

# An Expert System for Diagnosing Cough Using SL5 Object

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**Abstract:** *Background: A cough is a critical defensive reflex that improves clearance of secretions and particulates from the airways and protects against aspiration of foreign materials caused by aspiration or inhalation of particulate matter, pathogens, accumulated secretions, postnasal drip, inflammation, and mediators. In this paper will demonstrate an expert system capable of quickly diagnosing a patient's condition and recommending a suitable solution to the problem. The SL5 Object language was used to design and implement this expert system. A group of physicians tested this expert system and discovered it to be a useful tool that assists physicians and patients suffering from cough senses problems.*

**Keywords:** *Expert Systems, Knowledge, SL5 Object, cough Diseases, Diagnosis*

## 1- INTRODUCTION:

Cough is a natural defense mechanism that protects the respiratory system by removing excessive bronchial secretions and protecting it from foreign substances. It includes receptors, an afferent pathway, a center processing information, an efferent pathway, and effectors as a spontaneous reflex arc. The operational volume of the lung, which is dependent on the strength of the cough, is a determining element of cough efficacy. Coughing can be a voluntary act or a reflex arc that incorporates receptors, an afferent pathway, a processing center, an efferent route, and effectors in this case. The receptors are found throughout the bronchial tree, as well as in the ear, paranasal sinuses, pleura, diaphragm, pericardium, and esophagus, though to a lesser extent. Afferent impulses are sent from receptors. The majority of coughs presenting in the pharmacy will be caused by upper respiratory viral infection. Most coughs go away in three weeks and don't need to be treated. It's a good idea to consult your doctor if you have a persistent cough so they can investigate the source. A cough could be caused by a variety of factors. A short-term cough lasts no more than three weeks. Colds and influenza are two of the most common causes of short-term coughs. Symptoms usually go away on their own after a few days or weeks. Irritants like dust in your throat may make you cough. Allergies can also cause postnasal drip. Medical disorders and adverse effects that are more serious. Take extra vitamin C during cold and flu season if your cough is caused by a cold to shorten the duration and intensity of cold symptoms. The immune system is boosted by vitamin C. Chicken soup is a great home cure for coughs and colds since it contains various anti-inflammatory qualities[2].

## 2. EXPERT SYSTEM:

An expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field.

### How Do Expert Systems Work?

The strength of an ES derives from its *knowledge base* - an organized collection of facts and heuristics about the system's domain. An ES is built in a process known as *knowledge engineering*, during which knowledge about the domain is acquired from human experts and other sources by knowledge engineers.

The accumulation of knowledge in knowledge bases, from which conclusions are to be drawn by the inference engine, is the hallmark of an expert system.

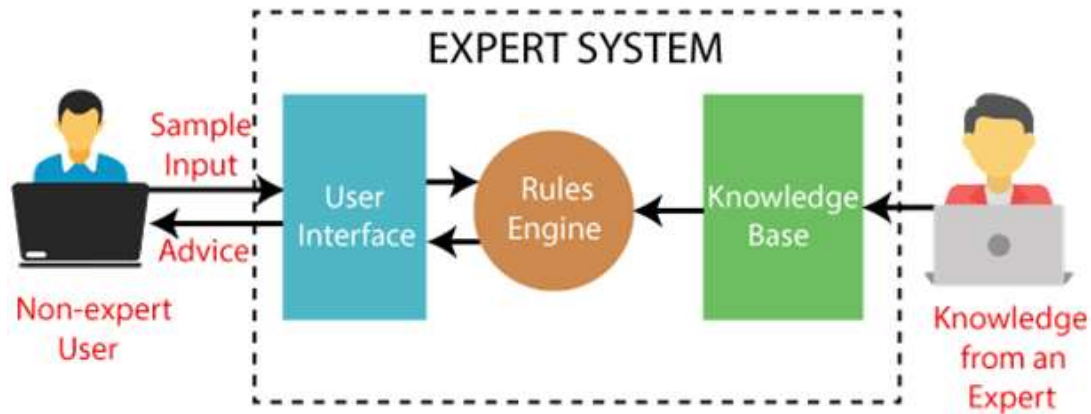


Figure 1 Expert Systems Work

### Knowledge Representation and the Knowledge Base

The knowledge base of an ES contains both factual and heuristic knowledge. Knowledge representation is the method used to organize the knowledge in the knowledge base. Knowledge bases must represent notions as actions to be taken under circumstances, causality, time, dependencies, goals, and other higher-level concepts.

Several methods of knowledge representation can be drawn upon. Two of these methods include:

1. Frame-based systems: are employed for building very powerful ESs. A frame specifies the attributes of a complex object and frames for various object types have specified relationships.
2. Production rules: are the most common method of knowledge representation used in business. Rule-based expert systems are expert systems in which the knowledge is represented by production rules. A production rule, or simply a rule, consists of an IF part (a condition or premise) and a THEN part (an action or conclusion). IF condition THEN action (conclusion).

### Expert System Technology

There are several levels of ES technologies available. Two important things to keep in mind when selecting ES tools include:

1. The tool selected for the project has to match the capability and sophistication of the projected ES, in particular, the need to integrate it with other subsystems such as databases and other components of a larger information system.
2. The tool also has to match the qualifications of the project team.

### Expert systems technologies include:

1. Specific expert systems: These expert systems actually provide recommendations in a specific task domain.
2. Expert system shells: are the most common vehicle for the development of specific ESs. A shell is an expert system without a knowledge base. A shell furnishes the ES developer with the inference engine, user interface, and the explanation and knowledge acquisition facilities.

## 3. LITERATURE REVIEW

There is a lot of Expert System that were designed to diagnose human Diseases. But there is no specialized expert system for diagnosis of cough diseases available free and use a language SL5. This expert system is easily used by Doctors and People concerned.

## 2. MATERIALS AND METHODS

The aim expert system performs diagnosis for cough diseases by presenting all symptoms. The aim expert system will ask the user to choose the type of symptoms. At the end expert system provides diagnosis, illness and recommendations for the user.

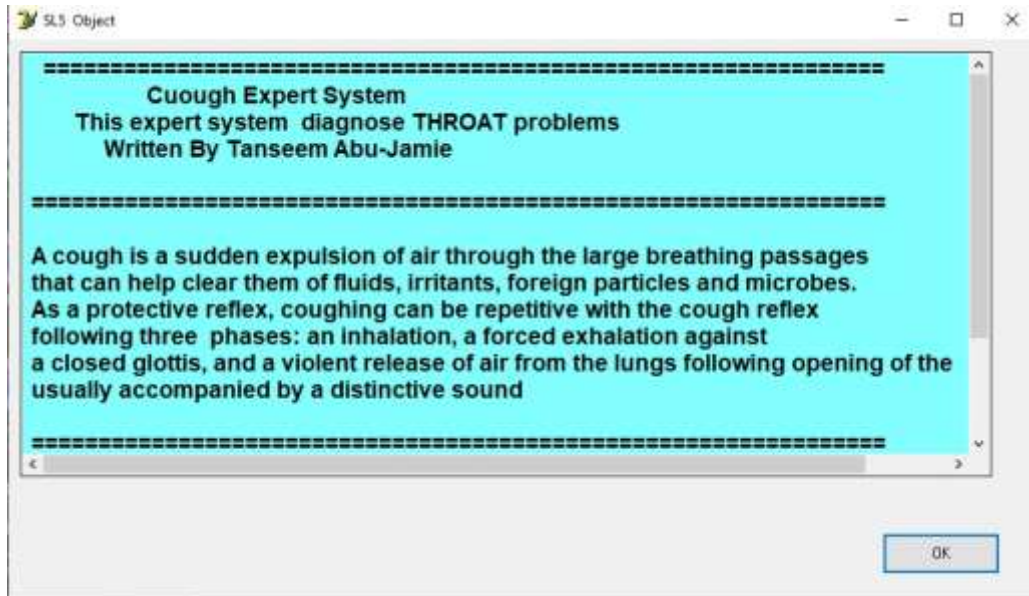


Figure 2 shows the main interface of the system

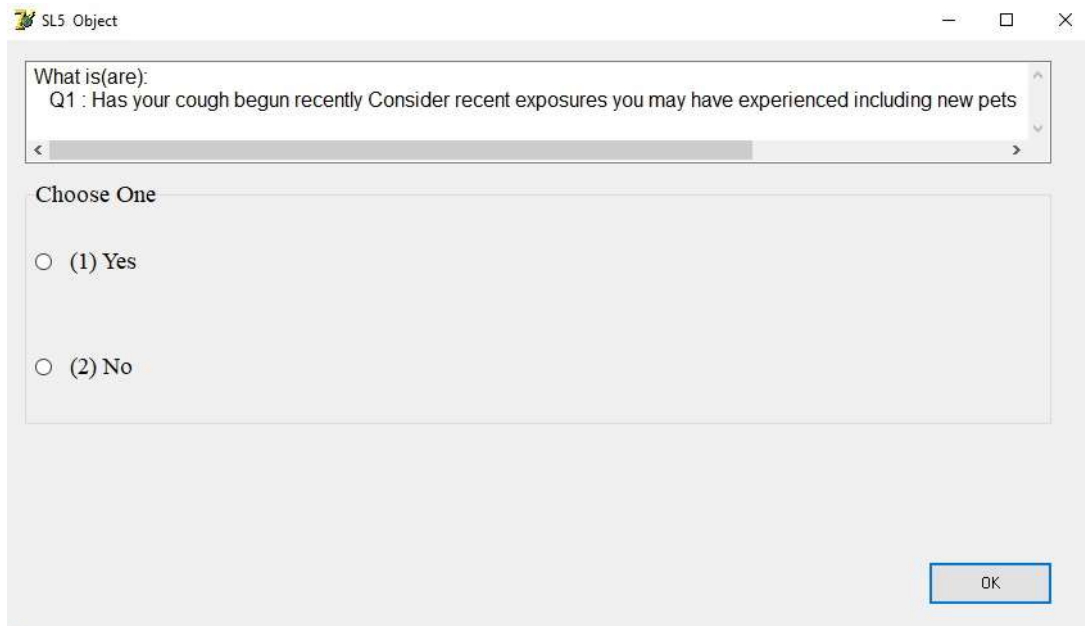


Figure 3 Questions

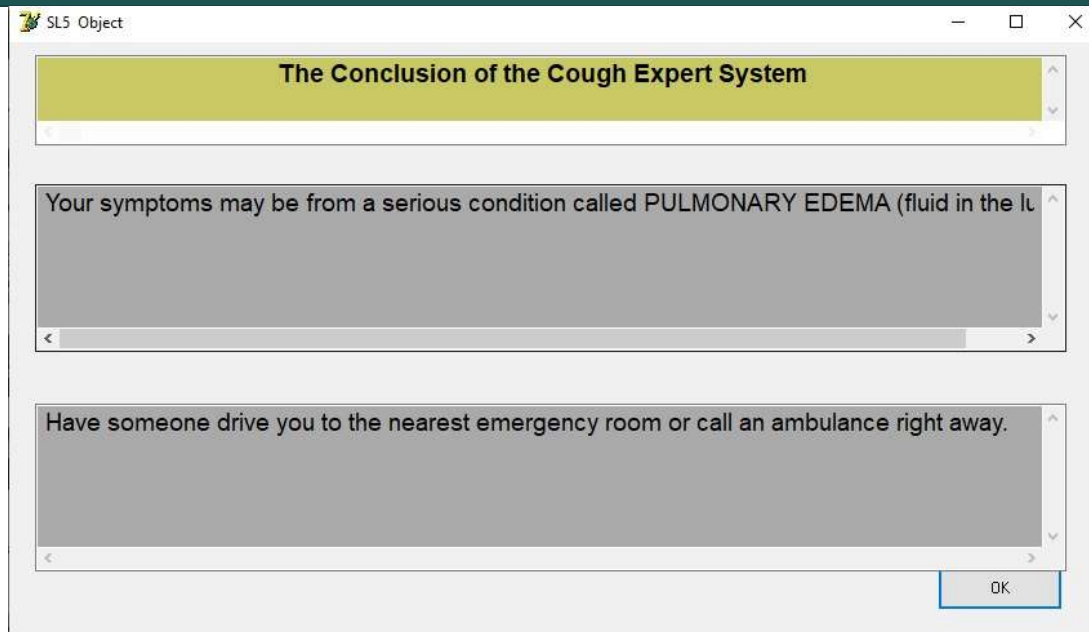


Figure 4Diagnosis and recommendation

### 3. What Is a Knowledge Representation?

Knowledge Representation in AI describes the representation of knowledge. Basically, it is a study of how the beliefs, intentions, and judgments of an intelligent agent can be expressed suitably for automated reasoning. One of the primary purposes of Knowledge Representation includes modeling intelligent behavior for an agent.

Knowledge Representation and Reasoning (KR, KRR) represents information from the real world for a computer to understand and then utilize this knowledge to solve complex real-life problems like communicating with human beings in natural language. Knowledge representation in AI is not just about storing data in a database, it allows a machine to learn from that knowledge and behave intelligently like a human being.

The different kinds of knowledge that need to be represented in AI include:

- Objects
- Events
- Performance
- Facts
- Meta-Knowledge
- Knowledge-base



Figure 5 kinds of knowledge

Here some overview about above DIAGNOSIS :

- a. **PULMONARY EDEMA:** Pulmonary edema is a condition in which the lungs fill with fluid. It's also known as lung congestion, lung water, and pulmonary congestion. When pulmonary edema occurs, the body struggles to get enough oxygen and you start to have shortness of breath.

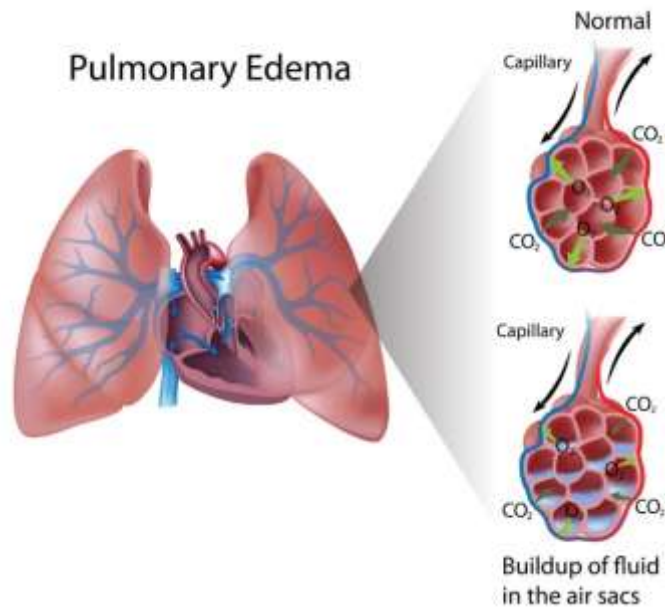


Figure 6 PULMONARY EDEMA

**Symptoms:**

In cases of pulmonary edema, your body will struggle to gain oxygen. This is due to the amount of increasing fluid in the lungs preventing oxygen moving into the bloodstream. Symptoms may continue to worsen until you get treatment. Symptoms depend on the type of pulmonary edema.

**Long-term pulmonary edema:**

The symptoms for long-term pulmonary edema include:

- shortness of breath when being physically active.
- difficulty breathing when lying down.

- wheezing.
- waking up at night with a breathless feeling that goes away when you sit up.
- rapid weight gain, especially in the legs.
- swelling in the lower part of the body

#### **Diagnosis of pulmonary edema**

Your doctor will look for fluid in your lungs, or symptoms caused by its presence. They will perform a basic physical examination and listen to your lungs with a stethoscope, looking for:

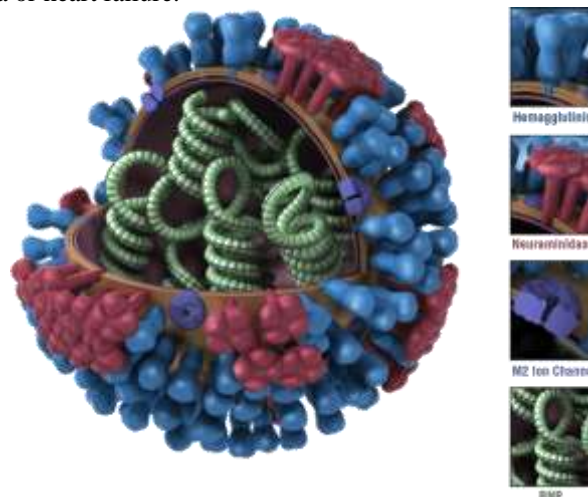
- an increased heart rate
- rapid breathing
- a crackling sound from your lungs
- any abnormal heart sounds

Your doctor may also look at your neck for fluid buildup, legs and abdomen for swelling, and if you have pale or blue-colored skin. They will also discuss your symptoms, and ask about your medical history. If they believe you have fluid in your lungs, they'll order additional tests.

Examples of tests used in diagnosing pulmonary edema include:

- complete blood count
- echocardiogram, or an ultrasound, to check for abnormal heart activity
- chest X-ray to see fluid
- blood tests to check oxygen levels
- electrocardiogram (ECG) to look for heart rhythm problems or signs of a heart attack

- b. **INFLUENZA (FLU):** commonly known as "influenza" or 'influenza', is an infectious disease caused by orthomyxoviruses. Flu symptoms range from mild to very strong. Symptoms include: fever, nasal congestion, sore throat, muscle pain, headache, cough and fatigue. These symptoms usually begin two days after exposure to the virus and last for less than a week. But the cough may last for more than two weeks. In children, there may be nausea and vomiting, but these symptoms are not common in adults. Nausea and vomiting are more commonly caused by gastroenteritis caused by infection, which is sometimes referred to as 'stomach flu' or '24-hour flu'. Complications of influenza include: viral pneumonia, secondary bacterial pneumonia, sinus infections, and worsening of pre-existing health problems such as asthma or heart failure.



**Figure 7 Types of INFLUENZA**

#### **causes**

There are three types of influenza viruses that infect humans, called type A, type B, and type C. The virus usually spreads through the air from coughing or sneezing. This often occurs over relatively short distances. It can also be spread by touching surfaces contaminated with the virus and then touching the mouth or eyes. A person may be contagious to others before and during the time when symptoms of the disease appear. Infection can be confirmed by testing the throat, sputum, or nose for the virus. There are a number of rapid tests available. However, some people may still carry the infection even though the results are negative. A type of polymerase chain reaction that detects the RNA of the virus is the most accurate test.

#### **Symptoms**

Flu symptoms, with fever and cough as the most common symptoms. Approximately 33% of people infected with the flu do not have symptoms. Flu symptoms can start suddenly a day or two after infection. The first symptoms are usually chills or a cold sensation, but fever is also common early in the infection, with body temperatures ranging from 38 to 39 degrees Celsius (about 100 to 103 degrees Fahrenheit). Most patients spend their sick days in bed with sporadic pain throughout the body, which is usually worse in the back and legs. Flu symptoms may include:

- fever and shivering
- cough
- Nasal congestion
- vomiting
- rhinitis
- sneeze
- muscle pain
- fatigue
- a headache
- tears
- supply
- ink

c. **CHRONIC BRONCHITIS:**

is inflammation of the breathing tubes. These are the airways called bronchi. This inflammation causes too much mucus production and other changes. There are different types of bronchitis. But the most common are acute and chronic.

Chronic bronchitis is long-term inflammation of the bronchi. It's common among smokers. People with chronic bronchitis tend to get lung infections more easily. They also have episodes of acute bronchitis, when symptoms are worse.

To be classified as chronic bronchitis:

- You must have a cough and mucus most days for at least 3 months a year, for 2 years in a row.
- Other causes of symptoms, such as tuberculosis or other lung diseases, must be ruled out.

People with chronic bronchitis have chronic obstructive pulmonary disease (COPD). This is a large group of lung diseases that includes chronic bronchitis. These diseases can block air flow in the lungs and cause breathing problems. The 2 most common conditions of COPD are chronic bronchitis and emphysema.



**Figure 8 CHRONIC BRONCHITIS**

**Causes:**

Chronic bronchitis is not caused by a virus or bacteria. Most experts agree that the main cause of chronic bronchitis is cigarette smoking. Air pollution and your work environment may also play a role. This is especially true if you also smoke. Bronchitis symptoms often happen with other lung diseases such as:

- Asthma
- Pulmonary emphysema
- Scarring of the lungs (pulmonary fibrosis)

- Lung cancer
- Tuberculosis
- Upper respiratory infections

**Symptoms:**

- Cough, often called a smoker's cough
- Coughing up mucus or sputum (expectoration)
- Wheezing
- Chest discomfort
- Shortness of breath

People with chronic bronchitis often have a cough and make mucus for many years before they have shortness of breath.

Chronic bronchitis may cause:

- Disability
- Frequent and severe infections that affect your airways
- Narrowing and plugging of your breathing tubes (bronchi)
- Trouble breathing

Other symptoms may include:

- Bluish fingernails, lips, and skin because of lower oxygen levels
- Wheezing and crackling sounds with breathing
- Swollen feet
- Heart failure

**d. ASTHMA:**

is a condition in which your airways narrow and swell and may produce extra mucus. This can make breathing difficult and trigger coughing, a whistling sound (wheezing) when you breathe out and shortness of breath. For some people, asthma is a minor nuisance. For others, it can be a major problem that interferes with daily active.

**Symptoms:**

Asthma symptoms vary from person to person.

Asthma signs and symptoms include:

- Shortness of breath
- Chest tightness or pain
- Wheezing when exhaling, which is a common sign of asthma in children
- Trouble sleeping caused by shortness of breath, coughing or wheezing
- Coughing or wheezing attacks that are worsened by a respiratory virus, such as a cold or the flu

Signs that asthma is probably worsening include:

- Asthma signs and symptoms that are more frequent and bothersome
- Increasing difficulty breathing, as measured with a device used to check how well your lungs are working (peak flow meter)
- The need to use a quick-relief inhaler more often

**Causes:**

It isn't clear why some people get asthma and others don't, but it's probably due to a combination of environmental and inherited (genetic) factors.

Asthma triggers

Exposure to various irritants and substances that trigger allergies (allergens) can trigger signs and symptoms of asthma.

Asthma triggers are different from person to person and can include:



- Airborne allergens, such as pollen, dust mites, mold spores, pet dander or particles of cockroach waste
- Respiratory infections, such as the common cold
- Physical activity
- Cold air
- Air pollutants and irritants, such as smoke
- Certain medications, including beta blockers, aspirin, and nonsteroidal anti-inflammatory drugs, such as ibuprofen (Advil, Motrin IB, others) and naproxen sodium (Aleve)
- Strong emotions and stress
- Sulfites and preservatives added to some types of foods and beverages, including shrimp, dried fruit, processed potatoes, beer and wine
- Gastroesophageal reflux disease (GERD), a condition in which stomach acids back up into your throat



Figure 9 ASTHMA

**e. TUBERCULOSIS:**

is an infectious disease usually caused by *Mycobacterium tuberculosis* (MTB) bacteria. Tuberculosis generally affects the lungs, but can also affect other parts of the body. Most infections show no symptoms, in which case it is known as latent tuberculosis. About 10% of latent infections progress to active disease which, if left untreated, kills about half of those affected. Typical symptoms of active TB are a chronic cough with blood-containing mucus, fever, night sweats, and weight loss. It was historically called consumption due to the weight loss. Infection of other organs can cause a wide range of symptoms.

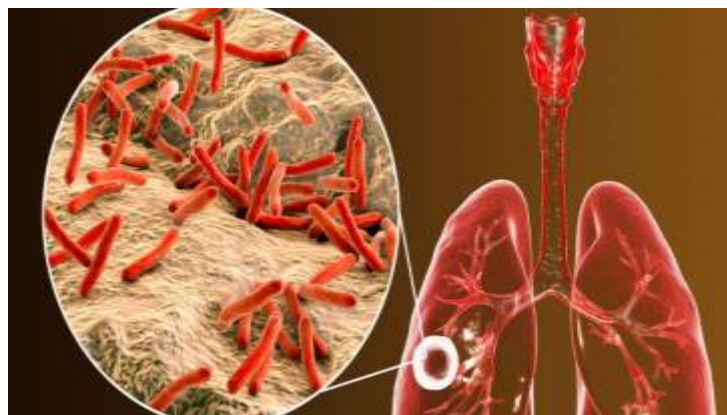


Figure 10 TUBERCULOSIS:

**Symptoms:**

Tuberculosis may infect any part of the body, but most commonly occurs in the lungs (known as pulmonary tuberculosis). Extrapulmonary TB occurs when tuberculosis develops outside of the lungs, although extrapulmonary TB may coexist with pulmonary TB.

General signs and symptoms include fever, chills, night sweats, loss of appetite, weight loss, and fatigue. Significant nail clubbing may also occur.

**Causes:**

The main cause of TB is Mycobacterium tuberculosis (MTB), a small, aerobic, nonmotile bacillus. The high lipid content of this pathogen accounts for many of its unique clinical characteristics. It divides every 16 to 20 hours, which is an extremely slow rate compared with other bacteria, which usually divide in less than an hour. Mycobacteria have an outer membrane lipid bilayer. If a Gram stain is performed, MTB either stains very weakly "Gram-positive" or does not retain dye as a result of the high lipid and mycolic acid content of its cell wall. MTB can withstand weak disinfectants and survive in a dry state for weeks. In nature, the bacterium can grow only within the cells of a host organism, but *M. tuberculosis* can be cultured in the laboratory.

**f. LUNG CANCER:**

also known as lung carcinoma, is a malignant lung tumor characterized by uncontrolled cell growth in tissues of the lung. This growth can spread beyond the lung by the process of metastasis into nearby tissue or other parts of the body. Most cancers that start in the lung, known as primary lung cancers, are carcinomas. The two main types are small-cell lung carcinoma (SCLC) and non-small-cell lung carcinoma (NSCLC). The most common symptoms are coughing (including coughing up blood), weight loss, shortness of breath, and chest pains.

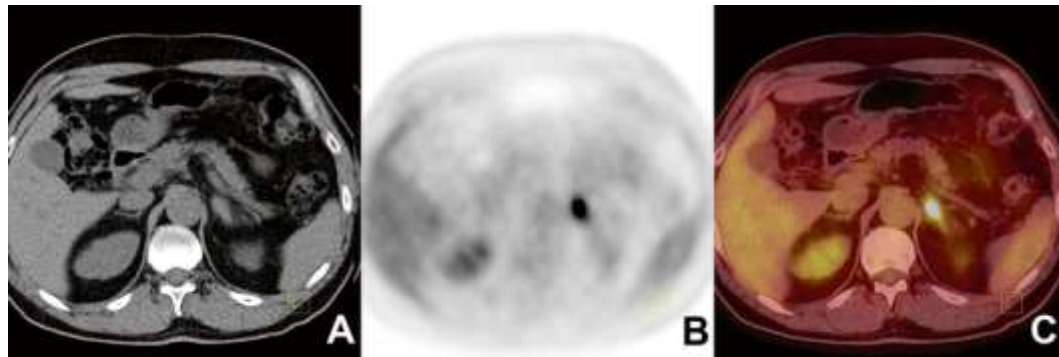


Figure 11 LUNG CANCER

**Symptoms:**

- Respiratory symptoms: coughing, coughing up blood, wheezing, or shortness of breath.
- Systemic symptoms: weight loss, weakness, fever, or clubbing of the fingernails.
- Symptoms due to the cancer mass pressing on adjacent structures: chest pain, bone pain, superior vena cava obstruction, or difficulty swallowing.

**Causes:**

Cancer develops after genetic damage to DNA and epigenetic changes. Those changes affect the cell's normal functions, including cell proliferation, programmed cell death (apoptosis), and DNA repair. As more damage accumulates, the risk for cancer increases.

- Smoking
- Radon gas
- Asbestos
- Air pollution
- Genetics

1- Has your cough begun recently? Consider recent exposures you may have experienced, including new pets, new environments, new medications, etc.

2- Are you very short of breath, and are you coughing up pink, frothy mucus?

|  |
|--|
| 3- Does your cough produce clear or pale-yellow mucus?   |
| 4- Does your cough produce yellow, tan, or green mucus?  |
| 5- Does the cough come with shortness of breath and wheezing?  |
| 6- Do you have heart problems? Also, do you have swelling in your legs and/or shortness of breath when you are active or after you have been lying down? |
| 7- Have you recently started coughing up blood or bloody sputum?   |
| 8- Have you recently started having sharp chest pain, rapid heartbeat, swelling of the legs and sudden shortness of breath?                              |
| 9- Do you have a fever, chills and night sweats along with chest pain when you cough or take a deep breath?  |
| 10- Have you unintentionally lost weight?  |
| 11- Did you inhale dust, particles, or an object?  |
| 12- Has your cough lasted longer than 6 weeks?   |

**Table 1: Questions that were used in the expert system**

#### 4. SYSTEM EVALUATION

As an introductory evolution, a group of doctors tested this proposed Expert System and they were satisfied with its performance, efficiency, user interface and ease of use.

#### 5. LIMITATIONS

Currently the proposed expert system is specialized in the diagnosis cough diseases.

#### 6. CONCLUSION

In this paper, a proposed expert system was presented for helping doctors to get the diagnosis faster and more accurate than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has user friendly interface. It was using SL5.

#### 4. EXPERT SYSTEM SOURCE CODE

```
INSTANCE Conc ISA display
WITH wait := TRUE
WITH delay changes := FALSE
WITH items [1] := title textbox
WITH items [2] := Diagnosis textbox
WITH items [3] := Recommend textbox
```

```
INSTANCE title textbox ISA textbox
WITH location := 20,10,800,70
WITH pen color := 0,0,0
```

WITH fill color := 200,200,100  
WITH justify IS center  
WITH font := "Arial"  
WITH font style IS bold  
WITH font size := 14  
WITH text := " The Conclusion of the Cough Expert System"

INSTANCE Diagnosis textbox ISA textbox

WITH location := 20,110,800,130  
WITH pen color := 0,0,0  
WITH fill color := 170,170,170  
WITH justify IS left  
WITH font := "Arial"  
WITH font size := 14  
WITH text := "-----"

INSTANCE Recommend textbox ISA textbox

WITH location := 20,280,800,130  
WITH pen color := 0,0,0  
WITH fill color := 170,170,170  
WITH justify IS left  
WITH font := "Arial"  
WITH font size := 14  
WITH text := "-----"

RULE R0

IF start

THEN ASK Q1:Has your cough begun recently? Consider recent exposures you may have experienced including new pets new environments new medications etc

RULE Q1NO

IF Q1:Has your cough begun recently? Consider recent exposures you may have experienced including new pets new environments new medications etc IS Yes

THEN ASK Q2:Are you very short of breath and are you coughing up pink frothy mucus?

RULE Q2Yes

IF Q2:Are you very short of breath and are you coughing up pink frothy mucus? IS Yes

THEN text OF Diagnosis textbox := "Your symptoms may be from a serious condition called PULMONARY EDEMA (fluid in the lungs)."

AND text OF Recommend textbox := "Have someone drive you to the nearest emergency room or call an ambulance right away."

RULE Q2No

IF Q2:Are you very short of breath and are you coughing up pink frothy mucus? IS No

THEN ASK Q3:Does your cough produce clear or pale yellow mucus?

RULE Q3Yes

IF Q3:Does your cough produce clear or pale yellow mucus? IS Yes

THEN text OF Diagnosis textbox := "You likely have a viral infection, which includes the FLU."

AND text OF Recommend textbox := "If it is within 48-72 hours from the beginning of symptoms, there are medications that your doctor can prescribe if you test positive for, or they suspect the FLU. If it is outside the 48-72-hour window or it is not the flu, then symptomatic treatment (treating cough, headache, sinus congestion, sore throat, etc. can be accomplished with an over-the-counter cough and cold medication). Get plenty of rest and drink plenty of water. Call your doctor if you have a high fever (>101.5°F) or your symptoms persist for more than 5 days."

RULE Q3No

IF Q3:Does your cough produce clear or pale yellow mucus? IS No

---

THEN ASK Q4:Does your cough produce yellow tan or green mucus?

RULE Q4Yes

IF Q4:Does your cough produce yellow tan or green mucus? IS Yes

THEN text OF Diagnosis textbox := "You may have an infection of the airways such as CHRONIC BRONCHITIS If you have a fever with shaking chills and are very ill you may have a more serious infection such as PNEUMONIA"

AND text OF Recommend textbox := "See your doctor or go to the closest emergency room if you are having trouble breathing. Your doctor can prescribe medicine to relieve your symptoms. Get plenty of rest, and drink lots of fluids. If you smoke, stop smoking."

RULE Q4no

IF Q4:Does your cough produce yellow tan or green mucus? IS No

THEN ASK Q5:Does the cough come with shortness of breath and wheezing?

RULE Q5Yes

IF Q5:Does the cough come with shortness of breath and wheezing?IS Yes

THEN text OF Diagnosis textbox := "These symptoms may be a sign of ASTHMA, a closure or restriction of the airways."

AND text OF Recommend textbox := "Asthma can be dangerous and should be diagnosed and treated by your doctor. Make sure that you get your annual influenza vaccination. If you feel that you can't catch your breath or can't stop coughing, then have someone drive you to the closest emergency room or call an ambulance."

RULE Q5no

IF Q5:Does the cough come with shortness of breath and wheezing?IS No

THEN ASK Q6:Do you have heart problems? Also do you have swelling in your legs and or shortness of breath when you are active or after you have been lying down?

RULE Q6Yes

IF Q6:Do you have heart problems? Also do you have swelling in your legs and or shortness of breath when you are active or after you have been lying down? IS Yes

THEN text OF Diagnosis textbox := ""

AND text OF Recommend textbox := ""

RULE Q6no

IF Q6:Do you have heart problems? Also do you have swelling in your legs and or shortness of breath when you are active or after you have been lying down? IS No

THEN ASK Q7:Have you recently started coughing up blood or bloody sputum?

RULE Q7Yes

IF Q7:Have you recently started coughing up blood or bloody sputum? IS Yes

THEN ASK Q8:Have you recently started having sharp chest pain rapid heartbeat swelling of the legs and sudden shortness of breath ?

RULE Q7noQ8no

IF Q7:Have you recently started coughing up blood or bloody sputum? IS No

OR Q8:Have you recently started having sharp chest pain rapid heartbeat swelling of the legs and sudden shortness of breath? IS No

THEN ASK Q9:Do you have a fever chills and night sweats along with chest pain when you cough or take a deep breath?

RULE Q8Yes

IF Q8:Have you recently started having sharp chest pain rapid heartbeat swelling of the legs and sudden shortness of breath?

---

IS Yes

THEN text OF Diagnosis textbox:= "These symptoms may be caused by TUBERCULOSIS or another type of infection."  
AND text OF Recommend textbox:= "Have someone drive you to the closest emergency room or call an ambulance."

RULE Q9Yes

IF Q9:Do you have a fever chills and night sweats along with chest pain when you cough or take a deep breath? IS Yes  
THEN text OF Diagnosis textbox := "These symptoms may be caused by TUBERCULOSIS or another type of infection."  
AND text OF Recommend textbox := "Have someone drive you to the closest emergency room or call an ambulance."

RULE Q9no

IF Q9:Do you have a fever chills and night sweats along with chest pain when you cough or take a deep breath? IS No  
THEN ASK Q10:Have you unintentionally lost weight?

RULE Q10yes

IF Q10:Have you unintentionally lost weight? IS Yes  
THEN text OF Diagnosis textbox := "This may be a sign of a serious illness, such as LUNG CANCER.  
Other signs of lung cancer may include a cough that produces bloody sputum, shortness of breath and wheezing."  
AND text OF Recommend textbox := "See your doctor right away"

RULE Q10noQ1Yes

IF Q10:Have you unintentionally lost weight? IS No  
OR Q1:Has your cough begun recently? Consider recent exposures you may have experienced including new pets new environments new medications etc IS YES  
THEN ASK Q11:Did you inhale dust particles or an object?

RULE Q11Yes

IF Q11:Did you inhale dust particles or an object? IS Yes  
THEN text OF Diagnosis textbox := "Irritation of the airways will cause coughing to attempt to clear the object or irritation out of the airway."  
AND text OF Recommend textbox := "If you smoke, stop smoking. If the coughing is severe or if you don't believe the irritant has been cleared from your airway, see your doctor or go to the emergency room right away."

RULE Q11no

IF Q11:Did you inhale dust particles or an object? IS No  
THEN ASK Q12:Has you cough lasted longer than 6 weeks?

RULE Q12Yes

IF Q12:Has you cough lasted longer than 6 weeks? IS Yes  
THEN text OF Diagnosis textbox := "This is known as CHRONIC COUGH The three most common causes are UPPER AIRWAY COUGH SYNDROME, ASTHMA and ACID REFLUX"  
AND text OF Recommend textbox := "UPPER AIRWAY COUGH SYNDROME is usually due to environmental exposures, such as ALLERGIC RHINITIS. This can be caused by triggers  
You can try over-the-counter antacids. See your doctor if symptoms are present most days of the week."

RULE Q12no

IF Q12:Has you cough lasted longer than 6 weeks? IS No  
THEN text OF Diagnosis textbox := "Unknown"  
AND text OF Recommend textbox := "For more information, please talk to your doctor. If you think your problem is serious, call your doctor right away. "

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