Asthma 2017: Establishing and Maintaining Control

Webinar for

Michigan Center for Clinical Systems Improvement (Mi-CCSI)

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Priority Health

October 16, 2017

Global INitiative for Asthma

Burden of asthma

- Asthma is one of the most common chronic diseases worldwide with an estimated 300 million affected individuals
- Prevalence is increasing in many countries, especially in children
- Asthma is a major cause of school and work absence
- Health care expenditure on asthma is very high
  - Developed economies might expect to spend 1-2 percent of total health care expenditures on asthma.
  - Developing economies likely to face increased demand due to increasing prevalence of asthma
  - Poorly controlled asthma is expensive
  - However, investment in prevention medication is likely to yield cost savings in emergency care

Asthma Prevalence

- Approx. 24.6 million Americans have asthma, including 6.2 million children (2015)
- Most common chronic disorder in children
- Children with asthma are 3 times more likely to miss school than children without the disease
  - 13.8 million days/year (2013)
- Asthma is the 3rd leading cause of hospitalization in children < 15 years of age
- Each year, asthma accounts for 1.5 million ED visits
- Annual economic cost is *$56 billion*
  - Direct costs; indirect costs (lost productivity); Rx single largest expenditure of >$6 billion

Asthma Prevalence

- Currently, prevalence rate is 8.4% in the U.S. (CDC)
  - An average of one out of 10 school-aged children has asthma
- Higher prevalence among the poor and minority populations
- Prevalence is increasing
  - Number of people with asthma in U.S. grew by 15% in the last decade
  - Greatest rise in asthma rates among black children (almost a 50% increase) from 2001 through 2009
  - It is estimated that the number of people (worldwide) with asthma will grow by more than 100 million by 2025
- 3,404 deaths annually in U.S. due to asthma (2010)
  - 11 people die from asthma each day in the U.S.
  - In Michigan, approx. 130 – 150 deaths/year (10-15 are children)

Asthma in Michigan

- 213,600 children and 654,100 adults currently have asthma in Michigan.
- >50% of Michigan adults with asthma had an asthma attack in the last year.
- 20% of Michigan adults with asthma are experiencing asthma symptoms every day.
- Asthma hospitalization rates are highest in very young children, age 0 to 4 years.
- Hospitalization rates for blacks are 4 times the rate for whites.

What is known about asthma?

- Asthma can be effectively treated
- When asthma is well-controlled, patients can
  - ✓Avoid troublesome symptoms during the day and night
  - ✓Need little or no reliever medication
  - ✓Have productive, physically active lives
  - ✓Have normal or near-normal lung function
  - ✓Avoid serious asthma flare-ups (also called exacerbations, or severe attacks)

State/National Response

- Asthma Initiative of Michigan (AIM) includes 10 local asthma coalitions who have formed the Michigan Consortium of Asthma Coalitions: visit www.GetAsthmaHelp.org
- U.S. Environmental Protection Agency (EPA) hosts annual National Asthma Forum and has created a website of asthma programs nationwide: visit www.asthmacommunitynetwork.org
- National Asthma Educator Certification Board (NAECB) includes ~200 certified asthma educators in Michigan (~3,500 in the nation): visit www.naecb.org to find an AE-C in your area

Definition of Asthma

- Asthma is a heterogeneous, chronic inflammatory disease of the airways characterized by:
  - Recurrent episodes of wheezing
  - Shortness of breath
  - Chest tightness/pain
  - Coughing
- Airflow limitation is at least partially reversible
- Airways are hyperresponsive (supersensitive) and react to a variety of stimuli or triggers

Asthma Pathophysiology

- In response to a trigger:
  - Airway inflammation
  - Bronchial smooth muscles constriction (bronchospasm)
  - Increased mucus production
  - The airways become narrow and breathing becomes difficult

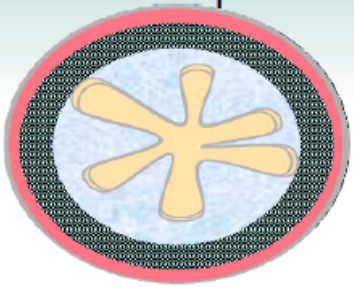
Asthma pathophysiology

Asthma pathophysiology

Key components: inflammation, bronchial hyper-reactivity, airway remodeling

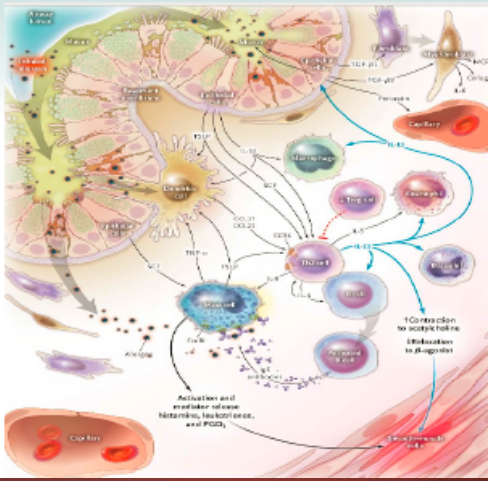
1970's → 1980's → 1990's → present

Bronchospasm

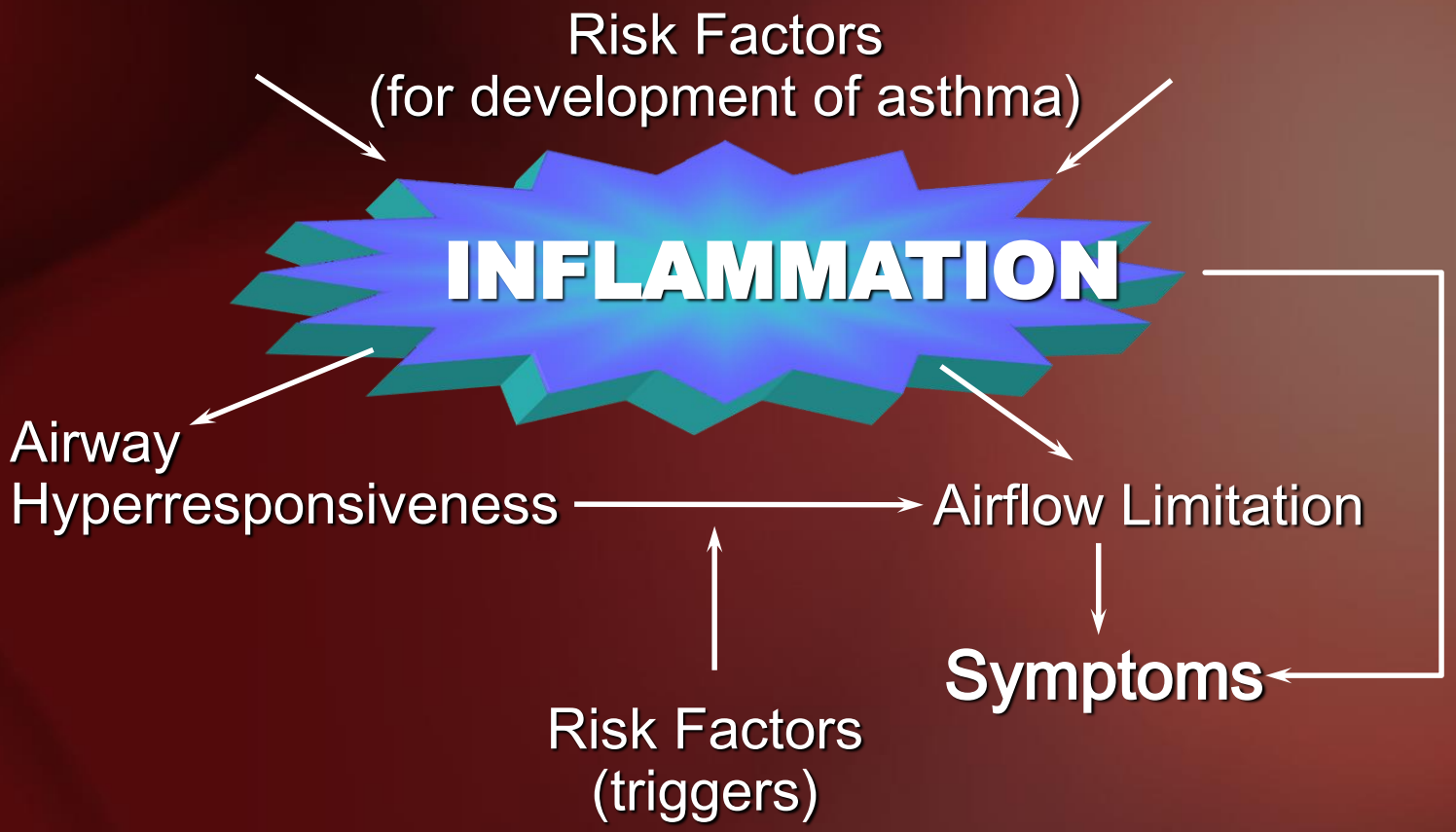


Bronchospasm
+ Inflammation

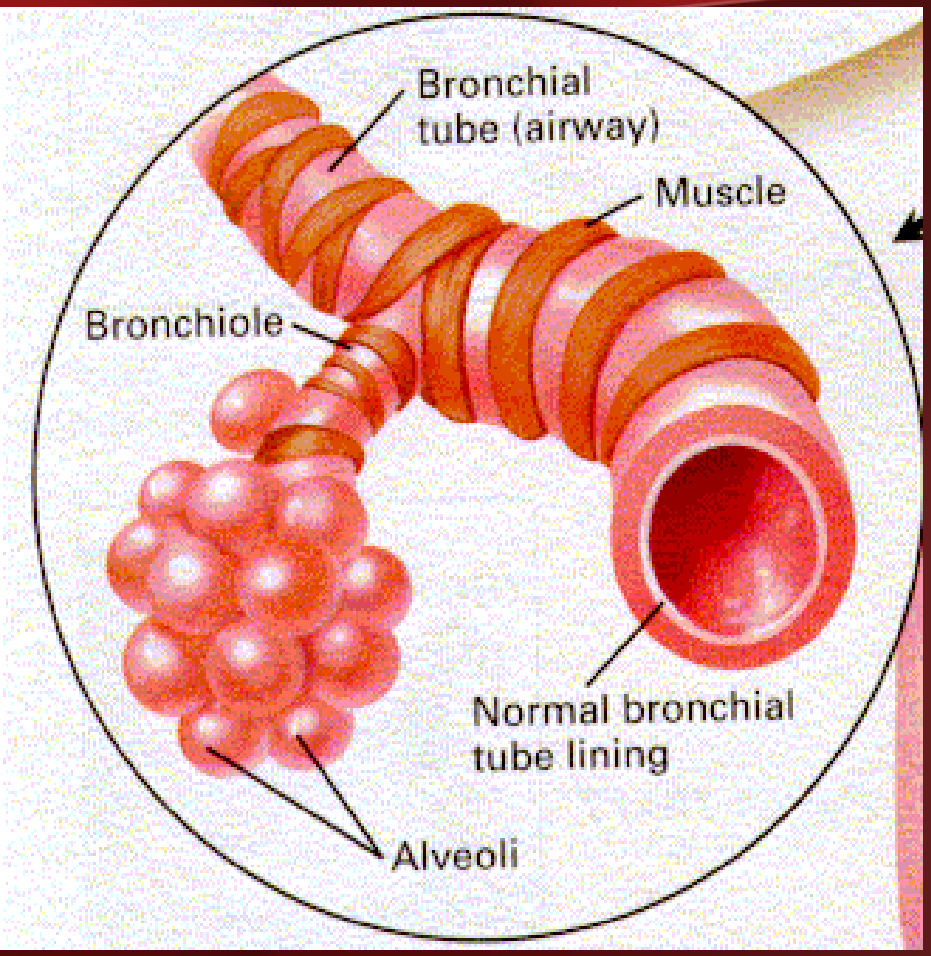
Bronchospasm
+ Inflammation
+ Remodeling

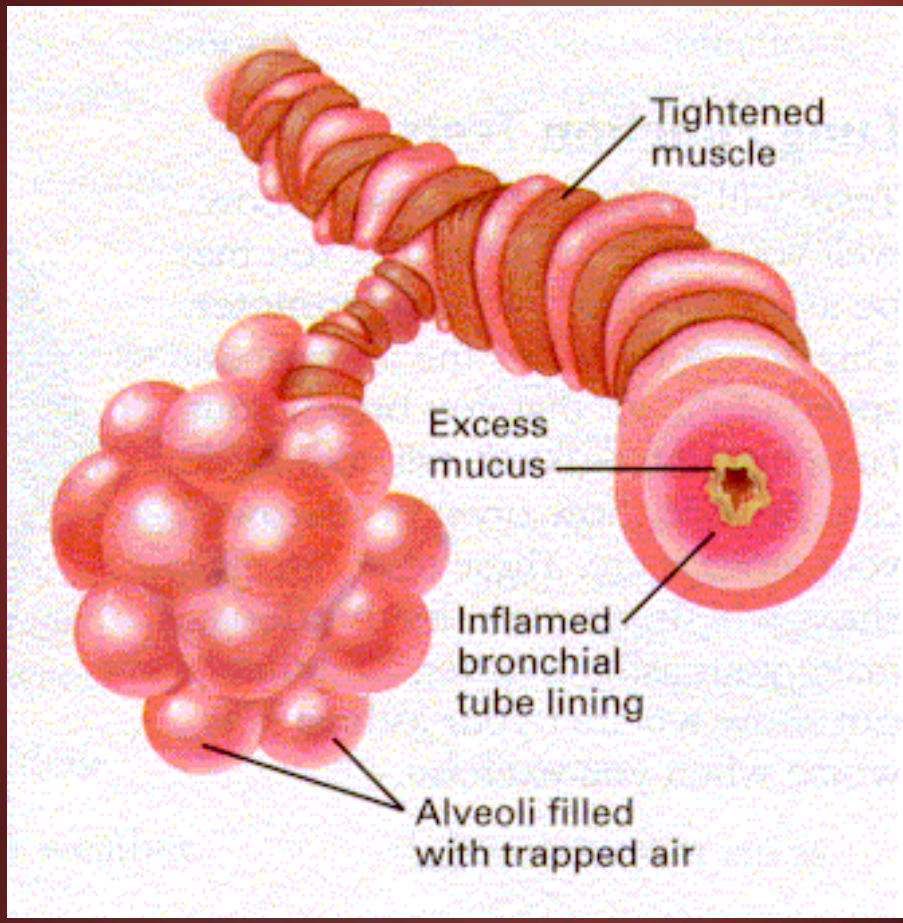


Mechanisms Underlying the Definition of Asthma

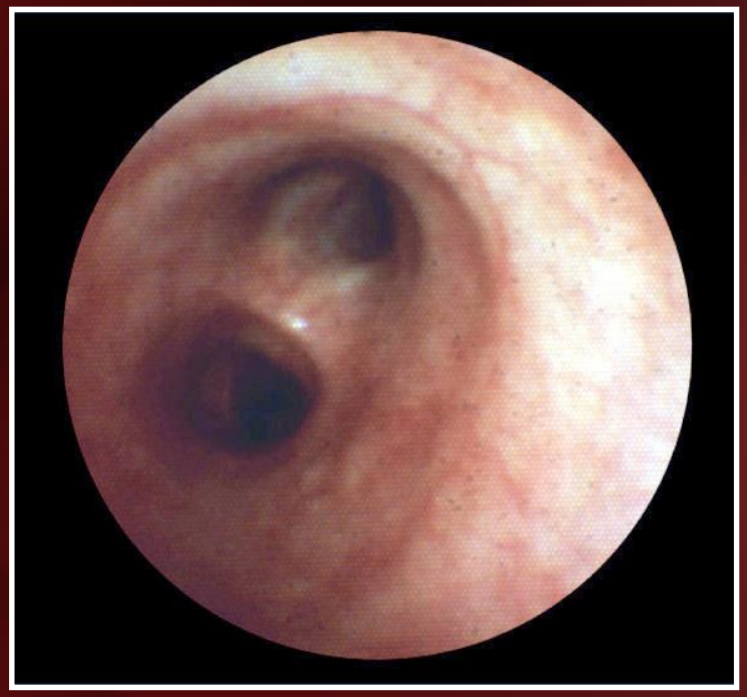


Normal vs. Asthma Airways

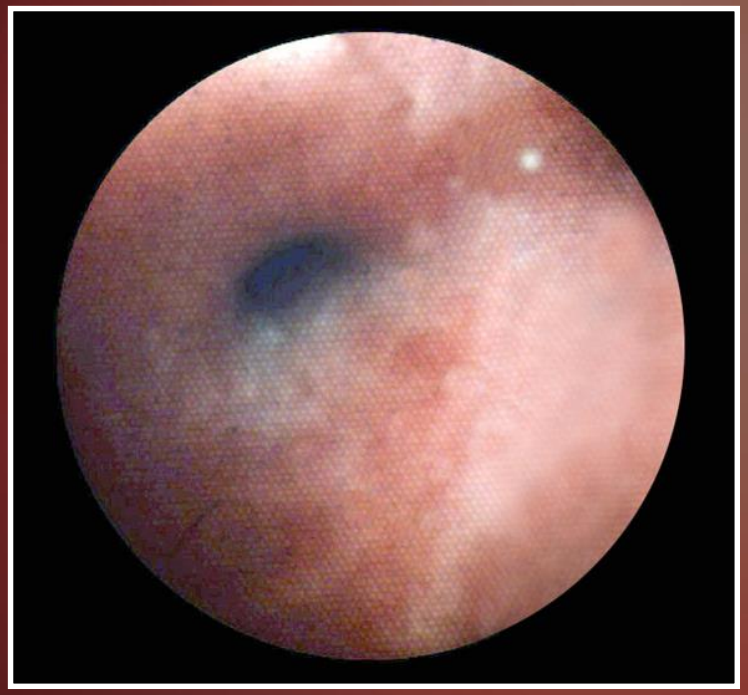




Asthma Airways

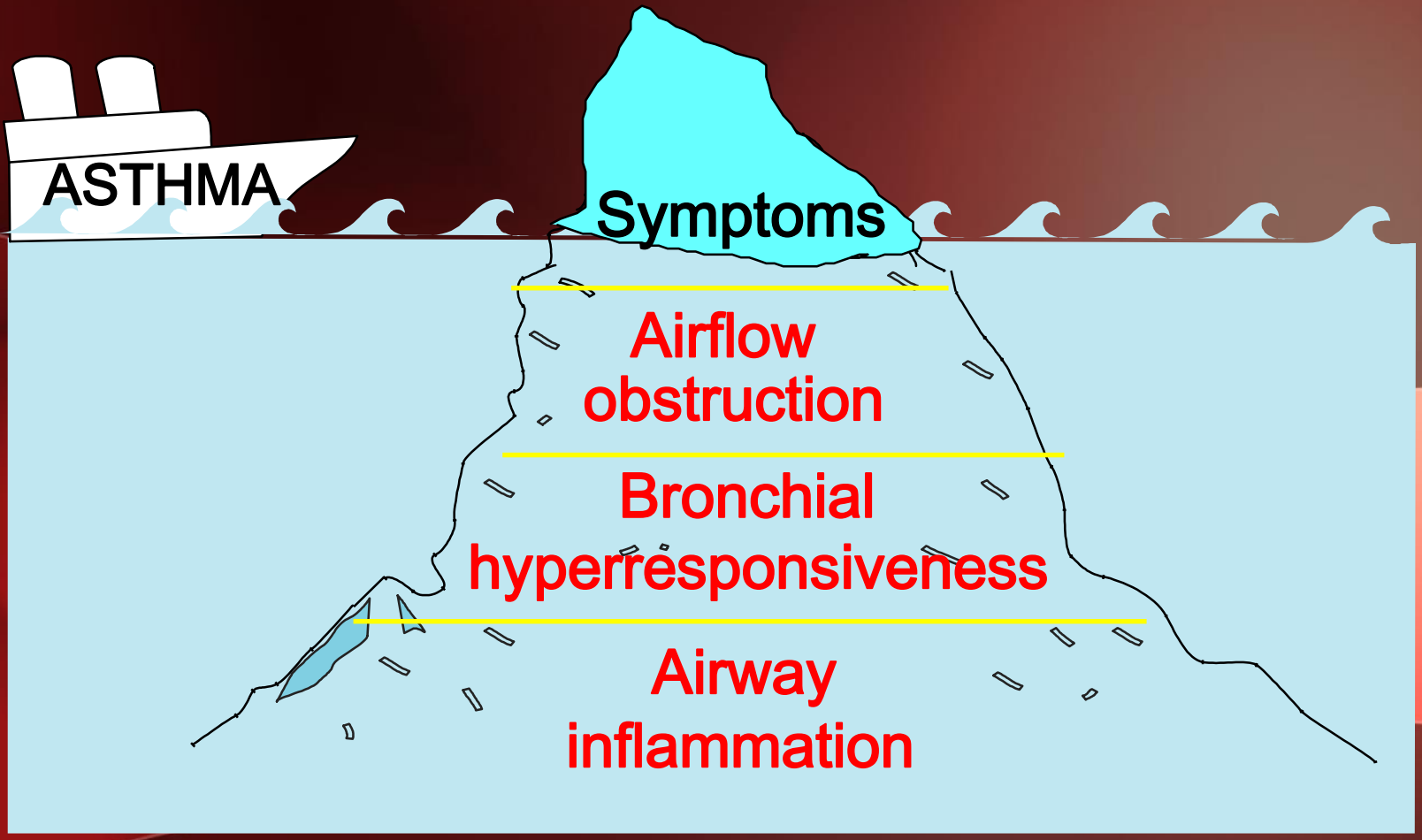


Before



10 Minutes After Allergen Challenge

The “Tip” of the Iceberg



Diagnosis of asthma – symptoms

- *Increased* probability that symptoms are due to asthma if:
  - More than one type of symptom (wheeze, shortness of breath, cough, chest tightness)
  - Symptoms often worse at night or in the early morning
  - Symptoms vary over time and in intensity
  - Symptoms are triggered by viral infections, exercise, allergen exposure, changes in weather, laughter, irritants such as car exhaust fumes, smoke, or strong smells
- *Decreased* probability that symptoms are due to asthma if:
  - Isolated cough with no other respiratory symptoms
  - Chronic production of sputum
  - Shortness of breath associated with dizziness, light-headedness or peripheral tingling
  - Chest pain

Factors Predicting Persistent Asthma

- Family history of asthma (maternal > paternal)
- Atopy (IgE/positive skin tests, eczema, rhinitis)
- Allergen exposure (dust mites / animals)
- Viral (RSV) infection
- Gender (males > females)
- Smoking (passive or active)
- The strongest *predictor* for wheezing that develops into asthma is ATOPY

Challenges in Treating Asthma

Assessing Symptoms

- Cough
- Wheeze
- Dyspnea
- Nocturnal symptoms
- Activity affected?

✓ Recurrent episodes of cough (± wheeze) are frequently due to asthma

✓ Coughing may be the *only* symptom present

Asthma Diagnosis

- Medical history
- Physical exam
- Measurements of lung function
  - Diurnal variation in peak flow
- Evaluation of allergic status
- Exclude alternative diagnoses
  - Bronchiolitis, cystic fibrosis, GERD, foreign body aspiration

Asthma Diagnosis
Medical History

- Repeated cough, wheeze, chest tightness
- Repeated diagnoses of reactive airway disease, allergic bronchitis or wheezy bronchitis
- Symptoms worsened by viral infection, smoke, allergens, exercise, weather
- Symptoms occur/worsen at night
- Reversible airflow limitation

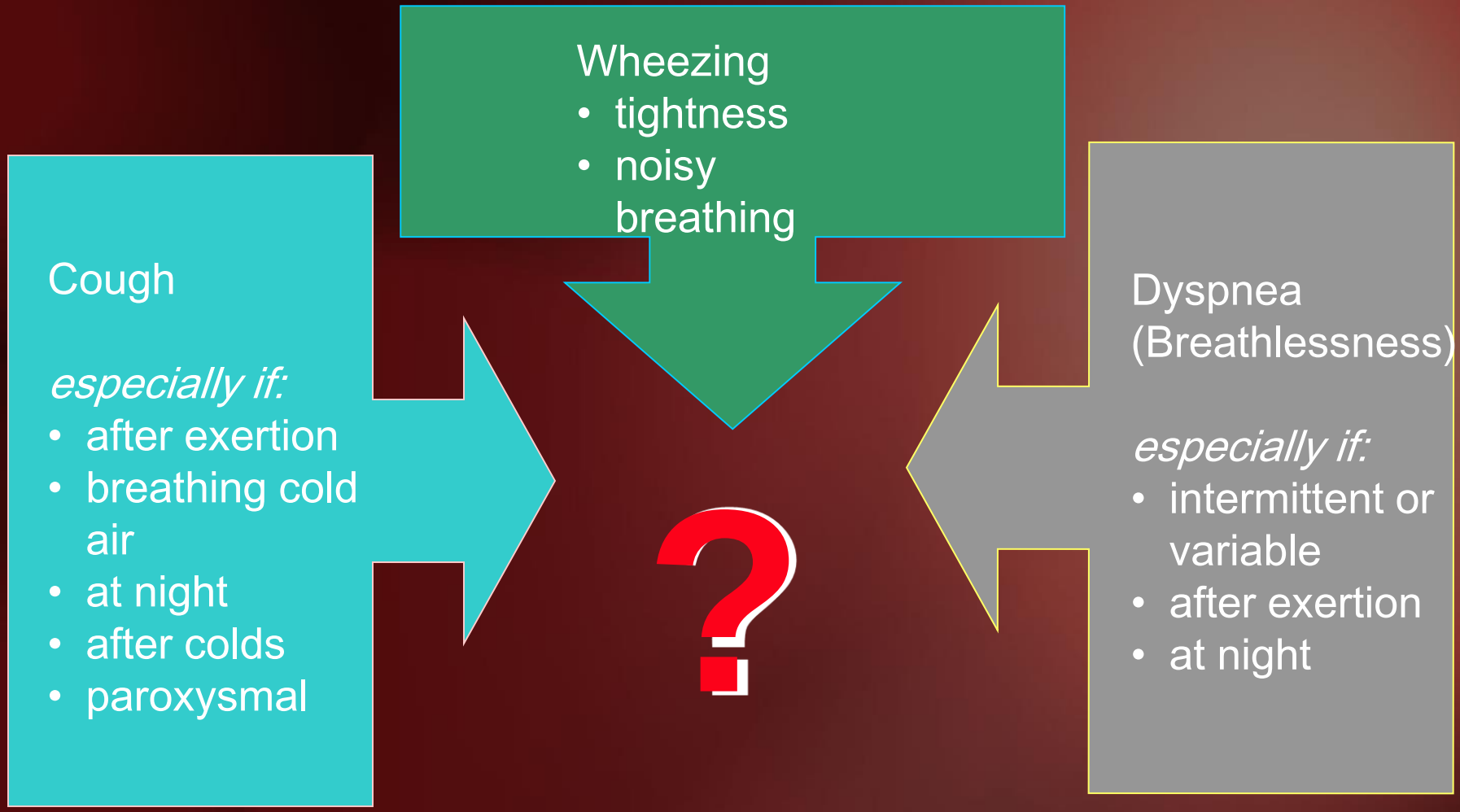
Wheezing may or may not be present

Asthma Diagnosis
Physical Exam

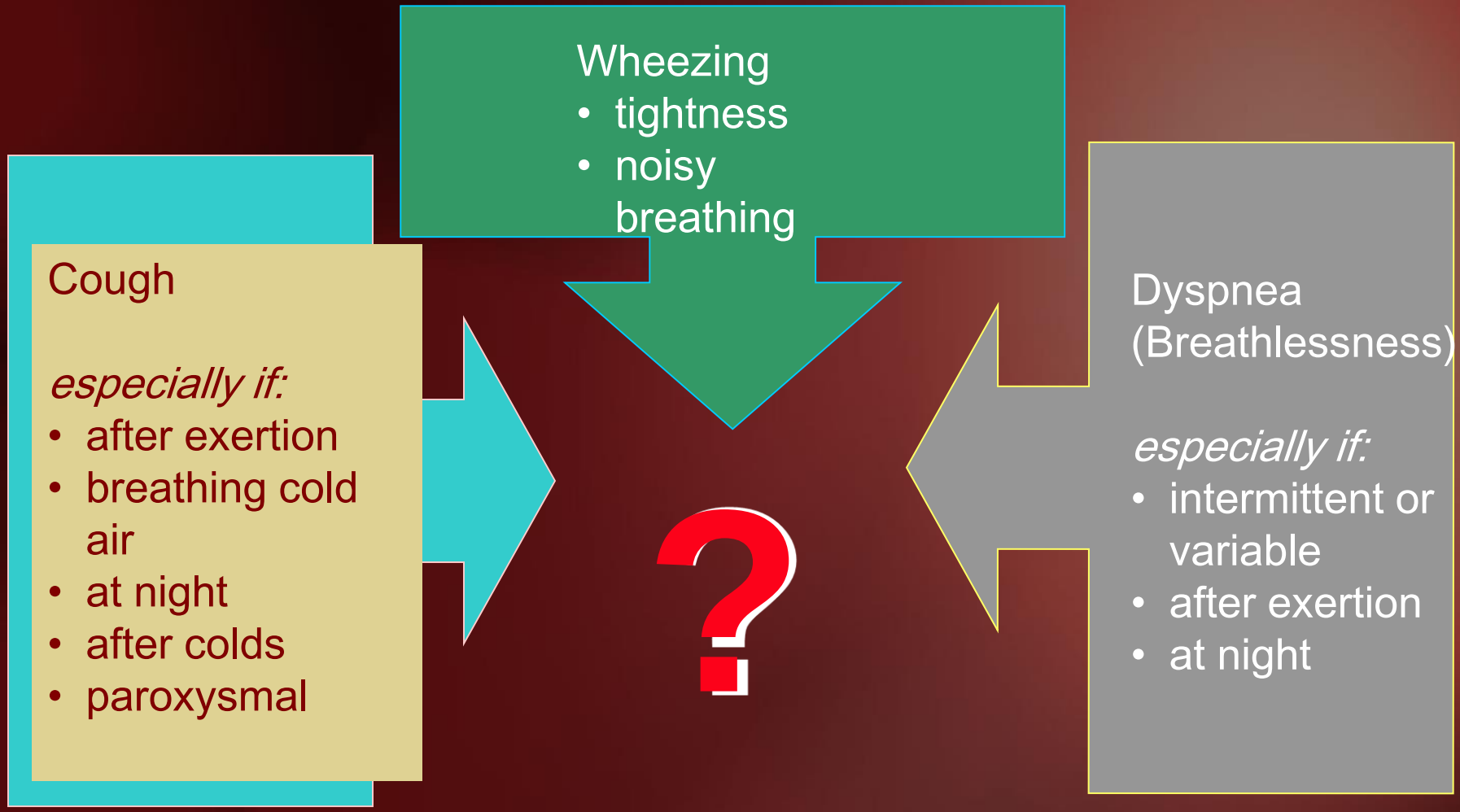
- Coughing, wheezing
- Prolonged forced expiration
- Use of accessory muscles
- Retractions
- Hyperexpansion of the chest
- Signs of other allergic diseases:
  - Atopic dermatitis
  - Allergic rhinitis

Physical examination of the chest may be normal

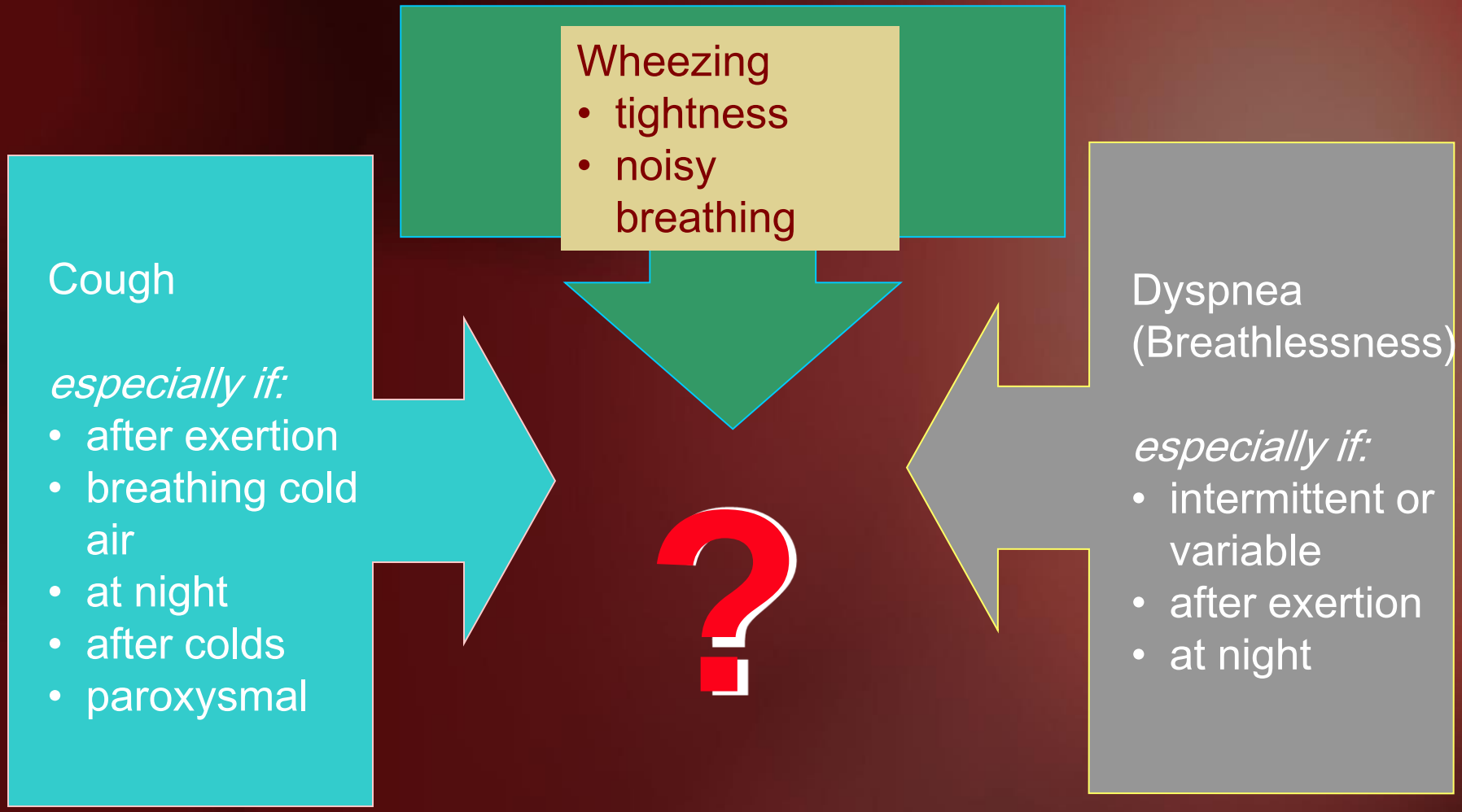
Asthma Diagnosis



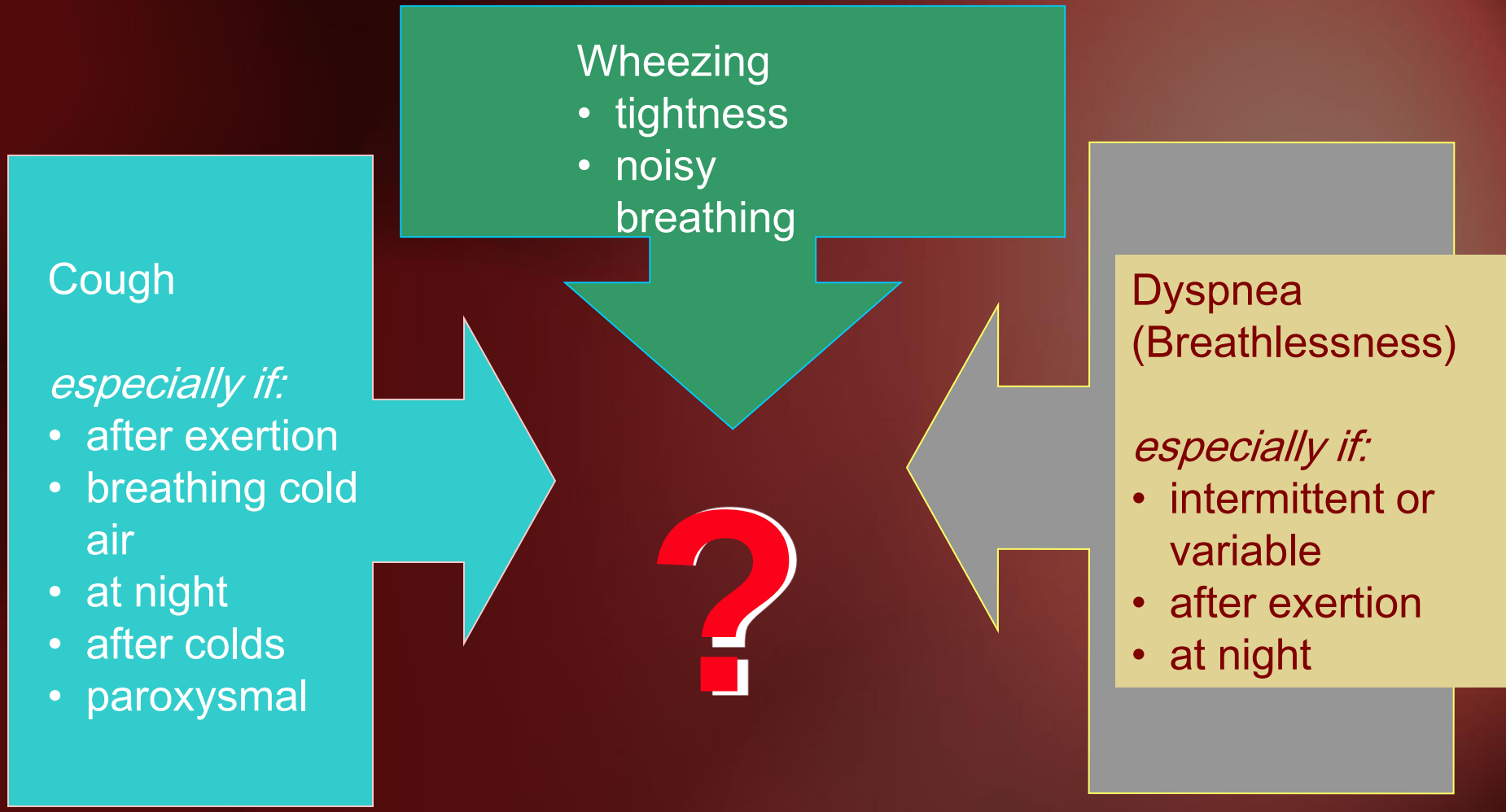
Asthma Diagnosis



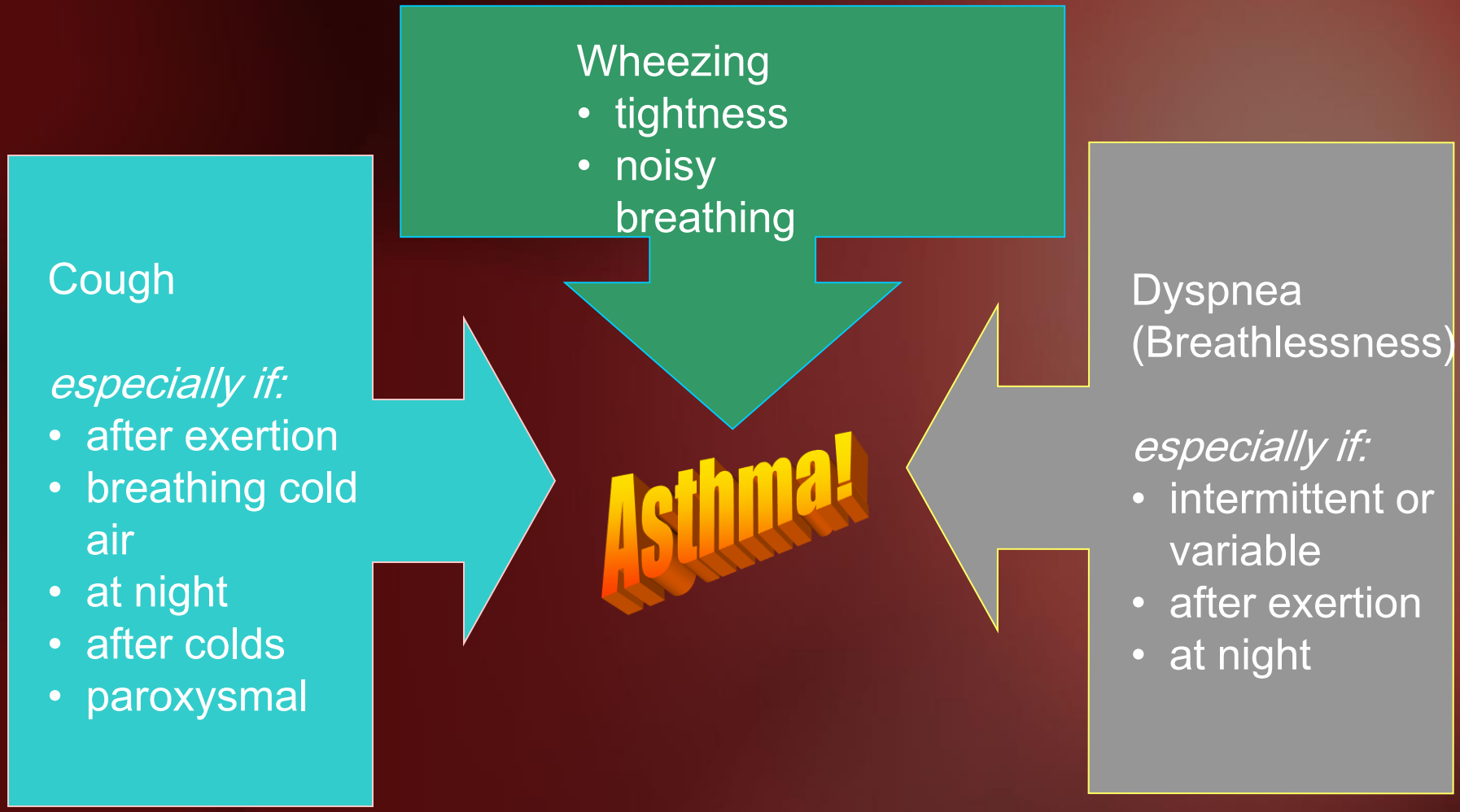
Asthma Diagnosis



Asthma Diagnosis



Asthma Diagnosis



Features suggesting asthma in children ≤5 years

Feature	Characteristics suggesting asthma
Cough  	Recurrent or persistent non-productive 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 Prolonged cough in infancy, and cough without cold symptoms, are associated with later parent-reported physician-diagnosed asthma, independent of infant wheeze
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; tires 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 ICS and as-needed SABA	Clinical improvement during 2–3 months of controller treatment and worsening when treatment is stopped

Asthma Predictive Index (API)

- High risk children (under age 3) who:
  - have had ≥ 4 wheezing episodes in the past year that lasted more than one day and affected sleep are significantly *more* likely to have persistent asthma after the age of 5 if they have either (1) of the following:

OR

One major criteria

- Parent with asthma
- Physician diagnosis of atopic dermatitis
- Evidence of sensitization to aeroallergens

Two minor criteria

- Evidence of sensitization to foods
- ≥4 percent blood eosinophilia
- Wheezing apart from colds

Castro-Rodriguez J et al. *AJRCCM* 2000; 162:1403-1406.

Asthma Predictive Index (API)

- Birth cohort followed through 13 years of age
- 76% of children diagnosed with asthma after 6 years of age had a positive asthma predictive index before 3 years of age.
- 97% of children who did not have asthma after 6 years of age had a negative asthma predictive index before 3 years of age.

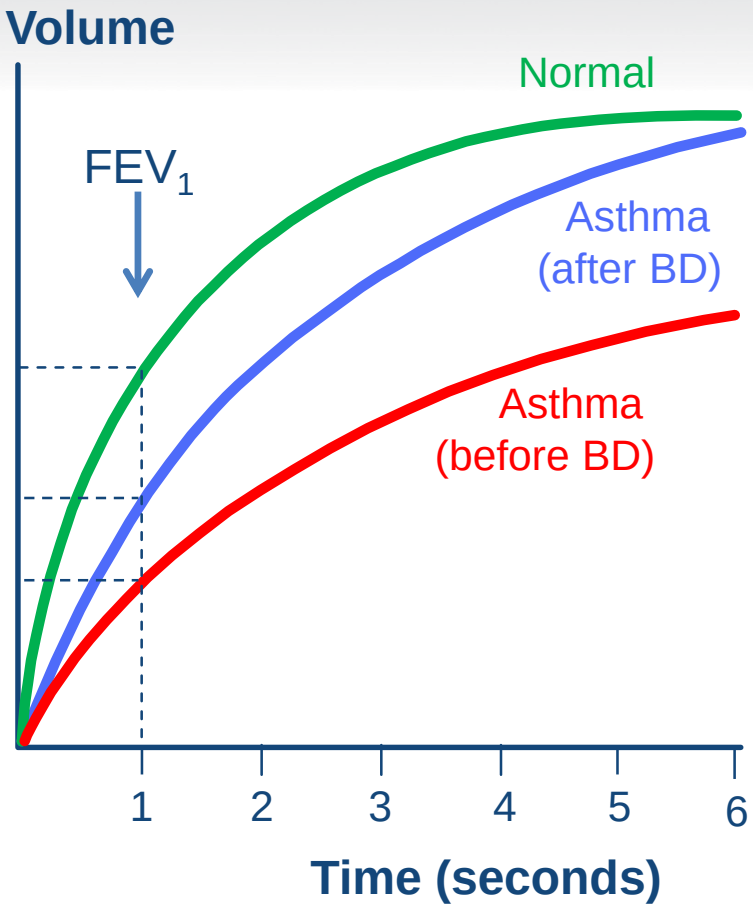
Castro-Rodriguez J et al. *AJRCCM* 2000; 162:1403-1406.

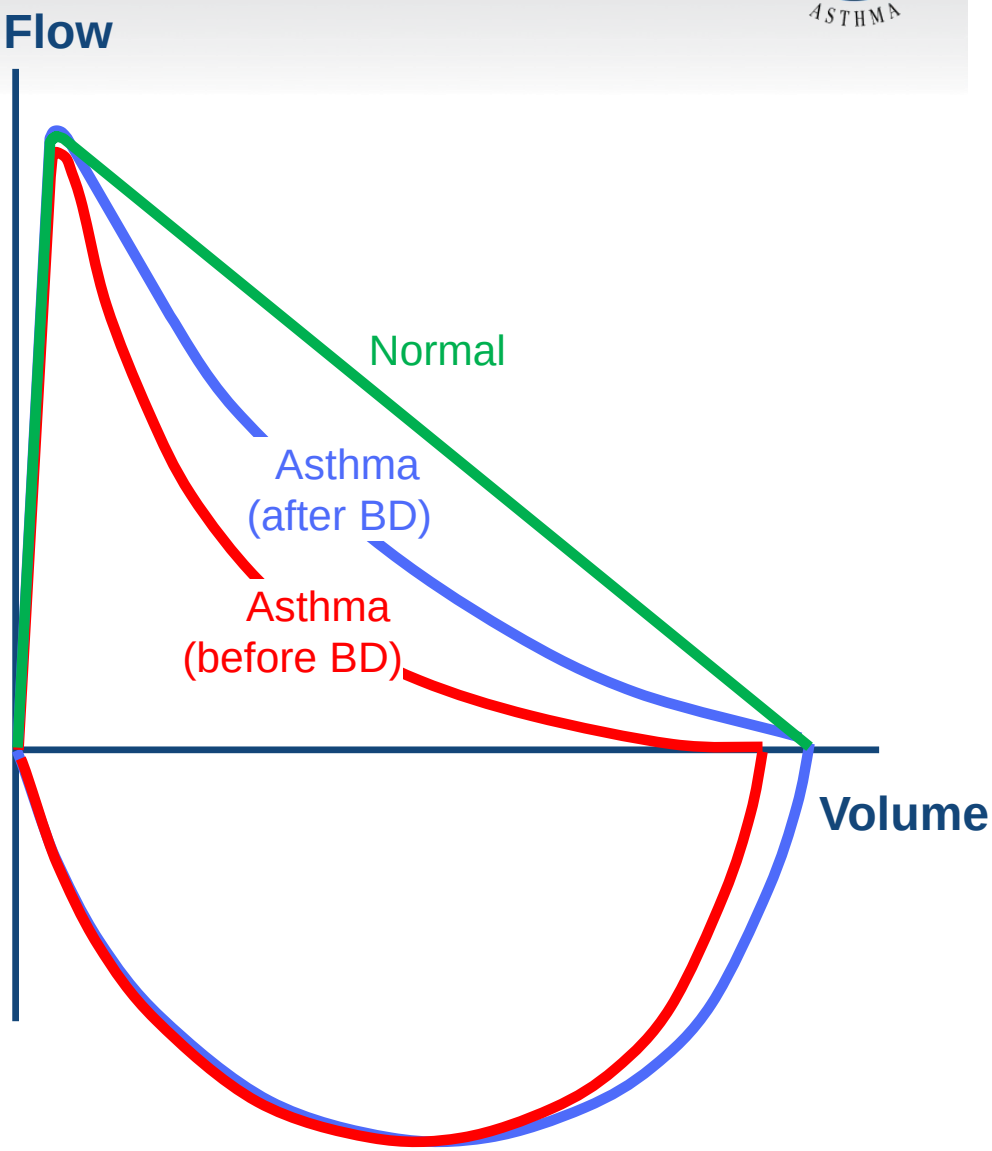
Spirometry

Measurements of Lung Function

- FEV_1
  - volume forcefully exhaled in 1 sec.
  - assesses large airways
- FVC
  - forced vital capacity
  - total amount forcefully exhaled
- FEV1 / FVC Ratio
  - helps differentiate obstruction vs. restriction
- FEF 25-75%
  - assesses small airways

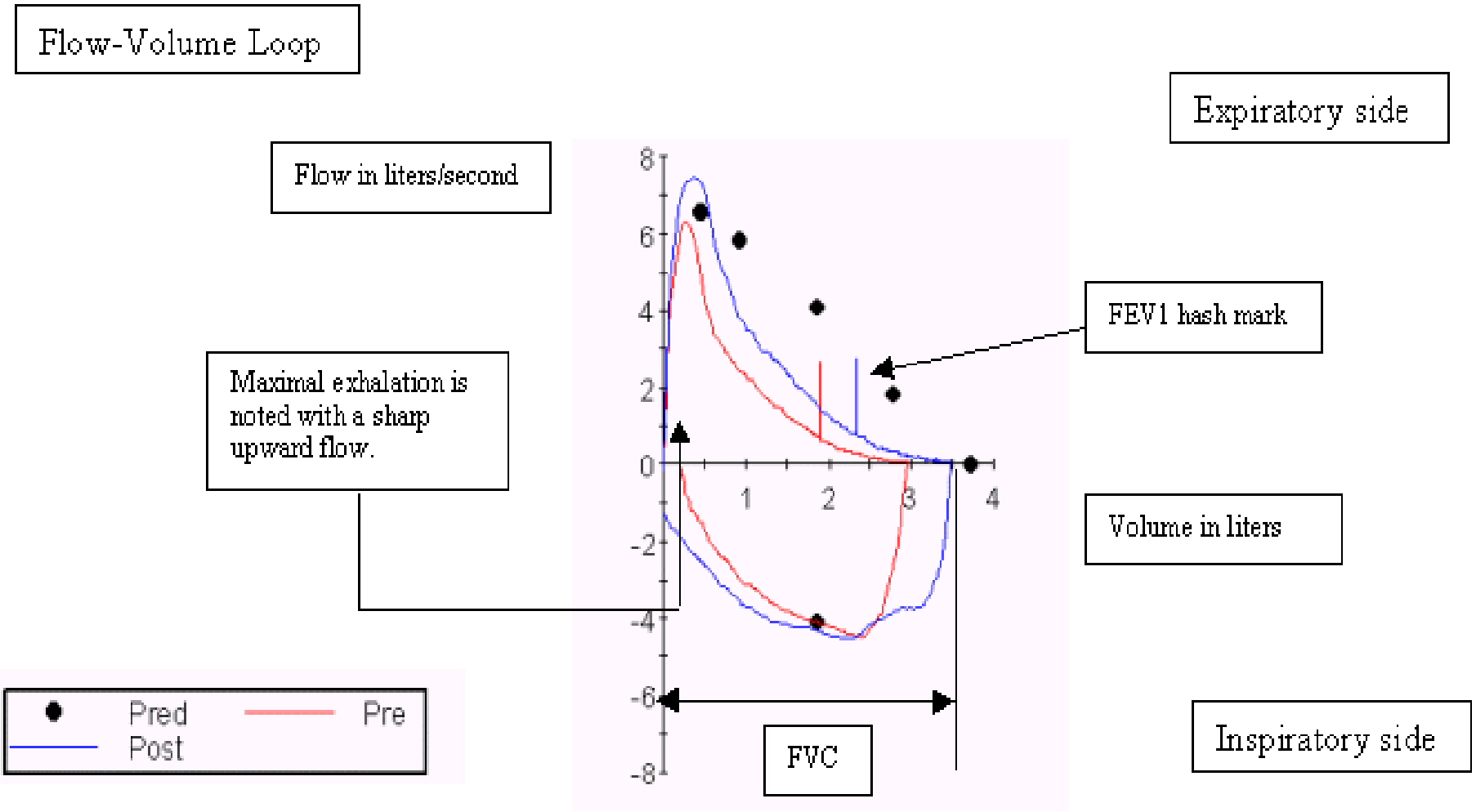
Typical spirometric tracings





Note: Each FEV_1 represents the highest of three reproducible measurements

Spirometry: Flow-Volume Loop Obstruction



Asthma Diagnosis
Measurements of Lung Function

Spirometry / Pulmonary Function Testing

Obstruction

- FEV_1 < 80%
- FEV_1 / FVC ratio < 80%

Reversibility

- FEV_1 change of > 12% and 200mL
- FEF_{25-75} change of > 25%

Diagnosis

Spirometry Results

- Classic finding is baseline spirometry reveals obstruction
- Post-bronchodilator spirometry may reveal reversibility
- Can still pursue post-bronchodilator spirometry even if baseline spirometry is normal
- Usually recommend 4 puffs of albuterol with spacer for post-bronchodilator trial
- Even if these values are all normal that does not completely exclude asthma

Flow-Volume Loops Side by Side Comparison

Exhalation Loops

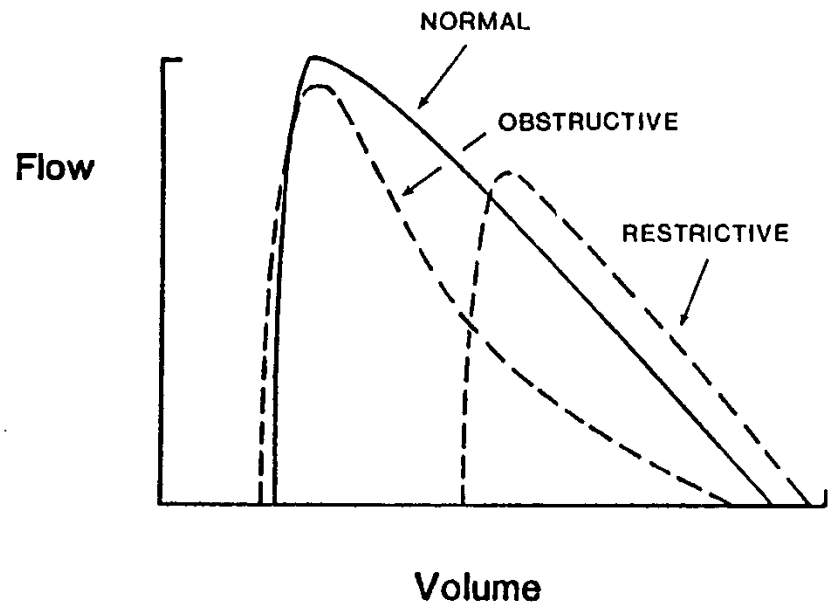


FIGURE 10–13. Changes in maximal expiratory flow-volume curve configuration occurring with mild to moderate restrictive or obstructive respiratory dysfunction. (Modified from Baum GL and Wolinsky E: Textbook of Pulmonary Diseases. 5th ed. Boston, Little, Brown & Co, 1994, with permission.)

Spirometric Results

Obstructive

- similar width to normal
- “scooped” appearance
- concave appearance

Restrictive

- narrowed width
- similar shape

Spirometry

- Patient Positioning & Coaching
  - Critical to achieving acceptable spirometry
  - Stand or sit upright – no bending at the waist
  - Trunk upright
  - Chin slightly elevated
  - Neck in extension
  - Nose clips (+/-) Be consistent

Spirometry: Bronchodilator Studies

- A normal baseline lung function test *does NOT rule out asthma*, nor does it negate the need for a post-bronchodilator study
- It is quite possible that your patient's flow-volume loops could still improve after 2-4 puffs of a bronchodilator!

Diagnosis

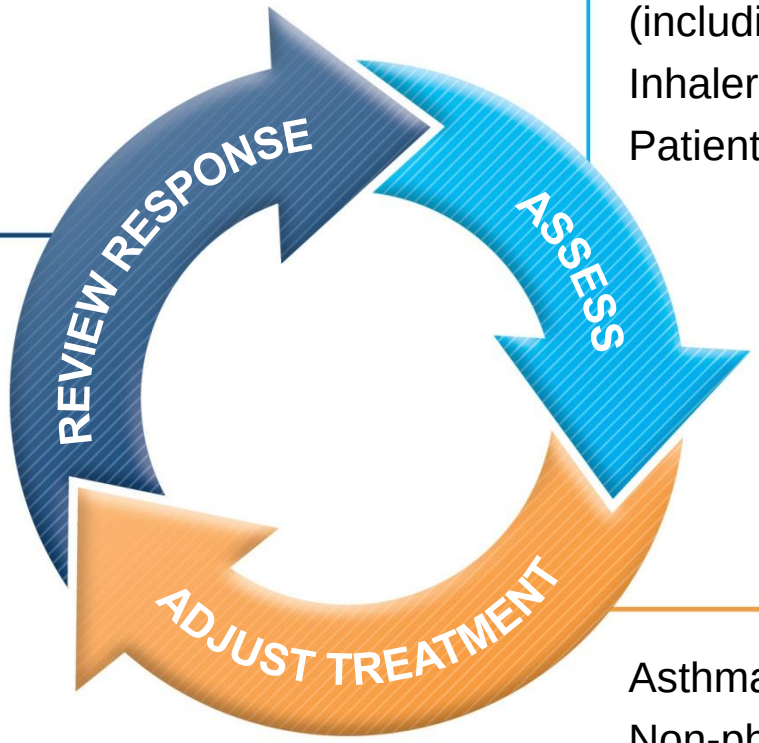
- Response to Medications
  - If still suspect asthma can pursue medication trial
  - Can consider a 2 to 4 week trial of inhaled steroid
  - Could also consider 2 week trial of oral steroids
  - Assess for spirometry changes at follow up
  - Significant improvement in symptoms and spirometry is consistent with asthma

CLASSIFYING ASTHMA SEVERITY AND INITIATING TREATMENT IN YOUTHS ≥ 12 YEARS AND ADULTS

EPR-3, p74, 344

Components of Severity		Classification of Asthma Severity			
		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 not daily	Daily	Continuous
	Nighttime Awakenings	≤2x/month	3-4x/month	>1x/week not nightly	Often nightly
	SABA use for sx control	≤2 days/week	>2 days/week not daily	Daily	Several times daily
	Interference with normal activity	none	Minor limitation	Some limitation	Extremely limited
	Lung Function	• Normal FEV_1 between exacerbations • FEV_1 > 80% • FEV_1/FVC normal	• FEV_1 >80% • FEV_1/FVC normal	• FEV_1 >60% but< 80% • FEV_1/FVC reduced 5%	• FEV_1 <60% • FEV_1/FVC reduced >5%
Risk	Exacerbations (consider frequency and severity)	0-2/year	> 2 /year →		
		Frequency and severity may vary over time for patients in any category			
		Relative annual risk of exacerbations may be related to FEV_1			
Recommended Step for Initiating Treatment		**Step 1**	**Step 2**	**Step 3** Consider short course of oral steroids	**Step 4 or 5**
		In 2 - 6 weeks, evaluate asthma control that is achieved and adjust therapy accordingly			

The control-based asthma management cycle



Diagnosis

Symptom control & risk factors (including lung function)

Inhaler technique & adherence

Patient preference

Symptoms

Exacerbations

Side-effects

Patient satisfaction

Lung function

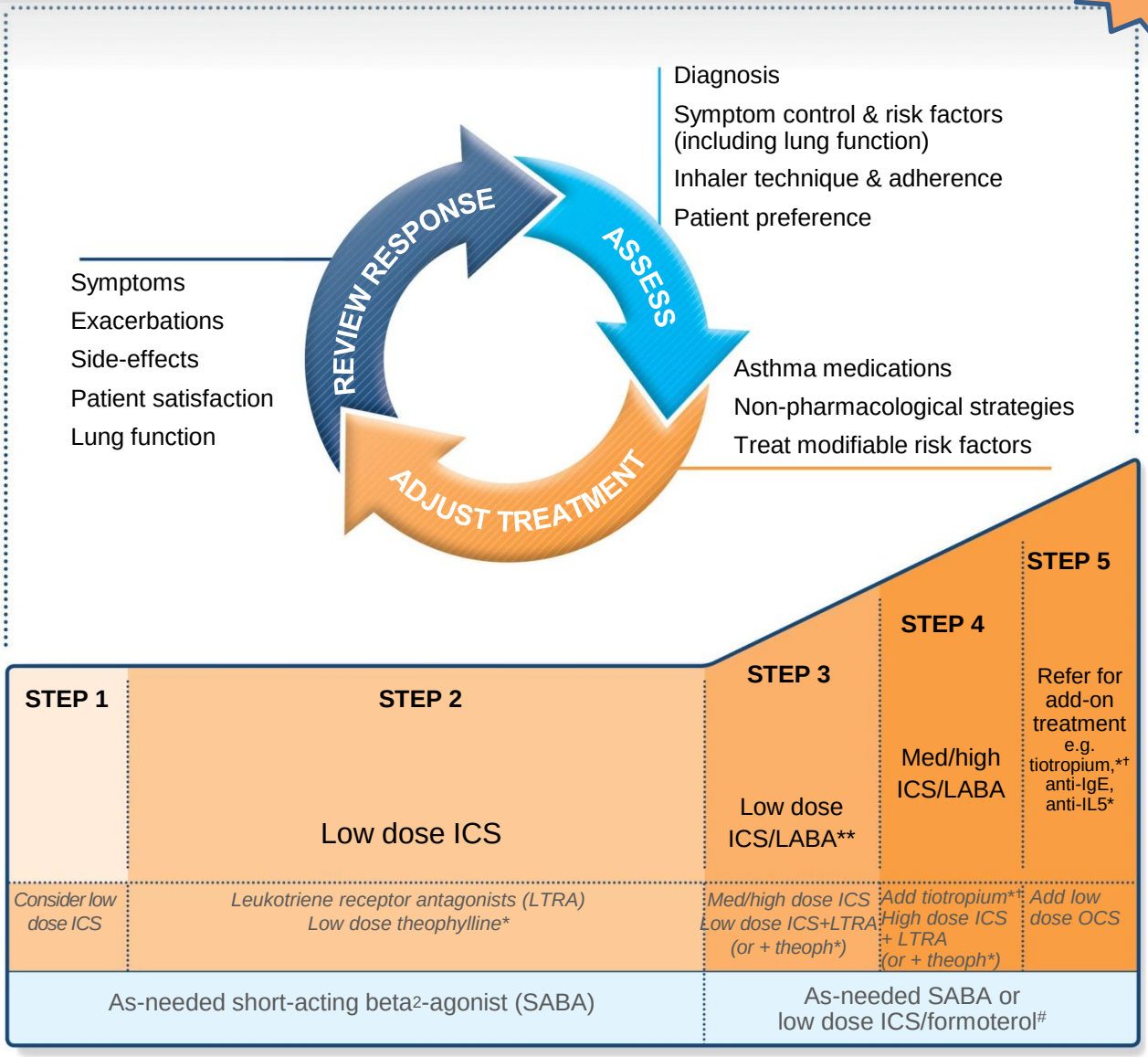
Asthma medications

Non-pharmacological strategies

Treat modifiable risk factors

Stepwise management - pharmacotherapy

UPDATED 2017



*Not for children <12 years

**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS

#For patients prescribed BDP/formoterol or BUD/formoterol maintenance and reliever therapy

† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations

Stepwise management – additional components

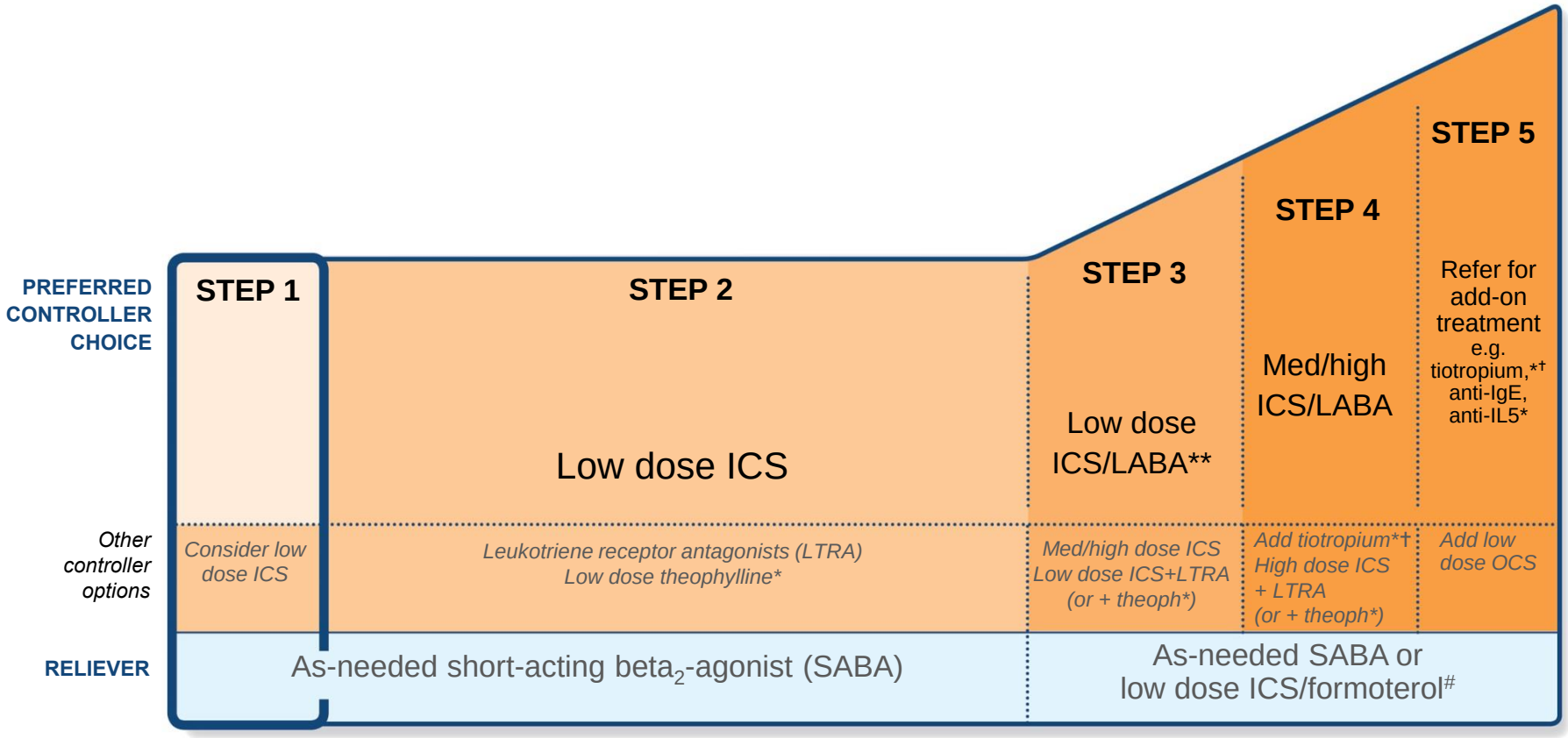
UPDATED 2017

REMEMBER TO...

- Provide guided self-management education
- Treat modifiable risk factors and comorbidities
- Advise about non-pharmacological therapies and strategies
- Consider stepping up if … uncontrolled symptoms, exacerbations or risks, but check diagnosis, inhaler technique and adherence first
- Consider adding SLIT in adult HDM-sensitive patients with allergic rhinitis who have exacerbations despite ICS treatment, provided FEV_1 is 70% predicted
- Consider stepping down if … symptoms controlled for 3 months + low risk for exacerbations. Ceasing ICS is not advised.

SLIT: sublingual immunotherapy

Step 1 – as-needed inhaled short-acting beta$_2$-agonist (SABA)



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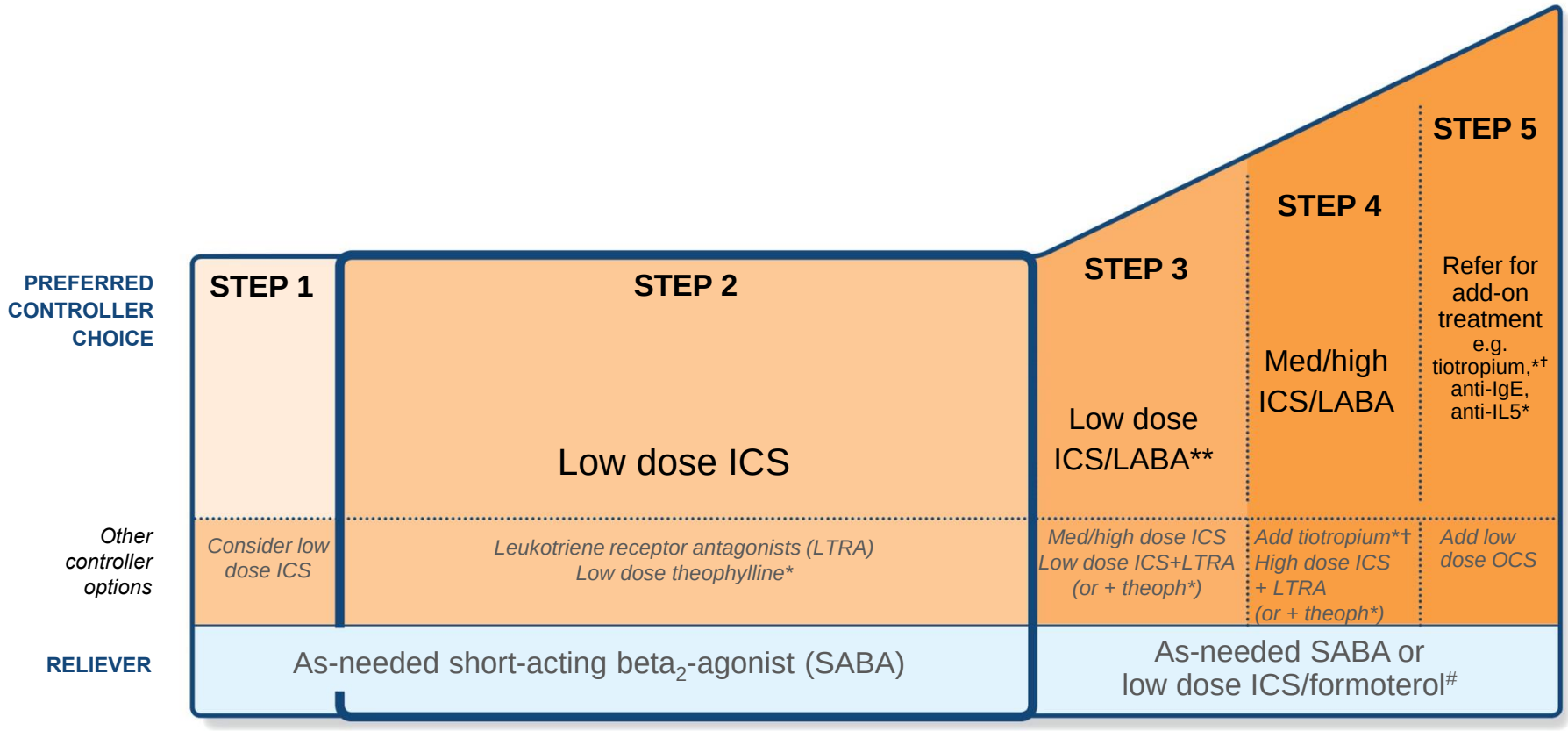
Step 2 – low-dose controller + as-needed inhaled SABA



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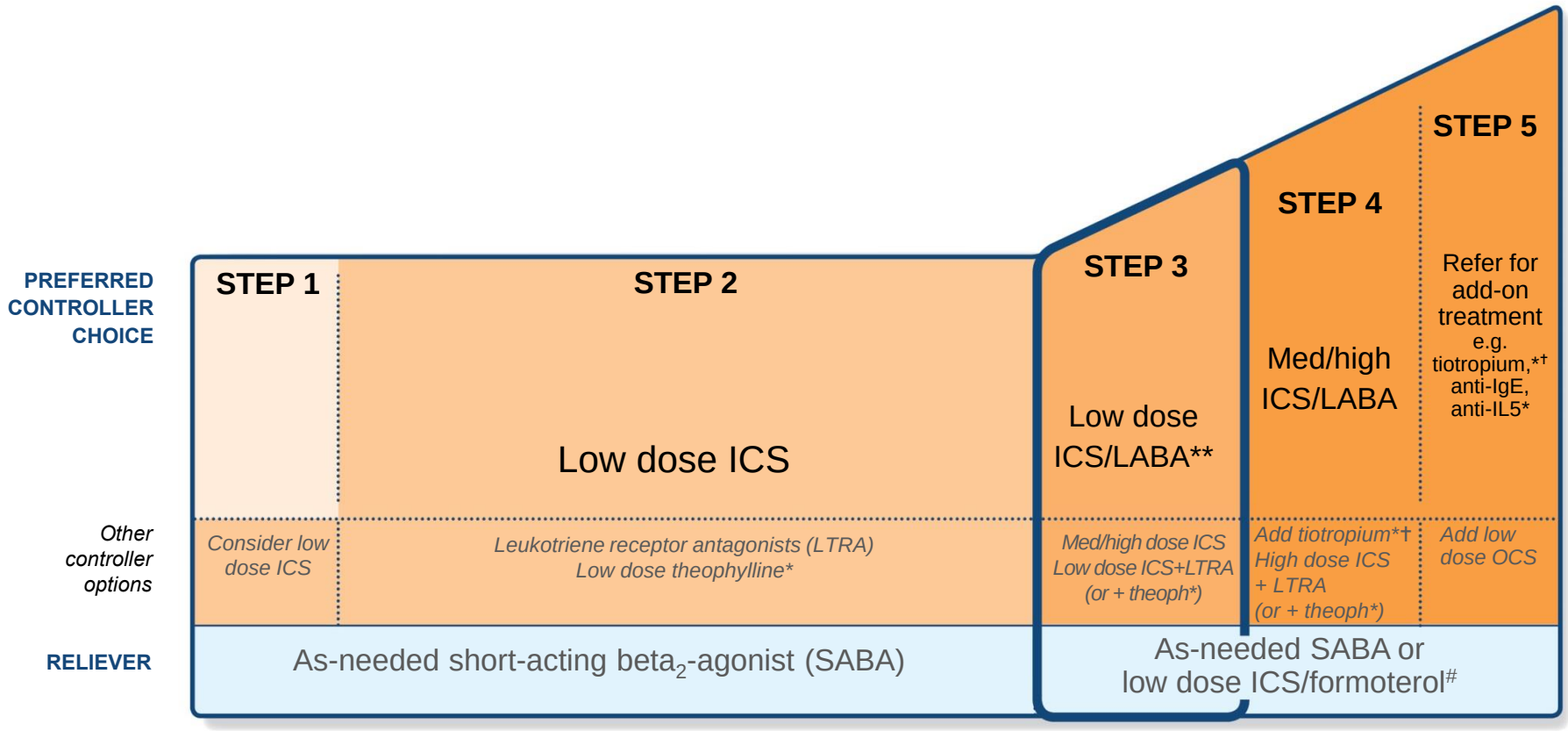
Step 3 – one or two controllers + as-needed inhaled reliever



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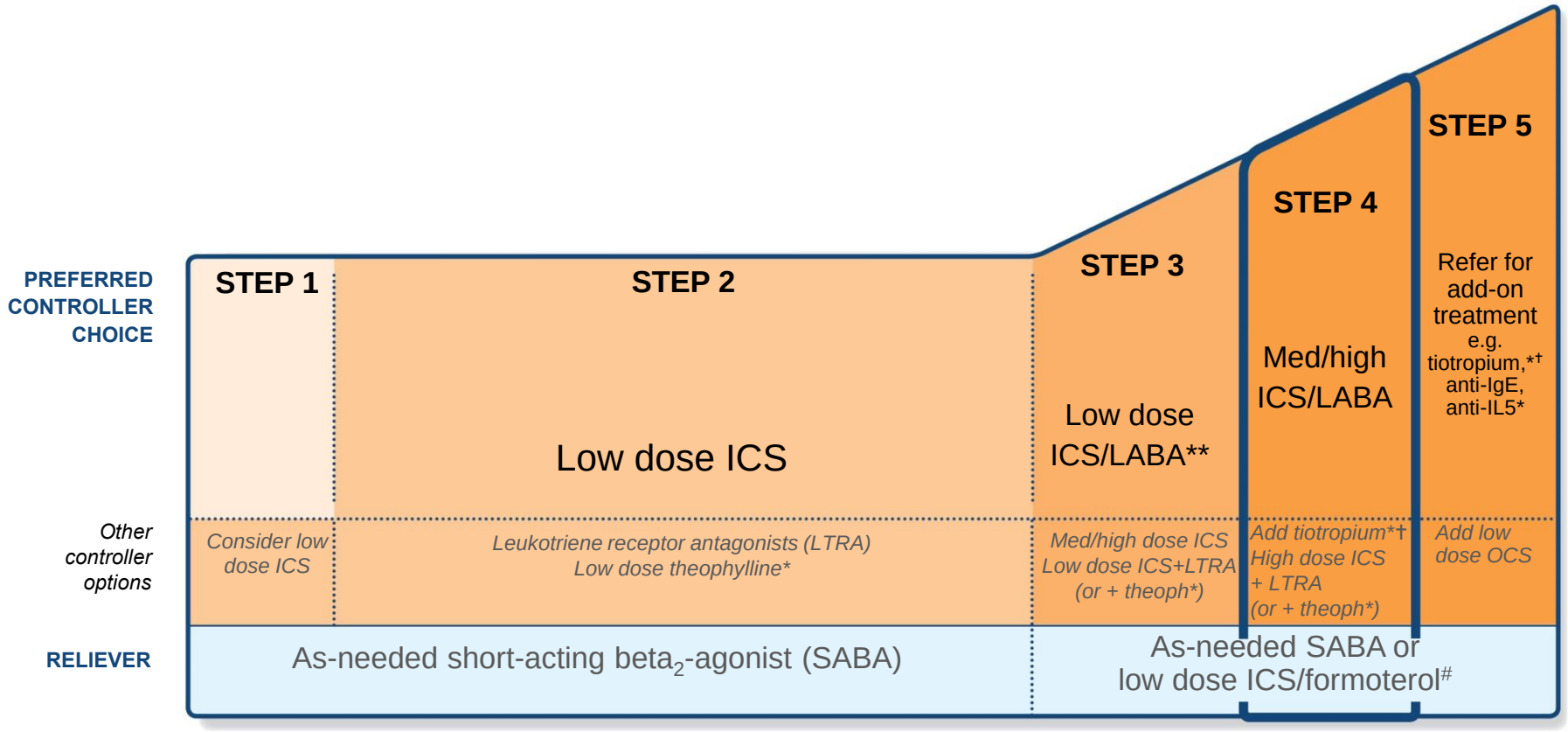
Step 4 – two or more controllers + as-needed inhaled reliever



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Step 5 – higher level care and/or add-on treatment

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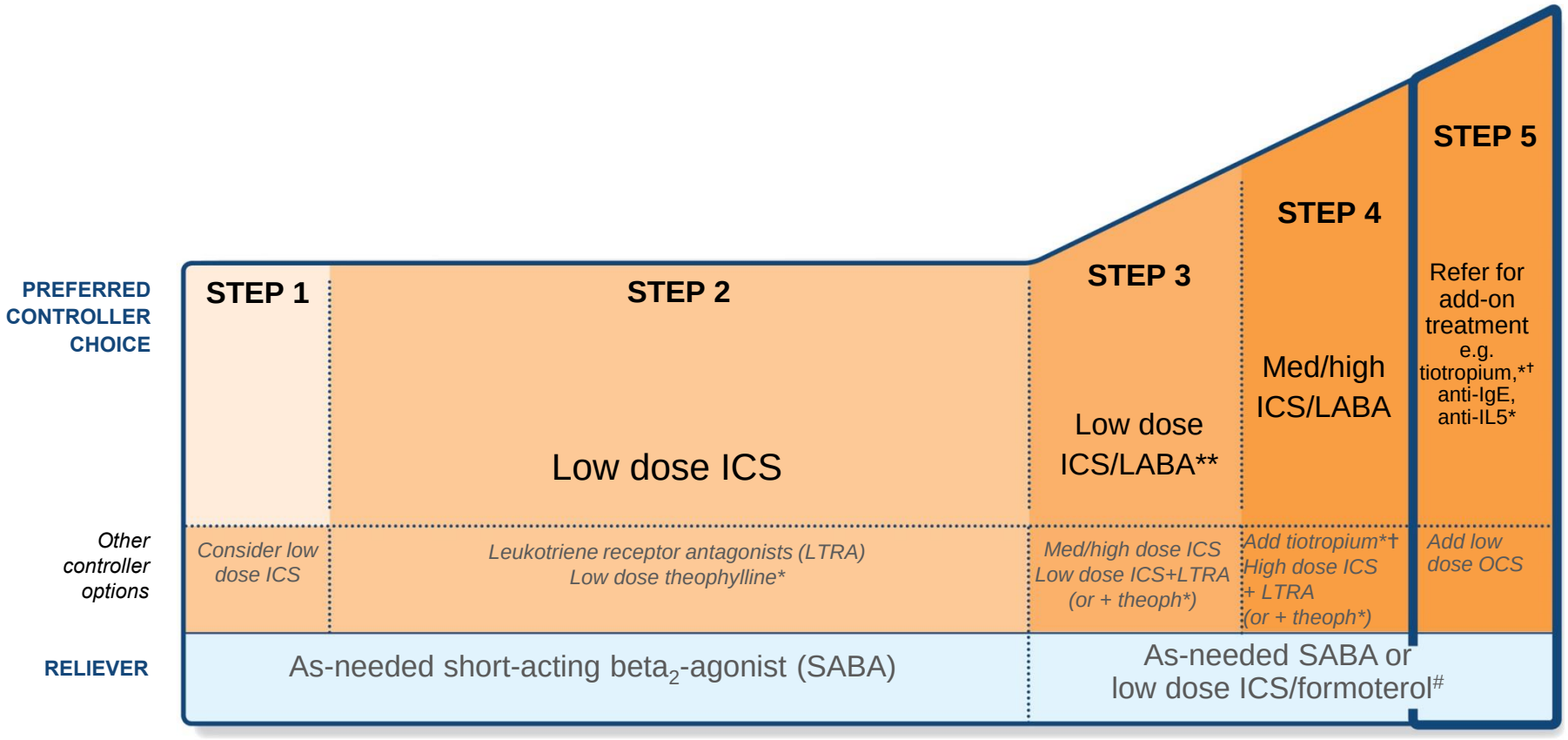

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ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN YOUTHS ≥ 12 YEARS OF AGE AND ADULTS

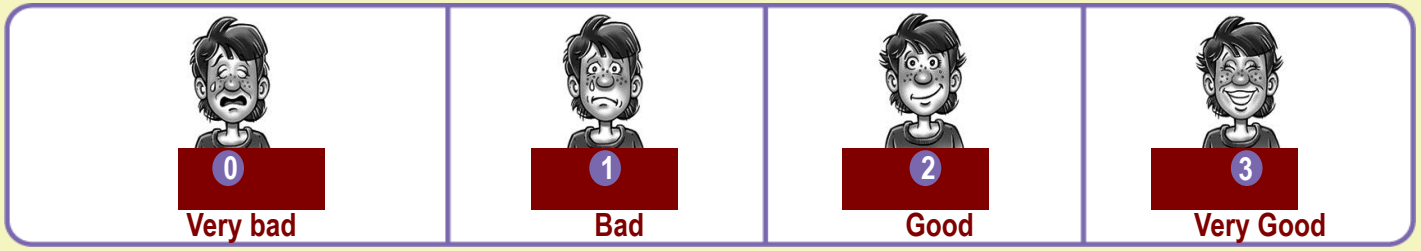
EPR-3, p77, 345

Components of Control		Classification of Asthma Control		
		Well Controlled	**Not Well Controlled**	**Very Poorly Controlled**
IMPAIRMENT	Symptoms	≤ 2 days/week	> 2 days/week	Throughout the day
	Nighttime awakenings	≤ 2/month	1-3/week	≥ 4/week
	Interference with normal activity	none	Some limitation	Extremely limited
	SABA use	≤ 2 days/week	> 2 days/week	Several times/day
	FEV_1 or peak flow	> 80% predicted/ personal best	60-80% predicted/ personal best	<60% predicted/ personal best
	Validated questionnaires ATAQ/ACT	0/≥ 20	1-2/16-19	3-4/≤15
RISK	Exacerbations	0- 1 per year	2 - 3 per year	> 3 per year
	Progressive loss of lung function	Evaluation requires long-term follow up care		
	Rx-related adverse effects	Consider in overall assessment of risk		
Recommended Action For Treatment		• **Maintain current step** • **Consider step down if well controlled at least 3 months**	• **Step up 1 step** • **Reevaluate in 2 - 6 weeks**	• **Consider oral steroids** • **Step up 1-2 weeks and reevaluate in 2 weeks**

Childhood Asthma Control Test™ (ACT): Questions Completed by Child

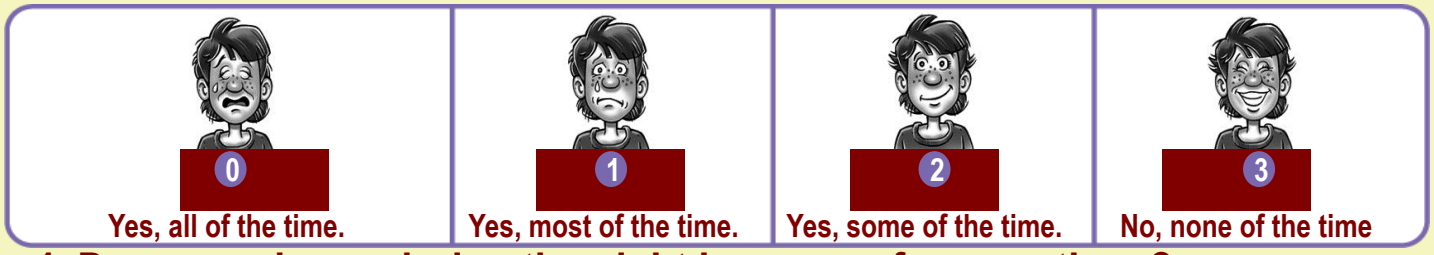
SCORE

1. How is your asthma today?

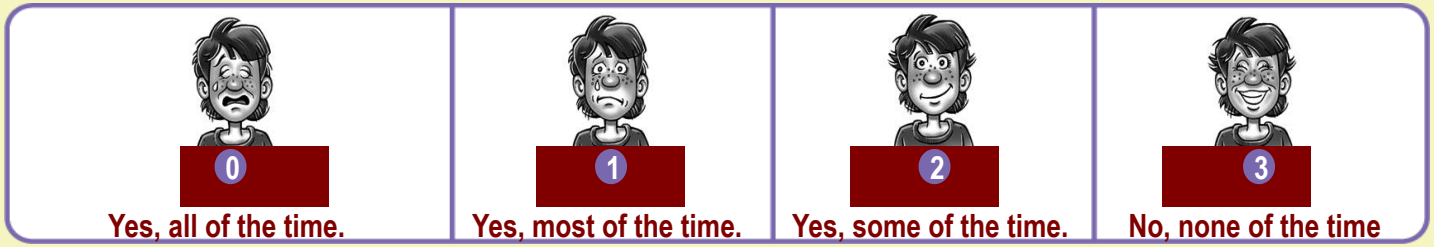


2. How much of a problem is your asthma when you run, exercise or play sports?

3. Do you cough because of your asthma?



4. Do you wake up during the night because of your asthma?



Childhood Asthma Control Test™ (ACT): Questions Completed by Parent/Caregiver

5. During the last 4 weeks, on average, how many days per month did your child have any daytime asthma symptoms?

5	4	3	2	1	0
Not at all	1-3 days/mo	4-10 days/mo	11-18 days/mo	19-24 days/mo	Everyday

6. During the last 4 weeks, on average, how many days per month did your child wheeze during the day because of asthma?

5	4	3	2	1	0
Not at all	1-3 days/mo	4-10 days/mo	11-18 days/mo	19-24 days/mo	Everyday

7. During the last 4 weeks, on average, how many days per month did your child wake up during the night because of asthma?

5	4	3	2	1	0
Not at all	1-3 days/mo	4-10 days/mo	11-18 days/mo	19-24 days/mo	Everyday

TOTAL

Asthma Control Test™ (ACT) for Patients 12 Years and Older

Score

1. In the past **4 weeks,** how much of the time did your **asthma** keep you from getting as much done at work, school or at home?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
1	2	3	4	5

2. During the past **4 weeks,** how often have you had shortness of breath?

More than once a day	Once a day	3 to 6 times a week	Once or twice a week	Not at all
1	2	3	4	5

3. During the past **4 weeks,** how often did your **asthma** symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night, or earlier than usual in the morning?

4 or more nights a week	2 or 3 nights a week	Once a week	Once or twice	Not at all
1	2	3	4	5

4. During the past **4 weeks,** how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

3 or more times per day	1 or 2 times per day	2 or 3 times per week	Once a week or less	Not at all
1	2	3	4	5

5. How would you rate your **asthma** control during the past **4 weeks**?

Not controlled at all	Poorly controlled	Somewhat controlled	Well controlled	Completely controlled
1	2	3	4	5

Patient Total Score

Treatment Strategies

Gain Control!

- Aggressive, intensive initial therapy to suppress airway inflammation and gain prompt control

Maintain Control

- Frequent follow-up clinically and physiologically
- Therapeutic modifications depending on severity and clinical course
- “Step down” long-term control medications to maintain control with minimal side effects

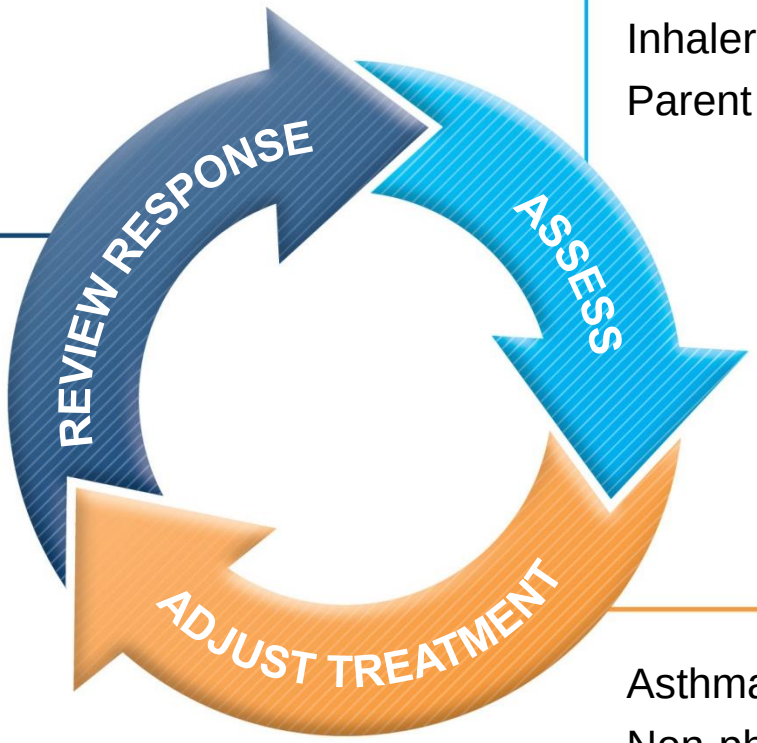
Recommended Action for Treatment Based on Assessment of Control

Well Controlled	Not Well Controlled	Very Poorly Controlled
Maintain current step	Step up 1 step and reevaluate in 2-6 weeks	Consider short course of oral corticosteroids
Consider step down if well controlled for at least 3 months	For side effects, consider alternative treatment options	Step up 1-2 steps and reevaluate in 2 weeks
		For side effects, consider alternative treatment options

Before stepping up check adherence and environmental control

Control-based asthma management cycle in children ≤5 years

Diagnosis
Symptom control & risk factors
Inhaler technique & adherence
Parent preference



Symptoms
Exacerbations
Side-effects
Parent satisfaction

Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors

Monitoring Asthma Control

Ask the patient

- Has your asthma awakened you at night or early morning?
- Have you needed more rescue inhaler than usual?
- Have you needed urgent care for asthma? (office, ED, etc)
- Are you participating in your usual or desired activities?
- What are your triggers? (and how can we manage them?)

Actions to consider

- Assess whether medications are being taken as prescribed
- Assess whether inhalation technique is correct
- Assess spirometry and compare to previous measurements
- Adjust medications, as needed to achieve best control with the lowest dose needed to maintain control
- Environmental mitigation strategy

Check adherence with asthma medications

- Poor adherence:
  - Is very common: it is estimated that 50% of adults and children do not take controller medications as prescribed
  - Contributes to uncontrolled asthma symptoms and risk of exacerbations and asthma-related death
- Contributory factors
  - Unintentional (e.g. forgetfulness, cost, confusion) and/or
  - Intentional (e.g. no perceived need, fear of side-effects, cultural issues, cost)
- How to identify patients with low adherence:
  - Ask an empathic question, e.g. "*Do you find it easier to remember your medication in the morning or the evening?*", or "*Would you say you are taking it 3 days a week, or less, or more?*"
  - Check prescription date, label date and dose counter
  - Ask patient about their beliefs and concerns about the medication

Strategies to improve adherence in asthma

- Only a few interventions have been studied closely in asthma and found to be effective for improving adherence
  - Shared decision-making
  - Comprehensive asthma education with nurse home visits
  - Inhaler reminders for missed doses
  - Reviewing patients' detailed dispensing records

Guided asthma self-management and skills training

Essential components are:

- Skills training to use inhaler devices correctly
- Encouraging adherence with medications, appointments
- Asthma information
- Guided self-management support
  - Self-monitoring of symptoms and/or PEF
  - Written asthma action plan
  - Regular review by a health care provider

‘Guided self-management education’

- Highly effective in improving asthma outcomes
  - Reduced hospitalizations, ED visits, symptoms, night waking, time off work, improved lung function and quality of life
- Three essential components
  - Self-monitoring of symptoms and/or PEF
  - Written asthma action plan
    - Describe how to recognize and respond to worsening asthma
    - Individualize the plan for the patient’s health literacy and autonomy
    - Provide advice about a change in ICS and how/when to add OCS
    - If using PEF, base action plan on personal best rather than predicted
  - Regular medical review

Questions?

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