ICSI Institute for Clinical Systems Improvement

Health Care Guideline

Diagnosis and Management of Asthma

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ICSI
Institute for Clinical Systems Improvement

Health Care Guideline and Order Set:
Diagnosis and Management of Asthma

Tenth Edition
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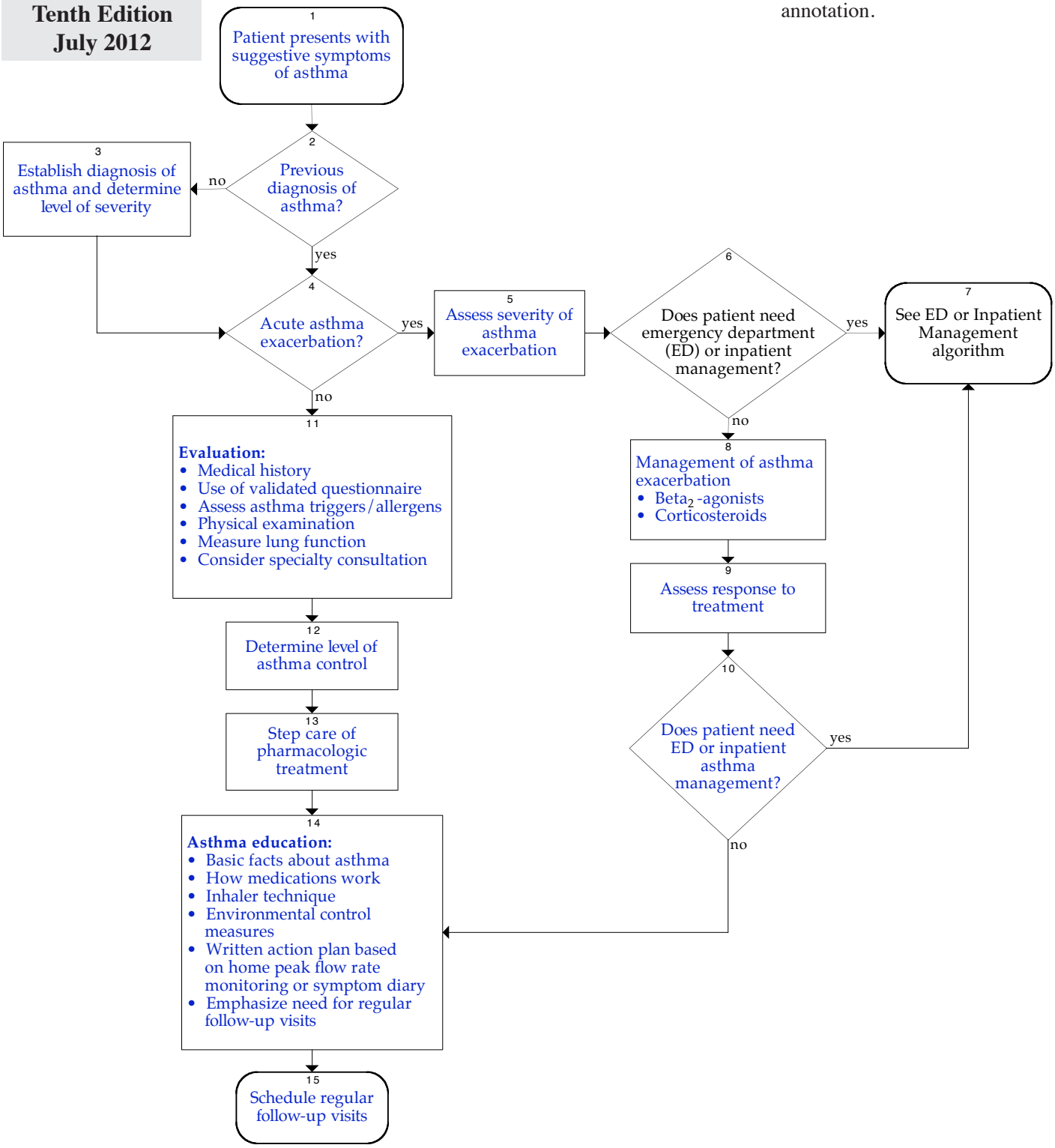
Main Algorithm

Text in blue in this algorithm indicates a linked corresponding annotation.



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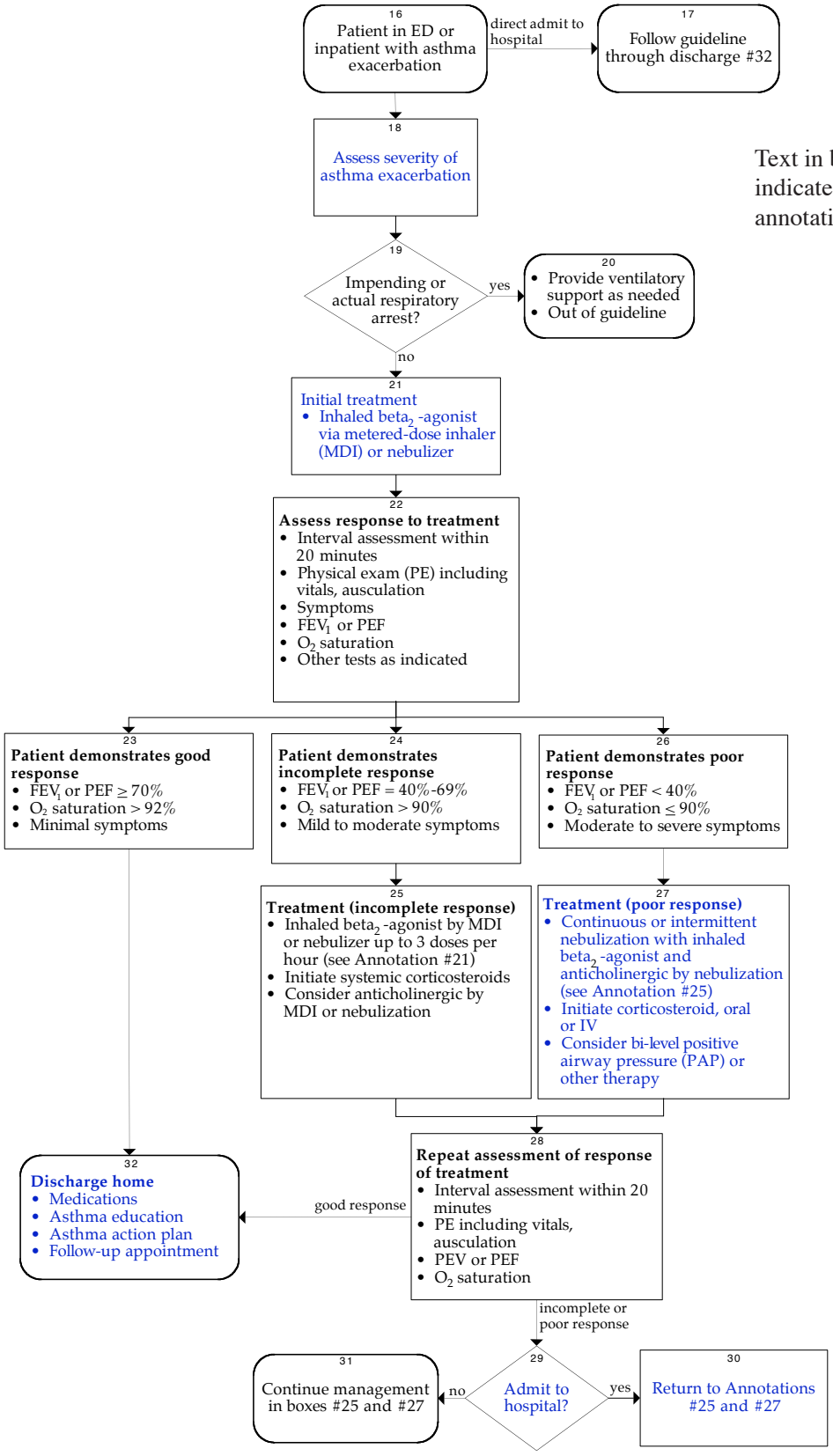
Emergency Department or Inpatient Management Algorithm



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Evidence Grading

Literature Search

A consistent and defined process is used for literature search and review for the development and revision of ICSI guidelines. The literature search was divided into two stages to identify systematic reviews, (stage I) and randomized controlled trials, meta-analysis and other literature (stage II).

A literature search on diagnosing and treating asthma focused on systematic reviews in PubMed and Cochrane databases. Publication dates included November 2009 through November 2011. Limitations were human data only and English language publications. Search strategy can be seen in MeSH terms: asthma, diagnosis, therapy, therapeutics.

Broader searches were conducted on the use of FENO (fraction of expired nitric oxide) testing, asthma management clinics, and quality improvement programs for symptom management. Included were trial data and observational studies, guidelines and reviews. Search strategies can be seen in MeSH terms: FENO, organization and administration, disease management, symptom management, palliative care, clinics, specialty, ambulatory, guideline/meta-analysis/controlled trial/review.

A final search on patient education and self-management focused on both randomized controlled trials and systematic reviews in PubMed from January 2009 through March 2012. Results were limited to English language publications. Search strategy can be seen in MeSH terms: effective, patient education handout/topic, self management and self-monitoring.

GRADE Methodology

Following a review of several evidence rating and recommendation writing systems, ICSI has made a decision to transition to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system.

GRADE has advantages over other systems including the current system used by ICSI. Advantages include:

- developed by a widely representative group of international guideline developers;
- explicit and comprehensive criteria for downgrading and upgrading quality of evidence ratings;
- clear separation between quality of evidence and strength of recommendations that includes a transparent process of moving from evidence evaluation to recommendations;
- clear, pragmatic interpretations of strong versus weak recommendations for clinicians, patients and policy-makers;
- explicit acknowledgement of values and preferences; and
- explicit evaluation of the importance of outcomes of alternative management strategies.

This document is in transition to the GRADE methodology

Transition steps incorporating GRADE methodology for this document include the following:

- Priority placed upon available Systematic Reviews in literature searches.
- All existing Class A (RCTs) studies have been considered as high quality evidence unless specified differently by a work group member.
- All existing Class B, C and D studies have been considered as low quality evidence unless specified differently by a work group member.
- All existing Class M and R studies are identified by study design versus assigning a quality of evidence. Refer to Crosswalk between ICSI Evidence Grading System and GRADE.
- All new literature considered by the work group for this revision has been assessed using GRADE methodology.

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Crosswalk between ICSI Evidence Grading System and GRADE

ICSI GRADE System	Previous ICSI System	
High, if no limitation	**Class A:**	Randomized, controlled trial
Low	**Class B:**	[observational] Cohort study
	Class C:	[observational] Non-randomized trial with concurrent or historical controls
Low		Case-control study
Low		Population-based descriptive study
***Low**		Study of sensitivity and specificity of a diagnostic test
* Following individual study review, may be elevated to Moderate or High depending upon study design		
	Class D:	[observational]
Low		Cross-sectional study Case series Case report
Meta-analysis	**Class M:**	Meta-analysis
Systematic Review		Systematic review
Decision Analysis		Decision analysis
Cost-Effectiveness Analysis		Cost-effectiveness analysis
Low	**Class R:**	Consensus statement
Low		Consensus report
Low		Narrative review
Guideline	**Class R:**	Guideline
Low	**Class X:**	Medical opinion

Evidence Definitions:

High Quality Evidence = Further research is very unlikely to change our confidence in the estimate of effect.

Moderate Quality Evidence = Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low Quality Evidence = Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate or any estimate of effect is very uncertain.

In addition to evidence that is graded and used to formulate recommendations, additional pieces of literature will be used to inform the reader of other topics of interest. This literature is not given an evidence grade and is instead identified as a **Reference** throughout the document.

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Foreword

Introduction

Asthma remains the number one chronic disease of childhood with 12.8 million school days missed. The toll of asthma includes 1.7 million emergency department visits, 10.6 million physician office visits, 444,000 hospitalizations and 3,613 deaths *(National Asthma Control Initiative, 2010 [Reference])*.

The United States has seen declining asthma death rates despite increased prevalence. Fewer patients who have asthma report limitation to activities. Twenty-three million Americans, one out of every 13 people, have this chronic inflammatory lung disease that if uncontrolled can lead to suffering with cough, wheezing and shortness of breath. Approximately 50% of asthma patients report having had an attack within one year, and they suffer a larger volume of missed school and work. Of all asthma patients, more than 13% suffer asthma attacks that require urgent medical care. The Centers for Disease Control identified its priority to be patients improving management of asthma symptoms *(Centers for Disease Control, 2011 [Reference])*.

If clinicians, payers, community partners and patients follow these clinical guidelines and control asthma, countless children and adults will benefit through reduced suffering and hospitalizations.

In the last two decades, ICSI has published three separate guidelines that converged into the current document. The Diagnosis and Management of Asthma guideline spans ambulatory to emergent and inpatient care. The ICSI work group welcomes your comments and suggestions.

(NHLBI, 2007 [Guideline])

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Scope and Target Population

This guideline addresses the diagnosis, emergent, inpatient and outpatient management of acute and chronic asthma in all patients over five years of age who present with asthma-like symptoms or have been diagnosed with asthma.

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Aims

1. Increase the rate of patients five years and older who have accurate assessment of asthma severity and control through the use of objective measures of lung function and symptoms. *(Annotations #5, 11, 12)*
2. Increase the rate of patients five years and older who have written asthma action plans, and timely and accurate assessment of asthma exacerbation. *(Annotation #14)*
3. Increase the rate of patients five years and older who have appropriate treatment and management of asthma in inpatient care settings. *(Annotation #29, 30)*
4. Increase the rate of patients five years and older who have follow-up visits to ensure asthma control is maintained and appropriate therapy is administered following any visit for asthma or medication adjustment. *(Annotations #9, 12, 13, 14, 30, 32)*

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Clinical Highlights

- Conduct interval evaluations of asthma including medical history and physical examination, assessment of asthma triggers and allergens, measurement of pulmonary function, and consideration of consultation and/or allergy testing. *(Annotation #11)*
- Assess control using objective measures and a validated asthma control tool. *(Annotation #12)*
- Match therapy with asthma control. *(Annotation #13)*
- Provide asthma education to patients and parents of pediatric patients. Education should include basic facts about asthma, how medications work, inhaler technique, a written action plan including home peak flow rate monitoring or a symptom diary, environmental control measures, and emphasis on the need for regular follow-up visits. *(Annotation #14)*

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Implementation Recommendation Highlights

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of the implementation of this guideline.

- Facilitate timely and accurate diagnosis of asthma, and asthma severity and control.
- Educate clinicians in the use of spirometry as a diagnostic tool.
- Educate clinicians and patients in the importance of developing a partnership using the ICSI Collaborative Conversation™ for Shared Decision-Making model to establish and maintain an asthma action plan and assess adherence.

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Related ICSI Scientific Documents

Guidelines

- Chronic Obstructive Pulmonary Disease
- Diagnosis and Treatment of Respiratory Illness in Children and Adults

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Definition

Clinician – All health care professionals whose practice is based on interaction with and/or treatment of a patient.

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Algorithm Annotations

Main Algorithm Annotations

1. Patient Presents with Suggestive Symptoms of Asthma

Definition of Asthma

Asthma is a chronic inflammatory disorder of the airways. It is 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, mucus plugs and frequently, permanent remodeling

Symptoms

- Wheezing
- Breathlessness
- Cough, productive or dry
- Chest discomfort

Pattern of symptoms

- Perennial/seasonal
- Episodic/continual
- Diurnal

Severity of symptom classification

- Number of symptom episodes per week
- Number of nocturnal symptoms per month
- Objective measures of lung function (forced expiratory volume in one second [FEV_1], peak expiratory flow rate [PEFR], PEF variability)

Symptoms of Asthma

Symptoms suggestive of asthma include episodic wheezing and cough with nocturnal, seasonal or exertional characteristics. Infants and children with frequent episodes of "bronchitis" are likely to have asthma. Atopic and positive family histories for asthma, particularly when associated with previously mentioned symptoms, should encourage one to consider a diagnosis of asthma.

Eliciting symptoms should emphasize characterizing the current classification scheme that describes frequency per week, changes in physical activity, diurnal variation, and seasonal variation. It is important to recognize

that patients with asthma are heterogeneous, falling into every age group, from infancy to older age, and presenting a spectrum of signs and symptoms that vary in degree and severity from patient to patient, as well as within an individual patient over time *(National Heart, Lung, Blood Institute, 2007 [Guideline])*.

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2. Previous Diagnosis of Asthma?

At each evaluation, it is important to consider whether or not a previous diagnosis was correct.

- History and physical consistent with diagnosis
- Response to therapy consistent with symptoms

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3. Establish Diagnosis of Asthma and Determine Level of Severity

Recommendations:

- The diagnosis of asthma is based on the patient's medical history, physical examination, pulmonary function tests and laboratory test results.
- Spirometry is recommended for the diagnosis of asthma.
- The level of asthma severity is determined by both impairment and risk.

Asthma triggers

- Viral respiratory infections
- Environmental allergens
- Exercise, temperature, humidity
- Occupational and recreational allergens or irritants
- Environmental irritants (perfume, tobacco smoke, wood-burning stoves)
- Drugs (aspirin, non-steroidal anti-inflammatory drugs [NSAIDs], beta-blocker) and food (sulfites)

Other historical components

- Emergency department visits and hospitalization
- Medication use (especially oral steroids)
- Lung function, PEFR variability
- Associated comorbidities, e.g., rhinitis, sinusitis, gastroesophageal reflux (GERD)

Clinical testing

- Accurate spirometry is recommended in every patient five years of age or older at the time of diagnosis.
- Additional studies done, tailored to the specific patient.
  - Allergy testing (e.g., skin testing, blood testing, in vitro-specific IgE antibody testing)
  - Chest radiography, to exclude alternative diagnosis
  - Bronchial provocation testing if spirometry is normal or near normal

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- Sinus x-rays or CT scan
- GERD evaluation
- CBC with eosinophils, total IgE, sputum exam
- Exhaled nitric oxide *(Dweik, 2010 [Guideline])*

Spirometry is the cornerstone of the laboratory evaluation that enables the clinician to demonstrate airflow obstruction and establish a diagnosis of asthma with certainty. Spirometry is essential for assessing the severity of asthma in order to make appropriate therapeutic recommendations. The use of objective measures of lung function is recommended because patient-reported symptoms often do not correlate with the variability and severity of airflow obstruction. Testing should be performed in compliance with the American Thoracic Society standards. Obstructive and restrictive ventilatory defects can generally be determined using forced expiratory volume in one second (FEV_1)/forced vital capacity (FVC) ratio *(American Thoracic Society, 1991 [Low Quality Evidence])*.

Spirometry is generally valuable in children five years of age or older; however, some children cannot conduct the maneuver, depending on developmental ability. Spirometry measurements (FEV_1, FVC, FEV_1/FVC) before and after the patient inhales a short-acting bronchodilator should be undertaken for patients in whom the diagnosis of asthma is being considered. Airflow obstruction is indicated by reduced FEV_1 and FEV_1/FVC values relative to reference or predicted values. Significant reversibility is indicated by an increase of 12 percent or greater and 200 mL in FEV_1, after inhaling a short-acting bronchodilator.

Diagnostic spirometry and a methacholine challenge test, if necessary, are important to clinching the diagnosis. The patient's history and response to therapy should guide other diagnostic tests when considering alternative diagnoses. Follow-up spirometry every one to two years in mild asthmatics will reconfirm the diagnosis, and objectify serial change and level of control. More frequent monitoring should be considered for the moderate and severe persistent categories.

Investigation into the role of allergy, at least with a complete history, should be done in every patient, given high prevalence of positive skin tests among individuals with asthma and the benefits of limiting exposure to known allergens. History may help to distinguish seasonal allergies but may be inadequate for periennial allergies. Eosinophil count and IgE may be elevated in asthma; however, neither test has sufficient specificity or sensitivity to be used alone in a diagnosis. The chest x-ray and electrocardiogram are usually normal in asthma but may be useful to exclude other pulmonary or cardiac conditions. Sputum examination may be helpful if sputum eosinophilia or infection are suspected.

Exhaled nitric oxide is a newly available quantitative, non-invasive measure of airway inflammation that is another tool to assess airway disease. The early use will be by asthma specialists rather than primary care. It can be useful in the diagnosis of eosinophilic airway inflammation as well as determining the likelihood of response to cortocosteroid treatment, monitoring the airway to determine if additional anti-inflammatory is needed, and assisting in evaluating adherence to anti-inflammatory medication. The American Thoracic Society has published a clinical practice guideline: "Interpretation of Exhaled Nitric Oxide Levels for Clinical Application" *(Dweik, 2011 [Guideline])*.

There are several clinical scenarios in children that have a frequent association with asthma and should strongly suggest asthma as a possible diagnosis. These include recurrent pulmonary infiltrates (especially right middle lobe infiltrates) with volume loss that clear radiologically within two to three days, and the diagnosis of pneumonia without fever. Asthma may cause some radiologic uncertainty since mucus plugging and atelectasis may be interpreted as infiltrates.

See Table 1, "Classifying Asthma Severity in Children 5-11 Years."

See Table 2, "Classifying Asthma Severity in Youths and Adults."

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Differential Diagnostic Possibilities for Asthma

Upper airway disease

- Allergic rhinitis and sinusitis *(Corren, 1992 [High Quality Evidence]; Rachelefsky, 1984 [Low Quality Evidence])*

Obstruction involving large airways

- Foreign body in trachea or bronchus
- Vocal cord dysfunction
- Vascular rings or laryngeal webs
- Laryngotracheomalacia, tracheal stenosis or bronchostenosis
- Enlarged lymph nodes or tumor (benign or malignant)
- Bronchiectasis of various causes, including cystic fibrosis

Obstruction of small airways

- Viral bronchiolitis or obliterative bronchiolitis
- Cystic fibrosis
- Bronchopulmonary dysplasia
- Pulmonary infiltrates with eosinophilia
- Chronic obstructive pulmonary disease (chronic bronchitis or emphysema)

Other causes

- Pulmonary embolism
- Congestive heart failure
- Cough secondary to drugs (angio-tension-converting enzyme [ACE] inhibitors)
- Aspiration from swallowing mechanism dysfunction or gastroesophageal reflux
- Recurrent cough not due to asthma

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Table 1. Classifying Asthma Severity in Children 5-11 Years

- **Classifying severity in children who are not currently taking long-term control medication.**

Components of Severity		Classification of Asthma Severity (Children 5–11 years of age)			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not daily	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	• Normal FEV_1 between exacerbations • FEV_1 >80% predicted • FEV_1/FVC >85%	• FEV_1 = >80% predicted • FEV_1/FVC >80%	• FEV_1 = 60–80% predicted • FEV_1/FVC = 75–80%	• FEV_1 <60% predicted • FEV_1/FVC <75%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2 in 1 year (see note) →		
		← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. →			
		Relative annual risk of exacerbations may be related to FEV_1			

- **Level of severity is determined by both impairment and risk. Assess impairment domain by patient's/caregiver's recall of the previous 2–4 weeks and spirometry. Assign severity to the most severe category in which any feature occurs.**
- **At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.**

Source: National Heart, Lung, Blood Institute. Expert panel report 3: guidelines for the diagnosis and management of asthma. 2007. See figure 3-4c, pg. 74 for classifying severity in patients after asthma becomes well controlled.

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Table 2. Classifying Asthma Severity in Youths and Adults

- **Classifying severity for patients who are not currently taking long-term control medications.**

Components of Severity		Classification of Asthma Severity (Youths ≥12 years of age and adults)			
			Persistent		
		Intermittent	Mild	Moderate	Severe
Impairment Normal FEV_1/FVC: 8–19 yr 85% 20 –39 yr 80% 40 –59 yr 75% 60 –80 yr 70%	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not >1x/day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	• Normal FEV_1 between exacerbations • FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 ≥80% predicted • FEV_1/FVC normal	• FEV_1 >60% but <80% predicted • FEV_1/FVC reduced 5%	• FEV_1 <60% predicted • FEV_1/FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2/year (see note) →		
		← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. →			
		Relative annual risk of exacerbations may be related to FEV_1			

- **Level of severity is determined by assessment of both impairment and risk. Assess impairment domain by patient's/caregiver's recall of previous 2–4 weeks and spirometry. Assign severity to the most severe category in which any feature occurs.**
- **At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.**

Source: National Heart, Lung, Blood Institute. Expert panel report 3: guidelines for the diagnosis and management of asthma. 2007. See figure 3-4c, pg. 74 for classifying severity in patients after asthma becomes well controlled.

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4. Acute Asthma Exacerbation?

Symptoms of an acute asthma episode include progressive breathlessness, cough, wheezing or chest tightness. An acute asthma episode is characterized by a decrease in expiratory airflow that can be documented and quantified by measurement of lung function (spirometry or peak expiratory flow rate [PEFR]). Indications for emergency care include:

- Peak flow less than 40% predicted normal
- Failure to respond to a $beta_2$-agonist
- Severe wheezing or coughing
- Extreme anxiety due to breathlessness
- Gasping for air, sweaty, or cyanotic
- Rapid deterioration over a few hours
- Severe retractions and nasal flaring
- Hunched forward

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5. Assess Severity of Asthma Exacerbation

Recommendations:

- Asthma severity must be promptly assessed using history, physical examination and objective measures of lung function during an exacerbation.
- Assess patient severity for risk of death from current exacerbation based on history, pulse oximetry, signs of respiratory distress, and spirometry.
- Assess patient for severity based on impairment using age-appropriate measures.
- Assess patient for severity of asthma based on future risk of exacerbation using age-appropriate measures.
- Spirometry is the preferred method for objective measurement of severity in acute exacerbation. FEV_1/FVC ratio is the preferred method for objective measurement of lung function, especially in children.
- Peak flow has not been found to be a reliable measure of severity in acute exacerbation *(Llewellin, 2002 [Low Quality Evidence]; Eid, 2000 [High Quality Evidence])*.

History

- Symptoms consistent with asthma
- Severity of symptoms, limitations and sleep disturbance
- Duration of symptoms
- Current medical treatment plan
- Adherence to medical treatment plan
- Rescue medication use:
  - Recent use of short-acting $beta_2$-agonists
  - Number of bursts of oral steroids in past year
- Review Asthma Action Plan and daily charting of peak flows
  - A difference of up to 35% was found to separate FEV_1 and peak flow percent predicted in acute exacerbation *(Llewellin, 2002 [Low Quality Evidence])*.
  - Peak flow rate has been shown unreliable for the classification of asthma severity *(Eid, 2000 [High Quality Evidence])*.
- Previous emergency department (ED) visits or hospitalization
- Record triggers:
  - Upper respiratory infection (URI)
  - Bronchitis, pneumonia, sinusitis
  - Exposure to allergens or irritants
  - Assessment of tobacco use and/or secondhand exposure

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- Exercise
- GERD

Clinicians treating asthma exacerbations should be familiar with the characteristics of patients at risk for life-threatening deterioration.

See Table 3, "Risk Factors for Death from Asthma."

Table 3. Risk Factors for Death from Asthma

Past history of sudden severe exacerbations
Prior intubation for asthma
Prior admission for asthma to an intensive care unit
Three or more emergency care visits for asthma in the past year
Hospitalization or an emergency care visit for asthma within the past month
Use of more than two canisters per month of inhaled short-acting beta$_2$-agonist
Current use of systemic corticosteroids or recent withdrawal from systemic corticosteroids
Difficulty perceiving airflow obstruction or its severity
Serious psychiatric disease or psychosocial problems
Low socioeconomic status and urban residence
Illicit drug use
Sensitivity to alternaria

(National Heart, Lung, Blood Institute, 2007 [Guideline])

Lung Function

- Spirometry (FEV_1) – preferred, FEV_1/FVC preferred in children
- Pulse oximetry

Physical Exam

- Vital signs: Temperature, blood pressure, pulse rate, respiratory rate, pulsus paradoxus
- Alertness
- Ability to talk
- Use of accessory muscles
- Auscultation of chest
- Color

Laboratory Studies

Treatment with bronchodilators should not be delayed for laboratory studies. Tests which may be useful include:

- Arterial blood gases (ABG's)
- Chest x-ray (CXR)
- Complete blood count (CBC)
- Electrocardiogram (EKG)

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- Electrolytes
- Theophylline level (if appropriate)

Table 4. Assessment of severity should be based on the following table.

Classifying Severity of Asthma Exacerbations				
	Mild	**Moderate**	**Severe**	**Respiratory Arrest Imminent**
Symptoms				
Breathlessness	While walking Can lie down	While at rest Prefers sitting	While at rest Sits upright	
Talks in	Sentences	Phrases	Words	
Alertness	May be agitated	Usually agitated	Usually agitated	Drowsy or confused
Signs				
Respiratory rate	Increased	Increased	Often > 30/min.	
Use of accessory muscles; suprasternal retractions	Usually not	Commonly	Usually	Paradoxical thoracoabdominal movement
Wheeze	Moderate, often only end expiratory	Loud; throughout exhalation	Usually loud; throughout inhalation and exhalation	Absence of wheeze
Pulse/minute	< 100	100-120	> 120 > 110 5-8 years old	Bradycardia
Pulsus paradoxus	Absent < 10 mmHg	May be present 10-25 mmHg	Often present > 25 mmHg (adult) 20-40 mmHg (child)	Absence suggests respiratory muscle fatigue
Functional Assessment				
FEV_1 or PEF % predicted or % personal best	> 70%	Approx. 40-69% or response lasts < 2 hours	< 40% predicted or personal best	< 25% Note: PEF may not be needed in very severe attacks
PaO_2 (on air)	Normal (test not usually necessary)	> 60 mmHg (test not usually necessary)	< 60 mmHg: possible cyanosis	
and/or				
PCO_2	< 42 mmHg (test not usually necessary)	< 42 mmHg (test not usually necessary)	≥ 42 mmHg: possible respiratory failure	
SaO_2 % (on air) at sea level	> 95% (test not usually necessary)	90-95% (test not usually necessary)	< 90	
	Hypercapnia (hypoventilation) develops more readily in young children than in adults and adolescents.			
Note: • The presence of several parameters, but not necessarily all, indicates the general classification of the exacerbation. • Many of these parameters have not been systematically studied, so they serve only as general guides.				

Adapted from National Heart, Lung, Blood Institute EPR-3, 2007.

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8. Management of Asthma Exacerbation

Recommendations:

- Treatment is begun with inhaled short-acting $beta_2$-agonists administered by meter dose inhaler (MDI)/spacer or nebulizer.

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- Further intensification of therapy is based on severity, response and prior history, but typically includes a short course of oral corticosteroids.

(McFadden, 2003 [Low Quality Evidence])

Treatment

Usual initial treatment is with short-acting beta$_2$-agonist (albuterol) administered by nebulizer or MDI/spacer.

Nebulized albuterol (2.5 mg/3 mL); depending on response to therapy, this dose may be repeated at 20-munite intervals for up to three times.

Albuterol MDI/spacer 2-6 puffs; depending on response to therapy, this dose may be repeated at 20-minute intervals for up to three times.

(National Heart, Lung, Blood Institute EPR-3, 2007 [Guideline]; Castro-Rodriguez, 2004 [Meta-analysis])

Alternatives:

Levalbuterol

Nebulized levalbuterol (1.25mg/3mL); depending on response to therapy, this dose may be repeated three times at 20 minute intervals.

Levalbuterol MDI/spacer 2-6 puffs; depending on response to therapy, this dose may be repeated three times at 20 minute intervals.

- Dose for those over 12 years of age is 0.63 mg (via nebulizer) three times daily (every six to eight hours). If patient does not exhibit adequate response, may increase dose to 1.25 mg via nebulizer three times daily (every six to eight hours).
- Dose for children 6-11 years of age is 0.31 mg (via nebulizer) three times daily. Routine dosing should not exceed 0.63 mg three times daily.

Ipratropium added to nebulized beta$_2$-agonist (albuterol)

- Nebulized dose for adults and those over 12 years of age is 0.5 mg every four hours. Not FDA approved for any indication in those less than 12 years of age.
- Ipratropium is not currently FDA approved for use in asthma.

Epinephrine: (1:1,000)

Adult: 0.3-0.5 mg subcutaneous or intramuscular injections (IM) every 20 minutes up to three doses

Pediatric: 0.01 mg/kg up to 0.3-0.5 mg subcutaneous or IM every 20 minutes up to three doses

Corticosteroids (see Appendix A, "Dosages of Drugs for Asthma Exacerbations in Emergency Medical Care or Hospital," for dosage recommendations)

- Strongly consider systemic corticosteroids in patients with acute asthma exacerbation. Corticosteroids aid symptom resolution and prevent asthma relapse *(Chapman, 1991 [High Quality Evidence]; Fanta, 1983 [High Quality Evidence]; Harris, 1987 [High Quality Evidence]; Scarfone, 1993 [High Quality Evidence])*.

Note: Do not use LABA monotherapy in acute asthma exacerbations. See http://www.fda.gov/Drugs/DrugSafety/SafeUseInitiative/default.htm (accessed April 24, 2012).

- Initiate inhaled corticosteroids to prevent future exacerbations.

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Antibiotics are not recommended for the treatment of acute asthma except for those patients with signs of acute bacterial infection, fever and purulent sputum.

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9. Assess Response to Treatment

Good response:

- PEFR or FEV_1 greater than or equal to 70% predicted normal
- No wheezing on auscultation

Incomplete response:

- PEFR or FEV_1 40-69% predicted normal
- Mild wheezing
- Consider hospitalization, particularly for high-risk patients

Poor response:

- PEFR or FEV_1 less than 40% predicted
- No improvement in respiratory distress
- Strongly consider hospitalization

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10. Does Patient Need Emergency Department (ED) or Inpatient Asthma Management?

Studies suggest that most children who require hospitalization can be identified by a repeat assessment one hour after initial treatment *(Kelly, 2004 [Low Quality Evidence]; Wilson, 2003 [Low Quality Evidence])*. After one hour, those children who continue to meet the criteria for a severe exacerbation have a greater than 86% chance of requiring hospitalization; those who meet the criteria for moderate exacerbation at one hour have an 84% chance of requiring hospitalization; and those whose assessment has remained the same or dropped to the mild level have only an 18% chance of requiring hospitalization. These severity assessment studies highlight the importance of regular, multifaceted assessments and close observation of children and adolescents who present to the office or ED with acute asthma exacerbations *(National Heart, Lung, Blood Institute, 2007 [Guideline])*.

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11. Evaluation

Recommendations:

Evaluation of asthma should include the following:

- Medical history
- Use of a validated asthma questionnaire

  Three validated tools are Asthma Control Test (ACT), Asthma Control Questionnaire (ACQ) and Asthma Therapy Assessment Questionnaire (ATAQ).
- Assess indoor and outdoor asthma triggers/allergens
- Physical examination

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- Measure lung function
- Consider specialty consultation

Medical History

- Disruption of usual activities (work, school, home)
- Sleep disturbance
- Level of usage of short-acting beta$_2$-agonist
- Adherence to medical treatment plan
- Interval exacerbation of symptoms (either treated by self or a health care clinician)
- Symptoms suggesting comorbid conditions or alternative diagnosis
- Side effects of medications

Reassessment of medical history can elicit factors that effect overall asthma control and sense of well-being *(Juniper, 1993 [Low Quality Evidence])*. The key symptoms that should alert the clinician include disruptive daytime symptoms and disturbances of sleep, and symptoms early in the morning that do not improve 15 minutes after using short-acting beta$_2$-agonist. The quantity of short-acting beta$_2$-agonist that is being used should be discussed since overuse can be a marker of the potentially fatality-prone asthmatic *(Spitzer, 1992 [Low Quality Evidence])*. The use of a quality-of-life tool or questionnaire can assist to elicit history *(Juniper, 1992 [Low Quality Evidence])*.

Use of a Validated Questionnaire

The self-assessment questionnaires that can be completed at office visits are intended to capture the patient's and family's impression of asthma control, self-management skills and overall satisfaction with care. Three multidimensional instruments have been developed and validated for assessment and monitoring of asthma. They are the Asthma Control Test (ACT), Asthma Control Questionnaire (ACQ) and Asthma Therapy Assessment Questionnaire (ATAQ). Only the ACT has been validated for use with children ages 4-11.

See http://www.nhlbi.nih.gov/guidelines/asthma/04_sec3_comp.pdf (Accessed April 24, 2012)

(Yawn, 2008 [Low Quality Evidence]; Skinner, 2004 [Low Quality Evidence])

Assess Asthma Triggers/Allergens

- Inquire about exposure to triggers and allergens (e.g., occupational, pets, smoke).
- Allergy testing is recommended for patients with persistent asthma who are exposed to perennial indoor allergens.

Comparison of Skin Tests with In Vitro Tests	
Advantages of Skin Tests	**Advantages of In Vitro Tests**
• Less expensive than in vitro tests • Results are available within one hour • Equally sensitive as in vitro tests • Results are visible to the patient. This may encourage compliance with environmental control measures	• Do not require knowledge of skin testing technique • Do not require availability of allergen extracts • Can be performed on patients who are taking medications that suppress the immediate skin test (antihistamines, antidepressants) • No risk of systemic reactions • Can be done for patients who have extensive eczema

Source: National Heart, Lung, Blood Institute EPR-3, 2007

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Studies of emergency department visits and near death show allergens as a factor in asthma exacerbation. Asthma triggers in the workplace also need to be considered. About 15% of asthma in adults is work related *(Blanc, 1987 [Low Quality Evidence]; Malo, 1992 [Low Quality Evidence]; O'Hollaren, 1991 [Low Quality Evidence]; Pollart, 1988 [Low Quality Evidence])*.

Physical Examination

- Assess signs associated with asthma, concurrent illness or medication side effects
- Height in children
- Head, eyes, ears, nose, throat, lungs, heart, skin

It is important to discuss any potential medication side effects as this often has a direct relationship to compliance. See Annotation #14, "Asthma Education," for more guidance on side effects.

The remainder of the physical exam either supports or refutes conditions and comorbidities discussed above (see history).

Measure Lung Function

It is important to measure lung function at each asthma related visit. The two main methods are spirometry and peak expiratory flow rate (PEFR). Spirometry is more precise and yields more information than PEFR. It is helpful to verify the accuracy of the peak flow meter. It is useful when certain physical limitations affect accuracy of PEFR (example: very young or elderly, neuromuscular or orthopedic problems) *(Miles, 1995 [Low Quality Evidence]; Enright, 1994 [Low Quality Evidence])*.

Spirometry is recommended:

- for initial diagnosis or to reassess or confirm diagnosis;
- after treatment is initiated or changed, and once symptoms and PEFR have stabilized, to document attainment of "near normal pulmonary function"; and
- at least every one to two years to assess maintenance of airway function – more often as severity indicates.

Regular monitoring of pulmonary function is particularly important for asthma patients who do not perceive their symptoms until obstruction is severe *(Kikuchi, 1994 [Low Quality Evidence]; Connolly, 1992 [Low Quality Evidence])*.

PEFR

- Used for follow-up, not for diagnosis

PEFR provides a simple, quantitative and reproductive measure of severity of airflow obstruction. The results are more reliable if the same type of meter, and preferably the patient's own, is used.

During interval assessment, the clinician should question the patient and review records to evaluate the frequency, severity and causes of exacerbation. Triggers that may contribute should be reviewed. All patients on chronic maintenance medication should be questioned about exposure to inhalant allergens.

Consider Specialty Consultation

Referral is recommended for consultation or care to a specialist in asthma care (allergist or pulmonologist, or other physicians who have expertise in asthma management, developed through additional training and experience) *(Zieger, 1991 [Low Quality Evidence])* when:

- Patient has had a life-threatening asthma exacerbation.

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- Patient is not meeting the goals of asthma therapy after three to six months of treatment. An earlier referral or consultation is appropriate if the physician concludes that the patient is unresponsive to therapy.
- Signs and symptoms are atypical, or there are problems in differential diagnosis.
- Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, VCD, GERD, chronic obstructive pulmonary disease [COPD]).
- Additional diagnostic testing is indicated (e.g., allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy).
- Patient requires additional education and guidance on complications of therapy, problems with adherence, or allergen avoidance.
- Patient is being considered for immunotherapy.
- Patient requires step 4 care or higher. Consider referral if patient requires step 3 care.
- Patient has required more than two bursts of oral corticosteroids in one year or has an exacerbation requiring hospitalization.
- Patient requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma. Depending on the complexities of diagnosis, treatment or the intervention required in the work environment, it may be appropriate in some cases for the specialist to manage the patient over a period of time or to co-manage with the PCP.

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12. Determine Level of Asthma Control

Recommendations:

- Clinicians should assign a level of control based on the most severe impairment or risk category of the patient.
- Clinicians should assign the level of asthma control (well controlled, not well controlled, or poorly controlled) based on the degree to which both dimensions of the manifestations of asthma – impairment and risk – are minimized by therapeutic intervention.
- Clinicians should determine their clinical actions (i.e., whether to maintain or adjust therapy) based on the level of control at the patient's follow-up assessment.

See Table 5, "Assessing Asthma Control in Children 5-11 Years of Age," and Table 6, "Assessing Asthma Control in Youths 12 Years of Age through Adults."

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Table 5. Assessing Asthma Control in Children 5-11 Years of Age

Components of Control		Classification of Asthma Control (Children 5–11 years of age)		
		Well Controlled	**Not Well Controlled**	**Very Poorly Controlled**
Impairment	Symptoms	≤2 days/week but not more than once on each day	>2 days/week or multiple times on ≤2 days/week	Throughout the day
	Nighttime awakenings	≤1x/month	≥2x/month	≥2x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week	Several times per day
	Lung function ▪ FEV_1 or peak flow ▪ FEV_1/FVC	 >80% predicted/ personal best >80%	 60–80% predicted/ personal best 75–80%	 <60% predicted/ personal best <75%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year	≥2/year (see note)	
		Consider severity and interval since last exacerbation		
	Reduction in lung growth	Evaluation requires long-term followup.		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		

Key: EIB, exercise-induced bronchospasm; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Notes:

- The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's/caregiver's recall of previous 2–4 weeks and by spirometry/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient's asthma is better or worse since the last visit.
- At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma control. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate poorer disease control. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have not-well-controlled asthma, even in the absence of impairment levels consistent with not-well-controlled asthma.

Source: National Heart, Lung, Blood Institute EPR-3, 2007

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Table 6. Assessing Asthma Control in Youths 12 Years of Age through Adults

Components of Control		Classification of Asthma Control (Youths ≥12 years of age and adults)		
		Well-Controlled	Not Well-Controlled	Very Poorly Controlled
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakening	≤2x/month	1–3x/week	≥4x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week	Several times per day
	FEV_1 or peak flow	>80% predicted/ personal best	60–80% predicted/ personal best	<60% predicted/ personal best
	Validated Questionnaires ATAQ ACQ ACT	 0 ≤0.75* ≥20	 1–2 ≥1.5 16–19	 3–4 N/A ≤15
Risk	Exacerbations	0–1/year	≥2/year (see note)	
		Consider severity and interval since last exacerbation		
	Progressive loss of lung function	Evaluation requires long-term followup care		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		

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

Key: EIB, exercise-induced bronchospasm; FEV_1, forced expiratory volume in 1 second.

Notes:

- The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's recall of previous 2–4 weeks and by spirometry/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient's asthma is better or worse since the last visit.
- At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma control. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate poorer disease control. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have not-well-controlled asthma, even in the absence of impairment levels consistent with not-well-controlled asthma.

Source: National Heart, Lung, Blood Institute EPR-3, 2007

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13. Step Care of Pharmacologic Treatment

Recommendations:

- Clinicians should follow the stepwise approach in asthma management therapy.
- Clinicians should use inhaled corticosteroids as the preferred treatment over leukotriene receptor antagonists in mild persistent asthma in adults and children.
- Clinicians should order annual influenza vaccination for patients with persistent asthma.

The aim of asthma therapy is to maintain control of asthma with the least amount of medication and hence minimize the risk for adverse effects. The stepwise approach to therapy – in which the dose and number of medications and frequency of administration are increased as necessary and decreased when possible – is used to achieve this control. Since asthma is a chronic inflammatory disorder of the airways with recurrent exacerbations, therapy for persistent asthma emphasizes efforts to suppress inflammation over the long-term and prevent exacerbations. See the following tables for Management Approach for Asthma.

Based on data comparing leukotriene receptor antagonists (LTRAs) to inhaled corticosteroids, inhaled corticosteroids are the preferred treatment option for mild persistent asthma in adults and children. LTRAs are an alternative, although not preferred, treatment.

(National Heart, Lung, Blood Institute, 2007 [Guideline]; Szefler, 2005 [High Quality Evidence]; Ducharme, 2002 [Systematic Review]; Bleecker, 2000 [High Quality Evidence])

Vaccinations

NOTE: Annual influenza vaccinations are recommended for patients with persistent asthma *(National Heart, Lung, Blood Institute, 1997 [R])*. Asthma is an independent risk factor for invasive pneumococcal disease *(Talbot, 2005 [Low Quality Evidence])*. The Advisory Committee on Immunization Practices (ACIP) recommends that persons aged 19 through 64 years who have asthma should receive a single dose of PPSV23. (http://www.cdc.gov/flu/protect/keyfacts.htm. Accessed April 12, 2012)

See Appendix B, "Usual Dosages for Quick-Relief Medications."

See Table 7, "Management Approach for Asthma in Children 5-11 Years of Age," and Table 8, "Management Approach for Asthma, 12 Years of Age and Older."

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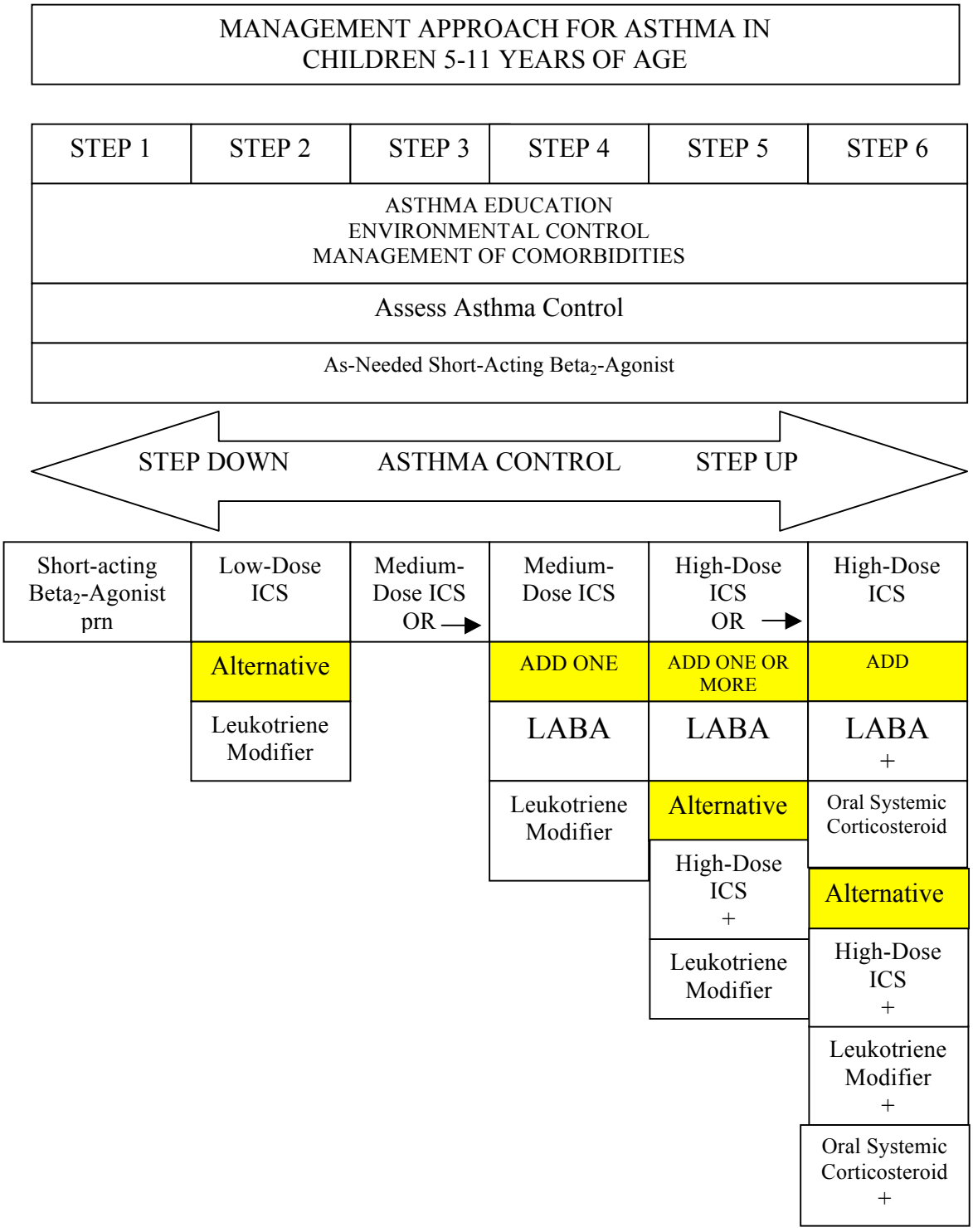
Table 7.



Adapted from: Global Initiative for Asthma, 2006; National Heart, Lung, Blood Institute EPR-3, 2007.

ICS = Inhaled corticosteroids

LABA = Long-acting beta$_2$-agonist

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Table 8.

MANAGEMENT APPROACH FOR ASTHMA 12 YEARS OF AGE AND OLDER					
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
ASTHMA EDUCATION ENVIRONMENTAL CONTROL MANAGEMENT OF COMORBIDITIES					
Assess Asthma Control					
As-Needed Short-Acting $Beta_2$-Agonist					
STEP DOWN ASTHMA CONTROL STEP UP					
Short-acting $Beta_2$-Agonist as needed	Low-Dose ICS	Medium-Dose ICS	Medium-Dose ICS + LABA	High-Dose ICS + LABA	High-Dose ICS + LABA + oral corticosteroid
	Alternative	Alternative	Alternative	ADD ONE OR MORE	ADD ONE OR MORE
	Leukotriene Modifier	Low-Dose ICS + LABA	Medium-Dose ICS + Leukotriene Modifier	Leukotriene Modifier	Leukotriene Modifier
		Low-Dose ICS + Leukotriene Modifier		Anti-IgE if applicable	Anti-IgE if applicable

Adapted from: Global Initiative for Asthma, 2006; National Heart, Lung, Blood Institute EPR-3, 2007.

ICS = Inhaled corticosteroids

LABA = Long-acting $beta_2$-agonist

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14. Asthma Education

Recommendations:

- Clinicians must provide self-management education to give patients with the skills necessary to control asthma and improve outcomes. When working with adult

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asthmatics, this education should include a written asthma action plan, patient self-monitoring and regular clinician follow-up *(Gibson, 2003 [Systematic Review])*.

- Clinicians should integrate asthma self-management education into all aspects of asthma care, as it requires repetition and reinforcement *(NAEPP Expert Panel Report 3 Guidelines for the Diagnosis and Management of Asthma, 2007 [Guideline])*.
- A collaborative approach toward shared decision-making should always be undertaken (Refer to Appendix F, "ICSI Shared Decision-Making Model.")
- Discuss all potential side effects.

Asthma self-management should:

- Begin at the time of diagnosis and continue through follow-up care.
- Involve all members of the health care team.
- Introduce the key educational messages by the principal clinician, and negotiate agreements about the goals of treatment, specific medications, and the actions patients will take to reach the agreed-upon goals to control asthma.
- Reinforce and expand key messages (e.g., the patient's level of asthma control, inhaler techniques, self-monitoring, use of a written asthma action plan) by all members of the health care team.
- Occur at all points of care where health professionals interact with patients who have asthma, including clinics, medical offices, emergency departments and hospitals, pharmacies, homes and community sites (e.g., schools, community centers).

Cues for the care team to initiate a Collaborative Conversation™ include:

- life goal changes,
- diagnosis/prognosis changes,
- change or decline in health status,
- change or lack of support,
- change in medical evident or interpretation of medical evidence, and
- clinician/caregiver contact.

Regular review, by an informed clinician, of the status of the patient's asthma control is an essential part of asthma self-management education. Teach and reinforce at **every** opportunity.

- Basic facts about asthma
  - The contrast between asthmatic and normal airways
  - What happens to the airways in an asthma attack
  - What defines well-controlled asthma and the patient's current level of control
- How medications work
  - Long-term control: medications that prevent symptoms, often by reducing inflammation
  - Quick relief: short-acting bronchodilator relaxes muscles around airways
  - Stress the importance of long-term control medications and not to expect quick relief from them

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- Potential side effects from inhaled steroids include oral candidiasis and dysphonia. $Beta_2$-agonists may cause tachycardia, tremor or nervousness. Individuals on long-term oral corticosteroids or frequent bursts of steroids need to be monitored for complications of corticosteroids use such as osteoporosis, hypertension, diabetes and Cushing's syndrome.

  The height of individuals on corticosteroids should be monitored over time. The potential effect on linear growth in children is important because these drugs tend to be used over long periods of time. Cumulative data in children suggest that low-to-medium doses of inhaled corticosteroids may have the potential of decreasing growth velocity, but this effect is not sustained in subsequent years of treatment, is not progressive and may be reversible *(National Heart, Lung, Blood Institute, 2007 [Guideline]; Childhood Asthma Management Program Research Group, The, 2000 [High Quality Evidence])*.

  Inhaled glucocorticoids used to treat asthma have been shown to have deleterious effects on bone mineral density and markers of bone mineral metabolism. The risk of fracture attributable to inhaled or nasal glucocorticoids is uncertain *(Lung Health Study Research Group, The, 2000 [High Quality Evidence])*.

- Inhaler technique (patient should repeat demonstration)
  - Metered-dose inhaler (MDI) or nebulizer use
  - Spacer/valved holding chamber use with MDI
  - Dry powder inhaler
- Environmental control measures
  - Identifying and avoiding exposure to allergens or other environmental triggers
- Written asthma action plan
  - If using a peak flow meter, technique should be assessed

This guideline recommends the use of written action plans as part of an overall effort to educate patients in self-management and is especially beneficial for patients with moderate or severe persistent asthma and patients with a history of severe exacerbations. Clinician should consider developing action plans with the patient utilizing a model such as the ICSI Shared Decision-Making Model.

Patient and Family Needs within an ICSI Collaborative Conversation™

- Request for support and information
- Advance care planning
- Consideration of values
- Trust
- Care coordination
- Responsive care system

All asthma patients should be given a written asthma action plan that includes two aspects: daily management, and how to recognize and handle worsening asthma. Written action plans are particularly recommended for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma. Review and refine the plan at follow-up visits.

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- Symptom self-monitoring and recognizing early signs of deterioration
- When and how to handle signs and symptoms of worsening asthma
- When and where to seek care
- Discuss plan for children at school, including management of exercise-induced bronchospasm.

- Emphasize need for regular follow-up visits and asthma treatment adherence

Supervised self-management (using patient education and adjustments of anti-inflammatory medication based on PEFR or symptoms coupled with regular medical review, utilization and adherence to medication) reduces asthma morbidity. This reduction includes lost workdays, unscheduled office visits, and ED and hospital admissions *(Gibson, 2003 [Systematic Review]; Lahdensuo, 1996 [High Quality Evidence]; Ignacio-Garcia, 1995 [High Quality Evidence])*.

- Encourage adherence when choosing and reviewing a treatment plan by using the Key Communication Skills
- Listening skills
- Questioning skills
- Information-giving skills

Develop an active partnership with the patient and family by:

- establishing open communications,
- identifying and addressing patient and family concerns about asthma and asthma treatment,
- identifying patient/parent/child treatment preferences regarding treatment and barriers to its implementation,
- developing treatment goals together with patient and family, and
- encouraging active self-assessment and self-management of asthma.

A sample Asthma Action Plan is attached in Appendix E, "Example of Asthma Action Plan."

See Minnesota Department of Health Action Plan at http://www.health.state.mn.us/divs/hpcd/cdee/asthma/ActionPlan.html (Accessed April 12, 2012).

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15. Schedule Regular Follow-Up Visits

Asthma is a chronic inflammatory lung disease, and all chronic diseases need regular follow-up visits. Practitioners need to assess whether or not control of asthma has been maintained and if a step-down in therapy is appropriate. Further, practitioners need to monitor and review the daily self-management and action plans, the medications, and the patient's inhaler and peak flow monitoring techniques. The exact frequency of visits is a matter of clinical judgment. If asthma is uncontrolled or a change in medication or clinical status has occurred, the patient should be followed in two to six weeks for an evaluation. A stable asthma patient should be followed at regular intervals of one to six months.

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Emergency Department or Inpatient Management Algorithm Annotations

18. Assess Severity of Asthma Exacerbation

See Annotation #5.

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21. Initial Treatment

See Annotation #8, "Management of Asthma Exacerbation."

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25. Treatment (Incomplete Response)

Recommendations:

- Systemic corticosteroids should be used for all patients who do not favorably respond to the initial beta$_2$-agonist therapy.
- Anticholinergic therapy may increase lung function and may decrease hospital admission rate.

Corticosteroids

Parenteral and enteral administration of corticosteroids requires about 6-24 hours to be effective. Intravenous (IV) and oral routes of corticosteroid administration appear to be equivalent *(Cunnington, 2005 [High Quality Evidence]; Becker, 1999 [High Quality Evidence]; Barnett, 1997 [High Quality Evidence]; Engel, 1990 [High Quality Evidence]; Jónsson, 1988 [High Quality Evidence]; Ratto, 1988 [High Quality Evidence]; Harrison, 1986 [High Quality Evidence])*. Medium to high doses of corticosteroids appear to be better than low doses; however, there is still a large range, roughly 160 mg methylprednisolone per day or 2 mg/kg/day in children. There is no evidence to support very high doses of steroids *(Rodrigo, 1999 [Low Quality Evidence]; Bowler, 1992 [High Quality Evidence])*. The National Asthma Education and Prevention Program guidelines recommend that patients admitted to the hospital should receive IV or oral steroids *(National Heart, Lung, Blood Institute, 2007 [Guideline])*.

There may be a role for inhaled high-dose corticosteroids in the emergency department in addition to the IV or oral route; however, the data do not support this as standard of care at this time *(Rodrigo, 2005 [High Quality Evidence]; Edmonds, 2003 [Systematic Review]; Edmonds, 2002 [Systematic Review])*.

In adult asthmatic cases where intolerance or non-compliance with oral steroid therapy is a concern, consider the use of intramuscular (IM) methylpredisone *(Lahn, 2004 [High Quality Evidence])*.

Anticholinergics

Inhaled ipratropium bromide: Adding multiple high doses of ipratropium bromide (0.5 mg nebulizer solution or 8 puffs by MDI in adults; 0.25-0.5 mg nebulizer solution or 4-8 puffs by MDI in children) to a selective short-acting beta$_2$-agonist produces additional bronchodilation, resulting in fewer hospital admissions, particularly in patients who have severe airflow obstruction *(Rodrigo, 2005 [High Quality Evidence]; Plotnick, 2000 [Systematic Review])*.

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27. Treatment (Poor Response)

See Appendix A, "Dosages of Drugs for Asthma Exacerbations in Emergency Medical Care or Hospital."

Recommendations:

- There is no clinical advantage to continuous versus intermittent nebulization of albuterol in the treatment of acute asthma exacerbations *(Stein, 2003 [High Quality Evidence]; Rodrigo, 2002 [Systematic Review]; Besbes-Quanes, 2000 [High Quality Evidence]; Weber, 1999 [High Quality Evidence]; Lin, 1993 [High Quality Evidence]; Rudnitsky, 1993 [High Quality Evidence])*.
- Clinicians should consider bi-level positive airway pressure for patients with severe asthma exacerbations as this may prevent mechanical intubations *(Soroksky, 2003 [High Quality Evidence])*.
- Clinicians may consider heliox as secondary therapy in asthma patients who do not respond to first-line therapies *(Ho, 2003 [Systematic Review]; Rodrigo, 2003 [Systematic Review])*.
- Clinicians may consider ketamine for use in severe asthma exacerbations *(Lau, 2001 [Low Quality Evidence]; Petrillo, 2001 [Low Quality Evidence])*.
- Clinicians should consider the use of magnesium sulfate in the treatment of severe acute asthma *(Cheuk, 2005 [Meta-analysis]; Kaye, 2002 [Low Quality Evidence]; Silverman, 2002 [High Quality Evidence]; Rowe, 2000 [Systematic Review])*.

Intermittent Nebulization Versus Continuous Nebulization

Intermittent nebulization versus continuous nebulization in the treatment of acute asthma has been evaluated quite extensively. The data would suggest that these treatments are equally efficacious; however, there may be a trend toward improvement in patients with severe asthma using continuous nebulization. In a subgroup analysis of patients whose initial FEV_1 was less than 50% predicted, there was a statistically significant improvement in FEV_1 in patients treated with continuous nebulization versus intermittent nebulization *(Lin, 1993 [High Quality Evidence])*. Similarly, in another subgroup analysis of patients whose initial PEFR was less than 200, there was a statistically significant improvement in PEFR and a decrease in hospital admissions in patients treated with continuous versus intermittent nebulization *(Rudnitsky, 1993 [High Quality Evidence])*. However, in another subgroup of patients whose FEV_1 was less than 50% predicted, there was no difference in improvement in FEV_1 or hospital admissions in patients treated with continuous versus intermittent nebulization *(Besbes-Quanes, 2000 [High Quality Evidence])*.

A meta-analysis suggests equivalence of continuous versus intermittent albuterol in treating asthma. This is determined by spirometry measurement and rates of admission to the hospital *(Rodrigo, 2002 [M])*. There does not seem to be any advantage of higher doses of albuterol for continuous nebulization. There was no difference in lung function in patients treated with 7.5 mg or 15 mg of albuterol *(Stein, 2003 [High Quality Evidence]*). Utilizing albuterol and ipatroprium bromide continuously versus albuterol alone demonstrated a trend toward improvement in reducing the length of stay in the emergency department and in hospital admission rates *(Weber, 1999 [High Quality Evidence])*.

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Bi-level Positive Airway Pressure (Bi-Level PAP)

Bi-level PAP therapy should be considered for patients presenting with an acute asthma exacerbation. Accumulating studies have shown a benefit in using bi-level PAP for patients presenting with non-cardiogenic respiratory failure. These studies included, but were not limited to, patients with asthma exacerbations.

A study *(Soroksky, 2003 [High Quality Evidence])* compared bi-level PAP ventilation plus conventional therapy versus conventional therapy in patients presenting with an acute asthma exacerbation. Patients in the bi-level PAP group showed a statistically significant improvement in lung function (measured by FEV_1), improved faster, and were less likely to require admission to the hospital and mechanical intubations.

Heliox

Heliox, a blend of helium and oxygen, is a low-density gas that has been shown in some studies to improve deposition of albuterol into distal airways when compared with nebulized albuterol with oxygen alone. To date, only small-sized randomized controlled trials have been performed. At best, these studies showed mild improvement in spirometry measures and perceived dyspnea scores in patients receiving heliox-driven albuterol nebulization versus patients receiving albuterol nebulization with oxygen alone. These improved measures were more prominent in patients with moderate to severe asthma exacerbations.

There is not enough evidence from large, prospective, randomized controlled trials to recommend heliox as first-line therapy in patients with asthma exacerbations. However, it is recommended that heliox be considered *(Ho, 2003 [Systematic Review]; Rodrigo, 2003 [Systematic Review])* as a secondary therapy in patients with a severe asthma exacerbation who are not responding to first-line therapies.

Ketamine

Ketamine and propofol are anesthetic agents with neuro-regulatory properties resulting in bronchodilation. The use of ketamine has shown benefit in improving airway parameters *(Petrillo, 2001 [Low Quality Evidence])*, but increased side effects have resulted in longer hospitalizations *(Lau, 2001 [Low Quality Evidence])*. Increased side effects of increased secretions, dysphorea and hallucinations are noted. Clinical data suggests that in the non-intubated patient the side effects may cancel benefit. Some reported case reports suggest benefit in intubated patients *(Lau, 2001 [Low Quality Evidence])*. Well-controlled studies are required to make a clear strong recommendation for use. Use of ketamine has been pursued only in severe asthmatic exacerbations.

Magnesium Sulfate

In vitro, magnesium acts as a smooth muscle dilator and may have some anti-inflammatory effects by decreasing super-oxide production in neutrophils. Its efficacy has not been consistently demonstrated in randomized control trials. It has not been demonstrated to cause any harmful effects. In a recent multicenter trial, IV magnesium sulfate improved pulmonary function only in patients with severe asthma, (FEV_1 less than 25%). It did not shorten length of hospital stay *(Silverman, 2002 [High Quality Evidence])*. In a systematic review, magnesium sulfate did not demonstrate improvement in PEFR, or in hospital length of stay. However, in a subset of patients with severe asthma exacerbations, PEFR, FEV_1 and length of stay were improved *(Rowe, 2000 [Systematic Review])*. There is insufficient evidence to support the routine use of IV magnesium in the emergency department setting *(Cheuk, 2005 [Meta-analysis]; Kaye, 2002 [Low Quality Evidence])*. However since it is safe and inexpensive, it should be considered for use in patients with severe asthma exacerbations.

Leukotriene Modifiers

The evaluation of leukotriene modifiers for acute asthma care is in its infancy. Pulmonary function has been shown to improve more rapidly when a leukotriene administered orally is added to the standard therapy

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of asthma care (beta$_2$-agonists/corticosteroids) in emergency department settings *(Emerman, 2001 [Cost-Effectiveness Analysis]; Silverman, 1999 [High Quality Evidence])*. More studies are needed to confirm these reports.

Montelukast in acute asthma management has been shown to improve pulmonary function in randomized controlled trials *(Camargo, 2003 [High Quality Evidence]; Cylly, 2003 [High Quality Evidence]*). However, statistical significance could not always be maintained.

The evidence is too preliminary to recommend leukotriene modifiers in acute asthma exacerbations.

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29. Admit to Hospital?

Also see Annotation #10, "Does Patient Need ED or Inpatient Asthma Management?"

The decision when to discharge from the emergency department (ED) or admit to the hospital must be individualized and depends on response to treatment, pulmonary function and socioeconomic factors. It is important to consider risk factors for asthma-related death *(National Heart, Lung, Blood Institute, 2007 [Guideline])*. Actual length of stay in the ED will vary; some departments have the ability for more extended treatment and observation, provided there is sufficient monitoring and nursing care.

Response to initial treatment in the ED can be based on a repeat assessment approximately 60-90 minutes after initiating bronchodilator therapy, which is a better predictor of the need for hospitalization than is the severity of an exacerbation on presentation *(Rodrigo, 1993 [Low Quality Evidence])*. Evaluation includes the patient's subjective response, physical findings, O_2 saturation and measurement of airflow. Other aspects to consider include duration and severity of symptoms, course and severity of prior exacerbations, medications used at the time of the exacerbation, access to medical care and medications, adequacy of support and home conditions, and presence of psychiatric illness. Pretreatment O_2 saturation less than or equal to 70%, persisting respiratory acidosis, or severe obstruction that does not improve with the administration of sympathomimetics indicates the need for hospitalization *(Higgins, 2003 [Low Quality Evidence])*.

Discharge is appropriate if FEV_1 or PEFR has returned to greater than or equal to 70% personal best or predicted, and symptoms are minimal or absent. Patients with an incomplete response (FEV_1 or PEFR 40-69%), and with mild symptoms should be assessed individually and may be appropriate for discharge with consideration of the above factors. It is recommended that patients with a rapid good response be observed for 30-60 minutes after the most recent dose of bronchodilator to ensure stability of response before being discharged home.

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30. Return to Annotations #25 and #27

Patients being admitted from the ED with an acute asthma exacerbation should be reassessed shortly after admission, with special emphasis on whether the patient is showing any clinical signs of improvement or deterioration (see Annotation #5, "Assess Severity of Asthma Exacerbation"). Objective data should include repeating of the patient's FEV_1 or PEFR. A complete physical exam should include emphasis on the patient's respiratory rate, air entry on lung exam, and the presence/absence of signs of increased work of breathing, such as supraclavicular or intercostal retractions.

Consider other illnesses and comorbidities. These may also cause dyspnea, chest tightness and wheezing:

- Viral pneumonitis
- Pneumothorax

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- Pulmonary embolism
- Vocal cord dysfunction syndrome
- COPD
- Pulmonary edema
- Endobronchial obstruction (tumor or foreign body)
- Acute hypersensitivity pneumonitis
- Epiglottitis

(ten Brinke, 2005 [Low Quality Evidence])

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32. Discharge Home

Recommendation:

- At discharge, provide patients with necessary medications and education in how to use them, instruction in self-assessment, an action plan for managing recurrence of airflow obstruction, and a follow-up appointment.

It is recommended that follow-up with an asthma care clinician occur within one week of discharge.

Medications

See Table 9, "Hospital Discharge Checklist for Patients with Asthma Exacerbations."

- Inhaled beta$_2$-agonist every two to six hours.
- Systemic corticosteroids are almost always the treatment of choice in patients with acute asthma exacerbation. Corticosteroids aid symptom resolution and prevent asthma relapse.
- Initiate or increase anti-inflammatory medication:
  - Inhaled corticosteroids
    - The role of inhaled corticosteriods after an emergency department visit is controversial *(Edmonds, 2003 [Systematic Review]; Rowe, 1999 [High Quality Evidence])*. However, it is the consensus of this group that inhaled corticosteriods should be encouraged at the time of discharge.
  - Consider leukotriene modifiers as an additive therapy.
- Antibiotics are not routinely used but may be warranted if patient has signs of acute bacterial infection, fever and purulent sputum.
- Long-acting beta$_2$-agonists as monotherapy are NOT recommended.

See Annotation #14 for asthma education and action plan.

See Annotation #15 for follow-up care.

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Table 9. Hospital Discharge Checklist for Patients with Asthma Exacerbations

Intervention	Dose/Timing	Education/Advice
Inhaled medications (MDI + spacer/holding chamber)	Select agent, dose and frequency (e.g., albuterol)	Teach purpose. Teach technique.
$Beta_2$-agonist		Emphasize need for spacer/holding chamber.
Corticosteroids	Medium dose	Check patient technique.
Oral medications	Select agent, dose and frequency	Teach purpose. Teach side effects.
Peak flow meter	Measure a.m. and p.m. PEF and record best of three tries each time	Teach purpose. Teach technique. Distribute peak flow diary.
Follow-up visit	Make appointment for follow-up care with primary clinician or asthma specialist	Advise patient (or caregiver) of date, time and location of appointment within 7 days of hospital discharge.
Action plan	Before or at discharge	Instruct patient (or caregiver) on simple plan for actions to be taken when symptoms, signs and PEF values suggest recurrent airflow obstruction.

Source: National Heart, Lung, Blood Institute EPR-2, 1997

Special Populations

Asthma in pregnancy

The treatment plan of asthma management in pregnancy should include reducing medication toxicity, teratogenicity and preserving uteroplacenta circulation. Changes in the mother's asthma status are expected in almost half of patients, with half of these expecting a worsening of asthma status, particularly if previous pregnancies had similar outcomes. Typical changes of pregnancy – those of increased heart rate, respiratory rate and decreases in baseline CO_2 levels – can lead to underdiagnosing asthma severity if not recognized *(Sakornbut, 2003 [Low Quality Evidence])*.

The treatment of acute asthma in pregnancy follows the guidelines for acute asthma care, keeping in mind the goals of the management and changes in physiology.

Albuterol is the preferred short-acting $beta_2$-agonist and has not been linked to adverse fetal outcomes in follow-up studies. Inhaled corticosteroids (ICSs) are the preferred treatment for long-term control medication. Budesonide is the preferred ICS because more data are available on using budesonide in pregnant women than are available on other ICSs, and the data are reassuring *(National Heart, Lung, Blood Institute, 2007 [Guideline]; NAEPP Export Panel Report, 2005 [Guideline])*. Systemic steroids, if used in the first trimester, may, though rarely, increase the frequency of cleft palate and possibly be associated with development of preeclampsia and prematurity. However, the risk to both mother and fetus of an unmanaged severe asthmatic attack overshadows the medication observed risks *(Schatz, 2009 [Low Quality Evidence])*.

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The Aims and Measures section is intended to provide guideline users with a menu of measures for multiple purposes, which may include the following:

- Population health improvement measures
- Quality improvement measures for delivery systems
- Measures from regulatory organizations such as The Joint Commission
- Measures that are currently required for public reporting
- Measures that are part of Center for Medicare Services Physician Quality Reporting initiative
- Other measures from local and national organizations aimed at measuring population health and improvement of care delivery

This section provides resources, strategies and measurement for use in closing the gap between current clinical practice and the recommendations set forth in the guideline.

The subdivisions of this section are:

- Aims and Measures
- Implementation Recommendations
- Implementation Tools and Resources
- Implementation Tools and Resources Table

Aims and Measures

1. Increase the rate of patients five years and older who have accurate assessment of asthma severity and control through the use of objective measures of lung function and symptoms. *(Annotations #5, 11, 12)*

   Measures for accomplishing this aim:

   a. Percentage of patients with spirometry or peak flow at the last visit related to asthma.

   b. Percentage of patients with assessment of asthma control using a validated questionnaire at the last visit related to asthma.

2. Increase the rate of patients five years and older who have written asthma action plans, and timely and accurate assessment of asthma exacerbation. *(Annotation #14)*

   The purpose of this aim is to improve partnership between patients and/or their parents (when applicable) with health care professionals regarding asthma management.

   Measure for accomplishing this aim:

   a. Percentage of 1) patients whose asthma is well controlled, 2) patients who are not at increased risk of exacerbations and 3) patients who have a current written asthma action/management plan. *(MN Community Measurement Optimal Asthma Care composite measure)*

3. Increase the rate of patients five years and older who have appropriate treatment and management of asthma in inpatient care settings. *(Annotation #29, 30)*

   Measures for accomplishing this aim:

   a. Percentage of hospitalized patients with asthma who are discharged on an inhaled anti-inflammatory medication.

   b. Percentage of discharged patients with asthma who are readmitted to hospital within 30 days.

   c. Percentage of patients with asthma who return to the emergency department for treatment of asthma within 30 days of last visit to the emergency department.

   d. Percentage of patients with an emergency department visit or inpatient admission for an asthma exacerbation who are discharged from the emergency department OR inpatient setting with an asthma discharge plan. *(National Committee for Quality Assurance/Physician Consortium for Performance Improvement)*

   e. Percentage of pediatric patients who have the following managed in inpatient care settings: *(Joint Commission)*

      - Use of relievers for inpatient asthma
      - Use of systemic corticosteroids for inpatient asthma
      - Home management plan of care given to patient/caregiver

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4. Increase the rate of patients five years and older who have follow-up visits to ensure asthma control is maintained and appropriate therapy is administered following any visit for asthma or medication adjustment. *(Annotations #9, 12, 13, 14, 30, 32)*

   Measures for accomplishing this aim:

   a. Percentage of patients whose asthma is not in control or have a change in medication or clinical status, who are seen by a health care clinician within two to six weeks.

   b. Percentage of patients whose asthma is in control who are seen by a health care clinician every one to six months.

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Measurement Specifications

Measurement #1a

Percentage of patients with spirometry or peak flow at the last visit related to asthma.

Population Definition

Patients five years and older diagnosed with asthma.

Data of Interest

$$\frac{\text{\# of patients with spirometry or peak flow measurement}}{\text{\# of patients seen for an asthma related visit}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who had spirometry or peak flow measurement at the last visit related to asthma.

Denominator: Number of asthma patients seen for an asthma related visit.

Include last visit with a clinician that has documentation of one of these ICD-9 diagnosis codes: 493.00, 493.01, 493.10, 493.11, 493.90, 493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis at the last visit. If a patient had multiple visits during the target month/quarter, select the last visit where asthma was addressed. The patient medical records are reviewed for documentation that spirometry or peak flow meter reading was done.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

It is important to periodically assess pulmonary function. The main methods are spirometry or PEFR. Spirometry is more precise and yields more information than PEFR. It is helpful to verify the accuracy of the peak flow meter. It is useful when certain physical limitations affect accuracy of PEFR (e.g., very young or elderly, neuromuscular or orthopedic problems). PEFR provides a simple, quantitative and reproductive measure of severity of airflow obstruction. The results are more reliable if the same type of meter, and preferably the patient's own, is used.

This is a process measure, and improvement is noted as an increase in the rate.

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Measurement #1b

Percentage of patients with assessment of asthma control using a validated questionnaire at the last visit related to asthma.

Population Definition

Patients five years and older diagnosed with asthma.

Data of Interest

$$\frac{\text{\# of patients who had an assessment of asthma control}}{\text{\# of patients seen for an asthma-related visit}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who had an assessment of asthma control using a validated questionnaire.

Denominator: Number of asthma patients seen for an asthma related visit.

Include last visit with a clinician that has documentation of one of these ICD-9 diagnosis codes: 493.00, 493.01, 493.10, 493.11, 493.90, 493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis at the last visit. If a patient had multiple visits during the target month/quarter, select the last visit where asthma was addressed. The patient medical records are reviewed for documentation of asthma control using a validated questionnaire.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as an increase in the rate.

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Measurement #2a

Percentage of patients whose asthma: 1) is well controlled, 2) patients who are not at increased risk of exacerbations and 3) patients who have a current written asthma action/management plan. *(MN Community Measurement Optimal Asthma Care composite measure)*

Notes

MN Community Measurement outcome composite measure on Optimal Asthma Care. Full specifications for this measure can be obtained through MN Community Measurement at http://www.mncm.org/site/?page=resources (Accessed April 27, 2012).

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Measurement #3a

Percentage of hospitalized patients with asthma who are discharged on an inhaled anti-inflammatory medication.

Population Definition

Patients five years and older with asthma related hospitalization.

Data of Interest

$$\frac{\text{\# of patients discharged on an inhaled anti-inflammatory medication}}{\text{\# of patients with asthma hospitalization}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who are discharged on an inhaled anti-inflammatory medication.

Denominator: Number of asthma patients who were hospitalized. Asthma includes ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11, 493.90, 493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis who were hospitalized. If a patient had multiple hospitalizations during the target month/quarter, select the last hospitalization for asthma. The patient medical records are reviewed for documentation of discharge with prescription for an inhaled anti-inflammatory medication.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as an increase in the rate.

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Measurement #3b

Percentage of discharged patients with asthma who are readmitted to hospital within 30 days of discharge.

Population Definition

Patients five years and older with hospitalization related to asthma.

Data of Interest

$$\frac{\text{\# of patients readmitted to the hospital within 30 days of discharge}}{\text{\# of asthma patients who were discharged from an asthma related hospitalization}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who are readmitted to the hospital within 30 days of discharge from an asthma-related hospitalization.

Denominator: Number of asthma patients who were discharged from an asthma-related hospitalization. Asthma includes ICD-9 diagnosis codes 493.00,493.01,493.10,493.11,493.90,493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis who were hospitalized. If a patient had multiple hospitalizations during the target month/quarter, select the last hospitalization for asthma. The patient medical records are reviewed for documentation of readmission to the hospital within 30 days of discharge.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is an outcome measure, and improvement is noted as a decrease in the rate.

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Measurement #3c

Percentage of patients with asthma who return to the emergency department for treatment of asthma within 30 days of last visit to the emergency department.

Population Definition

Patients five years and older with emergency department visit related to asthma.

Data of Interest

$$\frac{\text{\# of patients who return to the emergency department within 30 days of the last visit to the emergency department}}{\text{\# of asthma patients who were seen in the emergency department for asthma treatment}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who return to the emergency department for treatment of asthma within 30 days of the last visit to the emergency department.

Denominator: Number of asthma patients who were seen in emergency department for asthma treatment. Asthma includes ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11,493.90, 493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis who were seen in emergency department for asthma treatment. If a patient had multiple emergency department visits during the target month/quarter, select the last emergency department visit for asthma. The patient medical records are reviewed for documentation of return to the emergency department for asthma treatment within 30 days of the last visit to emergency department.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as a decrease in the rate. Specifically, this measure looks at overuse of the emergency department for treatment of asthma.

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Measurement #3d

Percentage of patients with an emergency department visit or inpatient admission for an asthma exacerbation who are discharged from the emergency department OR inpatient setting with an asthma discharge plan.

Population Definition

Patients five years and older with emergency department visit related to asthma.

Data of Interest

$$\frac{\text{\# of patients who have asthma discharge plan}}{\text{\# of asthma patients who were seen in the emergency department for asthma treatment}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who have asthma discharge plan.

Denominator: Number of asthma patients who were seen in emergency department or hospitalized for asthma treatment. Asthma includes ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11, 493.90, 493.91.

Method/Source of Data Collection

Identify patients with an asthma ICD-9 diagnosis who were seen in emergency department or hospitalized for asthma treatment. If a patient had multiple emergency department or hospital visits during the target month/quarter, select the last emergency department or hospital visit for asthma. The patient medical records are reviewed for documentation discharge plan for asthma.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as an increase in the rate. Specifically, this measure aims to reduce readmissions to the hospital or emergency department for asthma exacerbations.

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Measurement #3e

Percentage of pediatric patients who have the following managed in inpatient care settings: *(Joint Commission)*

- Use of relievers for inpatient asthma
- Use of systemic corticosteroids for inpatient asthma
- Home management plan of care given to patient/caregiver

Notes

This is a Joint Commission measure and is for Joint Commission reporting only.

Full specifications for this measure can be found at the Joint Commission Web site at:

http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures/

Web site link up-to-date as of April 2012.

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Measurement #4a

Percentage of patients whose asthma is not in control or have a change in medication or clinical status, who are seen by a health care clinician within two to six weeks.

Population Definition

Patients five years and older with asthma diagnosis

Data of Interest

$$\frac{\text{\# of patients who are seen by a clinician within two to six weeks of change in medication or clinical status}}{\text{\# of asthma patients with uncontrolled asthma or have a change in medication or clinical status}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who are seen by a clinician within two to six weeks of change in medication or clinical status.

Denominator: Number of asthma patients who are uncontrolled or have a change in medication or clinical status.

For classifications of asthma control by age, see Tables 5 and 6. Asthma includes ICD-9 diagnosis codes 493.00, 493.01,493.10,493.11,493.90, 493.91.

Method/Source of Data Collection

Identify patients with asthma ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11, 493.90, 493.91 at the last visit and asthma was not in control. or there was a change in medication or clinical status. Determine from documentation whether clinician saw them within two to six weeks of change in medication or clinical status.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as an increase in the rate.

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Measurement #4b

Percentage of patients whose asthma is in control who are seen by a health care clinician every one to six months.

Population Definition

Patients five years and older with asthma diagnosis

Data of Interest

$$\frac{\text{\# of patients who are seen by a clinician every one to six months}}{\text{\# of asthma patients who are controlled}}$$

Numerator/Denominator Definitions

Numerator: Number of asthma patients who are seen by a clinician every one to six months.

Denominator: Number of asthma patients who are controlled. For classifications of asthma control, see Tables 5 and 6. Asthma includes ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11, 493.90, 493.91.

Method/Source of Data Collection

Identify patients with asthma ICD-9 diagnosis codes 493.00, 493.01, 493.10, 493.11, 493.90, 493.91 at the last visit and asthma was in control. Determine from documentation whether clinician saw them within one to six months of the last visit for asthma.

Time Frame Pertaining to Data Collection

Monthly for groups that want to track process changes in a shorter period. Otherwise, data collection can also be done quarterly.

Notes

This is a process measure, and improvement is noted as an increase in the rate.

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Implementation Recommendations

Prior to implementation, it is important to consider current organizational infrastructure that address the following:

- System and process design
- Training and education
- Culture and the need to shift values, beliefs and behaviors of the organization.

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of the implementation of this guideline:

- Facilitate timely and accurate diagnosis of asthma, and asthma severity and control.
- Educate clinicians in the use of spirometry as a diagnostic tool.
- Educate clinicians and patients in the importance of developing a partnership using the ICSI Collaborative Conversation™ for Shared Decision-Making model to establish and maintain an asthma action plan and assess adherence.

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Implementation Tools and Resources

Criteria for Selecting Resources

The following tools and resources specific to the topic of the guideline were selected by the work group. Each item was reviewed thoroughly by at least one work group member. It is expected that users of these tools will establish the proper copyright prior to their use. The types of criteria the work group used are:

- The content supports the clinical and the implementation recommendations.
- Where possible, the content is supported by evidence-based research.
- The author, source and revision dates for the content are included where possible.
- The content is clear about potential biases and when appropriate conflicts of interests and/or disclaimers are noted where appropriate.

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Implementation Tools and Resources Table

Author/Organization	Title/Description	Audience	Web Sites/Order Information
Agency for Healthcare Research and Quality (AHRQ), U.S. Department of Health and Human Services	Innovations Exchange summary: Culturally Competent Parent Mentors Support Families of Minority Children with Asthma, Leading to Better Health, Less Missed School and Work. Strong evidence rating, program 2004-2007 by BlueCross BlueShield of MN. Black and Hispanic children and teens (6-18). Results: improved management, fewer missed school, work, emergency room incidents, and cost savings by participants. Updated on AHRQ Exchange June 2011. Includes hyperlink to the tool.	Patients and Families; Health Care Clinicians; Medicaid Managers; Health Plans	http://innovations.ahrq.gov/content.aspx?id=2922
Agency for Healthcare Research and Quality (AHRQ), U.S. Department of Health and Human Services	Asthma Return-on-Investment Calculator is a tool to explore financial returns from quality improvement and disease management programs for populations with asthma. Built by Thomson Reuters, contracted by AHRQ.	Health Care Clinicians; Medicaid Managers; Health Plans	http://statesnapshots.ahrq.gov/asthma/
Allergy and Asthma Network/Mothers of Asthmatics	A national non-profit network of families whose desire is to overcome allergies and asthma through knowledge. This Web site produces accurate, timely, practical and livable alternatives to suffering.	Patients and Families; Health Care Clinicians	http://www.aanma.org 1-800-878-4403
American Academy of Allergy, Asthma and Immunology	The largest professional medical organization in the United States devoted to the allergy/immunology specialty. The AAAAI is devoted to the advancement of the knowledge and practice of allergy, asthma and immunology for optimal patient care.	Patients and Families; Health Care Clinicians	http://www.aaaai.org 1-414-272-6071
American College of Allergy, Asthma and Immunology (AACAAI)	Provides both patient- and professional-oriented information on asthma diagnosis and management.	Patients and Families; Health Care Clinicians	http://www.acaai.org 1-847-427-1200

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Author/Organization	Title/Description	Audience	Web Sites/Order Information
American Lung Association (ALA)	Offers comprehensive information for patients and practitioners on asthma care and reduction of exacerbations and asthma triggers. **Asthma-Friendly Schools Initiative** The Asthma-Friendly Schools Initiative provides a framework and tools that communities and schools can use to work together on a comprehensive approach to asthma management, including planning tools, policy recommendations and education programs. **Open Airways For Schools** Elementary school children can learn to manage their own asthma when they participate in the American Lung Association's award-winning Open Airways For Schools.	Patients and Families; Health Care Clinicians	http://www.lungusa.org/ 1-800-586-4872 http://www.lung.org/lung-disease/asthma/in-schools/asthma-friendly-schools/
Association of Asthma Educators (AAE)	Promotes asthma education as an integral comprehensive asthma program to raise the competence of health care professionals who educate individuals and families affected by asthma, and to raise the standard of care and quality of asthma education delivered.	Health Care Clinicians	http://www.asthmaeducators.org/ 1-888-988-7747
Asthma and Allergy Foundation of America (AAFA)	Focus is on improving the quality of life for people with asthma and allergies and their caregivers, through education, advocacy and research. Provides practical information, community-based services, support and referrals through a national network of chapters and educational groups.	Patients and Families; Health Care Clinicians	http://www.aafa.org 1-800-727-8462
Centers for Disease Control and Prevention	CDC.gov is CDC's primary online communication channel. It provides users with credible, reliable health information on topics ranging from data and statistics to diseases and conditions and more.	Patients and Families; Health Care Clinicians	http://www.cdc.gov 1-800-232-4636

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Author/Organization	Title/Description	Audience	Web Sites/Order Information
MaineHealth AH! Health Asthma Program	Living Well with Asthma, a guide for patients and families: Instruction for infant, preschool and all age children and adults; includes action plans; inhaler, nebulizer, peak flow instructions; and much more. © February 2011, Maine Health.	Health Care Clinicians; Patients and Families; Schools; Daycare	http://www.mainehealth.org/asthma http://www.mainehealth.org/workfiles/mh_professional/Asthma/2011_asthma_guide.pdf MaineHealth Learning Resource Center toll-free phone: 866-609-5183
Medicaid Health Plans of American (MHPA) Center for Best Practices	Best Practices Compendium in Childhood Asthma Care, ©2011 MHPA, with independent grant support by Merck, leverages data, information, best practice case studies to disseminate innovative quality initiatives to care for underserved populations. Addresses utilization and costs (emergency and inpatient care versus coordinated primary care), disparities, measurement and accountability.	Health Care Clinicians; Medicaid Members and Families; Health Plans; Public Health; Communities	1050 18th Street, NW Suite 1010 Washington, DC 20036 phone (202) 857-5720 fax (202) 857-573 info@mhpa.org http://www.mhpa.org
Minnesota Department of Health	Offers information for health care professionals, schools and patients about asthma. An asthma action plan is also included in English and Spanish.	Patients and Families; Health Care Clinicians	http://www.health.state.mn.us http://www.health.state.mn.us/asthma/edtools.htm (651) 201-5000 1-888-345-0823
Minnesota Department of Health: Interactive Asthma Action Plan	The interactive Asthma Action Plan (iAAP) is a computerized clinical decision support tool for licensed health care clinicians who treat patients who have asthma. It follows the NIH, EPR-3 Asthma Guideline (2007) recommendations to assess asthma patients' severity or control level, and produces an individualized action plan and trigger control sheet, with options for sharing with schools.	Health Care Clinicians	http://www.Asthma-iAAP.org/about.html
National Association of School Nurses	School-based asthma treatment.	School Nurses and Staff	http://www.health.state.mn.us/asthma/documents/081511schoolemergencynursingprotocol.pdf

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Author/Organization	Title/Description	Audience	Web Sites/Order Information
National Asthma Control Initiative (NACI)	NACI is a broad-scale initiative of the National Asthma Education and Prevention Program, coordinated by the NHLBI, NIH, Department of Health and Human Services. The initiative aims to reduce asthma disparities by fostering collaboration among various sectors of home, work, health care clinicians and larger community to further care for asthma patients and share best practices. This action guide is designed to give individuals ideas on how they can better manage asthma.	Patients and Families; Health Care Clinicians; Schools; Coalitions; Employers; Employees; Insurers; Purchasers; Communities	http://www.nhlbi.nih.gov/health/prof/lung/asthma/naci-action-guide.pdf
National Asthma Education Certification Board	Promotes optimal asthma management and quality of life among individuals with asthma, their families and communities by advancing excellence in asthma education through the certified asthma educator process. Information relates to certificants, exam information, reimbursement for education, and online forums for discussion.	Health Care Clinicians, Asthma Educators	http://www.naecb.com
National Asthma Education and Prevention Program (NAEPP)	**Management Of Asthma Exacerbations: School Treatment** Suggested Emergency Nursing Protocol for Students with Asthma Symptoms Who Don't Have a Personal Asthma Action Plan.	School Nurses and Staff	http://www.health.state.mn.us/asthma/documents/081511schoolemergencynursingprotocol.pdf
NAEPP and National Association of School Nurses	Is the Asthma Action Plan Working? – A Tool for School Nurse Assessment This resource is for assessing whether or not an Asthma Action Plan is working for a student. Developed by National Asthma Education and Prevention Program (NAEPP) School Asthma Education Subcommittee.	School Nurses and Staff	http://www.nhlbi.nih.gov/health/prof/lung/asthma/asth_act_plan_frm.pdf
National Health Services, United Kingdom	Patient decision aid: Asthma – inhaled corticosteroids. Based upon 2008 British Asthma Guideline's stepwise approach to therapies, it presents green, yellow, red colored faces in graphic display of symptoms improvement and worsening with use of inhaled corticosteroids. Copyright 2009.	Patients and Families; Health Care Clinicians	http://www.npc.nhs.uk/therapeutics/respiratory/asthma/resources/pda_asthma_ics.pdf If use is for other than personal purposes, email request to download: copyright@npc.nhs.uk.

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Author/Organization	Title/Description	Audience	Web Sites/Order Information
National Heart, Lung, and Blood Institute (NHLBI)	Provides asthma health education resources for patients, school/day care clinicians and health professionals. Materials written in Spanish are available.	Patients and Families; Health Care Clinicians	http://www.nhlbi.nih.gov 1-800-490-9198
National Jewish Medical and Research Center (Lung Line)	At the forefront of research and medicine for more than 110 years. Integrates the latest scientific discoveries with coordinated care for pulmonary, cardiac, immune and related conditions.	Patients and Families; Health Care Clinicians	http://www.nationaljewish.org 1-877-225-5654
National Quality Forum NQF	NQF endorsed standards include measures for asthma assessment, management plans, appropriate medication use, and pharmacologic therapy.	Health Care Clinicians; Health Plans	http://www.qualityforum.org/Measures_List.aspx?#k=asthma
U.S. Environmental Protection Agency (EPA)	Offers asthma education that incorporates an awareness of indoor environmental asthma triggers (e.g., secondhand smoke, dust mites, mold, pet dander and cockroaches) and actions that can be taken to reduce children's exposure to them in homes, schools and child care settings.	Patients and Families; Health Care Clinicians	http://www.epa.gov/iaq 1-800-621-8431
Wisconsin Asthma Coalition (WAC)	WAC mission is to develop and implement a sustainable statewide action plan to expand and improve the quality of asthma education, management and services in the state. Materials and resources available include clinical care education, public policy, disparities and surveillance.	Patients and Families; Health Care Clinicians	http://dhs.wisconsin.gov/eh/Asthma/WAC.htm 1-608-266-1865

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ICSI Order Sets utilize two types of boxes for orders. One is the open box that clinicians will need to check for the order to be carried out. The second box is a pre-checked box; orders that have strong evidence and/or are standard of care and require documentation if the clinician decides to "uncheck" the order.

Organizations are recognizing the benefit of using pre-checked boxes for other orders to promote efficiency. Organizations are encouraged, through a consensus process, to identify those orders to utilize pre-checked boxes to increase efficiency, reduce calls to clinicians, and to reduce barriers for nursing and other professionals to provide care that is within their scope.

Throughout the order set you will note annotation numbers. These annotation numbers correspond with the guideline itself and provide associated discussion and evidence when available.

It is assumed that clinicians will supplement this information from standard pharmaceutical sources to inform their decisions for individual patients.

Order sets are available in MS Word format at http://www.icsi.org.

Order Set

Admission for Asthma in Adults

Scope and Target Population

This order set template pertains to adult patients with the diagnosis of asthma who are admitted from the ED or direct admit to the hospital and does not include orders that pertain to intensive care admission.

This order set template pertains to adult patients with the diagnosis of asthma who are admitted from the ED or direct admit to the hospital and does not include orders that pertain to intensive care admission.

Legend:
☐ Open boxes are orders that a clinician will need to order by checking the box
☑ Pre-checked boxes are those orders with strong supporting evidence and/or regulatory requirements that require documentation if not done.

Patient Information *(Two are required.)*

Last Name: _____
First Name: _____
Date of Birth: ___/___/_____
Patient's age: _____
ID #:

Admit/Attending Information

Admit unit: _____

Attending physician: _____
How to contact: _____

Diagnosis

Admitting Dx: asthma exacerbation

Secondary Dx: _____

Condition

☐ Stable ☐ Guarded ☐ Unstable ☐ Other _____

Code status ☐ Full code ☐ DNR ☐ DNI ☐ Other

Vitals

☐ On admission and every _____ hours
☐ Pulse oximetry every _____ hours
☐ Continuous pulse oximetry
☐ Weight and height on admission and then every _____ days

Activity

☐ Bed rest for _____ hours
☐ Bathroom privileges with assist as needed
☐ As tolerated

Adverse Drug Reactions/Allergies

☐ None
☐ Yes, Name: _____ Type of reaction: _____
_____ Type of reaction: _____
_____ Type of reaction: _____

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Nursing Orders

☐ Elevate head of bed 30 degrees
☐ Fall alert
☐ Intake and output every shift
☐ Foley catheter ☐ Insert now ☐ Insert as needed
☐ Oxygen:
☐ O_2 by nasal canula at _____ liters per minute
☐ O_2 by nasal canula to keep saturation greater than _____
☐ Peak flows every _____ hours

Call physician if:

☐ Heart rate greater than _____ or less than _____
☐ Respiratory rate greater than _____ or less than _____
☐ O_2 saturation less than _____
☐ Systolic blood pressure greater than _____ or less than _____
☐ Temperature greater than _____

Diet

☐ NPO for _____ hours ☐ general diet
☐ Other _____

IVs

☐ Establish IV saline lock with flush every day as needed
Check IV fluid if appropriate:

☐ D5 0.45% NaCl with 20 mEq KCl at _____ mL/hour
☐ D5 0.45% NaCl at _____ mL/hour
☐ Lactated ringers at _____ mL/hour
☐ _____ at _____ mL/hour

Medications *(See Annotations #25, #27)*

☐ Albuterol _____ mg by nebulizer every _____ hours
☐ Albuterol _____ mg by nebulizer continuously
☐ Albuterol MDI _____ puffs every _____ hours as needed
☐ Levalbuterol _____ mg by nebulizer every _____ hours as needed
☐ Levalbuterol MDI _____ puffs every _____ hours as needed
☐ Albuterol/ipratropium MDI _____ puffs every _____ hours as needed
☐ Albuterol/ipratropium _____ mL by nebulizer every _____ hours as needed
☐ Ipratropium _____ mg by nebulizer every _____ hours
☐ Methylprednisolone _____ mg IV every _____ hours
☐ Prednisone _____ mg by mouth daily
☐ Montelukast _____ mg by mouth at bedtime

Other Medications

☐ Budesonide _____ mcg _____ puffs _____ day
☐ Ciclesonide _____ mcg _____ puffs _____ day
☐ Fluticasone _____ mcg _____ puffs _____ day
☐ Mometasone _____ mcg _____ puffs _____ day

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Diagnostic Tests (*First day – those not performed in ED*)

Indication:_____

☐ CBC/Plts with differential ☐ STAT ☐ Routine
☐ Theophylline level ☐ STAT ☐ Routine
☐ Blood culture ☐ STAT ☐ Routine
☐ Sputum gram stain and culture ☐ STAT ☐ Routine
☐ Nasal pharyngeal swab for influenza ☐ STAT ☐ Routine
☐ Nasal wash for influenza ☐ STAT ☐ Routine
☐ Arterial blood gases ☐ STAT ☐ Routine
☐ Venous blood gases ☐ STAT ☐ Routine
☐ Chest x-ray: ☐ STAT ☐ Routine
☐ PA ☐ Lateral ☐ Portable Indication: _____
☐ _____
☐ _____

Other

Consults

☐ Pulmonary consult: reason
☐ Asthma education consult
☐ Tobacco cessation education consult *(for current users)*

Discharge Planning

☐ Social service consult for assistance in discharge planning
☐ Financial counselor consult
☐ Primary care follow-up
☐ Asthma Action Plan

Immunization Evaluation and Review

☐ Pneumococcal vaccine
☐ Influenza vaccination _____

Authorized Prescriber Signature:_____

Printed Name: _____

Date/Time of Orders:_____/_____/_____ _____:_____

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The subdivisions of this section are:

- References
- Appendices

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Links are provided for those new references added to this edition (author name is highlighted in blue).

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Appendix A – Dosages of Drugs for Asthma Exacerbations in Emergency Medical Care or Hospital

	Dosages		
Medication	Adult Dose	Child Dose*	Comments
Short-Acting Inhaled $Beta_2$-Agonists			
Albuterol			
Nebulizer solution	2.5-5 mg every 20 minutes for 3 doses, then 2.5-10 mg every 1-4 hours as needed, or 10-15 mg/hour continuously	0.15 mg/kg (minimum dose 2.5 mg) every 20 minutes for 3 doses, then 0.15-0.3 mg/kg up to 10 mg every 1-4 hours as needed, or 0.5 mg/kg/hour by continuous nebulization	Only selective $beta_2$-agonists are recommended. For optimal delivery, dilute aerosols to minimum of 3 mL at gas flow of 6-8 L/min. May mix with ipratropium nebulizer solution.
MDI	4-8 puffs every 20 minutes up to 4 hours, then every 1-4 hours as needed	4-8 puffs every 20 minutes for 3 doses, then every 1-4 hours inhalation maneuver. Use spacer/holding chamber	As effective as nebulized therapy if patient is able to coordinate.
MDI	See albuterol dose	See albuterol dose	Has not been studied in severe asthma exacerbations.
Levalbuterol (R-albuterol)			
Nebulizer solution	1.25-2.5 mg every 20 minutes for 3 doses, then 1.25-5 mg every 1-4 hours as needed, or 5-7.5 mg/hour continuously	0.075 mg/kg (minimum dose 1.25 mg) every 20 minutes for 3 doses, then 0.075-0.15 mg/kg up to 5 mg every 1-4 hours as needed, or 0.25 mg/kg/hour by continuous nebulization	0.63 mg of levalbuterol is equivalent to 1.25 mg of racemic albuterol for both efficacy and side effects.
Pirbuterol			
MDI (200 mcg/puff)	See albuterol dose	See albuterol dose; thought to be half as potent as albuterol on a mg basis	Has not been studied in severe asthma exacerbations. To be discontinued after December 31, 2013.
Systemic (Injected) $Beta_2$-Agonists			
Epinephrine 1:1,000 (1 mg/mL)	0.3-0.5 mg every 20 minutes for 3 doses subcutaneous	0.01 mg/kg up to 0.3-0.5 mg every 20 minutes for 3 doses subcutaneous	No proven advantage of systemic therapy over aerosol.
Terbutaline	0.25 mg every 20 minutes for 3 doses subcutaneous	0.01 mg/kg every 20 minutes for 3 doses then every 2-6 hours as needed subcutaneous	No proven advantage of systemic therapy over aerosol.

* Children younger than 12 years of age.

NOTE: Adapted from the National Heart, Lung, Blood Institute EPR-3, 2007. The NHBLI has not issued a comprehensive update to its 2007 drug information as of publication of the ICSI guideline.

For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Continued

	Dosages		
Medication	Adult Dose	Child Dose*	Comments
Anticholinergics			
Ipratropium bromide			
Nebulizer solution	0.5 mg every 30 minutes for 3 doses then every 2-4 hours as needed	0.25 mg every 20 minutes for 3 doses, then every 2 to 4 hours	May mix in same nebulizer with albuterol. Should not be used as first-line therapy; should be added to beta$_2$-agonist therapy.
MDI	8 puffs every 20 minutes as needed up to 3 hours	4-8 puffs every 20 minutes as needed up to 3 hours	Dose delivered from MDI has been studied but its efficacy is inconclusive.
Ipratropium with albuterol			
Nebulizer solution	3 mL every 30 minutes for 3 doses, then every 2-4 hours as needed	1.5 mL every 20 minutes for 3 doses, then every 2-4 hours	May be used up to 3 hours in the initial management of severe exacerbation.
MDI	8 puffs every 20 minutes as needed up to 3 hours	4-8 puffs every 20 minutes as needed up to 3 hours	
Systemic Corticosteroids	Initiate dosing at:		
	(Dosages and comments apply to all three corticosteroids)		
Prednisone Methylprednisolone Prednisolone	120-180 mg/day in 3 or 4 divided doses for 48 hours, then 60-80 mg/day until PEF reaches 80% of predicted or personal best	1 mg/kg every 6 hours for 48 hours then 1-2 mg/kg/day (maximum = 60 mg/day) in 2 divided doses until PEF 80% of predicted or personal best	For outpatient "burst" use 40-60 mg in single or 2 divided doses for adults for a total of 5-10 days. Children: 1-2 mg/kg/day, maximum 60 mg/day for 3-10 days.

* Children 5 to 12 years of age

Note

No advantage has been found for higher dose corticosteroids in severe asthma exacerbations, nor is there any advantage for intravenous administration over oral therapy, provided gastrointestinal transit time or absorption is not impaired. The usual regimen is to continue the frequent multiple daily dose until the patient achieves an FEV_1 or PEF of 50 percent of predicted or personal best and then lower the dose to twice daily. This usually occurs within 48 hours. Therapy following a hospitalization or emergency department visit may last from 3 to 10 days. If patients are then started on inhaled corticosteroids, studies indicate there is no need to taper the systemic corticosteroid dose. If the follow-up systemic corticosteroid therapy is to be given once daily, one study indicates that it may be more clinically effective to give the dose in the afternoon at 3 p.m., with no increase in adrenal suppression.

NOTE: Adapted from the National Heart, Lung, Blood Institute EPR-3, 2007. The NHBLI has not issued a comprehensive update to its 2007 drug information as of publication of the ICSI guideline.

For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Appendix B – Usual Dosages for Quick-Relief Medications

Medication	Adult Dose	Child Dose	Comments
Inhaled Short-Acting Beta$_2$-Agonists (SABAs)			
Albuterol HFA Pirbuterol Levalbuterol HFA	• 2 puffs every 4-6 hours as needed	• Safety and efficacy not established • 2 puffs every 4-6 hours as needed	• Not recommended for long-term daily treatment. Unscheduled use exceeding 2 days/week indicates the need for additional long-term controller therapy. • To be discontinued after December 31, 2013. • Differences in potency exist so that all products are essentially equal in efficacy on a per-puff basis. • May double usual dose for mild exacerbations. • Non-selective agents (e.g., epinephrine, isoproterenol, metaproterenol) are not recommended due to their potential for excessive cardiac stimulation, especially in high doses. • Spacer/holding chambers are recommended with MDI.
Albuterol	1.25-5 mg (.25-1 cc) in 3 cc of saline every 4-8 hours as needed	1.25-5 mg, in 3 cc of saline every 4-8 hours as needed	• May mix with cromolyn or ipratropium nebulizer solutions, or budesonide inhalant suspension. May double dose for severe exacerbations.
Levalbuterol nebulization	12 yrs and older is 0.63 mg to 1.25 mg every 8 hours as needed	6-11 years is 0.31 mg to 0.63 mg every 8 hours as needed	• Compatible with budesonide inhalant suspension 3 times daily
Anticholinergics			
Ipratropium HFA	**MDI** 2-3 puffs every 6 hours **Nebulizer** 0.25 mg every 6 hours	Safety and efficacy not established	• Evidence is lacking for anticholinergics producing added benefit to beta$_2$- agonists in long-term control asthma therapy.
Systemic Corticosteroids		(Applies to all three systematic corticosteroids)	
Methylprednisolone Prednisolone Prednisone	• Short course "burst": 40-60 mg/day as single or 2 divided doses for 3-10 days		• Short courses or "bursts" are effective for establishing control when initiating therapy or during a period of gradual deterioration. • The burst should be continued until patient achieves 70% PEF personal best or symptoms resolve. This usually requires 3-10 days but may require longer. There is no evidence that tapering the dose following improvement prevents relapse if sufficient doses of inhaled corticosteroids are used simultaneously.

NOTE: Adapted from the National Heart, Lung, Blood Institute EPR-3, 2007. The NHBLI has not issued a comprehensive update to its 2007 drug information as of publication of the ICSI guideline.
For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Appendix C – Usual Dosages for Long-Term Medications

Medication	Adult Dose	Child Dose*	Comments
Inhaled Corticosteroids (*See Estimated Comparative Daily Dosages for Inhaled Corticosteroids.*)			
Systemic Corticosteroids			*(Applies to all three corticosteroids)*
Methylprednisolone	7.5-60 mg daily in a single dose in a.m. or every other day as needed for control	0.25-2 mg/kg daily in single dose in a.m. or every other day as needed for control	• For long-term treatment of severe persistent asthma, administer single dose in a.m. either daily or on alternate days (alternate-day therapy may produce less adrenal suppression). • Short courses or "bursts" are effective for establishing control when initiating therapy or during a period of gradual deterioration. • The burst should be continued until patient achieves 70% PEF personal best or symptoms resolve. This usually requires 3-10 days but may require longer. There is no evidence that tapering the dose following improvement prevents relapse.
Prednisolone	Short-course "burst" to achieve control 40-60 mg per day as single or 2 divided doses for 3-10 days	Short-course "burst": 1-2 mg/kg/day, maximum 60 mg/day for 3-10 days	
Prednisone			
Inhaled Long-Acting Beta$_2$-Agonists (LABA)			• Should not be used for symptom relief or exacerbations. Use with corticosteroids.
Salmeterol	1 blister every 12 hours	1 blister every 12 hours	
Formoterol	1 capsule every 12 hours	1 capsule every 12 hours	• Each capsule is for single use only; additional doses should not be administered for at least 12 hours. • Capsules should be used only with the Aerolizor™ inhaler. Avoid swallowing the capsule.

NOTE: Adapted from the National Heart, Lung, Blood Institute EPR-3, 2007. The NHBLI has not issued a comprehensive update to its 2007 drug information as of publication of the ICSI guideline.
For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Continued

Medication	Adult Dose	Child Dose*	Comments
Combined Medication			
Leukotriene Receptor Antagonists (LTRAs)			
Montelukast	10 mg per day	• 5 mg per day (6-14 years of age) 10 mg per day (more than 14 years of age)	• Montelukast exhibits a flat dose-response curve.
Zafirlukast	40 mg daily (20 mg tablet twice daily)	• 20 mg daily (10 mg tablet twice daily) (7-11 years of age)	• Monitor for signs and symptoms of hepatic dysfunction. • For zafirlukast, administration with meals decreases bioavailability; take at least 1 hour before or 2 hours after meals.
Zileuton	2,400 mg daily (two 600 mg tablets twice daily)	NA	
Methylxanthines			
Theophylline	Starting dose 10 mg/kg/day up to 300 mg max; usual max 800 mg/day	Starting dose 10 mg/kg/day; usual max: 16 mg/kg/day	• Adjust dosage to achieve serum concentration of 5-15 mcg/mL at steady-state (at least 48 hours on same dosage). • Due to wide interpatient variability in theophylline metabolic clearance, routine serum theophylline level monitoring is important.
Immunomodulators Omalizumab	150-375 mg 2-4 weeks, depending on body weight and pretreatment serum IgE level		• Do not administer more than 150 mg per injection site. • Monitor for anaphylaxis for two hours following at least the first 3 injections.

NOTE: Adapted from the National Heart, Lung, Blood Institute EPR-3, 2007. The NHBLI has not issued a comprehensive update to its 2007 drug information as of publication of the ICSI guideline.
For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Appendix D – Usual Doses for Long-Term Medications – Comparative Puffs

Youths ≥ 12 years of age and adults

	Low (puffs/day)	Med (puffs/day)	High (puffs/day)
Beclomethasone MDI 40	2-6	8-12	> 12
Beclomethasone MDI 80	1-2	4-6	> 6
Ciclesonide MDI 80	2	4	———
Ciclesonide MDI 160	———	2	4
Budesonide DPI 90	2-6	8-12	> 12
Budesonide DPI 180	1-2	4-6	> 6
Fluticasone MDI 44	2-6	8-10	> 10
Fluticasone MDI 110	2	4	> 4
Fluticasone MDI 220	1	2	> 2
Fluticasone DPI 50	2-6	8-10	> 10
Fluticasone DPI 100	2	4	> 4
Fluticasone DPI 250	1	2	> 2
Mometasone DPI 110	2	4	> 4
Mometasone DPI 220	1	2	> 2

- All doses based on NHLBI guidelines (2007). Table is in total puffs per day. Most clinical dosing is twice daily; therefore, divide total dose by two and administer twice daily.
- The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy. The clinician must monitor the patient's response on several clinical parameters and adjust the dose accordingly. The stepwise approach to therapy emphasizes that once control of asthma is achieved, the dose of medication should be carefully titrated to the minimum dose required to maintain control, thus reducing the potential for adverse effect.
- Some dosages may be outside package labeling.

Compiled by:
Gail Brottman, MD; Donald Uden, PharmD; Angeline Carlson, PhD

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Children 5-11 years

	Low (puffs/day)	Med (puffs/day)	High (puffs/day)
Beclomethasone MDI 40	2-4	6-8	> 8
Beclomethasone MDI 80	1-2	4	> 4
Ciclesonide MDI	NI	NI	NI
Budesonide DPI 90	2-4	6-8	> 8
Budesonide DPI 180	1-2	4	> 4
Fluticasone MDI 44	2-4	6-8	> 8
Fluticasone MDI 110	1-2	4	> 4
Fluticasone MDI 220		2	≥ 2
Fluticasone DPI 50	2-4	6-8	> 8
Fluticasone DPI 100	1-2	4	> 4
Fluticasone DPI 250		1	≥ 2
Mometasone DPI 110	NI	NI	NI
Mometasone DPI 220	NI	NI	NI

- All doses based on NHLBI guidelines (2007). Table is in total puffs per day. Most clinical dosing is twice daily therefore, divide total dose by two and administer twice daily.
- The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy. The clinician must monitor the patient's response on several clinical parameters and adjust the dose accordingly. The stepwise approach to therapy emphasizes that once control of asthma is achieved, the dose of medication should be carefully titrated to the minimum dose required to maintain control, thus reducing the potential for adverse effect.
- Some dosages may be outside package labeling.
- NI = Not indicated

Compiled by:
Gail Brottman, MD; Don Uden, PharmD; Angeline Carlson, PhD
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Combination Therapy, Youth > 12 of age and adults

	Low (puffs/day)	Medium (puffs/day)	High (puffs/day)
Fluticasone/Salmeterol (Advair® diskus 100/50)	2		
Fluticasone/Salmeterol (Advair® diskus 250/50)		2	
Fluticasone/Salmeterol (Advair® diskus 500/50)			2
Fluticasone/Salmeterol (Advair® HFA 45/21)	4		
Fluticasone/Salmeterol (Advair® HFA 115/21)		4	
Fluticasone/Salmeterol (Advair® HFA 230/21)			4
Budesonide/Formoterol (Symbicort® 80/4.5)	2-4		
Budesonide/Formoterol (Symbicort® 160/4.5)		4	
Mometasone/ Formoterol (Dulera® HFA 100/5)	2	4	
Mometasone/ Formoterol (Dulera® HFA 200/5)		2	4

For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Combination Therapy, Children 5-11 years

	Low (puffs/day)	Medium (puffs/day)	High (puffs/day)
Fluticasone/Salmeterol (Advair® diskus 100/50)	2		
Fluticasone/Salmeterol (Advair® diskus 250/50)		1-2	2
Fluticasone/Salmeterol (Advair® diskus 500/50)			1-2
Fluticasone/Salmeterol (Advair® HFA 45/21)	2-4		
Fluticasone/Salmeterol (Advair® HFA 115/21)	2	2-4	
Fluticasone/Salmeterol (Advair® HFA 230/21)		2	2-4
Budesonide/Formoterol (Symbicort® 80/4.5)	2	4	
Budesonide/Formoterol (Symbicort® 160/4.5)		2	4
Mometasone/ Formoterol (Dulera® HFA 100/5)	2	2-4	
Mometasone/ Formoterol (Dulera® HFA 200/5)		2	2-4

For the most up-to-date medication and prescribing information, consult with your pharmacy or consider the following sources: www.epocrates.com, www.micromedex.com, www.uptodate.com, www.pdr.net.

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Appendix E – Example of Asthma Action Plan

MAYO CLINIC HEALTH SYSTEM
Franciscan Healthcare

Asthma Action Plan

Date of plan update_____

Name_____ DOB_____

Patient Label

Triggers of asthma:

☐ Pollen ☐ Infections ☐ Exercise ☐ Household Pets
☐ Weather/Temperature ☐ Dust Mites ☐ Mold ☐ Smoke/Pollution
☐ Strong Odors/Sprays ☐ Foods ☐ Emotions ☐ Household Products
☐ Other:_____

How many Emergency Room visits related to asthma have I had in the past year? _____
How many Hospitalizations related to asthma have I had in the past year? _____

Personal Best Peak Flow ☐

Asthma Control Test (ACT) Score ☐

GREEN ZONE — DOING WELL

You have ALL of these:
- Breathing is good
- No cough or wheeze
- Can work / exercise easily
- Sleeping all night

Peak Flow is between: ☐ and ☐
80-100% of personal best

Step 1: Take these controller medicines **every day**:

MEDICINE	HOW MUCH	WHEN

Step 2: If exercise triggers your asthma, take the following medicine **15 minutes before** exercises and sports.

MEDICINE	HOW MUCH
Albuterol	1-2 puffs

YELLOW ZONE — GETTING WORSE

You have ANY of these:
- Difficulty breathing
- Coughing
- Wheezing
- Tightness in chest
- Difficult to work / exercise
- Wake at night coughing

Peak Flow is between: ☐ and ☐
50-79% of personal best

Step 1: Keep taking GREEN ZONE medicines and ADD quick-relief medicine:

Step 2:

MEDICINE	HOW MUCH
Albuterol	2 puffs every 4 hours

Step 3: If symptoms persist for more than 24 hours, call your provider for additional instructions

Add prednisone _____ for _____ days

Remember to always use a spacing / holding chamber with your rescue inhaler.

RED ZONE — EMERGENCY!

You have ANY of these:
- It's very hard to breathe
- Nostrils open wide
- Medicine is not helping
- Trouble walking or talking
- Lips or fingernails are grey or bluish

Peak Flow is less than: ☐
below 50% of personal best

Take your RED ZONE medicine, call your provider and go to the emergency room or call 911 immediately.

Step 1:

MEDICINE	HOW MUCH
Albuterol	2-4 puffs every 20 minutes, up to 3 times in one hour

Asthma Action Plan

Our goal is to have well controlled asthma with no Emergency Room visits or Hospitalizations during the next year.

If your symptoms greatly improve or worsen over time, call your provider to review your action plan. **1-800-362-5454**. If you have any general questions regarding asthma you may also contact the Asthma Education Program at ext. 29862.

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Appendix F – ICSI Shared Decision-Making Model

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The technical aspects of Shared Decision-Making are widely discussed and understood.

- **Decisional conflict** occurs when a patient is presented with options where no single option satisfies all the patient's objectives, where there is an inherent difficulty in making a decision, or where external influencers act to make the choice more difficult.
- **Decision support** clarifies the decision that needs to be made, clarifies the patient's values and preferences, provides facts and probabilities, guides the deliberation and communication and monitors the progress.
- **Decision aids** are evidence-based tools that outline the benefits, harms, probabilities and scientific uncertainties of specific health care options available to the patient.

However, before decision support and decision aids can be most advantageously utilized, a Collaborative Conversation™ should be undertaken between the provider and the patient to provide a supportive framework for Shared Decision-Making.

Collaborative Conversation™

A collaborative approach toward decision-making is a fundamental tenet of Shared Decision-Making (SDM). The Collaborative Conversation™ is an inter-professional approach that nurtures relationships, enhances patients' knowledge, skills and confidence as vital participants in their health, and encourages them to manage their health care.

Within a Collaborative Conversation™ , the perspective is that both the patient and the provider play key roles in the decision-making process. The patient knows which course of action is most consistent with his/her values and preferences, and the provider contributes knowledge of medical evidence and best practices. Use of Collaborative Conversation™ elements and tools is even more necessary to support patient, care provider and team relationships when patients and families are dealing with high stakes or highly charged issues, such as diagnosis of a life-limiting illness.

The overall framework for the Collaborative Conversation™ approach is to create an environment in which the patient, family and care team work collaboratively to reach and carry out a decision that is consistent with the patient's values and preferences. A rote script or a completed form or checklist does not constitute this approach. Rather it is a set of skills employed appropriately for the specific situation. These skills need to be used artfully to address all aspects involved in making a decision: cognitive, affective, social and spiritual.

Key communication skills help build the Collaborative Conversation™ approach. These skills include many elements, but in this appendix only the questioning skills will be described. (For complete instruction, see O'Connor, Jacobsen "Decisional Conflict: Supporting People Experiencing Uncertainty about Options Affecting Their Health" [2007], and Bunn H, O'Connor AM, Jacobsen MJ "Analyzing decision support and related communication" [1998, 2003].)

1. **Listening skills:**

   Encourage patient to talk by providing prompts to continue such as "*go on, and then?, uh huh,"* or by repeating the last thing a person said, "*It's confusing*."

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Paraphrase content of messages shared by patient to promote exploration, clarify content and to communicate that the person's unique perspective has been heard. The provider should use his/her own words rather than just parroting what he/she heard.

Reflection of feelings usually can be done effectively once trust has been established. Until the provider feels that trust has been established, short reflections at the same level of intensity expressed by the patient without omitting any of the message's meaning are appropriate. Reflection in this manner communicates that the provider understands the patient's feelings and may work as a catalyst for further problem solving. For example, the provider identifies what the person is feeling and responds back in his/her own words like this: *"So, you're unsure which choice is the best for you."*

Summarize the person's key comments and reflect them back to the patient. The provider should condense several key comments made by the patient and provide a summary of the situation. This assists the patient in gaining a broader understanding of the situations rather than getting mired down in the details. The most effective times to do this are midway through and at the end of the conversation. An example of this is, *"You and your family have read the information together, discussed the pros and cons, but are having a hard time making a decision because of the risks."*

Perception checks ensure that the provider accurately understands a patient or family member, and may be used as a summary or reflection. They are used to verify that the provider is interpreting the message correctly. The provider can say *"So you are saying that you're not ready to make a decision at this time. Am I understanding you correctly?"*

2. **Questioning Skills**

Open and closed questions are both used, with the emphasis on open questions. Open questions ask for clarification or elaboration and cannot have a yes or no answer. An example would be *"What else would influence you to choose this?"* Closed questions are appropriate if specific information is required such as *"Does your daughter support your decision?"*

Other skills such as summarizing, paraphrasing and reflection of feeling can be used in the questioning process so that the patient doesn't feel pressured by questions.

Verbal tracking, referring back to a topic the patient mentioned earlier, is an important foundational skill (Ivey & Bradford-Ivey). An example of this is the provider saying, *"You mentioned earlier…"*

3. **Information-Giving Skills**

Providing information and **providing feedback** are two methods of information giving. The distinction between providing information and giving advice is important. Information giving allows a provider to supplement the patient's knowledge and helps to keep the conversation patient centered. Giving advice, on the other hand, takes the attention away from the patient's unique goals and values, and places it on those of the provider.

Providing information can be sharing facts or responding to questions. An example is *"If we look at the evidence, the risk is…"* Providing feedback gives the patient the provider's view of the patient's reaction. For instance, the provider can say, *"You seem to understand the facts and value your daughter's advice."*

Additional Communication Components

Other elements that can impact the effectiveness of a Collaborative Conversation™ include:

- Eye contact
- Body language consistent with message
- Respect

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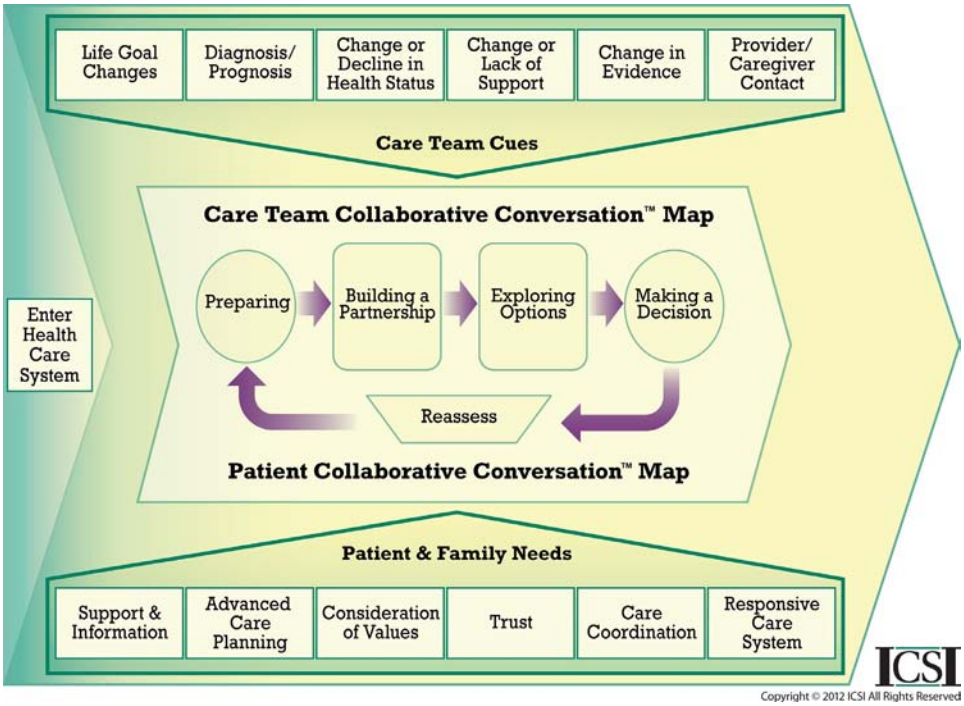
- Empathy
- Partnerships

Self-examination by the provider involved in the Collaborative Conversation™ can be instructive. Some questions to ask oneself include:

- Do I have a clear understanding of the likely outcomes?
- Do I fully understand the patient's values?
- Have I framed the options in comprehensible ways?
- Have I helped the decision-makers recognize that preferences may change over time?
- Am I willing and able to assist the patient in reaching a decision based on his/her values, even when his/her values and ultimate decision may differ from my values and decisions in similar circumstances?

When to Initiate a Collaborative Conversation™

A Collaborative Conversation™ can support decisions that vary widely in complexity. It can range from a straightforward discussion concerning routine immunizations to the morass of navigating care for a life-limiting illness. Table 1 represents one health care event. This event can be simple like a 12 year-old coming to the clinic for routine immunizations, or something much more complex like an individual receiving a diagnosis of congestive heart failure. In either case, the event is the catalyst that starts the process represented in this table. There are cues for providers and patient needs that exert influence on this process. They are described below. The heart of the process is the Collaborative Conversation™. The time the patient spends within this health care event will vary according to the decision complexity and the patient's readiness to make a decision.



Regardless of the decision complexity there are cues applicable to all situations that indicate an opportune time for a Collaborative Conversation™. These cues can occur singularly or in conjunction with other cues.

Cues for the Care Team to Initiate a Collaborative Conversation™

- **Life goal changes:** Patient's priorities change related to things the patient values such as activities, relationships, possessions, goals and hopes, or things that contribute to the patient's emotional and spiritual well-being.
- **Diagnosis/prognosis changes:** Additional diagnoses, improved or worsening prognosis.
- **Change or decline in health status:** Improving or worsening symptoms, change in performance status or psychological distress.
- **Change or lack of support:** Increase or decrease in caregiver support, change in caregiver, or caregiver status, change in financial standing, difference between patient and family wishes.
- **Change in medical evidence or interpretation of medical evidence:** Providers can clarify the change and help the patient understand its impact.
- **Provider/caregiver contact:** Each contact between the provider/caregiver and the patient presents an opportunity to reaffirm with the patient that his/her care plan and the care the patient is receiving are consistent with his/her values.

Patients and families have a role to play as decision-making partners, as well. The needs and influencers brought to the process by patients and families impact the decision-making process. These are described below.

Patient and Family Needs within a Collaborative Conversation™

- **Request for support and information:** Decisional conflict is indicated by, among other things, the patient verbalizing uncertainty or concern about undesired outcomes, expressing concern about choice consistency with personal values and/or exhibiting behavior such as wavering, delay, preoccupation, distress or tension. Generational and cultural influencers may act to inhibit the patient from actively participating in care discussions, often patients need to be given "permission" to participate as partners in making decisions about his/her care.

  Support resources may include health care professionals, family, friends, support groups, clergy and social workers. When the patient expresses a need for information regarding options and his/her potential outcomes, the patient should understand the key facts about options, risks and benefits, and have realistic expectations. The method and pace with which this information is provided to the patient should be appropriate for the patient's capacity at that moment.

- **Advance Care Planning:** With the diagnosis of a life-limiting illness, conversations around advance care planning open up. This is an opportune time to expand the scope of the conversation to other types of decisions that will need to be made as a consequence of the diagnosis.
- **Consideration of Values:** The personal importance a patient assigns potential outcomes must be respected. If the patient is unclear how to prioritize the preferences, value clarification can be achieved through a Collaborative Conversation™ and by the use of decision aids that detail the benefits and harms of potential outcomes in terms the patient can understand.
- **Trust:** The patient must feel confident that his/her preferences will be communicated and respected by all caregivers.
- **Care Coordination:** Should the patient require care coordination, this is an opportune time to discuss the other types of care-related decisions that need to be made. These decisions will most likely need to be revisited often. Furthermore, the care delivery system must be able to provide coordinated care throughout the continuum of care.

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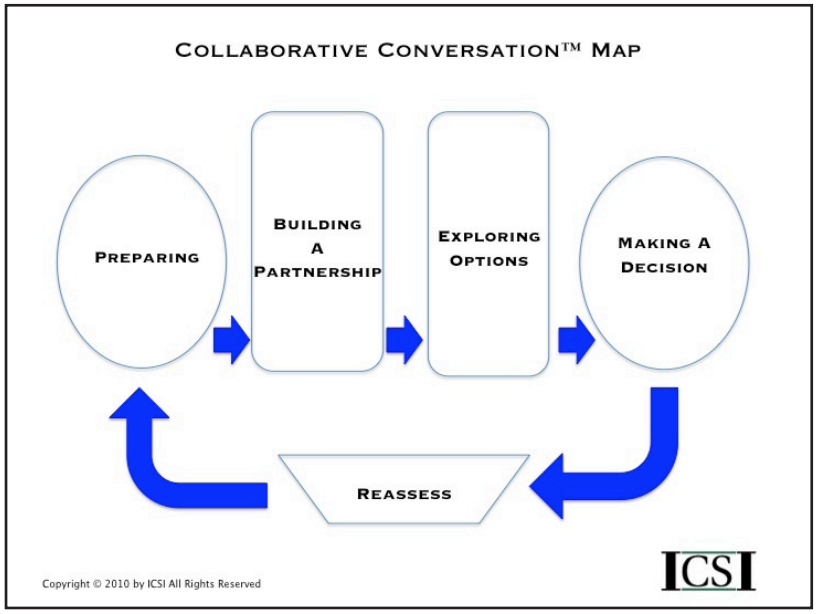
- **Responsive Care System:** The care system needs to support the components of patient- and family-centered care so the patient's values and preferences are incorporated into the care he/she receives throughout the care continuum.

The Collaborative Conversation™ Map is the heart of this process. The Collaborative Conversation™ Map can be used as a stand-alone tool that is equally applicable to providers and patients as shown in Table 2. Providers use the map as a clinical workflow. It helps get the Shared Decision-Making process initiated and provides navigation for the process. Care teams can used the Collaborative Conversation™ to document team best practices and to formalize a common lexicon. Organizations can build fields from the Collaborative Conversation™ Map in electronic medical records to encourage process normalization. Patients use the map to prepare for decision-making, to help guide them through the process and to share critical information with their loved ones.



Evaluating the Decision Quality

Adapted from O'Connor, Jacobsen "Decisional Conflict: Supporting People Experiencing Uncertainty about Options Affecting Their Health" [2007].

When the patient and family understand the key facts about the condition and his/her options, a good decision can be made. Additionally, the patient should have realistic expectations about the probable benefits and harms. A good indicator of the decision quality is whether or not the patient follows through with his/her chosen option. There may be implications of the decision on patient's emotional state such as regret or blame, and there may be utilization consequences.

Decision quality can be determined by the extent to which the patient's chosen option best matches his/her values and preferences as revealed through the Collaborative Conversation™ process.

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Disclosure of Potential Conflicts of Interest

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All ICSI documents are available for review during the revision process by member medical groups and sponsors. In addition, all members commit to reviewing specific documents each year. This comprehensive review provides information to the work group for such issues as content update, improving clarity of recommendations, implementation suggestions and more. The specific reviewer comments and the work group responses are available to ICSI members at http://bit.ly/Asthma0712.

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Institute for Clinical Systems Improvement

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ICSI Document Development and Revision Process

Overview

Since 1993, the Institute for Clinical Systems Improvement (ICSI) has developed more than 60 evidence-based health care documents that support best practices for the prevention, diagnosis, treatment or management of a given symptom, disease or condition for patients.

Audience and Intended Use

The information contained in this ICSI Health Care Guideline is intended primarily for health professionals and other expert audiences.

This ICSI Health Care Guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients and families are urged to consult a health care professional regarding their own situation and any specific medical questions they may have. In addition, they should seek assistance from a health care professional in interpreting this ICSI Health Care Guideline and applying it in their individual case.

This ICSI Health Care Guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition.

Document Development and Revision Process

The development process is based on a number of long-proven approaches and is continually being revised based on changing community standards. The ICSI staff, in consultation with the work group and a medical librarian, conduct a literature search to identify systematic reviews, randomized clinical trials, meta-analysis, other guidelines, regulatory statements and other pertinent literature. This literature is evaluated based on the GRADE methodology by work group members. When needed, an outside methodologist is consulted.

The work group uses this information to develop or revise clinical flows and algorithms, write recommendations, and identify gaps in the literature. The work group gives consideration to the importance of many issues as they develop the guideline. These considerations include the systems of care in our community and how resources vary, the balance between benefits and harms of interventions, patient and community values, the autonomy of clinicians and patients and more. All decisions made by the work group are done using a consensus process.

ICSI's medical group members and sponsors review each guideline as part of the revision process. They provide comment on the scientific content, recommendations, implementation strategies and barriers to implementation. This feedback is used by and responded to by the work group as part of their revision work. Final review and approval of the guideline is done by ICSI's Committee on Evidence-Based Practice. This committee is made up of practicing clinicians and nurses, drawn from ICSI member medical groups.

Implementation Recommendations and Measures

These are provided to assist medical groups and others to implement the recommendations in the guidelines. Where possible, implementation strategies are included that have been formally evaluated and tested. Measures are included that may be used for quality improvement as well as for outcome reporting. When available, regulatory or publicly reported measures are included.

Document Revision Cycle

Scientific documents are revised every 12-24 months as indicated by changes in clinical practice and literature. Each ICSI staff monitors major peer-reviewed journals every month for the guidelines for which they are responsible. Work group members are also asked to provide any pertinent literature through check-ins with the work group midcycle and annually to determine if there have been changes in the evidence significant enough to warrant document revision earlier than scheduled. This process complements the exhaustive literature search that is done on the subject prior to development of the first version of a guideline.

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