

Breathless: A Visual Exploration of Lung Diseases

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Abstract

In-depth analysis of lung disorders, their effects on people and communities, and the difficulties in treating them is provided in this research article. Lung conditions, such as chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and pneumonia, have grown to be major global public health worries. The causes, risk factors, diagnostic methods, available cures, and preventative measures for a variety of lung disorders are all examined in this essay. It is also investigated how lung disorders develop and advance due to hereditary factors, environmental variables like smoking and air pollution, and occupational hazards. In order to improve patient outcomes and lessen the burden of pulmonary illnesses, the findings highlight the vital relevance of early detection and prompt care. Lung disease development is known to be primarily influenced by genetic factors, environmental exposure, and occupational hazards. The study emphasizes the importance of interdisciplinary cooperation among healthcare experts, researchers, policymakers, and communities to effectively address the issues raised by lung disorders. Lung disease impact must be reduced through public health actions, such as raising awareness, encouraging healthy lifestyle choices, and putting preventive measures in place. These interventions include measures to reduce smoking, better air quality legislation, immunization campaigns, and early screening programs. The research report emphasizes the urgent need for ongoing study, advocacy, and policy implementation in its conclusion in order to lessen the burden of lung illnesses, enhance patient outcomes, and promote lung health globally. This project seeks to expand our knowledge of lung disorders by analyzing their causes, effects, and treatment options. It also aims to provide a foundation for future research in the area.

Keywords

Respiratory system, Pulmonary disease, Chronic obstructive pulmonary disease (COPD), Asthma, Lung cancer

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1. Introduction

As they have an effect on people, communities, and public health systems, lung illnesses have become a serious worldwide health concern. The prevalence of diseases like lung cancer, pneumonia, asthma, and chronic obstructive pulmonary disease (COPD) has steadily increased, leading to high rates of morbidity and mortality. These illnesses have a significant impact on people's social, emotional, and economic well-being in addition to their physical health. Addressing this urgent public health issue requires a thorough understanding of the causes, risk factors, diagnostic procedures, available treatments, and prevention methods related to lung illnesses.

2. Background

The main causes of illness and death globally are now lung illnesses, such as COPD, asthma, lung cancer, and pneumonia. Over 300 million people worldwide are afflicted by COPD, a progressive respiratory disorder marked by airflow restriction, and by 2030, it is expected to overtake heart disease as the third greatest cause of mortality. With an estimated 300 million sufferers worldwide, asthma is a chronic inflammatory disease of the airways that affects people of all ages. The most frequent cancer worldwide and the main reason for cancer-related deaths is lung cancer, which is primarily brought on by smoking. Lung infection known as pneumonia offers a serious risk to health, especially for those who are more susceptible, including young children, the elderly, and people with weakened immune systems.

The socioeconomic toll that lung illnesses take on people and societies is significant. Hospitalizations, medication, and long-term care are only a few of the expenses directly related to the management of chronic illnesses that are significant. The economic burden is also increased by indirect expenses like lost output from illness and early mortality. Lung disease has an impact on the healthcare system, workplace productivity, and the general well-being of society. It affects not just the affected individuals but also their families, communities, and wider society.

The development and progression of lung illnesses are influenced by a variety of causes and risk factors. Due to differences in their immune system and lung function-related genes, certain people are predisposed to diseases like COPD and asthma, making them more likely to develop those ailments. Smoking and exposure to air pollution are two important environmental risk factors for lung illnesses. The majority of cases of lung diseases that are preventable are still caused by cigarette smoking, both active and passive. Workers in several industries are also more likely to acquire lung disorders due to occupational dangers such exposure to asbestos, silica, and gases.

2.1. Techniques for Diagnosis

For lung disorders to be effectively managed, a precise diagnosis is essential. Identification and evaluation of lung disorders rely heavily on non-invasive diagnostic methods. Spirometry is a quick and common test that assesses lung function and aids



in the diagnosis of diseases including asthma and COPD. In addition to helping with the diagnosis and evaluation of lung illnesses, imaging investigations such as computed tomography (CT) scans and X-rays offer useful information about the structure of the lungs. To obtain tissue samples for additional analysis and to inform treatment choices, invasive procedures like bronchoscopy and lung biopsies may be required in some circumstances.

2.2. Treatment Options

A multidisciplinary strategy is used in the management of lung illnesses, which also includes non-pharmacological interventions. Medications like bronchodilators, corticosteroids, and immunomodulatory drugs are frequently used to treat COPD and asthma symptoms, reduce inflammation, and enhance lung function. Depending on the stage and nature of the illness, treatment options for lung cancer might range from surgery to radiation therapy to chemotherapy to targeted therapy to immunotherapy. A crucial part is also played by non-pharmacological therapies such oxygen therapy, lifestyle changes, and pulmonary rehabilitation programs. The study has contributions as follows:

"Breathless: A Visual Exploration of Lung Diseases" is a groundbreaking contribution to the field of medical education and public awareness. This innovative project combines art, technology, and medical science to create a visually captivating and informative experience that sheds light on the complexities and impact of lung diseases.

One of the most significant contributions of "Breathless" is its ability to bridge the gap between medical professionals and the general public. By presenting intricate and often abstract concepts through visually stunning imagery, the project enables a wider audience to grasp the intricate nature of lung diseases. This accessibility is crucial in raising awareness and understanding of these conditions, empowering individuals to recognize symptoms, seek timely medical attention, and engage in preventive measures.

Through its visual exploration, "Breathless" aims to dispel misconceptions and stigmas surrounding lung diseases. By portraying the affected lungs in a striking and relatable manner, the project humanizes the experience of those living with respiratory conditions. This approach fosters empathy, reduces discrimination, and encourages support and inclusivity for individuals battling lung diseases.

Another notable contribution of "Breathless" lies in its potential as an educational tool for healthcare professionals. By providing intricate visual representations of various lung diseases, the project offers a unique resource for medical training and continuing education. Physicians, nurses, and other healthcare providers can benefit from the enhanced understanding of disease processes and their visual manifestations, leading to improved diagnosis, treatment, and patient care.

In summary, "Breathless: A Visual Exploration of Lung Diseases" makes a significant contribution by utilizing art and technology to enhance public awareness, educate healthcare professionals, and stimulate further research. By engaging viewers through visually captivating representations, the project empowers individuals, reduces stigmas, and fosters a more comprehensive understanding of the complexities and impact of lung diseases. Ultimately, "Breathless" has the potential to improve patient care, advance medical knowledge, and promote a healthier society.

3. Respiratory System

On either side of the coffin's (tummy) casket are the lungs, a pair of pliable, air-filled organs. The trachea, or windpipe, transfers breathed air into the lungs through its tubular branches, or bronchi. The bronchi also split into lower and lower branches, or bronchioles, before becoming very small. Alveoli, a collection of tiny air sacs, are where the bronchioles eventually come to a stop. The alveoli are where the blood absorbs oxygen from the air. The blood transports carbon dioxide, a waste product of metabolism, to the alveoli where it can be breathed. A thin layer of cells known as the interstitium lies between



the alveoli and contains blood veins and cells that support the alveoli. A range of illnesses known as "lung conditions" affect the respiratory system and the lungs.

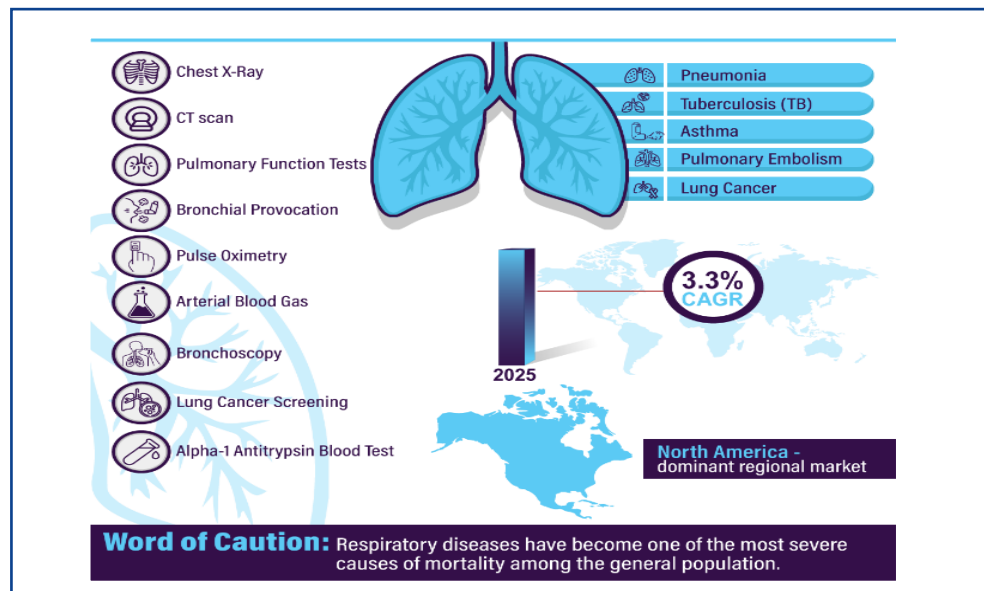


Figure 1. Respiratory Disease Test i.e. which identify lung disease

Shortness of breath is brought on by the chronic obstructive pulmonary disease (COPD), which affects the lungs. The most frequent cause of COPD is unquestionably smoking.

3.1. Emphysema

A kind of COPD that is typically brought on by smoking. It is difficult to breathe because air is trapped in the lungs due to damage to the alveoli, the thin walls separating the lungs' air sacs.

3.2. Chronic bronchitis

Recurrent, regular attacks of productive cough typically brought on by smoking. This type of COPD makes breathing challenging as well. Pneumonia is an infection of the lungs, either one or both. Although viruses can also cause pneumonia, bacteria, particularly *Streptococcus pneumoniae*, are the most frequent culprits.

3.3. Asthma

The lungs' airways (bronchi) swell and may spasm, resulting in breathlessness and wheezing. airborne viruses, allergies, or other. The lung condition known as chronic obstructive pulmonary disease (COPD) causes breathlessness. Smoking is without a doubt the most common cause of COPD.

3.4. Emphysema

A kind of COPD is often caused by smoking. Air is trapped in the lungs because of injury to the alveoli, the delicate walls dividing the lungs' air sacs, making breathing difficult.

Chronic bronchitis is marked by recurrent, frequent bouts of a productive cough, which are often triggered by smoking. Breathing becomes difficult for those with this kind of COPD. The lung condition known as chronic obstructive pulmonary disease (COPD) causes breathlessness. Smoking is without a doubt the most common cause of COPD.

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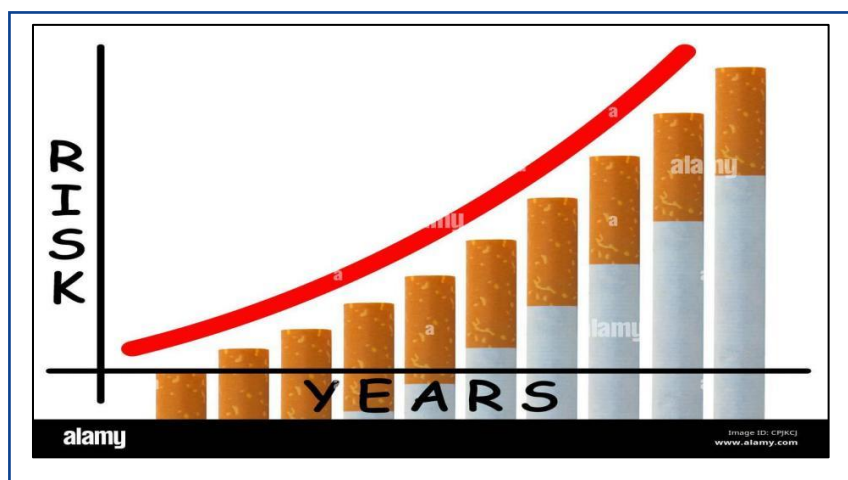


Figure 2. The consumption of cigarettes has highly increase since 1980 which increases lung disease

An infection of one or both of the lungs is known as pneumonia. Although viruses are capable of causing pneumonia, *Streptococcus pneumoniae* and other bacteria are more commonly to blame.

3.6. Asthma

Breathlessness and wheezing are caused by bronchial swelling and possible spasms in the lungs.

3.7. Lung cancer

Cancer may develop in practically any lung tissue. Smoking is the leading factor in lung cancer. The bacterium *Mycobacterium tuberculosis* causes TB, a slowly progressing pneumonia. Common signs of TB include a persistent cough, fever, weight loss, and night sweats. The bacterium *Mycobacterium tuberculosis* causes tuberculosis, a slowly progressing pneumonia. Common signs of tuberculosis include a persistent cough, fever, weight loss, and night sweats.

Acute respiratory distress syndrome (ARDS): Serious illness-related, sudden, severe lung damage. Typically, mechanical breathing and life support are required to survive until the lungs heal. The fungus *Coccidioides*, which is present in the soil of the southwestern United States, causes coccidioidomycosis, a kind of pneumonia. Most people either show no symptoms at all or just show mild flu-like symptoms and fully recover.

Infection brought on by breathing in *Histoplasma capsulatum*, a fungus that can be found in the soil in the eastern and central United States. Mild *Histoplasma* pneumonias represent the majority. Most people either show no symptoms at all or

just show mild flu-like symptoms and fully recover. Infection brought on by breathing in *Histoplasma capsulatum*, a fungus that can be found in the soil in the eastern and central United States. A minor *Histoplasma pneumonia* is one that simply produces a transient cough and flu-like symptoms.

3.8. Allergic alveolitis, or hypersensitivity pneumonitis

An allergic reaction in the lungs is brought on by inhaling dust and other chemicals. Farmers and other people who work with dusty, dried plant material frequently experience this. Most people either show no symptoms at all or just show mild flu-like symptoms and fully recover. Infection brought on by breathing in *Histoplasma capsulatum*, a fungus that can be found in the soil in the eastern and central United States. A minor *Histoplasma pneumonia* is one that simply produces a transient cough and flu-like symptoms.

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3.11. Flu

An infection with one or more flu viruses results in fever, body pain, and coughing that lasts for a week or longer. Particularly in older patients with underlying medical conditions, influenza can develop into a potentially fatal pneumonia. Mesothelioma is an uncommon type of cancer that most commonly affects the lungs but can develop in cells lining other body organs as well. Several decades after asbestos exposure, mesothelioma typically develops. Pertussis, sometimes known as whooping cough, is a virulent *Bordetella pertussis* infection of the bronchi that results in a chronic cough. Teenagers and adults are advised to get a booster dose of the Tdap vaccine to prevent pertussis.

3.12. Pulmonary hypertension

Several illnesses can cause elevated blood pressure in the arteries connecting the heart and lungs. Idiopathic pulmonary arterial hypertension is the name given to the disorder if no cause can be found.

3.13. Pulmonary embolism

A blood clot that generally forms in a leg vein may fragment and move to the heart, where it is pumped into the lungs. The most typical pulmonary embolism symptom is abrupt shortness of breath. A serious pneumonia brought on by a particular virus that was initially identified in Asia in 2002 is known as severe acute respiratory syndrome (SARS). SARS has not killed anyone in the United States, suggesting that global preventative methods have kept it under control.



3.14. SARS-CoV-2/COVID-19

This corona virus caused a global pandemic that started in 2019. It can cause pneumonia that affects both lungs, filling them with fluid and making breathing difficult. Acute respiratory distress syndrome and other respiratory illnesses like COVID-19 can cause long-term lung damage.

3.15. Pneumothorax

A chest infection brought on by abnormal air entry into the pleural space, which surrounds the lung. An injury may result in pneumothorax, or it may arise on its own.

3.16. Types of Lung Conditions

Chronic obstructive pulmonary disease (COPD), asthma, pneumonia, lung cancer, and tuberculosis are just a few examples of the various lung disorders that can affect people. The COPD's tendency to progress makes breathing difficult. In most cases, irritation is brought on by long-term exposure to irritants like cigarette smoke or air pollution. Inflammation of the airways characterizes the chronic respiratory condition asthma that makes breathing difficult. Inflammation of the air sacs in one or both lungs is a symptom of pneumonia. Lung cancer is a malignant disease that starts in the lungs and can spread to other body organs. An infection caused by germs; tuberculosis mostly affects the lungs.

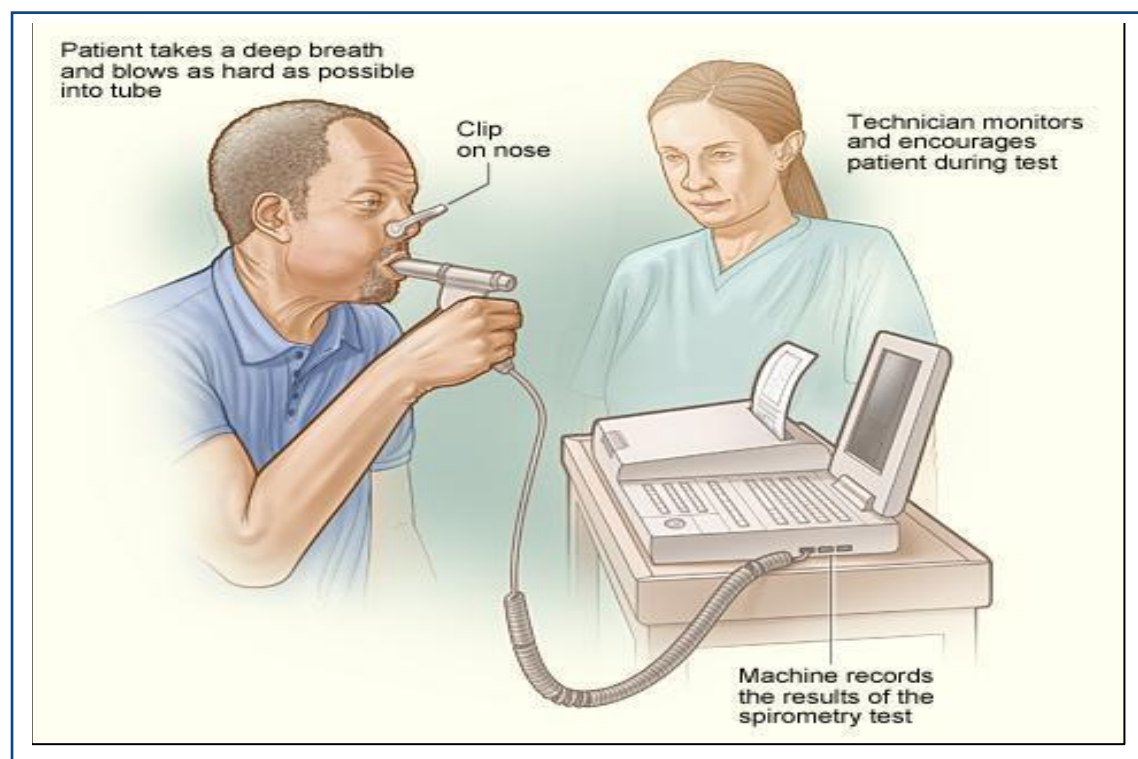


Figure 3. A full assessment of the respiratory system, including pulmonary function tests, physical examinations, and patient histories, is known as pulmonary function testing. Finding out the extent of pulmonary dysfunction is the main goal of pulmonary function testing.

3.17. Lung Tests

Chest X-ray: The initial lung-related test that occurs most frequently is a chest X-ray. It can detect foreign bodies, masses, air or fluid in the chest, lung fluid, pneumonia, and other issues. X-rays and a computer are used in computed tomography (CT scan), which creates detailed images of the lungs and adjacent structures.

3.18. Tests of pulmonary function (PFTs)

A battery of examinations to measure how effectively the lungs perform. The most common tests involve measuring lung capacity, forceful exhalation, and air transport between the lungs and blood.

3.19. Spirometry

This PFT component gauges how quickly and how much air you can exhale.

3.20. Sputum Culture

Identifying the bacterium causing pneumonia by growing the mucus coughed up from the lungs.

3.21. Peak flow measurement

During this test, your ability to quickly exhale air from your lungs is evaluated. It is frequently used to keep tabs on respiratory diseases like asthma. You will take a deep breath in and then forcefully exhale into a peak flow metre, which is a portable device that measures the speed of your breath, to complete the test. The graphic below illustrates the fundamental steps of a peak flow measurement.

3.22. Pulse oximetry

This test involves shining a light through your fingertip or earlobe to assess the amount of oxygen saturation in your blood. The test is noninvasive and painless. It is one of the major tests.

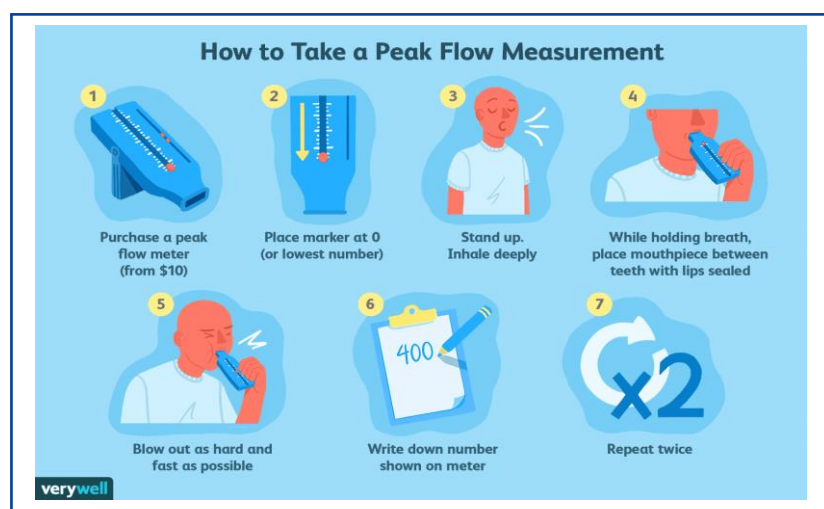


Figure 4.: Peak flow measurement test for diagnosing lung conditions

3.3. Lung Treatments

3.3.1. Lung biopsy

A small portion of lung tissue is removed surgically or by bronchoscopy. Lung problems can be identified by looking at the biopsied tissue under a microscope. Flexible bronchoscopy involves inserting an endoscope—a flexible tube with a camera and light at one end—through the mouth or nose into the bronchi. While doing a bronchoscopy, a physician may obtain biopsies or samples for culture.

Rigid bronchoscopy involves inserting a rigid metal tube into the airways of the lungs through the mouth. However, rigid bronchoscopy necessitates general (complete) anesthesia and is frequently more effective than flexible bronchoscopy. An MRI scanner produces high-resolution images of the internal structures of the chest using radio waves and a magnetic field. Surgery that enters the chest wall (thorax) is known as a thoracotomy. A lung biopsy or the treatment of some significant lung disorders may need a thoracotomy.

3.3.2. Endoscopic (flexible tube with a camera on the end) video-assisted thorascopic surgery (VATS)

Less invasive chest wall surgery. A variety of lung disorders may be treated or diagnosed with VATS.

3.3.3. Chest tube (thoracostomy)

To remove air or fluid from the area around the lung, a tube is placed through a cut in the chest wall.

3.3.4. Pleurocentesis

This procedure involves inserting a needle into the chest cavity to remove fluid around the lung. To determine the reason, a sample is typically analyzed. The majority of pneumonia cases are treated with antibiotics, which are drugs that destroy germs. Viral infection is not treatable by antibiotics.

3.3.5. Antiviral medications

When taken shortly after the onset of flu symptoms, antiviral medications help lessen the severity of influenza. Antiviral medications are ineffective for treating viral bronchitis.

3.3.6. Bronchodilators

Drugs that are inhaled can assist widen the bronchi, or airways. In those with asthma or COPD, this can lessen wheezing and shortness of breath. Inhaled or oral corticosteroids can lower inflammation and ameliorate asthmatic or COPD symptoms. Additionally, inflammation-related lung disorders that are less frequent can be treated with steroids.

3.3.7. Mechanical ventilation

A ventilator is a device that helps people breathe while they are suffering from severe lung disease attacks. Through a tube put into the mouth or neck, the ventilator pushes air into the patient. Using air pressure given by a machine through a mask, continuous positive airway pressure (CPAP) keeps the airways wide open. It helps some patients with COPD and is used at night to treat sleep apnea.



3.3.8. Lung transplant

Surgically removing the sick lungs and replacing them with healthy lungs from a donor. Lung transplantation is occasionally used to treat severe COPD, pulmonary hypertension, and pulmonary fibrosis.

3.3.9. Lung resection

The surgical removal of the damaged lung tissue. Lung resection is most frequently used to treat lung cancer.

3.3.10. Vasodilators

Some types of pulmonary hypertension may necessitate long-term medication to reduce lung pressure. These frequently need to be ingested via a continuous infusion into the veins. Surgery alone cannot always cure lung cancer; chemotherapy and radiation therapy must be used instead. Radiation and chemotherapy treatments can occasionally prolong life and aid with lung cancer symptoms.

3.4. Causes and Risk Elements

Smoking is the leading contributor to lung illnesses. Smoking tobacco exposes users to toxic compounds that hurt their lungs and raise their risk of lung cancer, COPD, and other respiratory conditions. Lung conditions can also be exacerbated by industrial dangers such as asbestos, coal dust, and silica, as well as by exposure to air pollution and secondhand smoke.

Genetics, age, gender, and way of life are additional lung disease risk factors. For instance, people are more prone to get lung disorders if their family has a history of them. The lungs might become weaker with age and become more prone to illnesses and infections. Women are more likely to get asthma than males, whereas men are more likely to suffer lung cancer. Stress, a sedentary lifestyle, and unhealthy eating habits can all raise one's risk of developing lung conditions.

3.5. The signs and the diagnosis

Depending on the type and severity of the problem, lung disease symptoms can vary. Coughing, wheezing, breathlessness, weariness, and recurrent respiratory infections are among the symptoms that are frequently experienced. The diagnosis of lung disorders frequently includes a physical examination, a study of the patient's medical history, and diagnostic procedures such as chest X-rays, CT scans, and pulmonary function testing. A diagnosis might also be supported by biopsies and blood tests.

3.6. Options for Treatment

The kind and severity of a lung illness determine the appropriate course of treatment. In addition to oxygen therapy and pulmonary rehabilitation, common therapies include drugs including bronchodilators, steroids, and antibiotics. In some circumstances, such as for lung cancer or advanced COPD, surgery may also be required. Lung diseases can be managed and prevented with the help of lifestyle modifications like giving up smoking, eating a nutritious diet, and exercising frequently.

4. Outcome and Discussion

The findings of this study demonstrate how seriously lung disorders affect both individuals and society as a whole. Increased healthcare expenses and a lower quality of life for those affected are results of the rising prevalence of diseases such as chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and pneumonia. These illnesses have a significant impact on not just physical health but also social interactions, economic stability, and emotional well-being.



The analysis of causes and risk elements demonstrates the complexity of lung diseases. These disorders arise and worsen as a result of a combination of genetic predisposition, environmental influences, and lifestyle choices. Implementing targeted prevention methods and identifying high-risk populations for early intervention require a thorough understanding of these factors. The study gives an overview of the numerous approaches for identifying and evaluating lung disorders in terms of diagnostic techniques. Invasive procedures like bronchoscopy and lung biopsies are also used, in addition to non-invasive diagnostics like spirometry and imaging examinations. Genetic testing, biomarker analysis and imaging technology improvements have all increased the accuracy and efficacy of diagnosis, allowing for earlier detection and intervention. The topic also covers lung disease treatments, highlighting the value of individualized and multidisciplinary strategies. The suggestion is included based on the observation and findings of the study.

5. Conclusions and Future Scope

The tremendous impact that lung disorders have on people, communities, and public health systems has been underlined in this research report. We have learned a great deal about the causes, risk factors, diagnostic procedures, therapeutic options, and preventative measures of several lung disorders, including chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and pneumonia. Our results highlight how important early detection and prompt treatments are to improving patient outcomes and lessening the burden of lung illnesses. Additionally, we have looked at how lung disorders develop and advance as a result of genetic, environmental, and occupational dangers (such as smoking and air pollution).

Furthermore, in order to successfully address the problems caused by lung diseases, collaboration among healthcare experts, researchers, politicians, and communities is essential. These difficulties include the increased incidence of lung conditions, the rising medical expenses incurred in treating them, and the significant negative effects on the quality of life of those who are afflicted. The report also emphasizes the significance of public health initiatives that promote healthy lifestyle choices, increase awareness, and implement efficient preventative measures. This includes initiatives like early screening campaigns, enhanced air quality rules, smoking cessation programs, and improved air quality laws.

In conclusion, by giving a thorough overview of the impact, causes, and treatment options of lung disorders, this research study adds to the body of knowledge already available on the subject. The critical need for further research, advocacy, and policy implementation to lessen the burden of lung diseases, enhance patient outcomes, and promote lung health in people and communities around the world is brought home by this. Provide a general interpretation of the results in the context of other evidence, and implications for future research.

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