# Chapter 4- Epidemiology- The Basic Science of Public Health

Winslow defined epidemiology as the "diagnostic discipline of public health".
Epidemiologic methods are used to investigate causes of diseases, to identify trends in disease occurrence that may influence the need for medical and public health services, and to evaluate the effectiveness of medical and public health interventions. It is used to perform public health's assessment function.
Epidemiology studies the patterns of disease occurrence in specific populations and the factors that influence these patterns.
The word epidemiology comes from the word epidemic which is an increase in the frequency of a disease above the usual and expected rate, which is called the endemic rate.
So epidemiologists count cases of the disease and ask questions like who is getting the disease, when and where is it occurring. Based on this they can make informed guesses as to why its occurring. Their ultimate goal is to use this knowledge to control and prevent the spread of disease.

**How Epidemiology Works**

First example was in London by a physician John Snow in 1853 and 1854. He is called the father of modern epidemiology. His study dealt with the spread of cholera through drinking water. He went to homes in a specific area where many cholera deaths occurred and asked where they got their water from. Most of the deaths were from a specific company while the other company had very few deaths so this was proof that the water was causing the cholera.
The government collects deaths, births, and other important statistics. Since it is preferable to recognize an epidemic before people start dying they use **Epidemiologic surveillance**- certain notifiable diseases must be reported as soon as they are diagnosed. These are infectious diseases that could be prevented if action is taken- ex. Syphilis, measles, hepatitis, tuberculosis. There are also some noninfectious diseases that must be reported.
Physicians and hospitals report to their local health dept. and CDC. Early reporting helps detect an emerging epidemic at an early stage so measures can be taken to prevent the spread of infectious disease.
Reporting of chronic diseases is less widespread but some monitor conditions such as birth defects, Alzheimer's, asthma, and cancers to help identify causes of these diseases- especially environmental causes that could be controlled or eliminated.
This system has also helped find new emerging diseases- Ex. AIDS.

**A Typical Epidemiologic Investigation- Outbreak of Hepatitis**

Hepatitis A is a notifiable disease in all 50 states. It is caused by a virus that contaminates food or water so it is important to report it right away and to identify the source of outbreak to prevent wider exposure (even though its usually not fatal).
Since it is a notifiable disease the local health dept. will be able to recognize when there is an outbreak because there will be much more cases. This will make it go from endemic

to epidemic. An epidemic calls for an investigation to figure out why its occurring- by asking who where and when questions.
This kind of medical detective work is nicknamed "shoeleather epidemiology":

- The investigator starts with the reported cases- the who
- They interview the person and ask when the first symptoms appeared
  Based on this they try to figure out where it came from and what all the victims have in common (ex. restaurant contamination= shigella, salmonella)

For some diseases even one case is considered an epidemic.
Since the anthrax attack in 2001 there were several notifiable diseases added caused by potential agents of bioterrorism. The first sign of a bioterror attack can be the report of single case identified in a hospital ER.

**Legionnaires' Disease**
In 1976 many of the people who went to the American Legion conference got sick. They figured out that many of the people who got sick stayed at a specific hotel and even people who just passed by had symptoms- suggesting it was airborne. They eventually figured out that it was caused by a bacteria which they found in the water of a cooling tower used for air conditioning. So this Legionella bacteria was pumped into the cooled air and inhaled by victims. Once they identified the bacteria they found it to be responsible for a number of other outbreaks of pneumonia. Legionellosis is now a notifiable disease.

**Eosinophilia-Myalgia Syndrome**
Although epidemiologists suspect infectious agents as the causes of outbreak of a new disease they must also consider toxic substances as an alternative cause. Ex. 1989 in New Mexico, doctors compared 3 patients with similar symptoms. Blood tests on all 3 revealed high levels of eosinophils (WBC). All 3 were taking a health food supplement called L- Tryptophan- which is a "natural" substance, a component of proteins which was said to be a treatment for insomnia, depression, and premenstrual symptoms. The doctors reported this and it was investigated. They found many more cases of the syndrome. The cause of this was that a recent change to in the factory's method of production caused a toxic contaminant to form.
There was a similar example of this with toxic oil in Spain.
Epidemiologic surveillance is a major line of defense in protecting the public against disease. It is the warning sign that tells the public that there is a new disease. The sooner the surveillance system kicks in the sooner action can be taken to prevent the epidemic. The government then acts to protect the health of the people. Epidemiologic surveillance has become even more important as concerns about bioterrorism have increased.

**Epidemiology and the Causes of Chronic Disease**
Epidemiology has had a different role in investigating the causes of diseases common in older age such as heart disease and cancer. Until recently these were thought to just be a part of old age.
These diseases do not have a single cause. They develop over a period of time, are often chronic and disabling (not rapid), and cannot be prevented or cured by a vaccine. The best thing to do is to learn how to prevent it or delay its onset. Epidemiologic studies can

help find causes which will help prevent it. However studying these diseases is hard because these diseases cant be attributed to a single cause. There may be many different factors that play a role- these factors are called "risk factors". It is also hard to determine causative factors because the disease develops over a long period of time- so its hard to determine what played a role.

**Heart Disease**

This is the leading cause of death in the US since the 1920s (when infectious diseases dropped). In 1948- there was a study in Framingham, Mass. to investigate factors that might be causing the problem. This was the first major epidemiologic study of a chronic disease. The study identified 3 major risk factors- high blood pressure, high blood cholesterol, and smoking. As a result of their findings levels for normal blood pressure and cholesterol have changed. Until this they assumed blood pressure and cholesterol increase as you get older. They realized that this wasn't true. Weight gain and lack of exercise were found to be associated with high blood pressure and cholesterol values and with an increased risk of heart disease.

When people learned about this many began to change their lifestyles. There were improvements, which were associated with the decline of risk factors.

This study gave us even more knowledge. Doctors learned about different types of cholesterol- high density lipoprotein (HDL)- the good cholesterol and low- density lipoprotein (LDL)- the bad cholesterol. Drinking alcohol in moderation has been found to increase HDL cholesterol and to prevent against heart disease.

1971- there was an offshoot of the study. Used families of original study to find genetic and environmental factors.

**Lung Cancer**

All they knew was the link between smoking and lung cancer. The two main hypothesis were smoking and air pollution.

- 1950s- physicians study in England- asked about their smoking habits. Conclusions:
    a) The death rate from lung cancer was 20x higher among smokers than nonsmokers and increasing as amount smoke increased.
    b) Death rate of ex smokers was lower than that of smokers and declined as time since quitting increased.
    c) The contrast in lung cancer mortality between smokers and non smokers was the same whether the doctors lived in rural or urban areas- showing that air pollution didn't affect this
    d) Deaths from heart attacks were significantly higher among heavy smokers aged 35-54 than among non smokers.
- Hammond and Horn study (US)- similar study. Results showed that smokers were 10x more likely to die of lung cancer than nonsmokers and cigarette smokers were 5x more likely to die of cancer of the lip, tongue, mouth, pharynx, larynx, and esophagus. Also, heavy smokers (2+ packs a day) were 2.4x more likely to die of heart disease.