Guideline for the Diagnosis and Management of Chronic Childhood Asthma

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Preface

Unless otherwise noted, this guideline is based on the National Institutes of Health (NIH) National Asthma Education and Prevention Program's (NAEPP) Expert Panel Report 3 (EPR-3) and updated in accordance with the NAEPP's 2020 Focused Updates to the Asthma Management Guidelines[1,13]. Childhood asthma is one of the most common chronic diseases of childhood. Approximately 5 million children in the United States have asthma, based on the annual National Health Interview Survey (NHIS)[2]. Investigators from the Arkansas Children's Center, Arkansas Children's Hospital, and University of Arkansas for Medical Sciences Department of Pediatrics have previously found the prevalence is higher when more robust interviews of parents/caregivers of Arkansas children are performed by local school nurses compared to the NHIS methods. In both rural and urban schools in Arkansas, a prevalence of 25%, or 1 of every 4 children has been documented and published[3,4].

Excluding prematurity, congenital anomalies, trauma, and homicide, after 1 year of age asthma is one of the leading natural causes of death in children[5]. According to the Arkansas Department of Health, 2-3 Arkansans (all ages) die each month (annualized average) from acute asthma. In the United States (U.S.), the annual direct costs of asthma including all ages is approximately $37.2 billion in 2007 U.S. dollars[6].

Failure to initiate treatment when the diagnosis is considered in young children increases the risks for morbidity and mortality in patients with chronic asthma.

Definitions

- Asthma is a chronic obstructive lung disease
    - Characterized by airways inflammation
    - Airways obstruction that is at least partially reversible

    - Increased airways responsiveness to a variety of stimuli
- Terms used in asthma management
    - **Severity** is the intrinsic intensity of the disease process, most easily and directly measured in a patient currently receiving long-term control treatment.
    - **Control** is the degree to which the manifestations of asthma are minimized and the goals of therapy are met including
        - Symptoms
        - Functional impairment
        - Adverse events
    - **Responsiveness** is the ease with which control is achieved by treatment.

Goals of Asthma Management

- Prevent symptoms
- Reduce/eliminate the use of short-acting $beta_2$ agonist ($\leq$2 days/week)
- Maintain normal or near normal pulmonary function
- Meet the patients'/families' treatment expectations
- Prevent or reduce the need for unscheduled visits for acute asthma
- Prevent progressive loss of lung function
- Optimize the therapeutic ratio of risk vs. benefit from pharmacotherapy

Risk Factors for the Development of Asthma

- Eczema, atopy, or a family history of asthma among first degree relatives are the strongest risk factors for the development of asthma. Eighty percent (80%) of children with asthma are atopic.
- Prematurity
- Tobacco smoke exposure
- Poverty
- Race
- Obesity

Common Triggers of Acute Asthma Symptoms/Exacerbations

- Viral respiratory infections
- Exertion
- Allergen exposure
- Environmental tobacco smoke
- Volatile organic compounds
- Poor air quality

- Carbon monoxide
- Particulate air pollution from internal combustion engines and industry
- High ozone

Diagnosis and Management of Asthma

Determine

- Episodic symptoms of airflow obstruction present, usually manifested by cough or wheezing episodes
- Airflow obstruction is present, and at least partially reversible
- Alternative diagnoses excluded, especially if poor response to initial therapy

Conduct

- Detailed history
- Physical exam
    - Often normal between exacerbations
    - Signs of atopy in allergic patients
- Spirometry, to demonstrate the severity of airway obstruction and reversibility, in patients ≥5 years-of- age, which assists in the assessment of asthma severity and control
    - There may be no more than a 50% correlation of history + physical exam with objective measures of airway function[7,8].
    - Objective measurement of lung function is required at the time of considering a diagnosis of asthma and in assessment of asthma control.

Laboratory Evaluation

Laboratory evaluation typically includes:

- Pulmonary function testing (PFT)
    - To detect obstruction and evaluate reversibility
    - Classifying chronic asthma severity and to aid in assessing asthma control
    - Recommended for all adults and children ≥5 years-of-age
    - Can be conducted in office setting
    - Spirometry performed in accordance with the American Thoracic Society standards[9]
    - Normal PFTs do not exclude a diagnosis of asthma
- Chest X-ray
    - Does NOT establish the diagnosis
    - May rule out other causes of wheezing/alternate diagnoses
    - NOT needed for most exacerbations

    - May be indicated when aspirated foreign body or pneumothorax is suspected at the time of considering an asthma diagnosis or for acute loss of control in a person known to have asthma
- Allergy testing to identify controllable/avoidable aeroallergens
- Final test may be a trial of medications based on severity assessment and the step-wise recommendations.

Differential Diagnoses

The following may be alternate diagnoses or co-morbid conditions which may lead to poor asthma control in patients with known asthma if not addressed and treated:

- Allergic rhinitis/sinusitis
- Foreign body
- Laryngomalacia
- Tracheomalacia
- Bronchomalacia
- Subglottic/tracheal stenosis
- Bronchial stenosis
- Vascular ring and congenital anomalies of the airways
- Cardiomyopathy, including congestive heart failure
- Laryngeal web
- Mediastinal masses
- Functional syndromes
- Vocal cord dysfunction
- Psychogenic cough
- Hyperventilation syndrome
- Hypersensitivity pneumonitis
- Cystic fibrosis
- Bronchiolitis obliterans
- Aspiration syndromes
- Symptomatic gastro-esophageal reflux
- Obesity
- Obstructive sleep apnea
- Allergic bronchopulmonary aspergillosis
- Alpha-1 antitrypsin deficiency
- Primary ciliary dyskinesia
- Immunodeficiency
- Bronchiectasis

Assessing the Possibility of Asthma in Children 0-4 years-of-age

- EPR-3 includes indicators of possible asthma in young children.
- After alternate diagnoses are excluded, if a child 0-4 years-of-age exhibits any 1 of the following characteristics the child has an 80% chance of having asthma at school age[10,11]:
    - Recurring episodes of cough lasting more than 10 days, or
    - Recurring episodes of wheezing, or
    - Recurrent "chest colds" lasting >10 days, or
    - Recurring pneumonia, bronchiolitis, or bronchitis, in otherwise healthy children and one of the following:
        - Parental history of asthma
        - Physician-diagnosed eczema
        - Allergic sensitization to ≥1 aeroallergen or 2 of the following:
            - Wheezing unrelated to upper respiratory infections
            - Blood eosinophil counts >4%
            - Allergic sensitization to milk, eggs, or peanuts
    - To assess asthma at this age, a child who meets the above criteria, and who has 1 or more of the following characteristics should be strongly considered for initiation of asthma management
        - Four (4) or more episodes of wheezing within a 12-month period, or
        - Episodes of persistent cough >4 weeks of duration, or
        - Acute wheeze episodes <6 weeks apart, or
        - Cough/wheeze episodes [which respond to short-acting $beta_2$ agonists (SABA)] requiring treatments with SABA >2 times/week, or
        - Requirement of oral corticosteroid bursts >2 times within 6 months
- Table 1 is provided to assist in classifying asthma in children 0-4 years-of-age[1]
    - If alternate diagnoses have been considered and excluded, controller medications should be started as causes of airways inflammation are identified and avoidance strategies initiated.
    - Any characteristic shown in Table 1 places the patient in the corresponding highest severity category.
- In Figure 1, the recommended step-wise approach initiation of controllers to initiate therapy is listed based on the assessment of severity.
    - For step 1 in the 0-4 year age group, for patients who have had 3+ wheezing episodes associated with viral upper respiratory infections in their lifetime (2+ in the last year) AND are asymptomatic between episodes, THEN a 7-10 day course of BID inhaled corticosteroids should be considered at the beginning of a respiratory illness. Higher ICS doses are suggested based on the latest available data in the literature[13-16].
    - Please note: For 4 year olds, the Step 3 and Step 4 guidelines, including Single Maintenance and Reliever Therapy (SMART) (see section on SMART below), for the 5-11 year age group may be used
    - It is not recommended to add PRN ICS to patients already on daily ICS

    - If LTRA is indicated, montelukast* is the recommended option for the 0-4 year age group
        - *Clinicians should be aware of a boxed warning ("black box warning") regarding the risk of serious neuropsychiatric effects, including but not limited to depression and suicidal behavior, found to be associated with montelukast[17]. If significant neuropsychiatric changes occur while on montelukast, the clinician should strongly consider stopping the montelukast as part of their assessment/management.
- After controller medications and avoidance strategies have been started, asthma control must be assessed at subsequent visits with the initial assessment 2-6 weeks after starting control treatments.
- As noted in Table 2, in children 0-4 years of age, a reduction or elimination of the frequency of exacerbations is the key indicator of control at this age as almost all acute episodes are triggered by viral respiratory infections in preschool children.
    - Between such viral respiratory infections the child is usually asymptomatic.
    - If the criteria in Table 1 are met, recurrent wheezing episodes with viral respiratory illnesses may indicate a young child has asthma.
    - Recurring episodes of wheezing after 2 years of age, unless there is an innate abnormality of the airway, is abnormal.
    - Asthma is the most common condition which predisposes an increased risk for recurring wheeze episodes.
    - Alternate diagnoses must be considered and excluded when asthma is considered at any age, or if patients with suspected asthma do not respond to currently recommended treatments.
    - Since >80% of children and >50% of adults who have asthma are atopic, identifying and avoiding aeroallergen triggers are imperative.
    - For highly allergic patients who do not respond to medical management of allergic rhinitis and associated allergy-related chronic asthma, referral to an allergist for consideration of allergy immunotherapy is recommended at any age.

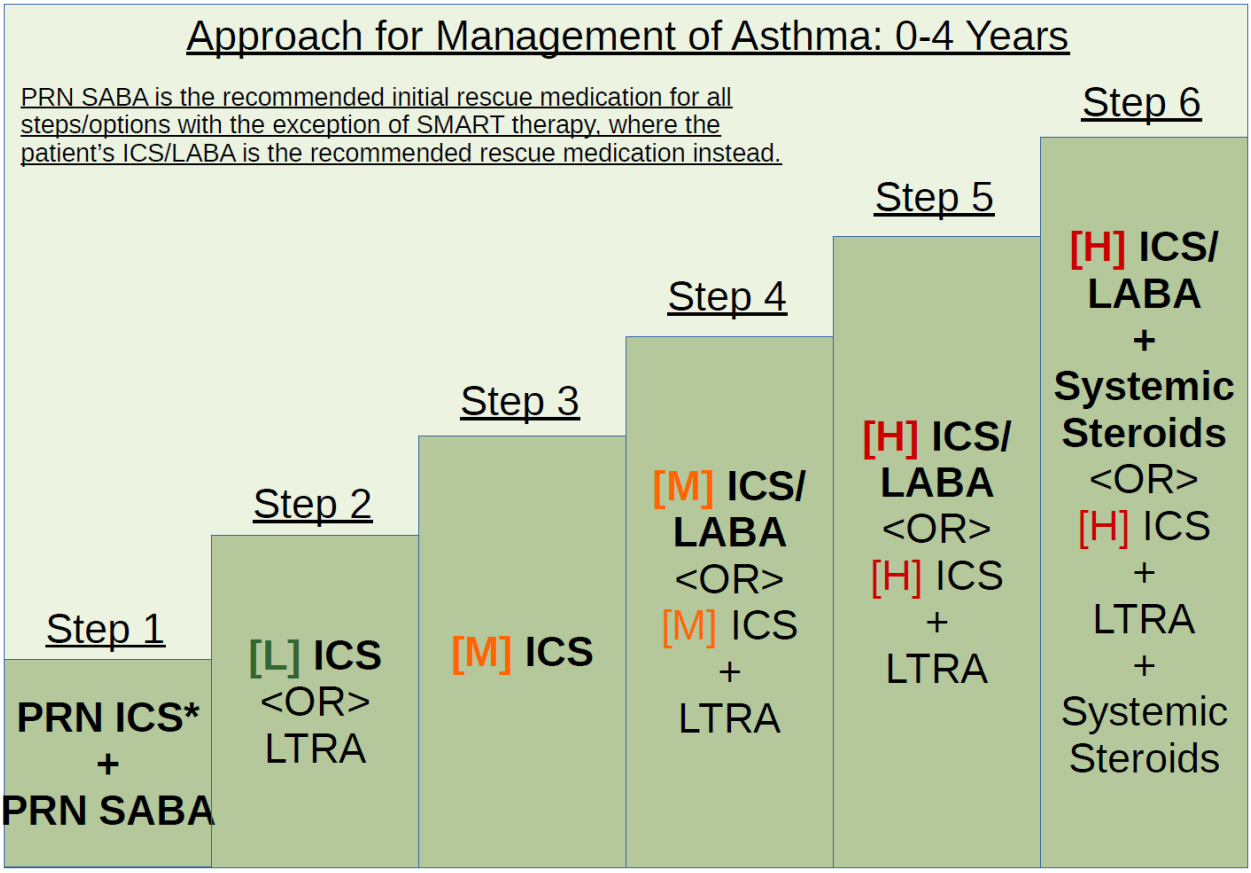
Table 1. Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long- term control medication. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Initial Classification of Asthma Severity (0-4 Years of Age) (NOT on regular controller medication)			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment	Symptoms	<= 2 days/week	>2 days/week, NOT daily	Daily	Through the day
	Nighttime awakenings	0	1-2x per month	3-4x/month	>1x/week
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week, NOT daily	Daily	Multiple times per day
	Interference with normal activity	None	Minor	Some	Extreme
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	>= 2 in 6 months *OR* >=4 wheezing episodes/year for >1 day + persistent asthma risk factors		
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3 + Consider short systemic corticosteroid course	

Figure 1. Step-wise Approach for Managing Asthma in Children 0-4 Years of Age

Note: Medications unavailable in the U.S. (e.g. Nedocromil) or very rarely used (e.g. theophylline) at the time of publication of this manuscript have been omitted for brevity.

ICS=inhaled corticosteroids; SABA=short-acting $beta_2$ agonist; LABA=long-acting $beta_2$ agonist; LTRA=leukotriene receptor antagonist; [L]=low dose; [M]=medium dose; [H]=high dose; PRN=as-needed



*See note on PRN ICS in the 0-4 year age group above.

Table 2. Assessing Asthma Control and Adjusting Therapy in Children 0-4 Years of Age. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Asthma Control Assessment/Adjustment of Therapy (0-4 Years of Age) (ON regular controller medication)		
		Well-controlled	Not well-controlled	Very poorly controlled
Impairment	Symptoms	<=2 days/week, NOT more than 1x/day	>2 days/week *OR* >1x/day	Through the day
	Nighttime awakenings	<=1x/month	>1x/month	>1x/week
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week	Multiple times per day
	Interference with normal activity	None	Some	Extreme
Risk	Exacerbations requiring oral systemic corticosteroids	0-1x/year	2-3x/year	>3x/year
Recommended Step for Initiating Treatment		No change. Consider step down if well-controlled >=3 months.	Step up 1 step	Step up 1-2 steps + Consider short course of systemic corticosteroids
		Consider before step-up: -Adherence, technique, environmental factors -Trial of the preferred option in the same step if using an alternative option		

Assessing the Possibility of Asthma in Children 5-11 and 12+ years of age

- Recurrent episodes of wheezing or episodes of prolonged cough
- Nocturnal or early morning wheeze or cough
- Recurring "chest colds" lasting >10 days/episode
- Recurrent bronchiolitis, bronchitis, or pneumonia in otherwise healthy children
- Recurring episodes of chest pain, cough, shortness of breath, or dyspnea with exertion during
    - Running
    - Playing
    - Sports participation
    - Laughing
    - Crying/sobbing

- At least 80% of patients with asthma exhibit acute symptoms with exertion.
- Exertion-related symptoms in a patient with known asthma may indicate poor asthma control[12].
- Table 3 is provided to assist in classifying asthma in children 5-11 years of age.
- Table 5 is provided to assist in classifying asthma in youth 12+ years of age.
- For children 5-11 and 12+ years of age, 6 areas of questioning must be asked to accurately assess asthma severity including
    - Symptoms
    - Nocturnal awakenings
    - Frequency of short-acting $beta_2$ agonist use
    - Physical activity limitations
    - Lung function testing results
    - Frequency of exacerbations requiring unscheduled visits for acute asthma
    - A positive response to these questions places the patient in the highest category for which there is a positive answer.
- Once asthma severity is assessed, the evidence-based recommendations are found in the step-wise approach to initiating controller therapy (Figure 2 for children 5-11 years of age, Figure 3 for youth 12+ years of age).
    - If LTRA is indicated, montelukast* can be used
        - *Clinicians should be aware of a boxed warning ("black box warning") regarding the risk of serious neuropsychiatric effects, including but not limited to depression and suicidal behavior, found to be associated with montelukast[17]. If significant neuropsychiatric changes occur while on montelukast, the clinician should strongly consider stopping the montelukast as part of their assessment/management.
    - Subcutaneous immunotherapy may be considered in Steps 2-4 if there is an allergic trigger. Subcutaneous immunotherapy should not be used during an

asthma exacerbation. Sublingual immunotherapy is typically not helpful for allergic asthma.
    - PRN ICS has NOT been associated with consistent risk/benefit improvement for the 5-11 year age group and is thus NOT presently recommended for the 5-11 year age group.
    - PRN ICS IS recommended as one of the preferred Step 2 options for the 12+ year age group if the patient does not have chronically very elevated or chronically poor symptom perception. If the PRN ICS option is chosen for Step 2, then the PRN ICS should be given immediately after each administration of PRN albuterol any time PRN albuterol is given, up to every 4 hours. Higher ICS doses are suggested based on the latest available data in the literature [13,14,15,16].
    - For the 12+ year age range, Steps 3-5, adding LAMA inhaler to ICS is a non-preferred option typically considered in cases where LABA is unable to be used. Adding LAMA to ICS is inferior to adding LABA to ICS with a comparatively less favorable risk/benefit profile.
    - Inhaled LAMA is contraindicated if there is a history of urinary retention or glaucoma
    - Inhaled LAMA is for long-term maintenance therapy only
    - For steps 5-6, an age-appropriate biologic should be considered
- SMART therapy
    - SMART: Single Maintenance and Reliever Therapy
    - Basic premise: ONE inhaler is used for BOTH controller/preventative purposes AND rescue purposes, instead of the traditional approach of having a specific inhaler for controller/preventative use and a different inhaler for rescue
    - Shown to improve asthma control, quality of life, urgent medical visits, and systemic corticosteroids courses compared to standard therapy in some studies without significant difference in harms [13,18-28]. Possible decreased growth suppression risk in the 4-11 year age group [13,18-28].
    - Potential for improvement in adherence
    - Recommended for ages 4-11 years and 12+ years as the preferred option for Steps 3 and 4
    - The SMART therapy guidelines are for outpatient/home care only and do NOT apply to emergency department or inpatient care at this time
    - Step 3
        - Low-dose ICS/LABA maintenance
        - SAME ICS/LABA 1-2 puffs PRN
        - Total daily puffs (SCH AND PRN) NOT to exceed
            - Ages 4-11 years: 8 puffs/day
            - Ages 12+ years: 12 puffs/day
            - If maximum puffs/day is reached and symptoms persist, then immediate/urgent physician assessment is warranted.
    - Step 4
        - Medium-dose ICS/LABA maintenance

        - SAME ICS/LABA 1-2 puffs PRN
        - Total daily puffs (SCH AND PRN) NOT to exceed
            - Ages 4-11 years: 8 puffs/day
            - Ages 12+ years: 12 puffs/day
            - If maximum puffs/day is reached and symptoms persist, then immediate/urgent physician assessment is warranted.
    - The LABA component of the ICS/LABA MUST be formoterol, NOT salmeterol or other LABAs
        - Formoterol has faster onset of action and was the LABA used in the studies backing the use of SMART therapy[13, 18-28]
        - Brand name examples of ICS/LABA combination inhalers APPROPRIATE for SMART therapy:
            - Dulera (mometasone/formoterol)
            - Symbicort (budesonide/formoterol)
        - Brand name examples of ICS/LABA combination inhalers <u>NOT</u> appropriate for SMART therapy:
            - Advair (fluticasone/salmeterol)
            - AirDuo RespiClick (fluticasone/salmeterol)
            - Breo Ellipta (fluticasone/vilanterol)
            - Wixela Inhub (fluticasone/salmeterol)
    - Do NOT prescribe ICS/LABA with formoterol concurrently with an ICS/LABA with different LABA
    - Good SMART therapy candidates:
        - History of a severe exacerbation in the prior year
        - Already on ICS/LABA maintenance with PRN SABA and asthma poorly controlled/considering stepping-up
    - Poor SMART therapy candidates:
        - Chronically very high or poor symptom perception
        - Asthma well-controlled on ICS/LABA with salmeterol
    - SMART therapy can be initiated at home as part of the asthma action plan
- Asthma control is assessed 2-6 weeks after initiating controller therapy and at subsequent visits to the primary care or specialty provider (Table 4 for children 5-11 years of age, Table 6 for youth 12+ years of age).
- Once asthma is well-controlled for at least 3-6 months, the medical provider should determine if control can be maintained by stepping down controller therapy to the next lower step.
    - Regarding inhaled corticosteroid therapy (ICS), this reduction should be no more than 50% of the current ICS dose per step down.
    - After step down, reassessment of control is required.
    - Step down to lower doses of controller therapy is more likely to be successful if strategies to identify and avoid triggers of airways inflammation have been implemented.

- Reassessments of control are required periodically based upon
    - Initial assessment of severity
    - Response to therapy

Table 3. Classifying Asthma Severity and Initiating Treatment in Children 5-11 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long-term control medication. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Initial Classification of Asthma Severity (5-11 Years of Age) (NOT on regular controller medication)			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment	Symptoms	<= 2 days/week	>2 days/week, NOT daily	Daily	Through the day
	Nighttime awakenings	<=2x/month	3-4x/month	>1x/week, NOT nightly	Often nightly
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week, NOT daily	Daily	Multiple times per day
	Interference with normal activity	None	Minor	Some	Extreme
	FEV1 (% predicted) *OR* % personal best peak flow	>80%	>80%	60-80%	<60%
	FEV1/FVC (% predicted)	>85%	>80%	75-80%	<75%
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	>=2x/year		
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3: Medium-dose ICS	Step 3: Medium-dose ICS *OR* Step 4
				Consider short course systemic corticosteroids	

Figure 2. Step-wise Approach for Managing Asthma in Children 5-11 Years of Age

Note: Medications unavailable in the U.S. (e.g. Nedocromil) or very rarely used (e.g. theophylline) at the time of publication of this manuscript have been omitted for brevity.

ICS=inhaled corticosteroids; SABA=short-acting beta$_2$ agonist; LABA=long-acting beta$_2$ agonist; LTRA=leukotriene receptor antagonist; [L]=low dose; [M]=medium dose; [H]=high dose; PRN=as-needed

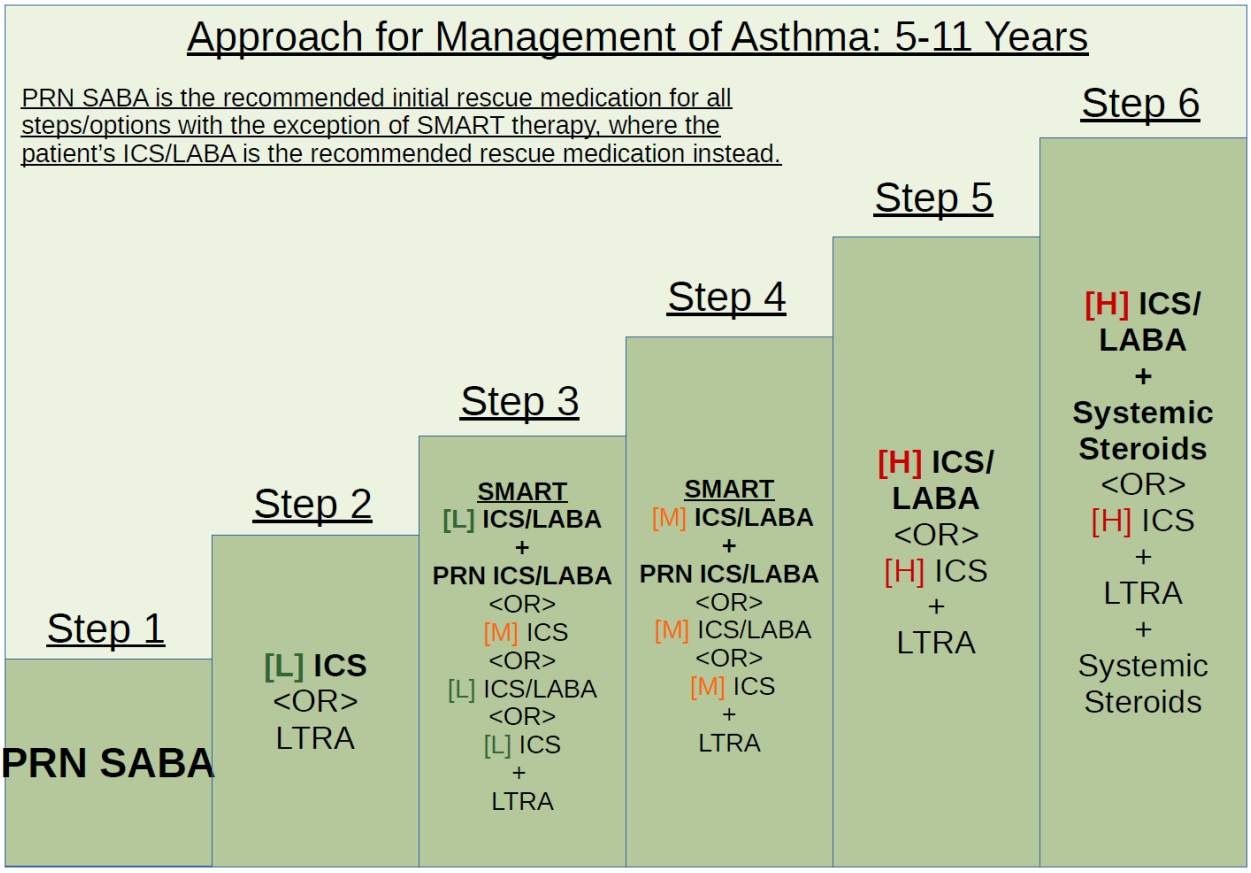


Table 4. Assessing Asthma Control and Adjusting Therapy in Children 5-11 Years of Age. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Asthma Control Assessment/Adjustment of Therapy (5-11 Years of Age) (ON regular controller medication)		
		Well-controlled	Not well-controlled	Very poorly controlled
Impairment	Symptoms	<=2 days/week, NOT more than 1x/day	>2 days/week *OR* >1x/day	Through the day
	Nighttime awakenings	<=1x/month	>=2x/month	>=2x/week
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week	Multiple times per day
	Interference with normal activity	None	Some	Extreme
	FEV1 (% predicted) *OR* % personal best peak flow	>80%	60-80%	<60%
	FEV1/FVC (% predicted)	>80%	75-80%	<75%
Risk	Exacerbations requiring oral systemic corticosteroids	0-1x/year	2-3x/year	>3x/year
Recommended Step for Initiating Treatment		No change. Consider step down if well-controlled >=3 months.	Step up at least 1 step	Step up 1-2 steps + Consider short course of systemic corticosteroids
		Consider before step-up: -Adherence, technique, environmental factors -Trial of the preferred option in the same step if using an alternative option		

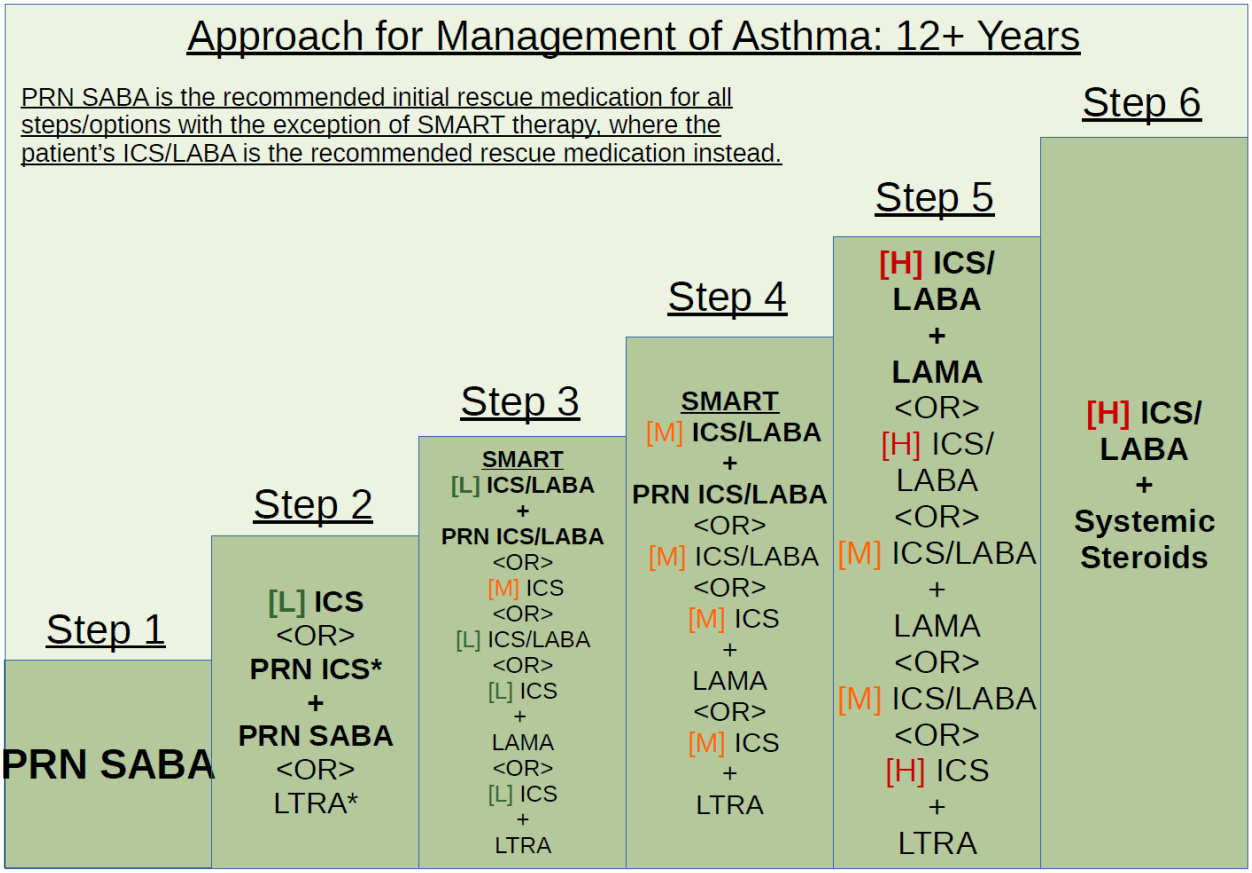
Table 5. Classifying Asthma Severity and Initiating Treatment in Youth ≥ 12 Years of Age and Adults: Assessing severity and initiating treatment for patients who are not currently taking long-term control medications. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Initial Classification of Asthma Severity (12+ Years of Age) (NOT on regular controller medication)			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment Normal FEV1/FVC: 8-19 yr: 85% 20-39 yr: 80% 40-59 yr: 75% 60-80 yr: 70%	Symptoms	<= 2 days/week	>2 days/week, NOT daily	Daily	Through the day
	Nighttime awakenings	<=2x/month	3-4x/month	>1x/week, NOT nightly	Often nightly
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week, NOT daily	Daily	Multiple times per day
	Interference with normal activity	None	Minor	Some	Extreme
	FEV1 (% predicted)	>80%	>80%	60-80%	<60%
	FEV1/FVC (% predicted)	Normal	Normal	5% less than normal	>5% less than normal
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	>=2x/year		
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3	Step 4 or 5
				Consider short course systemic corticosteroids	

Figure 3. Step-wise Approach for Managing Asthma in Youth ≥ 12 Years of Age and Adults

Note: Medications unavailable in the U.S. (e.g. Nedocromil) or very rarely used (e.g. theophylline) at the time of publication of this manuscript have been omitted for brevity.

ICS=inhaled corticosteroids; SABA=short-acting beta$_2$ agonist; LABA=long-acting beta$_2$ agonist; LTRA=leukotriene receptor antagonist; LAMA=long-acting muscarinic antagonist (inhaled); [L]=low dose; [M]=medium dose; [H]=high dose; PRN=as-needed



*See note on PRN ICS in the 12+ year age group above.

Table 6. Assessing Asthma Control and Adjusting Therapy in Youth ≥ 12 Years of Age and Adults. *A positive response places the patient in the highest category for which there is a positive answer.*

Components of Severity		Asthma Control Assessment/Adjustment of Therapy (12+ Years of Age) (ON regular controller medication)		
		Well-controlled	Not well-controlled	Very poorly controlled
Impairment	Symptoms	<=2 days/week	>2 days/week	Through the day
	Nighttime awakenings	<=2x/month	1-3x/week	>=4x/week
	Short-acting beta2-agonist use for symptom control (not prevention of EIB)	<=2 days/week	>2 days/week	Multiple times per day
	Interference with normal activity	None	Some	Extreme
	FEV1 (% predicted) *OR* % personal best peak flow	>80%	60-80%	<60%
	Asthma Therapy Assessment Questionnaire ©	0	1-2	3-4
	Asthma Control Questionnaire ©	<=0.75	>=1.5	N/A
	Asthma Control Test™	>=20	16-19	<=15
Risk	Exacerbations requiring oral systemic corticosteroids	0-1x/year	>=2x/year	
Recommended Step for Initiating Treatment		No change. Consider step down if well-controlled >=3 months.	Step up 1 step	Step up 1-2 steps + Consider short course of systemic corticosteroids
		Consider before step-up: -Adherence, technique, environmental factors -Trial of the preferred option in the same step if using an alternative option		

Reassessing Asthma Control

- The frequency of reassessment of asthma control is related to the initial asthma severity and responsiveness to treatment.
- In general, visits will range from monthly to yearly depending on initial severity and response to treatment. At each visit, the following points of evaluation are recommended
    - Signs and symptoms
    - Pulmonary function testing
        - A bronchodilator challenge with a short-acting $beta_2$ agonist, in addition to spirometry without bronchodilator, is recommended at least yearly.
    - Quality of life/functional status
    - History of exacerbations
    - Adherence and barriers to treatment
    - Revision/review of action plan at every visit
    - Review techniques for proper use of all inhaled devices
    - Communication and patient satisfaction
- Patients with well-controlled asthma rarely need short-acting $beta_2$ agonists and rarely (<1/year) need oral steroid bursts for acute asthma.

Indications for Referral to an Asthma Specialist:

- When control is not achieved with low-medium doses of ICS, either alone or in combination with recommended adjunctive therapies
- Children <5 years of age requiring >Step 2 therapy
- Older patients requiring >Step 3 therapy
- Difficulty in achieving or maintaining control
- Age-specific bone density concerns for patients requiring treatment Steps 5-6
- Frequent oral/systemic corticosteroid bursts for acute asthma episodes unresponsive to short-acting $beta_2$ agonists

Additional Testing

- Allergy evaluation
- Pulmonary function tests to help determine severity and guide treatment to achieve control
- Broncho-provocation test for patients with suspected asthma with normal office pulmonary function testing
- Evaluation to rule out alternate diagnoses or additional management of comorbid diagnoses

Risk Factors Associated with Increased Likelihood of Persistent, Poorly-Controlled Asthma:

- Albuterol use >2 times/week
- Nocturnal awakening >2 times/month
- Albuterol refills >2 times/year
- Oral steroid use >2 times/year
- Acute symptoms requiring health care visits >2 times/year

Table 7. Estimated Comparative Daily Dosages for Inhaled Corticosteroids in Children

Drug	Low Daily Dose			Medium Daily Dose			High Daily Dose		
	0-4 Years	5-11 Years	12+ Years	0-4 Years	5-11 Years	12+ Years	0-4 Years	5-11 Years	12+ Years
Beclomethasone dipropionate HFA (40 or 80mcg/puff)*	N/A	80-160 mcg	80–240 mcg	N/A	200–320 mcg	280–480 mcg	N/A	>320 mcg	>480 mcg
Budesonide DPI (90 or 180 mcg/puff)*	N/A	180–360 mcg	180–540 mcg	N/A	450–720 mcg	630–1,170 mcg	N/A	>800 mcg	>1,200 mcg
Budesonide Nebulization (0.25mg, 0.5mg, or 1mg respules)	0.5 mg	0.5 mg	N/A	1.0 mg	1.0 mg	N/A	2.0 mg	2.0 mg	N/A
Ciclesonide HFA (80mcg or 160mcg/puff)	N/A	80 mcg	80-160 mcg	N/A	>80-160 mcg	>160-320 mcg	N/A	>160 mcg	>320 mcg
Fluticasone furoate DPI (50, 100, or 200 mcg/puff)*	N/A	50 mcg	100 mcg	N/A	50 mcg	100 mcg	N/A	N/A	200 mcg
Fluticasone propionate HFA (44,110,or 220 mcg/puff)	88-176 mcg	88–176 mcg	88–264 mcg	220-352 mcg	220–352 mcg	>264–440 mcg	>352 mcg	>352 mcg	>440 mcg
Fluticasone propionate DPI (50, 100,or 250 mcg/puff)*	N/A	100–200 mcg	100–300 mcg	N/A	250–400 mcg	350–500 mcg	N/A	>400 mcg	>500 mcg
Mometasone furoate DPI (110 or 220 mcg/puff)*	N/A	110 mcg	110-220 mcg	N/A	220-<440 mcg	330-440 mcg	N/A	>=440 mcg	>=440 mcg
Mometasone furoate HFA (50, 100, or 200 mcg/puff)	N/A	50-100 mcg	100-200 mcg	N/A	>100-200 mcg	>200-400 mcg	N/A	>200 mcg	>400 mcg
*DPI and breath-triggered inhalers are NOT appropriate for younger children who cannot consistently coordinate the proper technique for these inhalers.									

This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.

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