

Teachers' notes; damage to lungs from tobacco smoke

Healthy lungs are light pink and sponge like, whilst a smoker's lungs appear dark and mottled due to inhaled tar. The texture of the two also differs, with damaged lungs being much harder and more brittle.

Alveoli (singular is alveolus) are tiny, delicate air sacs deep within the lungs. They look like little clusters of grapes at the ends of the bronchial branches in the lungs. The outside surface area of lung alveoli is covered with tiny capillaries. These capillaries and the walls of alveoli share a very thin membrane (skin) that allows oxygen from inhaled air to pass through the walls of alveoli and enter the bloodstream via the capillaries. At the same time, carbon dioxide is pushed out in the same way when the air is exhaled. A person can breathe in and out easily allowing for the correct balance of gas/blood exchange if the surface area of the lungs is undamaged.

Tar from cigarettes remains permanently in your lungs. However, some of the tar is exhaled when you breathe the smoke out, and some is coughed up. Tar that is absorbed by the lungs can cause lung cells to die. Cigarette smoke paralyses or destroys the 'cilia', which are fine hairs that line your upper airways and help to protect against infection. Smokers get more colds and respiratory infections than non-smokers and take longer to recover from those infections. When cilia are damaged, tar is able to penetrate further into your lungs, where it can do even more damage to the alveoli air sacs.

Over time, the toxins from inhaled cigarette smoke break the thin walls of alveoli (air sacs), leaving larger, less efficient air sacs. The sacs also begin to lose their bounce, making it harder to bring in the oxygen and expel carbon dioxide. Both can become partially trapped in the lungs. In a smoker, this process signals the beginning of permanent lung disease.

The effects of tobacco smoke on the respiratory system include:

Irritation of the trachea (windpipe) and larynx (voice box)

More mucus and infections: When you smoke the cells that produce mucus in your lungs and airways grow in size and number. As a result, the amount of mucus increases and thickens. Your lungs cannot effectively clean out this excess mucus. So, the mucus stays in your airways, clogs them, and makes you cough (smokers' cough). This extra mucus is also prone to infection. Smoking also causes your lungs to age faster and hinders their natural defence mechanisms from protecting you against infection.

Less airflow: Smoking inflames and irritates the lungs. Even one or two cigarettes cause irritation and coughing. Smoking can also destroy your lungs and lung tissue. This decreases the number of air spaces and blood vessels in the lungs, resulting in less oxygen to critical parts of your body. For example, your brain or heart.

Scarred Lungs: Smokers' lungs experience inflammation in the small airways and tissues of your lungs. This can make your chest feel tight or cause you to wheeze or feel short of breath. Continued inflammation builds up scar tissue, which leads to physical changes to your lungs and airways that can make breathing hard. Years of lung irritation can give you a chronic cough with mucus.

Chronic Obstructive Pulmonary Disease (COPD): COPD is a collection of lung diseases including chronic bronchitis, emphysema and chronic obstructive airways disease. Damage to the lungs results in difficulty blowing air out, causing shortness of breath. COPD symptoms include persistent cough with mucus and shortness of breath.

Chronic Bronchitis: Is repeated, frequent episodes of productive cough with breathing becoming increasingly laboured.

Emphysema: Smoking destroys the tiny air sacs, or alveoli, in the lungs that allow oxygen exchange. When you smoke, you are damaging some of those air sacs. Alveoli don't grow back, so when you destroy them, you have permanently destroyed part of your lungs. When enough alveoli are damaged, air gets trapped in the lungs making breathing difficult because the lungs enlarge and there is difficulty blowing air out. A bit like a balloon that keeps taking in air with very little air escaping.

Lung Cancer: Smoking is the biggest preventable cause of cancer in the UK and around 7 in 10 lung cancer cases in the UK are caused by smoking. Our bodies are designed to deal with mild damage, but they often can't cope with the amount of harmful chemicals in tobacco smoke.

Cilia and Respiratory Infections: Your airways are lined with tiny brush like hairs, called cilia. The cilia sweep out mucus and dirt so your lungs stay clear. Smoking temporarily paralyzes and even kills cilia. This makes you more at risk for infection. Smokers get more colds and respiratory infections than non-smokers. The lungs are also lined with broom-like hairs called cilia, which help clean the lungs. A few seconds after you light a cigarette, cilia slowdown in movement. Smoking just one cigarette can slow the action of your cilia for several hours. Smoking also reduces the number of cilia in your lungs, leaving fewer to properly clean the airways. Cilia that are paralysed (and not destroyed) can recover when smoking stops.

Exacerbation of Asthma: Smoking and breathing in other people's smoke can trigger asthma symptoms or even an asthma attack. The main symptoms of asthma are wheezing (a whistling sound when breathing), breathlessness, coughing, and a tight chest which may feel like a band is tightening around it. The symptoms can sometimes get temporarily worse. This is known as an asthma attack. Asthma is caused by swelling (inflammation) of the breathing tubes that carry air in and out of the lungs. This makes the tubes highly sensitive, so they

temporarily narrow and produce excessive mucus. It may occur randomly or after exposure to a trigger. Common asthma triggers include: smoke, pollution, cold air, infections like colds or flu, exercise and allergies to house dust mites, animal fur or pollen. Asthma is usually treated by using an inhaler which is a small device that lets you breathe in the medicine. Asthma sufferers may also need to take tablets along with inhalers. There's currently no cure, but identifying and avoiding asthma triggers coupled with medicines prescribed by a doctor can help keep symptoms under control. Severe asthma attacks can be life-threatening which is why it is important to avoid triggers, follow a treatment plan and not ignore symptoms if they are getting worse.