

***Human Biology ATAR – Task 3: Extended Response***

***Lung diseases and treatments (7.5%)***

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| --- | --- | --- | --- |
| Name: Keshy | | | |
| Time allowed: 1 Lessons | | | |
| **Section** | Your Mark | Marks available | Percentage |
| **Section 1:**  Report |  | 10 | 18.5% |
| **Section 2**:  Validation Test |  | 44 | 81.5% |
|  |  | **54** | **100%** |

**Declaration of Authenticity**

I (Student Name) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ declare that this work is my own and I have not plagiarised from any source.

Signature:  
  
Date:

**Lung disease and treatments**

You are to choose **one** lung disease from List A and **one** disease from List B to research and find information about the named aspects of each disease. You will then complete an in-class validation assessment on your research without notes.

DISEASES

|  |  |
| --- | --- |
| **LIST A** | **LIST B** |
| Chronic bronchitis | Pneumonia |
| Emphysema | Pleurisy |
| ~~Cystic fibrosis~~ | Tuberculosis |

Check list

* Cause, or main causes
* Symptoms and diagnosis
* Current treatments…how they work and what they do
* Prevention

Write the names of the diseases you have chosen here:

Disease A: emphysema

Disease B: pneumonia

**Marks Table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Report** | **Cause** | **Symptoms** | **Treatments** | **Prevention** | **Marks** | Your mark |
| **Disease A** | 1 | 1 | 1 | 1 | 5 |  |
| **Disease B** | 1 | 1 | 1 | 1 | 5 |  |

This sheet is to be the cover page of your report

Emphysema and Pneumonia

# Introduction

The respiratory system is a specialised system in the human body that facilitates the intake of oxygen and the removal of carbon dioxide; this process of inspiration and expiration is called breathing. The body needs oxygen on a cellular level to function properly. One of the most important organs in the respiratory system is the lungs; filling almost all of the chest cavity, structures within the lungs facilitate the exchange of gases so that a continual supply of oxygen is available for the body to function (Newton, 2020). A combination of lifestyle choices and genetics can compromise the functioning of the lungs in the short and long term, this can lead to disorders and diseases (Newton, 2020).

Lung diseases are disorders that result in the malfunctioning of the lungs, such as “asthma, chronic obstructive pulmonary disease (COPD), pneumonia, tuberculosis, lung cancer,” and many others. Emphysema and pneumonia are two such lung diseases (Mayo Clinic Staff, 2017).

Emphysema is a lung condition that causes shortness of breath and results in difficulty breathing, this happens because the alveoli, small structures in the lungs, are damaged (Newton, 2020). Pneumonia is an infection of the lungs, wherein an inflammatory response is triggered to fight the infection, causing difficulty breathing and pain in the lungs, pneumonia can be fatal in vulnerable persons (Mayo Clinic Staff, 2022).

# Emphysema

## Causes

Emphysema is caused by long-term and excessive exposure to airborne irritants (Newton, 2020). These irritating particles enter the lungs and begin to destroy important lung tissue. Individuals who smoke are more prone to emphysema as the fumes and chemicals released from the tobacco are very damaging irritants in the air (Heitz, 2021). Emphysema is one of the most common disorders that make up COPD (chronic obstructive pulmonary disease), as well as chronic bronchitis, wherein the lungs become inflamed as a result of damage to the lung tissue making respiration difficult.

Emphysema is characterised by widespread destruction of the lung tissue and the alveolar walls. The alveoli are specialised structures, in the form of tiny air sacs, within the lungs; there are millions of these within the lungs. These structures serve the purpose of gas exchange, the oxygen diffusing from the alveoli into the blood and the waste carbon dioxide diffusing from the blood into the alveoli, with the concentration gradient. The alveolar walls are one cell thick, and they are surrounded by blood capillaries in order to better facilitate the diffusion process. Alongside this, the circular shape of the alveoli paired with the elastic properties of its walls allows for the lungs to have an amazingly large internal surface area, this allows for more gas exchange to happen at a faster rate, allowing for the lungs to meet the oxygen demands of the entire body (Newton, 2020).

When continually exposed to excessive airborne irritants the alveolar walls lose their elasticity becoming thickened and swollen. This inflammation makes breathing difficult, and the exchange of gases is severely hindered. In healthy lungs when air is taken in the alveoli expands to breathe in as much as possible, also increasing the surface area of the lungs and the rate at which diffusion can occur. The efficiency of the exchanging of gases therefore depends on the actions of breathing and the structure of the alveoli, when the alveoli lose their elasticity many complications in the breathing process and the efficiency of gas exchange arise, creating the disorder known as emphysema.

The degradation of the alveolar walls can lead to tears and holes to develop as the walls are quite thin, this leads to the alveoli being much bigger and fewer in number, and having lost its ability to expand, the alveoli will contribute less to increase the surface area for gas exchange resulting in a slower rate of diffusion. The loss of elasticity also restricts the lungs’ ability to expel carbon dioxide from the body, resulting in an obstructed air flow as air is “trapped” impeding the flow of air and the ability for the respiratory system to provide the body with a continual supply of oxygen large enough to satisfy the body’s needs.

In rare cases, the development of emphysema has been linked to a genetic condition wherein there is a “hereditary deficiency due to a gene mutation”, this is more commonly known as AATD (Alpha1-antitrypsin deficiency) where the body’s normal production of AAT is reduced resulting in the destruction of lung tissue (BioNinja, n.a.). AAT is a protein responsible for protecting the body’s tissues from damage, as it releases infection fighting agents. People who are deficient in AAT are more likely to develop some form of COPD which will more than likely be emphysema, among possible others (American Lung Association, 2020).

## Symptoms

Shortness of breath, coughing and wheezing, pain and tightness within the chest region, a whistling or squeaky sound when breathing, fatigue, weight loss, and increased production of mucus, are symptoms or signs of emphysema. Individuals with emphysema can go many years without showing any symptoms, and if left alone emphysema can ultimately be fatal (Mayo Clinic Staff, 2017).

The aforementioned symptoms are unsurprising given the difficulty in inspiration and expiration present for those suffering from emphysema. The inflammation in the lungs, and the damage done to the alveoli are sure to cause pain and difficulty breathing.

## Treatment

Emphysema has no cure, and once a person develops emphysema there is no way to stop the disease’s progression. Emphysema will worsen until it ultimately leads to death. Treatment of emphysema aims to reduce symptoms and slow the progression of the disease whether it be by medication, therapy, and/or surgery (National Heart, Lung, and Blood Institute, 2022).

Medications can help to alleviate symptoms and offer temporary solutions to the complications presented by emphysema, for example, “bronchodilators” and “steroid” based medications can be used to open up air passages and alleviate inflammation, making breathing easier, reducing discomfort for the individual. Antibiotics can also be taken to fight possible infections that could make the condition worse (National Heart, Lung, and Blood Institute, 2022).

Therapies such as pulmonary rehabilitation or a moderate exercise and a change in lifestyle can slow the progression of emphysema. Physical exertion is ill-advised, but moderated physical activity such as yoga can strengthen the breathing muscles without putting too much strain on the lungs thereby worsening the disease. This is because the respiratory organs and muscles will have to work harder to supply the body with more oxygen, but not so much so that further damage is done to the alveoli (National Heart, Lung, and Blood Institute, 2022). Individuals with emphysema may also change their diet, and hobbies to help deal with symptoms such as weight loss, and to prevent the worsening of their condition. Oxygen therapy is provided for more severe cases (Newton, 2020).

Surgery is rare and only provided for people will severe and fatal cases of emphysema, where the disease has worsened so much so that surgery is required to lengthen the lifespan of the individual. Lung volume reduction, to remove the damaged alveoli can be undertaken, as well as lung transplants (Heitz, 2021).

## Prevention

Emphysema is caused by irritating particles entering the lungs and destroying lung tissue. Frequenting places with clean air and less smog, would make it so that the lung tissue is not exposed to as many irritants (Newton, 2020).

Refrain from smoking, as the fumes from the tobacco are very damaging to the lungs, if the individual is already a smoker, then quitting would be the best preventative. As emphysema normally results from poor lifestyle choices, making better choices to benefit the health of the lungs, such as breathing exercises, physical activity, refraining from doing drugs and/or smoking, is entirely beneficial to the prevention of developing emphysema (Mayo Clinic Staff, 2017).

# Pneumonia

## Causes

Pneumonia is an infection of the lungs caused by bacteria, viruses, fungi and other organisms. An immune response is triggered within the lungs causing the alveoli to inflame and fill with pus and mucous, which hinders the role of the respiratory system (Mayo Clinic Staff, 2022). The pus reduces the space available for air within the alveoli, as well as the surface area available for gas exchange within the lungs, making it hard for the lungs to meet the oxygen demands for the body as the diffusion rate would be lower (Newton, 2020).

Bacteria is the most common cause and type of pneumonia. Bacterial pneumonia is caused by a bacterial infection within the lungs, triggering the inflammatory response. The most common bacteria to cause bacterial pneumonia is Streptococcus pneumoniae, this type of pneumonia (also commonly called pneumococcal pneumonia) can occur on its own or can develop after a sickness such as the flu (American Lung Association, 2021).

Viral pneumonia is less common and often less serious than bacterial pneumonia. They often develop within the lungs in vulnerable persons such as young children, the elderly, individuals with lung diseases, those who are recovering from surgery, and those who have weaker immune systems. The most common causes for viral pneumonia in adults is the influenza virus and Covid-19 virus, the latter can be serious and cause respiratory failure (American Lung Association, 2021).

Fungi pneumonia is less common, present more commonly in people with chronic health conditions, or weakened immune systems, or people who are exposed to a lot of certain fungi. Because of this, fungi related lung infections are often far more serious, as they are present in vulnerable people (American Lung Association, 2021).

## Symptoms

Symptoms for pneumonia include chest pain when you breathe or cough, coughing that produces phlegm, fever, chills, sweating, shaking, fatigue, difficulty breathing, loss of appetite, nausea and vomiting, fast and shallow breathing and an elevated heart rate (Mayo Clinic Staff, 2022).

These align with what pneumonia as a disease is, as the inflamed alveoli would make breathing difficult, and the heart rate would need to be elevated to meet the oxygen demands of the body. The fluid in the alveoli would also result in phlegm being coughed up and pain when breathing, in more severe cases. It is worth mentioning that other abnormal symptoms can arise when faced with atypical pneumonic conditions in the form of the bacteria that caused it.

## Treatments

Treatment for pneumonia depends on the type of pneumonia, whether it is a bacterial or viral infection of the lungs. In bacterial infections the main treatment is antibiotics, either orally administered until symptoms go away, or injected depending on the severity of the case. For most people pneumonia is less severe, being an acute disease, pneumonia can be treated at home, or just waited out as the immune system does its job (Normandin, 2021).

Viral infections are often waited out, as antibiotics does not treat them. If the flu virus is thought to have caused the particular pneumonia than antiviral drugs can be prescribed. Often more severe cases of viral pneumonia are treated at the hospital, as oxygen therapy may be needed to provide the body with sufficient oxygen whilst the immune system works (American Lung Association, 2021).

Treatment for fungal pneumonia is primarily antifungal medication. Pneumonia in any form can be fatal if the individual faced with it has a weakened immune system, or are in a weakened condition.

## Prevention

Some vaccines can prevent some forms of pneumonia mainly bacterial pneumonia, the pneumococcal vaccination protects against the bacterium streptococcus pneumoniae, which is the main cause of bacterial pneumonia in most people. Influenza vaccines or the flu vaccine can help to prevent pneumonia that may develop as a result of having the flu (American Lung Association, 2021).

Keeping healthy and making good lifestyle choices in general can also help to prevent pneumonia, as people who are physically healthy are much less likely to have an infection develop in the lungs. It serves to reason that exercises and diets that strengthen the lungs will also aid in preventing infections. Avoiding irritants and fumes from smoking or polluted urban air is also better to keep the lung tissue healthy, lest another lung disease develop, making pneumonia more likely (Newton, 2020).

Keeping good hygiene to prevent colds and viruses that may end up causing pneumonia, as well as preventing pathogens from entering the body is also a preventative measure that can be taken to prevent pneumonia (Newton, 2020).

# Conclusion

Emphysema and pneumonia are lung diseases that can develop in the lungs, causing difficulty breathing and potentially shortening a person’s lifespan. Factors in an individual’s life can affect their respiratory system, causing diseases, and compromising the functioning of the body for the short and long term.

These diseases do not always have cures or effective treatments which is why preventative measures such as healthy choices must be taken in a person’s life to avoid ever contracting these diseases. The way a person chooses to live their lives can benefit the functioning of the body and lead to a long and healthy life for the individual involved.

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