

Evaluation and management of asthma

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Disclosures

- I do not have any relevant financial or commercial interests to disclose.
- I do not intend to discuss an unapproved or investigative use of a commercial product/device in my presentation.

Learning objectives

- Evaluation and management of exercise-induced bronchospasm
- Evaluation and management of vocal cord dysfunction
- Evaluation and management of asthma
 - Classifying intermittent versus persistent asthma based on severity and control in children, adolescents and adults
 - SMART (single maintenance and reliever therapy)

Clinical Case #1

- 16 year old athletic female with diagnosis of asthma
- Started ICS in 6th grade
- Presents to clinic for an initial visit and reports symptoms of shortness of breath and chest tightness with physical activity
- Reports pretreating with albuterol prior to physical activity and reports minimal improvement of symptoms

Clinical Case #2

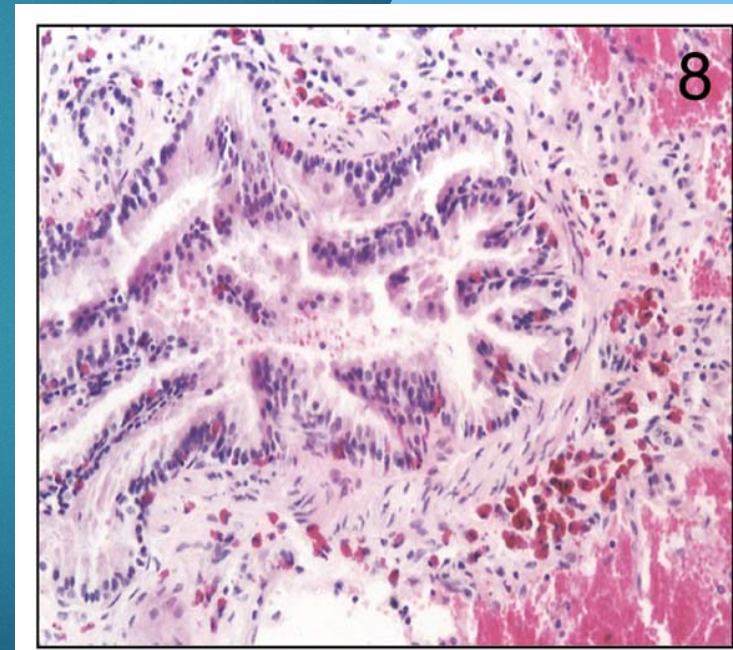
- 5 yo female with diagnosis of mild persistent asthma
- Started on ICS a few months ago with marginal improvement in symptoms
- Parents report use of nebulized albuterol and albuterol HFA multiple times per week for productive cough and wheeze

Clinical Case #3

- 12 yo male with diagnosis of severe persistent asthma
- Dx with asthma at 18 months by Pulmonology
- Typically requires 3-4 courses of systemic steroids yearly and reports prior hospitalization
- On high-dose ICS/LABA; has been on ICS since 18 months old

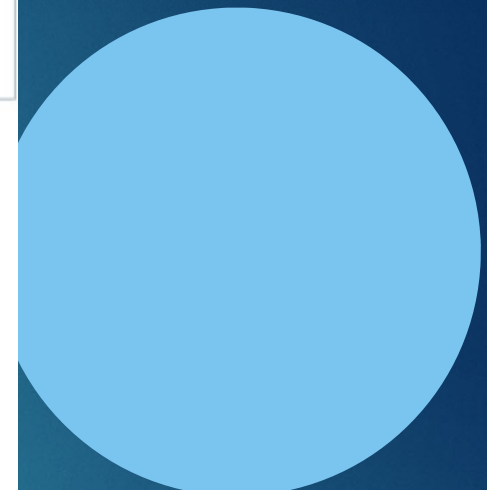
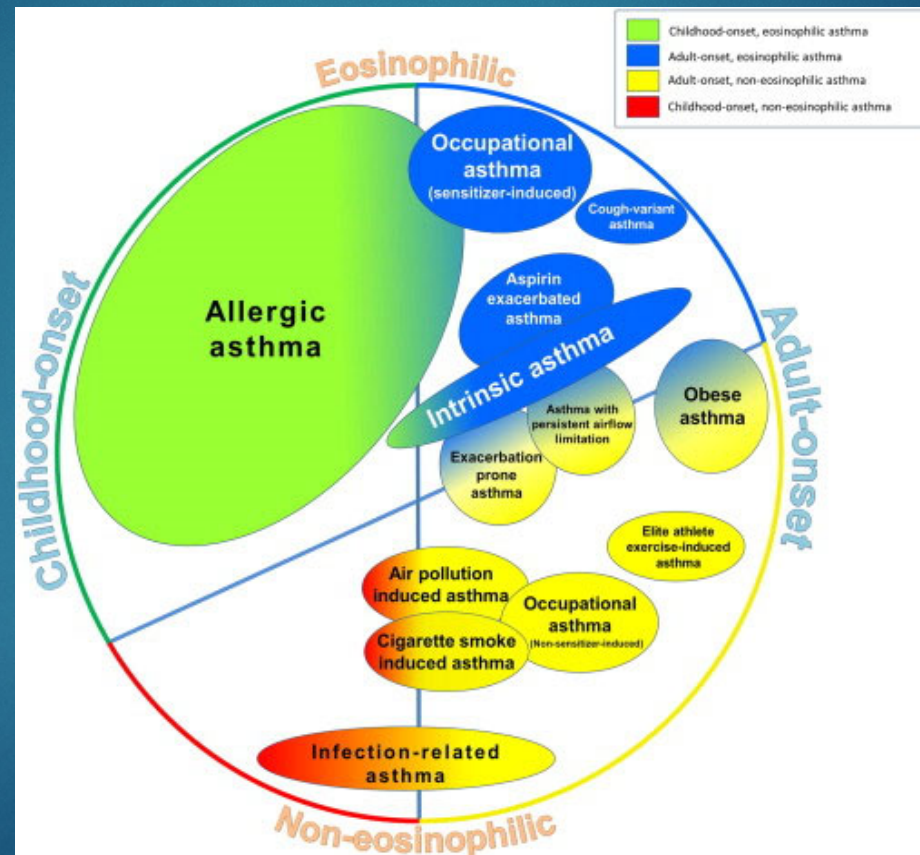
Asthma is characterized by airway inflammation and smooth muscle hyper-reactivity

Sputum, Spasm, & Swelling



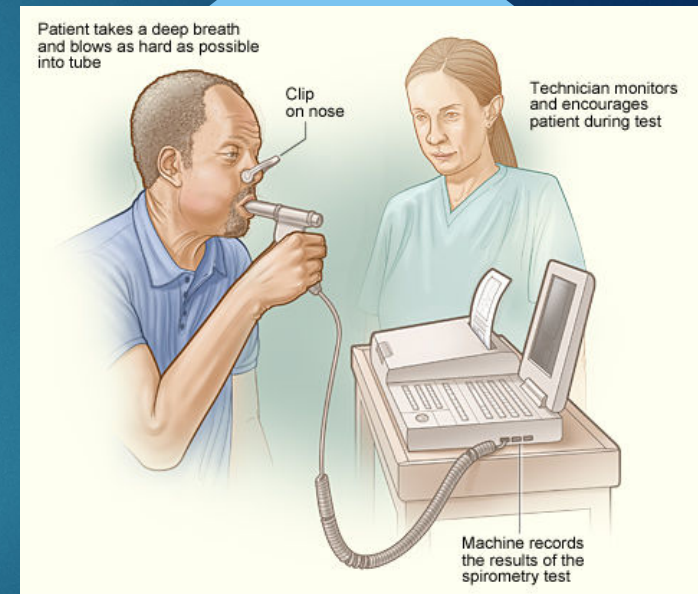
Slide courtesy: Dr. Michelle Hernandez

Types of Asthma

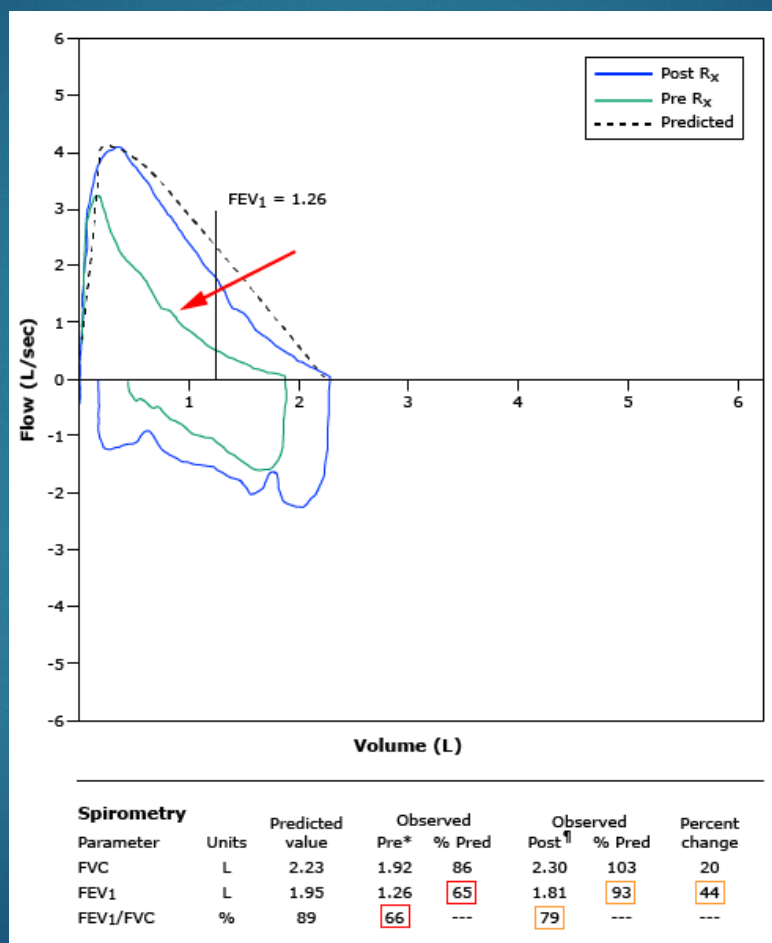


Asthma Diagnosis: Objective Testing

- Pulmonary Function Test
 - Obstructive pattern noted in patients with asthma
 - Albuterol challenge pre- and post-PFT to determine reversibility
- Bronchoprovocation
 - Methacholine challenge
 - Exercise challenge
 - Eucapnic voluntary hyperpnea (for athletes): breathing cold dry air x 6 min
- CXR

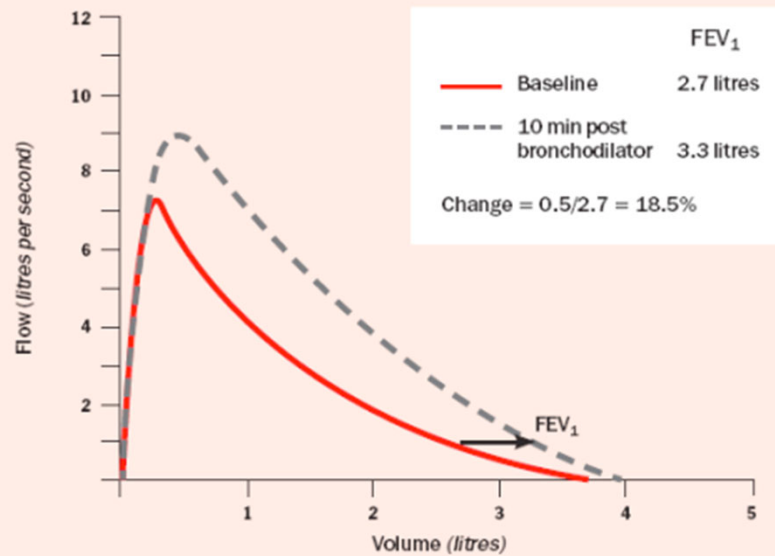


Obstructive defect on spirometry in a child



Positive bronchodilator challenge in asthma

Figure 1: Example of flow-volume loop tracing. The solid trace shows FEV₁ before bronchodilator administration while the dotted trace shows FEV₁ 10 minutes later (FEV₁ increases by 18.5% from 2.7 litres to 3.3 litres). Note the slightly abnormal baseline tracing, which is concave



***Increase FEV₁ or FVC (ATS) 12% with increase 200 ml*

***Increase FEF_{25-75%} of 20-25%*

Exercise-induced bronchoconstriction (EIB)

- Acute onset of bronchoconstriction occurring during or immediately after exercise
- Approximately 5-20% of the general population
- Up to 90% of patients with symptomatic asthma have some degree of EIB
 - The magnitude of EIB is most strongly correlated with the underlying degree of airway hyperresponsiveness and the presence of eosinophilic airway inflammation
- Many patients with mild intermittent asthma do not experience clinically significant bronchoconstriction even with strenuous exercise

Who and why?

- High endurance sports: swimming, cycling, triathlon and rowing
- Low endurance sports: gymnastics and sailing
- Minute ventilation (TV x RR) increases with exercise
 - Large volume of relatively cool, dry air inhaled during vigorous activity
 - Inspired gas is more fully humidified and closer to body temperature
- Probably airway dehydration as a result of increased ventilation → increased osmolarity of airway lining fluid → inflammation
- Numerous bronchoconstrictive & inflammatory mediators are secreted
 - Leukotrienes, histamine, interleukin-8, activation of Th2 lymphocytes

Clinical characteristics

- Initial bronchodilation during the first 6-8 minutes of exercise followed by bronchoconstriction
 - Begins 3 minutes after exercise, peaks within 10-15 minutes and resolves by 60 minutes
- Typical symptoms: shortness of breath, chest tightness and cough
- Allergic Asthma patients:
 - more likely when exercise includes exposure to the relevant allergen

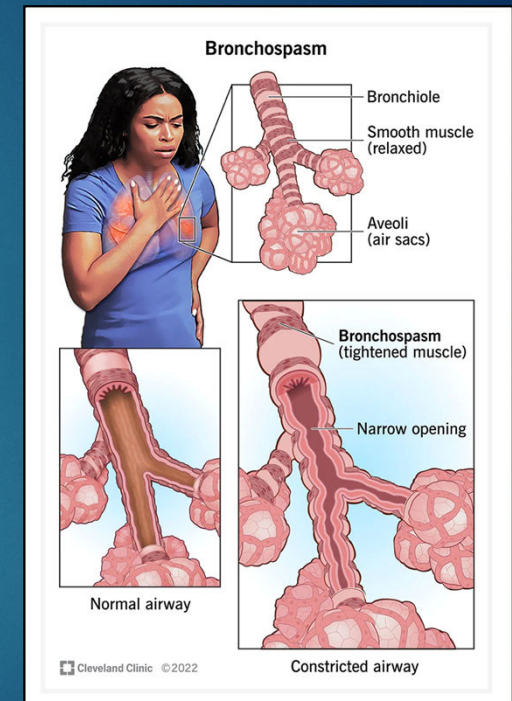


Image from: <https://my.clevelandclinic.org/health/diseases/22620-bronchospasm>

Differential Diagnosis

- Central airway obstruction
 - Ex: Double aortic arch and subglottic cysts
- Vocal cord dysfunction
- Exercise-induced laryngomalacia
- Exercise-induced anaphylaxis
- Exercise-associated reflux
- CV disease (arrhythmias)

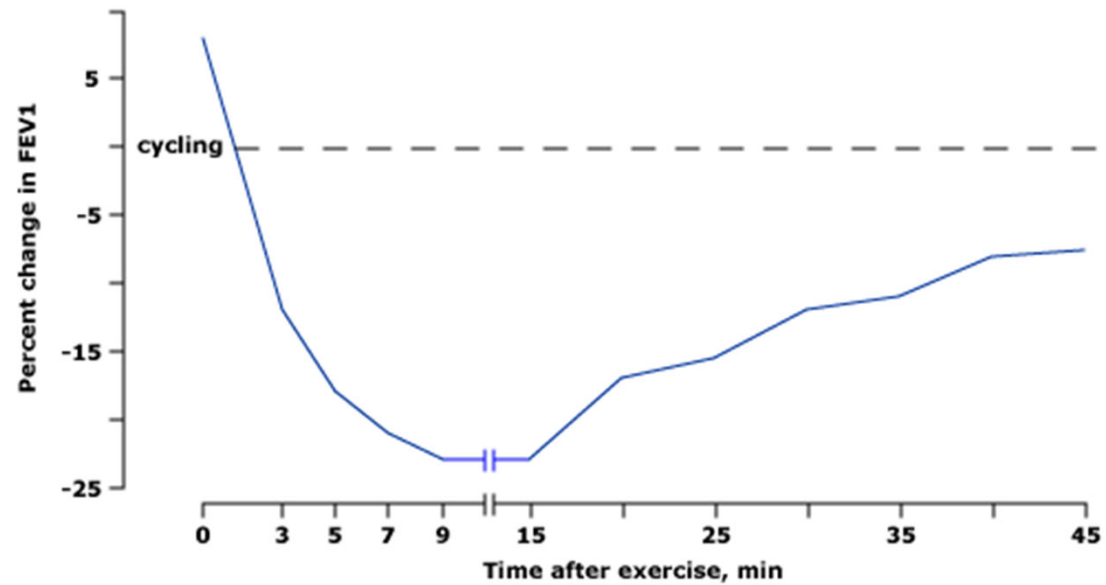
Diagnosis

- Combination of compatible clinical symptoms (eg, exercise-related symptoms of dyspnea, cough or wheeze)
- AND demonstration of reversible airflow limitation in response to exercise or a surrogate challenge
- Don't need exercise testing in patients with well-documented asthma and typical asthma symptoms following exercise
 - exception: if have limited improvement with albuterol

Exercise Challenge

- An exercise challenge test is the most direct and preferred way to establish a diagnosis of EIB
- Usually involves 6 -10 minutes of treadmill exercise
 - Goal: Raise the heart rate to 80-90% of the predicted maximum
 - Maximum Predicted Heart Rate: $220 - \text{age}$
- What is a positive test
 - Drop in $FEV_1 \geq 10\%$

Exercise-induced bronchoconstriction



The time course of exercise-induced bronchoconstriction in an asthmatic patient in whom the FEV1 fell by more than 20 percent after cycling. FEV1: forced expiratory volume in one second.

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EIB Management

- ❑ DO NOT avoid exercise
- ❑ Nonpharmacologic measures
 - ❑ Reduce the magnitude of minute ventilation ($TV \times RR$)
 - ❑ Improving a patient's CV fitness reduces the minute ventilation required for a given level of exercise
 - ❑ Increase the temperature and humidity of the inspired air
 - ❑ breathe through a loosely fitting scarf or mask when exercising in cold, dry conditions
- ❑ Allergic asthma
- ❑ Avoiding air pollution

Pharmacologic measures

□ Prevention

- 2 puffs of albuterol 15-20 minutes prior to exercise
- Improved control of underlying asthma
 - ICS ± LABA
- Leukotriene Receptor Antagonists

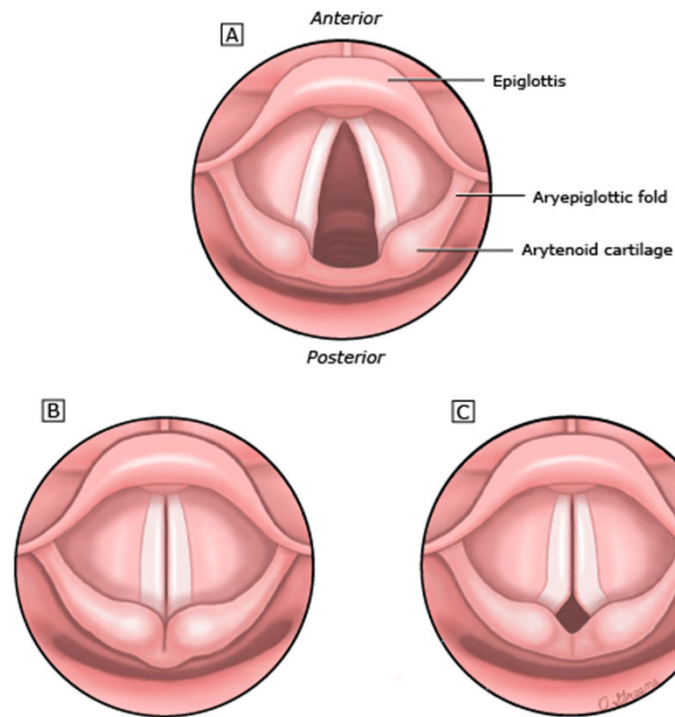
□ Acute Treatment

- Albuterol 2-4 puffs

Vocal cord dysfunction

- Inspiratory stridor accompanied by respiratory distress
- Symptoms: throat and upper chest tightness, throat clearing, dizziness, anxiousness, a choking sensation, sensation of not being able to breath, noisy breathing or stridor when breathing in, dysphonia and cough
- Onset of symptoms may be spontaneous or associated with triggers such as exercise, irritant exposure or anxiety
- Albuterol has minimal to no beneficial effect

Vocal cord movement



(A) Normal vocal cord abduction at midinspiration. The anterior tracheal rings are visible beyond the vocal cords. (B) Paradoxical adduction of the vocal cords at midinspiration, as seen in most cases of VCD. (C) Partial adduction of the vocal cords with a posterior opening or "chinking", as seen during inspiration in a small percentage of VCD cases.

Hoyte FC. Vocal cord dysfunction. In: *Conditions mimicking asthma*, Choo EM (Ed), Elsevier, Philadelphia 2013.

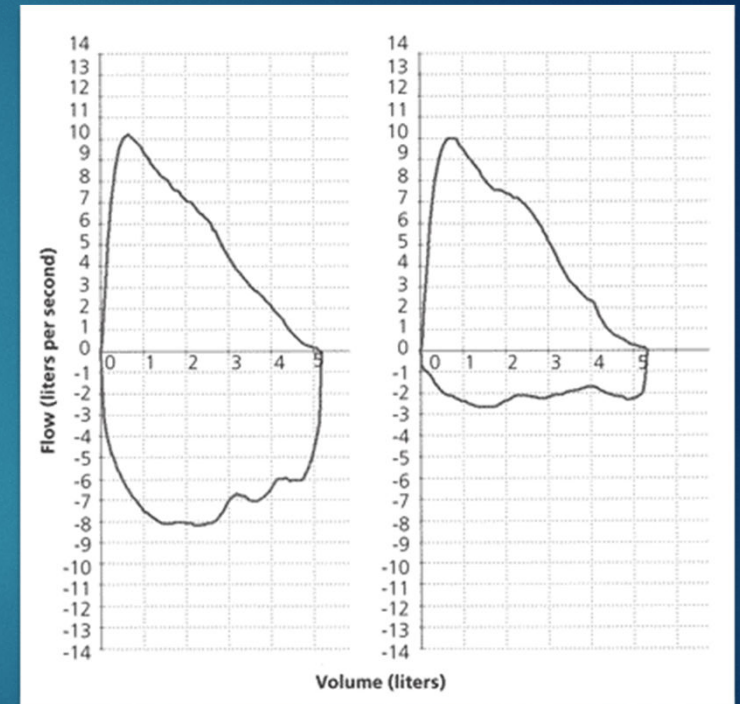
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What exacerbates VCD

- Asthma
- Exercise
- Irritants
 - Smoking
 - Air pollution
 - Perfumes and odors
- Upper respiratory infection
- Gastroesophageal reflux
- Psychosocial disorders and stress

VCD diagnosis

- Pulmonary function test
 - Flattening of the inspiratory loop
- Exercise testing
- Laryngoscopy can be performed immediately after exertion, when symptomatic



VCD management

- Acute episode:
 - Reassurance and supportive care until the episode spontaneously resolves
 - Asking patients to pant can sometimes abort an episode
 - Use of continuous positive airway pressure (CPAP) exercise
- Prevention:
 - Behavioral speech/voice therapy –help the patient regain laryngeal control
 - Vocal hygiene

VCD breathing exercises

□ Paused breathing

- Sit in a position that allows your neck & shoulders to relax but keep your back straight.
- Breathe in gently through the nose.
- Stick your tongue out of your mouth, past the teeth & lower lip, in preparation to exhale. This forward stretch of the tongue helps to open the airway at the vocal cords. This may be difficult to do with a severe spasm but will be easier the more you repeat this exercise.
- With the tongue out, exhale only through the mouth in slow, paused or spaced breaths. The timing should be like saying Ha, Ha, Ha, Ha, very slowly. Don't use your voice, just breathe out
- Repeat 10 times and practice 3 times a day so you will know how to do it well when VCD occurs.

VCD breathing exercises

□ Belly breathing

- Sit in a position that allows your neck and shoulder to relax but keep your back straight.
- Place your hand on your belly. Breathe in gently through the nose with your belly pushing your hand outward from your body.
- As you start to exhale, place the tip of your tongue where your upper teeth meet the roof of your mouth. This will allow you to make a hissing or “S” sound as you exhale. This creates a back pressure to help keep the airway open.
- Slowly exhale allowing the hand & belly to move inward to a resting position and make the hissing or “S” sound as you push the air between your tongue & teeth.

Clinical Case #1

- 16 year old athletic female with diagnosis of asthma
- Symptoms: shortness of breath (difficulty getting air in)
- Allergy testing: positive to ragweed, dust mite
- Spirometry: no evidence of obstruction but with flattening of the inspiratory loop
- Therapy: started breathing exercises/speech therapy with improvement in symptoms

Clinical Case #2

- 5 yo female with diagnosis of mild persistent asthma
 - Started on ICS a few months ago with marginal improvement in symptoms
 - Parents report use of nebulized albuterol and albuterol HFA multiple times per week for productive cough
- Prior to onset of cough was diagnosed with rhinoenterovirus and previously did not have respiratory symptoms
- Deny parental history of asthma, personal history of allergic rhinitis, eczema or food allergy
- She was treated with a 21 day course of Augmentin for presumed chronic sinusitis and symptoms resolved

Clinical Case #3

- 12 yo male with diagnosis of severe persistent asthma
 - Dx with asthma at 18 months by Pulmonology
 - Typically requires 3-4 courses of systemic steroids yearly
- Family has 2 inside dogs
- On high-dose ICS/LABA; has been on ICS since 18 months old
- Spirometry showed moderate-to-severe obstruction with improvement after bronchodilator

What's next?

- Check adherence and evaluate technique
 - Call pharmacy to confirm patient has filled prescriptions
 - Do they have a spacer?
- If adherence and technique are good, then step-up asthma therapy
 - Consider Spirivia 1.25 mcg 2 puffs daily
 - Consider montelukast 5 mg daily
 - *Discuss black box warning*
- Follow-up in 4-6 weeks to assess control
- If well-controlled, proceed with allergy testing
- If not well-controlled at follow-up visit, then obtain CBC with differential (evaluate eosinophilia), total IgE level and comprehensive environmental panel to determine eligibility for biologic
 - *Bridge to SCIT*
- Once asthma is well controlled, allergen immunotherapy will be started

Asthma assessment

- Good asthma control criteria
 - Symptoms of asthma requiring quick-reliever medication ≤ 2 days per week
 - Night-time awakenings no more than two nights per month
 - Lung function (PEF or FEV1) within the normal range (or within 20 percent of the patient's personal best value)
 - No more than one exacerbation in the past year requiring urgent care and/or oral glucocorticoids
 - Lung function

Asthma control

Components of Control		Classification of Asthma Control (Children 0–4 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	1x/month	>1x/month	>1x/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
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year	2–3/year	>3/year
	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; ICU, intensive care unit

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			
	<ul style="list-style-type: none"> FEV₁ or peak flow FEV₁/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)	
	Reduction in lung growth	Consider severity and interval since last exacerbation		
	Treatment-related adverse effects	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; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Asthma control

Components of Control		Classification of Asthma Control (≥12 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	≤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 requiring oral systemic corticosteroids	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.		
Recommended Action for Treatment (see figure 4–5 for treatment steps)		<ul style="list-style-type: none"> • Maintain current step. • Regular followups every 1–6 months to maintain control. • Consider step down if well controlled for at least 3 months. 	<ul style="list-style-type: none"> • Step up 1 step and Reevaluate in 2–6 weeks. • For side effects, consider alternative treatment options. 	<ul style="list-style-type: none"> • Consider short course of oral systemic corticosteroids. • Step up 1–2 steps, and Reevaluate in 2 weeks. • For side effects, consider alternative treatment options.

*ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.
Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit

Asthma control NOT achieved

- **Address the impairment domain**
 - Patient adherence and technique
 - Coexisting conditions (sinusitis), new or increased exposure to allergens or irritants, psychosocial problems
 - Alternative diagnosis: vocal cord dysfunction
- **Address the risk domain**
 - adherence, environmental exposures and exacerbations

Asthma severity

Assessing severity and initiating therapy in children who are not currently taking long-term control medication

Components of Severity		Classification of Asthma Severity (0–4 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	0	1–2x/month	3–4x/month	>1x/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
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year	≥2 exacerbations in 6 months requiring oral systemic corticosteroids, or ≥4 wheezing episodes/1 year lasting >1 day AND risk factors for persistent asthma ← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time. → Exacerbations of any severity may occur in patients in any severity category.		
Recommended Step for Initiating Therapy		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids	
(See figure 4–1a for treatment steps.)		In 2–6 weeks, depending on severity, evaluate level of asthma control that is achieved. If no clear benefit is observed in 4–6 weeks, consider adjusting therapy or alternative diagnoses.			

Key: EIB, exercise-induced bronchospasm

Asthma severity

Assessing severity and initiating therapy in children who are not currently taking long-term control medication

Components of Severity		Classification of Asthma Severity (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	<ul style="list-style-type: none"> • Normal FEV₁ between exacerbations • FEV₁ >80% predicted • FEV₁/FVC >85% 	<ul style="list-style-type: none"> • FEV₁ = >80% predicted • FEV₁/FVC >80% 	<ul style="list-style-type: none"> • FEV₁ = 60–80% predicted • FEV₁/FVC = 75–80% 	<ul style="list-style-type: none"> • FEV₁ <60% predicted • FEV₁/FVC <75%
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 .			
Recommended Step for Initiating Therapy (See figure 4–1b for treatment steps.)		Step 1	Step 2	Step 3, medium-dose ICS option	Step 3, medium-dose ICS option, or step 4 and consider short course of oral systemic corticosteroids
		In 2–6 weeks, evaluate level of asthma control that is achieved, and adjust therapy accordingly.			

Key: EIB, exercise-induced bronchospasm; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; ICS, inhaled corticosteroids

Asthma severity

— Assessing severity and initiating treatment for patients who are not currently taking long-term control medications

Components of Severity		Classification of Asthma Severity ≥12 years of age			
		Intermittent	Persistent		
			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 daily, and not more than 1x on any day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	<ul style="list-style-type: none"> • Normal FEV₁ between exacerbations • FEV₁ >80% predicted • FEV₁/FVC normal 	<ul style="list-style-type: none"> • FEV₁ >80% predicted • FEV₁/FVC normal 	<ul style="list-style-type: none"> • FEV₁ >60% but <80% predicted • FEV₁/FVC reduced 5% 	<ul style="list-style-type: none"> • FEV₁ <60% predicted • FEV₁/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 .			
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3	Step 4 or 5
(See figure 4–5 for treatment steps.)		and consider short course of oral systemic corticosteroids In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			

Key: FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Long-term control therapy in children 0-4 years

- ≥ 4 episodes of wheezing in the past year that lasted > 1 day and affected sleep
 - AND who have either one of the following:
 - parental history of asthma, physician's diagnosis of atopic dermatitis or evidence of sensitization to aeroallergens
 - OR (2) two of the following:
 - evidence of sensitization to foods, ≥ 4 percent peripheral blood eosinophilia or wheezing apart from colds
- To reduce impairment in those who consistently require symptomatic treatment > 2 days per week for a period of > 4 weeks
- To reduce risk in those with 2 exacerbations requiring systemic corticosteroids within 6 months
- During periods, or seasons, of previously documented risk for a child

<https://www.ncbi.nlm.nih.gov/books/NBK7229/>

Which asthma therapy should be started first?

- ICS preferred therapy
- FDA approved therapies
 - ICS budesonide nebulizer solution (children 1-8 yo)
 - ICS fluticasone DPI (children > 4 yo)
 - Salmeterol and combination product (salmeterol + fluticasone) DPI (children > 4 yo)
 - Montelukast 4 mg chewable tablet (children 2-6 yo) and 4 mg granules (children ≥ 1 yo)
- Reassess in 3 months and if improved consider step down therapy
- ***Administration of an ICS early in the course of the disease will not alter the underlying progression of the disease*

When to refer to an Allergist?

- Difficulties achieving or maintaining control of asthma
- A child 0-4 years old requires step 3 care or higher (step 4 care or higher for children 5-11 years old) to achieve or maintain control
- Patient has an exacerbation requiring hospitalization
- Immunotherapy is considered; additional tests are indicated to determine role of allergy
- Referral may be considered if child 0-4 years old requires step 2 care or a child 5-11 years old requires step 3 care

Estimated comparative daily dosages for ICS

Drug	Low Daily Dose		Medium Daily Dose		High Daily Dose	
	Child 0–4	Child 5–11	Child 0–4	Child 5–11	Child 0–4	Child 5–11
Beclomethasone HFA 40 or 80 mcg/puff	NA	80–160 mcg	NA	>160–320 mcg	NA	>320 mcg
Budesonide DPI 90, 180, or 200 mcg/inhalation	NA	180–400 mcg	NA	>400–800 mcg	NA	>800 mcg
Budesonide inhaled Inhalation suspension for nebulization (child dose)	0.25–0.5 mg	0.5 mg	>0.5–1.0 mg	1.0 mg	>1.0 mg	2.0 mg
Flunisolide 250 mcg/puff	NA	500–750 mcg	NA	1,000–1,250 mcg	NA	>1,250 mcg
Flunisolide HFA 80 mcg/puff	NA	160 mcg	NA	320 mcg	NA	≥640 mcg
Fluticasone HFA/MDI: 44, 110, or 220 mcg/puff	176 mcg	88–176 mcg	>176–352 mcg	>176–352 mcg	>352 mcg	>352 mcg
DPI: 50, 100, or 250 mcg/inhalation	NA	100–200 mcg	NA	>200–400 mcg	NA	>400 mcg
Mometasone DPI 200 mcg/inhalation	NA	NA	NA	NA	NA	NA
Triamcinolone acetonide 75 mcg/puff	NA	300–600 mcg	NA	>600–900 mcg	NA	>900 mcg

Key: HFA, hydrofluoroalkane; NA, not approved and no data available for this age group

Intermittent asthma (children 0-11 yo)

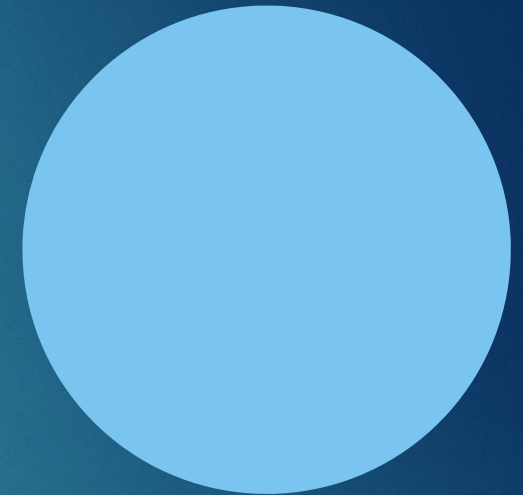
- If mild symptoms, recommend use of SABA (every 4-6 hours for 24 hours) as needed
 - If therapy needs to be repeated more than once every 6 weeks, consider step-up
- If a viral respiratory infection causes a moderate-to-severe exacerbation, a short course of oral systemic corticosteroids should be considered
- If a viral respiratory infection causes a severe exacerbation, consider starting oral steroids at the start of illness
- **close monitoring required— if ≥ 2 exacerbations within 6 months with symptoms in between, the child would likely benefit from daily controller therapy

Persistent asthma (children 0-4 yo) Step 1-2

- Children with ≥ 4 wheezing episodes in 1 year and risk factors for persistent asthma, benefit from daily long-term therapy
- Consider if there is a second exacerbation requiring OCS in 6 months or children who consistently require symptomatic treatment > 2 days a week for > 4 weeks
- Consider OCS for patients with exacerbation when long-term control therapy is started or in patients who have moderate-to-severe asthma
- Close monitoring necessary; follow-up in 4-6 weeks and if no improvement change therapy or consider alternative diagnosis
- If improvement for at least 3 months, then step down therapy

Persistent asthma (children 0-4 yo) Step 3-6

- Step 3
 - medium-dose ICS
- Step 4
 - medium-dose ICS + either LABA or montelukast
- Step 5
 - High-dose ICS AND either LABA or montelukast
- Step 6
 - High-dose ICS AND either LABA or montelukast AND oral systemic corticosteroids



Persistent asthma (children 5-11 yo) Step 1

- Daily long-term control medication
- SABA as needed to relieve symptoms
 - If needed > 2 days/week indicates need to step-up therapy
- Consider OCS for patients with exacerbation when long-term control therapy is started or in patients who have moderate-to-severe asthma
- Consider daily therapy only during specific periods of previously documented risk
- Consider treating patients with ≥ 2 exacerbations requiring OCS in the past year

Persistent asthma (children 5-11 yo) Step 2

- Daily low-dose ICS
- Alternative therapies include leukotriene receptor antagonist
 - Preferred montelukast (discuss black box warning)
 - Less likely to respond as favorably if they have lower lung function and/or higher markers of allergic airway inflammation

Persistent asthma (children 5-11 yo) Step 3-6

□ Step 3

- low-dose ICS plus some form of adjunctive therapy (LABA, LTRA) or medium-dose ICS
- Masoli et al. 2004- dose-response to fluticasone propionate plateaus between 100-200 mcg/day

□ Step 4

- medium-dose ICS + either LABA or montelukast

□ Step 5

- High-dose ICS + LABA (not preferred: + montelukast)

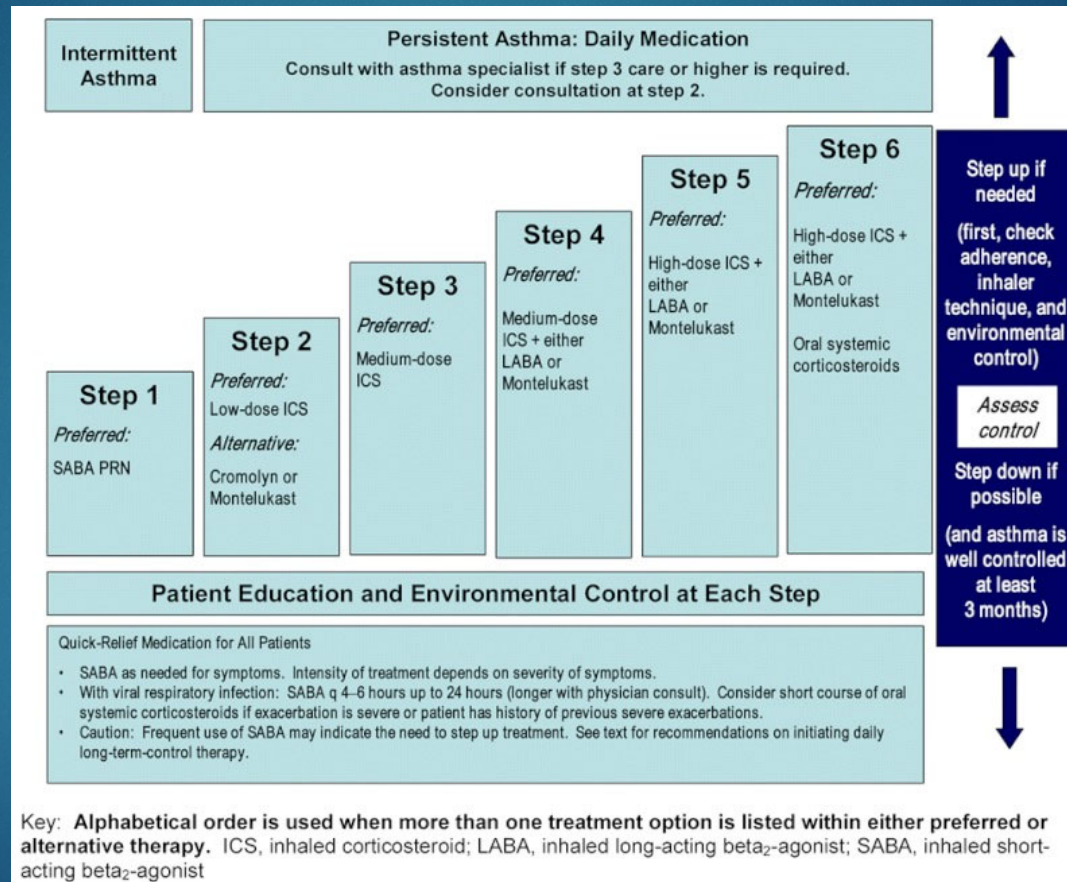
□ Step 6

- High-dose ICS + LABA + oral systemic corticosteroids (not preferred: + montelukast)
 - *Long-term OCS*

□ Use lowest dose possible, monitor for side effects, follow-up and refer to specialist

<https://www.ncbi.nlm.nih.gov/books/NBK7229/>

Asthma therapy based on severity



Intermittent asthma (≥ 12 yo) Step 1

- SABA as needed
- EIB— SABA shortly before physical activity
- If mild symptoms, use SABA as needed
 - If SABA (every 4-6 hours for 24 hours) must be repeated more than once every 6 weeks, a step up in long-term care is recommended.
- If a viral respiratory infection results in a moderate-to-severe exacerbation, consider OCS
- If a viral respiratory infection resulted in severe exacerbation, consider OCS at first sign of infection

Persistent asthma (≥ 12 yo) Step 2

- Daily low-dose ICS
- Alternative therapy: LTRA

Persistent asthma (≥ 12 yo) Step 3-6

- Step 3
 - Add LABA to a low-dose ICS OR increase to medium-dose ICS
 - Alternative therapy: add LTRA
 - Review inhaler technique and adherence prior to increasing therapy
 - Environmental factor and consider specialist referral
- Step 4
 - medium-dose ICS AND add LABA
 - Alternative therapy: add LTRA
- Step 5
 - High-dose ICS AND LABA
 - Omalizumab
- Step 6
 - Step 5 + OCS

<https://www.ncbi.nlm.nih.gov/books/NBK7222/>

Symbicort in intermittent asthma management

- Symbicort 80-4.5 mcg or Symbicort 160-4.5 mcg 1-2 puffs with spacer every 4 hours as needed
- May administer up to 2 inhalations every 20 minutes for 3 doses
- Maximum dose: 6 inhalations/exacerbation



SMART in pediatric (12-17 years) asthma management

- Maintenance therapy: 1-2 puffs twice daily or 2 puffs twice daily
- Reliever therapy: 1 additional inhalation as needed (maximum 8 inhalations/day)
- Recommend patients ≥ 12 years old for steps 3 and 4



SMART in adult asthma management

- SMART (single maintenance and reliever therapy)
 - The onset of action of formoterol is as rapid as albuterol with a longer duration of action
 - Symbicort 80-4.5 mcg 2 inhalations twice daily (maximum dose: 12 inhalations/day (including reliever therapy))
 - Same dosing as Symbicort 160-4.5 mcg
 - Maximum 12 puffs per day (controller + reliever)



<https://www.jaci-inpractice.org/action/showPdf?pii=S2213-2198%2821%2901128-4>

	Asthma Management Plan

GREEN ZONE

Child is **DOING WELL**. No cough and no wheezing. Child is able to do usual activities.

Continue daily asthma medications as previously prescribed

Exercise

2 puffs of albuterol 15-20 minutes prior to physical activity

YELLOW ZONE

Asthma is **GETTING WORSE**. Starting to cough, wheeze, or feel short of breath. Waking at night because of asthma. Can do some activities.

1st Step - Take Quick Relief medicine below. If possible, remove the child from the thing that made the asthma worse.

Albuterol 2-4 puffs every 4-6 hours as needed with spacer

OR

Symbicort 1-2 puffs every 4-6 hours as needed with spacer

RED ZONE

Asthma is **VERY BAD**. Coughing all the time. Short of breath. Trouble talking, walking or playing.

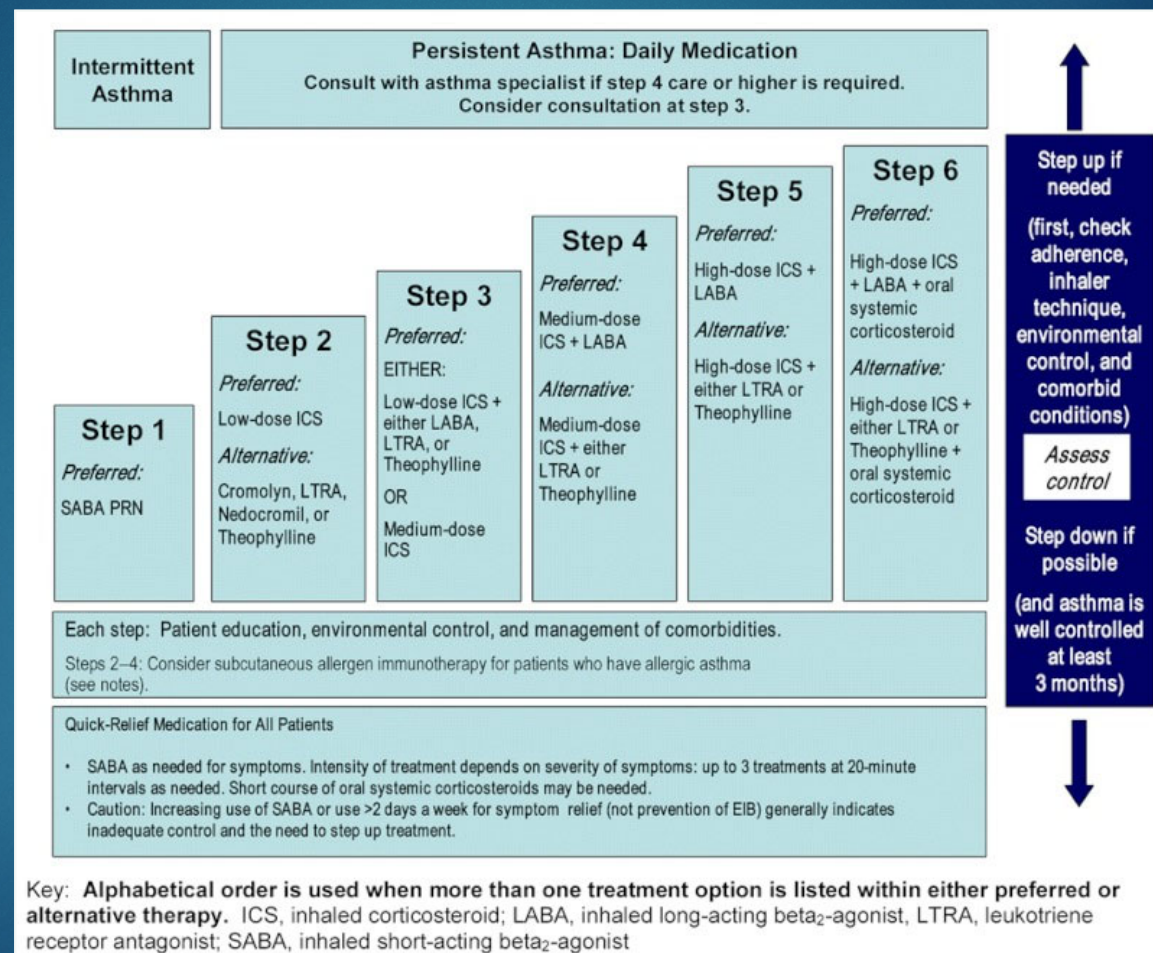
1st Step – Take Quick Relief medicine below:

Albuterol 4-6 puffs with spacer

You may repeat this every 20 minutes for a **total** of 3 doses.

2nd Step - Call 911 or go to the Emergency Department if the medications are not working.

Asthma therapy based on severity



When should a provider see a patient for follow-up and step-down asthma therapy?

- Follow-up visits: 1- to 6- month intervals, depending on the level of control
- Consider a 3-month interval if possible to step-down therapy
 - Reduced by 25-50% every 3 months to the lowest dose possible

References

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THANK YOU



QUESTIONS?