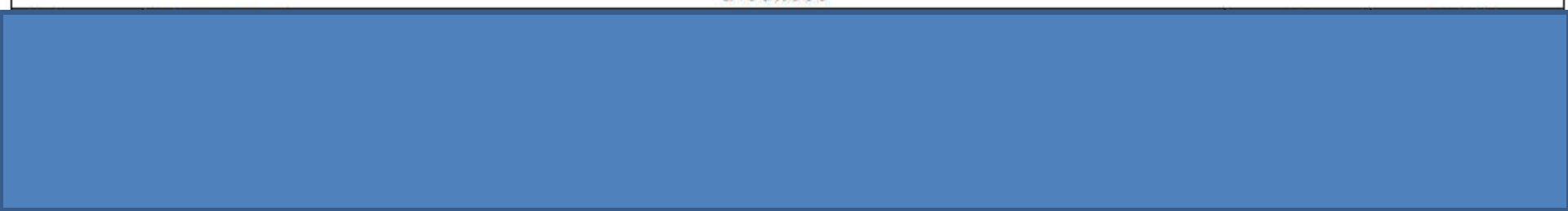


**Supportive module 3 "Basics of diagnosis, treatment and prevention of major pulmonary diseases "**



18.	Bronchial asthma	2	03/01
19.	Respiratory failure. Chronic pulmonary heart	2	10/01
20.	Pulmonary embolism	2	17/01
	Total	40	

Approved at a meeting of the Department of Internal Medicine  
protocol № 1/1 30.08.2016

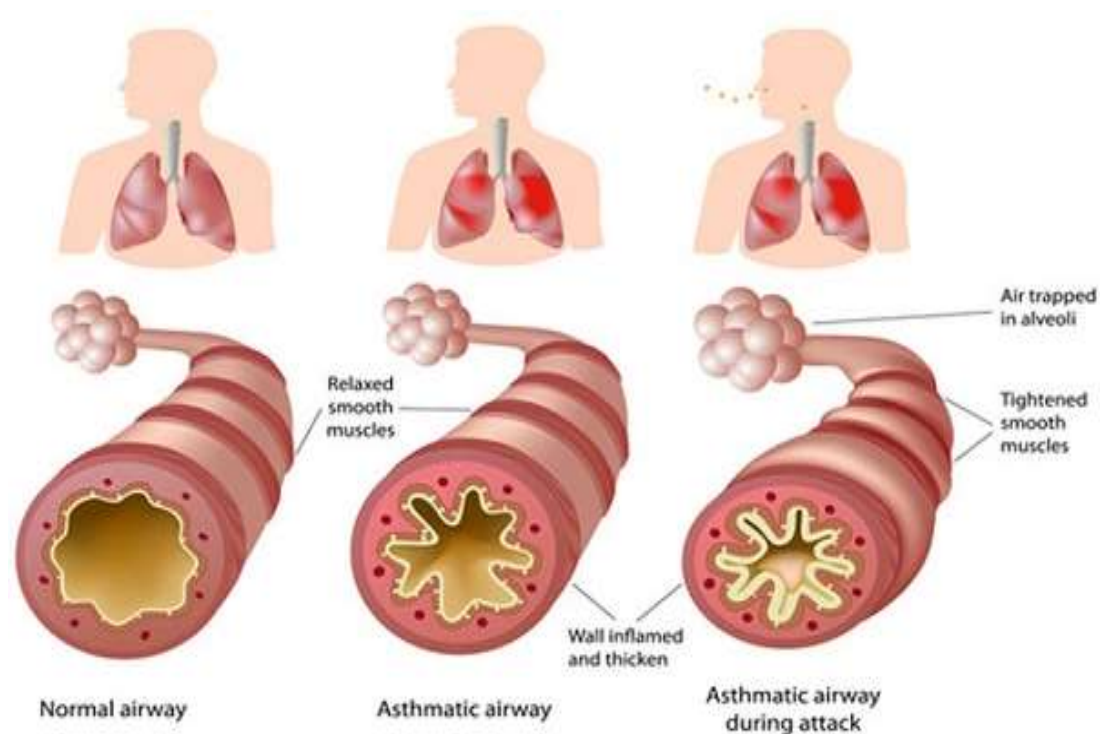
Supportive module 3 "Basics of diagnosis, treatment and prevention of major pulmonary diseases "

# Bronchial Asthma

LECTURE IN INTERNAL MEDICINE FOR IV COURSE STUDENTS

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# Plan of the Lecture



- Definition
- Epidemiology
- Risk Factors and Etiology
- Mechanisms
- Classification
- Clinical presentation
- Diagnosis
- Treatment
- Prognosis
- Prophylaxis
- Abbreviations
- Diagnostic guidelines

# Definition

(Bronchial) Asthma is defined as a chronic inflammatory disorder of the airways which is characterized by bronchial hyper-responsiveness and variable airflow obstruction, that is often reversible either spontaneously or with treatment, and manifests itself as recurrent episodes of wheezing, breathlessness, chest tightness and cough, that may occur a few times a day or a few times per week and depending on the person may become worse at night or with exercise.

# Global Initiative for Asthma (GINA)

In 1992, WHO and the US-based National Heart, Lung and Blood Institute jointly formed GINA to cut deaths and disability by developing and implementing an optimal strategy for asthma management and prevention. Since its inception GINA has:

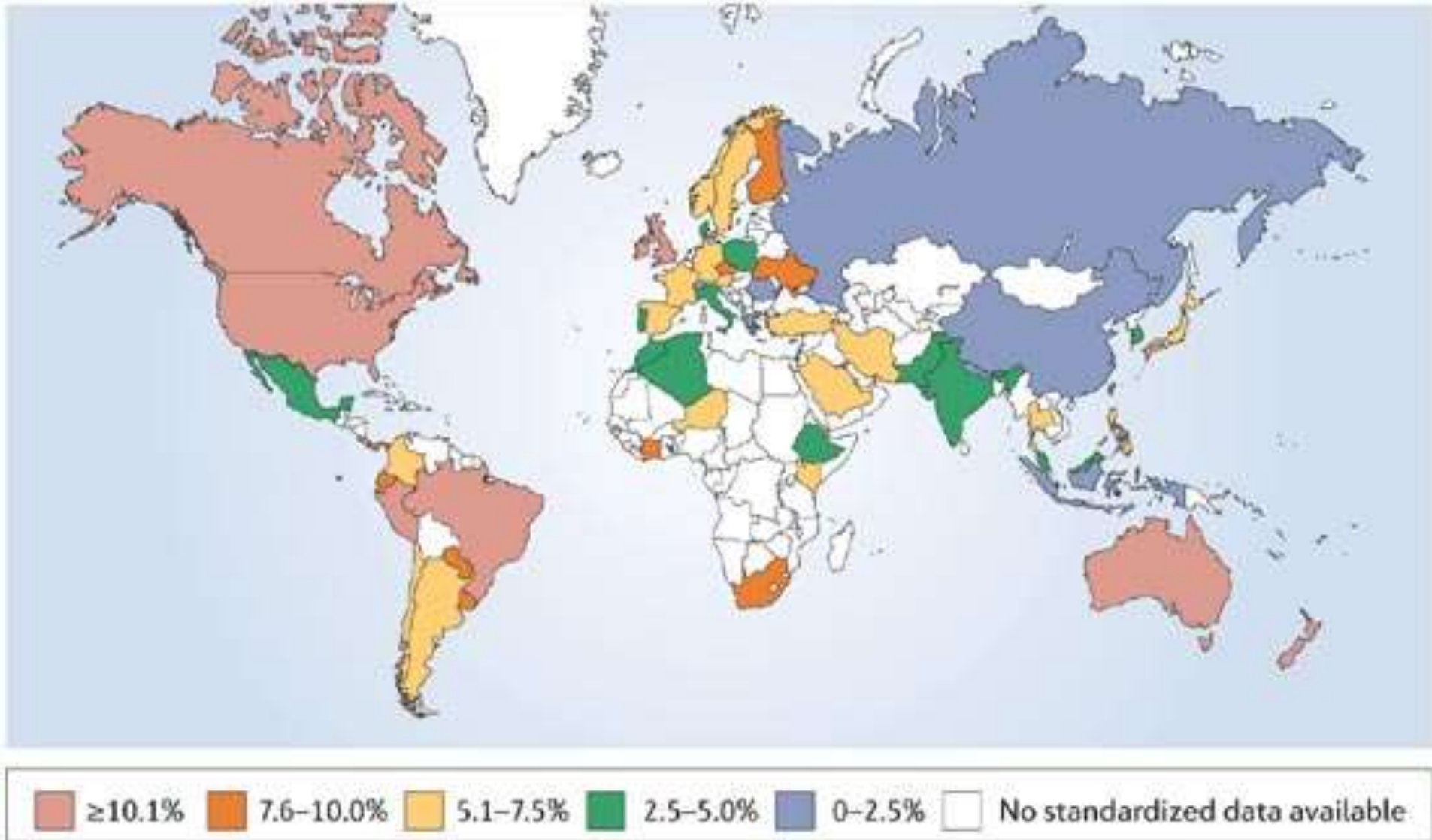
- produced a report covering a range of information detailing all the latest knowledge on causes, the mechanism, risk factors, management, education and socio-economic factors
- developed guidelines on asthma management
- held workshops to introduce the GINA program to public health officials and medical professionals

GINA's goal is to build an active network with multiple organizations concerned with asthma to ensure better patient care world-wide.

# Epidemiology

- Asthma is one of the most common chronic diseases worldwide
- There are about 315 million people estimated to be suffering from asthma worldwide
- The global prevalence of asthma, using a definition of clinical asthma or treated asthma, is estimated to be about 4.5%
- Using a less rigorous definition for diagnosis of asthma, the global prevalence is approximately 8.6%
- There has been an increase in prevalence of asthma over time, similar to other allergic disorders.
- An additional 100 million people worldwide are likely to develop asthma, by 2025

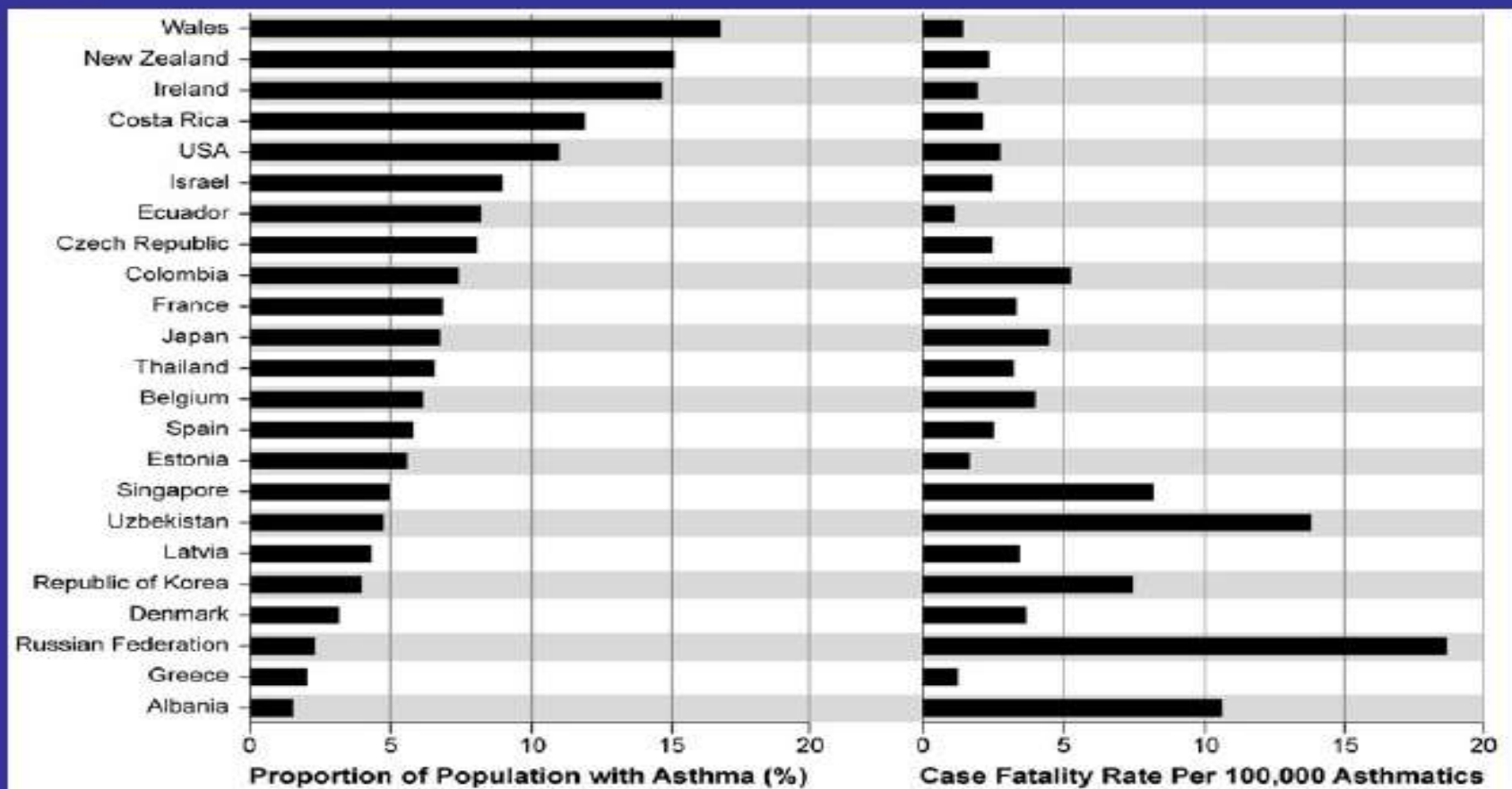
# Epidemiology



# Epidemiology



## Asthma Prevalence and Mortality



Source: Masoli M et al. Allergy 2004



# Risk Factors and Etiology

- Asthma is caused by a combination of complex and incompletely understood environmental and genetic interactions
- These factors influence both asthma severity and asthma responsiveness to treatment
- It is believed that the recent increased rates of asthma are due to changing epigenetics (heritable factors other than those related to the DNA sequence) and a changing living environment
- Onset before age 12 is more likely due to genetic influence, while onset after 12 is more likely due to environmental influence.

# Risk Factors and Etiology

## Environmental

- Smoking during pregnancy and after delivery is associated with a greater risk of asthma-like symptoms
- Low air quality (traffic pollution or high ozone levels) has been associated with asthma development and increased asthma severity
- Exposure to indoor volatile organic compounds may be a trigger for asthma (formaldehyde, phthalates, etc.)
- There is an association between acetaminophen (paracetamol) use and asthma
- Exposure to indoor allergens (dust mites, cockroaches, animal dander, and mold.)
- Certain viral respiratory infections (respiratory syncytial virus and rhinovirus)
- Certain other infections, however, may decrease the risk.

# Risk Factors and Etiology

## Hygiene Hypothesis

- The increased rates of asthma worldwide as a direct and unintended result of reduced exposure, during childhood, to non-pathogenic bacteria and viruses
- The reduced exposure to bacteria and viruses is due, in part, to increased cleanliness and decreased family size in modern societies
- Exposure to bacterial endotoxin in early childhood may prevent the development of asthma, but exposure at an older age may provoke bronchoconstriction
- Use of antibiotics in early life has been linked to the development of asthma
- Also, delivery via caesarean section is associated with an increased risk (estimated at 20–80%) of asthma
- There is a link between asthma and the degree of affluence.

# Risk Factors and Etiology

## Genetic

- Family history is a risk factor for asthma, with many different genes being implicated
- If one identical twin is affected, the probability of the other having the disease is approximately 25%
- By the end of 2005, 25 genes had been associated with asthma in six or more separate populations, including GSTM1, IL10, CTLA-4, SPINK5, LTC4S, IL4R and ADAM33, among others
- Some genetic variants may only cause asthma when they are combined with specific environmental exposures.

# Risk Factors and Etiology

## Medical Conditions

- A triad of atopic eczema, allergic rhinitis and asthma is called atopy
- The risk factor for developing asthma is a history of atopic disease
- Asthma has been associated with eosinophilic granulomatosis with polyangiitis (formerly known as Churg–Strauss syndrome), an autoimmune disease and vasculitis
- Individuals with urticaria may also experience symptoms of asthma
- There is a correlation between obesity and the risk of asthma
- Beta blocker medications can trigger asthma in those who are susceptible
- Other medications that can cause problems in asthmatics are angiotensin-converting enzyme inhibitors, aspirin, and NSAIDs.

# Risk Factors and Etiology

## Exacerbation

- Some individuals will have stable asthma for weeks or months and then suddenly develop an episode of acute asthma
- Different individuals react to various factors in different ways
- Most individuals can develop severe exacerbation from a number of triggering agents
- Home factors that can lead to exacerbation of asthma include dust, cat and dog hair, etc.
- Perfumes are a common cause of acute attacks in women and children
- Both viral and bacterial infections of the upper respiratory tract can worsen the disease
- Psychological stress may worsen symptoms.

# Risk Factors and Etiology

## Triggers

### inflammatory factors



respiratory infections

allergens

work

medication

### irritants



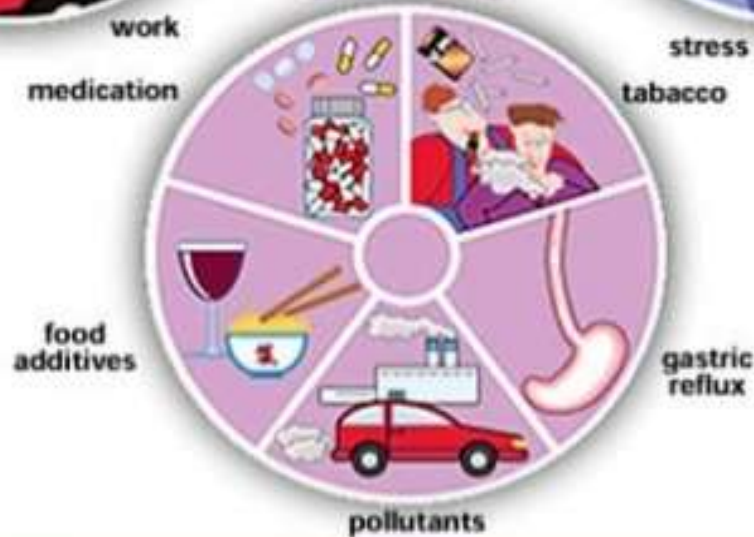
temperature change

exercise

strong odors

cold air

### others



stress and emotions

tobacco

food additives

pollutants

gastric reflux

# Mechanism

- The mechanism involves airway inflammation, intermittent airflow obstruction, and bronchial hyperresponsiveness
- Varying degrees of mononuclear cell and eosinophil infiltration, mucus hypersecretion, desquamation of the epithelium, smooth muscle hyperplasia, and airway remodeling are present
- Airway hyperresponsiveness or bronchial hyperreactivity is an exaggerated response to numerous stimuli
- The mechanisms include direct stimulation of airway smooth muscle and indirect stimulation by pharmacologically active substances from mediator-secreting cells (mast cells, nonmyelinated sensory neurons)
- The degree of airway hyperresponsiveness correlates with the severity of asthma.



# Mechanism

## Airway Inflammation 1

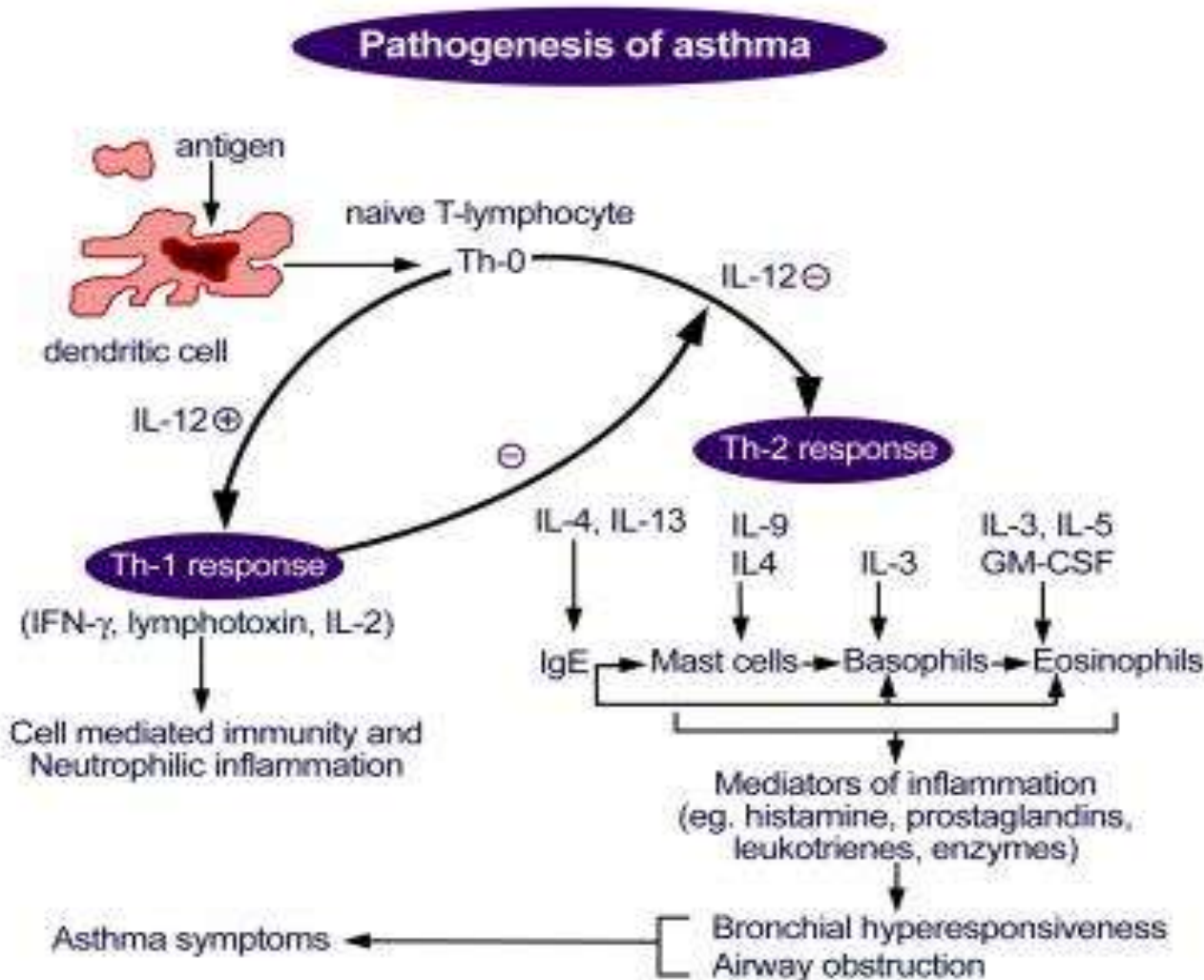
- The mechanism of inflammation in asthma may be acute, subacute, or chronic, and the presence of airway edema and mucus secretion also contributes to airflow obstruction and bronchial reactivity
- Some of the principal cells identified in airway inflammation include mast cells, eosinophils, epithelial cells, macrophages, and activated T lymphocytes.
- Other constituent airway cells, such as fibroblasts, endothelial cells, and epithelial cells, contribute to the chronicity of the disease
- Other factors, such as adhesion molecules (e.g., selectins, integrins), are critical in directing the inflammatory in the airway
- Cell-derived mediators influence smooth muscle tone and produce structural changes and remodeling of the airway

# Mechanism

## Airway Inflammation 2

- The presence of airway hyperresponsiveness or bronchial hyperreactivity in asthma is an exaggerated response to numerous exogenous and endogenous stimuli
- The mechanisms include direct stimulation of airway smooth muscle and indirect stimulation by pharmacologically active substances from mediator-secreting cells (e.g., mast cells, sensory neurons)
- Airway inflammation may represent a loss of normal balance between two "opposing" populations of Th lymphocytes (Th1 and Th2) with cytokine imbalance
- The degree of airway hyperresponsiveness correlates with the clinical severity of asthma.

# Mechanism



Mechanism of asthma. Antigen presentation by the dendritic cell with the lymphocyte and cytokine response leading to airway inflammation and asthma symptoms.

# Mechanism

## Airflow Obstruction

- Airflow obstruction can be caused by a variety of changes, including acute bronchoconstriction, airway edema, chronic mucous plug formation, and airway remodeling
- Acute bronchoconstriction is the consequence of immunoglobulin E-dependent mediator release upon exposure to aeroallergens and is the primary component of the early asthmatic response
- Chronic mucous plug formation consists of an exudate of serum proteins and cell debris that may take weeks to resolve
- Airway remodeling may profoundly affect the extent of reversibility of airway obstruction
- Airway obstruction causes increased resistance to airflow and decreased expiratory flow rates.

# Mechanism

## Bronchial Hyperresponsiveness 1

- Hyperinflation compensates for the airflow obstruction, but this compensation is limited when the tidal volume approaches the volume of the pulmonary dead space; the result is alveolar hypoventilation
- Uneven changes in airflow resistance, the resulting uneven distribution of air, and alterations in circulation from increased intra-alveolar pressure due to hyperinflation all lead to ventilation-perfusion mismatch
- Vasoconstriction due to alveolar hypoxia also contributes to this mismatch
- Vasoconstriction is also considered an adaptive response to ventilation/perfusion mismatch

# Mechanism

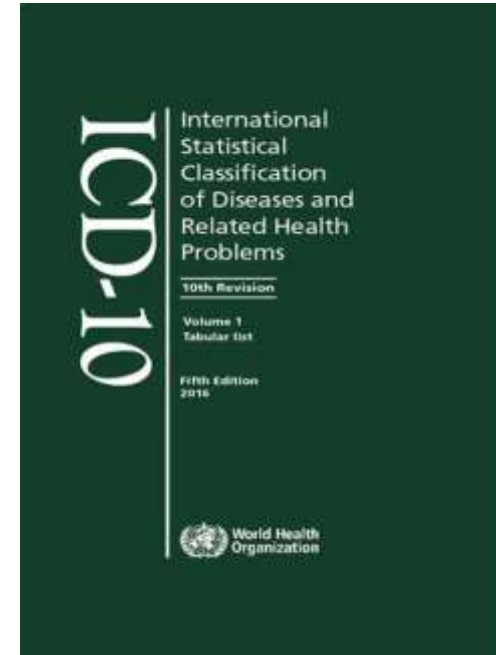
## Bronchial Hyperresponsiveness 2

- In the early stages, when ventilation-perfusion mismatch results in hypoxia, hypercarbia is prevented by the ready diffusion of carbon dioxide across alveolar capillary membranes and patients have hypoxemia in the absence of carbon dioxide retention
- Hyperventilation triggered by the hypoxic drive also causes a decrease in PaCO<sub>2</sub>
- With worsening obstruction and increasing ventilation-perfusion mismatch, carbon dioxide retention occurs
- Later, the increased work of breathing, increased oxygen consumption, and increased cardiac output result in metabolic acidosis
- Respiratory failure leads to respiratory acidosis due to retention of carbon dioxide as alveolar ventilation decreases.

# Classification

## International Classification of Diseases

- X Diseases of the respiratory system
- J45 Asthma
- J45.0 Predominantly allergic asthma
- J45.1 Nonallergic asthma
- J45.8 Mixed asthma
- J45.9 Asthma, unspecified
- J46 Status asthmaticus



# Classification

## The National Asthma Education and Prevention Program

- Intermittent
- Mild persistent
- Moderate persistent
- Severe persistent

*Classification is based on symptoms before treatment*

*Classification may change over time*

*A person in any category can have severe asthma attacks*

*Asthma in children younger than age 4 can be hard to diagnose and its symptoms may be different from asthma in older children or adults.*



# Classification

## Clinical

Severity	Symptom frequency	Night time symptoms	%FEV <sub>1</sub> of predicted	FEV <sub>1</sub> Variability	SABA use
Intermittent	≤2/week	≤2/month	≥80%	<20%	≤2 days/week
Mild persistent	>2/week	3–4/month	≥80%	20–30%	>2 days/week
Moderate persistent	Daily	>1/week	60–80%	>30%	daily
Severe persistent	Continuously	Frequent (7×/week)	<60%	>30%	≥twice/day

# Symptoms and Signs

- Asthma is characterized by recurrent episodes of wheezing, shortness of breath, chest tightness, and coughing
- Sputum may be produced from the lung by coughing but is often hard to bring up
- During recovery from an attack, it may appear pus-like due to high levels of white blood cells called eosinophils
- Symptoms are usually worse at night and in the early morning (bronchoconstriction is highest between the hours of 4:00 am and 6:00 am (the highest morbidity and mortality from asthma is observed during this time)) or in response to exercise or cold air
- Some people with asthma rarely experience symptoms, usually in response to triggers, whereas others may have marked and persistent symptoms.

# Clinical Manifestations

## Intermittent Asthma

- Symptoms (difficulty breathing, wheezing, chest tightness, and coughing):
  - Occur on fewer than 2 days a week
  - Do not interfere with normal activities
- Nighttime symptoms occur on fewer than 2 days a month
- Lung function tests (spirometry and peak expiratory flow[PEF]) are normal when the person is not having an asthma attack (the results of these tests are 80% or more of the expected value and vary little (PEF varies less than 20%) from morning to afternoon).

# Clinical Manifestations

## Mild persistent Asthma

- Symptoms occur on more than 2 days a week but do not occur every day
- Attacks interfere with daily activities
- Nighttime symptoms occur 3 to 4 times a month
- Lung function tests are normal when the person is not having an asthma attack (the results of these tests are 80% or more of the expected value and may vary a small amount (PEF varies 20% to 30%) from morning to afternoon).

# Clinical Manifestations

## Moderate persistent Asthma

- Symptoms occur daily, inhaled short-acting asthma medication is used every day
- Symptoms interfere with daily activities
- Nighttime symptoms occur more than 1 time a week, but do not happen every day
- Lung function tests are abnormal (more than 60% to less than 80% of the expected value), and PEF varies more than 30% from morning to afternoon.

# Clinical Manifestations

## Severe persistent Asthma

- Symptoms:
  - Occur throughout each day
  - Severely limit daily physical activities
- Nighttime symptoms occur often, sometimes every night
- Lung function tests are abnormal (60% or less of expected value), and PEF varies more than 30% from morning to afternoon.

# Clinical Manifestations

## History

- Whether symptoms are attributable to asthma
- Whether findings support the likelihood of asthma
- Asthma severity
- Possible precipitating factors
- Family history (asthma, allergy, sinusitis, rhinitis, eczema, nasal polyps)
- The social history (home and workplace characteristics, smoking, educational level, employment, social support, factors that may contribute to nonadherence of asthma medications, illicit drug use )
- The patient's exacerbation history (usual prodromal signs or symptoms, rapidity of onset, associated illnesses, number in the last year, need for emergency department visits, hospitalizations, etc.)
- The patient's perception of asthma is important regarding knowledge of asthma and treatment.

# Clinical Manifestations

## an Acute Episode

- In a mild episode, patients may be breathless after physical activity; they can talk in sentences and lie down; the respiratory rate (RR) is increased, and accessory muscles of respiration are not used; the heart rate (HR)  $< 100$  bpm; auscultation reveals end expiratory wheezing; oxyhemoglobin saturation (OS) is  $>95\%$
- In a moderately severe episode, the RR is increased; accessory muscles of respiration are used; HR is 100-120 bpm; loud expiratory wheezing can be heard; OS is 91-95%
- In a severe episode, patients are breathless during rest, sit upright, talk in words rather than sentences, and are usually agitated; RR  $>30$  1/m; accessory muscles of respiration are usually used, and suprasternal retractions are commonly present; HR is  $>120$  bpm; loud expiratory and inspiratory wheezing can be heard; OS  $<91\%$ .



# Complications

- Status asthmaticus or a sustained state of asthma if obstruction remains for days and weeks and fails to respond to treatment
- Pneumonia or infection in the lungs by bacteria or viruses
- Atelectasis or collapse of a section of the lung can happen if there is excessive mucosal blockage in a smaller airway
- Respiratory failure, where the levels of oxygen in the blood become dangerously low, or the levels of carbon dioxide become dangerously high
- Underperformance and fatigue at school, work or in recreational occupations is among the commonest complications of asthma
- Absenteeism from workplace
- Anxiety, Depression.

# Diagnosis

- The diagnosis remains largely clinical due to the absence of a gold standard
- The classical symptoms (wheezing, breathlessness, cough, and chest tightness) tend to be variable, seasonal, recurrent and/or nocturnal
- Presence of atopy, family history of asthma in a first degree relative, and/or symptomatic worsening after exposure to non-specific triggers support a diagnosis of asthma
- The presence of expiratory polyphonic wheeze is a typical finding, and hyperinflated chest may suggest long-standing disease
- Tachycardia, tachypnea, use of accessory muscles of respiration suggest an asthma exacerbation
- When the exacerbation is very severe, marked airflow limitation and air trapping may result in a 'silent chest' accompanied by signs of respiratory failure.

# Diagnosis

## Recommendations

- A clinical diagnosis of asthma should be suspected in the presence of recurrent/episodic wheezing, breathlessness, cough, and/or chest tightness with no alternative explanation for these symptoms
- None of the symptoms and signs are specific for asthma
- Absence of signs and symptoms at the time of presentation does not rule out the presence of asthma.

# Diagnosis

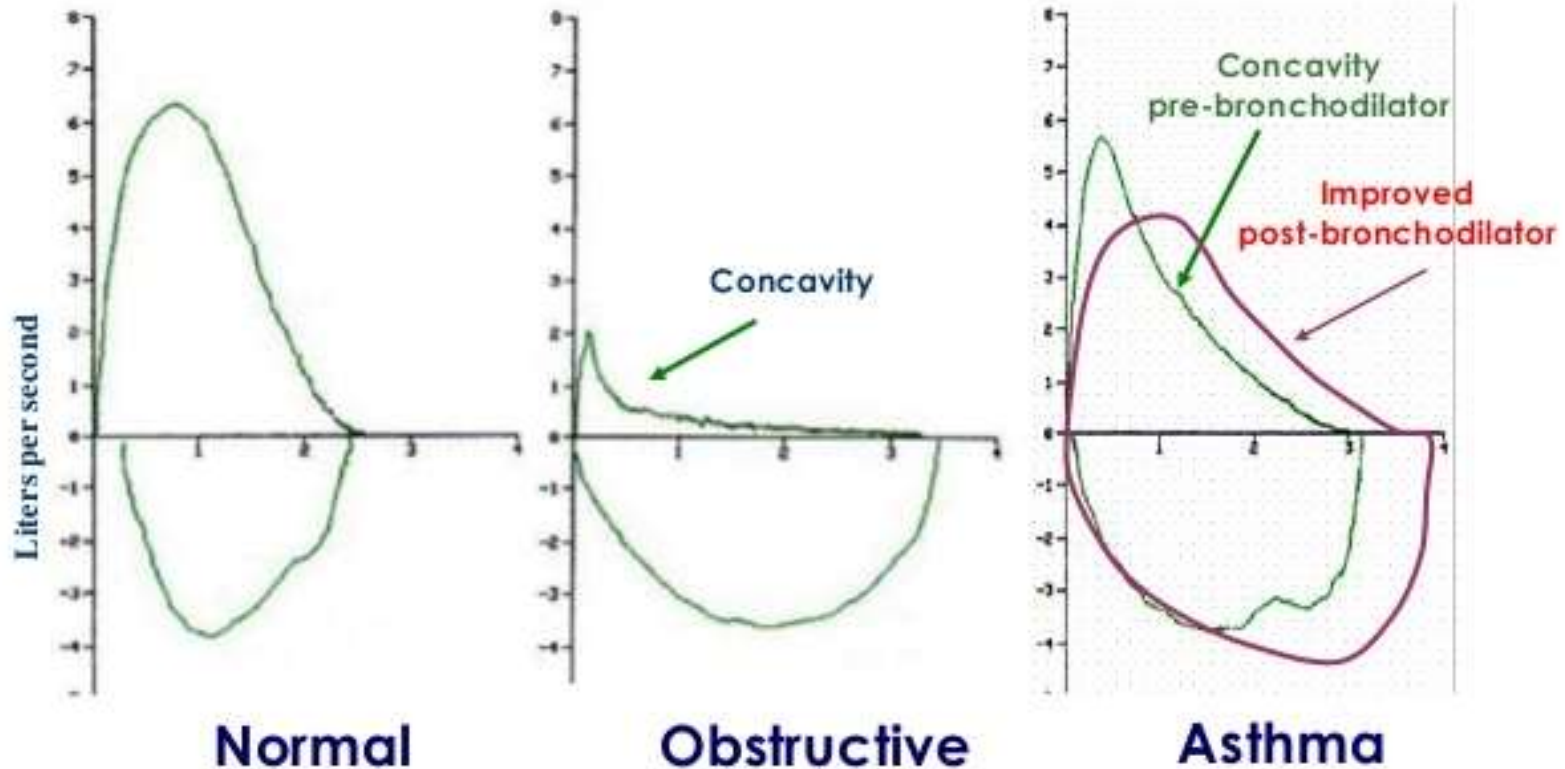
## Spirometry 1

- Spirometry is the single best test for asthma
- If the FEV1 measured by this technique improves more than 12% following administration of a bronchodilator such as salbutamol, this is supportive of the diagnosis
- It however may be normal in those with a history of mild asthma, not currently acting up
- As caffeine is a bronchodilator in people with asthma, the use of caffeine before a lung function test may interfere with the results
- Single-breath diffusing capacity can help differentiate asthma from COPD
- It is reasonable to perform spirometry every one or two years to follow how well a person's asthma is controlled.

# Diagnosis

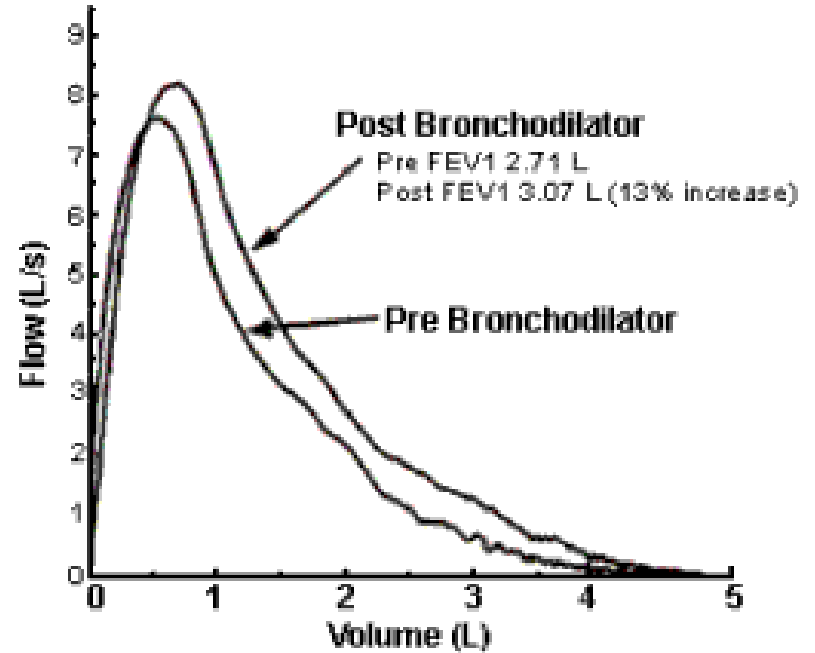
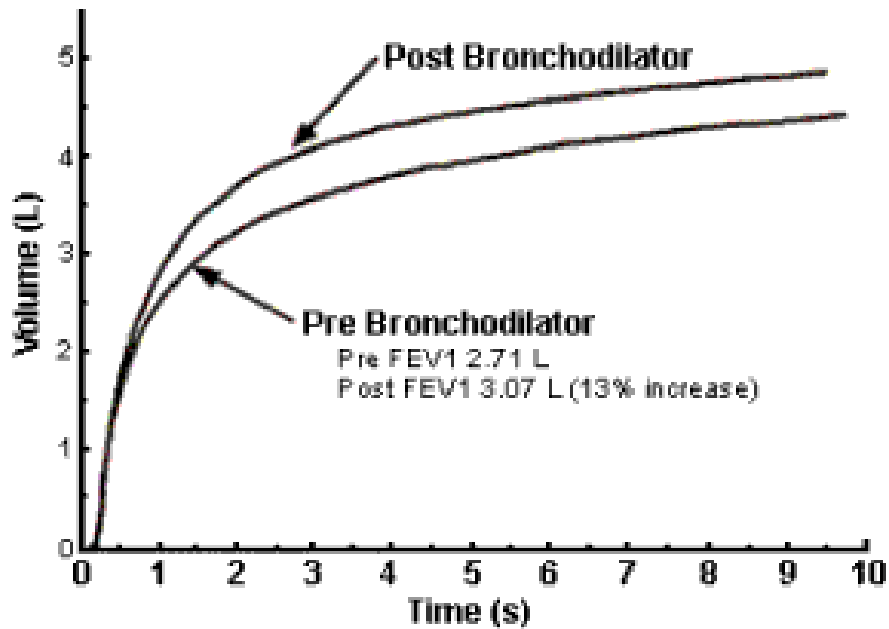
## Spirometry 2

### Types of Flow Volume Curves



# Diagnosis

## Spirometry 3



# Diagnosis

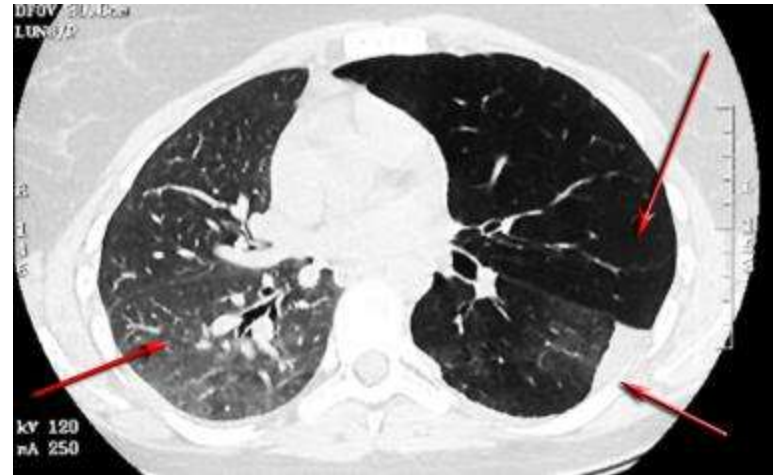
## Chest Radiography

- There is no role for routine chest radiography in a newly diagnosed patient of asthma
- A chest radiograph may be warranted when additional complications like allergic bronchopulmonary aspergillosis, or an alternative diagnosis like tuberculosis, are under consideration
- Presence of increased bronchovascular markings and low diaphragm are few features noted in asthmatics more commonly than normal individuals; however, these do not differentiate asthma from other pulmonary disorders.

# Diagnosis

## Imaging Studies

- CT, single-photon emission computerized tomography and positron emission tomography are being investigated to understand the pathophysiologic and anatomic abnormalities in asthmatics
- Currently they have no role in the routine diagnosis or management of asthma.



Asthma. Recurrent left lower lobe pneumonia.  
Mucoepidermoid carcinoma.



# Diagnosis

## Differentiation

- Allergic and Environmental Asthma
- Alpha1-Antitrypsin Deficiency
- Aspergillosis
- Bronchiectasis
- Bronchiolitis
- Chronic Obstructive Pulmonary Disease (COPD)
- Chronic Sinusitis
- Eosinophilic Granulomatosis with Polyangiitis (Churg-Strauss Syndrome)
- Cystic Fibrosis
- Foreign Body Aspiration
- Gastroesophageal Reflux Disease
- Heart Failure
- Pediatric Airway Foreign Body
- Pediatric Tracheomalacia
- Pulmonary Embolism
- Pulmonary Eosinophilia
- Sarcoidosis
- Upper Respiratory Tract Infection
- Vocal Cord Dysfunction

# Management

## Approach Considerations 1

- Medical care includes treatment of acute asthmatic episodes and control of chronic symptoms, including nocturnal and exercise-induced asthmatic symptoms
- Pharmacologic management inhaled corticosteroids, long-acting bronchodilators (beta-agonists and anticholinergics), theophylline, leukotriene modifiers, and more recent strategies such as the use of anti-immunoglobulin E (IgE) antibodies (omalizumab) and anti-IL-5 antibodies in selected patients
- Relief medications include short-acting bronchodilators, systemic corticosteroids, and ipratropium.

# Management

## Approach Considerations 2

- For all but the most severely affected patients, the ultimate goal is to prevent symptoms, minimize morbidity from acute episodes, and prevent functional and psychological morbidity to provide a healthy (or near healthy) lifestyle
- A stepwise (step-up if necessary and step-down when possible) approach to asthma management continues to be used in the current guidelines and is now divided into 3 groups based on age (0-4 y, 5-11 y, 12 y and older)
- The intensity of treatment depends on the severity of symptoms
- If rapid-acting beta<sub>2</sub> agonists are used more than 2 days a week for symptom relief (not including use of rapid-acting beta<sub>2</sub> agonists for prevention of exercise-induced symptoms), stepping up on treatment may need be considered.

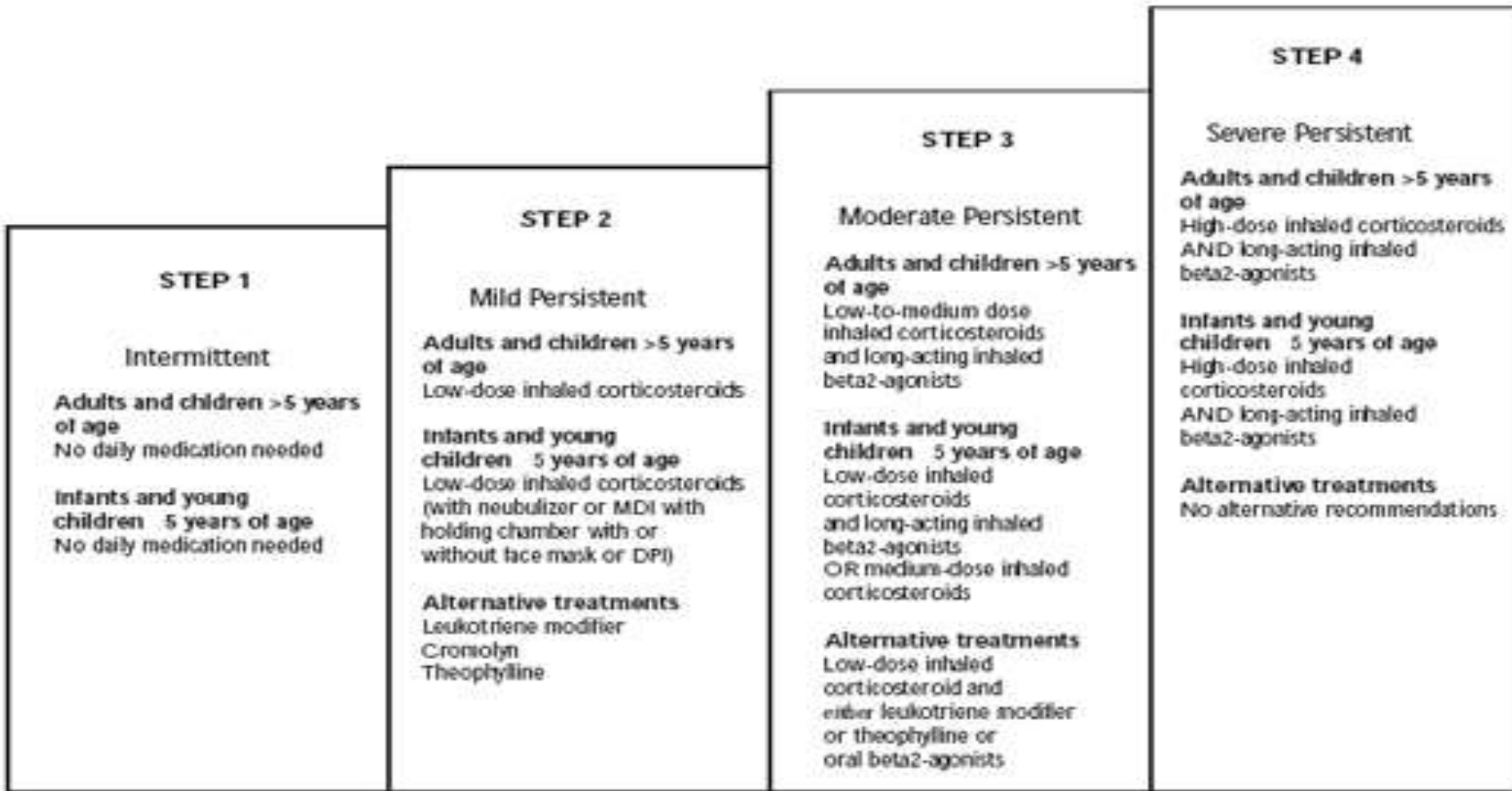
# Management

## Approach Considerations 3

- The 2015 Global Initiative for Asthma (GINA) guidelines identify inhaled corticosteroids as the preferred controller medication of choice for children and adults
- In general, patients should be assessed every 1-6 months for asthma control
- At every visit, adherence, environmental control, and comorbid conditions should be checked
- If the patient has good control of their asthma for at least 3 months, treatment can be stepped down; however, the patient should be reassessed in 2-4 weeks to make sure that control is maintained with the new treatment.

# Management

## The Stepwise Approach to Asthma Therapy



MDI indicates metered-dose inhaler; DPI, dry powder inhaler.

Source: Reference 6.

# Management

## Environmental Control

- Efforts should focus on the home, where 30-60% of time is spent
- Patients should clean and dust their homes regularly
- If a patient cannot avoid vacuuming, he or she should use a face mask or a double-bagged vacuum with a high-efficiency particulate air filter
- If possible, consideration can be given to moving to a higher floor in the house or different neighborhood
- Active smoking and exposure to passive smoke must be avoided
- Air pollution caused by traffic may increase the risk of asthma and wheezing, especially in individuals with *EPHX1* gene and enzyme activity.

# Management

## Allergen Immunotherapy

- The use of immunotherapy for the treatment of asthma is controversial
- The National Asthma Education and Prevention Program Expert Panel Report recommends that immunotherapy be considered if a relationship is clear between symptoms and exposure to an unavoidable allergen to which the patient is sensitive; symptoms occur all year or during a major portion of the year; symptoms are difficult to control with pharmacologic management because the medication is ineffective, multiple medications are required, or the patient is not accepting of medication.

# Management

## Monoclonal Antibody Therapy

- Omalizumab (a humanized murine IgG antibody against the Fc component of the IgE antibody (the part that attaches to mast cell surfaces)) was approved in 2003 for patients  $\geq 12$  y with moderate-to-severe persistent asthma who have a positive skin test result or in vitro reactivity to a perennial aeroallergen and whose symptoms are inadequately controlled with inhaled corticosteroids
- Mepolizumab (a humanized IgG1 kappa monoclonal antibody specific for interleukin 5) is indicated for add-on maintenance treatment of patients  $\geq 12$  y with severe asthma with an eosinophilic phenotype
- Reslizumab (an IgG kappa monoclonal antibody that inhibits IL-5) is indicated for add-on maintenance treatment of patients with severe asthma aged 18 years and older with an eosinophilic phenotype. It is administered as an intravenous infusion every 4 weeks.



# Management

## Fast-acting Medications

- Short-acting beta<sub>2</sub>-adrenoceptor agonists (SABA), such as salbutamol are the first line treatment for asthma symptoms and are recommended before exercise in those with exercise induced symptoms
- Anticholinergic medications, such as ipratropium bromide, provide additional benefit when used in combination with SABA in those with moderate or severe symptoms; they can also be used if a person cannot tolerate a SABA
- Older, less selective adrenergic agonists, such as inhaled epinephrine, have similar efficacy to SABAs; they are however not recommended due to concerns regarding excessive cardiac stimulation.

# Management

## Long-term Control 1

- Corticosteroids are generally considered the most effective treatment available for long-term control
- Inhaled forms such as beclomethasone are usually used except in the case of severe persistent disease, in which oral corticosteroids may be needed; it is usually recommended that inhaled formulations be used once or twice daily, depending on the severity of symptoms
- Long-term use of inhaled corticosteroids at conventional doses carries a minor risk of adverse effects (development of cataracts and a mild regression in stature)
- Long-acting beta-adrenoceptor agonists (LABA) such as salmeterol and formoterol can improve asthma control, at least in adults, when given in combination with inhaled corticosteroids; when used without steroids they increase the risk of severe side-effects and even with corticosteroids they may slightly increase the risk.

# Management

## Long-term Control 2

- Leukotriene receptor antagonists (such as montelukast and zafirlukast) may be used in addition to inhaled corticosteroids, typically also in conjunction with a LABA
- A similar class of drugs, 5-LOX inhibitors, may be used as an alternative in the chronic treatment of mild to moderate asthma among older children and adults
- Mast cell stabilizers (such as cromolyn sodium) are another non-preferred alternative to corticosteroids.

# Management

## Nebulizers and Spacers



Nebulizer



Dry powder inhaler



Spacer

Medications are typically provided as metered-dose inhalers (MDIs) in combination with an asthma spacer or as a dry powder inhaler. A nebulizer may also be used. Nebulizers and spacers are equally effective in those with mild to moderate symptoms.

# Management

## Emergency Management

- Oxygen to alleviate hypoxia if saturations fall below 92%
- Corticosteroid by mouth are recommended with five days of prednisone being the same 2 days of dexamethasone
- Magnesium sulfate intravenous treatment increases bronchodilation in moderate severe acute asthma attacks
- Heliox, a mixture of helium and oxygen, may also be considered in severe unresponsive cases
- The dissociative anesthetic ketamine is theoretically useful if intubation and mechanical ventilation is needed in people who are approaching respiratory arrest; however, there is no evidence from clinical trials to support this.

# Management

## Patient Education

- Patient education should be integrated into every aspect of asthma care
- All members of the healthcare team, including nurses, pharmacists, and respiratory therapists, should provide education
- Clinicians should teach patients asthma self-management based on basic asthma facts, self-monitoring techniques, the role of medications, inhaler use, and environmental control measures
- Treatment goals should be developed for the patient and family
- A written, individualized, daily self-management plan should be developed.

# Prognosis

- International asthma mortality is reported as high as 0.86 deaths per 100,000 persons in some countries
- Mortality is primarily related to lung function, but it has also been linked with asthma management failure, especially in young persons, age older than 40 years, cigarette smoking more than 20 pack-years, blood eosinophilia, forced expiratory volume in one second (FEV<sub>1</sub>) of 40-69% predicted, and greater reversibility
- The estimate of lost work and school time from asthma is approximately 100 million days of restricted activity
- Approximately 500,000 annual hospitalizations (40.6% in individuals aged 18 y or younger) are due to asthma
- Patients with poorly controlled asthma develop long-term changes over time (i.e., with airway remodeling).

# Prophylaxis

- Cover bedding with allergy-proof casings to reduce exposure to dust mites
- Remove carpets from bedrooms and vacuum regularly
- Use only unscented detergents and cleaning materials in the home
- Keep humidity levels low and fix leaks to reduce the growth of organisms such as mold
- Keep the house clean and keep food in containers and out of bedrooms
- If someone is allergic to an animal that cannot be removed from the home, the animal should be kept out of the bedroom
- Eliminate tobacco smoke from the home
- Avoid air pollution, industrial dust, and irritating fumes as much as possible.



# Abbreviations

COPD - Chronic Obstructive Pulmonary Disease

EF - peak expiratory flow

FEV<sub>1</sub> - forced expiratory volume in 1 second

ILO - inducible laryngeal obstruction

HR - heart rate

LABA - long-acting beta-adrenoceptor agonists

OS - oxyhemoglobin saturation

RR - respiratory rate

SABA - short-acting beta<sub>2</sub>-adrenoceptor agonists.

# Diagnostic and treatment guidelines

[Global Initiative for Asthma - Global Initiative for Asthma - GINA](#)

[Asthma Treatment & Management](#)

[Guidelines for diagnosis and management of bronchial asthma: Joint ICS/NCCP \(I\) recommendations](#)

[International ERS/ATS Guidelines on Definition, Evaluation and Treatment of Severe Asthma](#)

[BTS/SIGN British guideline on the management of asthma](#)

[Asthma](#)