HEALTH SCIENCES

PEDIATRIC PULMONOLOGY

Breathing Easy: Navigating New Asthma Guidelines, MART Therapy, and Pediatric Device Recommendations

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We Have No Financial Disclosures

Objectives

- Describe the pathophysiology of asthma and how it is classified by severity
- Identify asthma triggers and other factors that contribute to poor respiratory health
- Discuss the National Heart, Lung, and Blood Institute (NHLBI) 2020 Updated Asthma Guidelines
- Explain what MART therapy is, why it was added to the asthma guidelines, and how to apply it to patient care
- Discuss inhaler devices and techniques required for use

Pathophysiology and Classification of Asthma

What is Asthma?

Asthma is the most common chronic disease of childhood[1]

It is characterized by:

- Inflammation of the airways
- Mucus production
- Bronchoconstriction

It manifests as episodes of recurrent:

- cough
- shortness of breath
- wheezing
- chest tightness

Who Has Asthma?

According to data published by the CDC in 2021, the prevalence of asthma in children (<18 years old) is more than 4,600,000 children in the United States, or about 6.5% of children nationally[2].

In New Mexico, the prevalence of asthma in children (based on 2020 New Mexico Department of Health Statistics) was 7.2%[3].

The prevalence is even higher in patients who identify as Black (12%) and Hispanic (9.1%)[4].

Initial Visit: Making the Diagnosis

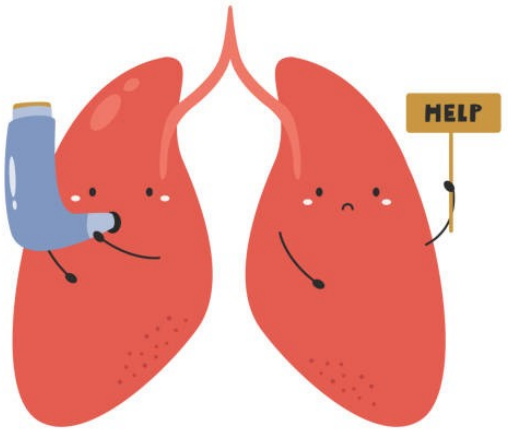
Symptoms which can lead to a diagnosis of asthma include:

- Cough – recurrent, non-productive, often worse at night, worsens with illness
- Wheezing – recurrent, with specific triggers
- Heavy Breathing – often “shortness of breath” with exercise or strong emotions
- Reduced Activity Tolerance – tiring earlier than peers, self-limiting activity
- Past Medical History – concurrent atopic dermatitis, allergic rhinitis, food allergy
- Family History – asthma in a first degree relative
- Trial of Therapy – clinical improvement within 2-3 months of starting low dose inhaled steroids or symptomatic worsening after cessation of treatment.

Asthma Classifications

The National Heart, Lung, and Blood Institute (NHLBI) categorizes asthma as[5]:

- intermittent
- mild persistent
- moderate persistent
- severe persistent



Initial Visit: Classifying Severity

Components of Severity		Intermittent			Persistent								
					Mild			Moderate			Severe		
		Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years
Impairment	Symptoms	≤2 days/week			>2 days/week but not daily			Daily			Throughout the day		
	Nighttime awakenings	0	≤2x/month		1–2x/month	3–4x/month		3–4x/month	>1x/week but not nightly		>1x/week	Often 7x/week	
	SABA* use for symptom control (not to prevent EIB*)	≤2 days/week			>2 days/week but not daily	>2 days/week but not daily and not more than once on any day		Daily			Several times per day		
	Interference with normal activity	None			Minor limitation			Some limitation			Extremely limited		
	Lung function		Normal FEV_1 between exacerbations	Normal FEV_1 between exacerbations									
	→ FEV_1* (% predicted)	Not applicable	>80%	>80%	Not applicable	>80%	>80%	Not applicable	60–80%	60–80%	Not applicable	<60%	<60%
	→ FEV_1/FVC*		>85%	Normal†		>80%	Normal†		75–80%	Reduced 5%†		<75%	Reduced >5%†
Risk	Asthma exacerbations requiring oral systemic corticosteroids‡	0–1/year			≥2 exacerb. in 6 months, or wheezing ≥4x per year lasting >1 day AND risk factors for persistent asthma	≥2/year		*Generally, more frequent and intense events indicate greater severity.*					
		*Consider severity and interval since last asthma 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 "Stepwise Approach for Managing Asthma Long Term," page 7)* *The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.*		Step 1			Step 2			Step 3	Step 3 medium-dose ICS* option	Step 3	Step 3	Step 3 medium-dose ICS* option or Step 4	Step 4 or 5
								Consider short course of oral systemic corticosteroids.					
		In 2–6 weeks, depending on severity, assess level of asthma control achieved and adjust therapy as needed. For children 0–4 years old, if no clear benefit is observed in 4–6 weeks, consider adjusting therapy or alternate diagnoses.											

From: NHLBI, 2020

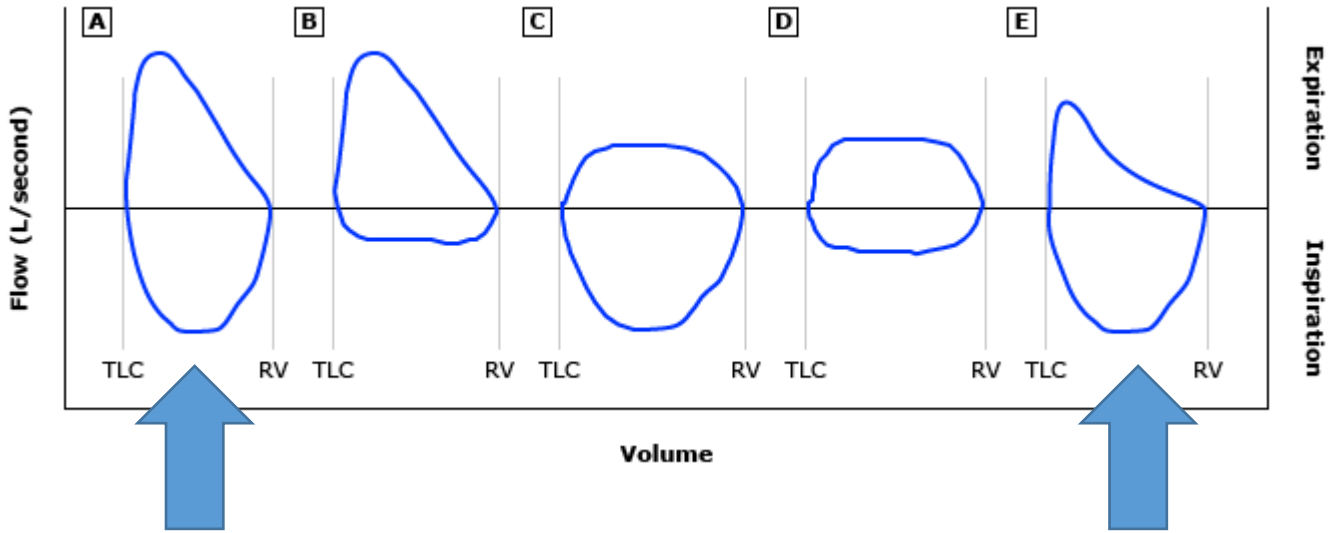
QUICK DISCLAIMER!

Pulmonary Function Testing is not required to diagnose asthma.

Typically, asthma can be diagnosed in the outpatient setting with a good history and appropriate clinical suspicion.

Remember: reliable (diagnostic) PFTs are difficult to obtain from patients less than 6-years-old.

Pulmonary Function Testing: Spirometry



Treatment for ages 0-4 Years

0–4 years of age							
		Intermittent Asthma	**Persistent Asthma: Daily Medication** Consult with asthma specialist if step 3 care or higher is required. Consider consultation at step 2.				
	Preferred Treatment†	SABA* as needed	low-dose ICS*	medium-dose ICS*	medium-dose ICS* + either LABA* or montelukast	high-dose ICS* + either LABA* or montelukast	high-dose ICS* + either LABA* or montelukast + oral corticosteroids
	Alternative Treatment†,‡		cromolyn or montelukast				
	If clear benefit is not observed in 4–6 weeks, and medication technique and adherence are satisfactory, consider adjusting therapy or alternate diagnoses.						
	Quick-Relief Medication	▪ SABA* as needed for symptoms; intensity of treatment depends on severity of symptoms. ▪ With viral respiratory symptoms: SABA every 4–6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if asthma exacerbation is severe or patient has history of severe exacerbations. ▪ Caution: Frequent use of SABA may indicate the need to step up treatment.					

From: NHLBI, 2020

Treatment for ages 5-11 Years

5–11 years of age	Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
Preferred Treatment[†]	SABA* as needed	low-dose ICS*	low-dose ICS* + either LABA,* LTRA,* or theophylline[(b)] **OR** medium-dose ICS	medium-dose ICS* + LABA*	high-dose ICS* + LABA*	high-dose ICS* + LABA* + oral corticosteroids
Alternative Treatment[†,‡]		cromolyn, LTRA,* or theophylline[§]		medium-dose ICS* + either LTRA* or theophylline[§]	high-dose ICS* + either LTRA* or theophylline[§]	high-dose ICS* + either LTRA* or theophylline[§] + oral corticosteroids
		Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. ▪ Caution: Increasing use of SABA or use >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment.					

From: NHLBI, 2020

Treatment for ages 12 Years and Older

≥12 years of age	Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
Preferred Treatment†	SABA* as needed	low-dose ICS*	low-dose ICS* + LABA* **OR** medium-dose ICS*	medium-dose ICS* + LABA*	high-dose ICS* + LABA* **AND** consider omalizumab for patients who have allergies††	high-dose ICS* + LABA* + oral corticosteroid§§ **AND** consider omalizumab for patients who have allergies††
Alternative Treatment†,‡		cromolyn, LTRA,* or theophylline§	low-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡	medium-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡		
		Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. ▪ Caution: Use of SABA >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment.					

From: NHLBI, 2020

Next Steps

Develop an individualized asthma management plan.

Educate families about proper inhaler and spacer technique.

Provide education on asthma action plan and emergency management.

Schedule follow-up visits to monitor and adjust treatment as needed.

Follow-Up Visits:

Components of Control		Well Controlled			Not Well Controlled			Very Poorly Controlled		
		Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years	Ages 0–4 years	Ages 5–11 years	Ages ≥12 years
Impairment	Symptoms	≤2 days/week	≤2 days/week but not more than once on each day	≤2 days/week	>2 days/week	>2 days/week or multiple times on ≤2 days/week	>2 days/week	Throughout the day		
	Nighttime awakenings	≤1x/month		≤2x/month	>1x/month	≥2x/month	1–3x/week	>1x/week	≥2x/week	≥4x/week
	Interference with normal activity	None			Some limitation			Extremely limited		
	SABA* use for symptom control (not to prevent EIB*)	≤2 days/week			>2 days/week			Several times per day		
	Lung function									
	→ FEV_1* (% *predicted*) or peak flow (% *personal best*)	Not applicable	>80%	>80%	Not applicable	60–80%	60–80%	Not applicable	<60%	<60%
	→ FEV_1/FVC*		>80%	Not applicable		75–80%	Not applicable		<75%	Not applicable
	Validated questionnaires†									
	→ ATAQ*	Not applicable	Not applicable	0	Not applicable	Not applicable	1–2	Not applicable	Not applicable	3–4
	→ ACQ*			≤0.75‡			≥1.5			Not applicable
	→ ACT*			≥20			16–19			≤15
Risk	Asthma exacerbations requiring oral systemic corticosteroids§	0–1/year			2–3/year	≥2/year		>3/year	≥2/year	
		Consider severity and interval since last asthma exacerbation.								
	Reduction in lung growth/Progressive loss of lung function	Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up care.		Not applicable	Evaluation requires long-term follow-up 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.*								

From: NHLBI, 2020

Adjusting the Management Plan:

Adjust dosage or switch medications based on symptom control and side effects.

Consider adding or removing controller or reliever medications.

Revise the asthma action plan based on current control and new information.

Identify and address new or ongoing triggers.

Reinforce asthma education and self-management strategies.

Adjusting the Management Plan:

Well controlled

- Maintain current therapy
- Follow up every 1-6 months
- Consider step down therapy if well controlled for at least 3 months

Not Well Controlled

- Step up 1 step
- Reevaluate in 2-6 weeks

Very Poorly Controlled

- Consider short course oral systemic corticosteroid
- Step up 1-2 steps
- Reevaluate in 2 weeks

When to Refer

Severe or Uncontrolled Asthma
- Persistent symptoms despite optimized therapy
- Frequent exacerbations requiring oral steroids or emergency care

Complex Cases
- Unusual symptom patterns or presentation not typical of asthma
- Severe respiratory distress or associated co-morbidities complicating management

Diagnostic Uncertainty
- Unclear or atypical diagnosis after standard evaluation
- Need for advanced diagnostic testing or specialized assessment

Poor response to standard treatment regiments

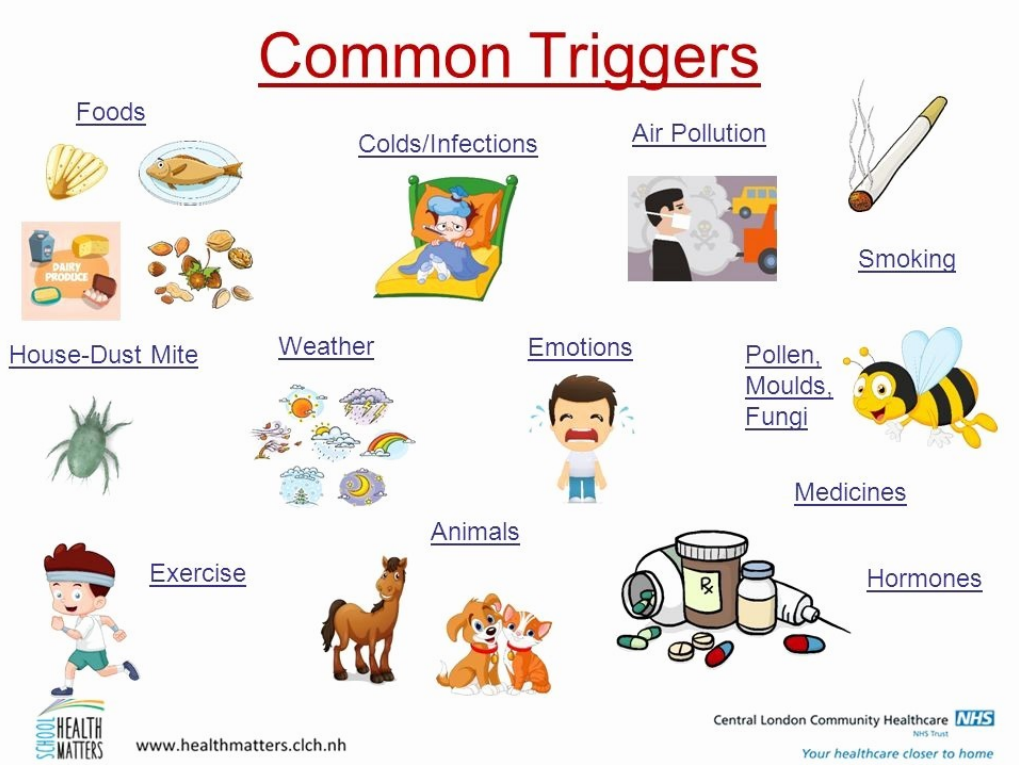
Asthma Triggers and Other Factors That Contribute to Poor Respiratory Health

Asthma Triggers

Vary from person to person

Common triggers include:

- Poor Air Quality
- Allergens
- Emotions
- Infections
- Physical Activity
- Weather



From: NMDOH, 2024

Asthma Triggers: Allergens

If there is a history of allergic rhinitis, allergic conjunctivitis, or atopic dermatitis that seems to be associated with difficulty breathing – consider testing RAST or skin prick testing.

There is some conflicting evidence on whether reducing indoor allergen exposure reduces asthma symptoms, so in practice, we focus on patients with high allergy burden or suspected trigger.

Don’t focus on allergy remediation and forget controller therapy.

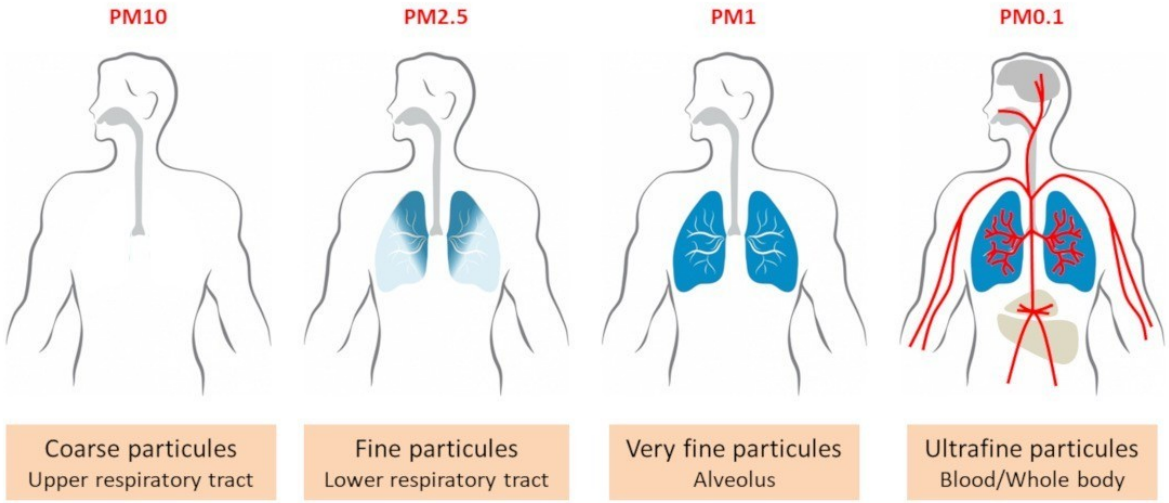
Asthma Triggers: Air Quality

Particulate Matter:

There is a significant association between air pollutants such as ozone, nitrogen oxides, aerosols, and particulate matter with asthma exacerbations [6].

Closer proximity of one's home and school to main roads is associated with greater asthma morbidity.

PM 2.5 can trigger asthma and are commonly measured/reported, but even ultrafine particles of PM <0.1 are associated with asthma exacerbations.



From: Encyclopedia of the Environment 2024

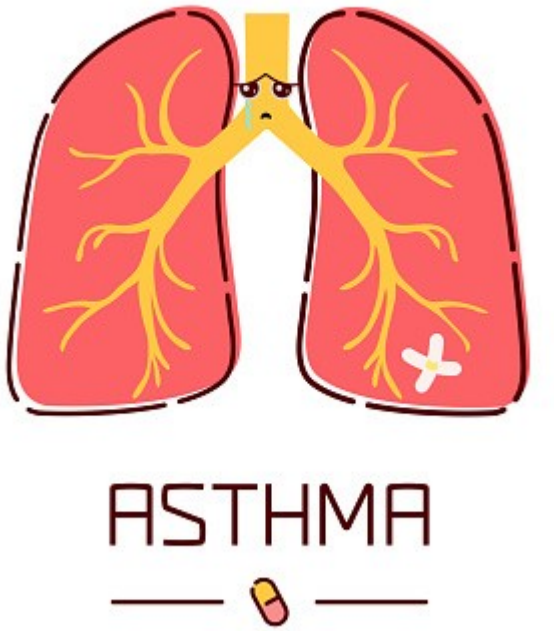
Asthma Triggers: Tobacco Smoke

Tobacco smoke, whether primary or second-hand, is associated with worse quality of life and increased asthma exacerbations.

- Increased airway reactivity
- Downregulation of host-defense genes
- Paralysis of cilia
- Increased mucus production
- Decreased antimicrobial activity
- Decreased alveolar development
- Decreased response to ICS and LTRA

NHLBI 2020 Updated Asthma Guidelines

NHLBI 2020 Updated Asthma Guidelines



In children 0 – 4 years of age with viral induced wheezing **WHO DO NOT HAVE WHEEZING IN BETWEEN ILLNESSES**

The recommendation is to start a short course of daily ICS at the first sign of respiratory illness with use of SABA for quick-relief of symptoms

Recommend using either:

Fluticasone HFA 110 mcg 2 puffs with spacer BID

or

Mometasone HFA 100 mcg 2 puffs with spacer BID

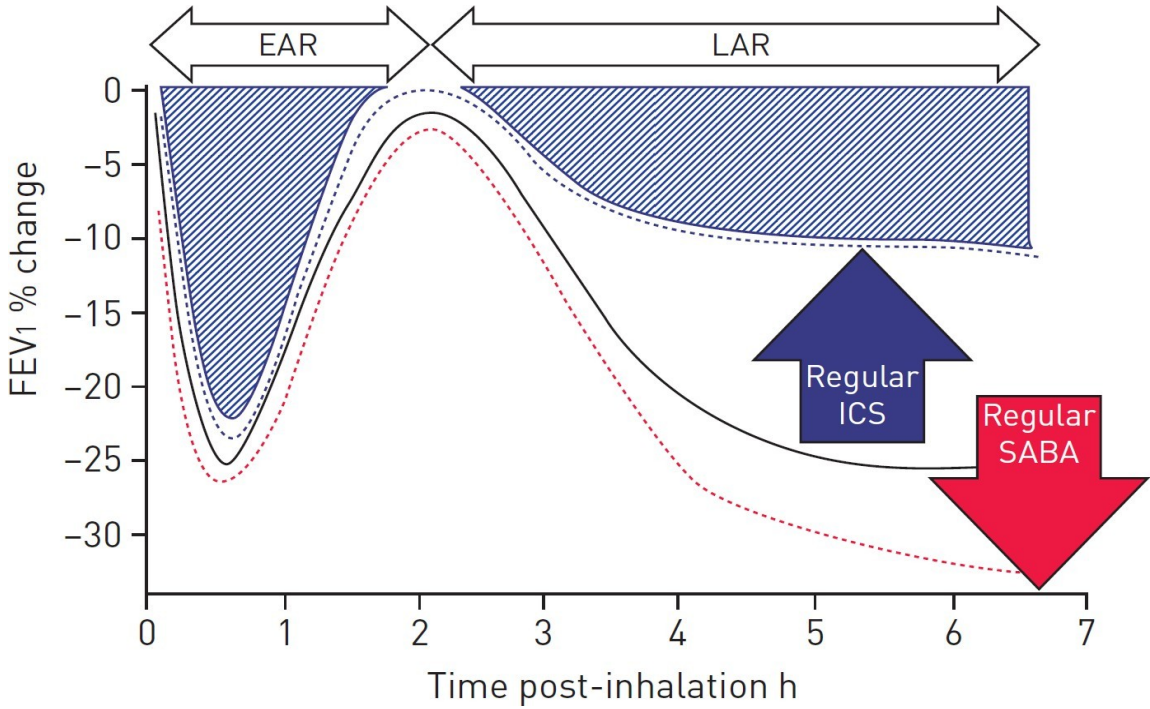
**ICS should be used for 7 days or duration of illness

The Importance of Steroids

EAR (Early Allergic Response) – 30 min to 3 hrs; mast cell degranulation; responds well to SABA.

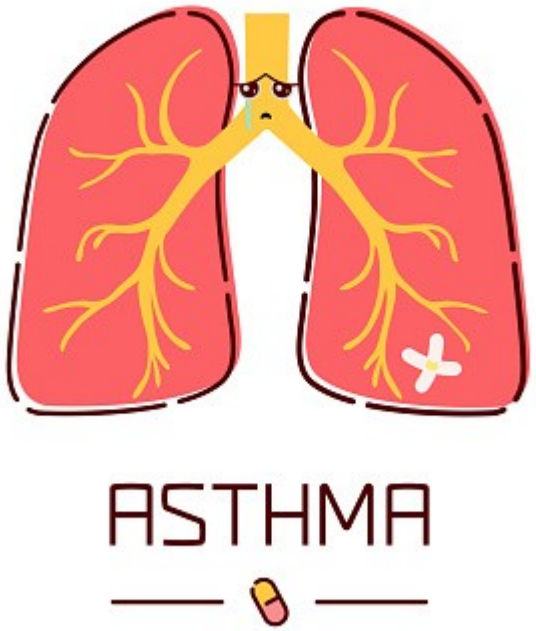
LAR (Late Allergic Response) – peaks around 4-8 hrs with usual response in 24 hrs; cellular inflammation, vascular permeability, mucus secretion; responds to steroids and LTRA.

In persistent asthma, regular ICS use reduces the severity of the LAR. Conversely, regular SABA (albuterol) use can make the LAR worse.



Eur Respir J 2015; 46: 819-831

NHLBI 2020 Updated Asthma Guidelines



In children 4 years of age and older who have moderate to severe asthma:

Recommend the use of ICS-**formoterol** in a single inhaler used as both daily controller and reliever therapy (MART Therapy)

Can use either:

budesonide-formoterol HFA

OR

mometasone-formoterol HFA

MART THERAPY

MART THERAPY

Use of an ICS-formoterol twice daily and as needed for quick relief of symptoms

- budesonide-formoterol
- mometasone-formoterol

Only been studied with use of formoterol as a long acting beta agonist[7]

- Has a rapid onset (<15 minutes)

MART THERAPY

Should use 1-2 puffs 1-2 times per day for control depending on severity of asthma symptoms

Then use 1-2 puffs as needed to address exacerbations

Dosing Guidelines

4-11: Do not exceed 8 puffs (36 mcg of formoterol)/day

12 and older: Do not exceed 12 puffs (54 mcg of formoterol)/day

Medications

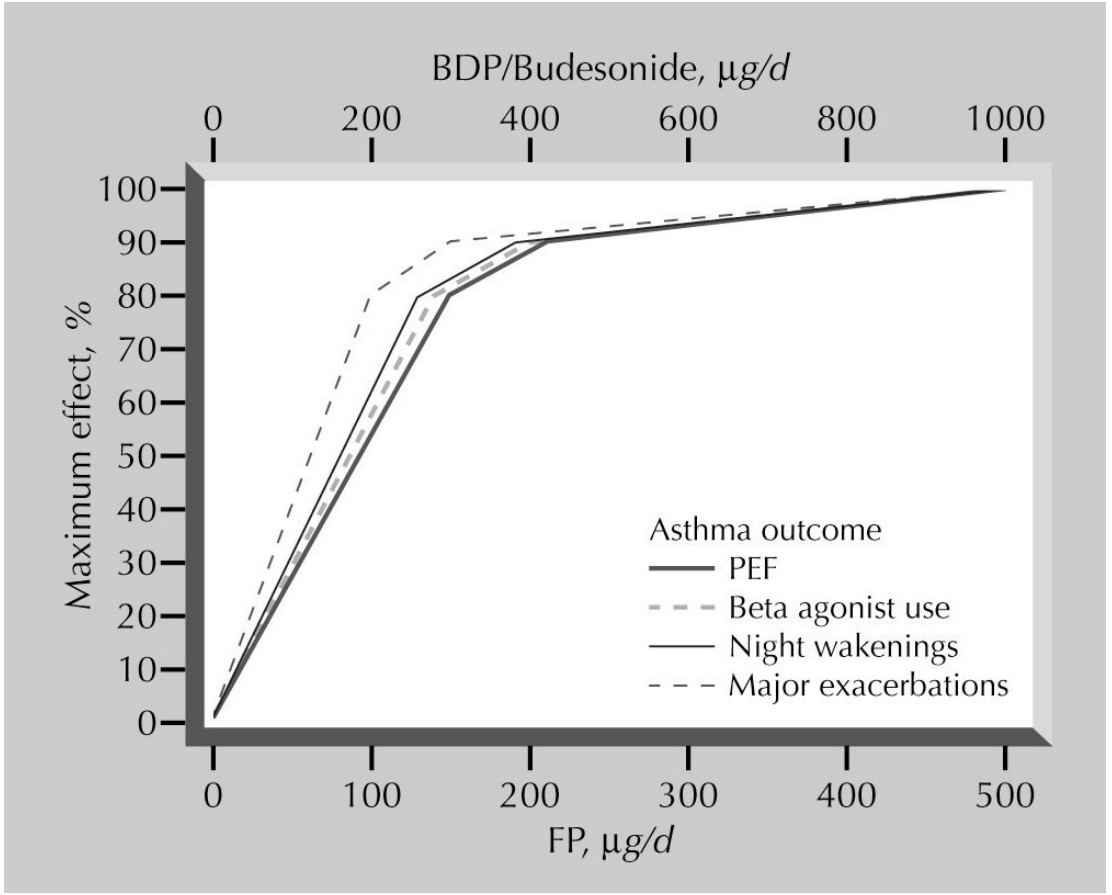
Short acting beta agonists (SABA). (Ex: albuterol, salmeterol)

Role: prevention/relief of bronchoconstriction, increased ciliary motion, “relief”

Timing: onset ~15 minutes, duration 2-6 hours

Think about: at high doses, beta-2 specificity is lost and can see side effects, overuse can downregulate response to future albuterol use.

Medications



Current Allergy and Asthma Reports. 2004. 4:144-148

Medications

Inhaled Corticosteroids/ Long Acting Beta Agonists (ICS/LABA). (Ex: budesonide/formoterol, fluticasone/salmeterol, mometasone/formoterol)

Role: “step up” from ICS use alone. Formoterol still has rather quick onset of action but lasts up to 12 hours.

Timing: Dosing typically every 12-24 hours (rescue dosing for MART therapy)

Think about: LABAs cannot be used alone as monotherapy (increased risk)

Medications

Leukotriene modifiers (Ex: montelukast)

Role: selective leukotriene receptor antagonist, prevention of bronchospasm particularly in patients with allergic phenotype, decreases inflammatory response.

Timing: daily dosing

Think about: works better in patients with concurrent allergic rhinitis or allergic conjunctivitis

PUBLIC SERVICE ANNOUNCEMENT

Montelukast…

Risk of neuropsychiatric events: reports of mood changes, agitation, aggression, depression, and suicidal thoughts or behavior.

Recommendation: Monitor for neuropsychiatric symptoms; discontinue if severe symptoms occur

Devices and Spacers

Devices

Medications delivered using a nebulizer:

albuterol, budesonide, ipratropium, levalbuterol

Hydrofluoroalkane (HFA) device:

albuterol, fluticasone, mometasone, ciclesonide, budesonide-formoterol, mometasone-formoterol, fluticasone-salmeterol

Breathe-actuated device:

albuterol, beclomethasone

Dry Powder Inhaler:

albuterol, fluticasone furoate, fluticasone propionate, fluticasone propionate/salmeterol, fluticasone furoate/vilanterol, mometasone, budesonide, tiotropium

Devices

Device technique is crucial in assuring proper delivery of medication.

For some children, breath coordination and peak inspiratory flow can be a limitation.

Device Considerations

Device	Trade Name	Brand Names	Inspiratory Flow	Recommended Age
pMDI	Albuterol Levalbuterol Mometasone Furoate Fluticasone Ciclesonide Fluticasone/Salmeterol Budesonide/Formoterol Formoterol/Mometasone Ipatropium	Ventolin, Proventil, Proair Xopenex Asmanex generic Alvesco Advair Symbicort Dulera Atrovent	Low	Spacer with mask < 5 years Spacer > 5 years
Respiclick*◊	Albuterol Fluticasone Fluticasone/Salmeterol	Proair ArmonAir Airduo	Med-Low	years
Redihaler*◊	Beclemethasone	Qvar	Med	7 years
Diskus*	Fluticasone Fluticasone/Salmeterol	Flovent Advair	Med-Low	7 years
Ellipta*◊	Fluticasone Fluticasone/Vilanterol	Arnuity Breo	Med-Low	7 years
Inhub*	Fluticasone/Salmeterol	Wixela	Med-Low	7 years
Flexhaler *	Buedesonide	Pulmicort	Med-High	7 years
Twisthaler *◊	Mometasone Furoate	Asmanex	Med-High	7 years
Respimat *	Tiotroprium	Spiriva	Low	7 years

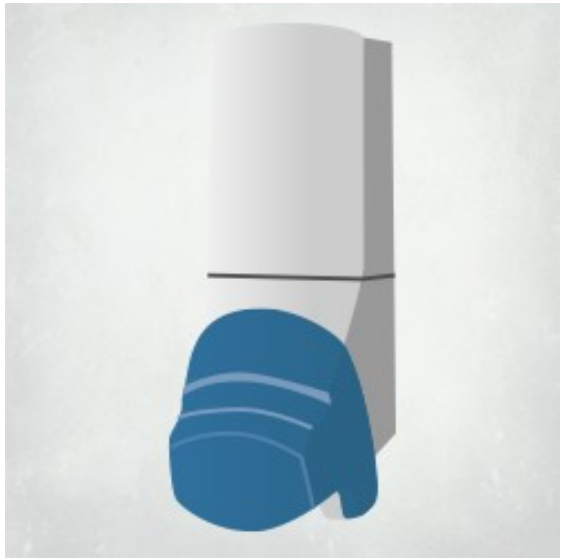
Children's Hospital of Colorado
Reach the Peak Conference 2024

Types of Devices

HFA/Metered Dose Inhaler

Dry Powder Inhaler

Breathe-actuated Device



Valved Holding Chambers ("Spacers")

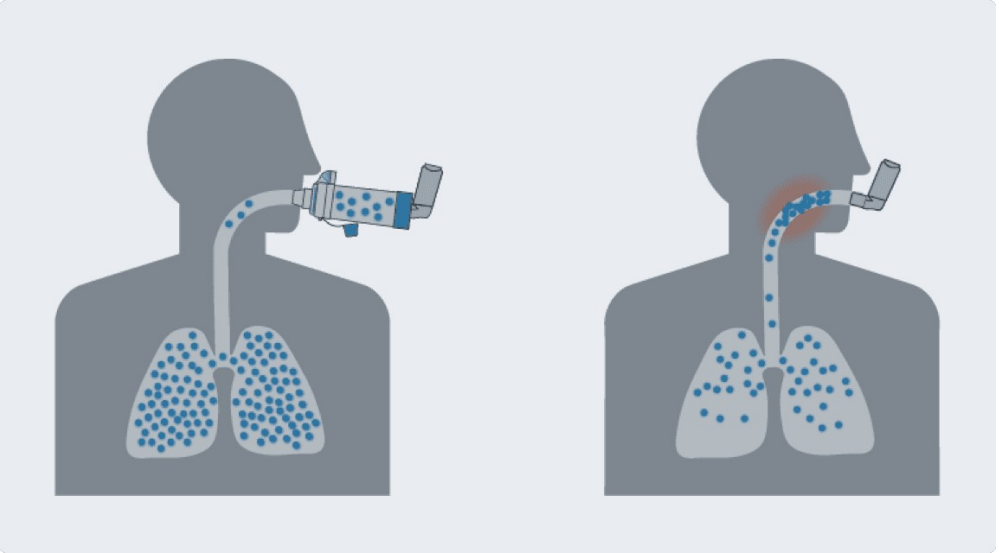
All HFA devices should be used with a valved holding chamber (VHC) to help reduce the amount of medication lost in the oropharynx and ensure proper delivery of medication to the lower airways

In young children and those who do not have appropriate breathe-coordination:

- VHC with facemask

For older children and adults with appropriate breathe-coordination:

- VHC with mouthpiece



Valved Holding Chambers (Spacers)

Top 8 Asthma Treatment Tidbits

1. Know your delivery device.
2. For standard inhalers, use a spacer.
3. Even infants can use an inhaler with a valved-holding chamber; no need to only use a nebulizer.
4. If there is suspicion of persistent asthma, ICS can be started in the PCP office (don't delay starting treatment because a referral to a subspecialist was made).
5. Asthma medications, including ICS and bronchodilators, are not addictive. They are critical for controlling inflammation and preventing symptoms.
6. There is currently no cure for asthma. It is a manageable condition, and treatment focuses on controlling symptoms and improving quality of life.
7. Consistent use of prescribed medications is necessary to maintain control and prevent future exacerbations, even if symptoms are well-managed.
8. Regular exercise can improve asthma control and overall health. Individuals with asthma should follow their treatment plan and use pre-exercise medication if prescribed.

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How to refer:

Fax a referral with current, relevant clinic notes to 505-272-5750

For any questions, reach out on the PALS Line: 575-272-2000

References

1. Zahran, H. S., Bailey, C. M., Damon, S. A., Garbe, P. L., & Breysse, P. N. (2018). *Vital signs: Asthma in children - United States, 2001–2016*. Centers for Disease Control and Prevention. http://dx.doi.org/10.15585/mmwr.mm6705e1

2. Centers for Disease Control and Prevention. (2023). *Most recent national asthma data*. Centers for Disease Control and Prevention. https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm

3. *Clearing the Air: A Quarterly New Mexico Asthma Data Report* . Health Data. (2022). https://www.nmhealth.org/data/

4. Association, A. L. (n.d.). *Asthma trends brief: Current asthma demographics*. Asthma Trends Brief: Current Asthma Demographics | American Lung Association. https://www.lung.org/research/trends-in-lung-disease/asthma-trends-brief/current-demographics#:~:text=Current%20Asthma%20Rates%20by%20Race%2FEthnicity,-Black%20individuals%20and&text=In%202022%2C%20Black%20individuals%20(10.3,other%20racial%20and%20ethnic%20groups.

5. U.S. Department of Health and Human Services. (n.d.). *2020 focused updates to the Asthma Management Guidelines*. National Heart Lung and Blood Institute. https://www.nhlbi.nih.gov/health-topics/asthma-management-guidelines-2020-updates

References

6. Zheng, X., Ding, H., Jiang, L., Chen, S., Zheng, J., Qiu, M., Zhou, Y., Chen, Q., & Guan, W. (2015). Association between Air Pollutants and asthma emergency room visits and hospital admissions in Time Series Studies: A systematic review and meta-analysis. *PLOS ONE*, *10*(9). https://doi.org/10.1371/journal.pone.0138146

7. Welsh, E. J., & Cates, C. J. (2010). Formoterol versus short-acting beta-agonists as relief medication for adults and children with asthma. *Cochrane Database of Systematic Reviews*, *2013*(5). https://doi.org/10.1002/14651858.cd008418.pub2

8. Children's Hospital Colorado. (2024). *Inhaled Devices for Pediatric Asthma*.