- Cough secondary to drugs (e.g., angiotensin converting enzyme [ACE] inhibitors)
- Vocal cord dysfunction
Stepwise Approach for Managing Asthma, Age 5-11

Intermittent Asthma
- Consult with asthma specialist if step 4 care or higher is required.
- Consider consultation at step 3.

Step 1
- Preferred: SABA PRN
- Alternative: Cromlyn, LTRA, Nedocromil, or Theophylline

Step 2
- Preferred: Low-dose ICS
- Alternative: High-dose ICS + either LABA, LTRA, or Theophylline

Step 3
- Preferred: Medium-dose ICS + LABA
- Alternative: Medium-dose ICS + either LTRA or Theophylline

Step 4
- Preferred: High-dose ICS + LABA
- Alternative: High-dose ICS + either LTRA or Theophylline

Step 5
- Preferred: High-dose ICS + LABA + oral systemic corticosteroid
- Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Quick-Relief Medication for All Patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.

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 beta_{2}-agonist, LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta_{2}-agonist
### Stepwise Approach for Managing Asthma, Age 12+

<table>
<thead>
<tr>
<th>Intermittent Asthma</th>
<th>Persistent Asthma: Daily Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Step 5</th>
<th>Step 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred: SABA PRN</td>
<td>Preferred: Low-dose ICS + LABA OR Medium-dose ICS</td>
<td>Preferred: Medium-dose ICS + LABA AND Consider Omalizumab for patients who have allergies</td>
<td>Preferred: High-dose ICS + LABA AND Consider Omalizumab for patients who have allergies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline</td>
<td>Alternative: Low-dose ICS + either LTRA, Theophylline, or Zileuton</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each step: Patient education, environmental control, and management of comorbidities.

Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Quick-Relief Medication for All Patients

- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Use of SABA >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.

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Key: Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy. EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, long-acting inhaled beta₂-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta₂-agonist
## Recommendations for Initial Visit

**Focus on:**
- Expectations of visit
- Asthma control
- Patients’ goals of treatment
- Medications
- Quality of life

**Ask relevant questions**
- “What worries you most about your asthma?”
- “What do you want to accomplish at this visit?”
- “What do you want to be able to do that you can’t do now because of your asthma?”
- “What do you expect from treatment?”
- “What medicines have you tried?”
- “What other questions do you have for me today?”
- “Are there things in your environment that make your asthma worse?”

**Teach in simple language:**
- What is asthma? Asthma is a chronic lung disease. The airways are very sensitive. They become inflamed and narrow; breathing becomes difficult.
- The definition of asthma control: few daytime symptoms, no night-time awakenings due to asthma, able to engage in normal activities, normal lung function.
- Asthma treatments: two types of medicines are needed:
  - Long-term control: medications that prevent symptoms, often by reducing inflammation.
  - Quick relief: short-acting bronchodilator relaxes muscles around airways.
- Bring all medications to every appointment.
- When to seek medical advice. Provide appropriate telephone number.

**Teach or review and demonstrate:**
- Inhaler and spacer or valved holding chamber (VHC) use. Check performance.
- Self-monitoring skills that are tied to a written asthma action plan:
  - Recognize intensity and frequency of asthma symptoms.
  - Review the signs of deterioration and the need to re-evaluate therapy:
    - Waking at night or early morning with asthma
    - Increased medication use
    - Decreased activity tolerance
- Use of a written asthma action plan (See figures 5 and 6.) that includes instructions for daily management and for recognizing and handling worsening asthma.

## Recommendations for First Followup Visit (2 to 4 Weeks or Sooner as Needed)

**Focus on:**
- Expectations of visit
- Asthma control
- Patient’s goals of treatment
- Medications
- Patient’s treatment preferences
- Quality of life

**Ask relevant questions from previous visit and also ask:**
- “What medications are you taking?”
- “How and when are you taking them?”
- “What problems have you had using your medications?”
- “Please show me how you use your inhaled medications.”

**Teach in simple language:**
- Use of two types of medications.
- Remind patient to bring all medications and the peak flow meter, if using, to every appointment for review.
- Self-assessment of asthma control using symptoms and/or peak flow as a guide.

**Teach or review and demonstrate:**
- Use of written asthma action plan. Review and adjust as needed.
- Peak flow monitoring if indicated
- Correct inhaler and spacer or VHC technique.
### Recommendations for Second Followup Visit

**Focus on:**
- Expectations of visit
- Asthma control
- Patients’ goals of treatment
- Medications
- Quality of life

**Ask relevant questions from previous visits and also ask:**
- “Have you noticed anything in your home, work, or school that makes your asthma worse?”
- “Describe for me how you know when to call your doctor or go to the hospital for asthma care.”
- “What questions do you have about the asthma action plan?”
- “Can we make it easier?”
- “Are your medications causing you any problems?”
- “Have you noticed anything in your environment that makes your asthma worse?”
- “Have you missed any of your medications?”

**Teach in simple language:**
- Self-assessment of asthma control, using symptoms and/or peak flow as a guide.
- Relevant environmental control/avoidance strategies:
  - How to identify home, work, or school exposures that can cause or worsen asthma
  - How to control house-dust mites, animal exposures if applicable
  - How to avoid cigarette smoke (active and passive)
- Review all medications.

**Teach or review and demonstrate:**
- Inhaler/spacer or VHC technique.
- Peak flow monitoring technique.
- Use of written asthma action plan. Review and adjust as needed.
- Confirm that patient knows what to do if asthma gets worse.

### Recommendations for All Subsequent Visits

**Focus on:**
- Expectations of visit
- Asthma control
- Patients’ goals of treatment
- Medications
- Quality of life

**Ask relevant questions from previous visits and also ask:**
- “How have you tried to control things that make your asthma worse?”
- “Please show me how you use your inhaled medication.”

**Teach in simple language:**
- Review and reinforce all:
  - Educational messages
  - Environmental control strategies at home, work, or school
  - Medications
  - Self-assessment of asthma control, using symptoms and/or peak flow as a guide

**Teach or review and demonstrate:**
- Inhaler/spacer or VHC technique.
- Peak flow monitoring technique, if appropriate.
- Use of written asthma action plan. Review and adjust as needed.
- Confirm that patient knows what to do if asthma gets worse.
### Intervals

#### For Follow-Up Care

<table>
<thead>
<tr>
<th>Phase</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>2 to 6 weeks</td>
</tr>
<tr>
<td>Step Up</td>
<td>2 to 6 weeks</td>
</tr>
<tr>
<td>Regain Control</td>
<td>2 to 6 weeks</td>
</tr>
<tr>
<td>Step Down</td>
<td>3 months</td>
</tr>
<tr>
<td>Control Achieved</td>
<td>1 to 6 months</td>
</tr>
</tbody>
</table>

#### For PFT/Spirometry

**Perform Testing During Following Times**

- **Initial Assessment**
  - After treatment is initiated and symptoms and PEF have stabilized
  - During periods of progressive or prolonged asthma control
  - At least every 1-2 years; more frequently in response to therapy
### Long-Term Management Goals of Therapy

#### Goal of Therapy: Control of Asthma

**Reduce Impairment**
- Prevent chronic and troublesome symptoms (e.g., coughing or breathlessness in the daytime, in the night, or after exertion).
- Require infrequent use (≤2 days a week) of inhaled SABA for quick relief of symptoms (not including prevention of exercise-induced bronchospasm [EIB]).
- Maintain (near) normal pulmonary function.
- Maintain normal activity levels (including exercise and other physical activity and attendance at school or work).
- Meet patients’ and families’ expectations of and satisfaction with asthma care.

**Reduce Risk**
- Prevent recurrent exacerbations of asthma and minimize the need for ED visits or hospitalizations.
- Prevent loss of lung function; for children, prevent reduced lung growth.
- Provide optimal pharmacotherapy with minimal or no adverse effects of therapy.
### Long-Term Management Age 5-11

Assessing Asthma Control and Adjusting Therapy

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Classification of Asthma Control (5–11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td>Symptoms</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>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Impairment</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Short-acting beta,-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Lung function</td>
<td>&gt;80% predicted/personal best</td>
</tr>
<tr>
<td>• FEV₁ or peak flow</td>
<td>&gt;80%</td>
</tr>
<tr>
<td>• FEV₁/FVC</td>
<td></td>
</tr>
<tr>
<td><strong>Exacerbations requiring oral systemic corticosteroids</strong></td>
<td>0–1/year</td>
</tr>
<tr>
<td>Reduction in lung growth</td>
<td>Evaluation requires long-term followup.</td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
</tr>
<tr>
<td><strong>Recommended Action for Treatment</strong></td>
<td>Maintain current step.</td>
</tr>
<tr>
<td>(See figure 4–1b for treatment steps.)</td>
<td>Regular followup every 1–6 months.</td>
</tr>
<tr>
<td></td>
<td>Consider step down if well controlled for at least 3 months.</td>
</tr>
<tr>
<td></td>
<td>• Consider alternative treatment options.</td>
</tr>
</tbody>
</table>

Key: EIB, exercise-induced bronchospasm; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity
Stepwise Approach for Managing Asthma, Age 5-11

Step 1
Preferred: SABA PRN

Step 2
Preferred: Low-dose ICS
Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline

Step 3
Preferred: EITHER: Low-dose ICS + either LABA, LTRA, or Theophylline OR Medium-dose ICS
Alternative: Medium-dose ICS + LABA

Step 4
Preferred: High-dose ICS + LABA
Alternative: High-dose ICS + either LTRA or Theophylline

Step 5
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Step 6
Step up if needed (first, check adherence, inhaler technique, environmental control, and comorbid conditions)
Assess control
Step down if possible (and asthma is well controlled at least 3 months)

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; SABA, inhaled short-acting beta₂-agonist

Each step: Patient education, environmental control, and management of comorbidities.
Steps 2-4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Quick-Relief Medication for All Patients
• SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
• Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.
### Long-Term Management

**Age 12 and older**

**Assessing Asthma Control and Adjusting Therapy**

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Classification of Asthma Control (≥12 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td><strong>Impairment</strong></td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>None</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>FEV₁ or peak flow</td>
<td>&gt;80% predicted/personal best</td>
</tr>
<tr>
<td>Validated questionnaires</td>
<td>0</td>
</tr>
<tr>
<td>ATAQ</td>
<td>0</td>
</tr>
<tr>
<td>ACQ</td>
<td>≤0.75*</td>
</tr>
<tr>
<td>ACT</td>
<td>≥20</td>
</tr>
</tbody>
</table>

**Risk**

- Exacerbations requiring oral systemic corticosteroids
  - 0–1/year
  - ≥2/year (see note)
  - Consider severity and interval since last exacerbation
  - Evaluation requires long-term followup care

- Progressive loss of lung function

- Treatment-related adverse effects
  - Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.

**Recommended Action for Treatment**

(see figure 4–5 for treatment steps)

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

*ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.

Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit
Stepwise Approach for Managing Asthma, Age 12 and Older

**Intensive Asthma**
- Consult with asthma specialist if step 4 care or higher is required.
- Consider consultation at step 3.

**Step 1**
- Preferred: SABA PRN
- Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline

**Step 2**
- Preferred: Low-dose ICS
- Alternative: Medium-dose ICS
- Preferred: Medium-dose ICS + LABA
- Alternative: Medium-dose ICS + either LTRA or Theophylline

**Step 3**
- Preferred: High-dose ICS + LABA
- Alternative: High-dose ICS + either LTRA or Theophylline

**Step 4**
- Preferred: High-dose ICS + LABA + oral systemic corticosteroid
- Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

**Step 5**
- Preferred: High-dose ICS + LABA + oral systemic corticosteroid
- Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Quick-Relief Medication for All Patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.

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; SABA, inhaled short-acting beta₂-agonist
# Pediatric/Adolescent Asthma Therapy Assessment Questionnaire (ATAQ)

**Patient Name:** ________________________________________________  
**ID Number:** __________________________________________________

**Physician Name:** ___________________________ **Date:** ____________

Please have the parent or guardian complete this questionnaire.

**INSTRUCTIONS:** Check 1 answer to each question and enter point value (0 or 1) on line. Add numbers in the **light blue** area and enter total **SCORE** here. Add numbers in the **dark blue** area and enter total **SCORE** here. If either **SCORE** is 1 or greater, discuss questionnaire with your doctor.

## Control Issues

1. In the past 4 weeks, did your child:
   a) Have wheezing or difficulty breathing when exercising?  
      - [ ] Yes (1)  
      - [ ] No (0)  
      - [ ] Unsure (1)  
   
   b) Have wheezing during the day when not exercising?  
      - [ ] Yes (1)  
      - [ ] No (0)  
      - [ ] Unsure (1)  
   
   c) Wake up at night with wheezing or difficulty breathing?  
      - [ ] Yes (1)  
      - [ ] No (0)  
      - [ ] Unsure (1)  
   
   d) Miss days of school because of his/her asthma?  
      - [ ] Yes (1)  
      - [ ] No (0)  
      - [ ] Unsure (1)  
   
   e) Miss any daily activities (such as playing, going to a friend's house, or any family activity) because of asthma?  
      - [ ] Yes (1)  
      - [ ] No (0)  
      - [ ] Unsure (1)  

## Other Issues

2. Does your child use an inhaler or a nebulizer for quick relief from asthma symptoms?  
   - [ ] Yes  
   - [ ] No  
   - [ ] Unsure

   (If Yes) In the past 4 weeks, what was the greatest number of times in 1 day your child used this inhaler/nebulizer?
   - [ ] 0  
   - [ ] 1 to 2  
   - [ ] 3 to 4  
   - [ ] 5 to 6  
   - [ ] More than 6

   Enter score ________

3. Has your child ever had a prescription for an asthma medicine that is NOT used for quick relief but is used to control his/her asthma?  
   - [ ] Yes  
   - [ ] No  
   - [ ] Unsure

   (If Yes or Unsure) What best describes how your child takes this medicine now?
   - Takes it every day  
     - [ ] (0)  
   - Takes it some days, but not other days  
     - [ ] (1)  
   - Used to take it, but now does not  
     - [ ] (1)

   Enter score ________

4. Are you dissatisfied with any part of your child's current asthma treatment?  
   - [ ] Yes (1)  
   - [ ] No (0)  
   - [ ] Unsure (1)

5. Do you believe that:
   a) Your child's asthma was well controlled in the past 4 weeks?  
      - [ ] Yes (0)  
      - [ ] No (1)  
      - [ ] Unsure (1)
   
   b) Your child is able to take his/her asthma medicine(s) as directed?  
      - [ ] Yes (0)  
      - [ ] No (1)  
      - [ ] Unsure (1)
   
   c) Your child's medicine(s) is useful for controlling his/her asthma?  
      - [ ] Yes (0)  
      - [ ] No (1)  
      - [ ] Unsure (1)

6. During this office visit, would you like the doctor to discuss:
   a) Different types of drugs available to control asthma?  
      - [ ] (1)
   
   b) Your child's asthma treatment options?  
      - [ ] (1)
   
   c) How your child prefers to take his/her asthma medicine(s)?  
      - [ ] (1)
   
   d) Other issues?  
      - [ ] (1)

   Enter score ________

---

*This reflects a lower threshold to identify potential control problems than was used in the ATAQ validation studies. This modification was designed to encourage patients and providers to discuss how asthma medications are being used.
# Asthma Control Test

**Know your score**

The Asthma Control Test™ provides a numerical score to help you and your healthcare provider determine if your asthma symptoms are well controlled.

Take this test if you are 12 years or older. Share the score with your healthcare provider.

**Step 1:** Write the number of each answer in the score box provided.

**Step 2:** Add up each score box for the total.

**Step 3:** Take the completed test to your healthcare provider to talk about your score.

If your score is 19 or less, your asthma symptoms may not be as well controlled as they could be. No matter what the score, bring this test to your healthcare provider to talk about the results.

1. In the **past 4 weeks**, how much of the time did your **asthma** keep you from getting as much done at work, school or at home?  
   - All of the time [1]  
   - Most of the time [2]  
   - Some of the time [3]  
   - A little of the time [4]  
   - None of the time [5]  

2. During the **past 4 weeks**, how often have you had shortness of breath?  
   - More than a day [1]  
   - Once a day [2]  
   - 3 to 6 times a week [3]  
   - Once or twice a week [4]  
   - Not at all [5]  

3. During the **past 4 weeks**, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?  
   - 4 or more nights a week [1]  
   - 2 to 3 nights a week [2]  
   - Once a week [3]  
   - Once or twice a week [4]  
   - Not at all [5]  

4. During the **past 4 weeks**, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?  
   - 3 or more times per day [1]  
   - 1 or 2 times per day [2]  
   - 2 or 3 times per week [3]  
   - Once a week or less [4]  
   - Not at all [5]  

5. How would you rate your asthma control during the past 4 weeks?  
   - Not Controlled [1]  
   - Poorly Controlled [2]  
   - Somewhat Controlled [3]  
   - Well Controlled [4]  
   - Completely Controlled [5]  

If your score is 19 or less, your asthma symptoms may not be as well controlled as they could be. No matter what your score is, share the results with your healthcare provider.

---

**Score Calculation:**  
(total of the above scores)

**TOTAL:**  

---

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Asthma Control Test is a trademark of QualityMetric Incorporated.  
This material was developed by GSK.
## Asthma Control Questionnaire (ACQ)

<table>
<thead>
<tr>
<th>Table 1. Asthma Control Questionnaire, 5-item version (ACQ 5)(^{14,15})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the number of the response that best describes how you have been during the past week</td>
</tr>
</tbody>
</table>

1. **On average, during the past week, how often were you woken by your asthma during the night?**
   - 0. Never
   - 1. Hardly ever
   - 2. A few times
   - 3. Several times
   - 4. Many times
   - 5. A great many times
   - 6. Unable to sleep because of asthma

2. **On average, during the past week, how bad were your asthma symptoms when you woke up in the morning?**
   - 0. No symptoms
   - 1. Very mild symptoms
   - 2. Mild symptoms
   - 3. Moderate symptoms
   - 4. Quite severe symptoms
   - 5. Severe symptoms
   - 6. Very severe symptoms

3. **In general, during the past week, how limited were you in your activities because of your asthma?**
   - 0. Not limited at all
   - 1. Very slightly limited
   - 2. Slightly limited
   - 3. Moderately limited
   - 4. Very limited
   - 5. Extremely limited
   - 6. Totally limited

4. **In general, during the past week, how much shortness of breath did you experience because of your asthma?**
   - 0. None
   - 1. Very little
   - 2. A little
   - 3. A moderate amount
   - 4. Quite a lot
   - 5. A great deal
   - 6. A very great deal

5. **In general, during the past week, how much of the time did you wheeze?**
   - 0. Not at all
   - 1. Hardly any of the time
   - 2. A little of the time
   - 3. A moderate amount of the time
   - 4. A lot of the time
   - 5. Most of the time
   - 6. All the time
Acute Exacerbations

Goals of Treatment

Goals

Correction of significant hypoxemia

Rapid reversal of airflow obstruction

Reduction of likelihood of relapse of exacerbation or recurrence of future obstruction by intensifying therapy

Careful assessment and monitoring
## Classification of Severity of Asthma Exacerbations

<table>
<thead>
<tr>
<th></th>
<th>Symptoms and Signs</th>
<th>Initial PEF (or FEV1)</th>
<th>Clinical Course</th>
</tr>
</thead>
</table>
| **Mild**       | Dyspnea only with activity (assess tachypnea in young children) | PEF ≥ 70 percent predicted or personal best | - Usually cared for at home  
- Prompt relief with inhaled SABA  
- Possible short course of oral systemic corticosteroids |
| **Moderate**   | Dyspnea interferes with or limits usual activity | PEF 40–69 percent predicted or personal best | - Usually requires office or ED visit  
- Relief from frequent inhaled SABA  
- Oral systemic corticosteroids; some symptoms last for 1–2 days after treatment is begun |
| **Severe**     | Dyspnea at rest; interferes with conversation | PEF <40 percent predicted or personal best | - Usually requires ED visit and likely hospitalization  
- Partial relief from frequent inhaled SABA  
- Oral systemic corticosteroids; some symptoms last for >3 days after treatment is begun  
- Adjunctive therapies are helpful |
| **Subset: Life threatening** | Too dyspneic to speak; perspiring | PEF <25 percent predicted or personal best | - Requires ED/hospitalization; possible ICU  
- Minimal or no relief from frequent inhaled SABA  
- Intravenous corticosteroids  
- Adjunctive therapies are helpful |
Management of Acute Exacerbations in Children

**Prevention**
- Patient Education
- Recognition of early signs of worsening
- Appropriate intensification of therapy by increasing SABA and adding short course of OCS
- Removal or withdrawal from of the environmental factor contributing to exacerbation
- Prompt communication between patient and clinician about serious deterioration in symptoms or peak flow, decreased responsiveness to SABAs, or decreased duration of effect

**Assessment**
- Serial measurements of lung function
- Pulse oximetry
- Signs and symptoms scores

**Intervention**
- Oxygen to relieve hypoxemia in moderate or severe exacerbations
- SABA to relieve airflow obstruction
- Addition of inhaled ipratropium bromide in severe exacerbations
- Systemic corticosteroids in moderate or severe exacerbations or for patients who fail to promptly and completely to SABA
- Consideration of adjunct treatment - magnesium sulfate or heliox, in severe exacerbations unresponsive to initial treatments mentioned
- Referral to followup care within 1-4 weeks, Asthma Action Plan, Education
## Special Situations

### Exercise Induced Bronchospasm (EIB)

#### Diagnosis
- Exercise challenge
- Undertake task that caused previous symptoms
- Finding of 15 percent decrease in PEF or FEV1

#### Management Strategies
- Inhaled beta2-agonists. SABA shortly before exercise or as close as exercise as possible. LABA can be protective up to 12 hours. With LABA some shortening of the duration of protection can occur with daily use.
- LTRAs can attenuate EIB
- Cromolyn taken shortly before exercise is an alternative treatment, but not as effective as SABA
- Warmup period prior to exercise can reduce degree of EIB
- Mask or scarf over mouth may attenuate cold-induced EIB
## Special Situations

### Surgery and Asthma

<table>
<thead>
<tr>
<th>Pre-surgery</th>
<th>Intra and Post-surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Review of systems</td>
<td>• For patients who have been on a long-term high-dose ICS, give 100mg hydrocortisone every 8 hours intravenously during the surgical period</td>
</tr>
<tr>
<td>• Review medication use (use of OCS for longer than 2 weeks in the past 6 months)</td>
<td>• Reduce the dose rapidly within 24 hours after surgery</td>
</tr>
<tr>
<td>• Measurement of pulmonary function</td>
<td>• Stress doses of corticosteroids may be considered for select patients treated with prior high-dose ICS</td>
</tr>
<tr>
<td>• If possible attempts should be made to improve lung function to either their predicted values (FEV1) or their personal best level (peak flow PEFR)</td>
<td></td>
</tr>
<tr>
<td>• Short course of OCS may be necessary to optimize lung function</td>
<td></td>
</tr>
</tbody>
</table>
### Special Situations

#### Pregnancy and Asthma

<table>
<thead>
<tr>
<th>Monitoring Recommendations</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Monitoring of asthma status during prenatal visits is encouraged since asthma improves for one-third and worsens for one-third of women</td>
<td>• Monitoring of asthma status during prenatal visits is encouraged since asthma improves for one-third and worsens for one-third of women</td>
</tr>
<tr>
<td>• Monthly evaluations of asthma history</td>
<td>• Monthly evaluations of asthma history</td>
</tr>
<tr>
<td>• Monthly PFT</td>
<td>• Monthly PFT</td>
</tr>
<tr>
<td>• Measurement with a peak flow meter may be sufficient</td>
<td>• Measurement with a peak flow meter may be sufficient</td>
</tr>
<tr>
<td>• Evaluations will determine whether to step up or step down treatment</td>
<td>• Evaluations will determine whether to step up or step down treatment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Albuterol</strong> is the preferred SABA due to its safety profile and most data related to safety during human pregnancy</td>
<td>• <strong>Albuterol</strong> is the preferred SABA due to its safety profile and most data related to safety during human pregnancy</td>
</tr>
<tr>
<td>• ICS are the preferred treatment for long-term control medication. <strong>Budesonide</strong> is the preferred ICS due to its safety profile and most data related to safety during human pregnancy</td>
<td>• ICS are the preferred treatment for long-term control medication. <strong>Budesonide</strong> is the preferred ICS due to its safety profile and most data related to safety during human pregnancy</td>
</tr>
<tr>
<td>• For treatment of comorbid conditions, <strong>intranasal corticosteroids</strong> are recommended for treatment of allergic rhinitis because of its low risk of systemic effect. <strong>Current second-generation antihistamines of choice are l</strong></td>
<td>• For treatment of comorbid conditions, <strong>intranasal corticosteroids</strong> are recommended for treatment of allergic rhinitis because of its low risk of systemic effect. <strong>Current second-generation antihistamines of choice are l</strong></td>
</tr>
<tr>
<td></td>
<td>oratadine and <strong>cetirizine</strong></td>
</tr>
</tbody>
</table>
# Medications - Long-term Usual Dosages Age 5-11

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>0–4 years</th>
<th>5–11 years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systemic Corticosteroids</strong></td>
<td></td>
<td></td>
<td></td>
<td>(Applies to all three corticosteroids)</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>2, 4, 8, 16, 32 mg tablets</td>
<td>0.25–2 mg/kg daily in single dose in a.m. or qod as needed for control</td>
<td>0.25–2 mg/kg daily in single dose in a.m. or qod as needed for control</td>
<td>For long-term treatment of severe persistent asthma, administer single dose in a.m. every 3–4 days (alternate-day therapy may produce less adrenal suppression).</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>5 mg tablets, 5 mg/5 cc, 15 mg/5 cc</td>
<td>Short-course &quot;burst&quot;: 1–2 mg/kg/day, maximum 30 mg/day for 3–10 days</td>
<td>Short-course &quot;burst&quot;: 1–2 mg/kg/day, maximum 60 mg/day for 3–10 days</td>
<td>Short courses or &quot;bursts&quot; are effective for establishing control when initiating therapy or during a period of gradual deterioration.</td>
</tr>
<tr>
<td>Prednisone</td>
<td>1, 2, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc</td>
<td>Safety and efficacy not established in children &lt;4 years</td>
<td>1 blister q 12 hours</td>
<td>There is no evidence that tapering the dose following improvement in symptom control and pulmonary function prevents relapse.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Patients receiving the lower dose (1 mg/kg/day) experience fewer behavioral side effects (Kayani and Shannon 2002), and it appears to be equally efficacious (Rachelefsky 2003).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For patients unable to tolerate the liquid preparations, dexamethasone syrup at 0.4 mg/kg/day may be an alternative. Studies are limited, however, and the longer duration of activity increases the risk of adrenal suppression (Hendele).</td>
</tr>
<tr>
<td><strong>Long-Acting Beta&lt;sub&gt;2&lt;/sub&gt;-Agonists (LABAs)</strong></td>
<td></td>
<td></td>
<td></td>
<td>Should not be used for symptom relief or exacerbations. Use only with ICSs.</td>
</tr>
<tr>
<td>Salmeterol</td>
<td>DPI 50 mcg/ blister</td>
<td>Safety and efficacy not established in children &lt;4 years</td>
<td>1 blister q 12 hours</td>
<td>Decreased duration of protection against EIB may occur with regular use.</td>
</tr>
<tr>
<td>Formoterol</td>
<td>DPI 12 mcg/ single-use capsule</td>
<td>Safety and efficacy not established in children &lt;5 years</td>
<td>1 capsule q 12 hours</td>
<td>Most children &lt;4 years of age cannot provide sufficient inspiratory flow for adequate lung delivery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Do not blow into inhaler after dose is activated.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Most children &lt;4 years of age cannot provide sufficient inspiratory flow for adequate lung delivery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Each capsule is for single use only; additional doses should not be administered for at least 12 hours.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Capsules should be used only with the inhaler and should not be taken orally.</td>
</tr>
</tbody>
</table>

*Dosages are provided for those products that have been approved by the U.S. Food and Drug Administration or have sufficient clinical trial safety and efficacy data in the appropriate age ranges to support their use.*
### Medications - Long-term
Usual Dosages Age 5-11

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>0–4 years</th>
<th>5–11 years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combined Medication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Fluticasone/Salmeterol      | DPI 100 mcg/50 mcg | Safety and efficacy not established in children <4 years | 1 inhalation bid | - There have been no clinical trials in children <4 years of age.  
- Most children <4 years of age cannot provide sufficient inspiratory flow for adequate lung delivery.  
- Do not blow into inhaler after dose is activated. |
| Budesonide/Formoterol       | HFA MDI 80 mcg/4.5 mcg | Safety and efficacy not established | 2 puffs bid | - There have been no clinical trials in children <4 years of age.  
| **Cromolyn/Nedocromil**     |             |           |            |          |
| Cromolyn                   | MDI 0.8 mg/puff | Safety and efficacy not established | 2 puffs qid | - 4–6 week trial may be needed to determine maximum benefit.  
- Dose by MDI may be inadequate to affect hyperresponsiveness.  
- One dose before exercise or allergen exposure provides effective prophylaxis for 1–2 hours. Not as effective as inhaled β2-agonists for EIB.  
- Once control is achieved, the frequency of dosing may be reduced. |
| Nebulizer                  | 20 mg/ampule | Safety and efficacy not established <2 years | 1 ampule qid |
| Nedocromil                 | MDI 1.75 mg/puff | Safety and efficacy not established <6 years | 2 puffs qid |
| **Leukotriene Receptor Antagonists (LTRAs)** |        |           |            |          |
| Montelukast                | 4 mg or 5 mg chewable tablet 4 mg granule packets | Safety and efficacy not established | 4 mg qhs (1–5 years of age) | Montelukast exhibits a flat dose-response curve. |
| Zafirlukast                | 10 mg tablet | Safety and efficacy not established | 10 mg bid (7–11 years of age) | No more efficacious than placebo in infants 6–24 months (van Adelsberg et al. 2005).  
- For zafirlukast, administration with meals decreases bioavailability; take at least 1 hour before or 2 hours after meals.  
- Monitor for signs and symptoms of hepatic dysfunction. |
| **Methylxanthines**        |             |           |            |          |
| Theophylline                | Liquids, sustained-release tablets, and capsules | Starting dose 10 mg/kg/day; usual maximum:  
- <1 year of age: 0.2 (age in weeks) + 5 = mg/kg/day  
- ≥1 year of age: 10 mg/kg/day | Starting dose 10 mg/kg/day; usual maximum: 16 mg/kg/day | Adjust dosage to achieve serum concentration of 5–15 mcg/mL at steady-state (at least 48 hours on same dosage).  
- Due to wide interpatient variability in theophylline metabolic clearance, routine serum theophylline level monitoring is essential.  
- See next page for factors that can affect theophylline levels. |

Key: DPI, dry powder inhaler; EIB, exercise-induced bronchospasm; HFA, hydrofluoroalkane (inhaler propellant); MDI, metered dose inhaler
# Medications - Quick-relief Usual Dosages Age 5-11

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>0–4 Years</th>
<th>5–11 Years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhaled Short-Acting Beta₂-Agonists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol CFC</td>
<td>90 mcg/puff,</td>
<td>1–2 puffs</td>
<td>2 puffs</td>
<td>Differences in potencies exist, but all products are essentially comparable on a per puff basis. An increasing use or lack of expected effect indicates diminished control of asthma. Not recommended for long-term daily treatment. Regular use exceeding 2 days/week for symptom control (not prevention of EIB) indicates the need for additional long-term control therapy. May double usual dose for mild exacerbations. Should prime the inhaler by releasing 4 actuations prior to use. Periodically clean HFA actuator, as drug may plug orifice. Children &lt;4 years may not generate sufficient inspiratory flow to activate an auto-inhaler. Nonselective agents (i.e., epinephrine, isoproterenol, metaproterenol) are not recommended due to their potential for excessive cardiac stimulation, especially in high doses.</td>
</tr>
<tr>
<td></td>
<td>200 puffs/canister</td>
<td>5 minutes before exercise</td>
<td>5 minutes before exercise</td>
<td></td>
</tr>
<tr>
<td>Albuterol HFA</td>
<td>90 mcg/puff,</td>
<td>2 puffs every 4–6 hours as needed</td>
<td>2 puffs every 4–6 hours as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 puffs/canister</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td>Levalbuterol HFA</td>
<td>45 mcg/puff,</td>
<td>Safety and efficacy not established in children &lt;4 years</td>
<td>2 puffs every 4–6 hours as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 puffs/canister</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td>Pirbuterol CFC Autohaler</td>
<td>200 mcg/puff,</td>
<td>Safety and efficacy not established</td>
<td>Safety and efficacy not established</td>
<td></td>
</tr>
<tr>
<td></td>
<td>400 puffs/canister</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td><strong>Nebulizer solution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol</td>
<td>0.63 mg/3 mL</td>
<td>0.63–2.5 mg in 3 cc of saline q 4–6 hours, as needed</td>
<td>1.25–5 mg in 3 cc of saline q 4–8 hours, as needed</td>
<td>May mix with cromolyn solution, budesonide inhalant suspension, or ipratropium solution for nebulization. May double dose for severe exacerbations.</td>
</tr>
<tr>
<td></td>
<td>1.25 mg/3 mL</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5 mg/3 mL</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 mg/mL (0.5%)</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td>Levalbuterol (R-albuterol)</td>
<td>0.31 mg/3 mL</td>
<td>0.31–1.25 mg in 3 cc q 4–6 hours, as needed</td>
<td>0.31–0.63 mg, q 8 hours, as needed</td>
<td>Does not have FDA-approved labeling for children &lt;6 years of age. The product is a sterile-filled preservative-free unit dose vial. Compatible with budesonide inhalant suspension.</td>
</tr>
<tr>
<td></td>
<td>0.63 mg/3 mL</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25 mg/0.5 mL</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25 mg/3 mL</td>
<td>as needed</td>
<td>as needed</td>
<td></td>
</tr>
</tbody>
</table>
## Medications - Quick-relief
### Usual Dosages Age 5-11

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>0–4 Years</th>
<th>5–11 Years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticholinergics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Ipratropium HFA          | MDI         | Safety and efficacy not established | Safety and efficacy not established | - Evidence is lacking for anticholinergics producing added benefit to beta₂-agonists in long-term control asthma therapy.  
- See “Management of Acute Asthma” for dosing in ED. |
|                          | Nebulizer solution | Safety and efficacy not established | Safety and efficacy not established | |
|                          | 0.25 mg/mL (0.025%) |           |            |                                                                          |
| **Systemic Corticosteroids** |       |           |            |                                                                          |
| Methylprednisolone       | 2, 4, 6, 8, 16, 32 mg tablets | Short course “burst”: 1–2 mg/kg/day; maximum 60 mg/day, for 3–10 days | Short course “burst”: 40–60 mg/day as single or 2 divided doses for 3–10 days | 
- Applies to the first three corticosteroids 
- Short courses or “bursts” are effective for establishing control when initiating therapy or during a period of gradual deterioration.  
- The burst should be continued until patient achieves 80% PEF personal best or symptoms resolve. This usually requires 3–10 days but may require longer. There is no evidence that tapering the dose following improvement prevents relapse. |
| Prednisolone             | 5 mg tablets, 5 mg/5 cc, 15 mg/5 cc |           |            |                                                                          |
| Prednisone               | 1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc |           |            |                                                                          |
| (Methylprednisolone acetate) | Repository injection | 40 mg/mL 80 mg/mL | 7.5 mg/kg IM once 240 mg IM once | - May be used in place of a short burst of oral steroids in patients who are vomiting or if adherence is a problem. |

Key: CFC, chlorofluorocarbon; ED, emergency department; EIB, exercise-induced bronchospasm; HFA, hydrofluoroalkane; IM, intramuscular; MDI, metered-dose inhaler; PEF, peak expiratory flow

*Dosages are provided for those products that have been approved by the U.S. Food and Drug Administration or have sufficient clinical trial safety and efficacy data in the appropriate age ranges to support their use.
## Medications - Long-term Usual Dosages Age 12+

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>Adult Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhaled Corticosteroids (ICS)</strong></td>
<td></td>
<td></td>
<td>(Applies to all three corticosteroids)</td>
</tr>
<tr>
<td><strong>Systemic Corticosteroids</strong></td>
<td></td>
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<tr>
<td>Methylprednisolone</td>
<td>2, 4, 8, 16, 32 mg tablets</td>
<td>7.5–60 mg daily in a single dose in a.m. or qod as needed for control</td>
<td>For long-term treatment of severe persistent asthma, administer single dose in a.m. either daily or on alternate days (alternate-day therapy may produce less adrenal suppression). Short courses or “bursts” are effective for establishing control when initiating therapy or during a period of gradual deterioration. There is no evidence that tapering the dose following improvement in symptom control and pulmonary function prevents relapse.</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>5 mg tablets, 5 mg/5 cc, 15 mg/5 cc</td>
<td>Short-course “burst” to achieve control, 40–60 mg per day as single or 2 divided doses for 3–10 days</td>
<td></td>
</tr>
<tr>
<td>Prednisone</td>
<td>1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc; 5 mg/5 cc</td>
<td></td>
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</tr>
<tr>
<td><strong>Inhaled Long-Acting Beta₂-Agonists (LABA)</strong></td>
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<tr>
<td>Salmeterol</td>
<td>DPI 50 mcg/ blister</td>
<td>1 blister q 12 hours</td>
<td>Should not be used for symptom relief or exacerbations. Use with ICS. Decreased duration of protection against EIB may occur with regular use.</td>
</tr>
<tr>
<td>Formoterol</td>
<td>DPI 12 mcg/ single-use capsule</td>
<td>1 capsule q 12 hours</td>
<td>Each capsule is for single use only; additional doses should not be administered for at least 12 hours. Capsules should be used only with the Aerolizer® inhaler and should not be taken orally.</td>
</tr>
<tr>
<td><strong>Combined Medication</strong></td>
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<tr>
<td>Fluticasone/Salmeterol</td>
<td>DPI 100 mcg/50 mcg, 250 mcg/50 mcg, or 500 mcg/50 mcg</td>
<td>1 inhalation bid; dose depends on severity of asthma</td>
<td>100/50 DPI or 45/21 HFA for patient 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 45 mcg/21 mcg</td>
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<tr>
<td></td>
<td>115 mcg/21 mcg</td>
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</tr>
<tr>
<td></td>
<td>230 mcg/21 mcg</td>
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</tr>
<tr>
<td>Budesonide/Formoterol</td>
<td>HFA MDI 80 mcg/4.5 mcg, 160 mcg/4.5 mcg</td>
<td>2 inhalations bid; dose depends on severity of asthma</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>
</tbody>
</table>
### Medications - Long-term Usual Dosages Age 12+

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<thead>
<tr>
<th>Medication</th>
<th>Dosage Form</th>
<th>Adult Dose</th>
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</thead>
<tbody>
<tr>
<td>Cromolyn and Nedocromil</td>
<td></td>
<td></td>
<td>4–6 week trial may be needed to determine maximum benefit.</td>
</tr>
<tr>
<td>Cromolyn</td>
<td>MDI</td>
<td>2 puffs qid</td>
<td>Dose by MDI may be inadequate to affect hyperresponsiveness.</td>
</tr>
<tr>
<td>0.8 mg/puff</td>
<td></td>
<td></td>
<td>One dose before exercise or allergen exposure provides effective prophylaxis for 1–2 hours. Not as effective for EIB as SABA.</td>
</tr>
<tr>
<td>Nebulizer</td>
<td>1 ampule qid</td>
<td></td>
<td>Once control is achieved, the frequency of dosing may be reduced.</td>
</tr>
<tr>
<td>20 mg/ampule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nedocromil</td>
<td>MDI</td>
<td>2 puffs qid</td>
<td></td>
</tr>
<tr>
<td>1.75 mg/puff</td>
<td></td>
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</tr>
<tr>
<td>Leukotriene Modifiers</td>
<td></td>
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</tr>
<tr>
<td>Leukotriene Receptor Antagonists</td>
<td></td>
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</tr>
<tr>
<td>Montelukast</td>
<td>4 mg or 5 mg</td>
<td>10 mg qhs</td>
<td>Montelukast exhibits a flat dose-response curve. Doses &gt;10 mg will not produce a greater response in adults.</td>
</tr>
<tr>
<td>chewable tablet</td>
<td>10 mg tablet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zafirlukast</td>
<td>10 or 20 mg tablet</td>
<td>40 mg daily</td>
<td>For zafirlukast, administration with meals decreases bioavailability; take at least 1 hour before or 2 hours after meals.</td>
</tr>
<tr>
<td>(20 mg tablet bid)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-Lipoxygenase Inhibitor</td>
<td></td>
<td></td>
<td>Monitor for signs and symptoms of hepatic dysfunction.</td>
</tr>
<tr>
<td>Zileuton</td>
<td>600 mg tablet</td>
<td>2,400 mg daily</td>
<td>For zileuton, monitor hepatic enzymes (ALT).</td>
</tr>
<tr>
<td>(give tablets qid)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylxanthines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theophylline</td>
<td>Liquids, sustained-</td>
<td>Starting dose 10 mg/</td>
<td>Adjust dosage to achieve serum concentration of 5–15 mcg/mL at steady-state (at least 48 hours on same dosage).</td>
</tr>
<tr>
<td></td>
<td>release tablets, and</td>
<td>kg/day up to 300 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>capsules</td>
<td>maximum; usual</td>
<td>Due to wide interpatient variability in theophylline metabolic clearance, routine serum theophylline level monitoring is important.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>maximum 800 mg/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See next page for factors that can affect theophylline levels.</td>
</tr>
<tr>
<td>Immunomodulators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omalizumab</td>
<td>Subcutaneous injection, 150 mg/1.2 mL following reconstitution with 1.4 mL sterile water for injection</td>
<td>150–375 mg SC q 2–4 weeks, depending on body weight and pretreatment serum IgE level</td>
<td>Do not administer more than 150 mg per injection site.</td>
</tr>
<tr>
<td></td>
<td>2–4 weeks, depending on body weight and pretreatment serum IgE level</td>
<td></td>
<td>Monitor for anaphylaxis for 2 hours following at least the first 3 injections.</td>
</tr>
</tbody>
</table>

Key: DPI, dry powder inhaler; EIB, exercise-induced bronchospasms; HFA, hydrofluoroalkane; IgE, immunoglobulin E; MDI, metered-dose inhaler; SABA, short-acting beta-agonist
### Medications - Quick-relief

#### Usual Dosages Age 12+

<table>
<thead>
<tr>
<th>Medication</th>
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<th>Adult Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhaled Short-Acting Beta₂-Agonists (SABA)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol CFC</td>
<td>90 mcg/puff, 200 puffs/canister</td>
<td>2 puffs 5 minutes before exercise</td>
<td>- An increasing use or lack of expected effect indicates diminished control of asthma.</td>
</tr>
<tr>
<td>Albuterol HFA</td>
<td>90 mcg/puff, 200 puffs/canister</td>
<td>2 puffs every 4–6 hours as needed</td>
<td>- Not recommended for long-term daily treatment. Regular use exceeding 2 days/week for symptom control (not prevention of EIB) indicates the need to step up therapy.</td>
</tr>
<tr>
<td>Pirbuterol CFC</td>
<td>200 mcg/puff, 400 puffs/canister</td>
<td></td>
<td>- Differences in potency exist, but all products are essentially comparable on a per puff basis.</td>
</tr>
<tr>
<td>Levalbuterol HFA</td>
<td>45 mcg/puff, 200 puffs/canister</td>
<td></td>
<td>- May double usual dose for mild exacerbations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Should prime the inhaler by releasing 4 actuations prior to use.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Periodically clean HFA activator, as drug may block/plug orifice.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Nonselective agents (i.e., epinephrine, isoproterenol, metaproterenol) are not recommended due to their potential for excessive cardiac stimulation, especially in high doses.</td>
</tr>
<tr>
<td><strong>Nebulizer solution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuterol</td>
<td>0.63 mg/3 mL 1.25 mg/3 mL 2.5 mg/3 mL 5 mg/mL (0.5%)</td>
<td>1.25–5 mg in 3 cc of saline q 4–8 hours as needed</td>
<td>- May mix with budesonide inhalant suspension, cromolyn or ipratropium nebulizer solutions. May double dose for severe exacerbations.</td>
</tr>
<tr>
<td>Levalbuterol (R-albuterol)</td>
<td>0.31 mg/3 mL 0.63 mg/3 mL 1.25 mg/0.5 mL 1.25 mg/3 mL</td>
<td>0.63 mg–1.25 mg q 8 hours as needed</td>
<td>- Compatible with budesonide inhalant suspension. The product is a sterile-filled, preservative-free, unit dose vial.</td>
</tr>
</tbody>
</table>
## Medications - Quick-relief
### Usual Dosages Age 12+

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<th>Medication</th>
<th>Dosage Form</th>
<th>Adult Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticholinergics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ipratropium HFA</td>
<td><strong>MDI</strong></td>
<td>2–3 puffs q 6 hours</td>
<td>Evidence is lacking for anticholinergics producing added benefit to beta-agonists in long-term control asthma therapy.</td>
</tr>
<tr>
<td></td>
<td>17 mcg/puff, 200 puffs/canister</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Nebulizer solution</strong></td>
<td>0.25 mg/mL (0.025%)</td>
<td>0.25 mg q 6 hours</td>
</tr>
<tr>
<td>Ipratropium with albuterol</td>
<td><strong>MDI</strong></td>
<td>2–3 puffs q 6 hours</td>
<td>Contains EDTA to prevent discoloration of the solution. This additive does not induce bronchospasm.</td>
</tr>
<tr>
<td></td>
<td>18 mcg/puff of ipratropium bromide and 90 mcg/puff of albuterol</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>200 puffs/canister</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Nebulizer solution</strong></td>
<td>0.5 mg/3 mL ipratropium bromide and 2.5 mg/3 mL albuterol</td>
<td>3 mL q 4–6 hours</td>
</tr>
<tr>
<td><strong>Systemic Corticosteroids</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>2, 4, 6, 8, 16, 32 mg tablets</td>
<td></td>
<td>Short course “burst”: 40–60 mg/day as single or 2 divided doses for 3–10 days</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>5 mg tablets, 5 mg/5 cc, 15 mg/5 cc</td>
<td></td>
<td>Short courses or “bursts” are effective for establishing control when initiating therapy or during a period of gradual deterioration.</td>
</tr>
<tr>
<td>Prednisone</td>
<td>1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc</td>
<td></td>
<td>The burst should be continued until symptoms resolve and the PEF is at least 80 percent of personal best. This usually requires 3–10 days but may require longer. There is no evidence that tapering the dose following improvement prevents relapse.</td>
</tr>
<tr>
<td><strong>Repository injection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Methylprednisolone acetate)</td>
<td>40 mg/mL, 80 mg/mL</td>
<td>240 mg IM once</td>
<td>May be used in place of a short burst of oral steroids in patients who are vomiting or if adherence is a problem.</td>
</tr>
</tbody>
</table>

Key: CFC, chlorofluorocarbon; EIB, exercise-induced bronchospasm; HFA, hydrofluoralkane; IM, intramuscular; MDI, metered-dose inhaler; PEF, peak expiratory flow
## Medications Long-term

<table>
<thead>
<tr>
<th>Name/Products</th>
<th>Indications/Mechanisms</th>
<th>Potential Adverse Effects</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-Acting Beta₂-Agonists (SABA)</strong></td>
<td>■ Relief of acute symptoms; quick-relief medication.</td>
<td>■ Tachycardia, skeletal muscle tremor, hypokalemia, increased</td>
<td>■ Drugs of choice for acute bronchospasm. Inhaled route has faster onset, fewer adverse effects, and is more</td>
</tr>
<tr>
<td>Inhaled SABA:</td>
<td>■ Preventive treatment for EIB prior to exercise.</td>
<td>lactic acid, headache, hyperglycemia. Inhaled</td>
<td>effective than systemic routes. The less beta₂-selective agents (isoproterenol, metaproterenol, isethionate,</td>
</tr>
<tr>
<td>Albuterol</td>
<td>■ Bronchodilation. Binds to the beta₂-adrenergic receptor, producing smooth muscle</td>
<td>route, in general, causes few systemic adverse effects. Patients</td>
<td>and epinephrine) are not recommended due to their potential for excessive cardiac stimulation, especially</td>
</tr>
<tr>
<td>Levalbuterol</td>
<td>relaxation following adenylyl cyclase activation and increase in cyclic AMP producing</td>
<td>with preexisting cardiovascular disease, especially the elderly,</td>
<td>in high doses. Oral systemic beta₂-agonists are not recommended.</td>
</tr>
<tr>
<td>Pirbuterol</td>
<td>functional antagonism of bronchoconstriction.</td>
<td>may have adverse cardiovascular reactions with inhaled therapy.</td>
<td></td>
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</tbody>
</table>
# Medications

## Long-term

<table>
<thead>
<tr>
<th>Name/Products (Listed Alphabetically)</th>
<th>Indications/Mechanisms</th>
<th>Potential Adverse Effects</th>
<th>Therapeutic Issues (Not All Inclusive)</th>
</tr>
</thead>
</table>
| Leukotriene Receptor Antagonists (LTRAs) | *Mechanisms*  
- Leukotriene receptor antagonist; selective competitive inhibitor of CysLT₁ receptor.  
- Montelukast tablets and granules | *Indications*  
- Long-term control and prevention of symptoms in mild persistent asthma for patients ≥1 year of age. May also be used with ICS as combination therapy in moderate persistent asthma. | *Indications*  
- No specific adverse effects have been identified.  
- Rare cases of Churg-Strauss have occurred, but the association is unclear. |
|  |  |  | *Therapeutic Issues*  
- May attenuate EIB in some patients, but less effective than ICS therapy (Vidal et al. 2001).  
- Do not use LTRA + LABA as a substitute for ICS + LABA. |
|  |  |  | *Therapeutic Issues*  
- A flat dose-response curve, without further benefit, if dose is increased above those recommended. |
| Zafirlukast tablets | *Indications*  
- Long-term control and prevention of symptoms in mild persistent asthma for patients ≥7 years of age. May also be used with ICS as combination therapy in moderate persistent asthma. | *Mechanisms*  
- Postmarketing surveillance has reported cases of reversible hepatitis and, rarely, irreversible hepatic failure resulting in death and liver transplantation. | *Therapeutic Issues*  
- Administration with meals decreases bioavailability; take at least 1 hour before or 2 hours after meals.  
- Zafirlukast is a microsomal P450 enzyme inhibitor that can inhibit the metabolism of warfarin. INRs should be monitored during coadministration.  
- Patients should be warned to discontinue use if they experience signs and symptoms of liver dysfunction (right upper quadrant pain, pruritis, lethargy, jaundice, nausea), and patients' ALTs should be monitored. |
| 5-Lipoxygenase Inhibitor | *Mechanisms*  
- Inhibits the production of leukotrienes from arachidonic acid, both LTB₄ and the cysteinyll leukotrienes. |  |  |
| Zileuton tablets | *Indications*  
- Long-term control and prevention of symptoms in mild persistent asthma for patients ≥12 years of age.  
- May be used with ICS as combination therapy in moderate persistent asthma in patients ≥12 years of age. | *Indications*  
- Elevation of liver enzymes has been reported. Limited case reports of reversible hepatitis and hyperbilirubinemia. | Zileuton is microsomal P450 enzyme inhibitor that can inhibit the metabolism of warfarin and theophylline. Doses of these drugs should be monitored accordingly.  
- Monitor hepatic enzymes (ALT). |
## Medications
### Long-term

<table>
<thead>
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<th>Potential Adverse Effects</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
</table>
| **Cromolyn Sodium and Nedocromil** | *Indications*  
  Long-term prevention of symptoms in mild persistent asthma; may modify inflammation.  
  Preventive treatment prior to exposure to exercise or known allergen.  
  *Mechanisms*  
  **Anti-inflammatory.** Blocks early and late reaction to allergen. Interferes with chloride channel function. Stabilizes mast cell membranes and inhibits activation and release of mediators from eosinophils and epithelial cells.  
  Inhibits acute response to exercise, cold dry air, and SO₂. | *Cough and irritation.*  
  *15–20 percent of patients complain of an unpleasant taste from nedocromil.* | *Therapeutic response to cromolyn and nedocromil often occurs within 2 weeks, but a 4- to 6-week trial may be needed to determine maximum benefit.*  
  *Dose of cromolyn by MDI (1 mg/puff) may be inadequate to affect airway hyperresponsiveness. Nebulizer delivery (20 mg/ampule) may be preferred for some patients.*  
  *Safety is the primary advantage of these agents.* |
| **Immunomodulators**           | *Indications*  
  Long-term control and prevention of symptoms in adults (≥12 years old) who have moderate or severe persistent allergic asthma inadequately controlled with ICS.  
  *Mechanisms*  
  Binds to circulating IgE, preventing it from binding to the high-affinity (FccRI) receptors on basophils and mast cells.  
  Decreases mast cell mediator release from allergen exposure.  
  Decreases the number of FccRIs in basophils and submucosal cells.  
  Pain and bruising of injection sites has been reported in 5–20 percent of patients.  
  Anaphylaxis has been reported in 0.2 percent of treated patients.  
  Malignant neoplasms were reported in 0.5 percent of patients compared to 0.2 percent receiving placebo; relationship to drug is unclear. | Monitor patients following injection. Be prepared and equipped to identify and treat anaphylaxis that may occur.  
  The dose is administered either every 2 or 4 weeks and is dependent on the patient’s body weight and IgE level before therapy.  
  A maximum of 150 mg can be administered in one injection.  
  Needs to be stored under refrigeration at 2–8 °C.  
  Whether patients will develop significant antibody titers to the drug with long-term administration is unknown. |
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<td></td>
<td></td>
</tr>
<tr>
<td>Inhaled LABA:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formoterol</td>
<td>Indications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmeterol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long-term prevention of symptoms, added to ICS</strong></td>
<td>Tachycardia, skeletal muscle tremor, hypokalemia, prolongation of QTc interval in overdose.</td>
<td>Not to be used to treat acute symptoms or exacerbations.</td>
<td></td>
</tr>
<tr>
<td><strong>Prevention of EIB.</strong></td>
<td>A diminished bronchoprotective effect may occur within 1 week of chronic therapy. Clinical significance has not been established.</td>
<td>Should not be used as monotherapy for long-term control of asthma or as anti-inflammatory therapy.</td>
<td></td>
</tr>
<tr>
<td><strong>Not to be used to treat acute symptoms or exacerbations.</strong></td>
<td>Potential risk of uncommon, severe, life-threatening or fatal exacerbation; see text for additional discussion regarding safety of LABAs.</td>
<td>May provide more effective symptom control when added to standard doses of ICS compared to increasing the ICS dosage.</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanisms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bronchodilation.</strong> Smooth muscle relaxation following adenylate cyclase activation and increase in cyclic AMP, producing functional antagonism of bronchoconstriction.**</td>
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<td></td>
</tr>
<tr>
<td><strong>Compared to SABA, salmeterol (but not formoterol) has slower onset of action (15–30 minutes). Both salmeterol and formoterol have longer duration (&gt;12 hours) compared to SABA.</strong></td>
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</tr>
<tr>
<td>Oral:</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Albuterol, sustained-release</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylxanthines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theophylline, sustained-release tablets and capsules</td>
<td><strong>Indications</strong></td>
<td><strong>Dose-related acute toxicities include tachycardia, nausea and vomiting, tachyarhythmias (SVT), central nervous system stimulation, headache, seizures, hematemesis, hyperglycemia, and hypokalemia.</strong></td>
<td><strong>Maintain steady-state serum concentrations between 5 and 15 mcg/mL. Routine serum concentration monitoring is essential due to significant toxicities, narrow therapeutic range, and individual differences in metabolic clearance. Absorption and metabolism may be affected by numerous factors which can produce significant changes in steady-state serum theophylline concentrations.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Adverse effects at usual therapeutic doses include insomnia, gastric upset, aggravation of ulcer or reflux, increased hyperactivity in some children, difficulty in urination in elderly males who have prostatism.</strong></td>
<td><strong>Patients should be told to discontinue if they experience toxicity.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Not generally recommended for exacerbations. There is minimal evidence for added benefit to optimal doses of SABA. Serum concentration monitoring is mandatory.</strong></td>
</tr>
</tbody>
</table>

Key: anti-IgE, anti-immunoglobulin E, EIB, exercise-induced bronchospasm; INR, International Normalized Ratio; LABA, long-acting beta₂-agonist; MDI, metered-dose inhaler; SABA, inhaled short-acting beta₂-agonist
# Medications

## Quick-Relief

<table>
<thead>
<tr>
<th>Name/Products</th>
<th>Indications/Mechanisms</th>
<th>Potential Adverse Effects</th>
</tr>
</thead>
</table>
| **Short-Acting Beta$_2$-Agonists (SABA)**
  
  Inhaled SABA:
  Albuterol
  Levalbuterol
  Pirbuterol | **Indications**
  - Relief of acute symptoms; quick-relief medication.
  - Preventive treatment for EIB prior to exercise.
  
  **Mechanisms**
  - **Bronchodilation.** Binds to the beta$_2$-adrenergic receptor, producing smooth muscle relaxation following adenylate cyclase activation and increase in cyclic AMP producing functional antagonism of bronchoconstriction. | **Tachycardia,** skeletal muscle tremor, hypokalemia, increased lactic acid, headache, hyperglycemia. Inhaled route, in general, causes few systemic adverse effects. Patients with preexisting cardiovascular disease, especially the elderly, may have adverse cardiovascular reactions with inhaled therapy. |

- **Therapeutic Issues**
  - Drugs of choice for acute bronchospasm. Inhaled route has faster onset, fewer adverse effects, and is more effective than systemic routes. The less beta$_2$-selective agents (isoproterenol, metaproterenol, isoetharine, and epinephrine) are not recommended due to their potential for excessive cardiac stimulation, especially in high doses. Oral systemic beta$_2$-agonists are not recommended.
  - For patients who have intermittent asthma, regularly scheduled daily use neither harms nor benefits asthma control (Drazen et al. 1996). Regularly scheduled daily use is not recommended.
  - Regular use >2 days/week for symptom control (not prevention of EIB), increasing use, or lack of expected effect indicates inadequate asthma control.
  - For patients frequently using SABA, anti-inflammatory medication should be initiated or intensified.
  - Levalbuterol at one-half the mcg dose produces clinically comparable bronchodilation and systemic side effects as racemic albuterol.
# Medications

## Quick-Relief

<table>
<thead>
<tr>
<th>Name/Products</th>
<th>Indications/Mechanisms</th>
<th>Potential Adverse Effects</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticholinergics</strong></td>
<td>▪ <strong>Indications</strong>&lt;br&gt;Relief of acute bronchospasm (See Therapeutic Issues column.).</td>
<td>▪ Drying of mouth and respiratory secretions, increased wheezing in some individuals, blurred vision if sprayed in eyes. If used in the ED, produces less cardiac stimulation than SABAs.</td>
<td>▪ Reverses only cholinergically mediated bronchospasm; does not modify reaction to antigen. Does not block EIB.</td>
</tr>
<tr>
<td>Ipratropium bromide</td>
<td>▪ <strong>Mechanisms</strong>&lt;br&gt;<strong>Bronchodilation.</strong>&lt;br&gt;Competitive inhibition of muscarinic cholinergic receptors.</td>
<td></td>
<td>▪ Multiple doses of ipratropium in the ED provide additive effects to SABA.</td>
</tr>
<tr>
<td></td>
<td>▪ Reduces intrinsic vagal tone of the airways. May block reflex bronchoconstriction secondary to irritants or to reflux esophagitis.</td>
<td></td>
<td>▪ May be alternative for patients who do not tolerate SABA.</td>
</tr>
<tr>
<td></td>
<td>▪ May decrease mucous gland secretion.</td>
<td></td>
<td>▪ Treatment of choice for bronchospasm due to beta-blocker medication.</td>
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<td></td>
<td></td>
<td></td>
<td>▪ Has not proven to be efficacious as long-term control therapy for asthma.</td>
</tr>
</tbody>
</table>

| **Corticosteroids** | **Indications**<br>For moderate or severe exacerbations to prevent progression of exacerbation, reverse inflammation, speed recovery, and reduce rate of relapse. | ▪ Short-term use: reversible abnormalities in glucose metabolism, increased appetite, fluid retention, weight gain, facial flushing, mood alteration, hypertension, peptic ulcer, and rarely aseptic necrosis. | ▪ Short-term therapy should continue until patient’s symptoms resolve. This usually requires 3–10 days but may require longer.  |
| Methylprednisolone | ▪ **Mechanisms**<br>**Anti-inflammatory.**<br>See figure 3–22.                          |                                                                                           | ▪ Action may begin within an hour.                                                   |
| Prednisolone        |                                                                                      |                                                                                           | ▪ There is no evidence that tapering the dose following improvement is useful in preventing a relapse in asthma exacerbations. |
| Prednisone          |                                                                                      |                                                                                           | ▪ Other systemic corticosteroids such as hydrocortisone and dexamethasone given in equipotent daily doses are likely to be as effective as prednisolone. |

Key: ED, emergency department; EIB, exercise-induced bronchospasm
## Delivery Devices

<table>
<thead>
<tr>
<th>Device/Drugs</th>
<th>Population</th>
<th>Optimal Technique*</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metered-dose inhaler (MDI)</td>
<td>≥5 years old (&lt;5 with spacer or valved holding chamber (VHC) mask)</td>
<td>Actuation during a slow (30 L/min or 3–5 seconds) deep inhalation, followed by 10-second breathhold. Under laboratory conditions, open-mouth technique (holding MDI 2 inches away from open mouth) enhances delivery to the lung. This technique, however, has not been shown to enhance clinical benefit consistently compared to closed-mouth technique (inserting MDI mouthpiece between lips and teeth).</td>
<td>Slow inhalation and coordination of actuation during inhalation may be difficult, particularly in young children and elderly. Patients may incorrectly stop inhalation at actuation. Deposition of 50–80 percent of actuated dose in oropharynx. Mouth washing and spitting is effective in reducing the amount of drug swallowed and absorbed systemically (Selroos and Halme 1991). Lung delivery under ideal conditions varies significantly between MDIs due to differences in formulation (suspension versus solution), propellant (chlorofluorocarbon (CFC) versus hydrofluoralkane (HFA)), and valve design (Dolovich 2000). For example, inhaled corticosteroid (ICS) delivery varies from 5–50 percent (Kelly 2003).</td>
</tr>
<tr>
<td>Beta₂-agonists</td>
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<tr>
<td>Corticosteroids</td>
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<tr>
<td>Cromolyn sodium</td>
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<tr>
<td>Anticholinergics</td>
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<tr>
<td>Breath-actuated MDI</td>
<td>≥5 years old</td>
<td>Tight seal around mouthpiece and slightly more rapid inhalation than standard MDI (see above) followed by 10-second breathhold.</td>
<td>May be particularly useful for patients unable to coordinate inhalation and actuation. May also be useful for elderly patients (Newman et al. 1991). Patients may incorrectly stop inhalation at actuation. Cannot be used with currently available spacer/valved-holding chamber (VHC) devices.</td>
</tr>
<tr>
<td>Beta₂-agonist</td>
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<tr>
<td>Dry powder inhaler (DPI)</td>
<td>≥4 years old</td>
<td>Rapid (60 L/min or 1–2 seconds), deep inhalation. Minimally effective inspiratory flow is device dependent. Most children &lt;4 years of age may not generate sufficient inspiratory flow to activate the inhaler.</td>
<td>Dose is lost if patient exhales through device after actuating. Delivery may be greater or lesser than MDI, depending on device and technique. Delivery is more flow dependent in devices with highest internal resistance. Rapid inhalation promotes greater deposition in larger central airways (Dolovich 2000). Mouth washing and spitting is effective in reducing amount of drug swallowed and absorbed (Selroos and Halme 1991).</td>
</tr>
<tr>
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<tr>
<td>Corticosteroids</td>
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<tr>
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<th>Optimal Technique*</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacer or valved holding chamber (VHC)</td>
<td>≥4 years old</td>
<td>Slow (30 L/min or 3–5 seconds) deep inhalation, followed by 10-second breathhold immediately following actuation. Actuate only once into spacer/VHC per inhalation (O’Callaghan et al. 1994). If face mask is used, it should have a tight fit and allow 3–5 inhalations per actuation (Amirav and Newhouse 2001; Everard et al. 1992). Rinse plastic VHCs once a month with low concentration of liquid household dishwashing detergent (1:5,000 or 1–2 drops per cup of water) and let drip dry (Pierart et al. 1999; Wildhaber et al. 2000).</td>
<td>Indicated for patients who have difficulty performing adequate MDI technique. May be bulky. Simple tubes do not obviate coordinating actuation and inhalation. The VHCs are preferred. Face mask allows MDIs to be used with small children. However, use of a face mask reduces delivery to lungs by 50 percent (Wildhaber et al. 1999). The VHC improves lung delivery and response in patients who have poor MDI technique. The effect of a spacer or VHC on output from an MDI depends on both the MDI and device type; thus data from one combination should not be extrapolated to all others (Ahrens et al. 1995; Dolovich 2000). Spacers and/or VHCs decrease oropharyngeal deposition and thus decrease risk of topical side effects (e.g., thrush) (Salzman and Pyszczynski 1988; Toogood et al. 1984). Spacers will also reduce the potential systemic availability of ICSs with higher oral absorption (Brown et al. 1990; Selroos and Halme 1991). However, spacer/VHCs may increase systemic availability of ICSs that are poorly absorbed orally by enhancing delivery to lungs (Dempsey et al. 1999; Kelly 2003). No clinical data are available on use of spacers or VHCs with ultrafine-particle-generated HFA MDIs. Use antistatic VHCs or rinse plastic nonantistatic VHCs with dilute household detergents to enhance delivery to lungs and efficacy (Lipworth et al. 2002; Pierart et al. 1999; Wildhaber et al. 2000). This effect is less pronounced for albuterol MDIs with HFA propellant than for albuterol MDIs with CFC propellant (Chuffart et al. 2001). As effective as nebulizer for delivering SABAs and anticholinergics in mild to moderate exacerbations; data in severe exacerbations are limited.</td>
</tr>
<tr>
<td>&lt;4 years old VHC with face mask</td>
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</tbody>
</table>

![Image](image.png)
## Delivery Devices

<table>
<thead>
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<th>Population</th>
<th>Optimal Technique*</th>
<th>Therapeutic Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nebulizer</td>
<td>Patients of any age who cannot use MDI with VHC and face mask.</td>
<td>Slow tidal breathing with occasional deep breaths. Tightly fitting face mask for those unable to use mouthpiece. Using the &quot;blow by&quot; technique (i.e., holding the mask or open tube near the infant's nose and mouth) is not appropriate.</td>
<td>Less dependent on patient's coordination and cooperation. Delivery method of choice for cromolyn sodium in young children. May be expensive; time consuming; bulky; output is dependent on device and operating parameters (fill volume, driving gas flow); internebulizer and intranebulizer output variances are significant (Dolovich 2000). Use of a face mask reduces delivery to lungs by 50 percent (Wildhaber et al. 1999). Nebulizers are as effective as MDIs plus VHCs for delivering bronchodilators in the ED for mild to moderate exacerbations; data in severe exacerbations are limited. Choice of delivery system is dependent on resources, availability, and clinical judgment of the clinician caring for the patient (Cates et al. 2002; Dolovich et al. 2005). Potential for bacterial infections if not cleaned properly.</td>
</tr>
<tr>
<td>Beta₂-agonists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corticosteroids</td>
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</tr>
</tbody>
</table>

Key: ED, emergency department; SABAs, inhaled short-acting beta₂-agonists

*See figures in "Component 2: Education for a Partnership in Asthma Care" for description of MDI and DPI techniques.
Doing Well

No cough, wheeze, chest tightness, or shortness of breath during the day or night
Can do usual activities
And, if a peak flow meter is used, Peak flow:
more than (80 percent or more of my best peak flow)

My best peak flow is:
Before exercise

Take these long-term control medicines each day (include an anti-inflammatory).

<table>
<thead>
<tr>
<th>Medicine</th>
<th>How much to take</th>
<th>When to take it</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 or 4 puffs, every 20 minutes for up to 1 hour</td>
<td>5 minutes before exercise</td>
</tr>
</tbody>
</table>

Take this medicine:

- 2 or 4 puffs or Nebulizer

Call the doctor before/within 24 hours after taking the oral steroid.

Then call your doctor NOW.
Go to the hospital or call for an ambulance

For:
Doctor: ____________________________ Date: ____________________________
Doctor’s Phone Number: ____________________________
Hospital/Emergency Department Phone Number: ____________________________

Medical Alert!

- Very short of breath, or
- Cannot do usual activities, or
- Symptoms are same or get worse after 24 hours in Yellow Zone
- Peak flow: less than (50 percent of my best peak flow)

Then call your doctor NOW. Go to the hospital or call for an ambulance

Asthma Is Getting Worse

Cough, wheeze, chest tightness, or shortness of breath, or waking at night due to asthma, or Can do some, but not all, usual activities

- Or-
Peak flow:
to (50 to 79 percent of my best peak flow)

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:
- Continue monitoring to be sure you stay in the green zone.

Add: quick-relief medicine—and keep taking your GREEN ZONE medicine.

- 2 or 4 puffs or Nebulizer

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:
- Take:
- 2 or 4 puffs or Nebulizer

Then call your doctor NOW.
Go to the hospital or call an ambulance if:
- You are still in the red zone after 15 minutes AND
- You have not reached your doctor.

DANGER SIGNS

Trouble walking and talking due to shortness of breath
- Take 4 or 6 puffs of your quick-relief medicine AND
- Go to the hospital or call for an ambulance

Lips or fingernails are blue

See the reverse side for things you can do to avoid your asthma triggers.
**Plan de acción para el control del asma**

**Para:**

____________________________________________________________

**Doctor:**

_________________________________________________________

**Fecha:**

_____________________

**Número telefónico del doctor:**

_______________________________________

**Número telefónico del hospital o de la sala de emergencias:**

_________________________________________

---

**ZONA VERDE**

**Se siente bien**

- Sin los síntomas de alarma (sibilancias), opresión en el pecho o dificultad para respirar durante el día o la noche
- Puede realizar sus actividades normales
- Y, si usa el medidor de flujo máximo:
  - Su flujo máximo está en más de _____
    - (el 80% o más de su valor óptimo personal de flujo máximo)
  - Su valor óptimo personal de flujo máximo es: _

Tome estos medicamentos de control a largo plazo todos los días (incluido un antiinflamatorio).

<table>
<thead>
<tr>
<th>Medicamento</th>
<th>Cuánto debe tomar</th>
<th>Cuándo debe tomar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Cuando debe hacer ejercicio:q**

- 2 o 4 descargas

---

**ZONA AMARILLA**

Su asma está empeorando

- Tienen tos, sibilancias, opresión en el pecho o dificultad para respirar o
- Se despiertan de noche por el asma o
- Pueden hacer algunas de sus actividades normales, pero no todas

O bien,

- Su flujo máximo está entre ____________ y ____________
  - (el 50% y el 79% de su valor óptimo personal de flujo máximo)

**PRIMERO**

Agregue el medicamento de alivio rápido y siga tomando el medicamento de la ZONA VERDE.

- **Tome este medicamento:**
  - (agonista beta 2 de acción corta)

- **Use el nebulizador:**
  - 2 o 4 descargas cada 20 minutos por un máximo de 1 hora

---

**SEGUNDO**

Si sus síntomas (y el flujo máximo, si se lo mide) regresan a la ZONA VERDE después de 1 hora del tratamiento anterior:

- **Llame al doctor:**
  - Para ajustar el control del asma

---

Si sus síntomas (y el flujo máximo, si se lo mide) no regresan a la ZONA VERDE después de una hora del tratamiento anterior:

- **Tomé:**
  - (agonista beta 2 de acción corta)

- **Use el nebulizador:**
  - 4 o 6 descargas

- **Agregue:**
  - mg diarios de ____________ durante _______ días

---

**ZONA ROJA**

¡Alerta médica!

- Tienen mucha dificultad para respirar o
- Los medicamentos de alivio rápido no le han ayudado o
- No pueden hacer sus actividades normales o
- Los síntomas son iguales o empeoran después de haber pasado 24 horas en la Zona Amarilla

**Tome este medicamento:**

- (agonista beta 2 de acción corta)

- **Use el nebulizador:**

---

**¡Alerta médica!**

- Tienen dificultad para caminar y hablar por la falta de aire.
- **Vaya al hospital o llame al**: ____________________

---

**SEÑALES DE PELIGRO**

- Tienen dificultad para caminar y hablar por la falta de aire.
- Tienen los labios o las uñas azules.

**Tome**

- (agonista beta 2 de acción corta)

- **Use el nebulizador:**

---

Al reverso encontrará qué puede hacer para evitar los factores que le desencadenan el asma.