# BRONCHIAL ASTHMA

**Concerning bronchial asthma in children all of the :following is true, EXCEPT**

A. Common disorder in children

toddler B. Usually precipitated by viral infections in the age group

C. Is characterized by alveolar collapse

D. Is common at night

E. Broncho- spasm may be precipitated by house dust or mite in

the bed clothes

# 1. ASTHMA

- **Asthma is a chronic inflammatory disorder of airways with episodic airway obstruction**

**. Many cells and mediators are involved in this process – eosinophils, mast cells and T-lymphocytes. Chronic inflammation is associated with bronchial hyperresponsivness and leads to episodes of wheezing, coughing, tightness in the chest, breathlessness, shortage of breath specially at night and in the morning. This episodes are usually associated with variable obstruction which is reversible spontaneously or by treatment.**

# Asthma

- Usually associated with airflow obstruction of variable severity.
- Airflow obstruction is usually reversible, either spontaneously, or with treatment
- The inflammation associated with asthma causes an increase in the baseline bronchial hyperresponsiveness to a variety of stimuli

# BURDEN OF ILLNESS

- Significant cause of school/work absence.
- Health care expenditures very high.
- Morbidity and mortality are on the rise.

# Asthma Triggers

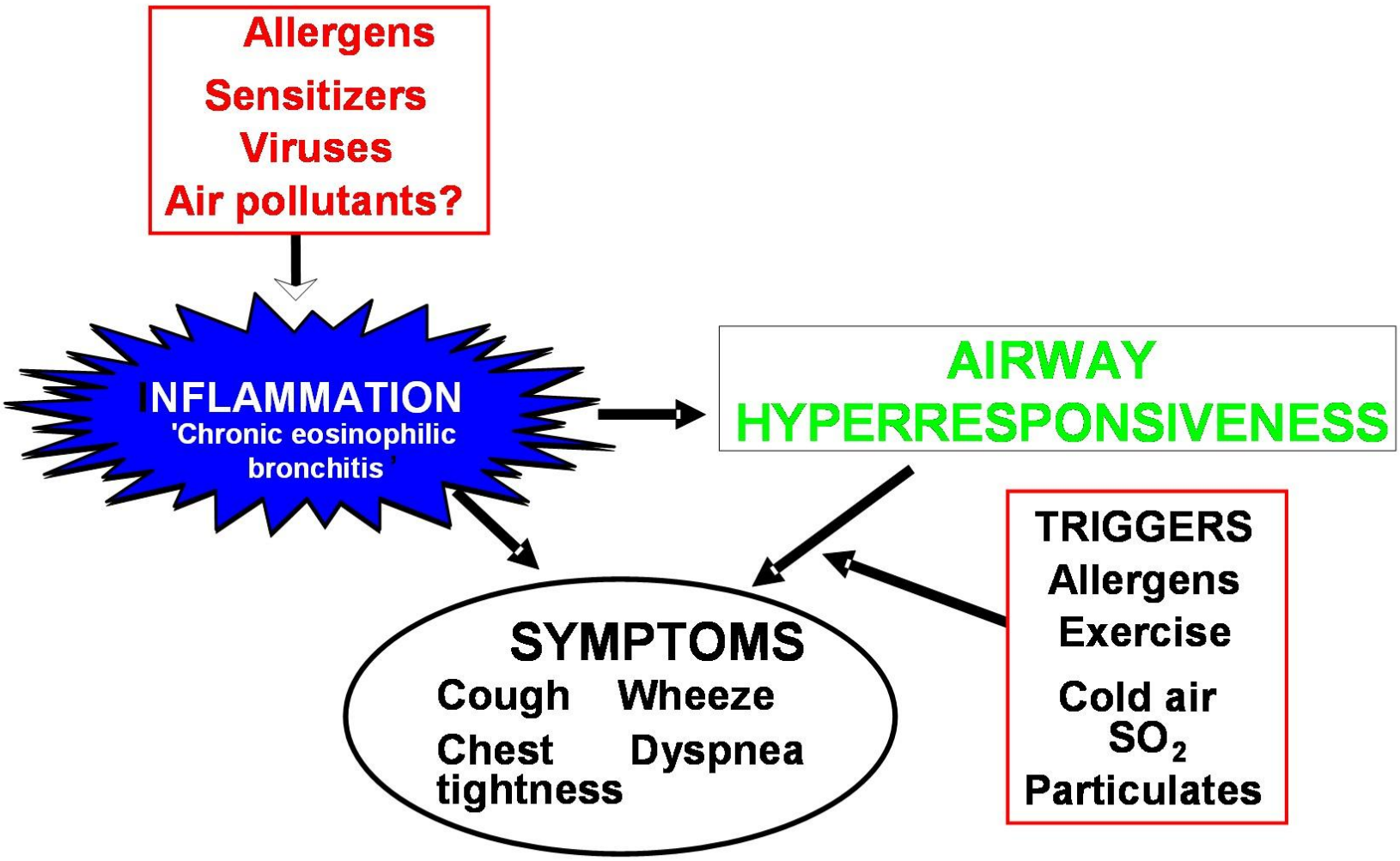
- Early childhood caused by viral

- Late by :
- Allergens
  - Dust mites, pollen, indoor and outdoor pollutants, irritants (smoke, perfumes, cleaning agents)
- Pharmacologic agents (ASA, beta-blockers)
- Physical triggers (exercise, cold air)
- Physiologic factors
  - Stress, GERD, viral and bacterial URI, rhinitis

- **May predispose to asthma**
- Childhood infections,
- e.g. respiratory syncytial virus
- Allergen exposure, e.g. house
- dust mite, household pets
- Indoor pollution
- Dietary deficiency of antioxidants
- Exposure to pets in early life

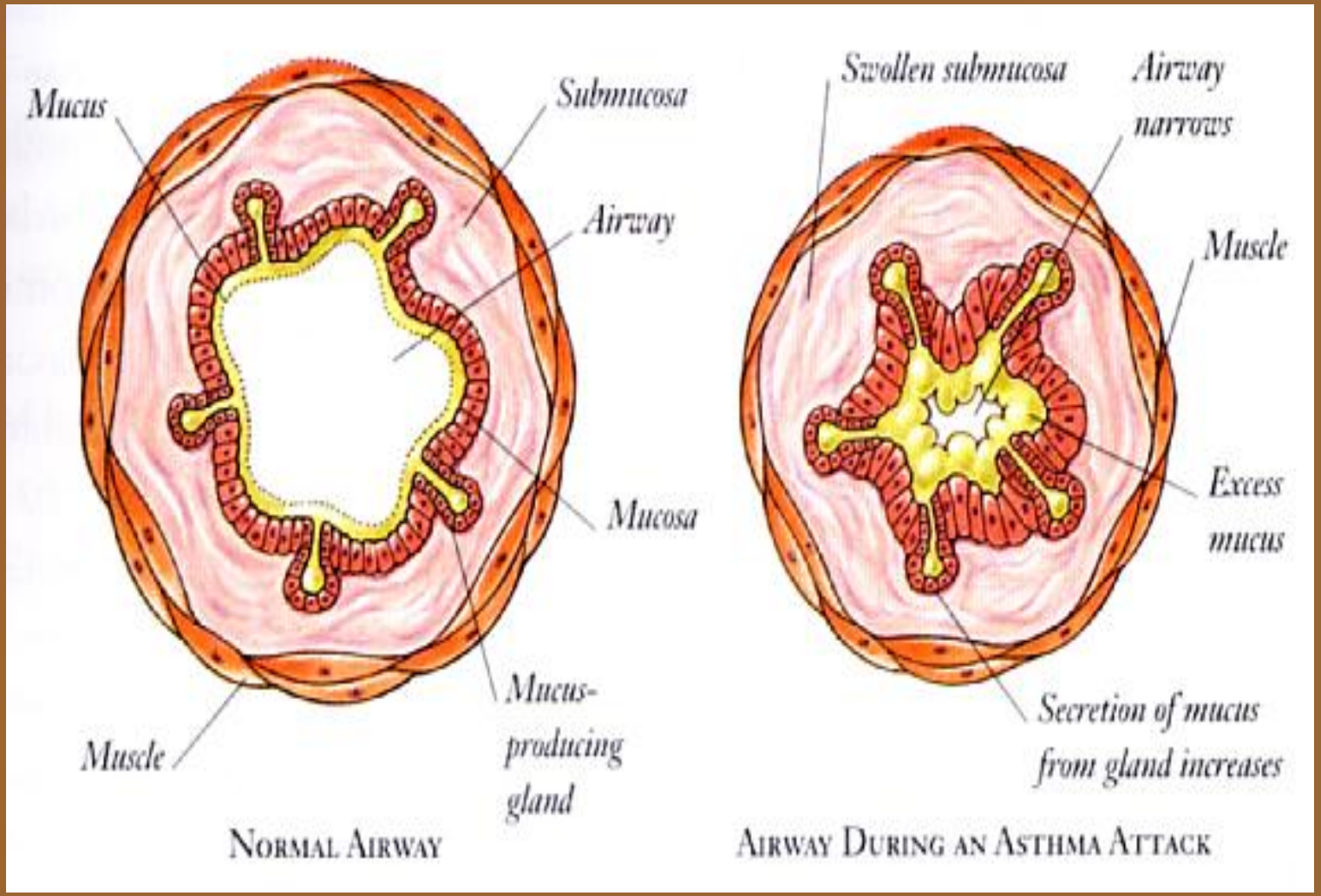
- **May protect against asthma**
- Living on farm
- Large families
- Childhood infections,
- including parasites
- Predominance of
- lactobacilli in gut flora
- Exposure to pets in early life

# Mechanisms: Asthma Inflammation

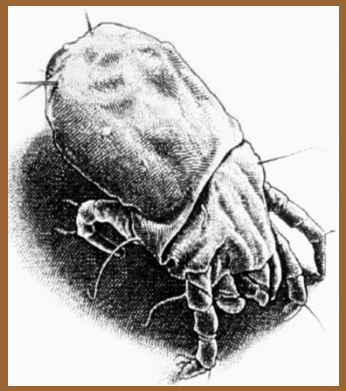


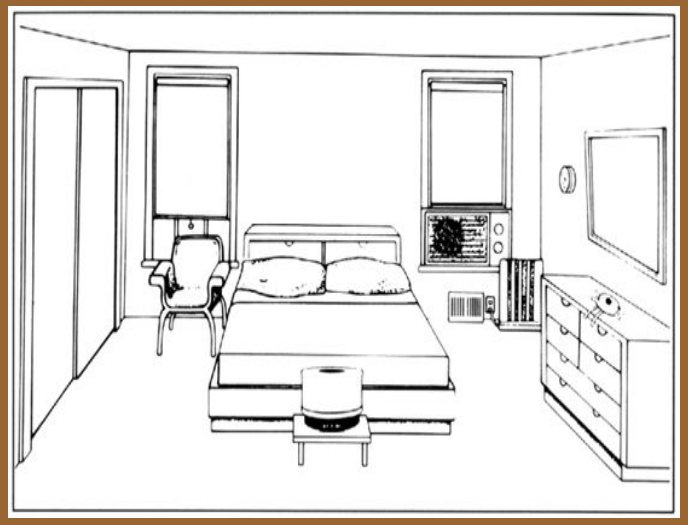

Source: Peter J. Barnes, MD

# ASTHMA : PATHOLOGY

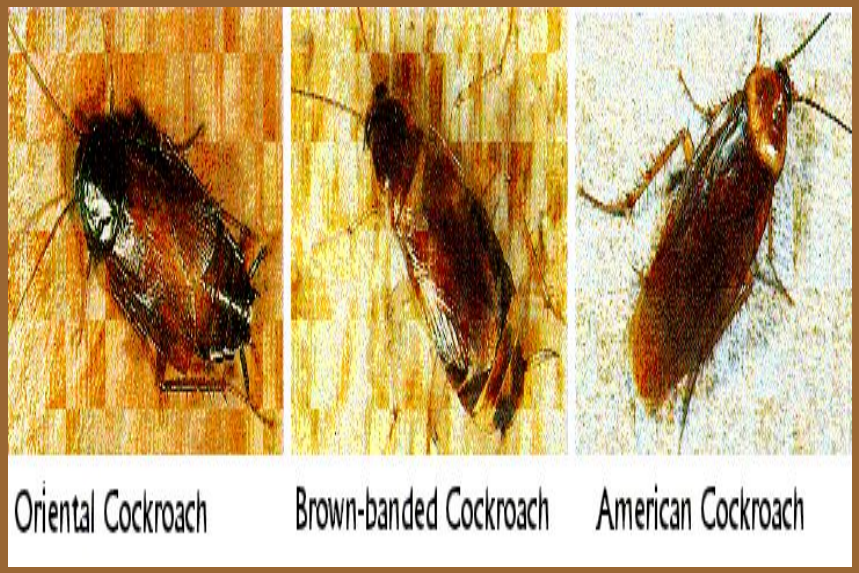


House dust mites





Furnishing ( pillows , mattress ,carpets ,




Moldes … fongus

# PETS

- People allergic to pets should not have them in the house.
- At a minimum, do not allow pets in the bedroom.

- Early ( 15-30 minutes)
- Late ( 4-12 houres)
- Clinical presintation:
- Diffuse wheezing expiratory then inspiratory
- Prolong expiratory phase
- Dcreased breath sounds
- Rhochia / rales
- *Most common symptom ,,,,, cough*

- **Acute severe asthma**
- • PEF 33–50% predicted (< 200 L/min)
- Increase in resipartory rate
- Tachycardia
- • Inability to complete sentences in 1 breath

- **Life-threatening features**
- • PEF < 33% predicted (< 100 L/min)
- • *SpO2 < 92% or PaO2 < 8 kPa (60 mmHg) (especially if being*
- treated with oxygen)
- • Normal or raised *PaCO2*
- • Silent chest
- • Cyanosis
- • Feeble respiratory effort
- • Bradycardia or arrhythmias
- • Hypotension
- • Exhaustion
- • Confusion
- • Coma
- **Near-fatal asthma**
- • Raised *PaCO2 and/or requiring mechanical ventilation with*
- raised inflation pressures

# Diagnostic Testing

- Complete blood count
- Chest x ray ,,,, hyperinflation chest
- IgE level
- Sinus  xray not routinely used
- Gold stander spirometry
- FEV1/FVC < 80%
- Bronchodilator ,,,, > 12%
- Exercise ,,,,,, < 15%
- Peak expiratory flow (PEF) ….. < 20 %
  - Inexpensive
  - Patients can use at home
    - May be helpful for patients with severe disease to monitor their change from baseline every day
    - Not recommended for all patients with mild or moderate disease to use every day at home

# PEAK FLOW METER

Diagnosis of ASTHMA or COPD can be confirmed by demonstrating the presence of airway obstruction using Spirometry.

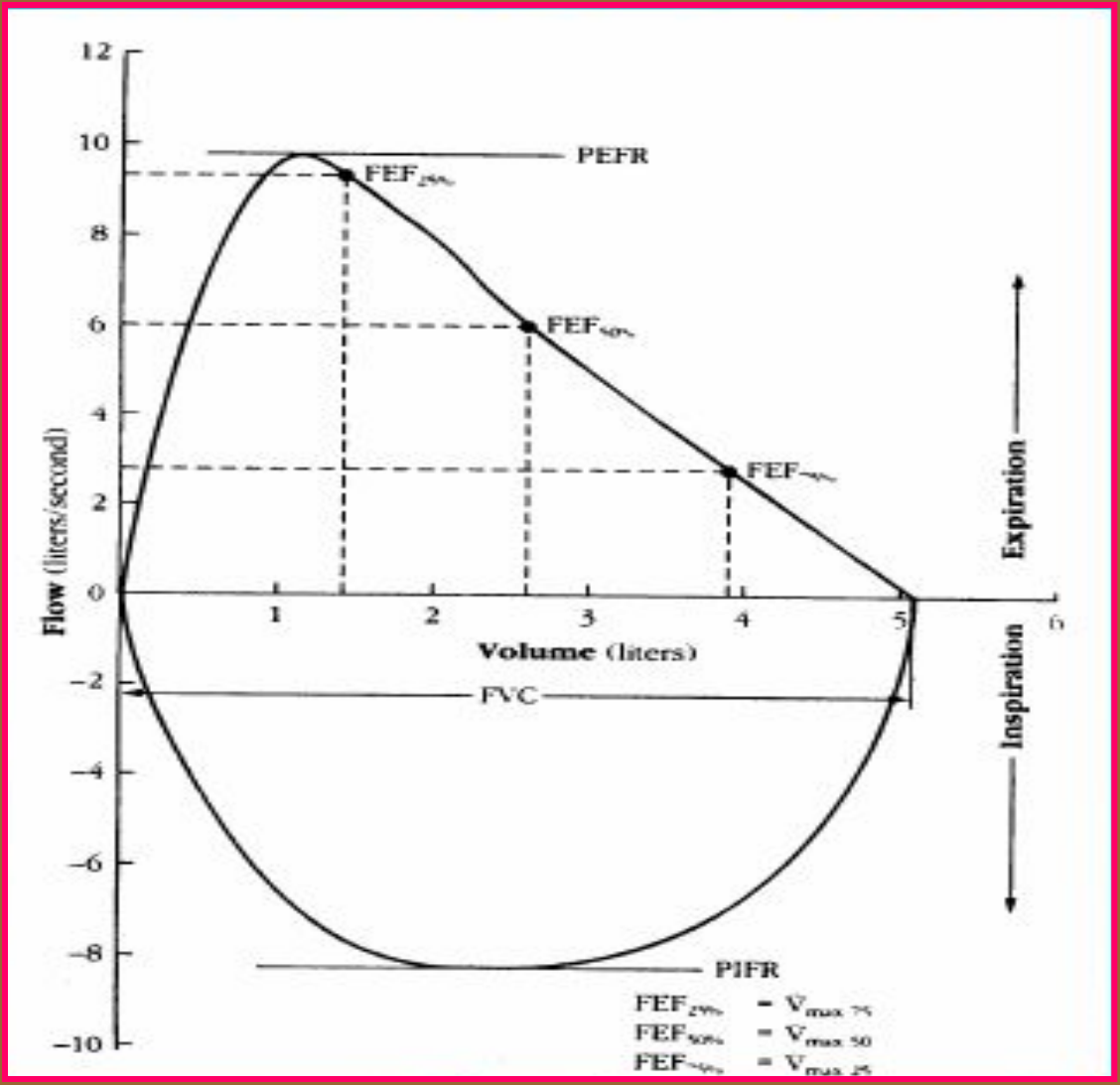
# Diagnostic Testing

- Spirometry
  - Recommended to do spirometry pre- and post-use of an albuterol MDI to establish reversibility of airflow obstruction
  - ≥ 12% reversibility and an increase in FEV1 of 200cc is considered significant
  - Obstructive pattern:  reduced FEV1/FVC ratio
  - Restrictive pattern:  reduced FVC with a normal FEV1/FVC ratio

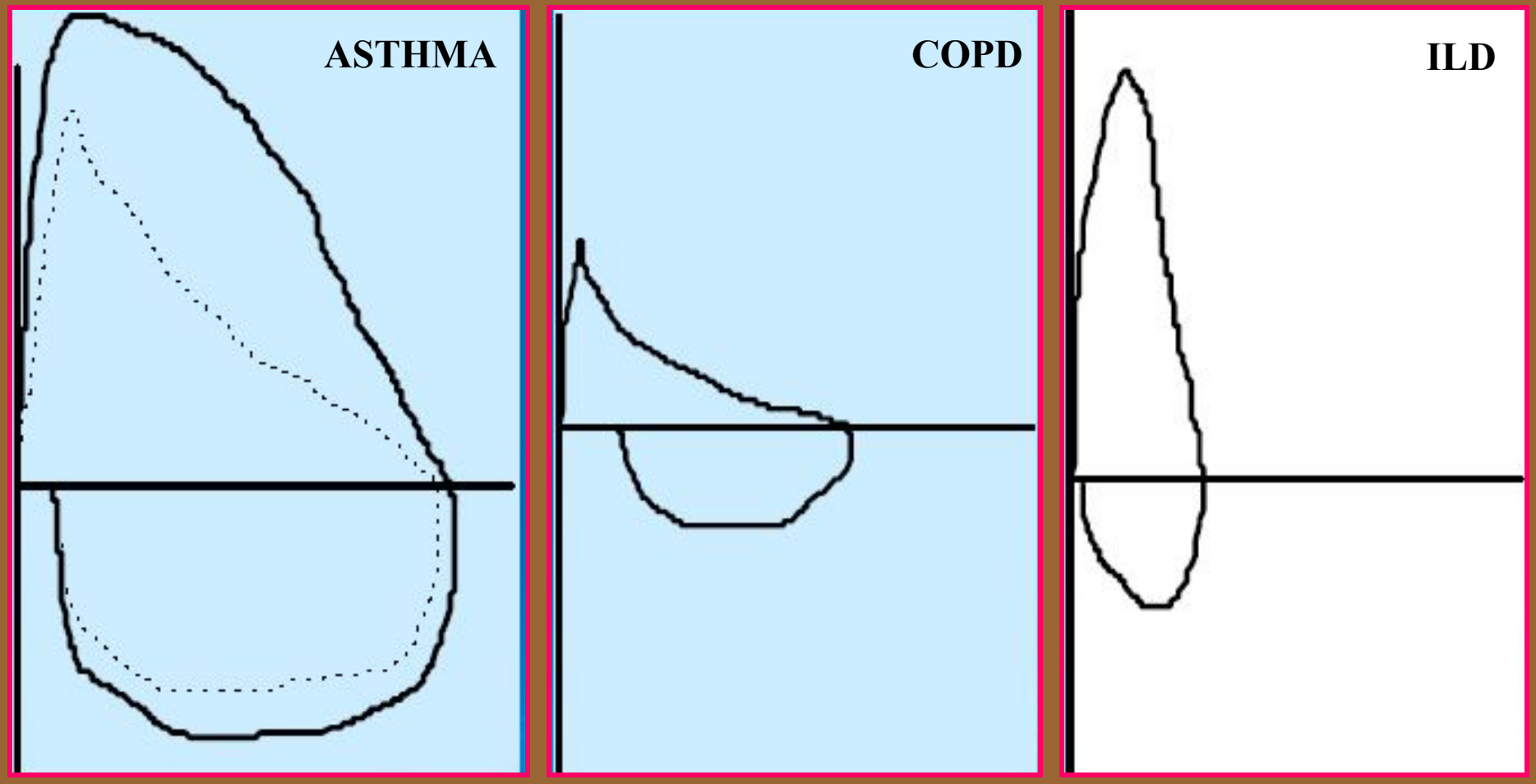
# Diagnostic Testing

- Spirometry
  - Can be used to identify reversible airway obstruction due to triggers
  - Can diagnose Exercise-induced asthma (EIA) or Exercise-induced bronchospasm (EIB) by measuring FEV1/FVC before exercise and immediately following exercise, then for 5-10 minute intervals over the next 20-30 minutes looking for post-exercise bronchoconstriction

# Normal Flow-Volume Loop



# Flow-Volume Loop in disease




Mild reversible obstruc

Severe irreversible obstr

Severe restrictive dis

# Diagnostic Testing

- Methacholine challenge
  - Most common bronchoprovocative test
  - Patients breathe in increasing amounts of methacholine and perform spirometry after each dose
  - Increased airway hyperresponsiveness is established with a 20% or more decrease in FEV1 from baseline at a concentration < 8mg/dl
  - May miss some cases of exercise-induced asthma

# Diagnostic testing

- Diagnostic trial of anti-inflammatory medication (preferably corticosteroids) or an inhaled bronchodilator
  - Especially helpful in very young children unable to cooperate with other diagnostic testing
  - There is no one single test or measure that can definitively be used to diagnose asthma in every patient

# Goals of Asthma Treatment

- Control chronic and nocturnal symptoms
- Maintain normal activity, including exercise
- Prevent acute episodes of asthma
- Minimize ER visits and hospitalizations
- Minimize need for reliever medications
- Maintain near-normal pulmonary function
- Avoid adverse effects of asthma medications

# Pharmacotherapy

- Albuterol (salbutamol)
  - Short-acting beta2-agonist
    - ATP to cAMP leads to relaxation of bronchial smooth muscle, inhibition of release of mediators of immediate hypersensitivity from cells, especially mast cells
    - To prevent exercise bronchial asthma
  - Should be used prn not on a regular schedule
    - Prior to exercise or known exposure to triggers
    - Up to every 4 hours during acute exacerbation
    - ***Most effective inhaler rather than orally***

# Pharmacotherapy

- Long-acting beta2-agonists (LABA)
  - Beta2-receptors are the predominant receptors in bronchial smooth muscle
  - Stimulate ATP- cAMP which leads to relaxation of bronchial smooth muscle and inhibition of release of mediators of immediate hypersensitivity
  - Inhibits release of mast cell mediators such as histamine, leukotrienes, and prostaglandin-D2
  - Beta1-receptors are predominant receptors in heart, beta2-receptors

# Pharmacotherapy

- Long-acting beta2-agonists (LABA)
  - Salmeterol (Serevent) , formoterol
  - Salmeterol with fluticasone (seritide)
  - Formoterol with budesonide (symbicort)
  - Should only be used as an additional treatment when patients are not adequately controlled with inhaled corticosteroids
  - Should not be used as rescue medication

# Pharmacotherapy

- Inhaled Corticosteroids
  - Anti-inflammatory
  - Act locally in lungs
    - Some systemic absorption
    - Risks of possible growth retardation thought to be outweighed by benefits of controlling asthma
  - Not intended to be used as rescue medication
  - Benefits may not be fully realized for 1-2 weeks
  - Preferred treatment in persistent asthma

# Pharmacotherapy

- Mast cell stabilizers (cromolyn /nedocromil)
  - Inhibits release of mediators from mast cells (degranulation) after exposure to specific antigens
  - Blocks Ca2+ ions from entering the mast cell
  - Safe for pediatrics (including infants)
  - Should be started 2-4 weeks before allergy season when symptoms are expected to be effective
  - *Can be used before exercise*

# Pharmacotherapy

- Leukotriene receptor antagonists
  - Leukotriene - mediated effects include:
    - Airway edema
    - Smooth muscle contraction
    - Altered cellular activity associated with the inflammatory process
  - Receptors have been found in airway smooth muscle cells and macrophages and on other pro-inflammatory cells (including eosinophils and certain myeloid stem cells) and nasal mucosa

# Pharmacotherapy

- Theophylline
  - Narrow therapeutic index/Maintain 5-20 mcg/mL
  - Mechanism of action
    - Smooth muscle relaxation (bronchodilation)
    - Suppression of the response of the airways to stimuli
    - Increase force of contraction of diaphragmatic muscles
  - Interacts with many other drugs

# Various severities of asthma

- Step-wise pharmacotherapy treatment program for varying severities of asthma
  - Mild Intermittent (Step 1)
  - Mild Persistent (Step 2)
  - Moderate Persistent (Step 3)
  - Severe Persistent (Step 4)
- Patient fits into the highest category that they meet one of the criteria for

# Mild Intermittent Asthma

- Day time symptoms ≤ 2 times / week
- Night time symptoms ≤ 2 times /month
- PEF or FEV1 ≥ 80% of predicted
- PEF variability < 20%
  - PEF and FEV1 values are only for adults and for children over the age of 5

# Mild Persistent Asthma

- Day time symptoms > 2/week, but < 1/day
- Night time symptoms < 1 night q week
- PEF or FEV1 $\geq$ 80% of predicted
- PEF variability 20%-30%

# Moderate Persistent Asthma

- Day time symptoms q day
- Night time symptoms > 1 night q week
- PEF or FEV1 60%-80% of predicted
- PEF variability >30%

# Severe Persistent Asthma

- Day time symptoms:  continual
- Night time symptoms: frequent
- PEF or FEV1 $\leq$ 60% of predicted
- PEF variability > 30%

# Pharmacotherapy for Adults and Children Over the Age of 5 Years

- Step 1 (Mild intermittent asthma)
  - No daily medication needed
  - PRN short-acting bronchodilator (SABA) MDI
  - Severe exacerbations may require systemic corticosteroids
  - Although the overall diagnosis is “mild intermittent” the exacerbations themselves can still be severe

# Pharmacotherapy for Adults and Children Over the Age of 5 Years

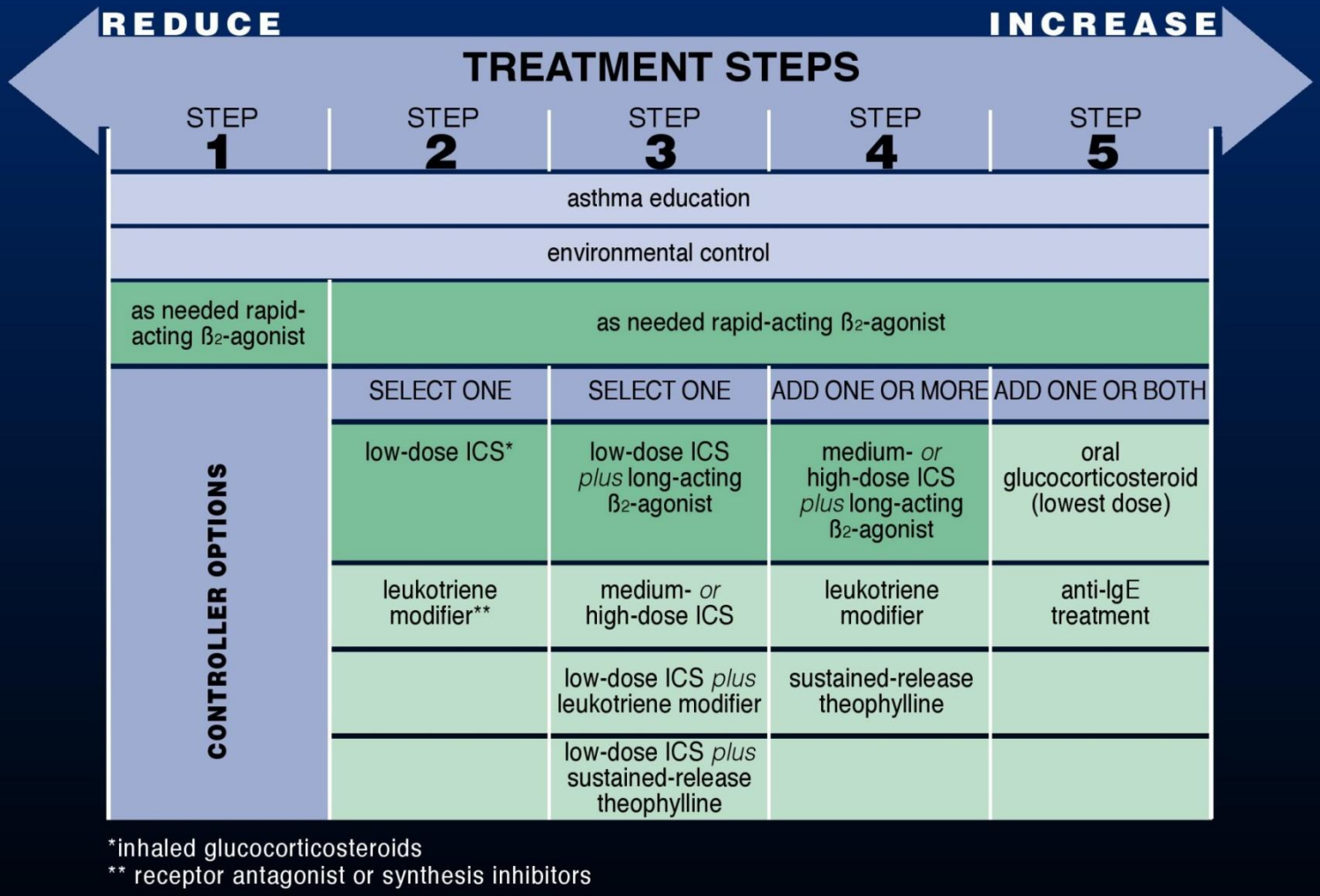
- Step 2 (Mild persistent)
  - Preferred Treatment
    - Low-dose inhaled corticosteroid daily (ICS)
  - Alternative Treatment (no particular order)
    - Cromolyn
    - Leukotriene receptor antagonist
    - Nedocromil
    - Sustained release theophylline to maintain a blood level of 5-15 mcg/mL

# Pharmacotherapy for Adults and Children Over the Age of 5 Years

- Step 3 (Moderate persistent)
  - Preferred Treatment
    - Low-to-medium dose inhaled corticosteroids (ICS)
    - WITH long-acting inhaled beta2-agonist (LABA)
  - Alternative Treatment
    - Increase inhaled corticosteroids within the medium dose range
    - Add leukotriene receptor antagonist or theophylline to the inhaled corticosteroid

# Pharmacotherapy for Adults and Children Over the Age of 5 Years

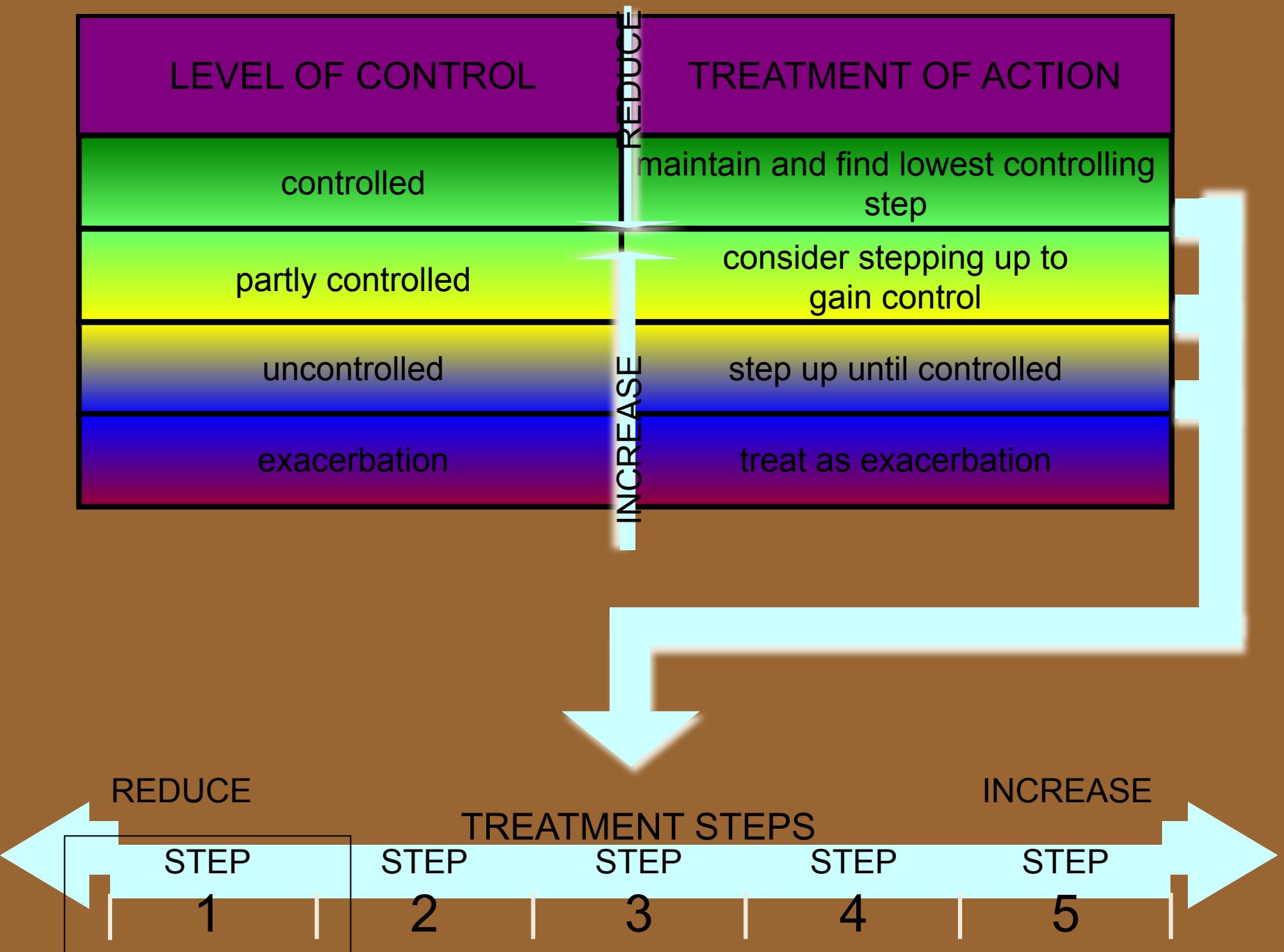
- Step 4 (Severe persistent)
  - Preferred Treatment
    - High-dose inhaled corticosteroids
    - AND long-acting inhaled beta2-agonists
    - AND (if needed) oral corticosteroids
    - IV fluid
    - *Miost  tent not used*




*inhaled glucocorticosteroids
** receptor antagonist or synthesis inhibitors

# *Levels of Asthma Control*

| *Characteristic* | Controlled | Partly controlled (Any present in any week) | Uncontrolled |
|---|---|---|---|
| Daytime symptoms | None (2 or less / week) | More than twice / week | 3 or more features of partly controlled asthma present in any week |
| Limitations of activities | None | Any | |
| Nocturnal symptoms / awakening | None | Any | |
| Need for rescue / "reliever" treatment | None (2 or less / week) | More than twice / week | |
| Lung function (PEF or $FEV_1$) | Normal | < 80% predicted or personal best (if known) on any day | |
| Exacerbation | None | One or more / year | 1 in any week |


LEVEL OF CONTROL
TREATMENT OF ACTION
REDUCE
INCREASE
controlled
maintain and find lowest controlling step
partly controlled
consider stepping up to gain control
uncontrolled
step up until controlled
exacerbation
treat as exacerbation
REDUCE
INCREASE
TREATMENT STEPS
STEP 1
STEP 2
STEP 3
STEP 4
STEP 5

# *Short acting and long acting b2-agonist*


*Short acting b2-agonist*


*Long acting b2-agonist*


MDI
Inhaled steroid
Turbuhaler
Diskhaler
Pulmicort
Turbuhaler
200 micrograms
100 doses
Powder inhaler
ASTRA
Glaxo
FLIXOTIDE
Diskus
250

# Combination (ICS)+(LABA)


Flixotide (ICS) + Serevent (LABA)


Pulmicort (ICS)+ Oxis (LABA)

# Acute Exacerbations

- Inhaled albuterol is the treatment of choice in absence of impending respiratory failure
- MDI with spacer as effective as nebulizer with equivalent doses
- Adding an antibiotic during an acute exacerbation is not recommended in the absence of evidence of an acute bacterial infection

# Acute Exacerbations

- Beneficial
  - Inhaled atrovent added to beta2-agonists
  - High-dose inhaled corticosteroids
  - MDI with spacer as effective as nebulizer
  - Oxygen
  - Systemic steroids
- Likely to be beneficial
  - IV theophylline

# Exercise-induced Bronchospasm

- Evaluate for underlying asthma and treat
- SABA are best pre-treatment
- Mast cell stabilizers less effective than SABA
- Anticholinergics less effective than mast cell stabilizers
- SABA + mast cell stabilizer not better than SABA alone

# THANK YOU

QUESTIONS ??

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