

# Lung Cancer and Tuberculosis: A Scientific and Social Review

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kathy.liu

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## Abstract

The human respiratory system is an vital organ system that carries out life-sustaining processes. Like other organ systems, it is prone to a plethora of diseases, both systematic and non-systematic. The objective of this research article is to compare and contrast two lethal respiratory diseases: lung cancer and tuberculosis. This article discusses the scientific nature, the diagnosis, the treatment, and the social and ethical impacts of the two diseases. In particular, this article dissects and presents ethical issues pertaining to tuberculosis, a disease that has been dubbed a social disease, and lung cancer. This article provides an insight into health sciences and its relationship with the greater society.

## Introduction

The respiratory system is a biological system that consists of many organs to help the body take in oxygen and expel carbon dioxide (respiration). Lungs are essential respiratory organs that facilitate respiration via inhalation and exhalation. Lungs are susceptible to both infectious and non-infectious diseases, including Tuberculosis (TB) and lung cancer. In comparing the two diseases, they have a few similarities regarding symptoms and diagnosis; however, they have dissimilar causes and treatments. In a real-life context, both have ethical issues pertaining to human rights.

## Medical Overview

Lung cancer is a non-bacterial induced, aggressive, and metastatic cancer mainly caused by cigarette smoking; exposure to carcinogens such as pollution, asbestos, and chemicals; and genetic inheritance. Most lung cancer begins in the cells lining the bronchi and parts of the lung such as the bronchioles<sup>10</sup>. Inhaling carcinogens, such as cigarette smoke, instigate changes in cells' genes, causing them to grow faster. Over time, abnormal cells will acquire further mutations, causing them to progress into cancerous cells and form a malignant tumor in the lungs. Cancer cells will damage lung tissues. Malignant lung tumors grow rapidly and may block the airway, making it difficult to breathe. Common symptoms of lung cancer include coughs, fatigue, and chest pain. In contrast, TB is a bacterial-induced, infectious disease caused by mycobacterium tuberculosis (Mtb)<sup>10</sup>. Unlike lung cancer, TB is a non-hereditary, air-borne disease. When people with TB coughs or speaks, they release TB bacterium-carrying air droplets. When others inhale the TB infected air, the bacterium will enter their body. A strong immune system can prevent the bacteria from becoming active; in this case, the person will have latent TB<sup>11</sup>. If a person is immunosuppressed, such as those with HIV, the TB bacteria is likely to become active and lodge in the lungs where it will grow and multiply, causing pulmonary TB<sup>12</sup>. A person is only contagious if they have active TB bacteria in their body. Similar to lung cancer, TB causes coughing, fatigue, and chest pain<sup>13</sup>. TB can spread to other parts of the body (i.e. bones and brain). When lung tissues are affected by TB bacteria, it becomes hard, making oxygen exchange difficult or impossible. The cells that make up lung tissues begin to die, leading to lung tissue deterioration. This allows the bacteria to spread through the destructed tissue by gaining access to blood vessels that allow it to travel through the bloodstream and be disseminated. Likewise, lung cancer can spread when malignant cells break away from the primary tumor in the lungs, travel through the bloodstream or lymph stem, and grow a secondary tumor elsewhere. Individuals at high risk for getting lung cancer or TB are recommended to undergo screening tests. The most common screening for lung cancer is the CT scan, where cancerous regions will appear as lesions – small, abnormal areas – in the lungs. CT scan results help locate the tumor, reducing the need for exploratory surgeries. A popular screening test for TB is the Mantoux skin test, which involves injecting a purified protein derivative of Mtb into the surface of the forearm<sup>1</sup>. Within 48-72 hours of injection, the diameter of the indurated area is measured; if the induration is greater than 6mm, the test is considered TB-positive. Immunodeficiencies (ex. HIV) and vaccinations (ex. Bacillus Calmette–Guérin vaccine: BCG) can generate false-positive results. To rule out TB, X-Rays may be used for further diagnosis.

## Diagnosis

Both diseases can be diagnosed with X-Ray and sputum cytology. On X-Rays, the two diseases' appearances are different; lung cancer appears as visible, individual masses/nodules<sup>2</sup> while TB appears as connected, light spots<sup>3</sup>. X-Rays provide accurate diagnosis by using color contrast to generate a comprehensive image of the lungs. A disadvantage of X-Ray is

radiation exposure which can cause cell mutations that may lead to cancer. Sputum cytology involves examining samples of sputum under the microscope for lung cancer cells or TB bacterium. Sputum cytology is useful for staging lung cancer and for confirming TB diagnosis done by X-Ray, where the disease may resemble other respiratory diseases.

## Treatment

If untreated, both diseases can be fatal. TB is a rarely surgical disease mainly treated with antibiotics. When used correctly, the medications are highly successful. Incorrect use of antibiotics can cause multi-drug resistant TB (MDR-TB), where the bacteria becomes resistant towards front-line medications. Extensively drug resistant TB (XDR-TB), where TB bacteria develops resistance against more antibiotics, can develop. Both MDR-TB and XDR-TB are difficult and expensive to treat. In contrast, because lung cancer is non-bacteria induced, antibiotics are not common treatment options. One treatment method is to surgically remove the tumor and margin tissues. The surgery has various risks, including excessive bleeding and wound infection. The survival rate of lung cancer is lower than that of TB. 52% of lung cancer patients live over 5 years after diagnosis<sup>4</sup>

## Prevention

To prevent TB, some countries (ex. China) offer BCG vaccine; however the vaccine's effectiveness is questioned, thus countries like Canada do not offer it. Although there are no sure way to prevent lung cancer, stop smoking can reduce risk of getting it.

## Ethical review

There are various ethical arguments surrounding lung cancer and TB. TB is a disease of poverty and inequality where access to treatment services is associated with people's inability to realize their human rights<sup>7</sup>. Some countries do not offer free TB treatment, violating their obligation to provide accessible healthcare treatment. As written in Article 25 of the Universal Declaration of Human Rights, the Human Right to Health grants everyone the right to the highest attainable level of health and to access essential medicines<sup>5</sup>. Countries with high numbers of TB patients are the ones who do not offer free TB care, implying the relationship between treatment cost and TB. A similar ethical issue regarding human rights arises with lung cancer. In Canada, smokers are required to pay up to 40%-100% higher insurance fees<sup>8</sup>. Although the implementation was intended to be a monetary enticement to stop smoking, financially enticing smokers to quit is an unjustified, paternalistic interference with personal autonomy as smokers should be allowed to make lifestyle choices free from coercion of insurer<sup>9</sup>. At the end, smokers may opt-out of buying health insurance due to the increased fees for smokers; this can be detrimental to their overall well-being.

In conclusion, both lung cancer and TB harm the respiratory system and impact people's health. By knowing the causes and symptoms for the diseases, patients can obtain early diagnosis and proper treatment. In treating and preventing lung cancer and TB, monetary factors should be balanced with basic human rights. Easy and immediate access to health care is essential for a positive prognosis and successful disease management.

## References

1. Skin testing can detect previous exposure to the organism (or BCG vaccination) by provocation of a well-established, cell-mediated immune reaction. A purified protein derivative (PPD) of *Mycobacterium tuberculosis* is injected intradermally into the flexor surface of the forearm and the local response is measured. The interpretation of tuberculin tests depends on BCG vaccination history, immune status and concurrent viral infection.  
REFERENCE LINK
2. If your doctor thinks you have lung cancer, chances are you will have a chest X-ray to confirm the diagnosis. On a chest X-ray of someone with lung cancer, there is usually a visible mass or nodule. This mass will look like a white spot on your lungs, while the lung itself will appear black. However, an X-ray may not be able to detect all forms of cancer or smaller lesions.  
REFERENCE LINK
3. There are multiple light areas (opacities) of varying size that run together (coalesce). Arrows indicate the location of cavities within these light areas.  
REFERENCE LINK
4. You may hear doctors talk about '1 year survival' and '5 year survival'. This relates to the number of people in research who lived for at least a year or at least 5 years after they were diagnosed. Doctors use these figures to compare the results of different treatments in research studies. It does not mean those people only lived for 1 year or 5 years.  
REFERENCE LINK
5. Article 25 1. Everyone has the right to a standard of living adequate for the health and wellbeing of himself and of his family,

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including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control. 2. Motherhood and childhood are entitled to special care and assistance. All children, whether born in or out of wedlock, shall enjoy the same social protection  
REFERENCE LINK

6. Governments have an ethical responsibility to provide free and universal access to diagnosis and adequate treatment of TB. This obligation is grounded in their duty to fulfill the human right to health. Not only does TB treatment significantly improve the health condition of individuals, stopping the spread of a highly-infectious disease also benefits the broader community.  
REFERENCE LINK

7. Tuberculosis is a disease of poverty and inequality. ... Many of the factors that increase vulnerability to contracting [TB] or reduce access to diagnostic, prevention and treatment services are associated with people's ability to realize their human rights.  
REFERENCE LINK

8. Premiums for smokers are anywhere from 40% to 100% higher than for non-smokers, depending on health history, due to increased risk.  
REFERENCE LINK

9. Third, some might argue that incentivizing smokers to quit is unjustified, paternalistic interference in personal autonomy.  
REFERENCE LINK

10. Tuberculosis (TB) is caused by a bacterium called *Mycobacterium tuberculosis*.  
REFERENCE LINK

11. TB bacteria can live in the body without making you sick. This is called latent TB infection. In most people who breathe in TB bacteria and become infected, the body is able to fight the bacteria to stop them from growing. People with latent TB infection do not feel sick and do not have any symptoms. People with latent TB infection are not infectious and cannot spread TB bacteria to others. However, if TB bacteria become active in the body and multiply, the person will go from having latent TB infection to being sick with TB disease.  
REFERENCE LINK

12. For people whose immune systems are weak, especially those with HIV infection, the risk of developing TB disease is much higher than for people with normal immune systems.  
REFERENCE LINK

13. Symptoms of TB disease include: a bad cough that lasts 3 weeks or longer pain in the chest coughing up blood or sputum weakness or fatigue weight loss no appetite chills fever sweating at night  
REFERENCE LINK