ASTHMA EXACERBATION MANAGEMENT

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FIGURE 1. ALGORITHM FOR ASTHMA EXACERBATION MANAGEMENT – OUTPATIENT CLINIC

Triage RN/MA:

- Check HR, RR, temp, pulse ox. Triage level as appropriate
- Notify attending physician if patient in severe distress (RR greater than 35, oxygen saturation less than 90%, speaks in single words/trouble breathing at rest)

Primary RN:

- Give oxygen to keep pulse oximetry greater than 90%

Treatment

1. Give nebulized or MDI albuterol up to 3 doses. Albuterol dosing is 0.15 to 0.3mg/kg per 2007 NHLBI guidelines.
   - Less than 20 kg: 2.5 mg neb x 3 or 2 to 4 puffs MDI albuterol x 3
   - 20 kg or greater: 5 mg neb x 3 or 4 to 8 puffs MDI albuterol x 3
   *Note: For moderate (dyspnea interferes with activities)/severe (dyspnea at rest) exacerbations you can add atrovent to nebulized albuterol at 0.5mg/neb x 3.
2. Repeat vital signs every 30 minutes
3. Prednisone 2 mg/kg orally with a maximum dose of 80 mg should be given if there is not complete response** after one treatment dose (please see dexamethasone dosing guide if using dexamethasone instead of prednisone)

   (Contraindications: varicella, varicella exposure, tuberculosis, severe respiratory distress, recent [within 2 weeks] steroids)

Inclusion Criteria

- 2 years or older
- Treated for asthma or asthma exacerbation
- First time wheeze with history consistent with asthma

Exclusion Criteria

- Patients treated for bronchiolitis, viral pneumonia, aspiration pneumonia, croup, chronic lung disease, bronchopulmonary dysplasia, cystic fibrosis, airway anomalies, cardiac disease, neurologic disorders

Complete Response?**

Discharge

- Discharge home if stable for 1 to 2 hours after last bronchodilator therapy
- Intensify home albuterol therapy to every 4 hours as needed
- Oral Steroids for 5 days if needed
- Follow-up scheduled
- Asthma Education and MDI teaching
- Re-label medications for home if possible

ED Transfer Criteria

- No response or incomplete response to 3 back to back treatments OR
- Oxygen saturations below 90% on room air OR
- Requiring nebulizer treatments more often than every 2 hours

Dexamethasone Dosing Guide for Asthma

<table>
<thead>
<tr>
<th>General Weight Range</th>
<th>Suggested Dose</th>
<th>Tablets/Strengths (based on 2mg and 4mg tablet availability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8kg</td>
<td>4mg</td>
<td>1 x 4mg tablet</td>
</tr>
<tr>
<td>8-10kg</td>
<td>6mg</td>
<td>3 x 2mg tablets</td>
</tr>
<tr>
<td>10-15kg</td>
<td>8mg</td>
<td>2 x 4mg tablets</td>
</tr>
<tr>
<td>15-18kg</td>
<td>10mg</td>
<td>5 x 2mg tablets OR 2.5 x 4mg tablets</td>
</tr>
<tr>
<td>18-20kg</td>
<td>12mg</td>
<td>3 x 4mg tablets</td>
</tr>
<tr>
<td>20-25kg</td>
<td>14mg</td>
<td>7 x 2mg tablets OR 3.5 x 4mg tablets</td>
</tr>
<tr>
<td>25kg and greater</td>
<td>16mg</td>
<td>4 x 4mg tablets</td>
</tr>
</tbody>
</table>

** Complete response is defined as oxygen saturations over 90%, no significant increased work of breathing, (PAS less than 7)**
FIGURE 2. ALGORITHM FOR ASTHMA MANAGEMENT – EMERGENCY DEPARTMENT

**Intended for:** Children 2 years or older with acute wheeze or cough AND A HISTORY OF:
- Asthma OR
- Episodic symptoms of airflow obstruction (recurrent cough and/or wheeze)—including anaphylaxis—that are at least partially reversible with bronchodilator treatment

**NOT Intended for:** Children less than 2 years old; co-morbid conditions, including: chronic lung disease, cystic fibrosis, cardiac disease, bronchiolitis, stridor, aspiration or neuromuscular disorders

**Triage RN/Primary RN:**
Routine vital signs and check saturation, blood pressure
- Perform Pediatric Asthma Score (PAS)
- If PAS score is 8 or above and the patient has a history of asthma, reactive airway disease, recurrent albuterol use or recurrent wheezing, initiate the ED asthma nurse standing order including oral steroids (dexamethasone)
- Oxygen to keep SpO₂ greater than 90%
- Notify respiratory therapy

**RT or RN:**
- Give up to three initial inhaled albuterol or combination ipratropium - albuterol treatments, either nebulized or via MDIs. See weigh specific dosing below. Refer to standing order.
- Repeat PAS pre and post nebulizer.
- Dexamethasone (or equivalent) 0.6mg/kg orally with a maximum dose of 16 mg to any child with a PAS score over 7 if not contraindicated. **Goal is administration within 60 min of arrival.**
- Initiate asthma bundle (RT assess and treat flowsheet).

*See algorithm on next page*
FIGURE 2. ALGORITHM FORASTHMA MANAGEMENT – EMERGENCY DEPARTMENT (CONTINUED)

Perform Pediatric Asthma Score (PAS)

**Inclusion Criteria**
- 2 years or older
- Treated for asthma or asthma exacerbation
- First time wheeze with history consistent with asthma

**Exclusion Criteria**
- Patients treated for bronchiolitis, viral pneumonia, aspiration pneumonia, croup, chronic lung disease, bronchopulmonary dysplasia, cystic fibrosis, airway anomalies, cardiac disease, neurologic disorders

**Discharge Criteria:**
- PAS less than 7 and SpO₂ 90%

**Discharge Plan**
- Home bronchodilator therapy every 4 hours as needed for cough, wheezing or trouble breathing
- Prescribe single dose of oral dexamethasone to be given 24-36 hours after initial dose for patients receiving 2 or more albuterol treatments and consider if patient has a history of severe asthma exacerbations
- Prescribe furosemide propane (Flovent) 44 mcg 2 puffs twice a day if the patient has albuterol use 3 or more days/week (excluding pretreatment) or 2 or more steroids bursts in the last 12 months (including this ED visit)
- Complete asthma bundle
- Asthma Education and Asthma Action Plan
- If needed, provide phone number(s) for potential PCP
- Re-label beta agonist and controller for home use

**Good Response**
- PAS 5 to 7 within 30 minutes of completing nebs AND SpO₂ greater than 90% on room air (RA) 30 minutes after albuterol dose

- **Observation**
  - Observe for at least 60 minutes
  - VS (HR, RR, SpO₂), PAS in 1 hour
  - If PAS 8 or if hypoxic, treat as “Incomplete Response”

**Discharge Criteria:**
- PAS less than 7 and SpO₂ 90%

**Discharge Plan**
- Home bronchodilator therapy every 4 hours as needed for cough, wheezing or trouble breathing
- Prescribe single dose of oral dexamethasone to be given 24-36 hours after initial dose for patients receiving 2 or more albuterol treatments and consider if patient has a history of severe asthma exacerbations
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- Complete asthma bundle
- Asthma Education and Asthma Action Plan
- If needed, provide phone number(s) for potential PCP
- Re-label beta agonist and controller for home use

**Good Response**
- PAS 5 to 7 within 30 minutes of completing nebs AND SpO₂ greater than 90% on room air (RA) 30 minutes after albuterol dose

- **Observation**
  - Observe for at least 60 minutes
  - VS (HR, RR, SpO₂), PAS in 1 hour
  - If PAS 8 or if hypoxic, treat as “Incomplete Response”

**Incomplete Response**
- PAS 8 to 11 or Poor Response (PAS 12 to 15) with saturation less than 90%

- **Observation**
  - Place on cardio-respiratory monitor with VS (HR, RR, SpO₂) every hour
  - Albuterol continuous neb with oxygen as needed to keep saturations >90%

- **Recheck in one hour:**
  - If PAS less than 8, go off continuous
  - If PAS 8 or if hypoxic, treat as “Incomplete Response”
  - Place on cardio-respiratory monitor with VS (HR, RR, SpO₂) every 1 hour

- **Admit Criteria**
  - PAS < 8, Once patient is off continuous:
    - Observe for 2 hours
    - If PAS is 8 or more, put child back on continuous
    - If PAS is 12 or greater, go to “Poor Response” below.

- **Admit Criteria**
  - PAS 8-11, For patients still on continuous nebs:
    - Repeat PAS every hour
    - Consider a 30 minute trail off continuous neb.
    - Go to “POOR RESPONSE” if PAS is 12 or greater

- **Admit Criteria**
  - PAS >12, Poor Response:
    - Consider ABG and CXR
    - Increase albuterol per ED attending and adjunct therapies such as IV magnesium, noninvasive ventilation, or subcutaneous terbutaline
    - Consult ICU

- **Admit Criteria**
  - Colorado Springs Hospital- Admit to PICU

**Admit Criteria**
- Requires more than one dose of IV magnesium, terbutaline infusion, or subcutaneous epinephrine
- Continuous neb requirements below
- Change in mental status
- Impending respiratory failure

<table>
<thead>
<tr>
<th>Weight</th>
<th>Albuterol Dose</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20 kg</td>
<td>2.5 mg</td>
<td>times 3</td>
</tr>
<tr>
<td>20 kg or more</td>
<td>5 mg</td>
<td>times 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PAS &lt; 8, Once patient is off continuous:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Observe for 2 hours</td>
</tr>
<tr>
<td>- If PAS is 8 or more, put back on continuous nebs and monitor hourly.</td>
</tr>
<tr>
<td>- If PAS is less than 8 at 2 hours give 2-8 puffs Albuterol MDI and wean as tolerated and consider discharge</td>
</tr>
</tbody>
</table>

**Admit Criteria**
- Colorado Springs Hospital- Admit to PICU

**Admit Criteria**
- Unable to wean albuterol to every 2 hours or SpO₂ less than 90% on room air.

**Admit Criteria**
- **RT and floor RN must be notified before transfer to the inpatient unit**
**FIGURE 3. ALGORITHM FOR ASTHMA MANAGEMENT – INPATIENT AND NOC**

**Inclusion Criteria**
- 2 years or older
- Treated for asthma or asthma exacerbation
- First time wheeze with history consistent with asthma

**Exclusion Criteria**
- Patients treated for bronchiolitis, viral pneumonia, aspiration pneumonia, croup, chronic lung disease, bronchopulmonary dysplasia, cystic fibrosis, airway anomalies, cardiac disease, neurologic disorders

**Initial assessment:**
- Vital signs, SP02, PAS score
- Chronic asthma severity
- Continuous monitoring *only if on continuous nebulizer*

**Guideline and bronchodilator wean eligible?**
- Clinically indicated care
- Can still use asthma order set

**Does child meet discharge criteria?**
- Patient on room air
- Beta agonist required every four hours
- Family able to manage care (if not, consider consulting social work)

**Discharge Plan**
- Controller for persistent asthma
- Oral steroids
- Home bronchodilator therapy every 4 hours for 72 hours or until completing oral steroids
- Finalize and document Asthma Action Plan and Asthma education during Phase 3
- Place orders for re-label of asthma medications for home use and send to pharmacy during within 24 hours of discharge
- If needed, provide phone number(s) for potential PCP. Assist in arranging follow up care.

**Monitoring:**
- Routine vital signs per protocol including PAS score per Asthma Clinical Care Guideline as appropriate
- Continuous pulse oximeter and CVR monitoring *only while on continuous nebulizer *
- IV access is only needed in a child who is being admitted to the Intensive Care Unit or who is not tolerating liquids or oral corticosteroid therapy or otherwise clinically indicated

**Is Child Improving?**
- No

- There is no mandatory RRT associated with bronchodilator weaning no matter how long the child has been on continuous albuterol. If the treating team is concerned about deterioration, then, an RRT can be called. Continue inpatient management and consider consulting pulmonary in children needing continuous for more than 12 hours.

  **For acute deterioration or escalation of the PEWS to 5 or more**, consider RRT:
  - Work up including blood gas and x-ray
  - Increase SABA dosing
  - Subcutaneous Terbutaline or Epinephrine
  - RRT and PICU transfer is required for Magnesium and theophylline and when giving terb drip or epi on the floor.
  - RRT and PICU transfer is required for Non-invasive ventilation (CPAP, BiPAP etc) *the child may already have a PEWS of 5 on continuous. The RRT would only be for escalating PEWS scores*
FIGURE 4. PROGRESSION THROUGH THE BRONCHODILATOR WEANING PROTOCOL

**Intended for:** patients 2 years or older who are being treated for asthma or an asthma exacerbation, including first time wheeze

**NOT Intended for:** patients less than 2 years old; co-morbid conditions, including but not limited to: chronic lung disease, cystic fibrosis, cardiac disease, bronchiolitis, croup/stridor, aspiration, neurological disorder

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**NORMAL PROGRESSION**

**Advance Phase**
If PAS improved by 2 or more
  OR
  PAS 7 or less
  OR
If PAS has not improved by at least 2
  But is NOT getting worse
  AND
In phase 12 hours or more
*RT to notify RN and MD whenever patient changes phases

**Continue Current Phase**
If PAS is less than 12
  AND
Has not improved by at least 2
  AND
In phase less than 12 hours

If in phase 1 for 12 hours, attempt 15-30 minute trial off of continuous nebs
  If tolerated: Advance
  If fails: Place back on continuous neb, discontinue the protocol and NOTIFY MD
  RRT is NOT required

**ABERRANT COURSE**

**Escalation**
If at any time PAS is more than 7 AND worsens by 2 or more
  OR
  PAS is 12 or more
  OR
PAS worsens by more than 2 within 1 hour after advancing

**ESCALATE AND NOTIFY Bedside RN and MD**
If PAS improves by 2 or more
  AND
PAS 11 or less

**Continue Current Phase**
If PAS has not improved by at least 2
  OR
PAS is 12 or more
  OR
The patient is worsening

**NOTIFY MD**
If PAS has not improved by at least 2
  OR
PAS is 12 or more
  OR
The patient is worsening

**RE-EVALUATE**
In less than 1 HOUR
TABLE 1. PEDIATRIC ASTHMA SEVERITY (PAS) SCORE

NOTE: Use PAS Score to guide intervention and response to treatment. Older pediatric asthma patients may exhibit lower PAS scoring during an exacerbation.

<table>
<thead>
<tr>
<th>Score</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiratory rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 to 3 years</td>
<td>34 or less</td>
<td>35 to 39</td>
<td>40 or greater</td>
</tr>
<tr>
<td>4 to 5 years</td>
<td>30 or less</td>
<td>31 to 35</td>
<td>36 or greater</td>
</tr>
<tr>
<td>6 to 12 years</td>
<td>26 or less</td>
<td>27 to 30</td>
<td>31 or greater</td>
</tr>
<tr>
<td>older than 12 years</td>
<td>23 or less</td>
<td>24 to 27</td>
<td>28 or greater</td>
</tr>
<tr>
<td><strong>Oxygen requirements</strong></td>
<td>Greater than 90% on room air</td>
<td>85% to 90% on room air</td>
<td>Less than 85% on room air</td>
</tr>
<tr>
<td><strong>Auscultation</strong></td>
<td>Normal breath sounds to end-expiratory wheeze only</td>
<td>Expiratory wheezing</td>
<td>Inspiratory and expiratory wheezing to diminished breath sounds or poor aeration</td>
</tr>
<tr>
<td><strong>Retractions</strong></td>
<td>Zero to one site</td>
<td>Two sites</td>
<td>Three or more sites</td>
</tr>
<tr>
<td><strong>Dyspnea</strong></td>
<td>Speaks in sentences, coos and babbles</td>
<td>Speaks in partial sentences, short cry</td>
<td>Speaks in single words/short phrases/grunting</td>
</tr>
</tbody>
</table>
TABLE 2. BRONCHODILATOR WEANING PROTOCOL
For patients 2 years or older, who are being treated for asthma or an asthma exacerbation. Any patient with asthma on the floor (including PICU transfers) can be placed on this protocol. Children should be taken off of the protocol if they require more than one intensification per phase, fail a trial off of continuous, or by provider discretion. Once taken off the protocol, the Provider will determine/order timing of bronchodilator wean.

<table>
<thead>
<tr>
<th>PHASE 1</th>
<th>PHASE 2</th>
<th>PHASE 3</th>
<th>PHASE 4</th>
<th>INTENSIFICATION</th>
</tr>
</thead>
</table>
| **Continuous Nebulizer**  
Albuterol  
**Weight: Dose**  
More than 20 kg: 10 mg/hour  
Less than 20 kg: 7.5 mg/hour  
**Anschutz- Patients requiring higher doses of continuous albuterol must be transferred to the PICU**  
**Colorado Springs Hospital- Patients requiring continuous albuterol must be transferred to the PICU**  
- OR-  
Albuterol every 2 hours via neb  
**Weight: Dose**  
More than 20 kg: 5 mg  
Less than 20 kg: 2.5 mg  
(See Table 4 for dosing and requirements.)** | **Albuterol** every 2 hours via MDI/VHC  
**Weight: Dose**  
More than 20 kg: 8 puffs  
Less than 20 kg: 4 puffs  
- OR-  
Albuterol every 2 hours via neb  
**Weight: Dose**  
More than 20 kg: 5 mg  
Less than 20 kg: 2.5 mg | **Albuterol** every 3 hours via MDI/VHC  
**Weight: Dose**  
More than 20 kg: 8 puffs  
Less than 20 kg: 4 puffs  
- OR-  
Albuterol every 3 hours via neb  
**Weight: Dose**  
More than 20 kg: 5 mg  
Less than 20 kg: 2.5 mg | **Albuterol** every 4 hours via MDI/VHC  
**Weight: Dose**  
More than 20 kg: 4 puffs  
Less than 20 kg: 2 puffs  
- OR-  
Albuterol via nebulizer times one  
**Weight: Dose**  
More than 20 kg: 10 mg  
Less than 20 kg: 7.5 mg –  
(See Table 4 for dosing and requirements.)** |

**Systemic Corticosteroids**

| RT evaluate every hour  
• HR, RR, SpO2, RA.  
• Pediatric Asthma Severity Score (PAS)  
• Initiate education on “what is asthma”, signs and symptoms, and triggers | RT evaluate every 2 hours  
• HR, RR, SpO2, RA.  
• Pediatric Asthma Severity Score (PAS)  
• Initiate education on MDI with VHC use (handout) | RT evaluate every 3 hours  
• HR, RR, SpO2, RA.  
• Pediatric Asthma Severity Score (PAS)  
• Peak flow Education (>6 yrs.)  
• BPA triggers for AAP and asthma teaching.  
• Finalize AAP and Asthma education. Check understanding of key concepts, device technique, review meds, and AAP with patient/family. | RT evaluate every 4 hours  
• HR, RR, SpO2, RA.  
• Pediatric Asthma Severity Score (PAS)  
• Peak flow Education (>6 yrs.)  
• BPA triggers for RT to re-label meds for home use. | RT evaluate in 1 hour  
• HR, RR, SpO2, RA.  
• Pediatric Asthma Severity Score (PAS)  
• Peak flow Education (>6 yrs.) |

| RN evaluate every hour  
• Continuous SpO2, HR, RR, with full cardiorespiratory assessment. Temp & BP Q4hr | RN evaluate every 2 hours  
• Spot check SpO2, HR, RR, with full cardiorespiratory assessment. Temp & BP Q4hr | RN evaluate every 4 hours  
• Spot check SpO2, full set of VS, with full cardiorespiratory assessment.  
• Review AAP is complete and reconciled with DC orders. Ensure Asthma education documented. | RN evaluate in 1 hour  
• Continuous SpO2 HR, RR, check BP, full cardiorespiratory assessment |

| Provider  
• Add controller medications.  
• Verify orders for AAP/Education | Provider  
• Review AAP | | |
TARGET POPULATION

Inclusion Criteria

- 2 years and older
- Being treated for asthma or an asthma exacerbation
- First time wheeze with a history consistent with asthma

Exclusion Criteria

- Patients being treated primarily for bronchiolitis, viral pneumonia, aspiration pneumonia, or croup. (Patients with an asthma exacerbation who also have a viral illness will benefit from the clinical care guidelines.)
- Chronic lung disease, bronchopulmonary dysplasia (BPD), cystic fibrosis, airway anomalies (e.g. tracheomalacia), cardiac disease, or neurologic disorders

CLINICAL MANAGEMENT

Diagnosing Asthma

- **Suspect asthma** in any child with episodic symptoms of airflow obstruction (cough, wheeze, shortness of breath) that is at least partially reversible with a bronchodilator
- **Rule out other causes of airway obstruction** such as cystic fibrosis, recurrent aspiration, airway anomalies (such as tracheomalacia), GERD, sinusitis, and foreign body aspiration

Asthma Severity Assessment

**Intermittent vs. Persistent asthma:**

- Persistent asthma is diagnosed if the child has any of the following:
  - Symptoms more than twice per week during the day
  - Symptoms twice per month at night
  - Any exercise limitation
  - FEV1 less than 80% predicted (for children over 5 years)
  - Two or more steroid bursts for asthma in 12 months

**Treat persistent asthma with a daily controller medication such as inhaled corticosteroids**

- See [Appendix A. Asthma Management-Outpatient](#)
- See [Table 3. Dosage of Daily Controller Medication for Asthma Control](#)

Keys to Managing Any Asthma Exacerbations

**Telephone Triage**

- **Mild** (dyspnea with activities and/or peak flow greater than 80% of personal best) → Primary Care Provider (PCP) contact AND short acting bronchodilator every 4 hours.
- **Moderate** (Dyspnea interfering with activities and peak flow 50 to 80% of personal best) → Same day clinic visit AND short acting bronchodilator every 4 hours AND consider home prednisone/dexamethasone.
- **Severe** (Dyspnea interfering with speech and peak flow 50 to 80% of personal best) → Emergency Department (ED) visit AND repeat short acting bronchodilator every 20 minutes up to 3 doses.
- **Life Threatening** (Severe difficulty breathing, not able to speak, cyanosis, combative, agitated or difficult to arouse) → Activate EMS.
CLINICAL ASSESSMENT

History

- Document recent exposures to asthma triggers including illness. Document recent beta agonist use and any oral steroid use. Assess the timeline of progression of the exacerbation.

- Evaluate chronic asthma severity by asking about baseline daytime and nighttime asthma symptom frequency, and bronchodilator use previous to this exacerbation, and history of previous asthma exacerbations and oral steroid bursts. Document the chronic asthma severity, chronic asthma medications, and reported medications adherence in the medical record. (For severity assessment please see appendix B).

Physical exam

- Evaluate for cough, wheeze, tachypnea, increased work of breathing, low oxygen saturation

- Use Pediatric Asthma Severity (PAS) Score to guide intervention and response to treatment. PAS\textsuperscript{2,4,5} score includes the following elements: Respiratory rate, Oxygen requirements, Auscultation, Retractions, Dyspnea

Laboratory and radiologic studies

- Chest X-Ray: Consider if history of choking and/or foreign body aspiration, delayed symptom resolution, persistent asymmetric lung exam.

- NOTE: A normal chest exam does not exclude asthma.

- Arterial or venous blood gas: Consider in cases with impending respiratory failure.

TREATMENT

Therapeutics

- **Oxygen**: Start supplemental oxygen for any child whose oxygen saturation is less that 90%. Increase as needed.

- **Short-acting beta-agonist (SABA)**: Used for reversal of bronchospasm. SABAs should be used in every child admitted to the hospital for asthma.

- See Figure 4. Progression Through the Bronchodilator Weaning Protocol

- See Table 4. Dosage of Medications for Asthma Exacerbations, and

- See Table 2. Bronchodilator Weaning Protocol

Systemic corticosteroids\textsuperscript{6,7} should be used in all children admitted to the hospital for asthma. Steroids are recommended early in the course of an exacerbation for children who do not respond quickly or completely to inhaled beta-agonists. Oral corticosteroids have similar bioavailability to parenteral steroids. The 2007 NHLBI guidelines do not endorse doubling inhaled corticosteroid dosing. **Contraindications**: varicella, varicella exposure, tuberculosis, severe respiratory distress, recent steroid course (within 2 weeks), currently on steroids

Use the chronic asthma severity assessment to initiate or continue appropriate chronic asthma medications. (see Appendix B).

- **Emergency treatment for impending respiratory failure per Emergency Department** (Figure 2) and **Inpatient** (Figure 3) Guidelines. For medication dosing recommendations, see Table 3 and Table 4.

Education

- Provide education about asthma, exacerbations, and medications prior to discharge. Asthma education is most effective if it is delivered throughout stay and documented in an individualized asthma action plan upon discharge. Please find a one page asthma education sheet in Appendix C and view Epic screen shots of the asthma action plan in Appendix D.
• The CHCO Asthma bundle is a standard asthma discharge package that includes chronic asthma assessment, trigger evaluation, asthma action plan creation, and standard discharge instructions.

Follow up
• Follow up with patient’s primary care provider should be arranged within 10 days of discharge or treatment in any setting.

Consult asthma specialists (pulmonary or allergy) for any patient with:
• ICU admission for asthma
• Exacerbation complicated or triggered by complicating illnesses such as allergies
• Need for extensive education
• Questioning the diagnosis of asthma

Please refer all high-risk asthma patients seen at Children’s Hospital Colorado (CHCO) to the high risk asthma clinic at CHCO or back to their asthma specialist. (High risk = 1 or more hospitalizations or 2 or more ED visits in 12 months or an ICU admission ever)

Consult social work for any child/family that has trouble obtaining medications or complying with the recommended therapy for asthma.

CLINICAL CARE GUIDELINES FOR TREATMENT OF ASTHMA EXACERBATIONS

• Outpatient: See Appendix A: Outpatient Chronic Asthma Management, Appendix B: Stepwise Approach to Asthma Treatment and Figure 1: Algorithm for Asthma Exacerbation Management—Outpatient Clinic
• Emergency Department: See Figure 2: Algorithm for Asthma Management- Emergency Department
• Inpatient: See Figure 3: Algorithm for Asthma Management--Inpatient

CHILDREN’S HOSPITAL COLORADO HIGH RISK ASTHMA PROGRAM

The high risk asthma program will be notified about any child who has been admitted to the hospital for asthma or who has been seen in our emergency department for asthma more than twice in 12 months. A letter to the primary care provider (PCP) will be sent after the index visit episode to notify the PCP that their patient is at high risk for another severe asthma exacerbation. If the PCP approved or if we do not hear from the PCP that they would not like to have their patient contacted, a letter will be sent to the family to reinforce asthma education and to offer an appointment in the high-risk asthma clinic to any patient not already followed by an asthma specialist.
### TABLE 3. DOSAGE OF DAILY CONTROLLER MEDICATION FOR ASTHMA CONTROL

**NOTE:** Products that are underlined bold text are available on the inpatient formulary at Children’s Hospital Colorado

<table>
<thead>
<tr>
<th>Inhaled Corticosteroid Controller Medications</th>
<th>FDA Approved Age (yrs)</th>
<th>Low Dose</th>
<th>Medium Dose</th>
<th>High Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On Children’s Hospital Colorado Formulary</strong></td>
<td></td>
<td>less than 12 years of age</td>
<td>greater than 12 years of age/adults</td>
<td>less than 12 years of age</td>
</tr>
<tr>
<td>Advair HFA (fluticasone/salmeterol) MDI</td>
<td>12+</td>
<td>N/A</td>
<td>(45/21) 4</td>
<td>N/A</td>
</tr>
<tr>
<td>Asmanex® (mometasone) 110 mcg DPI*</td>
<td>4+</td>
<td>N/A</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Flovent® HFA (fluticasone) 44 mcg MDI</td>
<td>4+</td>
<td>2 to 4</td>
<td>2 to 6</td>
<td>4 to 8</td>
</tr>
<tr>
<td>Flovent® HFA (fluticasone) 110 mcg MDI*</td>
<td>4+</td>
<td>N/A</td>
<td>2</td>
<td>2-3</td>
</tr>
<tr>
<td>Pulmicort Respules® (budesonide) 0.25, 0.5, or 1 mg*</td>
<td>1+</td>
<td>0.25 - 0.5 mg</td>
<td>0.5 mg</td>
<td>0.5 - 1 mg</td>
</tr>
<tr>
<td>Dulera® (mometasone/formoterol) MDI</td>
<td>12+</td>
<td>N/A</td>
<td>(100/5) 4</td>
<td>(100/5) 4</td>
</tr>
<tr>
<td><strong>Not on Children’s Hospital Colorado Formulary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advair® Diskus® (fluticasone/salmeterol) DPI*</td>
<td>4+</td>
<td>(100/50) 1-2</td>
<td>(100/50) 2</td>
<td>(250/50) 1-2</td>
</tr>
<tr>
<td>Flovent® HFA (fluticasone) 220 mcg MDI</td>
<td>4+</td>
<td>N/A</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Flovent® Diskus® (fluticasone) 50 mcg DPI</td>
<td>4+</td>
<td>2 to 4</td>
<td>2 to 6</td>
<td>4 to 8</td>
</tr>
<tr>
<td>Pulmicort Flexhaler® (budesonide) 90 mcg DPI</td>
<td>6+</td>
<td>2 to 4</td>
<td>2 to 6</td>
<td>4 to 8</td>
</tr>
<tr>
<td>Pulmicort Flexhaler® (budesonide) 180 mcg DPI</td>
<td>6+</td>
<td>1 to 2</td>
<td>1 to 3</td>
<td>2 to 4</td>
</tr>
<tr>
<td>QVAR® HFA (beclomethasone) 40 mcg MDI</td>
<td>5+</td>
<td>2 to 4</td>
<td>2 to 6</td>
<td>4 to 8</td>
</tr>
<tr>
<td>QVAR® HFA (beclomethasone) 80 mcg MDI</td>
<td>5+</td>
<td>1 to 2</td>
<td>1 to 3</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Symbicort® (budesonide/formoterol) 80/4.5 MDI*</td>
<td>12+</td>
<td>2 to 4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Symbicort® (budesonide/formoterol) 160/4.5 MDI*</td>
<td>12+</td>
<td>N/A</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>Alvesco (ciclesonide) 80 mcg MDI</td>
<td>12+</td>
<td>N/A</td>
<td>1 to 2</td>
<td>N/A</td>
</tr>
<tr>
<td>Alvesco (ciclesonide) 160 mcg MDI</td>
<td>12+</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>Arnuity Ellipta (fluticasone furorate) 100 mcg DPI</td>
<td>12+</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Arnuity Ellipta (fluticasone furorate) 200 mcg DPI</td>
<td>12+</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Asmanex HFA (mometasone) 100 mcg MDI</td>
<td>4+</td>
<td>1</td>
<td>2</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Asmanex HFA (mometasone) 200 mcg MDI</td>
<td>12+</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>Breo Ellipta (fluticasone/vilanterol) 100/25, 200/25</td>
<td>18+</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*MDI: Metered-Dose Inhaler, DPI: Dry Powder Inhaler*
### TABLE 4. DOSAGE OF MEDICATIONS FOR ASTHMA EXACERBATIONS

<table>
<thead>
<tr>
<th>Medication</th>
<th>Children 12 years and younger</th>
<th>Adult or Children over 12 years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Albuterol</strong>: <em>Intermittent</em> Nebulizer solution (Available 2.5mg/3mL, 5 mg/mL)</td>
<td>0.15 mg/kg (minimum dose 2.5 mg) every 20 Minutes for 3 doses the 0.15 to 0.3 mg/kg up to 10 mg every 1 to 4 hours as needed</td>
<td>2.5 to 5 mg every 20 minutes for 3 doses, then 2.5 to 10 mg every 1 to 4 hours as needed</td>
<td>Only selective beta₂-agonists are recommended. For optimal delivery, dilute aerosols to minimum of 3 mL at gas flow of 8 L/min. May mix with ipratropium nebulizer solution.</td>
</tr>
<tr>
<td><strong>Albuterol</strong>: <em>Continuous</em> Nebulizer solution (Available 5 mg/mL)</td>
<td>20 kg or more: 10 mg/hour</td>
<td>10 mg/hour continuously</td>
<td>Use large volume nebulizers for continuous administration. May mix with ipratropium nebulizer solution.</td>
</tr>
<tr>
<td>Albuterol: MDI (Available 90 mcg/puff)</td>
<td>4 to 8 puffs every 20 minutes for 3 doses, then every 1 to 4 hours. Use valved holding chamber (VHC); add mask in children less than 4-6 years of age.</td>
<td>4 to 8 puffs every 20 minutes up to 4 hours, then every 1 to 4 as needed.</td>
<td>In mild to moderate exacerbations, MDI plus VHC is as effective as nebulized therapy with appropriate administration technique and coaching by trained personnel.</td>
</tr>
<tr>
<td><strong>Levalbuterol/R-albuterol</strong>¹⁰,¹¹ (See Restrictions): Nebulizer solution (Available 0.63 mg/3 mL, 1.25 mg/3 mL)</td>
<td>0.075 mg/kg (minimum dose 1.25 mg) every 20 minutes for 3 doses, then 0.075 to 0.15 mg/kg up to 5 mg every 1 to 4 hours as needed.</td>
<td>1.25 to 2.5 mg every 20 minutes for 3 doses, then 1.25 to 5 mg every 1 to 4 hours as needed.</td>
<td>Levalbuterol administered in one-half the mg dose of albuterol provides comparable efficacy and safety. Has not been evaluated by continuous nebulization. The following restrictions apply to the use of Levalbuterol: a) The patient has failed albuterol therapy b) The patient has experienced side effects from albuterol c) The patient has allergies to the preservatives in albuterol d) The patient is on Levalbuterol therapy on admission</td>
</tr>
<tr>
<td>Levalbuterol /R-albuterol (See Restrictions): MDI (Available 45mcg/puff)</td>
<td>See albuterol MDI dosing</td>
<td>See albuterol MDI dosing</td>
<td>See restrictions for Levalbuterol nebulizer solution above.</td>
</tr>
</tbody>
</table>
### Systemic (Injected) Beta₂-Agonists and Adjunct Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Children 12 years and younger</th>
<th>Adult or Children over 12 years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epinephrine:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Available 1:1,000 1mg/mL)</td>
<td>IM: 0.01 mg/kg (0.01 mL/kg/dose of 1mg/mL solution) not to exceed 0.5 mg every 20 minutes for 3 doses</td>
<td>IM: 0.3 to 0.5 mg every 20 minutes for 3 doses</td>
<td>No proven advantage of systemic therapy over aerosol.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Terbutaline:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Available 1mg/mL)</td>
<td>RRT required to administer on the floor</td>
<td>0.01 mg/kg every 20 minutes for 3 doses, then every 2 to 6 hours as need subcutaneously. Maximum 0.3mg/dose</td>
<td>No proven advantage of systemic therapy over aerosol. Subcutaneous Terbutaline can be used to intensify a patient who is on continuously nebulized albuterol.</td>
</tr>
<tr>
<td></td>
<td>(Available 1mg/mL)  One dose can be given on the floor for acute deterioration or poor response to inhaled beta-agonist therapy. A 2nd dose can ONLY be given if transfer to the PICU is delayed.</td>
<td>0.25 mg every 20 minutes for 3 doses subcutaneously</td>
<td></td>
</tr>
<tr>
<td><strong>Theophylline:</strong></td>
<td></td>
<td>If no theophylline given in the last 24 hours, initial dose is 5 mg/kg. If theophylline has been given in the last 24 hours; initial dose is 2.5 mg/kg. Maintenance dose and monitoring per CHCO pharmacy formulary.</td>
<td>Not recommended by the national asthma guidelines due to the narrow window of clinical efficacy and risk of adverse effects.</td>
</tr>
<tr>
<td>(Available 1mg/mL)</td>
<td>RRT required to administer on the floor. Can be started on the floor only after an RRT has been called, Pulmonary Team has been consulted and transfer to the PICU is delayed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ipratropium:</strong></td>
<td>0.5mg can be given up to 3 times and then as needed.</td>
<td>0.5mg can be given up to 3 times and then as needed.</td>
<td>May be used for up to 3 times in the initial management of severe exacerbations. The addition of Ipratropium to albuterol has not been shown to provide further benefit once the patient is hospitalized.</td>
</tr>
<tr>
<td>Nebulizer solution</td>
<td>(Available in 2.5 mL vial containing 0.5 mg ipratropium bromide, may be mixed with Albuterol) OR Ipratropium with albuterol: Nebulizer solution (Available 3 mL vial containing 0.5 mg ipratropium bromide and 2.5 mg albuterol)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjunct Treatments for Exacerbation: Only to be used in the Emergency Department or PICU. If used on the floor, RRT is required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Magnesium sulfate</strong></td>
<td>40 mg/kg IV over 30 minutes. Maximum: 2g</td>
<td>40 mg/kg IV over 30 minutes. Maximum: 2g</td>
<td>For use in life-threatening exacerbations and in those whose exacerbations remains severe after 1 hour of intensive conventional therapy.</td>
</tr>
<tr>
<td>(Available 12-14)</td>
<td></td>
<td></td>
<td>Patients given one dose of Magnesium in the ED and stable 1 hour after administration can be transferred to the General Care floors.</td>
</tr>
</tbody>
</table>
## Systemic Corticosteroids

Note: Intravenous route should only be used if patient is unable to tolerate oral intake or in cases of impending respiratory failure.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Children 12 years and younger</th>
<th>Adult or Children over 12 years</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dexamethasone</td>
<td>0.6mg/kg (Maximum16mg) one dose per day for 48 hours (two doses total)</td>
<td>0.6mg/kg (Maximum 16mg) one dose per day for 48 hours (two doses total)</td>
<td>Dexamethasone should be started in the emergency department or in primary care clinics by the treating provider. It is not recommended as a medication to keep at home due to risk of immunosuppression with multiple doses.</td>
</tr>
<tr>
<td>Prednisone or Methylprednisolone or Prednisolone</td>
<td>2 mg/kg in 2 divided doses (Maximum = 60 mg/day outpatient and 80 mg/day inpatient/ED)</td>
<td>40 to 80 mg/day in 1 to 2 divided doses</td>
<td>For outpatient “bursts”: In adults, can be dosed in single or 2 divided doses for total of 5 to 10 days. In children: 1 to 2 mg/kg/day for 3 to 10 days</td>
</tr>
</tbody>
</table>
### TABLE 5. DEXAMETHASONE DOSING GUIDE FOR ASTHMA

<table>
<thead>
<tr>
<th>General Weight Range</th>
<th>Suggested Dose</th>
<th>Tablets/strengths (based on 2mg and 4mg tablet availability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8kg</td>
<td>4mg</td>
<td>1 x 4mg tablet</td>
</tr>
<tr>
<td>8-10kg</td>
<td>6mg</td>
<td>3 x 2 mg tablets</td>
</tr>
<tr>
<td>10-15kg</td>
<td>8mg</td>
<td>2 x 4mg tablets</td>
</tr>
<tr>
<td>15-18kg</td>
<td>10mg</td>
<td>5 x 2mg tablets OR 2.5 x 4mg tablets</td>
</tr>
<tr>
<td>18-20kg</td>
<td>12mg</td>
<td>3 x 4 mg tablets</td>
</tr>
<tr>
<td>20-25kg</td>
<td>14mg</td>
<td>7 x 2mg tablets OR 3.5 x 4mg tablets</td>
</tr>
<tr>
<td>25kg and greater</td>
<td>16mg</td>
<td>4 x 4mg tablets</td>
</tr>
</tbody>
</table>

### FIGURE 5. ALGORITHM FOR DEXAMETHASONE DOSING FOR INPATIENT ASTHMA

- **Did patient receive dexamethasone** in the CHCO ED, at an outside ED/Urgent Care, or outpatient clinic within the past 24 hours?
  - **YES**
    - Is the patient on continuous albuterol?
      - **NO**
        - Order a second dose* of dexamethasone.
        - *0.6mg/kg/dose (16mg max) PO once 24-36 hours after first dose (timing based on convenience of scheduling). Dose should be administered using whole or crushed 2mg tablets (no liquid). **MAX 2 doses of dexamethasone total.** Do not administer dexamethasone IV/IM.
      - **YES**
        - Discontinue any dexamethasone orders. Do not administer dexamethasone IV/IM.
      - If patient does not improve or clinically worsens after second dose of dexamethasone, change to prednisone/prednisolone 2mg/kg/day in 2 divided doses or methylprednisolone IV as clinically indicated.
  - **NO**, patient received prednisone/prednisolone in the ED or clinic.
    - Continue with prednisone/prednisolone and follow the Asthma CCG as usual.
    - Start prednisone/prednisolone 2mg/kg/day in 2 divided doses or methylprednisolone IV as clinically indicated 24 hours after dexamethasone dose.
PARENT | CAREGIVER EDUCATION\textsuperscript{15,16}

- Asthma education will be provided throughout episode of treatment including PCP, specialist visit, ED and inpatient.
- Best Practice Alerts (BPAs) will be triggered at phase 3 to alert the RT to complete the \textit{asthma action plan} (AAP) and to finalize discharge asthma education; and at phase 4 to remind RT to re-label asthma medications and to send to pharmacy.
- An \textit{asthma action plan} will be completed for all children who are discharged from the hospital with a primary diagnosis of asthma. Any child diagnosed with reactive airway disease (RAD) in the medical record is considered to have the same diagnosis as asthma. \textit{Creation of an AAP for any patient receiving scheduled albuterol treatments should be considered}\textsuperscript{17}.
- The action plan should include controller medications (or “no controller indicated”), triggers (check the Allergy section and H&P note for known environmental allergens)), and follow up provider and phone number (cannot state “Parent Smart Number.”) May use Child Health Clinic and phone number for all non-established PCP’s at discharge. At any site where EPIC is used, the action plan can be found under the RT Navigator (for RTs) or the Dispo/Discharge Navigator (for RNs) under “Asthma Plan.” (Please remember to fully complete the form and Mark as Reviewed)
- Patient and primary caregiver need to demonstrate understanding of signs and symptoms, medication and device use, patient specific asthma triggers, peak flow education/monitoring (when applicable) and the \textit{asthma action plan}.
- The RN/RT who completes the AAP needs to document it was given to the family under the Education/LRA Navigator, pull in “Asthma” and document appropriate education under “asthma action plan.”
- Smoke avoidance and cessation counseling referral will be provided to patients and primary caregivers.

<table>
<thead>
<tr>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma Triggers</td>
<td>Asthma Triggers</td>
</tr>
<tr>
<td>Asthma: What is it?</td>
<td>Asthma: What is it?</td>
</tr>
<tr>
<td>Diskus</td>
<td>Diskus</td>
</tr>
<tr>
<td>Home nebulizer treatments</td>
<td>Home nebulizer treatments</td>
</tr>
<tr>
<td>Metered dose inhaler</td>
<td>Metered dose inhaler</td>
</tr>
<tr>
<td>Peak flow meter</td>
<td>Peak flow meter</td>
</tr>
</tbody>
</table>
APPENDIX A. ASTHMA MANAGEMENT – OUTPATIENT

Asthma Management for Children and Adults (age 5+ yrs)
Good asthma control reduces the risk of exacerbations and long-term pulmonary damage.

Make the Diagnosis
1. Consider the diagnosis of asthma if symptoms include: recurrent coughing, wheezing or shortness of breath relieved by a bronchodilator.
2. Spirometry: ≥12% increase of FEV₁ post-bronchodilator.
3. Consider co-morbidities or alternate diagnosis, especially if poor control: GERD, aspiration, airway anomaly, foreign body, cystic fibrosis, vocal cord dysfunction, tobacco/secondhand smoke exposure, or COPD. GERD is a common co-morbidity.
4. If diagnosis in doubt, consult with an asthma specialist.

Key Points of Assessment and Treatment
1. Asthma is a variable disease and needs to be assessed at every visit.
2. Use the Assess Asthma Control box to guide your assessment and make treatment decisions.
3. The goal of asthma therapy is to keep the patient in control as much as possible with the least amount of medication.
4. If at the first visit the patient is not well-controlled (see below), begin controller therapy. A patient should be diagnosed with Persistent Asthma if he/she needs a daily controller medication to stay in control.

Assess Asthma Control (determination of level of control is dictated by the criterion at the lowest level of control)

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Well-Controlled</th>
<th>Not Well-Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime symptoms</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
<td>Throughout the day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2 times/month</td>
<td>1-3 times/week</td>
<td>≥4 times/night</td>
</tr>
<tr>
<td>Limitation of activities</td>
<td>None</td>
<td>Some limitation</td>
<td>Extremely limited</td>
</tr>
<tr>
<td>Short-acting beta₂ agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
<td>&gt;2 days/week</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Asthma Control Test (ACT)¹</td>
<td>Score of ≥20</td>
<td>Score of 16-19</td>
<td>Score of ≤15</td>
</tr>
<tr>
<td>Courses of prednisone in last year</td>
<td>&lt;2</td>
<td>≥2</td>
<td>≥2</td>
</tr>
<tr>
<td>Spirometry ²</td>
<td>FEV₁ % predicted</td>
<td>60-80% predicted or personal best</td>
<td>≤5% decrease in ratio for age</td>
</tr>
<tr>
<td></td>
<td>FEV₁/FVC ratio</td>
<td>Normal ratio for age</td>
<td></td>
</tr>
</tbody>
</table>

If Well-Controlled:
Follow the Stepwise Approach Guideline. Consider step down if well-controlled for 3 consecutive months. Re-assess every 1 to 6 months.

If Not Well-Controlled:
Follow the Stepwise Approach Guideline. If initial visit, start at Step 2. Step up until well controlled. Re-assess in 2 to 6 weeks. For side effects, consider alternative treatment.

If Very Poorly Controlled:
Consider course of prednisone (1-2 mg/kg, daily max 60 mg). If initial visit, start at Step 2. Step up 1-2 steps using Stepwise Approach Guideline. Re-assess in 2 weeks.

Consider Referral to a Specialist
If not well-controlled within 3-6 months using stepwise approach OR if 2 or more ED visits or hospitalizations for asthma in a year.

Other Things to Consider at Every Visit
- Check adherence and address possible poor adherence to medication.
- Review environmental factors: e.g., pets, cigarette smoke, perfume, allergy season, respiratory infection.
- Provide self-management education.
- Develop and review a written asthma control plan in partnership with the patient.
- Integrate education into all points of care where healthcare professionals interact with patient.
- Review inhaler technique. Encourage use of spacers with all MDIs.
- Treat co-morbid conditions: rhinitis and sinusitis, obesity, gastroesophageal reflux, obstructive sleep apnea, stress, depression or anxiety, allergic bronchopulmonary aspergillosis.

¹For the full ACT go to www.healthteamworks.org/guidelines/asthma.html
²Spirometry is suggested annually and/or any time the clinical picture changes or does not make sense.
APPENDIX B. ASTHMA STEPWISE APPROACH (AKA ‘STEPS’)

Asthma Stepwise Approach
Good asthma control reduces the risk of exacerbations and long-term pulmonary damage.

**Step 1**
Age 5+ years
- Short-acting beta-agonist (e.g., albuterol) PRN
- If used more than 2 days per week (other than for exercise) consider inadequate control and the need to step up treatment.

**Step 2**
Age 5+ years
- Preferred: Low-dose inhaled steroid + LABA
- Alternative: Medium-dose inhaled steroid + LABA
- Alternative: Medium-dose inhaled steroid + Leukotriene blocker or Cromolyn

**Step 3**
Age 5+ years
- Preferred: Medium-dose inhaled steroid + LABA
- Alternative: High-dose inhaled steroid + Leukotriene blocker

**Step 4**
Age 5-11 years
- Preferred: High-dose inhaled steroid + LABA + Oral steroid
- Alternative: High-dose inhaled steroid + leukotriene blocker + Oral steroid

**Step 5**
Age 5-11 years
- Preferred: High-dose inhaled steroid + LABA - and - Consider omalizumab if allergies

**Step 6**
Age 5-11 years
- Preferred: High-dose inhaled steroid + LABA + Oral steroid - and - Consider omalizumab if allergies

All ages Steps 3 through 6: Consider alternative therapy within step before stepping up.

Schedule Follow-Up Care
Frequency of follow-up visits based on severity:
- Step 1-2: 1-2x per year
- Step 3-4: Every 6 months
- Step 5-6: Every 3 months

Consider immunotherapy if allergic asthma.
### APPENDIX C. ASTHMA EDUCATION

### What is Asthma?

Your child is in the Emergency department or Urgent care for an asthma attack. Asthma is a lung disease. Asthma causes the airways (breathing tubes in the lungs) to swell, fill with mucous and get smaller making it hard to breathe. There is no cure, but asthma can be well controlled so that your child can be healthy and join in all of their favorite activities.

### How can I take care of my child?

Follow your Asthma Action Plan and come back to the Emergency Department or Urgent Care if your child has these symptoms.

- It’s hard to breathe while walking or talking.
- The muscles in your child’s neck, chest or ribs are pulling in or your child’s nostrils are flaring with each breath.
- The quick relief inhaler isn’t working and your child is getting worse.
- Hard to wake up or keep awake
- Your child’s skin, or lips look blue, if they pass out from asthma or if they cannot breathe. **If this happens, call 911 right away.**

### What causes an asthma attack?

The things that cause asthma attacks are called triggers. Each child has different triggers for their asthma. Common triggers for wheezing include:

- Allergens: dust, grass, pollen, animals, and others
- Infections: cold and viruses
- Irritants: **any type of smoke (including tobacco and marijuana),** paint fumes, aerosols, and others

### What type of medicines treat asthma?

Medicines used to treat asthma make symptoms better by lessening swelling and relaxing tight muscles around the airways (bronchospasm). There are three main types of medicine for asthma.

- **Quick relief inhalers**, like albuterol or levalbuterol, quickly relax the muscles around the airways and should make the asthma attack better within 5-10 minutes. These medicines are also called bronchodilators.
- **Controller medicines** (inhaled steroids). They need to be taken every day, even when your child feels good, because they prevent asthma symptoms and attacks. These medicines help to lessen swelling inside the airways but they won’t work quickly enough to stop symptoms during an asthma attack.
- **Oral Steroids** are stronger steroids **taken by mouth. These are used to lessen swelling in the lungs. Oral steroids are needed for most children seen in the emergency department or urgent care with an asthma attack.**

All medicines may have side effects. Tell your child’s primary care provider about any worries you have about side effects from your child’s medicines. It is very important to follow the directions on when and how to use your child’s asthma medicines to keep asthma well-controlled.

### When can my child return to school or daycare?

Asthma is not contagious. Your child should go to school if he or she is having mild asthma symptoms, but should avoid gym or vigorous activity on these days.
APPENDIX D. ASTHMA ACTION PLAN EPIC SCREENSHOTS

Provider view, accessible through navigator or the More Activities Menu

My Asthma Action Plan

Asthma Triggers
- Any type of smoke
- Colds and Viruses
- Mold
- Cockroach
- Dogs
- Cats
- Animals
- Exercise
- Dust
- Strong smells
- Pollens
- Other

Best peak flow: _______________________________ Recalculate zone peak flow ranges

Green Zone - I feel good

Peak flow: more than __________

What should I do?
- Avoid my asthma triggers.
- See my health care provider every 1 to 6 months for asthma check ups.
- If needed take 2-4 puffs of your quick relief inhaler (albuterol or xopenax) at least 10 minutes before exercise.
- Take my daily medicines to stay in control of my asthma.

Controller Medicine: ________________________

No controller medicine

Nasal saline rinse as instructed

Nasal Steroids [ ]

Antihistamine [ ]

Other instructions:

Yellow Zone - I don’t feel good

Peak flow: __________ to __________

What should I do?
- Continue taking my daily controller medicines and add the quick relief medication listed below.

Quick Relief Medicines

Inhaler: Albuterol: ProAir(red), Ventolin(blue) or Proventil(yellow) with spacer, ProAir RespClick (white), Xopenax (blue) with spacer

Nebulizer: Albuterol 2.5mg, Xopenax 0.5mg, Xopenax 1.25mg

- If symptoms go away within 30 minutes return to the green zone
- Asthma symptoms can get worse fast. When in doubt call your provider for advice.
- If symptoms are not getting better in 24 hours, continue quick relief every 4 hours and call your provider.

Steroid Medicine

Start prednisolone as directed, Start prednisone as directed, Increase controller medicine as directed

Add inhaled steroids as directed, Use dexamethasone as instructed

Other instructions:
Red Zone - I feel BAD and need help

What should I do?
- Use your quick relief medicine (albuterol or xopenex) every 20 minutes for a total of 3 doses while you go to see a health care provider.
- You need help fast. Friends or family should call 911 if your skin or lips turn blue, if you pass out from asthma, or if you cannot breathe.

Other instructions:
Patient view

**Asthma Plan**

**My Asthma Action Plan**

<table>
<thead>
<tr>
<th>Physician or Clinic: Pc Cent Provider Ztest</th>
<th>Name: Tobramycin Pk Ztest</th>
</tr>
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<tr>
<td>PCP phone: None</td>
<td>DOB: 6/20/2006</td>
</tr>
<tr>
<td>Visit date: April 13, 2017</td>
<td>Last reviewed: 4/13/2017 1:15 PM</td>
</tr>
</tbody>
</table>

**Asthma Triggers:**
- Mold
- Any type of smoke
- Colds and Viruses

**Green Zone - I feel good**
I play, sleep, and go to school. Breathing is easy. No cough or wheezing. I am using my quick relief medicine less than 2 times per week.

**What should I do?**
- Avoid my asthma triggers
- See my health care provider every 1 to 6 months for asthma check ups
- If needed, take 2-4 puffs of my quick relief inhaler (albuterol or xopenex) at least 10 minutes before exercise
- Take my daily medicines to stay in control of my asthma

**Controller Medicines**
- Montelukast (Singulair) 4mg Once daily
- Loratadine (Claritin) 10mg Once daily by mouth
- Nasal saline rinse as instructed

**Yellow Zone - I don’t feel good**
I have trouble playing or sleeping. I am coughing, wheezing, or having trouble breathing or speaking. I am using my quick relief medicine more than 2 times per week.

**What should I do?**
- Continue taking my daily controller medicines and add quick relief medicine
  - Inhaler: Albuterol: ProAir(red), Ventolin(blue) or Proventil(yellow) with spacer 2-4 puffs Every 4 hours as needed
  - Nebulizer: Albuterol 2.5mg Every 4 hours as needed
- If symptoms go away within 30 minutes return to green zone.
- Asthma symptoms can get worse fast. When in doubt call your provider for advice
- If symptoms are not getting better in 24 hours, continue quick relief every 4 hours and call your provider.
  - Start prednisone as directed

**Red Zone - I feel BAD and need help**
I cannot play, do activities, or sleep. My cough or wheeze is not getting better with my asthma medicine. I need my quick relief medicine more than every 4 hours.

**What should I do?**
- Take your quick relief inhaler with spacer 4-6 puffs every 20 minutes while you go to see a health care provider right away.
- You need help fast. Friends or family should call 911 if your skin or lips turn blue, if you pass out from asthma, or if you cannot breathe.

**Healthcare Provider Authorization:**

**Date:**

**Parent/Guardian Authorization:**

**Date:**
REFERENCES


Additional related literature

General:


The role of clinical care pathways in the treatment of pediatric asthma:


The impact of clinical care pathways on house staff:


**Continuous nebulization for the treatment of acute asthma exacerbation**


**Ipratropium bromide:**


**Nebulizers vs metered-dose inhalers with valved holding chambers:**


**Noninvasive ventilation:**


**Health Team Works website**

1. Figures 1. and 2. - [http://healthteamworks.ebizcdn.com/b44afe91b8a427a6be2078cc89bd6f9b](http://healthteamworks.ebizcdn.com/b44afe91b8a427a6be2078cc89bd6f9b)

**Inhaled corticosteroids:**


**Specialty care:**


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