



# Pediatric Asthma: An Overview

## 2 Contact Hours

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***RN.com acknowledges the valuable contributions of...***

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### **Purpose**

The purpose of this course is to provide healthcare professionals with an overview of asthma, one of the most common pediatric restrictive airway diseases.

A brief review of the respiratory system is presented, as well as signs, symptoms, and treatment of asthma in children. The course also describes the methods used to diagnose and prevent pediatric asthma, and provides information about educational measures related to asthma awareness in children.

### **Learning Objectives**

After successful completion of this course, you will be able to:

- Identify the components and functions of the respiratory system
- Describe signs and symptoms of asthma in children
- Define methods used to diagnose asthma
- Describe treatment modalities for pediatric asthma

- Define education measures related to asthma awareness
- Identify and describe preventative measures for asthma

## **Glossary**

### **Bronchial hyper-responsiveness**

Is defined as an elevated bronchoconstrictor response that can result from a number of different types of triggers.

### **FEF (Forced Expiratory Flow)**

A measure of how much air can be exhaled from the lungs. It is an indicator of large airway obstruction.

### **FEV1 (Forced Expiratory Volume in One Second)**

The amount of air which can be forcibly exhaled from the lungs in the first second of a forced exhalation.

### **FEV1/FVC**

The ratio of FEV1 to FVC. This indicates what percentage of the total amount of air is exhaled from the lungs during the first second of forced exhalation.

### **FVC (Forced Vital Capacity)**

The amount of air which can be forcibly exhaled from the lungs after taking the deepest breath possible.

### **MVV (Maximal Voluntary Ventilation)**

MVV is a value determined by having the patient inhale and exhale as rapidly and fully as possible in 12 seconds. The results reflect the status of the muscles used for breathing, how stiff the lungs are, and if there is any resistance in the airways when breathing.

### **Natural history of disease**

The course of asthma over time, either remission or increasing severity, is frequently referred to as the natural history of the disease.

### **PEFR (Peak Expiratory Flow Rate)**

PEFR measures the effectiveness of treatment in improving airway diseases.

### **Respiratory impairment**

Respiratory impairment is the frequency and intensity of symptoms and functional limitations that a patient with asthma is experiencing or has recently experienced.

### **Risk for asthma**

Risk for asthma is an estimate of the possibility of either asthma exacerbations or of progressive loss of pulmonary function over time.

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## **Spirometry**

Spirometry is a test of the air capacity of the lung. This specialized test utilizes a machine called a spirometer to measure the volume of air inspired and expired by the lungs.

## **VC (Vital Capacity)**

VC is the amount of air that can be forcibly exhaled from the lungs after a full inhalation.

## **Introduction**

More than 25 million Americans suffer from asthma, and it is one of the most common chronic diseases of childhood, affecting an estimated 6.8 million children under the age of eighteen (Centers for Disease Control and Prevention [CDC], 2014a).

Asthma is a chronic lung disease that inflames and narrows the airways, and causes recurring periods of wheezing, chest tightness, shortness of breath, and coughing (CDC, 2011; Sharma, 2014).

Although asthma is a chronic disease without a cure, with proper diagnosis and management, asthma can be controlled.

## **Definition of Asthma**

According to the National Heart Lung and Blood Institute (NHLBI, 2012), asthma is a complex disorder characterized by variable and recurring symptoms, airflow obstruction, bronchial hyper-responsiveness, and an underlying inflammation.

The interaction of these features determines the clinical manifestations and severity of asthma.

## **Restrictive Airways Disease Versus Asthma**

Reactive airway disease (RAD) or reactive airways dysfunction syndrome (RADS) is a non-specific term often used interchangeably with asthma. RAD is most often used as a “catch-all” diagnosis for children who may or may not have asthma, and is a term that has limited clinical significance (Malo, Chan-Yeung, & Lemiere, 2014).

The term reactive airway disease was coined by S.M. Brooks and colleagues in 1985. Over time, the term “RAD or RADS” has become a common term to apply to children who do not have a definitive diagnosis of asthma, as they are too young to perform diagnostic pulmonary function tests (Malo et al., 2014).

## **Test Yourself**

RAD or RADS is:

- A. Synonymous with asthma
- B. A catch all term that includes asthma
- C. A specific diagnosis

The correct answer is B.

## **Anatomy of the Respiratory Tract**

The upper respiratory tract consists of the:

- Nasopharynx
- Oropharynx
- Laryngopharynx

The upper airway structures warm, filter, and humidify inspired air.

The lower respiratory tract includes the:

- Larynx
- Trachea
- Bronchi and bronchopulmonary segments

(Martini, Nath, & Bartholomew, 2012).

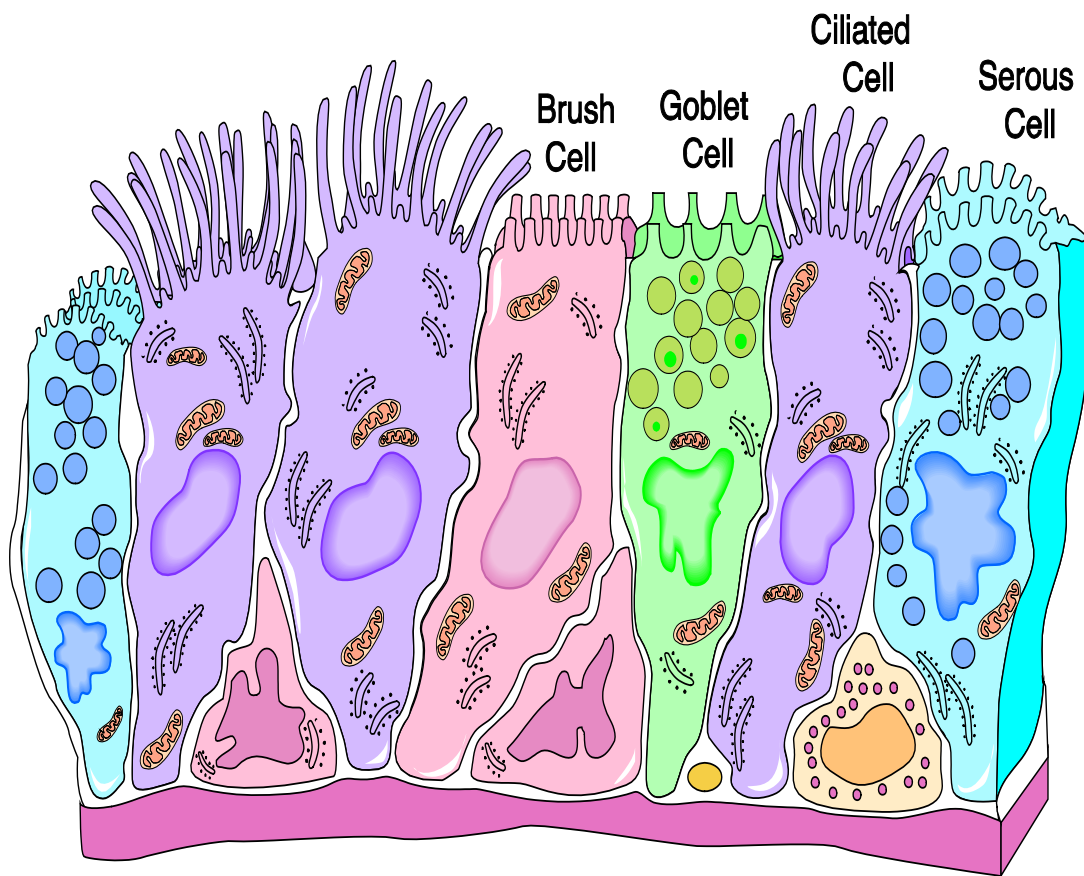
## **Normal Lung Function**

### **Respiratory Defenses**

As oxygen passes through the nose and mouth, it is warmed and moistened to help prevent injury to the lining of the airways.

The cellular lining of the airways is coated with a thin layer of mucus, similar to what is found in the nose.

Just as the nose and upper airway trap and filter chemicals and large particulate matter (smoke, sprays, bacteria, mold, pollen, and dust), the sticky mucus of the airways also helps to trap foreign particles.



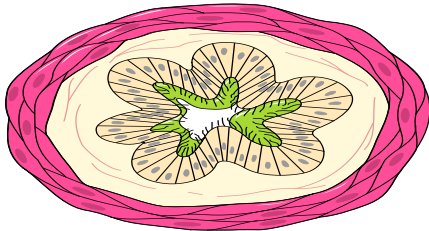
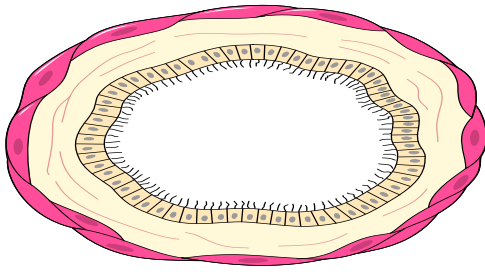
*Image of specialized cells in the tracheal epithelium*

### **Pathophysiology of Asthma**

Asthma is a chronic and complex disease condition that involves episodes of inflammation and narrowing of small airways (NLHBI, 2012).

With asthma, the presence of inflammation in the airways causes increased mucus production, swelling of the mucosa, and contraction of the muscles of the airway.

These changes diminish the effectiveness of the airway, and cause chest tightness, coughing and wheezing, especially at night and in the early morning.



*This image depicts a cross-section of a normal bronchial and a bronchial of an individual with asthma.*

### **Test Yourself**

What is the pathophysiology of asthma?

- A. Increased mucus production and swelling of the mucosa
- B. Decreased mucus production and contraction of the airways
- C. Hyperventilation and mucosal degeneration

The correct answer is: A.

### **Differences with Children**

There are some differences with the anatomy in children, which can affect the respiratory system. These include:

- Infants have smaller nares, and are obligate nose breathers (until about 1-2 months of age).
- Children eight and younger have immature cartilage, and the epiglottis is more flaccid, making it difficult to completely close.
- The trachea has a narrower diameter than an adult's.
- Lung tissue develops and grows from birth to about the age of twelve. The alveoli multiply over ten times the amount an infant is born with.
- Children younger than six breathe with their abdominal muscles, as there is weak musculature with thoracic muscles (Ward & Hisley, 2011).

### **Etiology of Asthma**

According to the NLHBI (2007), current research suggests that the beginnings of asthma start early in life.

Two major factors influence the development of asthma: host factors (genetics) and exposure to environmental factors that occur at a critical time during the development of the immune system.

A definitive cause of the inflammatory process leading to asthma has not yet been established (Sharma, 2014).

However, a genetic predisposition for developing an immunoglobulin E (IgE)-mediated response to common aeroallergens is a strong identifiable predisposing factor for developing asthma (Sharma, 2014).

### **Test Yourself**

Two major factors influencing the development of asthma are genetics and the environment.

- A. True
- B. False

The correct answer is: A.

### **Symptoms of Asthma**

Asthma is characterized by variable and recurring symptoms, including:

- Wheezing
- Coughing - can be irritating and non-productive
- Chest tightness
- Shortness of breath
- Difficulty breathing, especially at night and early in the morning
- Tachypnea
- Retractions and/or nasal flaring
- Hypoxia and cyanosis with severe attacks

The amount of inflammation, the airway width, and underlying bronchial hyper-responsiveness (which enhances susceptibility to bronchospasm) will contribute to the severity of the attack (Potter, 2010).

Over time, scarring of the lungs may develop due to prolonged airway inflammation.

### **Pathological Changes In Asthma**

#### **Introduction**

Airflow is limited as a result of three major changes in the airway:



- **Bronchoconstriction** - bronchial smooth muscle contraction that quickly narrows the airways in response to exposure to a variety of stimuli, including allergens or irritants.
- **Airway hyper-responsiveness** - an exaggerated bronchoconstrictor response to stimuli.
- **Airway edema** - as the disease becomes more persistent and inflammation becomes more progressive, edema, mucus hypersecretion, and formation of thick mucus plugs further limit airflow.

## **Bronchoconstriction**

Bronchoconstriction causes narrowing of the airways and leads to clinical symptoms.

In an acute episode, bronchoconstriction (bronchial smooth muscle contraction) rapidly narrows the airways in response to the exposure.

Triggers that can induce bronchoconstriction include allergens, exercise, cold air, and irritants. A reaction due to an exposure to an allergen results in a release of IgE-dependent mediators from mast cells (histamine, tryptase, prostaglandins, leukotrienes) that combine to contract the airway.

The reasons why the airway contracts are not known, but it is thought to be related to pro-inflammatory cytokines and eosinophils.

Eosinophils are often the most common inflammatory cells present in the lungs of asthma patients, but the importance of these white blood cells has not been well understood. A relationship does exist between eosinophils, mucus accumulation and lung dysfunction associated with asthma (Sharma, 2014).

## **Airway Edema**

As asthma increases, so does inflammation.

Additional factors begin to further limit airflow. These factors include:

- Increased inflammation
- Additional mucus production
- Formation of thick mucus plugs
- Structural changes, such as hyperplasia and hypertrophy of the airway smooth muscle (Sharma, 2014)

Once structural changes begin to occur, the usual asthma treatment may be ineffective.

## **Airway Hyper-responsiveness**

Airway hyper-responsiveness is an exaggerated bronchoconstrictor response to a variety of irritants and conditions.

The mechanisms that can influence airway hyper-responsiveness include:

- Inflammation
- Structural changes
- Dysfunctional neuro-regulation, with the presence of inflammation

The degree of inflammation appears to be a major factor in determining the degree of airway hyper-responsiveness.

Treatment that is directed toward reducing inflammation can help to reduce airway hyper-responsiveness and improve asthma control (Sharma, 2014).

## **Airway Remodeling**

In some individuals with asthma, airflow limitation may only be partially reversible due to permanent structural changes in the airway. Therapy can't reverse loss of lung function either.

Airway remodeling involves permanent changes in the airway that result in an increase in airflow obstruction and airway responsiveness. Structural changes can result in:

- Subepithelial fibrosis
- Thickening of the sub-basement membrane
- Airway smooth muscle hypertrophy and hyperplasia
- Blood vessel proliferation and dilation
- Mucous gland hyperplasia and hypersecretion

The regulation of the repair and remodeling process is not well understood, but it is believed it will offer a key explanation toward understanding the nature of asthma and the limitations to a therapeutic response.

In a severe asthma attack, the airways can occlude and can result in death.

## **Factors Involved In Airway Inflammation**

### **Introduction**

The processes that can cause asthma to occur are still under investigation.

Even though there are several types of asthma, airway inflammation is always a constant factor.

### **Airway Inflammation**

Airway inflammation can be caused by a number of triggers that include:

- Exercise
- Allergies
- Infection
- Pollutants, including second-hand smoke
- Changes in the weather
- Emotional stress

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- Sudden temperature changes
- Diet

All of the above can trigger an episode of asthma.

(The American Lung Association [ALA], 2012).

## **Exercise**

Over 80 percent of children with asthma trigger an attack when they are running (PubMed Health, 2013).

If bronchodilator medications are used before exercise, it will usually prevent most of these episodes.

Prolonged running in cold weather, allergy season or during a respiratory illness may not respond to bronchodilators.

There are reports that swimming appears to be the least asthma-provoking form of exercise.

Most children with proper control of asthma can fully participate in physical activities.

## **Allergies**

Children with asthma can suffer an attack when exposed to certain materials, such as pollen, animals, and mold.

The allergens that cause an attack are frequently common indoor inhalants such as feathers, molds, pets, dust mites, and insects such as cockroaches.

Outdoor inhalants that can trigger asthma are often molds and pollens.

During an allergic reaction, chemicals such as histamine are released that can cause excessive mucus production, inflammation and swelling of the lining of the airways and muscle contraction (American Lung Association, 2012).

## **Infections**

Respiratory infections and the flu will often trigger severe episodes of asthma.

According to research, the triggers for asthma attacks tend to be viral, not bacterial, and will therefore not respond to antibiotic therapy (ALA, 2012).

This information supports the recommendation that children with asthma should be vaccinated yearly to protect them against the flu (CDC, 2014b).

## **Weather**

Children who have asthma report that a number of weather conditions can trigger an asthma attack, especially in the presence of cold air. Sudden temperature changes can also be a trigger.

Children should be encouraged to avoid inhaling cold air by wearing a scarf or special ski mask.

Windy weather can also contribute to an exacerbation of asthma.

Increased levels of pollen can be introduced into the air when it is windy.

A light rainfall might decrease the pollen count but increase the potential for mold (ALA, 2012).

## **Emotions**

Although emotions and strong feelings can sometimes trigger asthma, they do not cause the condition.

Any activity that causes deep breathing (running, crying, laughing) can also trigger an asthma attack.

Some children with asthma do experience high levels of anxiety related to the fear of another asthma attack and the possibility of not being able to breathe.

If anxiety or panic produces rapid breathing, an attack can be triggered. Keeping an anxious child calm will also help to decrease the potential for an attack (ALA, 2012).

## **Diet**

Asthma is often associated with several common food allergies. Thus, allergy testing in asthmatics is an important part of the diagnosis process.

Foods rarely trigger an asthma attack; however, exposure on a daily basis can lead to a gradual worsening of asthma.

Some foods containing sulfites, found in dried fruits and processed foods, can worsen asthma symptoms. Food-triggered asthma, however, is considered a relatively rare subset of the number of asthma attacks.

Food preservatives can also trigger an asthma attack (ALA, 2012).

## **Pollutants**

Secondhand smoke, outdoor air pollution, exposure to chemicals, and radon can all cause or worsen lung disease.

Children should avoid exercising or playing outside on "bad air" days. Parents should be aware of the air quality in the area in which they live.

Parents should be aware of any potential chemical exposure in and around their home. Households and vehicles should be smoke-free (ALA, 2012).

## **Hidden Asthma**

According to the American Lung Association (ALA, 2012), unless an episode of coughing, wheezing, or rapid breathing becomes evident, many children can unknowingly be suffering from hidden asthma.

There is usually some degree of airway obstruction that is difficult to distinguish even with auscultation, but the condition can be manifested by limitation of physical activity and an increase in respiratory illness.

Hidden asthma is often caused by allergies. Pulmonary function studies usually reveal this type of asthma (ALA, 2012).

## **Test Yourself**

Manifestations of hidden asthma are:

- A. Early morning dyspnea and malaise
- B. Limited physical activity and recurrent respiratory infections
- C. Labored breathing and constant fatigue

The correct answer is: B.

## **Clinical Testing in Children**

### **Introduction**

Pulmonary function tests (PFT) can give the healthcare provider additional information about the type of lung disease, the response to therapy, and changes in lung function over time. These tests are generally non-invasive and require the child to exhale into a device to record measurements.

Some common diagnostic tests include:

- Spirometry
- Lung volumes
- Infant pulmonary function testing
- Methacholine challenge
- Bronchoscopy and laryngoscopy

### **Spirometry**

Spirometry is a simple, non-invasive lung function test used to establish the diagnosis of asthma in children aged five and older. It is a type of pulmonary function test that measures the amount of air taken in (volume) and exhaled as a function of time (see definitions in glossary). Children ages 3-6 years, and some older children with musculoskeletal problems cannot accurately perform the maneuvers required for spirometry.

Accurately testing children for asthma when they are young can be a challenge, as lung function tests cannot be accurately performed. Spirometry is recommended as an objective tool for the diagnosis and management of asthma, as the medical history and physical examination are not reliable means of excluding other diagnoses or of assessing lung status (Sharma, 2014).

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During a spirometry test, a patient places the mouth over the mouthpiece of the spirometer, takes a deep breath in, and then blows out as forcefully as possible.

When instructing a patient in the performance of a spirometry test, the healthcare provider instructs the patient to inhale deeply prior to rapidly exhaling into the spirometer, so that all the air is completely exhausted from the lungs.

Spirometry gives healthcare professionals two important numbers that may indicate problems with lung function:

- **Forced Vital Capacity (FVC):** How much air is expelled from the lungs during expiration
- **Forced Expiratory Volume (FEV1):** The amount of air that can be forcibly exhaled in one second

Results of spirometry testing vary, but are based on predicted values of a standardized, healthy population, and are performed in accordance with the American Thoracic Society standards.

## **Lung Volume**

Lung volume tests measure:

- **Total Lung Capacity (TLC):** How much air is in the lungs
- **Functional Residual Capacity (FRC):** How much air is in the lungs after expiration
- **Residual Volume (RV):** How much air is left in the lungs after a forced expiration

## **Infant Pulmonary Function Testing**

Infant Pulmonary Lung Function Tests

- Infant PFTs are a special type of pulmonary function test that is only done in specialized centers.
- In infants, lung function testing requires sedation, usually oral sedation, so the child is passive during testing.
- Infant PFTs can be performed very early in life until about 2 to 4 years of age depending on the equipment and size of the child.
- Once children undergoing an infant PFT are asleep, they are placed in the equipment with a mask over their mouth and nose. They breathe air with oxygen, if needed, through the mask. Lung volumes and flows are measured while the child breathes through the mask.
- An inflatable jacket is also placed around the child's chest to help them blow out air (Children's Hospital of Pittsburgh, 2010).

## **Methacholine Challenge**

This type of test uses an aerosolized challenge agent called methacholine to determine airway reactivity.

It involves the patient breathing the agent and performing a series of spirometry tests (Sharma, 2014).

## **Bronchoscopy and Laryngoscopy**

Bronchoscopy and laryngoscopy involve using a slim scope that directly visualizes the upper airways (laryngoscopy) or the lower airways below the vocal cords (bronchoscopy).

Cultures and biopsy specimens can be obtained through the channel of the scope.

## **Additional Diagnostic Testing**

Additional studies may be performed based on individual needs and may include:

- Allergy testing
- Chest x-ray and ECG to rule out alternative diagnosis
- Sinus x-rays or computed tomography (CT) scan
- Lab work such as complete blood count (CBC) with eosinophils, total IgE, sputum exam

Biomarkers of inflammation are currently being evaluated for their usefulness in the diagnosis and assessment of asthma.

Biomarkers include total and differential cell count and mediator assays in sputum, blood, urine, and exhaled air (Sharma, 2014).

## **Differentiating Obstructive and Restrictive Disorders**

Obstructive and restrictive ventilation problems are usually confirmed by examining the FEV1/FVC ratio before and after the patient inhales a short-acting bronchodilator:

- If both the FEV1 and FVC are low but the ratio of FEV1/FVC is normal, restrictive lung disease is most likely present. Examples of restrictive airways disease in children include asbestosis, sarcoidosis and pulmonary fibrosis.
- If the FEV1 and FEV1/FVC ratio are both low, obstructive lung disease is present. This is seen most commonly in asthma or diseases that affect the airways, and how fast a child can breathe out.

A good response to asthma treatment is when there is no wheezing on auscultation and the FEV1 is greater than 70% of the predicted normal value.

A poor response to treatment is considered to be an FEV1 less than 50% of predicted normal and no improvement in respiratory distress (Potter, 2010).

## **Using Peak Flow Monitors**

### **Introduction**

Peak flow meters are simple devices that the asthmatic patient over the age of 5 can be taught to use.

The peak flow meter determines the Peak Expiratory Flow Rate (PEFR), which provides a simple, objective, and repeatable way of tracking the severity of the asthma.

The peak flow meter consists of a tube with a sliding indicator that moves along a scale marked in liters per minute.

Generally the numbers marked on the tube are color coded (red, yellow and green) to represent 3 different zones (NLHBI, 2013).

### **Peak Flow Meters**

Peak flow meters are easy to use, non-invasive monitoring devices that you can teach the patient to use at home, to regularly monitor lung function.

The patient should be instructed to inhale deeply before placing the peak flow meter in the mouth, and to then exhale out or blow out as hard and as fast as possible into the meter. A good example for children is telling them that it is like blowing out a candle on a cake.

It is not necessary to exhale totally, which can cause coughing.

When the patient exhales, the meter will indicate which color-coded zone the patient's current lung capacity fits into (NLHBI, 2013).

### **Limitations of Peak Flow Meters**

A limitation of a peak flow reading is that it only measures the condition of the large airways.

If there are problems occurring in the small airways, a person can be symptomatic and still have good peak flow readings.

Although peak flow meters are not as effective as spirometers at measuring FEV<sub>1</sub>, it is a measure that can be taken at home.

Note that peak flow meters are designed for monitoring, not as diagnostic tools.

### **Green Zone**

The green zone is 80 to 100 percent of the best personal score.

This means that lung function is satisfactory and a change in therapy is not indicated.

### **Yellow Zone**

The yellow zone represents 50 to 80 percent of the best personal score.

This indicates that there is a change in lung function and caution is advised.

The healthcare provider should be immediately contacted so that management protocols can be adapted to changing lung function.

It may be necessary to alter or increase medications temporarily.

### **Red Zone**

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The red zone represents less than 50 percent of the personal best score.

This is an emergency situation and the healthcare provider should be contacted immediately.

Most asthma-related deaths result from delays in seeking medical attention.

### **Test Yourself**

What does the yellow zone on the peak flow monitor indicate?

- A. Lung function is satisfactory
- B. There is a change in lung function
- C. An emergency situation is present

The correct answer is: B.

### **Management of Pediatric Asthma**

Although asthma cannot be cured, most asthmatics can learn to control the disease, so that attacks are infrequent and manageable.

Once a diagnosis has been determined, collecting detailed information about the child's symptoms and health can be useful to help guide treatment. This includes:

- Identifying precipitating factors such as irritants or allergens and other health problems that can exacerbate an attack (such as viral illness)
- Assessing the child's/parent's ability for self-management
- Assigning a severity to the asthma (Potter, 2010)

### **Goals of Asthma Management in Children**

According to the National Lung Heart and Blood Institute (2007) the goals toward treating asthma include:

- Using objective measures of lung function to determine the severity of the disease and monitor the course of therapy (control and responsiveness to treatment)
- Using environmental control measures to diminish or eliminate precipitating factors associated with an exacerbation of an asthma attack
- Providing education to patients and their families and the development of a caring relationship between the clinician and the patient
- Administering long-term medication therapy and management designed to prevent and/or reverse asthma episodes and exacerbation

The treatment goals for asthma are the same whether asthma is well controlled or not; difficulty breathing and the other manifestations associated with asthma are minimized by therapeutic intervention (NLHBI, 2012).

### **Four Components of Asthma Management**

There are four recommended clinical practice guidelines considered to be crucial for the diagnosis and management of asthma (Potter, 2010). They include:

- Measures of monitoring and assessment that are obtained by physical examination, patient history, patient report, and objective tests (used to diagnose and assess the characteristics and severity of asthma and to determine whether asthma control is achieved and maintained)
- Education toward a partnership in asthma care
- Control of conditions that can affect asthma, such as environmental conditions
- Medication therapy

Specific clinical recommendations for managing asthma on a long-term basis and for managing exacerbations that incorporate the four components should include assessment and monitoring that are closely linked to the severity, control, and responsiveness to treatment.

## **Pharmacology**

### **Introduction**

Asthma is commonly treated with two types of medications:

- Inhaled corticosteroids (ICS): Used during an acute attack to resolve symptoms; and for long-term control to prevent asthma relapse.
- Short-acting beta2-agonist (Bronchodilator): Used for quick-relief / rescue medication, such as albuterol, which is administered by nebulizer or MDI/spacer.

(Potter, 2010).

### **Inhaled Corticosteroids**

Inhaled corticosteroids are the most effective medications for long-term management of persistent asthma, and should be utilized by patients and clinicians as is recommended in the guidelines for control of asthma.

Corticosteroids act by reducing swelling and mucus production in the airways. As a result, airways are less sensitive and less likely to react to triggers (Potter, 2010).

The Expert Panel (2007) recommends that long-term control medications be taken on a long-term basis to achieve and maintain control of persistent asthma, and that inhaled corticosteroids (ICS) are the most potent and consistently effective long-term control medication for asthma.

### **B-2 Agonists (Bronchodilators)**

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Albuterol sulfate (Ventolin ®) is a short-acting beta2-agonist (bronchodilator) administered by nebulizer or spacer.

This medication is used intermittently, as needed, during acute exacerbations of the disease such as the sudden onset of symptoms or an asthma attack.

Dosage:

**For children aged 12 and older:**

2.5 mg three times a day by nebulizer, given over 5-15 minutes (Comerford, 2013).

**For children aged 6 - 11 years old:**

0.1 to 0.15mg/kg by nebulizer given over 5-15 minutes, with subsequent doses administered according to response.

Total dosage should not exceed 2.5 mg three times a day (Comerford, 2013).

**Test Yourself**

Inhaled corticosteroid therapy is used for:

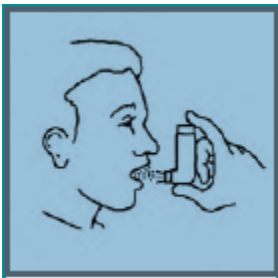
- A. Emergency management
- B. Short-term management
- C. Long-term management

The correct answer is: C.

**Teaching Your Patient to Use an Inhaler**

It is important to instruct children to use an inhaler correctly, to ensure that the full prescribed dose of the drug actually enters the lungs. It is advisable to use a spacer or holding chamber with an inhaler in children.

Instruct the child to use the inhaler in one of the three ways pictured below (A or B are best, but C can be used if the child has difficulty with the other two ways):



**A.** Hold the inhaler 1-2 inches in front of the mouth (about the width of two fingers).



**B.** Use a spacer / holding chamber.



**C.** Place the inhaler directly in the mouth. This method should **not** be used with steroids.

### **Instructions for Using an Inhaler**

Instruction in the correct use of an inhaler will ensure that the proper dosage of a medication will be delivered adequately.

The nurse is in the ideal position to educate the patient and the family on the correct use of an inhaler, to ensure that the full dosage of drug is delivered, so that maximum benefit can be derived from the drug.

Instructions to provide when teaching a child how to use an inhaler correctly:

1. Instruct the child to take off the cap and shake the inhaler.
2. Encourage the child to expel as much air from the lungs as possible by breathing out all the way.
3. Demonstrate how to hold the inhaler and encourage the child to breathe in slowly.
4. As the child breathes in slowly through the mouth, instruct the child to press down on the inhaler once. If the child is using a holding chamber, the inhaler should be depressed before the child begins to inhale, and then the child should continue breathing in slowly, and deeply.
6. Instruct the child to hold his breath for a slow count of 10, if possible.
7. For inhaled quick-relief medicine (short-acting beta2 agonists), wait about 15–30 seconds between puffs.

There is no need to wait between puffs for other medicines (NHLBI, 2013).

### **Did you Know?**

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**In children younger than four years of age, an appropriately sized mask should be used with both inhalers and nebulizers.**

## **Hospitalization for Pediatric Asthma**

When a child is hospitalized with asthma, there is a great need for an increased level of monitoring and care. The risks associated with potential hospitalization include severe symptoms, previous hospitalization and previous intubation (CDC, 2014a).

Hospitalization contributes to increased costs of care and are thought to be somewhat preventable in many cases if families and children are educated in interventions and management strategies (CDC, 2014a).

Recognition of the early signs and symptoms of asthma, avoiding triggers, proper healthcare and managing medications can be difficult. This is evidenced by the high rate of children that visit the emergency department for treatment of asthma symptoms.

## **Education to Prevent and Control Asthma**

### **Introduction**

Controlling and preventing asthma requires education and counseling. The healthcare provider should encourage the child to:

- Follow a self-management plan and learn to monitor asthma symptoms to develop an awareness for a pending attack.
- Participate regularly in physical activity to maintain cardiovascular health. Adjustments to medication may be required before, during or after exercise.
- Become familiar with using a peak flow monitor, to measure lung function, and increase awareness of an impending attack.

### **Action Plans**

The NHLBI recommends that all asthmatics should receive a written asthma action plan to guide their self-management efforts (NHLBI, 2007).

The Expert Panel recommends that all patients who have asthma be provided a written asthma action plan that includes instructions for:

- Daily treatment (including medications and environmental controls)
- How to recognize and handle worsening asthma

An example of an asthma action plan can be found at:

[http://www.nhlbi.nih.gov/health/public/lung/asthma/asthma\\_actplan.pdf](http://www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf)

## **Assessment of Severity**

All patients should have an initial severity assessment based on measures of current impairment and future risk in order to determine type and level of initial therapy needed (NHLBI, 2007; Potter, 2010).

It is recommended that once a diagnosis of asthma is made, clinicians classify asthma severity using the domains of current impairment and future risk for guiding decisions in selecting initial therapy.

## **Asthma Control**

At planned follow-up visits, asthma patients should review level of control with their healthcare provider, based on multiple measures of current impairment and future risk in order to guide clinician decisions to either maintain or adjust therapy.

It is recommended that every patient who has asthma be taught to recognize symptom patterns and/or Peak Expiratory Flow (PEF) measures that indicate inadequate asthma control and the need for additional therapy, and that control be routinely monitored to assess whether the goals of therapy are being met (ALA, 2012).

## **Follow Up**

Patients who have asthma should be scheduled for planned follow-up visits at periodic intervals in order to assess their asthma control and modify treatment if needed.

It is recommended that monitoring and follow up is essential and that the stepwise approach to therapy, in which the dose and number of medications and frequency of administration are increased as necessary and decreased when possible, be used to achieve and maintain asthma control (ALA, 2012).

## **Environmental Control**

Clinicians should review each patient's exposure to allergens and irritants and provide a multi-pronged strategy to reduce exposure to those allergens and irritants to which a patient is sensitive and exposed.

It is recommended that patients who have asthma be questioned about exposure to inhalant allergens, tobacco smoke and other irritants.

It is recommended that allergen avoidance receives a multifaceted, comprehensive approach that focuses on the allergens and irritants to which the patient is exposed to (ALA, 2012).

## **Patient and Family Teaching**

Parents of children with respiratory disorders can become frightened. Adequate emotional support is needed. Some key points include:

- Involve parents in the care of their child.
- Verbalize results of assessments, and goals of treatment.

- The anxiety of the child can increase respiratory distress. Find out what works best for the child to help decrease anxiety.
- Educate on health promotion, such as immunizations, decreasing environmental exposures at home, etc.

## **Conclusion**

In this course, you learned:

- Asthma control is essential for the wellbeing of any child diagnosed with the disease.
- Healthcare professionals are in a unique position to prevent ongoing asthma episodes by learning about and teaching children and their families how to prevent an attack.

## **Resources and References**

Here are some resources and references to further your studies.

### **Resources**

American Academy of Pediatrics

1 800-433-9016

<http://www.aap.org/>

American College of Allergy, Asthma, and Immunology

1-800-842-7777

[www.Acaai.Org](http://www.Acaai.Org)

American Lung Association

1-800-586-4872

[www.lungusa.org](http://www.lungusa.org)

Association of Asthma Educators

1-888-988-7747

[www.asthmaeducators.org](http://www.asthmaeducators.org)

Asthma and Allergy Foundation of America

1-800-727-8462

[www.aafa.org](http://www.aafa.org)

Centers for Disease Control and Prevention

1-800-311-3435

[www.cdc.gov](http://www.cdc.gov)

National Heart, Lung, and Blood Institute Information Center

1-301-592-8573

[www.nhlbi.nih.gov](http://www.nhlbi.nih.gov)

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