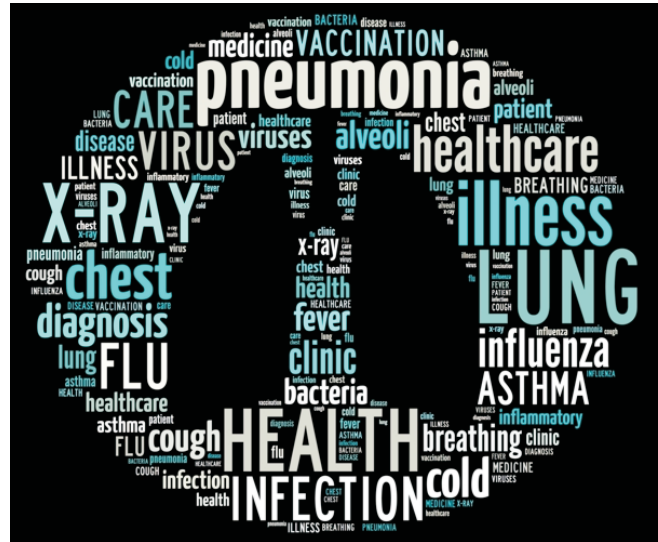


Respiratory System: Diseases and Disorders

YOUR RESPIRATORY SYSTEM functions without you even thinking about it. You breathe in and out all day long without a care: it's effortless. However there are times when breathing can become difficult due to a disease or a medical condition. This unit explores common disorders and diseases of the respiratory system.



Objective:



Describe diseases and disorders of the lungs and upper respiratory system.

Key Terms:



alveoli	dyspnea	pneumonia
anorexia	emphysema	pulse oximetry
aspiration	hemoptysis	radiation therapy
asthma	laryngitis	respiratory system
atelectasis	lobar pneumonia	rhinitis
bronchoscopy	lobes	sinusitis
chest x-ray (CXR)	lobectomy	spirometry
chronic disease	lung cancer	sputum
chronic bronchitis	lungs	tachypnea
chronic obstructive pulmonary disease (COPD)	malignancy	thoracentesis
common cold	mediastinum	upper respiratory infection (URI)
cryoablation	metastasized	wheezing
cyanosis	nosocomial pneumonia	
	orthopnea	
	pneumectomy	

Diseases and Disorders: Lungs and Upper Respiratory System

The **respiratory system** is a set of organs and accessory structures that allow the body to bring oxygen in and then exchange the oxygen for carbon dioxide. Oxygen is carried throughout the body and carbon dioxide is released from the body. The **lungs** are a pair of organs in the chest that supply the body with oxygen and remove carbon dioxide from the body. Lungs sit on each side of the chest and are separated by the mediastinum. The **mediastinum** is the area between the lungs in the center of the chest. The organs in this area include the heart, the trachea, the esophagus, the thymus, and lymph nodes. Lungs are cone-shaped and are made of spongy tissue. The apex is the narrow top portion of the lung. The base is the wide bottom of the lung. **Lobes** are the sections of the lung.



FIGURE 1. This image depicts the airways within the respiratory system. Diseases and disorders of the lungs include COPD, pneumonia, asthma, and cancer. Diseases and disorders of the upper respiratory system include rhinitis, sinusitis, laryngitis, and the common cold.

DISEASES AND DISORDERS OF THE LUNGS

COPD

Chronic obstructive pulmonary disease (COPD) is a persistent lung disease that includes bronchitis, emphysema, or both. COPD occurs when there is persistent airflow obstruction through the bronchial tubes and lungs. A **chronic disease** is a condition that lasts one year or more, gradual in onset, and requires ongoing medical attention. There are two main types of COPD: emphysema and chronic bronchitis. Both can be caused by smoking or by exposure to irritating gases.

♦ TYPES, CAUSES, AND RISKS:

- **Emphysema** is a condition in which the alveoli lose their elastic property. **Alveoli** are tiny air sacs in the lungs that resemble grape clusters located at the end of the bronchioles. It is within the alveoli that oxygen is exchanged for carbon dioxide. In emphysema

Chronic Obstructive Pulmonary Disease (COPD)

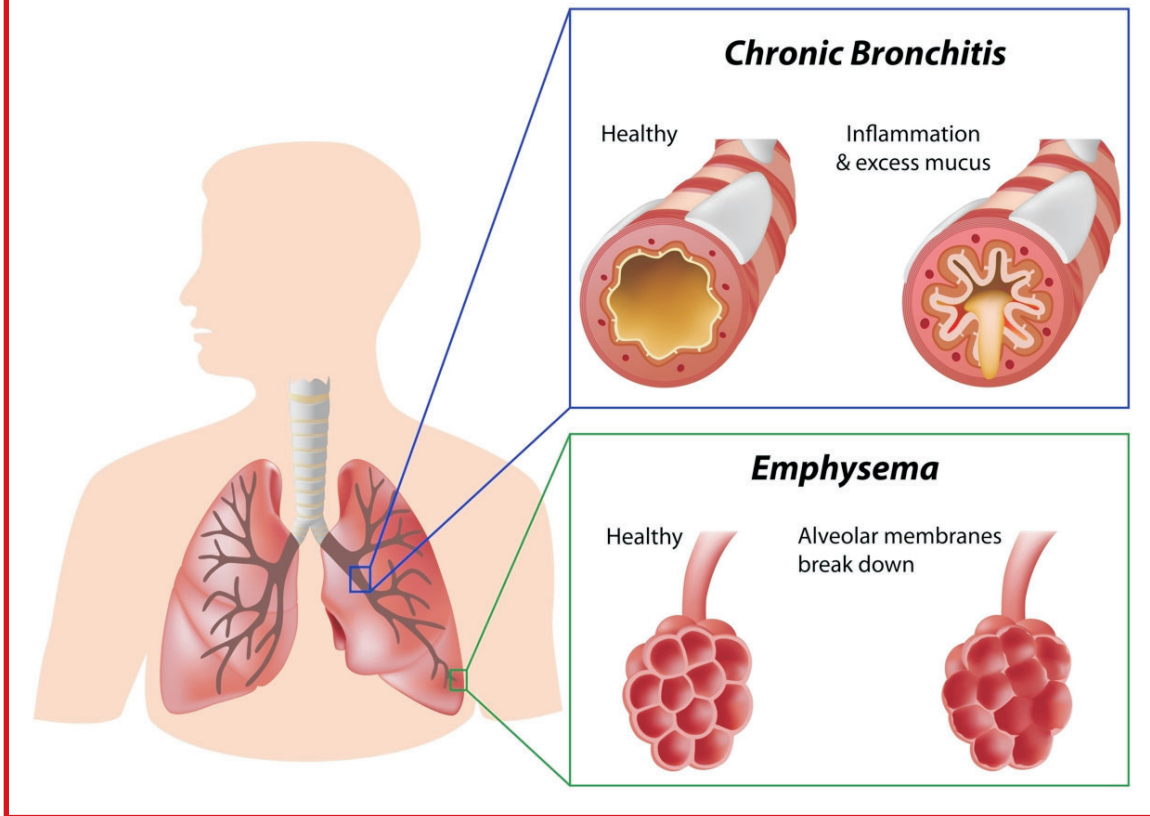


FIGURE 2. COPD is a persistent lung disease that includes bronchitis, emphysema, or both. COPD occurs when there is persistent airflow obstruction through the bronchial tubes and lungs. Both are caused by smoking or by exposure to irritating gases.

the alveoli sacs do not deflate with expiration. This leads to the inability of the person to fully exhale the carbon dioxide in the lungs. Causes and risks include:

- Causes of emphysema include smoking. (There is a strong link between smoking and emphysema.) Constant over inflation of the lungs causes the ribs to remain slightly expanded leaving the person with a barrel-like appearance to the chest. (Because the alveolar sacs do not deflate, air remains in the lungs.)
- Risks when emphysema is diagnosed include increased respiratory infections and heart disease. A person with emphysema may exhibit **tachypnea** (fast breathing above the rate of 20 breaths per minute). The person may also have a cough, especially in the morning. There is a strong link between smoking and the development of emphysema.
- **Chronic bronchitis** is the long-term irritation of the bronchial tubes leading into the lungs. The bronchial tubes are responsible for carrying the air to and from the alveoli. Cause and risk of chronic bronchitis is:
 - Cause is a narrowing of the tubes due to irritation or inflammation.
 - Risk is that the lungs produce mucous which may block these narrowed airway passages.

◆ SIGNS AND SYMPTOMS:

- **Dyspnea** is difficulty breathing, especially with exertion.
- Chronic persistent cough.
- Productive cough of mucous. Mucous may be clear, white, yellow, or green.
- **Cyanosis** is a blue tinge around the lips and in the fingernail beds.
- Lack of energy or fatigue.
- Chest tightness.
- Swelling in feet and ankles.

◆ DIAGNOSIS: To diagnose COPD, a health care practitioner takes a detailed history of the person's symptoms and performs a physical examination. Then, lung (pulmonary) function tests determine how much air is being inhaled and exhaled and also measures the amount of oxygen in the blood stream. Diagnostic tests include:

- **Spirometry** is a common pulmonary function test in which a person exhales into a tube connected to an instrument that measures the air capacity of the lungs: a spirometer. The lung volume is measured, as well as how fast the air was blown out of the lungs.
- **Pulse oximetry** is a measure of the percentage of oxygen concentration in the blood stream. A small probe is placed on a fingertip or earlobe to measure the percentage of oxygen in the blood stream.
- Chest x-rays help to diagnose emphysema.
- Computerized tomography (CT) of the lungs may help to diagnose emphysema. A CT scan produces computer generated cross-sectional images of the organs for diagnosis.

◆ TREATMENT: COPD treatments are determined by the symptoms and the diagnostic results of performed tests. It's recommended that a person with COPD or other respiratory infections:

- Quit smoking. This is the most important treatment for COPD (if the person is a smoker).
- Remove them self from exposure to irritating materials at work. Irritating materials negatively affect lung function.
- Receive medication from a healthcare provider for any respiratory infection.
- Use bronchodilators (in the form of inhalers) to relax the bronchial tubes. Inhaled steroids may also be used to decrease inflammation.
- Increase the blood oxygen content via oxygen therapy.
- Follow exercise, nutrition, and lifestyle changes to enhance respiratory function.
- Elevate the head and torso to make it easier to breathe. [NOTE: **Orthopnea** (ortho-meaning straight and -pnea meaning breathing) is a condition that makes breathing difficult when lying down. It occurs in many disorders of the respiratory and cardiac systems.]

Pneumonia

Pneumonia is an acute infection or inflammation of the alveoli in one or both lungs caused by viruses or bacteria. The alveoli fill with pus or fluid and become solid and may collapse. The collapse is called **atelectasis**: commonly called a collapsed lung.

♦ TYPES, CAUSES, AND LOCATIONS:

- Community-acquired pneumonia is the most common type of pneumonia and is caused by viruses and bacterial infections. This type of pneumonia spreads by an infected person coughing and spreading droplets that contain the bacteria or virus to others.
- **Lobar pneumonia** is acute pneumonia that involves the entire lobe of a lung. Lobes are the sections of the lung: the right lung has 3 lobes and the left lung has 2 lobes.
- **Aspiration** is inhaling something into the lungs other than air: often water, vomit, or food. Aspiration pneumonia is an infection that develops when a person inhales foreign material. This is a concern for people who have difficulty swallowing and for those who are elderly or have dementia.
- **Nosocomial pneumonia** is a hospital-acquired disease picked up during a hospital stay or visit to a physician office or clinic. The person may have been admitted to the hospital for an unrelated injury or disease and acquired pneumonia during the stay.

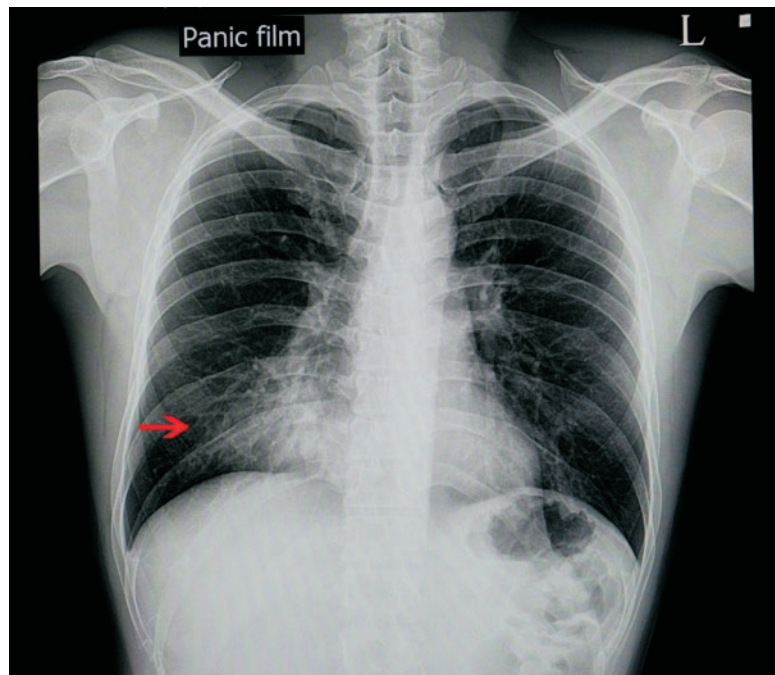


FIGURE 3. This chest x-ray belongs to a patient who has pneumonia on the right side. The location is marked with a red arrow. The pneumonia is in the right lower lobe of the lung.

♦ SIGNS AND SYMPTOMS:

- Fever, sweating or shaking, and chills (when an infection is present).
- Dyspnea or shortness of breath.
- Cough, which may be productive.
- Chest pain with coughing or exertion.
- Confusion or a lower than normal body temperature due to a poor immune system (symptomatic with some older adults).

♦ DIAGNOSIS:

- A health history noting any complaints of the above signs and symptoms.

- Use of a stethoscope to listen for crackling, rumbling, or other abnormal sounds when breathing.
 - A chest x-ray obtained and reviewed by the radiologist. A **chest x-ray (CXR)** is a procedure that uses a small amount of radiation to produce an image for evaluation of the organs and structures in the chest.
 - A pulse oximetry test. (Pneumonia can prevent the lungs from supplying the body with sufficient oxygen.)
 - Collection of a **sputum** (mucus from the lungs) sample. To collect the sample, the patient performs a deep cough. The sputum is then examined for bacteria or other abnormal cells.
 - A **bronchoscopy** is a surgical procedure in which the airways of the lungs are examined by passing a tube through the mouth and into the lungs. A bronchoscopy may be performed if further diagnosis or a biopsy is needed from the lungs.
- ♦ **TREATMENT:** Pneumonia treatment focuses on eliminating the cause and rehabilitating the person back to good respiratory health. Treatments include:
- Drinking plenty of fluids to help “mobilize” the mucus making it easier to cough it out.



FURTHER EXPLORATION...

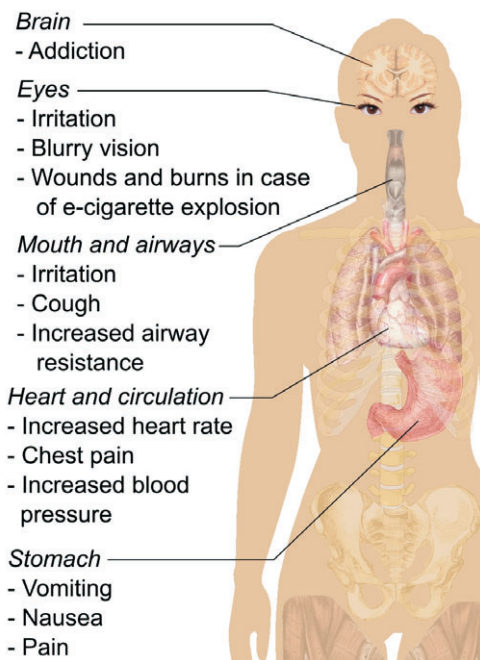
ONLINE CONNECTION: E-Cigarettes: Know the Risks

E-cigarettes, or vaping, is becoming very popular among young people, as well as those who are attempting to quit tobacco smoking. E-cigarettes are made in a wide variety of flavors, which may make it appear more like a ‘harmless’ activity. As an activity or as an alternative to cigarette smoking, studies are reporting that vaping does have an effect on the body.

As with anything you do, it is essential that you understand the risks and the benefits of what you are considering. This is especially important when your health may be at risk.

Learn more about the use of e-cigarettes and the effects they have not only on your respiratory system but on other body systems as well on the U.S. Surgeon General’s website at <https://e-cigarettes.surgeongeneral.gov/knowtherisks.html> and on the Center on Addiction website at <https://www.centeronaddiction.org/e-cigarettes/about-e-cigarettes/10-surprising-facts-about-e-cigarettes>.

Adverse effects of vaping



(Image courtesy Wikipedia at [https://commons.wikimedia.org/wiki/File:Adverse_effects_of_vaping_\(raster\).png](https://commons.wikimedia.org/wiki/File:Adverse_effects_of_vaping_(raster).png))

- Taking medications to reduce fever and fight infection as directed by the physician.
- Resting. Resting is key as rest allows the lungs to heal.
- Using cough suppressants under the direction of the physician. Coughing is the body's "plan" for clearing the airways.

Asthma

Asthma is a chronic inflammation disease of the airways leading to the lungs. A person having an asthma attack has difficulty-moving air in and out of the lungs. The disease seems to run in families or be genetic and can begin at any age. With proper treatment, the person can live a healthy life. There is no cure for asthma however it can be treated. Asthma is caused by various triggers which make the airways constrict or narrow. Asthma is no longer considered a single disease. It is treated based on the identified trigger.

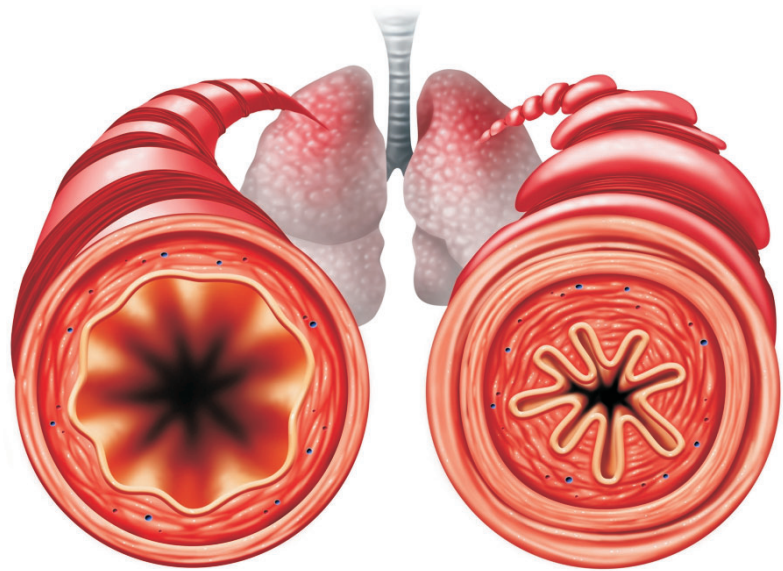


FIGURE 4. You see a healthy bronchial tube on the left and a constricted bronchial tube on the right that represents an asthma flare up.

♦ COMMON ASTHMA TRIGGERS:

- Cold weather.
- Exercise.
- Allergens, including animals, mold, dust, food, or smoke.
- Medications, such as aspirin, can induce asthma.

♦ SIGNS AND SYMPTOMS: The following indicators are likely to bring a person to the doctor for a diagnosis.

- Chest tightness, especially during cold weather or exercise.
- Difficulty breathing or shortness of breath. The person may feel as if they are unable to get enough air into their lungs.
- **Wheezing** is a high-pitched whistling sound as one takes a deep breath.
- Frequent cough, especially at night.
- Tachypnea (rapid breathing).

♦ DIAGNOSIS: Asthma diagnostics are conducted by a health professional and may include:

- A complete health history including symptom occurrences and triggers.
- Listen to the air exchange within the lungs with a stethoscope.

- Spirometry testing to measure the amount and the rate at which air is moved out of the lungs.
- Allergy testing to eliminate or confirm asthma flare-up triggers.
- ♦ **TREATMENT:** The treatment of asthma depends upon the trigger and controlling that trigger. Asthma treatment focuses on living a normal life with asthma. Once the trigger is identified, health professionals assist the patient and family in creating an asthma treatment plan to help limit flare-ups. Asthma treatments may include:
 - Avoidance of the triggers.
 - Quick relief medication used during a flare-up. This medication is likely given through an inhaler and taken as soon as symptoms worsen. Inhaled medications help relax the airways so breathing becomes easier.
 - Long-term medication taken daily. These medications are often steroids taken daily regardless of how well the person feels.

Lung Cancer

Lung cancer is a malignant disease that begins in the lungs. A **malignancy** is a condition dangerous to health: a term often used interchangeably with the term ‘cancer.’

- ♦ **RELATED FACTORS AND RISKS:** Although the cause of lung cancer is unclear, there are several factors that may increase the risk of developing lung cancer. For example:
 - Smoking increases the risk for lung cancer although the risk does decrease when the person stops smoking.
 - Being elderly.
 - A family history of lung cancer.
 - Exposure to chemicals, such as asbestos, either at work or in the home.
- ♦ **SIGNS AND SYMPTOMS:** Typically, there are no early signs or symptoms of lung cancer. However, the following occurrences should be reported to the doctor:
 - A cough that does not go away and worsens over time
 - **Hemoptysis** is spitting up or coughing up blood.
 - **Anorexia** is the loss of appetite.

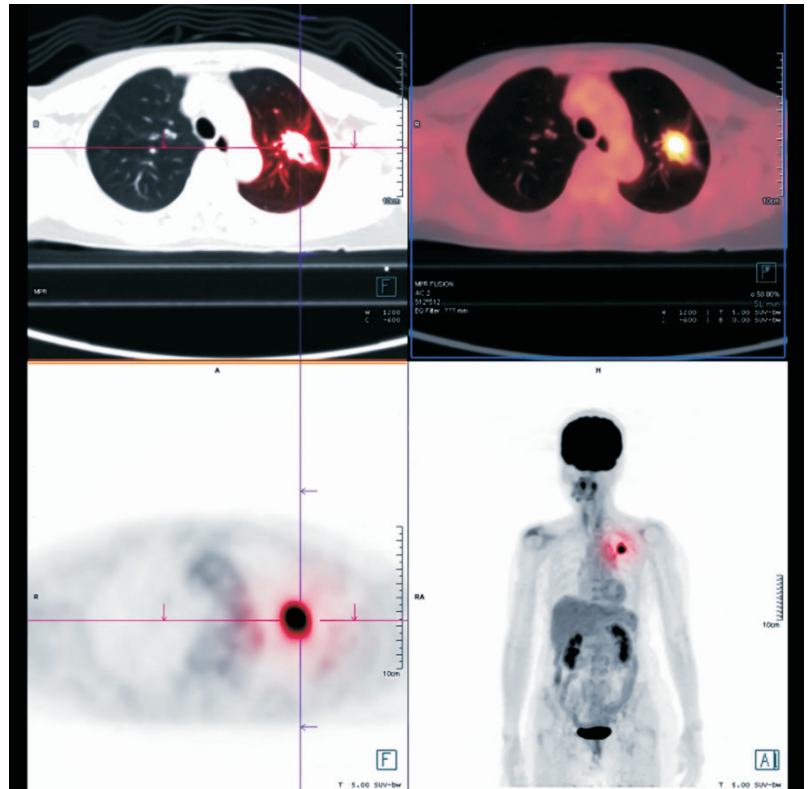


FIGURE 5. Lung cancer is a malignant disease that begins in the lungs. This PET scan film of lung cancer is from different body angles. The cancerous tumor absorbs the radiation and shows up brighter than the surrounding tissue.

- Pain in the chest or side that does not go away.
- Shortness of breath or wheezing.
- Tiredness or fatigue.
- ♦ **DIAGNOSIS:** The diagnosis of lung cancer begins with the health professional and may include several steps. For example, a health professional would:
 - Take a comprehensive health history and perform a physical examination.
 - Order radiological or imaging tests to provide pictures of the lungs. There are several types of imaging tests used in the diagnosis of lung cancer.
 - A computerized tomography (CT) scan.
 - A positron emission tomography (PET) scan uses radioactive tracers that are absorbed by the cancer cells. Then, a special camera takes a picture of the areas of radioactive uptake by the cancer cells.
 - Obtain and examine a sputum specimen microscopically for the presence of cancer cells.
 - Conduct a bronchoscopy to get direct visual examination of the internal structures of the respiratory system.
 - Perform a thoracentesis when fluid is found around the lungs. **Thoracentesis** is a surgical procedure in which a needle is inserted between two ribs to extract any fluid. Then, the fluid is examined for cancer cells.
- ♦ **TREATMENT:** Lung cancer treatment options include surgical and non-surgical techniques.
 - **Lobectomy** is the surgical removal of the affected lobe of the lung. This procedure leaves the person with a partial lung.
 - **Pneumonectomy** is the surgical removal of an entire lung. This procedure leaves the person with one lung.
 - **Cryoablation** is a non-surgical treatment in which a needle inserted into the tumor injects a cold gas to freeze the cancer cells.
 - **Radiation therapy** is a non-surgical treatment using high-power energy beams to destroy the cancer cells. The therapy can be used for lung tumors as well as cancer cells that may have **metastasized** (spread) to other body parts, such as to the brain or to bones.

DISEASES AND DISORDERS OF THE UPPER RESPIRATORY SYSTEM

An **upper respiratory infection (URI)** is a disease of the nose, sinuses, larynx, or throat: the structures of the upper respiratory system. A URI is commonly called a cold. The **common cold** is a contagious viral infection of the upper respiratory tract transmitted by airborne droplets or by direct contact with infected secretions.

- ♦ **SYMPTOMS:** Symptoms of a URI depend upon the structure that is inflamed or infected. General symptoms include cough, sore throat, sneezing, and runny nose.

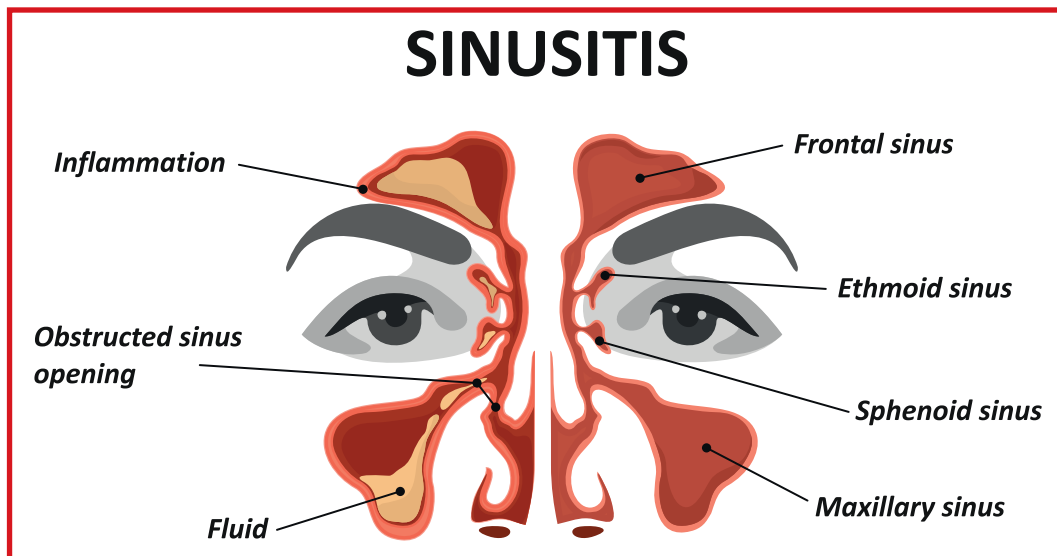


FIGURE 6. This image depicts healthy and inflamed sinuses.

- **Rhinitis** is drainage through the nose (a runny nose). The drainage is normally clear and thin. A physician should be contacted if the drainage becomes thick or colored (green or yellow).
- **Sinusitis** is an inflammation of the facial sinuses. The symptoms may include fullness in the face and pain or tenderness below the eyes. A person could also experience increased nasal drainage and fever.
- **Laryngitis** is inflammation of the larynx that results in hoarseness or loss of voice and a sore throat. (The larynx is an upper respiratory system structure commonly known as the voice box.)
- ♦ **DIAGNOSIS:** Diagnosis of an URI includes a comprehensive physical examination that considers the patient's history and symptoms. A sample of nasal drainage or a throat swab may be obtained and submitted for laboratory when there is a question of bacterial infection.
- ♦ **TREATMENT:** URI treatment depends upon the physical findings.
 - Fluids are encouraged to thin the drainage thin and to keep it flowing.
 - Medications may be ordered for pain or fever relief.
 - Rest is encouraged to allow the body to heal.

Summary:



Your respiratory system provides vital oxygen to cells and removes carbon dioxide as a waste product. When the respiratory system becomes compromised by disease or illness it affects daily life. Suddenly, we become very aware of our breaths and any struggles that occur with those breaths. Respiratory diseases and disorders can happen to anyone at any age. Keeping your respiratory system healthy and recognizing any change in breathing is very important to your wellbeing.

Checking Your Knowledge:



1. Differentiate the COPD disorders.
2. Explain the importance of a complete health history and physical examination to respiratory health.
3. Compare lung cancer treatments including the benefits of one treatment over another.
4. Play the “Respiratory Disorder Quizlet” at https://quizlet.com/_6cksnp. Report your score.
5. List the respiratory system structures are impacted by lung and upper respiratory diseases and disorders.

Expanding Your Knowledge:



We have all had a respiratory disease at one time. With care, some of the respiratory diseases and disorders may be prevented or controlled. Research how infectious respiratory diseases are spread and how chronic diseases can be controlled. Design a respiratory health awareness poster to share with your school that includes prevention of respiratory diseases and the care of the disease. Begin your research with the Web Links resources.

Web Links:



Lung Cancer

<https://www.mayoclinic.org/diseases-conditions/lung-cancer/symptoms-causes/syc-20374620>

Pulmonary Rehabilitation

<https://www.nhlbi.nih.gov/health-topics/pulmonary-rehabilitation>

Smoking and Respiratory Diseases

https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/pdfs/fs_smoking_respiratory_508.pdf