Development of Disease

Lecture 12 – Dr. Gary Mumaugh

- **Disease Definitions**
- A pathological condition affecting a part, organ or entire system of an organism and it is identified by a specific group of signs or symptoms
    - Could be several causes including infection, genetic defect, or environmental

- A secondary definition for disease states that it is a societal condition or tendency regarded as abnormal and harmful
- A disease then is recognized by its ability to damage aspects of (or in its entirety) an organism with which it comes into contact
- Though a disease's origins, nature and effects (based upon its subject and strength) may vary, the overriding similarity of all diseases is that they cause sickness to those organisms in which they infiltrate

Disease: History

- In prehistoric times, epidemics and infectious diseases were rare
    - Persons lived far away from one another (communities more spread apart)
    - Animals did not reside in the same confines as humans and could not serve as a conduit for transmitting pathogens

- As animals became more domesticated and humans began to cultivate plants for consumption and other purposes, a shift from hunter-gatherer, nomadic lifestyle to a steadfast, agricultural society began to occur
- The movement to become a more agricultural society affected the spread of infectious disease
- It necessitated the need for persons to live closer to one another so that they all needed to help with planting and harvesting
- Many families lived together with extended families and multiple generations also with pets
- And, though food was more readily available than it had been in the past, malnutrition still posed a major problem
    - Diet of the agrarian lifestyle (predominately carbohydrate based as opposed to hunter-gathers who consume larger amounts of meat)

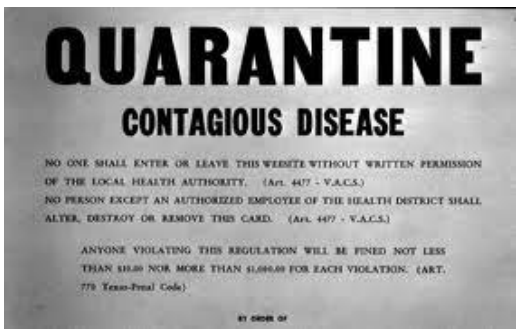
Disease: History - Continued

- The different jobs of people invited additional exposure to new people and geographical areas
    - All of this, with bad hygiene, contributed to a more rapid spreading of disease
- Researchers have concluded that since the advent of agriculture, the level to which infectious diseases have plagued humans has only increased
- When an outbreak occurred, the early settlers efforts were included:
    - herbal and animal medicines
    - sorcery and witchcraft-type elixirs
    - and then the beginnings of true medicinal treatments

- Within the past century, major strides in the battle to find treatments and preventative measures to fight infectious diseases
- This is evident by the decline in deaths attributed to such epidemic-incited illnesses such as: pneumonia, influenza, tuberculosis and diarrhea
- In 1900, 33 percent of all deaths were the result of pneumonia, influenza, tuberculosis and diarrhea
- In 1990, the leading causes of death to man were found to be heart disease, cancer and stroke.
    - In 1990, infectious diseases were the cause of less than four percent of all deaths
- Medical professionals, researchers, microbiologists and infectious disease specialists have worked to develop the following five areas:
    - Quarantine of infected individuals
    - Improved sanitation of human waste
    - Pest control
    - Vaccines
    - Antibiotics

Disease: Treatment & Preventative Protocols
Quarantine

- An important component of fighting infectious disease was to isolate (and separate) the contagion from the rest of the organism
- Because the nature of a disease is to spread and take over, it is paramount to limit their exposure and access as best one can
- During the 14th century, as an outgrowth of an attempt to set-up a quarantine-like environment to deter plagues of epidemic proportions , ships coming to port were required to sit at anchor for 40 days before entering port
- Most common quarantines
    - Most common isolation of sick individuals. Obviously this then helps prevent the disease from spreading to massive groups of people



Disease: Treatment & Preventative Protocols – Continued

Quarantine

- Quarantines can be shaped around the idea of limiting the movement of healthy populations during epidemics and isolating healthy individuals exposed to an illness
- Many times Quarantines act only as a method for curtailing the spread of disease
- Because many people don't show outward signs of illness, it may be difficult to assess who is infected and who is not

- There are persons who act as carriers (asymptomatic person who can have the disease, remain unaffected yet carry it to others)
- These persons are perhaps the most dangerous for they are difficult to diagnosis and, thus, remain at-large capable of carrying and spreading the disease
- With modern came new methods for curtailing and curing select diseases
- The reliance upon quarantines for treating infectious diseases has been severely cut-back
- Yet there still remain a handful of diseases: cholera, diphtheria, tuberculosis, plagues, yellow fever and other severe viruses that remain best served by quarantines

Sanitation

- Dating as far back as 800 B.C., sanitation is another method that has long been used to deter the spread of disease
- Archeological evidence points out the importance of clean water and that the quick and efficient disposal of waste played a significant role in maintaining civilizations
- The Romans and Greeks relied upon sanitation because they believed in the benefits of healthy living

- They built latrines and sewer systems as a means for isolating and removing waste from living areas
- Through the work of John Snow in London, the connection between poor sanitation and the spread of disease became most evident
- It was at this time that an outbreak of cholera in the city of London was taking out the entire population
- Meticulously plotting the residence of each patient, Snow discovered there to be a cluster of cholera patients around a particular water pump
- A simple removal of the pump handle proved sufficient enough to stop the epidemic
- Snow astutely surmised that germs in the water were causing the back-up of cholera and that polluted water was acting to transmit the disease throughout the city
- Based upon Snow's findings and subsequent studies, by the late 19th century, English laws regulating sanitation were implemented

Disease: Treatment & Preventative Protocols – Continued

Sanitation

- Later in time, these laws proved to significantly increase life expectancy of the area's residents
- Today, public water supplies are, by law, regularly treated to remove pathogenic organisms
- Referred to as a 'purification process', these activities can take the form of settling tanks, filtration and chlorine treatments

Pest Control

- Toward the end of the 19th century, it was detected that vectors of insects were spreading diseases
- The major epidemic known as 'Yellow Fever' was one of the first diseases this was noted
    - During the Spanish-American War, the United States Army lost 958 soldiers in battle, and they lost more than 5,000 to yellow fever
- In order for the U.S. to occupy Cuba so that a stable government could be formed, they realized they would need to protect the troops from yellow fever
- A commission studied the cause and transmission of the disease, after tireless efforts they eventually found the Cuban mosquito, to be the vector spreading yellow fever
    - Further experiments, later demonstrated that the causative agent was a virus that was carried by the mosquito
- Present day, vectors are known to be the causal agent of many human diseases
- For example, Lyme disease, though transmitted from an infected deer to human by the deer tick, is caused by Borrelia burgdorferi
- Mosquitoes are known to spread West Nile Virus
- Insects are not alone in their ability to spread and/or transmit to humans
- Rodents have the ability to transmit disease
    - The contraction of the some diseases is almost always associated with contact between the patient and rodents or rodent litter
- In order to control vector-borne diseases, the vector itself is what often needs to be sequestered
- At times, this may mean quarantine, although more likely this involves the use of pesticides and other procedures that have the ability to prevent contact between the vector and humans