Relevance to Population
Asthma is a chronic inflammatory disease of the airways affecting an estimated 25.9 million people in the U.S. with increasing prevalence, mortality and cost of care. Asthma is the most common chronic disorder of children affecting an estimated 7.1 million children and the leading cause of school absenteeism, accounting for more than 14 million lost school days according to the American Lung Association. It is also the leading cause of work loss for adults, accounting for an estimated 14.2 million lost workdays each year. Asthma affects proportionately more children than adults, more women than men, more nonwhites than whites and more of those residing in the Northeast compared with those residing in other regions. The prevalence rate for asthma in CY2012 at UPMC Health Plan was 6.65% percent for all products with 16.5% percent for SNP members, 6.14% for Medicare members and 4.89% for CHIP members.

Population Covered by Guideline: All Health Plan members with Asthma.

Clinical Indicators Measured by UPMC Health Plan
- Use of Appropriate Medications for People with Asthma- HEDIS®
- Medication Management for People with Asthma- HEDIS®
- Asthma Medication Ratio- HEDIS®
- Percentage of people with Asthma on appropriate medication and who are also on inhaled corticosteroids
- Percentage of people with a diagnosis of Asthma who have had a spirometry test within the last 24 months

Additional HEDIS® Measures for Respiratory Conditions
- Appropriate Testing for Children with Pharyngitis
- Appropriate Treatment for Children with Upper Respiratory Infection
- Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis

Asthma Definition (ICSI 2012) Asthma is a chronic inflammatory disorder of the airways, characterized by:
- Airway inflammatory cells, including eosinophils, macrophages, mast cells, epithelial cells and activated lymphocytes that release various cytokines, adhesion molecules and other mediators
- Inflammation resulting in an acute, subacute or chronic process that alters airway tone, modulates vascular permeability, activates neurons, increases secretion of mucus, and alters airway structure reversibly or permanently
- Airway hyperresponsiveness in response to allergens, environmental irritants, viral infections and exercise
- Airflow obstruction caused by acute bronchial constriction, edema, mucous plugs and frequently, permanent remodeling.

Key Points
- Airway inflammation contributes to hyperresponsive airways, airflow limitation, respiratory symptoms, and disease chronicity.
- Viral respiratory infections are one of the most important causes of asthma exacerbation.
- Use of the patient’s Asthma Action Plan containing the following written information is recommended:
  - How to monitor asthma daily, either by symptoms or peak flow monitoring
  - Asking your doctor about receiving the flu and pneumonia vaccines
  - List of medications as controllers taken regularly to prevent acute exacerbations and relievers taken for quick relief of symptoms or to prevent exercise-induced asthma
  - Action plan for worsening of symptoms or peak flow readings not improving with current medications

Current Major National Asthma Guidelines
Goal of Asthma Management: To maintain long-term monitoring and control of asthma with minimal adverse effects by using optimal asthma education and therapy.

Asthma Diagnosis available at http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf - refer to section 2

- History, Physical Examination, and Spirometry measurement demonstrating:
  - Episodic symptoms of airflow obstruction/airway hyperresponsiveness: breathlessness, wheezing, coughing, and chest tightness.
  - Spirometry, performed pre- and post-bronchodilator, to confirm evidence of airflow obstruction that is at least partially reversible in adults and children ≥ 5 years old.
  - Exclusion of other diagnoses: foreign body, Cystic Fibrosis, vocal cord dysfunction, tracheomalacia, COPD, CHF, PE, tumor, GERD, medications
  - Allergy testing such as Skin and RAST (RadioAllergoSorbent Test) can help identify risk factors that may cause asthma symptoms in individual patients.
  - For suspected asthma with normal spirometry, bronchoprovocation (methacholine, histamine, cold air, or exercise) may be useful.


- Objective assessment of pulmonary function using spirometry to measure FEV1, FVC (or FEV6), and FEV1/FVC pre- and post-bronchodilator is necessary for the diagnosis of asthma.
  - Significant reversibility is demonstrated by an increase of ≥ 12% or 200 mL in FEV1, after a short-acting bronchodilator. (Sveum 2012)
  - Spirometry measures should be followed over the patient’s lifetime to detect decline of pulmonary function.
    - Spirometry frequency (NHLBI Expert Panel 2007)
      - At the time of initial assessment
      - After stabilization on treatment, to document return to near normal airway function
      - During periods of progressive or prolonged loss of asthma control
      - At least every 1-2 years to assess maintenance of airway function
  - Office-based physicians who care for asthma patients should have access to spirometry for asthma diagnosis and monitoring.
  - For children, FEV1/FVC appears to be a more sensitive measure of severity; FEV1 is useful to assess risk of exacerbations.

Components of Asthma Management

- Measures of Assessment and Monitoring: Patient history, physical exam, and objective tests to diagnose, assess, and monitor the level of asthma control. Classify asthma severity using measures in the following 2 domains:
  - Impairment (symptoms over the previous 2 to 4 weeks)
  - Risk (frequency and intensity of exacerbations)
- Develop a Doctor-Patient Partnership to achieve guided self-management of asthma – giving people the ability to control their own asthma is associated with improved clinical outcomes. Key components include:
  - Joint goal setting
  - Education - teaching by health care team with frequent reinforcement. Key components include:
    - Recognition of early signs of worsening asthma and a prompt symptom response plan
    - Medications (actions, benefits, side effects, difference between “relievers” and “controllers”)
    - Proper use of inhalers
    - Home allergen control
  - Self-monitoring (regular use of either symptom-based or peak flow monitoring are effective)
  - Regular health care visits to review asthma control, treatment, and self-management skills
  - Written action plan that integrates self-monitoring with evidence-based management for both long-term control of asthma and treatment of acute exacerbations.
- Control Environmental Factors and Comorbid Conditions that Affect Asthma: avoid tobacco smoke exposure.
• Diet: High intake of fruits, vegetables and the Mediterranean diet appears protective against developing asthma and allergies in early childhood (Chatzi and Kogevinas).
• Pharmacotherapy for acute exacerbations and maintenance to maintain control and prevent exacerbations (below).

Management of Asthma Exacerbations (refer below to NHLBI 2007 algorithms Management of Asthma Exacerbations – Home Treatment and Management of Asthma Exacerbations – ED and Hospital Treatment):

• Initial Evaluation  
  Assess symptoms and vital signs. In the absence of impending respiratory failure, spirometry with both inspiratory and expiratory loops should be done to assess baseline level of obstruction and differentiate acute asthma from vocal cord dysfunction or hyperventilation. These measures can also be performed after initial treatment with a SABA if the assessment is limited by patient discomfort. Peak flow has not been found to be a reliable measure of severity in acute asthma exacerbation.

• Initial Management:  
  o Inhaled SABA every 20 minutes.  
  o Systemic corticosteroids should be utilized in all but the mildest exacerbations, especially if B-agonist therapy does not achieve sustained improvement, if exacerbation occurs when already on steroids, or previous exacerbations required oral steroids (GINA 2012) and IV corticosteroids should be considered when the FEV1 is <40% predicted.  
    ▪ Oral steroids are usually as effective as IV.  
    ▪ Consider IV steroids if there is emesis (GINA 2012) or when the FEV1 is < 40% predicted (NHLBI 2007).  
    ▪ An IM dose of steroids may be may be helpful in patients discharged from the ED. (GINA 2012)  
    ▪ A 7 day course of steroids in adults is as effective as a 14 day course.  
    ▪ A 3-5 day course of steroids is considered appropriate in children.  
  o Inhaled steroids are effective as part of therapy for asthma exacerbations, provide added benefit and should be initiated along with systemic steroids. (GINA 2012)

Alternatives for severe, refractory acute asthma exacerbations not responding to treatment to help reduce need for intubation/ventilator support:
  o Epinephrine 1:1000 (NHLBI 2007) (ICSI 2012)  
    ▪ Adult: 0.5-0.5 mg subQ or IM every 20 min up to 3 doses (caution in the elderly, patients with severe HBP and/or coronary artery disease)  
    ▪ Children: 0.01 mg/kg up to 0.3-0.5 mg subQ or IM every 20 min up to 3 doses  
  o IV Magnesium as a single 2 gram infusion over 20 min. is not routinely recommended but may be helpful in selected instances including: (GINA 2012)  
    ▪ Adults with FEV1 25-30% predicted upon presentation  
    ▪ Adults and children who fail to respond to initial treatment  
    ▪ Children whose FEV1 fails to improve above 60% predicted after 1 hour of care  
  o Heliox (low density blend of helium and oxygen gases) + albuterol nebulizer treatment (ICSI 2012):  
    ▪ Small randomized controlled trials showed mild improvement in spirometry and dyspnea  
    ▪ Current evidence supports secondary but not primary therapy for asthma exacerbations  
  o Bilevel Positive Airway Pressure non-invasive ventilation (BiPAP) is probably beneficial in severe asthma and status asthmaticus refractory to standard treatment, but experience is limited (ICSI 2012)  
    ▪ Reported benefit is mostly from case series: improved FEV1 and fewer admissions from ED  
    ▪ Recommended: Criteria for Use: respirations > 25/min, pulse > 110/min, use of accessory muscles, FEV1 < 50% predicted, PCO2 < 60 mmHg  
    ▪ Contraindications to BiPAP in acute asthma: (Soroksky)  
      ➢ Absolute: need for immediate endotracheal intubation, decreased level of consciousness, excess secretions/aspiration risk, inability to properly fit mask  
      ➢ Relative: hemodynamic instability, severe hypoxia and/or hypercapnia, poor patient cooperation, severe agitation, lack of trained/experienced staff
• **Discharge Management** Patients who receive systemic corticosteroids in the ED should be given a course of oral corticosteroids on discharge. If not already on an ICS, the patient should be given a prescription for an ICS, instructed in its use, and a follow-up appointment scheduled with a specialist in asthma or with their primary care physician.

• **Maintenance Pharmacotherapy for Asthma** – Key Points:
  - **STEP 1**: Acute symptom management: Short-acting Beta-agonist (SABA) meds act rapidly to relax bronchial smooth muscle and are preferred for relief of acute symptoms and prevention of exercise-induced asthma.
  - **STEP 2**: Long-term asthma control: Controller meds that reduce airway inflammation and prevent bronchoconstriction are most effective to achieve and maintain good control and should be taken regularly on a long-term basis:
    - Preferred Controller - Inhaled Corticosteroids (ICS) are the most effective and the preferred long-acting controllers for mild, moderate, and severe persistent asthma; they are generally safe and well tolerated at moderate doses.
    - Alternative controllers for mild persistent asthma – Leukotriene Receptor Antagonists (LTRAs), Cromolyn, or Theophylline.

Step-up or add on therapy for persistent asthma despite compliance with ICS:
  - **STEP 3**:
    - Preferred – Low-dose ICS + Long-Acting Beta2-Agonists (LABA) or Medium Dose ICS
      - A combination inhaler with ICS + rapid and long-acting B$_2$-agonist can maintain effective asthma control, reduce exacerbations and hospitalizations
      - LABAs are more effective than LTRA in restoring normal airway function
      - LABA monotherapy SHOULD NOT BE USED – it has been linked to fatal asthma attacks and LABAs should not be used for asthma without an ICS
      - For children ≥ 5 yrs with moderate persistent asthma not controlled on low-dose ICS, increasing ICS is given equal weight to adding LABA.
      - For children ≥ 5 yrs with severe persistent asthma, the combination of ICS + LABA is preferred.
    - Alternative – Low-dose ICS + LTRA and/or inhaled [LABA+anticholinergic] or theophylline
      - Consider LTRA, especially if there is strong desire for an oral agent, greater anti-inflammatory effect, lung function is normal, and/or there is allergic rhinitis (Currie).
      - Combination inhaled LABA + anticholinergic (ipratropium bromide) may provide greater benefit without increase in significant adverse events (GINA 2012) (Aaron):
        - Improved FEF and FEV$_1$
        - Lower risk of hospitalization
        - May be considered before theophylline
        - NOTE: Ipratropium is not FDA approved for asthma or for use in children < 12 years of age
  - **STEP 4**:
    - Preferred – Medium-dose ICS + LABA
    - Alternative – Medium-dose ICS + LTRA or theophylline
  - **STEP 5**:
    - Preferred – High-dose ICS + LABA and consider Omalizumab for patients with allergies
  - **STEP 6**:
    - Preferred – High-dose ICS + LABA + oral corticosteroid and consider Omalizumab for patients with allergies

NOTE: If theophylline is used, monitoring of serum theophylline levels is essential.
Key: ED: emergency department; MDI: metered-dose inhaler; PEF: peak expiratory flow; SABA: short-acting beta2-agonist (quick-relief inhaler)

### FIGURE 5-6. MANAGEMENT OF ASTHMA EXACERBATIONS: EMERGENCY DEPARTMENT AND HOSPITAL-BASED CARE

#### Initial Assessment (see figures 5-1, 5-3)
- Brief history, physical examination (auscultation, use of accessory muscles, heart rate, respiratory rate), FEV<sub>1</sub> or PEF, oxygen saturation, and other tests as indicated

<table>
<thead>
<tr>
<th>FEV&lt;sub&gt;1&lt;/sub&gt; or PEF ≥40% (Mild-to-Moderate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Inhaled SABA by nebulizer or MDI with valved holding chamber, up to 3 doses in first hour</td>
</tr>
<tr>
<td>- Oral systemic corticosteroids if no immediate response or if patient recently took oral systemic corticosteroids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FEV&lt;sub&gt;1&lt;/sub&gt; or PEF &lt;40% (Severe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Oxygen to achieve SaO&lt;sub&gt;2&lt;/sub&gt; ≥90%</td>
</tr>
<tr>
<td>- High-dose inhaled SABA plus ipratropium by nebulizer or MDI plus valved holding chamber, every 20 minutes or continuously for 1 hour</td>
</tr>
<tr>
<td>- Oral systemic corticosteroids</td>
</tr>
</tbody>
</table>

#### Impending or Actual Respiratory Arrest
- Intubation and mechanical ventilation with 100% oxygen
- Nebulized SABA and ipratropium
- Intravenous corticosteroids
- Consider adjunct therapies

#### Repeat Assessment
- Symptoms, physical examination, FEV<sub>1</sub>, SaO<sub>2</sub>, other tests as needed

- Administer to Hospital Intensive Care (see box below)

#### Moderate Exacerbation
- FEV<sub>1</sub> or PEF ≥40% predicted/personal best
- Physical exam: moderate symptoms
  - Inhaled SABA every 60 minutes
  - Oral systemic corticosteroids
  - Continue treatment 1-2 hours, provided there is improvement; make admission decision in <4 hours

#### Severe Exacerbation
- FEV<sub>1</sub> or PEF <40% predicted/personal best
- Physical exam: severe symptoms at rest, accessory muscle use, chest retractions
- History: high-risk patient
- No improvement after initial treatment
  - Oxygen
  - Nebulized SABA + ipratropium, hourly or continuous
  - Oral systemic corticosteroids
  - Consider adjunct therapies

#### Good Response
- FEV<sub>1</sub> or PEF ≥70% after last treatment
- Normal oxygen saturation
- Physical exam: normal

- Discharge Home
  - Continue treatment with inhaled SABA
  - Continue course of oral systemic corticosteroids
  - Consider initiation of an ICS
  - Patient education
    - Review medications, including inhaler techniques
    - Review/Initiate action plan
    - Recommend close medical follow-up

#### Incomplete Response
- FEV<sub>1</sub> or PEF 40-90%
- Mild-to-moderate symptoms

- Admit to Hospital Ward
  - Oxygen
  - Inhaled SABA
  - Systemic (oral or intravenous) corticosteroids
  - Consider adjunct therapies
  - Monitor vital signs, FEV<sub>1</sub>, or PEF, SaO<sub>2</sub>

#### Poor Response
- FEV<sub>1</sub> or PEF ≤40%
- Dyspnea, confusion

- Admit to Hospital Intensive Care
  - Oxygen
  - Inhaled SABA hourly or continuously
  - Intravenous corticosteroids
  - Consider adjunct therapies
  - Possible intubation and mechanical ventilation

#### Individualized decision re: hospitalization (see text)

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**Key:**
- FEV<sub>1</sub>, forced expiratory volume in 1 second
- ICS, inhaled corticosteroid
- MDI, metered dose inhaler
- PCO<sub>2</sub>, partial pressure of carbon dioxide
- PEF, peak expiratory flow
- SABA, short-acting beta<sub>2</sub>-agonist
- SaO<sub>2</sub>, oxygen saturation

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Clinical practice guidelines are designed to assist clinicians by providing a framework for the evaluation and treatment of patients. The asthma guideline is based on the most current recommendations from the National Institutes of Health, National Heart, Lung, and Blood Institute, Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, Full Report 2007. The current full Asthma Guideline is available at http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm.

Additional Resources for UPMC Health Plan Members

- **MyHealth Advice Line** is staffed by experienced Registered Nurses and is available 24/7 to provide telephone support to members. Call 1-866-918-1591. TTY/TDD users should call 1-866-918-1593.

- **Health Coach Programs** provide intensive case management for members with specific chronic illnesses or conditions. The programs are built upon best practices and accepted clinical guidelines and include:
  - Diabetes
  - Respiratory
    - Asthma
    - COPD
  - Behavioral Health
    - Depression
  - Cardiovascular
    - Heart failure
    - Coronary artery disease

  Additional Health Coach Program information available to members and providers by calling: 1-866-778-6073

- **Additional Health Condition Management Programs** include:
  - Hypertension
  - Hyperlipidemia
  - Low Back Pain
  - ESRD
  - Wound Care
  - Oncology
  - Rare & Chronic Conditions
  - Attention Deficit/Hyperactivity Disorder (ADHD)
  - Anxiety Disorders
  - Substance Abuse

- **Online** interactive preventive health programs and resources are available in partnership with WebMD at www.upmchealthplan.com
  - MyHealth Ready to Quit™
  - MyHealth Step Up to Wellness™
  - MyHealth Eating Well™
  - MyHealth Weigh to Wellness™
  - MyHealth Less Stress™
  - MyHealth OnLine Emotional Health Program™
Scientific Evidence Sources


Sveum R et al. Institute for Clinical Systems Improvement. Diagnosis and Management of Asthma. Updated July 2012. Available at: [https://www.icsi.org/_asset/rsjvnd/Asthma.pdf](https://www.icsi.org/_asset/rsjvnd/Asthma.pdf)