Guideline Eligibility Criteria: Patients ≥ 1 year with a diagnosis of asthma/recurrent wheezing in whom foreign body or vocal cord dysfunction have been ruled out.

Guideline Exclusion Criteria: Bronchiolitis, cystic fibrosis, bronchopulmonary dysplasia, bacterial pneumonia, neurological disorders, immuno-deficiency diseases, trach patients, and cardiac patients (unless ordered).

Definition: (1-3) Asthma is the most common chronic disorder in childhood (10-12%). It is an inflammatory disorder of the airways in which cells and cellular elements play a role. In susceptible individuals, inflammation causes recurrent episodes of coughing (particularly at night or early morning), wheezing, breathlessness, and chest tightness. Asthma breathing problems or exacerbations are “episodic”, however, the underlying inflammation is continuous. Environmental factors play a critical role in asthma recognition and management. Asthma exacerbations are associated with widespread but variable airflow obstruction and are often reversible with or without treatment.

Pathophysiology: (1, 3-5) Asthma is a complex, interactive process that depends on the interaction of:
- Bronchoconstriction
- Airway hyper responsiveness
- Airway edema

Asthma Predictors: (1, 9-12)
- Family history of asthma, eczema, and/or smoking
- Patient history of allergic rhinitis, sinusitis, nasal polyps, eczema, or BPD
- Recurrent cough, bronchitis, and bronchiolitis

Diagnosis: (1-5) The initial diagnosis of asthma in children is often difficult and requires that other diagnoses be excluded. An in depth clinical history combined with a thorough physical examination are necessary to make this determination.

History: Assessment of (1, 3-5)
- Cough, wheeze, shortness of breath, and/or chest tightening that occurs in an “episodic” fashion. These symptoms may occur or worsen with:
  - Exercise
  - Changes in the weather
  - Night hours
  - Viral infection(s)
  - Inhalant trigger exposure (smoke, fur, dust mites, mold, pollen, etc.)
  - Irritant trigger exposure (airborne chemicals (aerosols), smoke, etc.)
  - Strong emotional expressions (laughing, crying)
  - Menstrual cycles

Tests to exclude other diagnoses when H&P is equivocal:
- Chest x-ray
- Bronchoprovocation test
- Allergen testing (eosinophilia, total IgE, rarely aspergillosis)

Physical Examination: Assess for (1, 3-5)
- Severity of respiratory symptoms using the Clinical Respiratory Score (CRS, p.2)
- Rhinitis, increased nasal secretions, mucosal swelling, or nasal polyps
- Airflow obstruction or airway hyper responsiveness are present and are at least partially reversible e.g. spirometry shows ↑ Forced Expiratory Volume in 1 second of ≥ 12% from baseline or ≥ 10% of predicted after the patient inhales a short-acting bronchodilator.

Note: Office based physicians who manage asthma patients should have access to spirometry that meets ATS standard (1,6)

Diagnostic Tools to Assess Severity (Tables 1 & 3) (1,6)
1. Spirometry - FEV₁ in children ≥ 5 years
   Airway hyper responsiveness test using Methacholine

Patients at risk of asthma-related death should be advised to seek medical care early during an exacerbation (Table 3, p 4).

Factors that place patients at risk for asthma-related death include: (1, 4)
- Co-morbid conditions such as heart or lung disease
- Previous severe exacerbation (e.g. intubation or ICU admission)
- ≥ 2 hospitalizations or > 3 EC visits in the past year
- Use of > 1 canister of Short Acting Beta Agonist (SABA) per month
- Difficulty perceiving airway obstruction or the severity of worsening asthma (parent &/or child)
- Low socioeconomic status or inner-city residence
- Illicit drug use
- Major psychosocial problems or psychiatric disease

Life-threatening asthma is a constellation of symptoms that can occur in any patient with asthma and includes:
- Marked chest tightness
- Wheezing, severe shortness of breath
- Retractions
- Cyanosis
- Inability to speak or speak in sentences due to dyspnea
- Hunched posture
- Altered mental status (agitation, anxiety, lethargy)

Co-morbid Conditions: (1, 7-8) Gastroesosophageal reflux disease (GERD), obstructive sleep apnea (OSA), obesity, rhinitis, and sinusitis

Goals of Therapy: To reduce the frequency and severity of asthma exacerbations and reduce long term sequelae by maintaining asthma control with the least amount of therapeutic interventions/medications possible. Intensive education and monitoring are required in caring for all children with asthma. (1, 15-17)
### Clinical Respiratory Score (CRS)

<table>
<thead>
<tr>
<th>Assess</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2 mos &lt; 50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos &lt; 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5 yrs &lt; 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 5 yrs &lt; 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos 50-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos 40-50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1-5 yrs 30-40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 5 yrs 20-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos &gt; 60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12 mos &gt; 50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1-5 yrs &gt; 40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 5 yrs &gt; 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good air movement,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>scattered expiratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wheezing, loose rales/crackles.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed air movement,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>inspiratory and expiratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wheezes or rales/crackles.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diminished or absent breath sounds, severe wheezing, or rales/crackles, or marked prolonged expiration.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Accessory Muscles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild to no use of accessory muscles. Mild to no retractions, nasal flaring on inspiration.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate intercostal retractions, mild to moderate use of accessory muscles, nasal flaring.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe intercostal and subglottal retractions, nasal flaring.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental Status</td>
<td>Normal to mildly irritable</td>
<td>Irritable, agitated, restless.</td>
<td>Lethargic</td>
</tr>
<tr>
<td>Room Air Sp0₂</td>
<td>&gt; 95%</td>
<td>90-95%</td>
<td>&lt; 90%</td>
</tr>
<tr>
<td>Color</td>
<td>Normal</td>
<td>Pale to normal</td>
<td>Cyanotic, dusky</td>
</tr>
</tbody>
</table>

(Add score from all rows to calculate total CRS score)

### Exacerbation Management (see Respiratory Assessment and Management Protocol (RAMP, p 6):

**In-Home and/or Office**

1. Assess severity to initiate therapy (1st time episode (CRS Score above & Table 1, p 3)
2. Classify severity of exacerbations (Table 3, p 4)
3. Identify triggers and manage control measures
4. Initiate use of inhaled short acting beta agonist (SABA)
5. Begin oral systemic corticosteroid
6. Offer supplemental oxygen if necessary and available
7. Identify and manage aggravating co-morbid conditions
8. Provide ongoing education (Table 4, p 4)
9. Consider EC admission if symptoms persist, are of sufficient severity, or patient has risk factors for asthma related death (see sections below)

**Emergency Center**

1. Follow above steps, and if severity warrants 2. Place on continuous SABA
3. Double up dose of inhaled corticosteroids
4. Initiate ipratropium bromide
5. Change systemic corticosteroids to IV
6. If condition unchanged or worsening consider initiation of adjunctive therapies including: IV magnesium sulfate (evidence supports), IV terbutaline (evidence inconclusive), heliox (evidence inconclusive), and non-invasive positive pressure ventilation (NPPV - evidence inconclusive). If symptoms do not improve consider PICU admission
7. If symptoms are unchanged or improving slightly but continued close monitoring is still required consider inpatient admission
8. If symptoms have improved or ceased initiate ASTHMA ACTION PLAN and discharge home to f/u with PCP.

#### PICU

1. Continue above and consider adjunctive therapies yet to be initiated (see RAMP p 6)
2. Consider intubation for mechanical ventilation

**Inpatient Care**

1. Continue therapies initiated and wean as appropriate according to RAMP (p 6)
2. Evaluate patient/caregiver knowledge and skills and provide re-enforcement or required education (Table 4, p 4)
3. Initiate Asthma Action Plan to prevent chronic and disabling symptoms

**Office Follow-up and Long-term Management**

1. Assess control (frequency of SABA use for symptom management and PEF) to monitor and adjust therapy (Table 2, p 3)
   - Note: Spirometry can demonstrate obstruction and assess reversibility in patients ≥ 5 years
2. Consider daily peak-flow monitoring in patients with moderate or severe persistent asthma; a history of severe exacerbations; or who are unable to perceive airway obstruction or worsening asthma.
3. Classify severity of exacerbations (Table 3, p 4)
4. Initiate Asthma Action Plan (see p 7 & 8)

Pharmacotherapies that should be included are:
- Long Term Control Medications:
  - Inhaled corticosteroids (ICS)
  - Long acting β agonists for mod persistent asthma (LABA)
  - Leukotriene receptor agonists
  - Anti-immunoglobulin E for severe persistent allergic asthma in children ≥ 12 years
- Quick Relief or Exacerbation Medications:
  - Short acting β agonists (SABA)
  - Oral systemic corticosteroids (OCS)

(Refer to TCH Formulary for prescribing info)

#### Outcome Measures

1. Increased use of asthma order sets
2. All pts have Action Plans with copy on chart
3. Appropriate treatment with anti-inflammatory medication
4. Reduction in Average Length of Stay (LOS)
5. Arrival to delivery timing of steroid administration
6. Number of IDS pts with an Action Plan at admission
7. Increased % of pts receiving influenza immunization
8. Neb Mask vs MDI exclusions appropriately applied

#### Critical Points of Evidence

**Evidence Supports** *(1, 15-17)*

- Subcutaneous immunotherapy for pts who have a clearly documented allergen relationship with their mild-moderate persistent asthma symptoms *(26)*
- Immediate use of steroids during an exacerbation *(27-29)*
- Magnesium sulfate in acute severe exacerbation *(30-34)*
- Ipratropium bromide in an acute exacerbation in the emergency department setting *(35, 36)*
- Educational interventions to improve outcomes *(19-21)*

---

*(Tables and figures may be visually simplified or omitted for natural text representation)*
Evidence Supports (continued) (1,15-17)
- Viral respiratory infection as a developmental factor for asthma and asthma symptom exacerbation (33-39)
- Spirometry in children ≥ 5 years as a diagnostic aid, to classify severity, and for periodic monitoring by office based physicians who care for asthma patients (1,6,40-41)
- Spirometry in children ≥ 5 years as a diagnostic aid, to classify severity, and for periodic monitoring by office based physicians who care for asthma patients (1,6,40-41)

Evidence Against (1,15-17)
- Inhaled Corticosteroids (ICSs) for the purpose of altering the underlying severity or progression of the disease (1,42)
- Use of IV magnesium sulfate in patients with mild to moderate acute asthma in the EC (30-34)
- Anticholinergic use for in-hospital care (35,36)
- Utility of CXR for improved diagnosis of asthma in first time wheezing patients (1)
- Ketamine for acute rescue therapy (43)

Evidence Lacking/Inconclusive
- Doubling the dose of ICSs for an established asthma exacerbation (44-46)
- Heliox as an added benefit to SABA and corticosteroids for treatment of acute exacerbations (47-49)
- Non Invasive Positive Pressure Ventilation (NPPV) as an added benefit for acute exacerbations (50-56)
- Terbutaline as an added benefit for acute exacerbations compared to SABA, corticosteroids and Ipratropium (57)

Table 1: CLASSIFYING ASThma SEVERITY and INITIATING THERAPY (note that some criteria vary by age)

<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>Symptoms</td>
<td>≤ 2 days/wk</td>
<td>&gt; 2 days/wk</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0-1/mos if 5-12 yrs</td>
<td>1-2/mos if 5 yrs</td>
</tr>
<tr>
<td>SABA use for symptoms</td>
<td>≤ 2 days/wk</td>
<td>&gt; 2 days/wk</td>
</tr>
<tr>
<td>Limitation of normal activity</td>
<td>None</td>
<td>Minor</td>
</tr>
<tr>
<td>Lung function*</td>
<td>FEV₁ &gt; 80%</td>
<td>FEV₁/FVC &gt; 85% if 5-12 yrs</td>
</tr>
<tr>
<td></td>
<td>FEV₁/FVC normal if ≥ 12 yrs</td>
<td>FEV₁ &gt; 80% if 5-12 yrs</td>
</tr>
<tr>
<td>Risk</td>
<td>≥ 2 in 6 mos if &lt; 5 yrs OR ≥ 4 wheezing episodes per 1 year and lasting &gt; 1 day if &lt; 5 yrs</td>
<td></td>
</tr>
<tr>
<td>Recommended Step for Initiating Therapy (see Table 5, p 5)</td>
<td>Step 1</td>
<td>Step 2</td>
</tr>
</tbody>
</table>

Table 2: ASSESSING CONTROL and ADJUSTING THERAPY

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impairment</td>
<td>≤ 2 days/wk</td>
<td>&gt; 2 days/week or if ≤ 12 yrs multiple times on ≤ 2 days/wk</td>
<td>Throughout the day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤ 1x/mos if ≤ 12 yrs, ≤ 2x/mos if &gt; 12 yrs</td>
<td>≥ 2x/mos if ≤ 12 yrs, 1-3x/wk if &gt; 12 yrs</td>
<td>≥ 2x/week if ≤ 12 yrs, ≥ 4x/wk if &gt; 12 yrs</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Some limitation</td>
<td>Extremely limited</td>
</tr>
<tr>
<td>SABA use for symptoms</td>
<td>≤ 2 days/wk</td>
<td>&gt; 2 days/wk</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Lung function*</td>
<td>FEV₁ &gt; 80%</td>
<td>FEV₁ &gt; 60% if 5-12 yrs</td>
<td>&lt; 60%</td>
</tr>
<tr>
<td></td>
<td>FEV₁/FVC &gt; 80%</td>
<td>FEV₁/FVC &gt; 75% if ≥ 12 yrs</td>
<td>&lt; 75%</td>
</tr>
<tr>
<td>Risk</td>
<td>0-1x/yr</td>
<td>2-3x/yr if &lt; 5 yrs</td>
<td>≥ 2x/yr if ≥ 5 yrs</td>
</tr>
<tr>
<td>Reabcdenred Action for Treatment (see Table 5, p 7)</td>
<td>Consider step down if well controlled for ≥ 3 mos.</td>
<td>Step up 1 step. Re-evaluate in 2-6 wks.</td>
<td>Consider short course oral corticosteroid. Step up 1-2 steps. Re-evaluate in 2 wks.</td>
</tr>
</tbody>
</table>

* Note that some individuals with smaller lungs in relation to their height (such as a thin individual with narrow A-P diameter to their chest) may NORMALLY have FEV₁ < 80% and/or FEV₁/FVC < 85%. Lung function measures should be correlated with clinical assessment of asthma severity.
† For initial therapy of moderate or severe persistent asthma consider short course of oral corticosteroids.

### Table 3: CLASSIFYING SEVERITY of EXACERBATIONS

<table>
<thead>
<tr>
<th>Symptoms and signs</th>
<th>Initial PEF (or FEV₁)*</th>
<th>Clinical Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild</strong></td>
<td>Dyspnea only with activity (assess tachypnea in young children)</td>
<td>PEF ≥ 70 percent predicted or personal best</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>Dyspnea interferes with or limits usual activity</td>
<td>PEF 40–69 percent Predicted or personal best</td>
</tr>
<tr>
<td><strong>Severe</strong></td>
<td>Dyspnea at rest; interferes with conversation</td>
<td>PEF &lt; 40 percent predicted or personal best</td>
</tr>
<tr>
<td><strong>Life Threatening</strong></td>
<td>Too dyspneic to speak; perspiring</td>
<td>PEF &lt; 25 percent predicted or personal best</td>
</tr>
</tbody>
</table>

* Note that some individuals with smaller lungs in relation to their height (such as a thin individual with narrow A-P diameter to their chest) may NORMALLY have FEV₁ < 80% and/or FEV₁/FVC < 85%. Lung function measures should be correlated with clinical assessment of asthma severity.


### Table 4: ON-GOING PATIENT and FAMILY EDUCATION

<table>
<thead>
<tr>
<th>Keys Components of Patient and Family Asthma Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Facts:</strong>&lt;br&gt;• The contrast between airways of a person who has and a person who does not have asthma&lt;br&gt;• The role of inflammation&lt;br&gt;• What happens to the airways during an asthma attack</td>
</tr>
<tr>
<td><strong>Role of Medications:</strong>&lt;br&gt;• Long-term control medications:&lt;br&gt;  o Prevent symptoms, often by reducing inflammation. Must be taken daily.&lt;br&gt;• Quick-relief medications:&lt;br&gt;  o Short acting beta agonists relax airway muscles to provide prompt relief of symptoms. Note: Use of short acting β agonist quick relief medications &gt;2 days a week to relieve asthma symptoms suggests the need to re-assess asthma control and consider escalation of therapy.</td>
</tr>
<tr>
<td><strong>Patient Skill Set:</strong>&lt;br&gt;• Self-monitoring:&lt;br&gt;  o Self-assessment of level of asthma control.&lt;br&gt;  o Monitoring symptoms and, if prescribed, Peak Expiratory Flow Measures.&lt;br&gt;  o Recognizing symptom patterns &amp; early signs and symptoms of worsening asthma.&lt;br&gt;  o Use of a written asthma action plan to know when and how to:&lt;br&gt;    - Take daily actions to control asthma.&lt;br&gt;    - Adjust medication(s) early in response to signs of worsening asthma.&lt;br&gt;    - Seek medical care as directed.&lt;br&gt;    - Value of compliance and periodic monitoring to adjust therapy&lt;br&gt;• Taking medications correctly&lt;br&gt;• Inhaler technique (demonstration/return demonstration)&lt;br&gt;• Use of devices as prescribed (valved holding chamber or spacer, nebulizer).&lt;br&gt;• Identifying and avoiding triggers that worsen the patient’s asthma (allergens, irritants, tobacco smoke)</td>
</tr>
</tbody>
</table>

Table 5: STEPWISE APPROACH to MANAGEMENT
Before stepping up: review adherence, inhaler technique, environmental control, and co morbid conditions

<table>
<thead>
<tr>
<th>Step</th>
<th>Preferred treatment</th>
<th>Alternative treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>SABA prn</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Low dose ICS</td>
<td>&lt; 5 yrs: Cromolyn, montelukast&lt;br&gt;≥ 5 yrs: Cromolyn, nedocromil, LRTA, or theophylline</td>
</tr>
<tr>
<td>Step 3</td>
<td>&lt; 5 yrs: Medium dose ICS&lt;br&gt;≥ 5 yrs: Low dose ICS + LABA or medium dose ICS</td>
<td>Low dose ICS + either LRTA or theophylline&lt;br&gt;Alternative treatments</td>
</tr>
<tr>
<td>Step 4</td>
<td>Medium dose ICS + LABA or Montelukast</td>
<td>Medium dose ICS + theophylline&lt;br&gt;Alternative treatments</td>
</tr>
<tr>
<td>Step 5</td>
<td>&lt; 5 yrs: High dose ICS + LABA or montelukast&lt;br&gt;≥ 5 yrs: High dose ICS + LABA</td>
<td>≥ 5 yrs: High dose ICS + LRTA or theophylline.&lt;br&gt;≥ 12 yrs: Consider Omalizumab for patients who have allergies.</td>
</tr>
<tr>
<td>Step 6</td>
<td>0-4 yrs: High does ICS + oral corticosteroids + LABA or Montelukast&lt;br&gt;≥ 5 yrs: High dose ICS + LABA + oral corticosteroids&lt;br&gt;≥ 12 yrs: Consider Omalizumab for patients who have allergies.</td>
<td>High dose ICS + LABA+LRTA or theophylline&lt;br&gt;5-12 yrs: High dose ICS + LRTA or theophylline + oral corticosteroids</td>
</tr>
</tbody>
</table>

Note: The stepwise approach is meant to assist, not replace clinical decision making. If clear benefit is not observed within 4-6 weeks when patient technique and adherence is satisfactory, consider adjusting therapy and/or consider alternative diagnoses.

RESPIRATORY ASSESSMENT AND MANAGEMENT PROTOCOL (RAMP)

Patients ≥ 1 year of age with asthma/wheeze, excluding bronchiolitis, cystic fibrosis, trach pts, neuromuscular diseases & cardiac pts (unless ordered)

Alert: Consider Fast Tracking Life Threatening Asthma Clinic Patients

Brief history & physical exam w/ CRS

Monitor oxygen saturation and administer oxygen to maintain SpO₂ ≥ 90%

Consider PEF if Personal Best Known or use Predicted Table; FeV₁ may be used in children > 6 yrs and available

Consider Child Life consult for coping techniques, procedural teaching and psychological support

Mild = CRS ≤ 3; FEV₁ or PEF ≥ 60%

- Suppl Oxygen to achieve SpO₂ ≥ 90%
- SABA neb or MDI w/valved holding chamber
  - ≥ 2 yrs: 4 puffs; ≥ 2 yrs: 6 puffs
  - Reassess for D/C or further tx
- Begin corticosteroid

Moderate = CRS 4-6; FEV₁ or PEF ≥ 40%

- Suppl Oxygen to achieve SpO₂ ≥ 90%
- SABA neb or MDI w/valved holding chamber
  - ≤ 2 yrs: 6 puffs; ≥ 2 yrs: 6-8 puffs
  - Q 20 min PRN up to 3 doses; then Q 1-3 h
- Begin corticosteroid
- Consider Ipratropium

Severe = CRS 6-8; FEV₁ or PEF < 40%

- Suppl Oxygen to achieve SpO₂ ≥ 90%
- SABA neb or MDI w/valved holding chamber 8 puffs
  - Q 20 min X 3 doses; if no response after 1st tx ADD Ipratropium
- Begin corticosteroid
- Assess patient after 3rd treatment; if no improvement notify MD immediately and place on continuous SABA and give 3rd dose of Ipratropium

Repeat Assessment after Each Treatment and Determine if Inpatient Admission is Required

SABA Weaning Criteria & Regimen

CRS 3 - 6 and improving

V/S stable and weaning from O₂

CRS ≤ 3; FEV₁ or PEF ≥ 60%

Previous Treatment Level: Wean To:

- SABA or MDI 8 puffs → 6 puffs & continue to taper
- Continuous SABA → Q 2 h
- Q 1 h → Q 2 h
- Q 2 h → Q 3 h

Complete Asthma Action Plan & Prepare for Discharge

- Q 3 h → Q 4 h for cough or wheeze
- Discharge Criteria: Room air, SABA Q4 h X 2 & CRS < 3

Discharge Home

- Continue SABA treatment as per Asthma Action Plan
- Complete course of oral systemic corticosteroid
- Initiation or continue Long Term Control Meds (escalate if necessary)
- Patient Education
  - Review medications including drug delivery technique
  - Review Written Action Plan
  - Recommend close medical follow-up including discharge visit recommendations with appropriate phone numbers
- Perform Med Reconciliation

CRS > 3 and < 6; FEV₁ or PEF ≥ 40% and Not Improving - Admit to Hospital

- Suppl Oxygen to achieve SpO₂ ≥ 90%
- SABA or MDI w/valved holding chamber
- Obtain order to increase strength if on Levalbuterol (if applicable)
  - ≤ 2 yrs: 4 puffs; ≥ 2 yrs: 6-8 puffs
  - Q 20 min up to 3 doses
- Add Ipratropium
- Place on continuous SABA

Repeat Assessment

Continuing Improvement

CRS < 3; FEV₁ or PEF > 60%

- Continue Weaning until Discharge criteria met

CRS 3 - 6; FEV₁ or PEF 40%- 60%

- If in Special Care transfer to Acute Care Status
- Continue Weaning until Discharge Criteria met

CRS ≥ 6 with no improvement

FEV₁ or PEF ≤ 40%

- Admit to Special Care Unit based on patient care requirements and policy
- Suppl oxygen to achieve SpO₂ ≥ 90%
- Place on continuous SABA
- Add Ipratropium if not already given
- IV route for corticosteroid
- Consider adjunct therapies as above
- Mechanical ventilation as needed

No Improvement or Worsening Condition

- Treat as Impending or Actual Resp. Arrest
- Consider Pulmonary Consult and Referral to Life Threatening Asthma (LTA) Clinic
- Consider Referral to Allergy & Immunology
- Off Algorithm

Impending or Actual Respiratory Arrest = CRS 8-12; FEV₁ or PEF < 25%

- Unable to talk, severe distress
- Suppl Oxygen to achieve SpO₂ ≥ 90%
- Continuous SABA
- Consider IV magnesium sulfate in cases of severe acute exacerbation only
- Intravenous corticosteroid
- Add Ipratropium
- ABG, VBG, or CBG
- May consider adjunctive therapies where evidence is inconclusive (e.g. IV terbutaline, NPPV, heliox)
- Mechanical ventilation as needed
- Admit to PICU
MY EVERY DAY ASTHMA ACTION PLAN

DATE: ___-___-___

I should always avoid tobacco smoke and my asthma triggers which include:

I should always rinse my mouth out after using my inhaler

GREEN ZONE PLAN

In the GREEN ZONE I have:
- No cough
- No wheeze
- No chest tightness
- My peak flow is over ___

I should:
- Take my CONTROLLER medication ___ (name of medicine), ___ times a day
- Inhaler ___ (name of medicine) ___ puffs BEFORE EXERCISE
- Other daily medicines I should be taking are:

YELLOW ZONE PLAN

In the YELLOW ZONE I have:
- Early asthma symptoms
- A slight cough or wheeze
- The start of a cold
- My peak flow is between ___ and ___

I need QUICK RELIEF and should:
- Inhaler Albuterol or Xopenex ___ puffs every ___ for relief of my symptoms
- Continue taking my daily meds
- Additional medicines I should take are:

RED ZONE PLAN

In the RED ZONE I have:
- An increasing cough
- An increasing wheeze
- Fast breathing
- Peak flow less than ___

I should:
- CONTINUE ALL MY YELLOW ZONE MEDICINES
- Add Prednisone ___ tabs OR Prednisone ___ mL ___ times a day for ___ days
- Additional medicines I should take are:

DANGER ZONE: CALL 911 or go to nearest Emergency Room if:
- Breathing very hard or fast
- Between the ribs is sucking in
- Breathing so hard I can’t walk or talk
- Medications are not working
- Using stomach muscles to breath
- Lips or fingertips look blue

I NEED IMMEDIATE HELP – CALL 911 or Go to the Emergency Room!

Action Plan Developed by: ___________________________ on ___/___/___; Signature: ___________________________

Asthma Teaching Completed by: ___________________________ on ___/___/___; Signature: ___________________________

Patient/Parent: My signature here means that this Every Day Asthma Action Plan has been discussed with me and that I understand what needs to be done when symptoms are occurring to get better control of my child’s asthma.

Signature: ___________________________
After being seen by a doctor for RED ZONE asthma symptoms I need to:

- Call Dr. __________________ at _____ - _____ - ______ for an appointment within ____ days
- Remember to always WASH MY HANDS and AVOID ASTHMA TRIGGERS including:
  
  ______________________________________________________
  ______________________________________________________
- ADD Prednisone _____ tabs OR Prednisolone _____ mL’s _____ times a day for ________ days while following my YELLOW ZONE PLAN

Then:

- I should stop the extra medicine and follow my EVERY DAY ASTHMA ACTION PLAN

I need to follow my EVERY DAY ASTHMA ACTION PLAN all the time to get better control of my asthma.
References


References (continued)


References (continued)


**Guideline Preparation**

This guideline was prepared by the Evidence-Based (EB) Clinical Decision Support Team in collaboration with content experts at Texas Children’s Hospital and the Texas Children’s Pediatric Associates. Development of this guideline supports the TCH Quality and Patient Safety Program initiative to promote clinical guidelines and outcomes that build a culture of quality and safety

**EB Clinical Decision Support Team**

Co-Chair: Marilyn Hockenberry, PhD, RN-CS, PNP, FAAN
Co-Chair: Charles Macias, MD, MPH

Research Specialist: Bonnie L. Magliaro, MS, RN

**Content Expert Team Members**

Team Chairperson:
- Stuart L. Abramson, MD - Allergy/Immunology
- Bloom, Joey, RN – IRIS/EPIC
- Alva Cambria-Hargrove – TCPA Administration
- Tiffany Clarke, RN - IRIS/EPIC Liaison
- Ekiria Collins, MA - Asthma Educator
- Anne Dykes, MS, RN - Emergency Center CNS
- Quinn Franklin, MS – Child Life
- Yong S. Han, MD - FIS
- Suzanne Inguez – Respiratory Therapy
- Julie P. Katkin, MD – Pulmonary Medicine
- Mona L. McPherson, MD – Critical Care Medicine
- Binita Patel, MD – Nephrology & Parent Representative
- Diana L. Schaumburg, RN – Quality & Outcomes Management
- Archana Shah. MD - TCPA
- Marianna M. Sockrider, MD – Pulmonary Medicine
- Wayne P. Toote, RN – Emergency Center
- Jeffrey L. Wagner – Clinical Pharmacist

**Development Process**

This guideline was developed using the process outlined in the EB Clinical Decision Support Manual (2007). The review summary documents the following steps:

1. **Review Preparation**
   - PICO questions established
   - Evidence search terms confirmed with content experts

2. **Review of Existing Internal and External Guidelines**
   - One internal bronchiolitis guideline found (Critical Care Dr. McPherson)
   - One published guideline from the AAP/AHRQ and two from children’s hospitals were used

3. **Search for Relevant Evidence**
   - Searched: Medline, EmBase, Cochrane, AHRQ, CINAHL, Trip, Best BETS, AAP, PedsCCM, U of Mich, Google Scholar

4. **Critically Analyze the Evidence**

5. **Summarize the Evidence by preparing the guideline, order sets and interdisciplinary plan of care**
   - Materials used in the development of the guidelines, review summaries and content expert team meeting minutes are maintained in a bronchiolitis EB review manual within the Center for Quality.

**Evaluating the Quality of the Evidence**

The Critical Appraisal Skills Program (CASP) criteria were used to evaluate the quality of articles reviewed. Application of the CASP criteria are completed by rating each reviewed study or review as:

- **Strong study/systematic review** - well designed, well conducted, adequate sample size, reliable measures, valid results, appropriate analysis, and clinically applicable/relevant.

- **Study/systematic review with minor limitations** - specifically lacking in one of the above criteria

- **Study/systematic review with major limitations** - specifically lacking in several of the above criteria.

Published clinical guidelines evaluated for this review using the AGREE criteria. The summary of these guidelines are found at the end of this document. AGREE criteria uses a 1-4 point likert scale to evaluate 23 questions evaluating: Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence. The higher the score the more comprehensive the guideline.

This guideline specifically summarizes the evidence in support of or against specific interventions and identifies where evidence is lacking. The following categories describe how research findings provide support for treatment interventions.

- "Evidence that supports" the guideline (p.2 & 3) provides evidence from more than one well-done randomized controlled trial (RCT) (based on CASP criteria) that the benefits of the intervention exceed harm.

- "Evidence against" (p.2 & 3) provides clear evidence from more than one well-done RCT (based on CASP criteria) that the intervention is likely to be ineffective or that it is harmful.

- "Evidence lacking" (p.2 & 3) indicates there is currently insufficient data or inadequate data to recommend for or against specific intervention.

**Recommendations**

Recommendations for the guidelines were developed by a consensus process directed by the existing evidence, content experts and patient and family preference when possible. The Content Expert Team and EB Clinical Decision Support Team remain aware of the controversies in the management of bronchiolitis in young patients. When evidence is lacking, options in care are provided in the guideline and the order sets that accompany the guideline.

**Approval Process**

Guidelines are reviewed and approved by the Content Expert Team, EB Clinical Decision Support Team, EB Executive Steering Team, Pharmacy and Therapeutics Committee and other appropriate hospital committees as deemed appropriate for the guideline’s intended use. Guidelines are reviewed and updated as necessary every 2 years within the EB Clinical Decision Support Team at Texas Children’s Hospital. Content Expert Teams will be involved with every review and update.

**Disclaimer**

Guideline recommendations are made from the best evidence, expert opinions and consideration for the patients and families cared for within TCH/TCPA. The guideline is NOT intended to impose standards of care preventing selective variation in practice that are necessary to meet the unique needs of individual patients. The physician must consider each patient's circumstance to make the ultimate judgment regarding best care.

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