
بسم الله الرحمن الرحیم

ASTHMA

ginasthma.ir

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Arak.UMS

- Asthma in early childhood is a heterogeneous condition with many phenotypes that may account for different responses to treatment and varied outcomes.

The Tucson Children's Respiratory Study

- It identified four different wheezing phenotypes in childhood by the occurrence of wheezing symptoms during the first 3 years of life and again at age 6 years:
- (1) never (51%);
- (2) transient early (20%), with onset of wheezing before age 3 years with wheezing resolved by age 6 years;
- (3) persistent (14%), with onset of wheezing before age 3 years with continued wheezing at age 6 years;
- (4) late-onset (15%), with onset of wheezing between 3 and 6 years of age.
- Further analyses of the TCRS cohort revealed differences in risk factors and persistence of the disease between atopic and nonatopic persistent wheezers

- Major factors that increase the risk of persistent asthma are other allergic diseases, reduced lung function, and viral respiratory wheezing illnesses and bacterial colonization in infancy

- The severity of asthma in early childhood determines the severity of the symptoms and loss of lung function in later years

Risk Factors for Fatal Asthma

Asthma History

- **Previous severe exacerbation** (e.g., intubation or intensive care unit (ICU) admission for asthma)
- Hospitalization or ED visit for asthma in the past year
- Currently using or having recently stopped using oral corticosteroids (a marker of event severity)
- Not currently using ICS
- Use of >2 canisters per month of short-acting bronchodilators
- Difficulty perceiving asthma symptoms or severity of exacerbations

Other risk factors:

- lack of a written asthma action plan, sensitivity to Alternaria Social History
- Low socioeconomic status or inner-city residence
- Illicit drug use
- Major psychosocial problems
- Comorbidities
- Cardiac disease
- Food allergy in a patient with asthma
- Other chronic lung disease
- Chronic psychiatric disease

Modified versus Original Asthma Prevention Index (API)

Predictive Index (API) was derived from the Tucson cohort study to predict future wheezing and asthma risk in children 3 years of age with at least one previous episode of wheezing

1. A history of four or more wheezing episodes, with at least one diagnosed by a physician.
2. In addition, the child must meet at least one of the following major conditions or at least two of the following minor criteria.

Modified API	Original API
MAJOR CRITERIA	
Parental history of asthma	Parental history of asthma
Physician-diagnosed atopic dermatitis	Physician-diagnosed atopic dermatitis
Allergic sensitization to at least one aeroallergen*	
MINOR CRITERIA	
Allergic sensitization to milk, egg, or peanuts*	Physician-diagnosed allergic rhinitis*
Wheezing unrelated to colds	Wheezing unrelated to colds
Blood eosinophils ≥4%	Blood eosinophils ≥4%

Wheezing in infant and children:

- Infants and preschool children typically experience short, recurrent exacerbations of cough and wheeze separated by symptom-free intervals.

Features Suggesting a Diagnosis of Asthma in Children

Children 5 Years and Younger

Feature	Characteristics Suggesting Asthma
Cough	Recurrent or persistent nonproductive cough that may be worse at night or accompanied by some wheezing and breathing difficulties Cough occurring with exercise, laughing, crying, or exposure to tobacco smoke in the absence of an apparent respiratory infection
Wheezing	Recurrent wheezing, including during sleep or with triggers such as activity, laughing, crying, or exposure to tobacco smoke or air pollution
Difficult or heavy breathing or shortness of breath	Occurring with exercise, laughing, or crying
Reduced activity	Not running, playing, or laughing at the same intensity as other children, tiring earlier during walks (wants to be carried)
Past or family history	Other allergic disease (atopic dermatitis or allergic rhinitis) Asthma in first-degree relatives
Therapeutic trial with low-dose inhaled corticosteroid and as-needed short-acting β_2-agonist	Clinical improvement during 2-3 months of controller treatment and worse when treatment is stopped

Children 6-11 Years

Diagnostic Feature	Criteria for Making the Diagnosis
1. History of variable respiratory symptoms	
Wheeze, shortness of breath, chest tightness and cough	Generally more than one type of respiratory symptoms
Descriptors may vary between cultures and by age (e.g., children may be described as having heavy breathing)	Symptoms occur variably over time and vary in intensity
	Symptoms are often worse at night or on waking
	Symptoms are often triggered by exercise, laughter, allergens, cold air
	Symptoms often appear or worsen with viral infections
2. Confirmed variable airflow limitation	
Documented excessive variability in lung function[a] (one of more of the tests below)	The greater the variations, or the more occasions excess variation is seen, the more confident the diagnosis
AND documented airflow limitation[a]	At least once during the diagnostic progress when FEV_1 is low, confirm that FEV_1/FVC is reduced (normally >0.9 in children)
Positive bronchodilator (BD) reversibility test[a] (more likely if BD medication withheld before test)	Increase in FEV_1 of >10%-12% predicted
Excessive variability in twice daily PEF over 2 weeks[a]	Average daily diurnal PEF variability >13%[b]
Significant increase in lung function after 4 weeks of ICS or oral steroids	Increase in FEV_1 of >12% predicted after 4 weeks of treatment, outside of respiratory infections
Positive exercise challenge[a]	Fall in FEV_1 of >10-12% predicted, or PEF >15%
Positive methacholine challenge	Fall in FEV_1 from baseline of ≥20% with standard doses of methacholine
Excessive variation in lung function between visits[a] (less reliable)	Variation in FEV_1 of >12% predicted or > 15% in PEF between visits (may include respiratory infections)

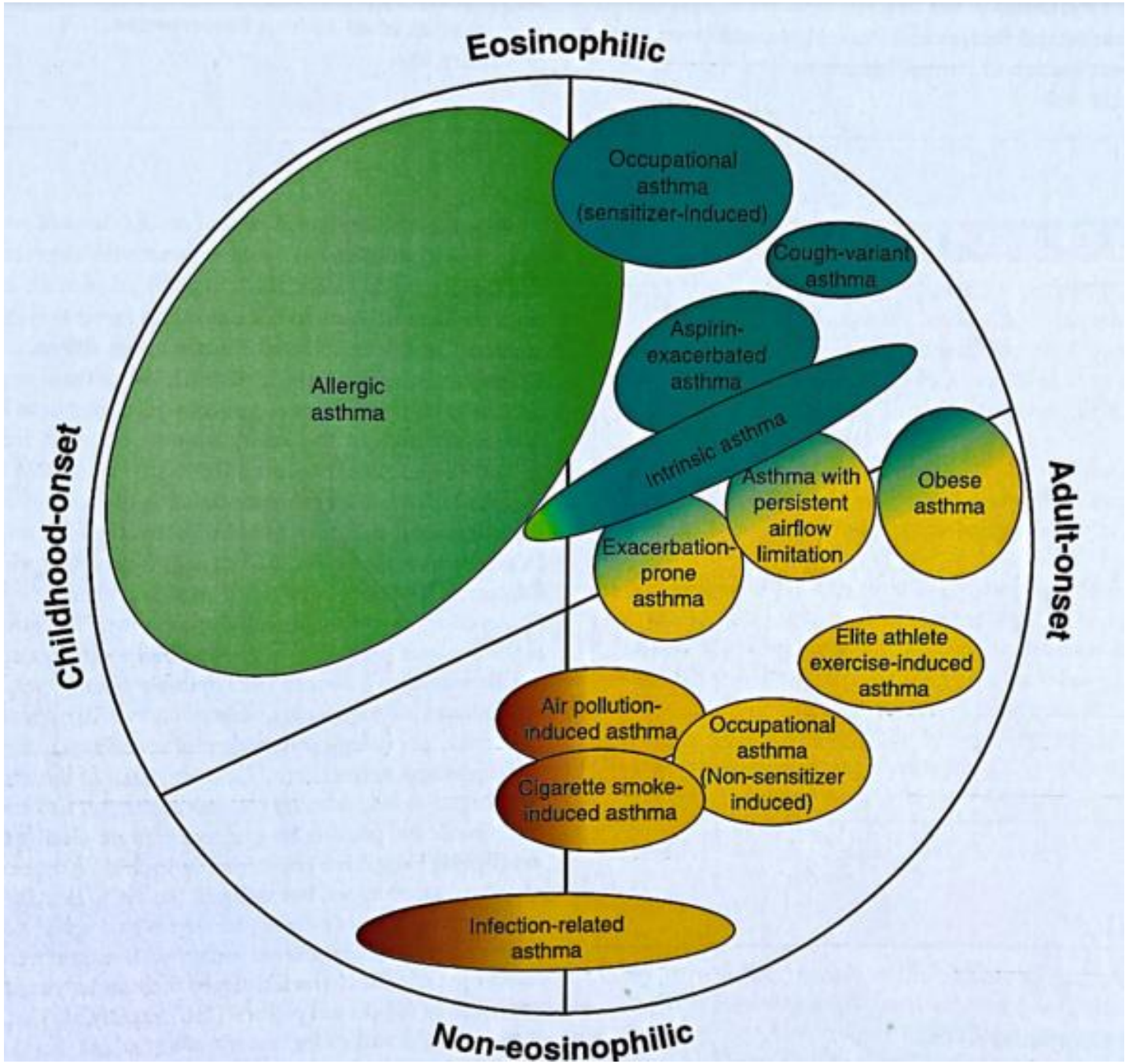
Age-Related Differential Diagnosis for Wheezing

Condition	RELATIVE FREQUENCY OF OCCURRENCE		
	Infancy	Childhood	Adolescence
Asthma	+	+++	+++
Airway malacia	++	+	–
Cystic fibrosis	+++	+	±
Foreign body	++	+++	±
Airway infection	+++	++	+
Bronchopulmonary dysplasia	+++	+	–
Primary ciliary dyskinesia	+	++	+
Bronchiectasis	+	+	+
Congenital anomalies (vascular ring)	+++	+	–
Vocal cord dysfunction	–	±	++
Tumors	±	±	±
Aspiration syndromes	+	±	±
Pulmonary edema	+	+	+

Atypical Symptoms Indicating Need for Referral for Additional Diagnostic Evaluation

- Failure to thrive
- Neonatal or very early onset of symptoms (especially if associated with failure to thrive)
- Vomiting associated with respiratory symptoms
- Continuous wheezing
- Failure to respond to asthma controller medications
- No association of symptoms with typical triggers, such as viral upper respiratory infections
- Focal lung or cardiovascular signs or finger clubbing
- Hypoxemia outside context of viral illness

Asthma phenotype



Pulmonary Function Tests

- The results should be reproducible, be comparable to established norms, and provide objective assessment of the disease over time.

peak expiratory flow rate (PEF)

>%80 Green zone

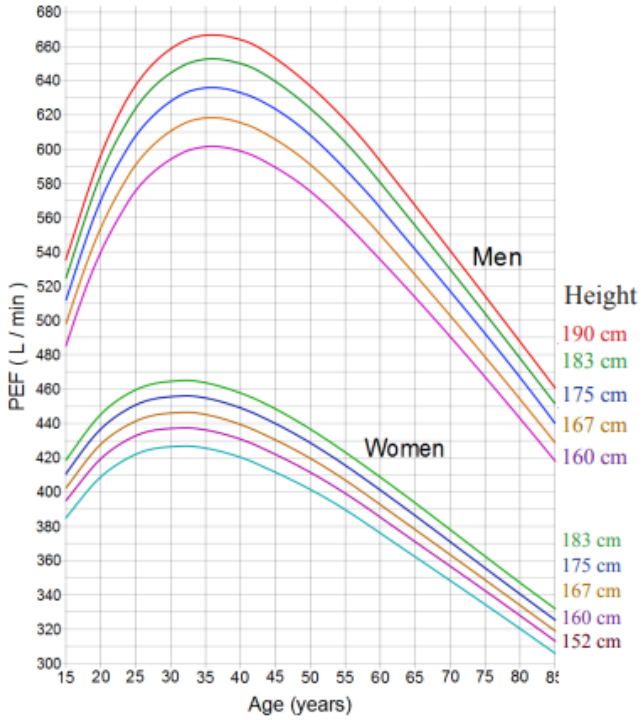
%80 -%50 Yellow zone

< %50 Red zone

پیوست شماره ۵- مقادیر طبیعی پیک‌فلومتری در کودکان و نوجوانان(زیر ۱۵ سال)

Height (m)	Height (ft)	Predicted EU PEFR (L/min)		Height (m)	Height (ft)	Predicted EU PEFR (L/min)
0.85	2'9"	87		1.30	4'3"	212
0.90	2'11"	95		1.35	4'5"	233
0.95	3'1"	104		1.40	4'7"	254
1.00	3'3"	115		1.45	4'9"	276
1.05	3'5"	127		1.50	4'11	299
1.10	3'7"	141		1.55	5'1	323
1.15	3'9"	157		1.60	5'3"	346
1.20	3'11"	174		1.65	5'5"	370
1.25	4'1"	192		1.70	5'7"	393

پیوست شماره ۴- مقادیر طبیعی پیک‌فلومتری در بزرگسالان



peak expiratory flow rate (PEF)

- As recommended by the EPR-3, peak expiratory flow rate (PEF) is a valuable, easily available measurement, well-suited for monitoring trends in asthma control over time in children aged 4 years and older and less so for the diagnosis of asthma or in classifying asthma severity.
- Daily diurnal PEF variability is calculated from twice daily
- In asthma average daily diurnal PEF is more than 13%

- PEF data may not predict use of medical services as strongly as symptom scores alone.

Spirometry:

- Spirometry is helpful in the evaluation of wheezing, with reversible airflow obstruction being highly suggestive of asthma.
- It measures forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), maximum forced expiratory flow (FEF MAX) and forced expiratory flow at 25%, 50%, 75% and between 25% and 75% of forced vital capacity (FEF25 , FEF50 , FEF75 and FEF25- 75 respectively)

Spirometry:

- FEV1 is independently associated with future asthma symptoms
- FEV1 is generally normal in children with asthma, even in severe persistent childhood asthma, whereas FEV1 /FVC declines as asthma severity increases
- Prebronchodilator and postbronchodilator determinations can be obtained in children, with improvements of 10% to 12% for FVC and FEV1 and 25% for FEF25-75 considered to be clinically significant

- The presence of a low FEV1 /FVC ratio is indicative of intrathoracic airflow obstruction, which can be seen in patients with asthma and most other disorders associated with diffuse lower airway inflammation, including cystic fibrosis, bronchiectasis, and primary ciliary dyskinesia.

Other diagnostic device:

- Specialized pulmonary function testing, including body plethysmography, impulse oscillometry, and infant pulmonary function testing is available in most medical centers specializing in the care of children.

body plethysmography:

- Lung volume measurements include thoracic gas volume (TGV), which is combined with spirometric measurements to yield residual volume (RV) ; total lung capacity (TLC); and RV/TLC.
- The latter ratio measures air trapping and is a very sensitive measure of pulmonary dysfunction in children with mild, intermittent asthma

Impulse oscillometry (IOS):

- Impulse oscillometry (IOS) measurements are noninvasive and based on signals of respiratory system resistance and reactance produced by a loudspeaker imposed on the child's respiratory system during quiet tidal breathing.
- Abnormalities have been demonstrated in groups of preschool 5 and young children with asthma

Bronchial Provocation

- If a diagnosis of asthma in a child is not clear because of an atypical history, persistent symptoms, an abnormal physical examination, or documented airway obstruction, the use of bronchial provocation testing might elicit evidence of AHR and may be useful in establishing the diagnosis.
- The most common are methacholine, exercise, adenosine 5'-monophosphate, and cold air

Fractional Exhaled Nitric Oxide :

- FeNO is a well-studied biomarker of airway inflammation, can be measured noninvasively in children, and may be a useful diagnostic tool.
- FeNO has been demonstrated to have moderate capability to differentiate young children with asthma from those without, to identify children who are likely to respond to ICS, and to predict those children who will experience an asthma relapse after reduction of ICS

Coexisting Issues in Pediatric Asthma

- Sinusitis-Asthma Relationship
- Gastroesophageal Reflux Disease .

Management of Asthma in Infants and Children

Both asthma severity and asthma control are evaluated in the context of two domains:

Impairment Domain Goals

- **Prevent chronic and troublesome symptoms** (e.g., coughing or breathlessness in the day, in the night, or after exertion).
- **Require infrequent use (**2 or fewer days per week) of shortacting beta-agonists (SABA) for quick relief of symptoms (not including prevention of exercise-induced bronchospasm[EIB]).
- Maintain (near) **normal lung function** (peak expiratory flow [PEF] or spirometry).
- Maintain **normal activity levels** (including exercise and other physical activity, attendance at school or work).
- Meet patient's and family's expectations of and **satisfaction** with asthma care.

Risk Domain Goals

- **Prevent recurrent exacerbations** of asthma and minimize the need for emergency department visits or hospitalizations.
- **Prevent loss of lung function**; for children, prevent reduced lung growth.
- Allow minimal or **no adverse effects of therapy**.

Asthma drug

Quick-Relief

Short-acting β_2-agonists

Anticholinergics

Systemic corticosteroids

Long-Term Control

Corticosteroids—inhaled and systemic

Long-acting β_2-agonists

Leukotriene receptor antagonists

Methylxanthines

Anticholinergics

Omalizumab

Mepolizumab

Reslizumab

Benralizumab

Dupilumab

Action plan:

My Asthma Action Plan

Patient name: _____

Medical record #: _____

Physician's name: _____ DOB: _____

Physician's phone #: _____ Completed by: _____ Date: _____

Long-Term-Control Medicines	How Much To Take	How Often	Other Instructions
		_____ times per day EVERY DAY!	
		_____ times per day EVERY DAY!	
		_____ times per day EVERY DAY!	
		_____ times per day EVERY DAY!	

Quick-Relief Medicines	How Much To Take	How Often	Other Instructions
		Take ONLY as needed	NOTE: If this medicine is needed frequently, call physician to consider increasing controller medications.

Special instructions when I feel good, not good, and awful.

GREEN ZONE

I feel *good*.
(My **peak flow** is in the **GREEN** zone.)

Prevent asthma symptoms every day:
- ☐ Take my long-term-control medicines (above) every day.
- ☐ Before exercise, take _____ puffs of _____
- ☐ Avoid things that make my asthma worse like: _____

YELLOW ZONE

I do *not* feel *good*.
(My **peak flow** is in the **YELLOW** zone.)
My symptoms may include one or more of the following:
- Wheeze
- Tight chest
- Cough
- Shortness of breath
- Waking up at night with asthma symptoms
- Decreased ability to do usual activities
- _____
- _____

CAUTION: I should continue taking my long-term-control asthma medicines every day AND:
- ☐ Take _____

If I still do not feel good, or my peak flow is not in the Green Zone within 1 hour, then I should:
- ☐ Increase _____
- ☐ Add _____
- ☐ Call _____

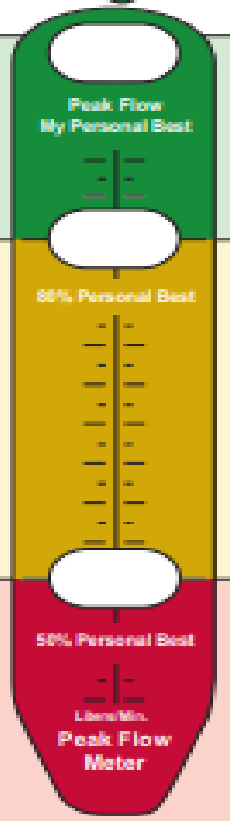
RED ZONE

I feel *awful* :
(My **peak flow** is in the **RED** zone.)
Warning signs may include one or more of the following:
- It's getting harder and harder to breathe.
- Unable to sleep or do usual activities because of trouble breathing.

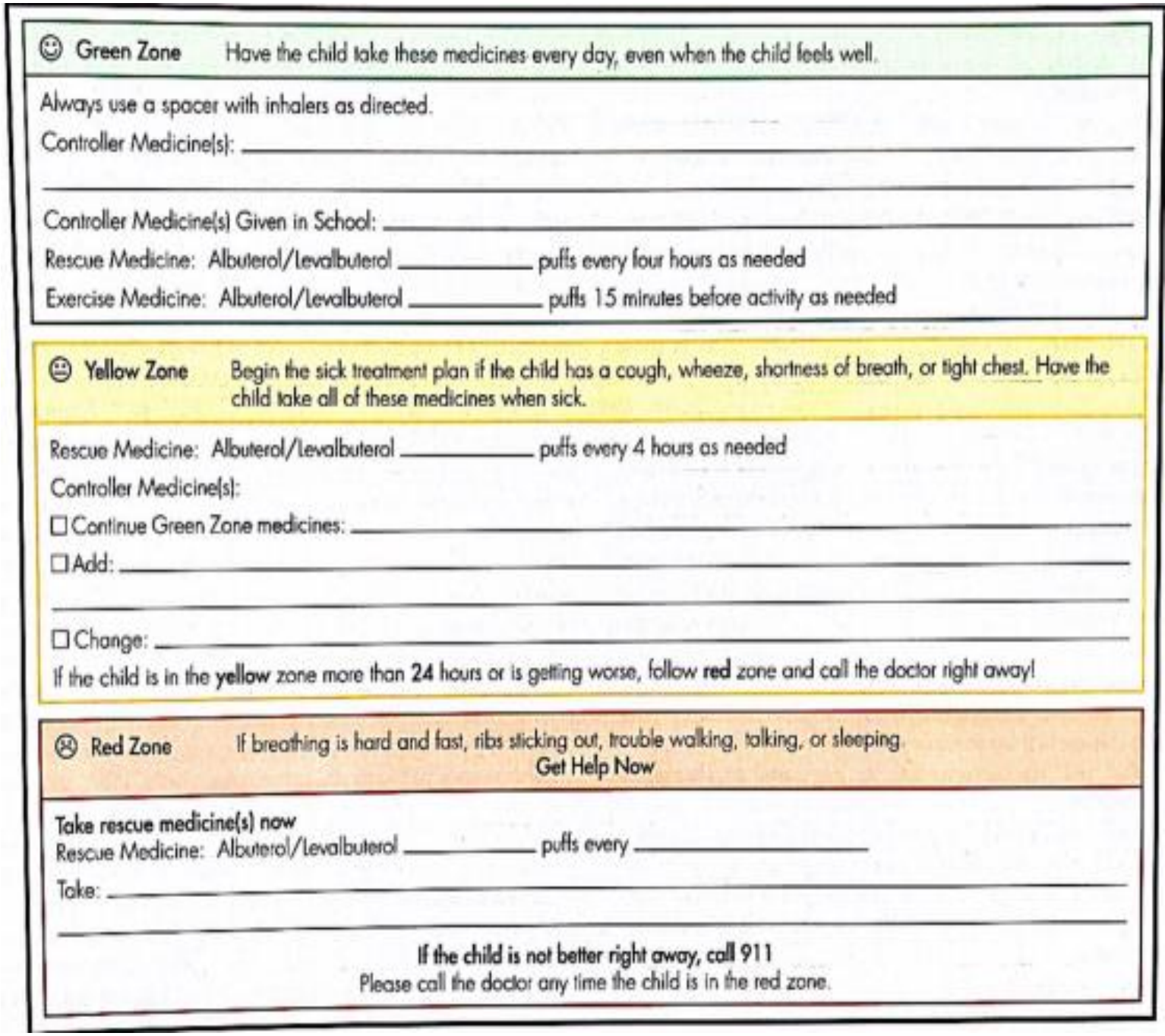
MEDICAL ALERT! Get help!
- ☐ Take _____ until I get help immediately!
- ☐ Take _____
- ☐ Call _____

DANGER!
Get help immediately!

Call 9-1-1 if you have trouble walking or talking due to shortness of breath or lips or fingernails are gray or blue.



Action plan:



Green Zone Have the child take these medicines every day, even when the child feels well.

Always use a spacer with inhalers as directed.

Controller Medicine(s): _____

_____

Controller Medicine(s) Given in School: _____

Rescue Medicine: Albuterol/Levalbuterol _____ puffs every four hours as needed

Exercise Medicine: Albuterol/Levalbuterol _____ puffs 15 minutes before activity as needed

Yellow Zone Begin the sick treatment plan if the child has a cough, wheeze, shortness of breath, or tight chest. Have the child take all of these medicines when sick.

Rescue Medicine: Albuterol/Levalbuterol _____ puffs every 4 hours as needed

Controller Medicine(s):

☐ Continue Green Zone medicines: _____

☐ Add: _____

_____

☐ Change: _____

If the child is in the **yellow** zone more than **24** hours or is getting worse, follow **red** zone and call the doctor right away!

Red Zone If breathing is hard and fast, ribs sticking out, trouble walking, talking, or sleeping.
Get Help Now

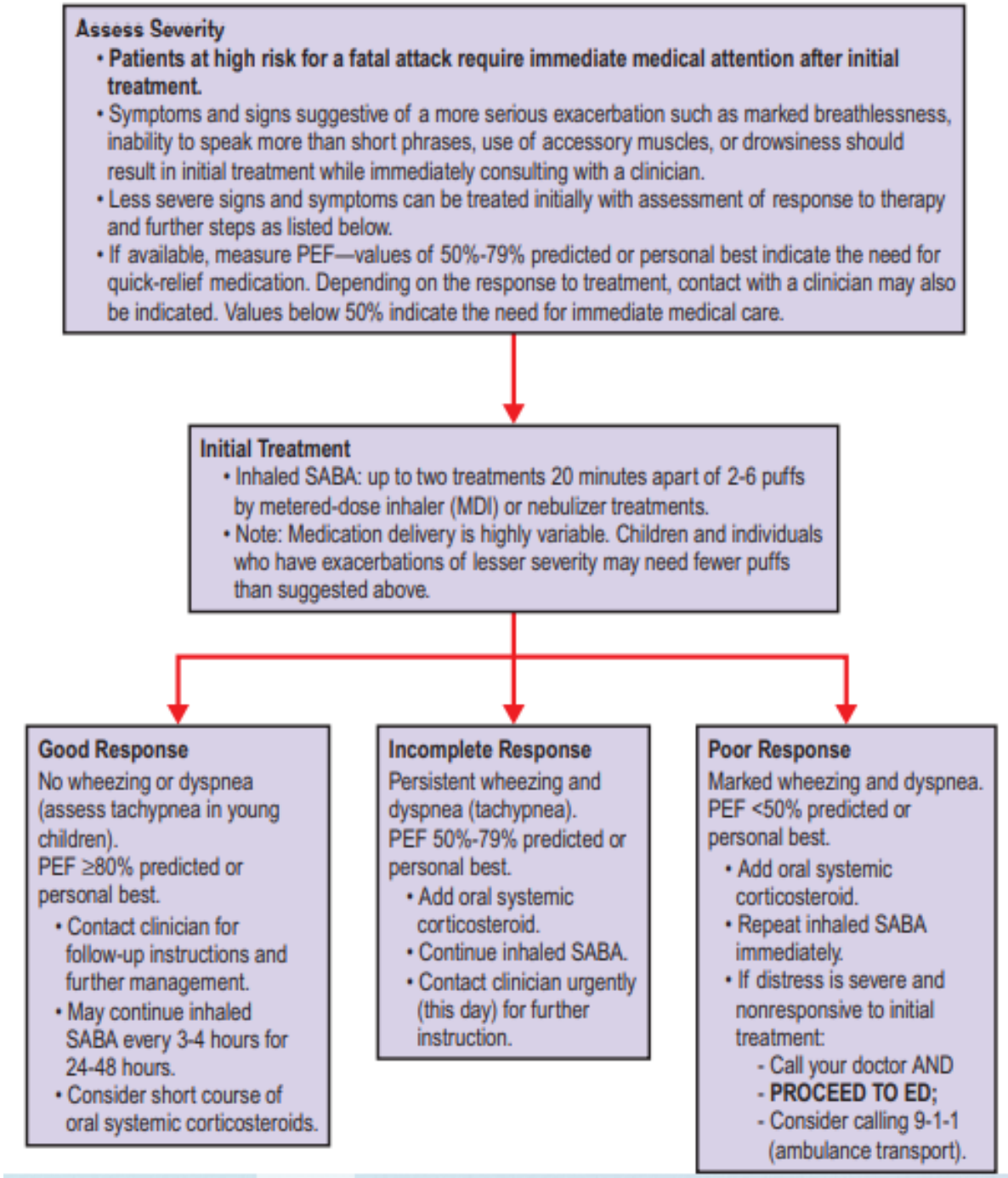
Take rescue medicine(s) now
Rescue Medicine: Albuterol/Levalbuterol _____ puffs every _____

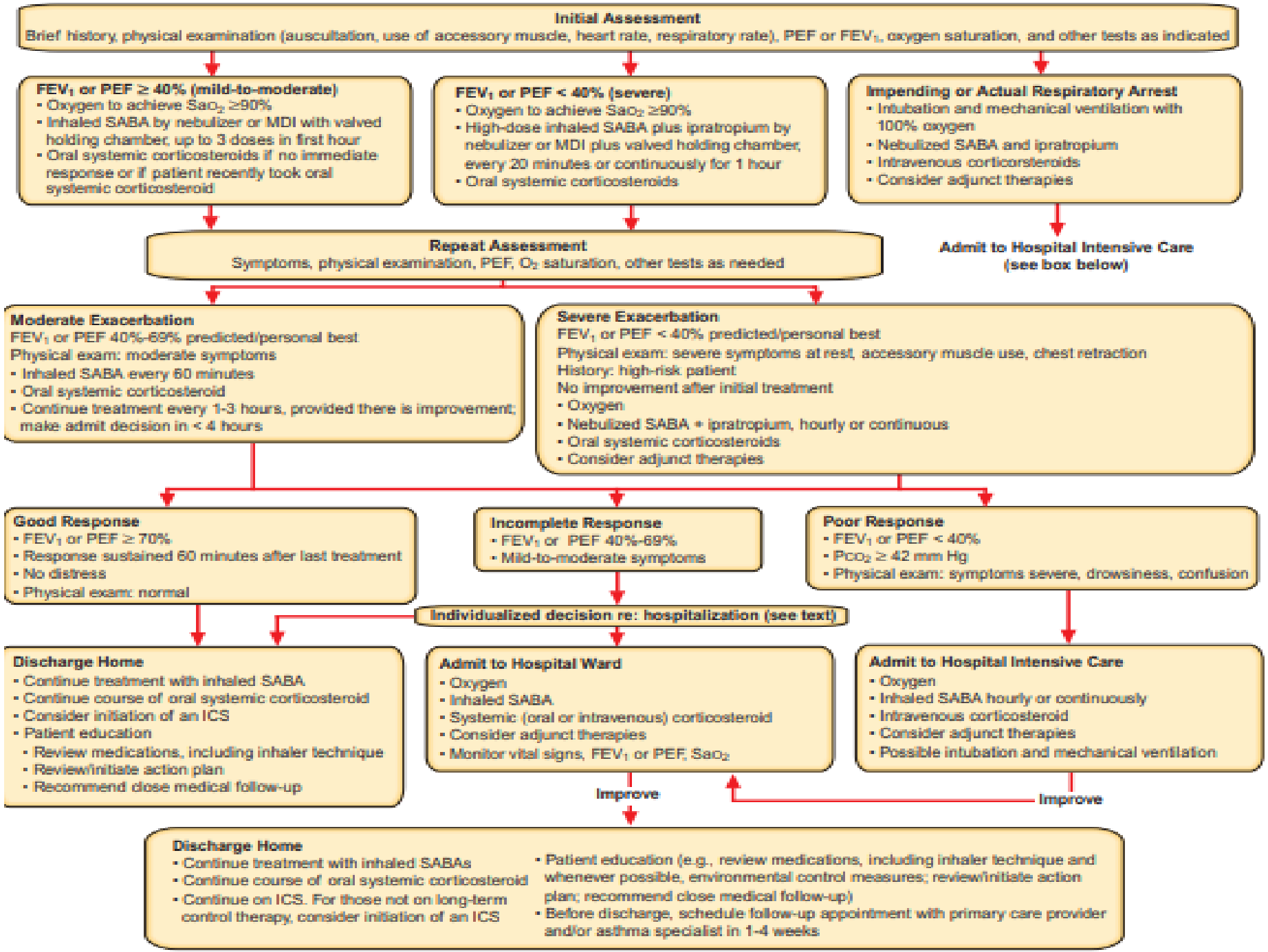
Take: _____

_____

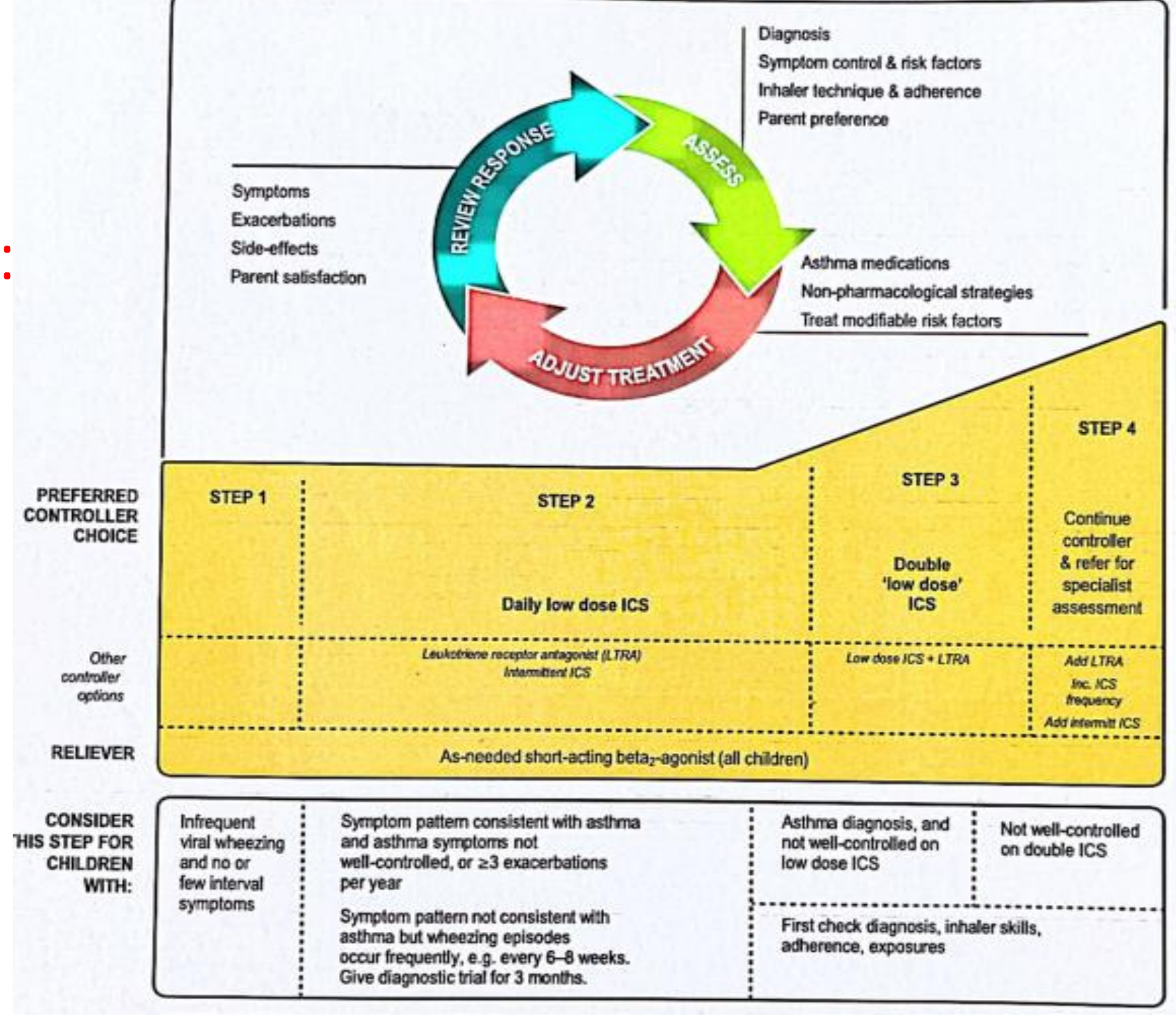
If the child is not better right away, call 911
Please call the doctor any time the child is in the red zone.

Management of asthma exacerbations:



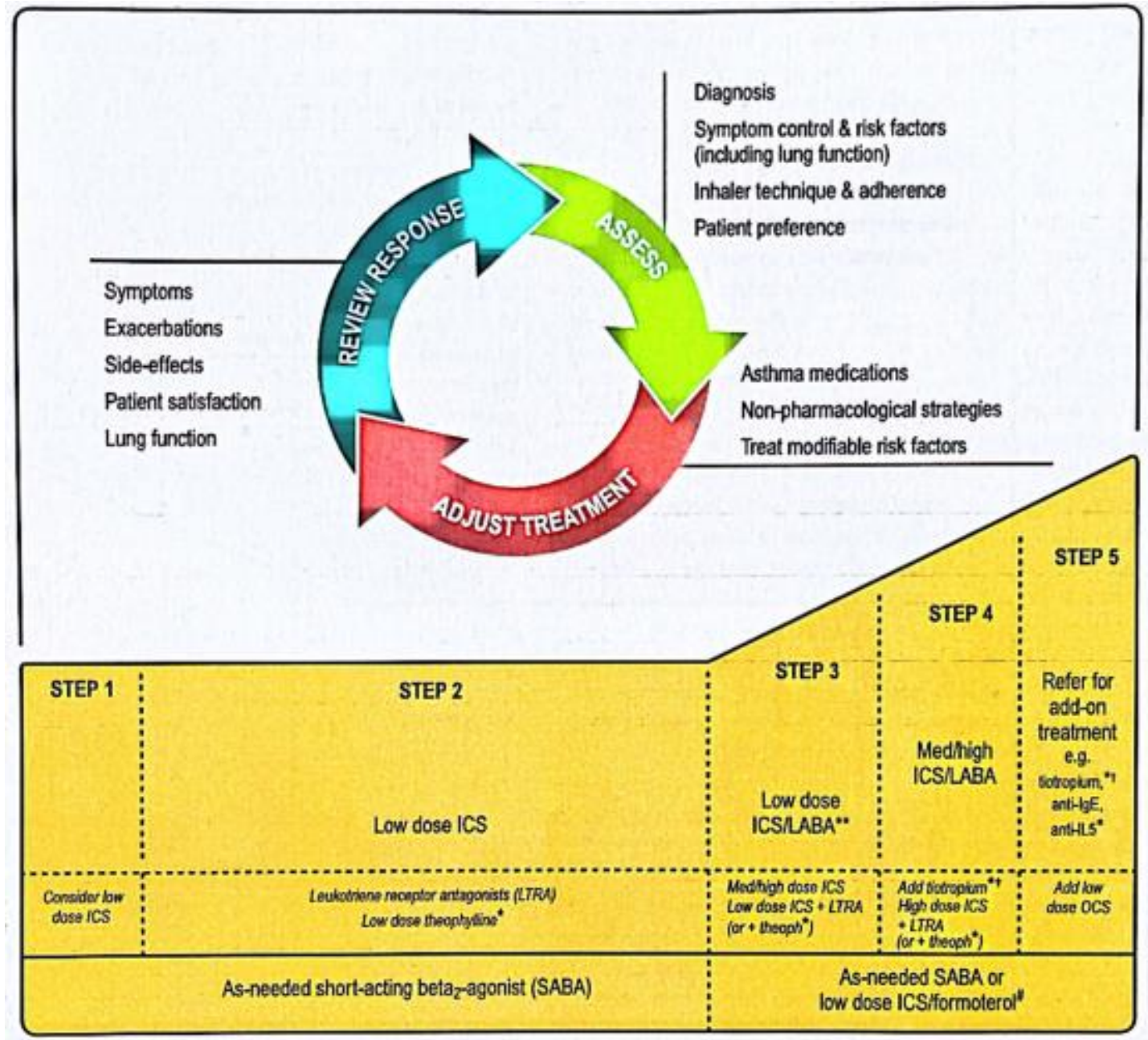

Initial Assessment
Brief history, physical examination (auscultation, use of accessory muscle, heart rate, respiratory rate), PEF or FEV1, oxygen saturation, and other tests as indicated
FEV1 or PEF ≥ 40% (mild-to-moderate)
• Oxygen to achieve SaO2 ≥90%
• Inhaled SABA by nebulizer or MDI with valved holding chamber, up to 3 doses in first hour
• Oral systemic corticosteroids if no immediate response or if patient recently took oral systemic corticosteroid
FEV1 or PEF < 40% (severe)
• Oxygen to achieve SaO2 ≥90%
• High-dose inhaled SABA plus ipratropium by nebulizer or MDI plus valved holding chamber, every 20 minutes or continuously for 1 hour
• Oral systemic corticosteroids
Impending or Actual Respiratory Arrest
• Intubation and mechanical ventilation with 100% oxygen
• Nebulized SABA and ipratropium
• Intravenous corticorsteroids
• Consider adjunct therapies
Repeat Assessment
Symptoms, physical examination, PEF, O2 saturation, other tests as needed
Admit to Hospital Intensive Care (see box below)
Moderate Exacerbation
FEV1 or PEF 40%-69% predicted/personal best
Physical exam: moderate symptoms
• Inhaled SABA every 60 minutes
• Oral systemic corticosteroid
• Continue treatment every 1-3 hours, provided there is improvement; make admit decision in < 4 hours
Severe Exacerbation
FEV1 or PEF < 40% predicted/personal best
Physical exam: severe symptoms at rest, accessory muscle use, chest retraction
History: high-risk patient
No improvement after initial treatment
• Oxygen
• Nebulized SABA + ipratropium, hourly or continuous
• Oral systemic corticosteroids
• Consider adjunct therapies
Good Response
• FEV1 or PEF ≥ 70%
• Response sustained 60 minutes after last treatment
• No distress
• Physical exam: normal
Incomplete Response
• FEV1 or PEF 40%-69%
• Mild-to-moderate symptoms
Poor Response
• FEV1 or PEF < 40%
• PCO2 ≥ 42 mm Hg
• Physical exam: symptoms severe, drowsiness, confusion
Individualized decision re: hospitalization (see text)
Discharge Home
• Continue treatment with inhaled SABA
• Continue course of oral systemic corticosteroid
• Consider initiation of an ICS
• Patient education
• Review medications, including inhaler technique
• Review/initiate action plan
• Recommend close medical follow-up
Admit to Hospital Ward
• Oxygen
• Inhaled SABA
• Systemic (oral or intravenous) corticosteroid
• Consider adjunct therapies
• Monitor vital signs, FEV1 or PEF, SaO2
Admit to Hospital Intensive Care
• Oxygen
• Inhaled SABA hourly or continuously
• Intravenous corticosteroid
• Consider adjunct therapies
• Possible intubation and mechanical ventilation
Improve
Improve
Discharge Home
• Continue treatment with inhaled SABAs
• Continue course of oral systemic corticosteroid
• Continue on ICS. For those not on long-term control therapy, consider initiation of an ICS
• Patient education (e.g., review medications, including inhaler technique and whenever possible, environmental control measures; review/initiate action plan; recommend close medical follow-up)
• Before discharge, schedule follow-up appointment with primary care provider and/or asthma specialist in 1-4 weeks

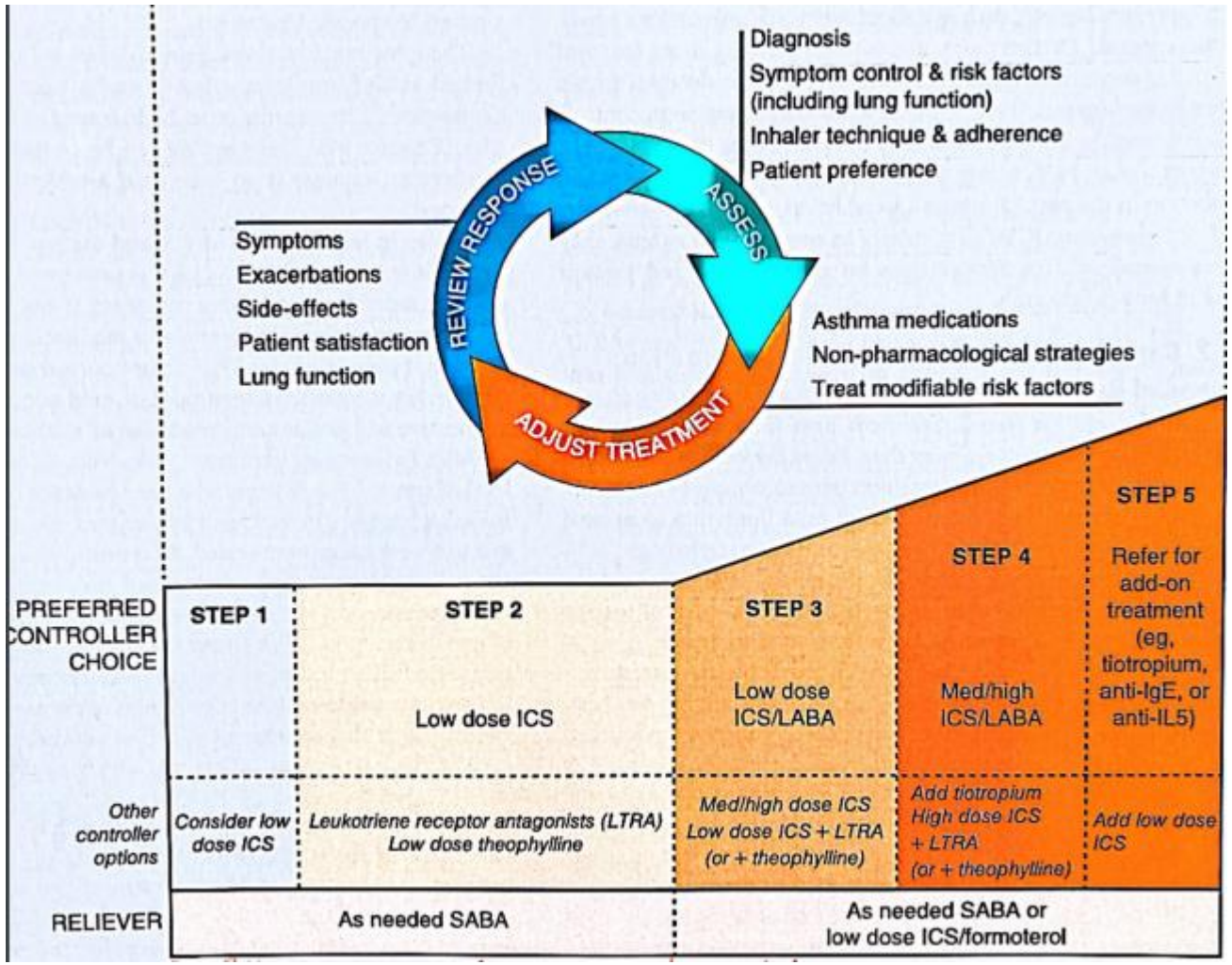
treatment in children 4 years old and younger:



Respiratory Symptoms	
Breathlessness, wheezing, cough, chest tightness, phlegm production	Variable in intensity and over time Triggered by viral infection, exercise, laughter, irritants or allergens
Variable Airway Obstruction	
Spirometry	FEV_1/FVC <0.75-0.8 AND Increase in FEV_1 ≥12% and ≥200 mL after bronchodilator or a course of controller therapy
PEF	Increase >60 L/min (minimum ≥20%) after bronchodilator or a course of controller therapy Diurnal variability >8% (twice-daily PEF) or > 20% (multiple PEF daily)
Bronchoprovocation Tests	
Methacholine or Histamine	PC_{20} < 4 mg/mL or PD_{20} <100 µg (4-16 mg/mL or 100-400 µg is borderline)
Mannitol	PC_{15} <635 mg
Hypertonic Saline	Decrease in FEV_1 ≥15% with standard doses
Exercise Challenge	Decrease in FEV_1 ≥10%-15% with standard protocol
Eucapnic Voluntary Hyperventilation	Decrease in FEV_1 ≥10%-15% with standard protocol

Severity Category/Component	Asthma Severity Classification: Frequency/Nature of Component			
		PERSISTENT		
	Intermittent	Mild	Moderate	Severe
IMPAIRMENT				
Symptoms	≤2 day/wk	>2 day/wk but not daily	Daily	Throughout the day
Nighttime awakenings	≤2 ×/mo	3-4 ×/mo	>1 ×/wk but not nightly	7 ×/wk
SABA use for symptom control	≤2 day/wk	>2 day/wk but not >1 ×/day	daily	Several times a 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 >60% but <80% predicted	FEV_1 <60% predicted
Normal FEV_1/FVC:	FEV_1 >80% predicted	FEV_1/FVC normal	FEV_1/FVC reduced 5%	FEV_1/FVC reduced >5%
8-19 yr: 85%	FEV_1/FVC normal			
20-39 yr: 80%				
40-59 yr: 75%				
60-80 yr: 70%				
RISK				
Exacerbations requiring oral systemic corticosteroids	0-1/yr	≥2/yr		
	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**
			Consider short course of oral corticosteroids.	
	In 2-6 wk, evaluate level of control that is achieved and adjust therapy accordingly.			


Diagnosis
Symptom control & risk factors (including lung function)
Inhaler technique & adherence
Patient preference
REVIEW RESPONSE
ASSESS
ADJUST TREATMENT
Symptoms
Exacerbations
Side-effects
Patient satisfaction
Lung function
Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors
STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
Low dose ICS
Low dose ICS/LABA**
Med/high ICS/LABA
Refer for add-on treatment e.g. tiotropium,*† anti-IgE, anti-IL5*
Consider low dose ICS
Leukotriene receptor antagonists (LTRA)
Low dose theophylline*
Med/high dose ICS
Low dose ICS + LTRA (or + theoph*)
Add tiotropium*†
High dose ICS + LTRA (or + theoph*)
Add low dose OCS
As-needed short-acting beta2-agonist (SABA)
As-needed SABA or low dose ICS/formoterol#


Diagnosis
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ADJUST TREATMENT
Symptoms
Exacerbations
Side-effects
Patient satisfaction
Lung function
Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors
PREFERRED CONTROLLER CHOICE
STEP 1
STEP 2
Low dose ICS
STEP 3
Low dose ICS/LABA
STEP 4
Med/high ICS/LABA
STEP 5
Refer for add-on treatment (eg, tiotropium, anti-IgE, or anti-IL5)
Other controller options
Consider low dose ICS
Leukotriene receptor antagonists (LTRA)
Low dose theophylline
Med/high dose ICS
Low dose ICS + LTRA
(or + theophylline)
Add tiotropium
High dose ICS + LTRA
(or + theophylline)
Add low dose ICS
RELIEVER
As needed SABA
As needed SABA or low dose ICS/formoterol

Control Category/Component	Asthma Control Classification: Frequency/Nature of Component		
	Well-Controlled	Not Well-Controlled	Very Poorly Controlled
IMPAIRMENT			
Symptoms	≤2 days/wk but not more than once/day	>2 days/wk or multiple times on ≤2 days/wk	Throughout the day
Nighttime awakenings	≤1 ×/mo	≥2 ×/mo	≥2 ×/wk
Interference with normal activity	None	Some limitation	Extremely limited
Short-acting β_2-agonist use for symptom control (not prevention of EIB)	≤2 days/wk	>2 days/wk	Several times/day
Lung function:	>80% predicted/personal best	60%-80% predicted/personal best	<60% predicted/personal best
FEV_1 OR peak flow	>80%		<75%
FEV_1/FVC		75%-80%	
RISK			
Exacerbations requiring oral systemic corticosteroids	0-1/yr	≥2/yr (see note below)	
	Consider severity and interval since last exacerbation.		
Reduction in lung growth	Evaluation requires long-term follow-up.		
Treatment-related adverse effects	Medication side effects can range in intensity from none to very troublesome and worrisome. The level of intensity does not correlate with specific levels of control but should be considered in the overall assessment of risk.		

A. ASSESSMENT OF CURRENT CLINICAL CONTROL (PREFERABLY OVER 4 WEEKS)			
Characteristic	**Controlled (All of the following)**	**Partly Controlled (Any measure present)**	**Uncontrolled**
Daytime symptoms	None (twice or less/week)	More than twice/week	Three or more features of partly controlled asthma*†
Limitation of activities	None	Any	
Nocturnal symptoms/awakening	None	Any	
Need for reliever/rescue treatment	None (twice or less/week)	More than twice/week	
Lung function (PEF or FEV_1) ‡	Normal	<80% predicted or personal best (if known)	
B. ASSESSMENT OF FUTURE RISK (RISK OF EXACERBATIONS, INSTABILITY, RAPID DECLINE IN LUNG FUNCTION, SIDE EFFECTS)			
Features that are associated with increased risk of adverse events in the future include poor clinical control, frequent exacerbations in past year,* ever admission to critical care for asthma, low FEV_1, exposure to cigarette smoke, high-dose medications.			

Asthma comorbids:

Comorbidity	Potentially Useful Tests
Rhinitis	
Allergic	Allergy skin prick test Serum-specific IgE
Nonallergic	ENT examination
Associated with nasal polyps	Sinus radiography/CT scan
CRS and sinusitis	
GERD	Proton-pump inhibitor treatment trial 24-hr esophageal pH measurement Imaging techniques
Obesity	BMI and other obesity measures Detection of metabolic syndrome
OSA	Sleep studies
Psychopathologies	Psychological evaluation
Dysfunctional breathing	Nijmegen questionnaire
VCD	Flow-volume loop Laryngoscopy Dynamic CT of the larynx
Hormonal and metabolic disorders	Hormone measurements
COPD and smoking	Pulmonary function tests Chest radiography/CT scan

Inhaled corticosteroids dose:

Drug	Low Daily Dose, Adult	Medium Daily Dose, Adult	High Daily Dose, Adult
Beclomethasone HFA 40 or 80 µg/puff	80-240 µg	>240-480 µg	>480 µg
Ciclesonide MDI 80 µg/puff, 160 µg/puff	80-240 µg	240-320 µg	>320 µg
Budesonide DPI 90, 180, or 200 µg/inhalation	180-600 µg	>600-1200 µg	>1200 µg
Fluticasone propionate HFA/MDI: 44, 110, or 220 µg/puff DPI: 50, 100, or 250 µg/inhalation	88-264 µg 100-300 µg	>264-440 µg >300-500 µg	>440 µg >500 µg
Fluticasone furoate DPI: 100 or 200 µg	100 µg	N/A	200 µg
Mometasone DPI 200 µg/inhalation	200 µg	400 µg	>400 µg

Exercise induced asthma:

Preexercise Approaches to Exercise-Induced Bronchoconstriction

Class	Example	Onset	Duration
Long-acting β_2-agonist	Salmeterol	≈20-60 min	8-10 hr[a]
Short-acting β_2-agonist	Albuterol	≈15 min	3-4 hr
Leukotriene modifier	Montelukast	≈30-120 min	8-10 hr
Mast cell stabilizers	Cromolyn	≈15 min	1.5-2 hr

Patient With Exercise-Induced Bronchoconstriction

Symptoms	First-Line Therapy	Second-Line Therapy
Normal Lung Function (FEV_1 >80%)		
Rare symptoms of asthma; mild–moderate exercise-induced bronchoconstriction (EIB)	β-Agonist or chromone before exercise	Leukotriene modifier 2 hr before exercise
Asthma symptoms >2×/wk and/or moderate–severe EIB	Daily leukotriene modifier ± β-agonist before exercise	Daily ICS (low dose) ± β-agonist before exercise
Reduced Baseline Lung Function (FEV_1 <80%)		
Asthma symptoms >2×/wk and EIB	Daily ICS (≥moderate dose) ± β-agonist before exercise	Add leukotriene modifier for persistent symptoms. Avoid LABA if possible.

Growth of Asthmatic Children

- Children with persistent asthma of at least moderate severity may exhibit impaired growth and often have a temporary decrease in growth velocity, although the eventual adult height attained is likely to be normal

Antibiotics and Childhood Asthma

- Antibiotic exposure in fetal life, particularly those used to treat respiratory infections, was associated with an increased risk of asthma in both a large prospective birth cohort and a systematic review
- Because most exacerbations of asthma are related to viral illnesses, little evidence exists to support a beneficial effect of treating asthma exacerbations with an antibiotics.

Indoor allergen

The average child or adult spends at least 23 hours a day indoors—at home, in school, or at work.

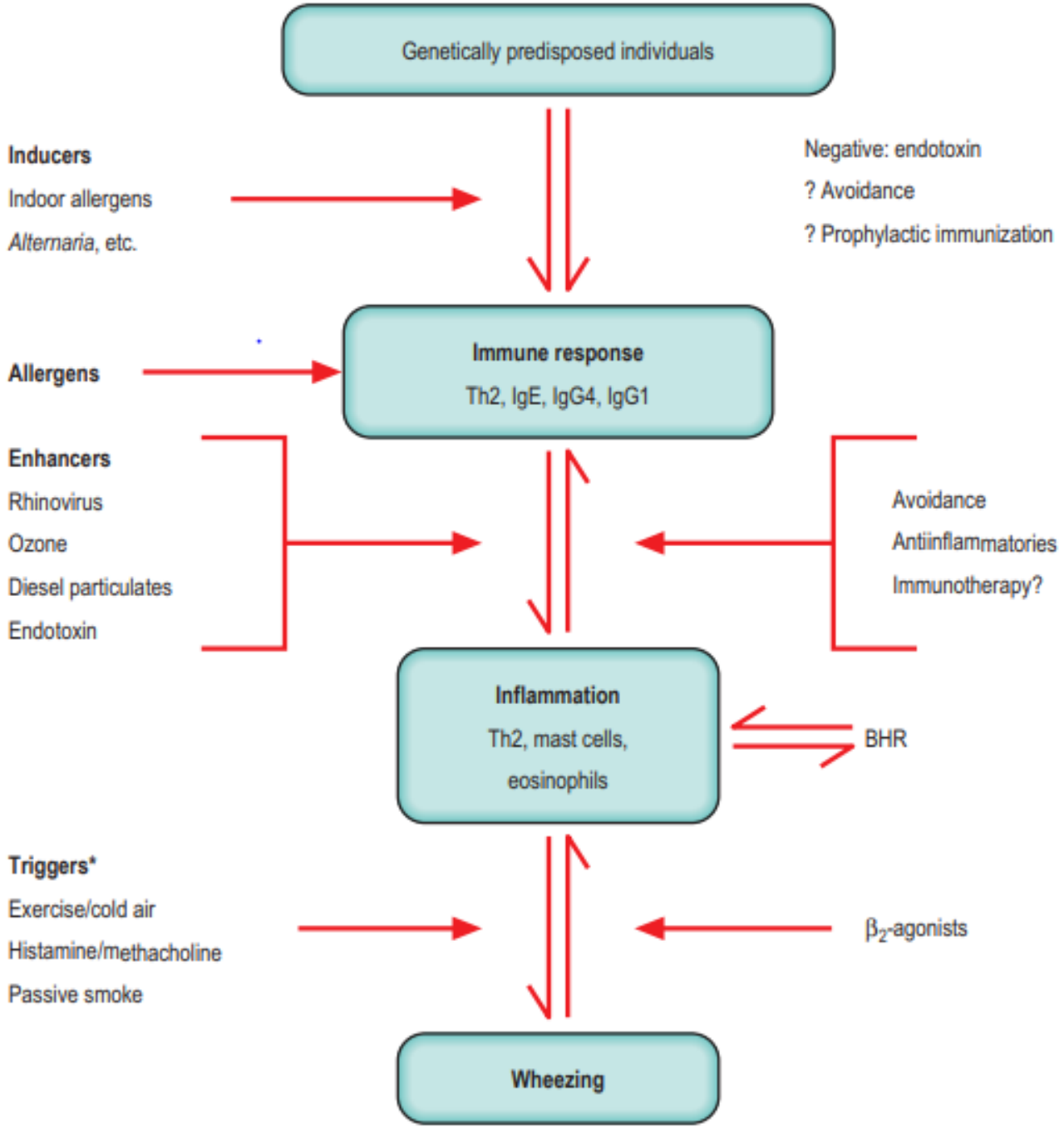
Allergens carried on smaller particles (e.g., cat and dog) stay airborne; as a result, larger quantities are inhaled.

With some allergens (e.g., cat and dog), the highest levels of exposure are not associated with the highest prevalence of sensitization and may induce tolerance.

Many different allergens are found indoors, but dust mite, cat, cockroach, mouse, and dog appear to be the most important.

Allergen avoidance is front-line treatment for asthma, perennial rhinitis, and atopic dermatitis, but in order to be successful, avoidance needs to be both comprehensive and specific for those allergens to which the patient has demonstrable sensitization

Indoor Allergens



SOURCES OF ALLERGENS IN HOUSE DUST

ACARIDS

- Dust mites/domestic mites
  - *Dermatophagoides pteronyssinus*
  - *Dermatophagoides farinae*
  - *Euroglyphus maynei*
  - *Blomia tropicalis*
  - Storage mites
- Others
  - Spiders
  - Silverfish

MAMMALS

- Cats (*Felis domesticus*)
- Dogs (*Canis familiaris*)
- Rabbits
- Ferrets
- Rodents
  - Pets (mice, gerbils, guinea pigs, chinchilla, others)
  - Pests
    - Mice (*Mus musculus*)
    - Rats (*Rattus norvegicus*)

INSECTS

- Cockroaches
  - *Blattella germanica* (German cockroach)
  - *Periplaneta americana* (American cockroach)
  - *Blatta orientalis* (Oriental cockroach)
- Others
  - *Harmonia axyridis*—Asian lady beetle
  - Crickets
  - Flies
  - Fleas
  - Moths
  - Midges

FUNGI

Derived from Inside House

- *Penicillium*
- *Aspergillus*
- *Cladosporium* (growing on surfaces of rotting wood)
- Other species

Derived from Outside House

- Multiple species from entry with incoming air

POLLENS

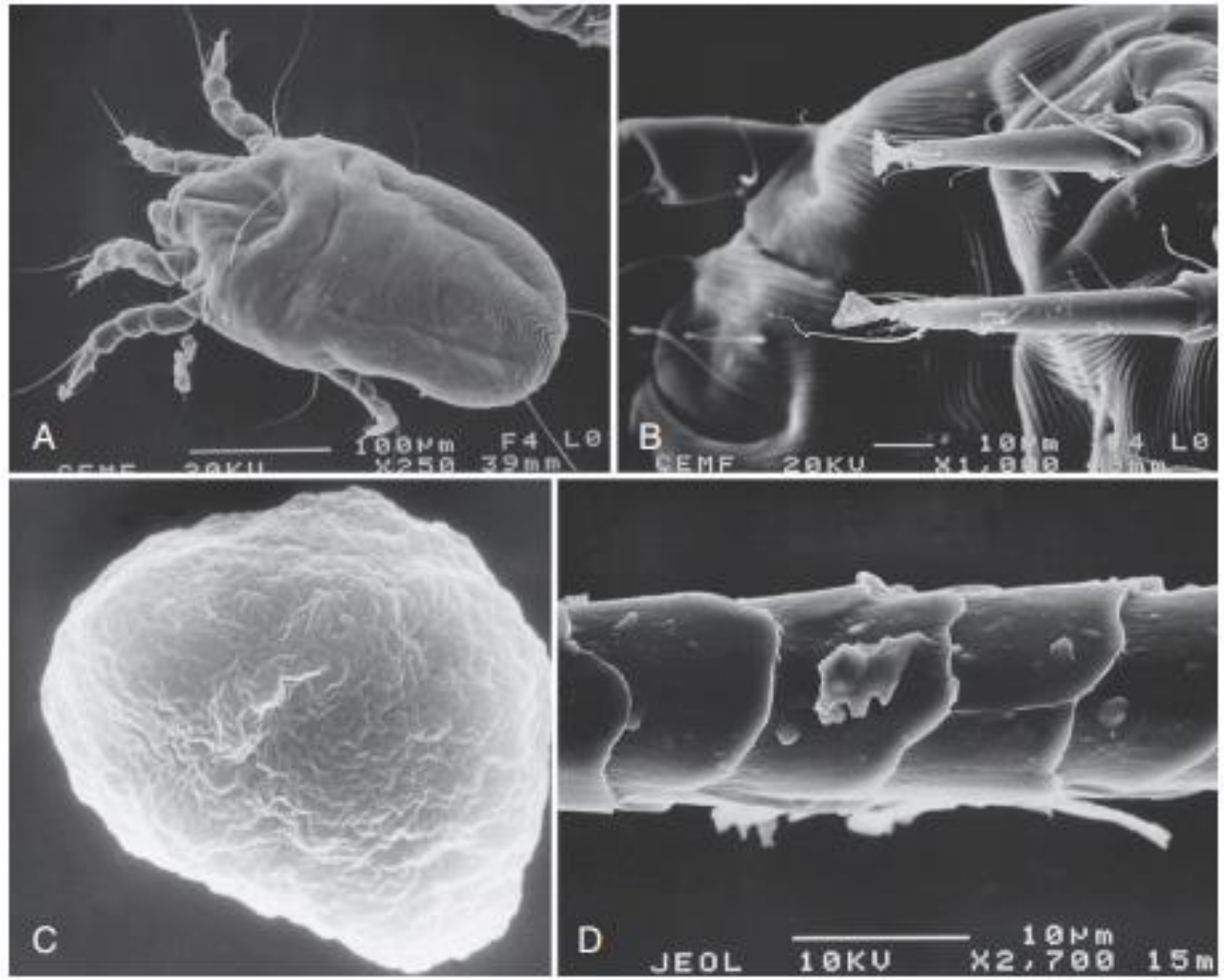
Derived from Outside House

- Multiple plant species

MISCELLANEOUS

- Horse hair in furniture
- Kapok (insulation, filling; silky fibers from ceiba tree)
- Food dropped by residents

Dust mite



AVOIDANCE MEASURES FOR MITE ALLERGENS

BEDROOMS

- 1. Cover mattresses and pillows with impermeable covers.
- 2. Wash bedding regularly at 130°F.
- 3. Remove carpets, stuffed animals, and clutter from bedroom.
- 4. Vacuum weekly (wearing a mask) using vacuum cleaner with a double-thickness bag or a high-efficiency particulate air (HEPA) filter.

REST OF HOUSE

- 1. Minimize carpets and furniture.
- 2. Reduce humidity below 45% relative humidity (or 6 g H2O/kg air).
- 3. Treat carpets with benzyl benzoate or tannic acid

AVOIDANCE MEASURES FOR CAT ALLERGENS

- **Removal of cat from the home** (Reducing allergen levels requires about 12 to 16 weeks after cat is removed.)
- **Measures to reduce allergen with cat in situ**

  1. Reduce reservoirs for cat allergen (e.g., carpets, sofas).
  2. Use vacuum cleaners with effective filtration system.
  3. Increase ventilation or use high-efficiency particulate air (HEPA) filters to remove small airborne particles.
  4. Wash cat weekly, if possible

Outdoor Allergens:

- POLLEN
- FUNGI
- ANIMALS

Allergen Source	Particle Type
Bacteria	Cells, fragments, metabolites
Thermophilic actinomycetes	Spores, metabolites
Algae	Cells, fragments, metabolites
Protozoa	Metabolites
Fungi	Spores, hyphal fragments
Ferns and mosses	Spores
Grasses, weeds, and trees	Pollens, cytoplasmic particles
Arthropods	Feces, saliva, body parts
Birds	Feces, epidermal debris
Mammals	Dander, saliva, urine

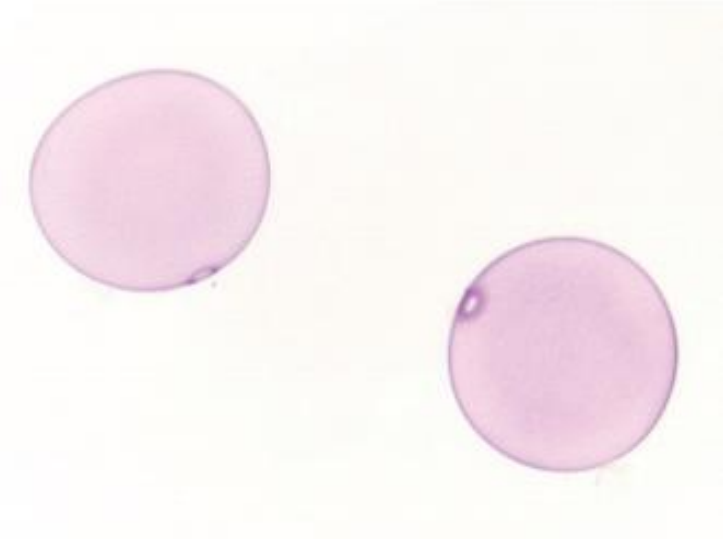
cedar

Birch tree

pigweed

Russian thistle

Grass



Alternaria spores

Impact of Climate Change on Aeroallergens

- As reported by McDonald, the efficiency of pollen capture is less dependent on the size of the grain than on the duration of rainfall and the character of the droplet.
- A light shower of 0.1 cm accumulated rainfall will be 99% effective in removing pollen if raindrops are drizzle-size (about 0.2 mm) and only 75% efficient with 1.0 mm droplets.
- A flurry of large 4.0 mm drops, as in a thunderstorm, will only remove 25% to 33% of the grains.
- Greater sustained rainfall of at least 1.0 cm will be 80% to 99% effective regardless of the droplet size.

Impact of Climate Change on Aeroallergens

- increased short ragweed (A. artemisiifolia) biomass and pollen production of 61% to 90% with increased ambient CO2 .
- Pollen counts correlate with mean temperature increase
- In the face of adequate moisture, increased CO2 generally increases plant biomass and pollen production

Asthma and covid19:

- **Are people with asthma at increased risk of COVID-19, or severe COVID-19**?
- People with asthma do not appear to be at increased risk of acquiring COVID-19, and systematic reviews have not shown an increased risk of severe COVID-19 in people with well-controlled, mild-to-moderate asthma
- **Are people with asthma at increased risk of COVID-19-related death?**
- Overall, people with well-controlled asthma are not at increased risk of COVID-19-related death x(Williamson, Nature 2020; Liu et al JACI IP 2021) § However, the risk of COVID-19 death was increased in people who had recently needed OCS for their asthma (Williamson, Nature 2020) and in hospitalized patients with severe asthma (Bloom, Lancet RM 2021).
- **What are the implications for asthma management?**
- It is important to continue good asthma management (as described in the GINA report), with strategies to maintain good symptom control, reduce the risk of severe exacerbations and minimise the need for OCS
- **Have there been more asthma exacerbations during the pandemic?**
- No. In 2020, many countries saw a reduction in asthma exacerbations and influenza-related illness. The reasons are not precisely known, but may be due to hand washing, masks and social/physical distancing that reduced the incidence of other respiratory infections, including influenza

Asthma and covid19:

- Advise patients to continue taking their prescribed asthma medications, particularly inhaled corticosteroids
- For patients with severe asthma, continue biologic therapy or oral corticosteroids if prescribed
- **Are inhaled corticosteroids (ICS) protective in COVID-19**?
- In one study of hospitalized patients aged ≥50 years with COVID-19, ICS use in those with asthma was associated with lower mortality than in patients without an underlying respiratory condition (Bloom, Lancet RM 2021)
- **Make sure that all patients have a written asthma action plan, advising them to**: Increase controller and reliever medication when asthma worsens
- Take a short course of OCS when appropriate for severe asthma exacerbations
- Avoid nebulizers where possible, to reduce the risk of spreading virus
- Pressurized metered dose inhaler via a spacer is preferred except for life-threatening exacerbations

Asthma and covid19:

- Avoid spirometry in patients with confirmed or suspected COVID-19, or if community transmission of COVID-19 is occurring in your region
- Follow aerosol, droplet and contact precautions if spirometry is needed
- Consider asking patients to monitor PEF at home, if information about lung function is needed
- Follow strict infection control procedures if aerosol-generating procedures are needed

covid19 and vaccination:

- **COVID-19 vaccination and biologic therapy**
- We suggest that biologic therapy and COVID-19 vaccine should not be given on the same day, so that adverse effects of either can be more easily distinguished
- **After COVID-19 vaccination**
- people who have been fully vaccinated against COVID-19 should continue to wear a mask in crowded settings.
- **Influenza vaccination**
- Remind people with asthma to have an annual influenza vaccination

A gap of 14 days between COVID-19 vaccination and influenza vaccination is recommended by CDC

با تشکر از توجه شما