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Public Health Journeyman

Volume 2. Principles of Communicable Disease

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This is volume 2 of your 3 volume, A-set career development course (CDC) and here we address the principles of communicable disease. Unit 1 looks at the principles of epidemiology, specifically we begin by examining host-agent relationships and the chain of infection that relates to the communicable disease process. We also discuss host, environmental factors, and the operational importance of how those factors affect disease occurrence. We then discuss biostatstics as the measurements of central tendency, and noneffectiveness, incidence, and attack rates. Finally, we look at epidemiological investigations to include study methods and procedures for conducting those investigations.

In unit 2, we examine communicable disease, specifically, respiratory diseases like influenza and pulmonary tuberculosis; sexually transmitted infections, specifically syphilis, gonorrhea, chlamydia, other common sexually transmitted diseases, the human immunodeficiency virus, and managing sexually transmitted infectious patients. Then, we examine viral hepatitis and its types, prevention, and control measures. Finally, section four will examine the rabies control program, including rabies itself and the animal bite control program.

A glossary is included for your use.

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NOTE:

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

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Unit 1. Principles of Epidemiology

EPIDEMIOLOGY is the study of the various factors that determine the frequency and distribution of diseases in populations. For example, epidemiology is concerned with such things as how often diseases occur in a population, the number of people affected, and where the diseases occur. Epidemiology uses this information to understand the causes of diseases and the best ways to prevent them. In the Air Force, Public Health performs these epidemiology functions.

There is no single cause for any disease. The simple presence of disease agents (bacteria, viruses, fungi, etc.) in the environment is not enough to explain disease outbreaks. For example, *Clostridium botulinum*, the disease agent involved in botulism, is generally present everywhere in our daily environment. However, an outbreak occurs only when several conditions are met. To prevent and control human diseases that are caused by infectious agents, you must understand how disease agents exist in nature, the means by which they reach humans, and how humans and agents interact. You will learn these principles of infectious disease epidemiology in this unit.

1–1. Communicable Disease Process

To understand any communicable disease process, you must know the relationships between the host and the disease agent. Let’s take a brief look at some of these.

201. Host-agent relationships

A host is a person or other living animal, including birds and arthropods, which are harboring a disease agent. Some agents, such as protozoa and helminth, pass through successive stages of development while in two or more different species of hosts.

Host

To understand the relationship between host and agent better, let’s consider diphyllobothriasis. Diphyllobothriasis is a tapeworm disease in humans.

The cycle

The cycle of diphyllobothriasis begins when an infected human excretes tapeworm eggs. The eggs are discharged into fresh water, where they hatch and infect small shellfish. Susceptible fish eat the small shellfish, and then the tapeworm larvae undergo another stage of development within the fish. A human catches this fish and eats it raw or undercooked. The larval tapeworms develop to maturity in this human and start producing more eggs to start the cycle over again.

The host name

In this instance of tapeworm disease, the human is called the *primary* (*definitive*) *host* because the tapeworm attains its maturity and goes through its sexual or reproductive stage in the human. The shellfish and freshwater fish are called the *secondary* (*intermediate*) *hosts* because the tapeworm is in larval stages while in these animals.

The host as carrier

The host of the disease can be a "carrier." A carrier is a person or animal that harbors a disease agent, but has no clinical signs of the disease. The carrier is a potential source of infection to others. The carrier state may last for a lifetime, as in the case of Typhoid Mary, a New York City cook in the early 1900s who was the first healthy carrier of typhoid fever ever identified. On the other hand, it may last for only a few weeks, as often happens with carriers of the polio virus, diphtheria, bacilli, or streptococci. In investigating outbreaks of disease due to agents that can cause carrier states, finding the source of infection may be difficult since the host will not appear to be ill.

Agent

Infectious disease agents are organisms that live on or in the body of a host and can produce disease or illness.

Agent locations

All living organisms carry disease agents on or in themselves. Disease agents may occupy almost any location on the host's body. For example, viruses and some bacteria invade and multiply within the very cells of the host.

Agent differences

Different agents have different abilities to produce disease in particular hosts. These differences are often described in terms of infectivity, pathogenicity, and virulence.

Infectivity

Infectivity is the ability of the agent to invade and multiply, or to produce infection, in a host. The chicken pox and measles viruses are very infective, easily infecting a susceptible host. On the other hand, the bacteria causing tuberculosis and leprosy have low infectivity. Long, intimate exposure to an infected person is required before a second person becomes infected; and then the infection does not always lead to disease.

Pathogenicity

Pathogenicity is the ability of an agent to produce clinical disease in a host. Some agents, such as the measles virus, produce disease in virtually all infected persons. These agents are highly pathogenic. Other agents, such as the polio virus, produce disease in only a small percentage of infected individuals. Such agents have low pathogenicity. Agents also vary in the severity of the disease they cause.

Virulence

Virulence is defined as "the proportion of clinical cases resulting in severe clinical manifestations." Rabies produces severe, and usually fatal, manifestations; thus, the rabies virus is highly virulent. Upper respiratory viruses generally produce less severe diseases. Therefore, these viruses have low virulence.

Agent types

There are many types of organisms, and you need to know some of their characteristics. Specifically, you need to know about the types of organisms that include disease agents and cause illness.

Metazoa

Metazoa are multicellular organisms, often referred to as parasites. Metazoa that cause infection or disease include nematodes (roundworms), trematodes (flukes and flatworms), and cestodes (tapeworms). These organisms are capable of causing disease in both animals and humans.

Protozoa

Protozoa are single-celled, animal-like organisms. Most are free-living and found in soil and water. A few parasitic protozoa cause disease; for example, *Entamoeba* and *Giardia* are usually waterborne or foodborne and cause diarrhea. *Plasmodium*, the agent that causes malaria, is normally transmitted by mosquitoes and causes fever, anemia, and death. *Pneumocystis carinii* infection results in a severe or fatal pneumonia in Acquired Immunodeficiency Syndrome (AIDS) patients. *Trichomonas* is a protozoa transmitted by sexual contact, which causes persistent infections in the genital tracts of both males and females.

Fungi

Fungi are found almost everywhere. There are about 80,000 fungi species. Only a few of the fungi species cause disease. There are two forms of fungi: single cell (yeast) and multicellular (molds). Some fungi, usually those that cause disease, can live in either form and are called biphasic (two phases) or dimorphic (two forms). *Histoplasma* and *Coccidioides* are examples of dimorphic fungi. Fungal diseases can be limited to the skin or mucous membranes (superficial), occur in deeper tissues, or involve the entire body (systemic). Ringworm is a superficial fungal infection (not a true worm), while *Histoplasma* results in a deep-seated or systemic infection.

Bacteria

Bacteria are microscopic, single-celled organisms appearing in variations of three different shapes: bacillus (rod), coccus (sphere), and spirillum (spiral). Although many are capable of causing disease, most bacteria are beneficial. They perform important functions, such as fermentation of foods (beer, cheese, and buttermilk), digestion of raw sewage, and protection against disease-causing bacteria. In fact, the bacteria normally found in human intestines aid in the digestion of nutrients and prevent the growth of some dangerous bacteria. Examples of disease causing bacteria are *Shigella*, a bacillus; *Staphylococcus aureus*, a coccus; and *Vibrio cholerae*, a spirillum.

Rickettsia

Rickettsiae are small bacteria; however, they do not have all the characteristics typical of bacterial cells. Most are obligate, intracellular parasites; that is, they must live within living cells. Many rickettsial diseases are spread by arthropods. For example, Rocky Mountain spotted fever is caused by *Rickettsia* (*Rickettsii*), which are transmitted by ticks. Mites, lice, and fleas spread typhus. *Chlamydiae*, which are also classified in the rickettsia group, are also intracellular parasites and cause a variety of diseases; most notably the sexually transmitted infection (STI) called chlamydia.

Viruses

Viruses are particles of nucleic acid (either deoxyribonucleic acid [DNA] or ribonucleic acid [RNA]) surrounded by a protein sheath; they are highly infectious. Mature virus particles, called virions, must infect and use a living cell for energy production and replication. Viruses cause common diseases, like hepatitis, measles, rubella, and influenza.

Host-agent interaction

When a host is exposed to a disease agent, there are three possible outcomes as listed here:

1. Nowhere to lodge—the disease agent may not be able to penetrate the host's body, or if it penetrates, it is not able to lodge anywhere before being eliminated.
2. No effect—the disease agent may enter and lodge in the host's body, but cause no symptoms of disease.

3. Great effect—the disease agent may lodge, multiply, and cause signs and symptoms of disease.

How agents enter the body

In humans and higher animals, microbial disease agents normally enter the body by ingestion, inhalation, or penetration as explained below.

1. Ingestion—the agent may be swallowed, ingested with food or drink, or introduced by putting fingers, cigarettes, or other materials in the mouth.
2. Inhalation—the agent may be inhaled along with air.
3. Penetration—the agent may penetrate the skin by entering through a cut or an insect bite, and so forth.

Once in the body, the disease agent finds the right place to live.

Where to live

Most disease agents can only live in a certain type of cell or organ. These are called the agent's "target cell" or "target organ." For example, some agents live in the intestines, while others live in the blood or in the respiratory tract.

Raising a family

The agent must be able to reproduce for survival. Some tapeworms lay about a million fertilized eggs. Why so many? Species survival depends on it!

Leaving home

The disease agents must be able to exit the target organ and survive outside of the host until they enter a new host, or are transmitted through direct contact.

202. Chain of infection

Communicable diseases are those diseases that are transmittable among various hosts. They may result from close, or direct, contact with an infected person or animal; from exposure to the breath, cough, or bodily discharges (e.g., sputum, mucus, urine, feces) a person or animal; from foods, liquids, or articles contaminated by an infected person or animal; or from the bites of humans or animals. You know about organisms, such as viruses, rickettsia, protozoa, fungi, and bacteria that cause communicable diseases. Most of these organisms are too small to be seen without a microscope. Some of them survive only a few minutes outside the human body; whereas, others survive for years in the general environment. When these infectious organisms enter the human body and begin to multiply or reproduce, they may cause communicable diseases. The chain of infection describes how these disease agents are spread.

The chain

Communicable diseases result from an orderly progression of events. This series of events may be explained using a three-link chain. Each link represents a factor, or set of factors, essential to the transmission of disease. These links are the source, mode of transmission, and host. If any one of the links in the chain is broken, the disease cannot spread.

1. Source: The source or reservoir of the disease agent.
2. Mode: The mode is the means by which the disease agent may be transmitted.
3. Host: A susceptible person or host.

Source of disease agent

The source of a disease agent is the person, animal, inanimate object, or substance from which the infectious agent passes to a host.

Person

If the source is a person, the person may be either a case or a carrier as described below.

- Case: A case is a person who is actually ill with a disease.
- Carrier: As discussed earlier, a carrier is a person who harbors disease organisms, but is not ill. Carriers can spread germs in the same manner as cases; however, carriers are more dangerous because they may not know they are harboring and spreading infectious organisms.

Animal

An animal may also be a source of infection. Animals may be ill with disease, or harbor an organism, without showing signs of illness, much like human carriers.

Inanimate/Substance

In some cases, the source of the infectious agent is not a living organism; it may be some inanimate object or substance. For example, soil may be the source of a number of disease agents including those from the *Clostridia* genus that cause botulism and tetanus.

Modes of disease transmission

The *means of transmission* link in the chain of infection is how the infectious agent gets from a source to a susceptible individual. There is a variety of mechanisms by which an infectious agent can be spread from a source to a host. These mechanisms include both direct and indirect transmission. The table below lists the types and methods of transmission.

Types and Descriptions of Disease Transmission

Types	Descriptions
Direct transmission	Direct transmission is essentially the immediate transfer of infectious agents to a portal in which infection may take place and the results can take these two forms: • Direct contact: Diseases such as rabies and gonorrhea are transferred or spread by direct contact. This transfer occurs by contact such as touching, biting, kissing, or sexual intercourse. • Contact with droplets: Diseases such as measles, *Haemophilus* meningitis, and influenza are transmitted by contact with droplets of spray. Transmission may occur by close contact with droplets of spray onto the mucous membranes of the eyes, nose, or mouth while sneezing, coughing, spitting, singing, or talking. This type of direct spread is usually limited to a distance of 3 feet or less.
Indirect transmission	Transmission can occur through indirect means such as vehicleborne, vectorborne, and airborne as discussed below: • Vehicleborne: Transmission of a vehicleborne infection is indirect because the infection occurs without direct exposure or contact with the reservoir (ill person). The infection occurs as a host or susceptible person comes in contact with contaminated inanimate objects (fomites) or materials. Vehicles may include toys, handkerchiefs, soiled bedding or clothes, cooking utensils, water, food, milk, blood, body fluids, tissues, or organs. • Vectorborne transmission: Vectorborne diseases are divided into two categories, mechanical and biological.

Types and Descriptions of Disease Transmission	
Types	**Descriptions**
Indirect transmission (continued)	1. Mechanical: Crawling or flying insects, such as roaches or filth flies, can spread diseases mechanically by carrying disease organisms on their feet or proboscis (mouth parts). Organisms passing through insect intestinal tract to a susceptible host may also spread disease mechanically. 2. Biological: In diseases spread biologically, the organism must multiply (propagation), undergo further development (cyclic), or both (cyclopropagative) before the arthropod can transmit the infective form of the agent to humans. Biological transmission is different from mechanical in that the arthropod itself is infected with the organism. • Airborne transmission: The disease is airborne-transmitted by the dissemination of microbes or microbial particles in the air to a suitable portal, usually the respiratory tract. The microbes or particles may stay in the air for long periods, some retaining their infectivity and others losing their infectivity. "Droplet nuclei" are microbial aerosols that result from evaporation of fluid from droplets expelled from an infected host. Droplet nuclei remain in the air for long periods; diseases such as tuberculosis are transmitted by droplet nuclei. Transmission also may occur from airborne dusts, such as fungal spores, that have been separated from the soil by the wind.

Susceptible person (host)

A susceptible (or nonimmune person) is one who has little or no resistance to a particular organism, and if exposed to this organism, is likely to contract infection or disease. By contrast, an immune person is one who has a high degree of resistance to the organism, and when exposed, does not develop the infection or disease. In some cases, immunity to a disease is relative and can be overwhelmed by exposure to a very large number of the disease organisms.

Breaking the chain

The most effective way to prevent and/or control disease is to, "Break the Chain of Infection!" In order to use prevention and control measures effectively, you must know the characteristics of the disease agent, means of transmission, and susceptible persons. As you will see, not all control measures work equally well for all diseases. Measures may be best used against one particular link; or prevention, and control measures may have to be used against two or more links to break the chain of infection. You must also know the characteristics of the disease agent (e.g., incubation periods, signs and symptoms, etc.). These characteristics will be discussed in detail with each disease listed in Unit 2.

Source control and prevention measures

Measures to control or prevent infection at the source include diagnosis and treatment, isolation, destruction of the source, and education.

- Diagnosis and treatment: Diagnosis and treatment of the source or case not only resolves the infection in the source patient, but also may prevent it from spreading to others.
- Isolation: There are no treatments for diseases such as hepatitis B, AIDS, and rabies, so other measures must be considered. Therefore, in some cases, it may be necessary to isolate the patient from others.
- Destruction of the source: An alternative to isolation is killing or destroying the source. This may include sterilizing or disinfecting equipment, materials, or surfaces.
- Education: Patient education is a very important control measure to break the source link. Patients may be taught the significance of infection, the importance of taking medication, the means to avoid reinfection, and how to prevent the spread to others. For example, a crucial

part of tuberculosis control is convincing the patient to take medication daily for six to 12 months.

Means of transmission

Prevention and control measures used to break this link may include preventing contact with the source (direct contact transmission) or vehicle. Measures such as environmental sanitation, water treatment, food hygiene, and waste treatment control the spread of agents through the vehicles of water, milk, and food. Vector control minimizes the spread of disease. As with measures directed against the source of infection, prevention and control efforts against the means of transmission must be appropriate. For example, it is not feasible to kill all mosquitoes carrying malaria at a deployment site. Area spraying may reduce the numbers, but will not prevent infection.

Thus, other measures are used for the susceptible person, such as insect repellent, bed nets, and chemoprophylaxis (e.g., malaria pills). Also, it would be inappropriate to restrict hepatitis B or human immunodeficiency virus (HIV) carriers from food handler duties since the viruses are not spread by food.

Susceptible person

Immunization, prophylaxis, and education are some of the prevention and control measures used to break this link. Again, the measures must be suitable for the particular disease and the susceptible person or population. For example, you couldn't immunize someone to protect them from malaria because there is no vaccine for that disease. Vaccines are not available for many other diseases, so education becomes important.

Our communicable disease programs emphasize education as a means of disease prevention. Field sanitation briefings, squadron AIDS presentations, and individually counseling STI patients are all a means to break this link by training personnel how to avoid the source, avoid the means of transmission, or minimize their susceptibility.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

201. Host-agent relationships

1. How is the term "host "defined?

2. How is the term "carrier" defined?

3. What are infectious disease agents?

4. What is infectivity?

5. What is pathogenicity?

6. When a host is exposed to a disease agent, what are the three possible outcomes?

7. What are the three main modes of entry used by disease agents to enter the body?

202. Chain of infection

1. What are the three parts to a chain of infection?

2. What may serve as a source of infection?

3. What are the two ways direct transmission can occur?

4. What are the three ways indirect transmission can occur?

5. What measures may be used to break the chain of infection at each link?

1–2. Factors Affecting Disease Occurrence

Why do we get sick? Why do some people get sick, while others do not? Many of us ask these questions when someone we know gets sick or dies. There are a number of factors involved with the occurrence of disease. In this section, you'll learn some of these factors. First, let us consider the body defenses.

203. Host factors

The human body has a number of defenses. The intact skin and mucous membranes provide the body with a protective covering against living agents and many chemicals. Other structures, such as the hair, sweat glands, and fat pads help to protect the body against physical forces and aid in thermal regulation. Our eyes wink and blink, and our tears have a cleansing action; thus, providing protection against objects or pathogens.

The skeleton protects the delicate vital organs such as the brain, heart, lungs, and abdominal organs. The abdominal cavity is well lubricated so the organs will slide out of line with direct pressure and sharp objects. Coughing and sneezing are the respiratory system's way of getting rid of harmful substances. The cilia within the upper respiratory tract constantly beat to move a layer of mucous with trapped particles to the outside. Also, vomiting and diarrhea are the gastrointestinal tract defense mechanisms,and the kidney and liver filter out, or detoxify, various chemicals.

General body defenses

The body has internal defenses against disease agents, such as bacteria that are able to gain access to the body. For example, inflammation is a defense mechanism used by the body to ward off and

destroy harmful agents. Numerous white blood cells (WBC) go to the scene of an infection to surround and engulf the agents. Pathogens are moved via lymph channels to lymph nodes, which are filter-like structures lined with WBCs. Even if these fail and the pathogens get into the blood stream, large filters with WBCs located in the bone marrow, liver, and spleen will take over the defense.

Intrinsic factors

When investigating the occurrence of a disease, age, gender, and race are often the first things you need to determine. These *host characteristics* are often associated with disease occurrence and may be involved with the degree of exposure to a disease agent. Also, persons of different ages, sexes, or races may differ in susceptibility to certain agents. Furthermore, age, gender, or ethnic group may affect specific immunity in the population at risk.

Age

Young children's defense mechanisms against disease are poorly developed. This is the reason for the high mortality rates in infants less than one year old, especially in developing countries. Their immune systems just cannot fight disease organisms as well as an adult or older child. As we get older, our defense mechanisms are more developed and stronger. However, we also start coming in contact with more people and things that are the sources of disease.

At first, we are allowed to play in our own yard; as we get older, we can play across the street, and in the neighborhood. At five or six, we start school, and each stage of our life brings us in contact with new people and places. We develop immunity to many diseases such as measles, poliomyelitis, and chickenpox as children and are protected for life. As we reach the later years of our lives, our defense system starts to weaken,and we are more susceptible to disease again.

Gender

Gender affects the distribution of disease due to anatomical differences, hormonal factors, and exposure potential. Older men frequently develop prostate infections. Women do not have a prostate and so they obviously, do not get prostate infections. Urinary bladder infections are more common in females than males because of the different anatomy of the urinary tract. Estrogen, a female hormone, seems to protect against some diseases such as heart disease and osteoporosis. These are just a few examples of sex differences.

Race

You can probably already think of some examples of disease differences between the races, such as sickle cell anemia in persons of African and southern Mediterranean descent. Did you also know tuberculosis is more of a problem in those same persons? Diabetes is common in Jewish males. Some of the reasons for these differences are known, and others are just theories. The differences may be due to exposure potential, differences in immunity, or other defense systems.

General health status of host

In addition to the structural and functional aspects of the human body, the general health status of the host is a significant factor in disease occurrence. The general health status of the host includes his or hers physiological state, nutritional status, preexisting disease, and stress.

Physiological state

Physiological state can affect disease occurrence in a number of ways. For example, pregnancy enhances the risk of certain diseases such as urinary tract infections. Also, women lose the protective effect of estrogen at menopause and are at higher risk of certain chronic diseases, such as heart disease and osteoporosis.

Nutritional status

Nutritional status can affect the frequency with which certain diseases occur. As the body's nutrients are depleted, it has less energy to produce antibodies and white blood cells to fight off disease agents.

One of the reasons third world countries have higher mortality rates is their people do not have balanced diets. There are also specific nutritional deficiencies that produce diseases. For example, lack of vitamin C results in scurvy, or lack of iron can result in iron-deficiency anemia.

Preexisting disease

We have known for a long time that the existence of one disease tends to pave the way for another illness. For example, older people dying of a chronic, noninfectious disease will frequently develop bacterial bronchopneumonia. Diabetics are susceptible to many bacterial infections, and otherwise "mild" respiratory viral infections may pave the way for a severe bacterial disease.

Stress

Stress is another factor that influences disease occurrence by not allowing the body's defense system to function at its fullest.We all have been told by our mothers not to get wet and chilled or we will catch a cold. Chilling is a stress on the body that weakens our defense system, allowing a cold virus opportunity to invade the body.

Human behavior and disease

Human behavior, including individual practices and the customs of groups, has a tremendous impact on exposure to disease agents and the manner in which agents may be transmitted. Behavioral factors and environmental influences are often hard to distinguish since they tend to influence each other. Let's examine some of the ways that human behavior can affect disease transmission.

Diet

The diet and food preparation practices of a population often influence the health and disease patterns within the community. For example, in some oriental countries, raw fish are an important part of the diet, as a result, certain diseases, such as anisakiasis and *vibrio* infections are more common. In communities where pork is eaten, individuals may be at risk of trichinosis infection if the pork is undercooked; in communities where pork is not eaten, the risk of trichinosis is less.

There are other examples. In the past, raw milk was sold in almost every state in the United States, and was the source of outbreaks of various diseases including Q-fever, salmonellosis, and brucellosis. Pasteurization eliminated virtually all of the diseases that were transmitted by milk. However, recently with the emphasis on natural foods, some states have allowed the sale of raw milk and there has been a resurgence of these milkborne diseases.

Human waste disposal

Proper human waste disposal is important in preventing disease transmission. Improper disposal of waste, which frequently occurs in underdeveloped and poorly educated countries, attracts flies that spread enteric infectious agents. In addition, when drinking water is contaminated by human waste, the result is diseases such as hepatitis A, typhoid, and giardiasis.

In some areas of the world, human feces (night soil) are used for fertilizer. This practice directly contaminates food crops that are consumed raw, such as lettuce and tomatoes. This practice allows diseases such as typhoid, dysentery, amebiasis, and hepatitis A to be transmitted. Clams, oysters, and other shellfish may become contaminated if grown in sewage-polluted water. In the past, major outbreaks of hepatitis have been directly traced to sewage-contaminated shellfish.

Personal hygiene

Personal hygiene is one of the most important factors in the control of communicable disease. For example, an individual's hands are frequently contaminated during the day. If that person is a food handler, the result can be a foodborne outbreak from salmonella or staphylococcus.

In a childcare employee, contaminated hands could result in the spread of hepatitis A or shigella. Good hand washing eliminates these problems. Some people may not practice good personal hygiene. In some situations, individuals may not be able to practice good hygiene because of their

circumstances. Soap and water may not be available. For example, in World War II, some troops were unable to bathe routinely and this led to lice infestations. Since lice transmit diseases such as typhus, the troops' clothing had to be sprayed regularly with DDT (an insecticide) to kill the lice.

Personal contact

Personal contact includes handshaking, kissing, and sexual intercourse. Kissing can spread infectious mononucleosis and cold sores (herpes virus). Intercourse and related activities can spread things such as crab lice, the herpes virus, and gonorrhea. Childcare centers are a good environment for the transmission of hepatitis A, pinworms, and numerous respiratory diseases. Sanitary surveys and education of employees at childcare centers are extremely important in preventing these diseases.

Household hygiene

Family health depends on the degree of sanitation and hygiene within the household. In certain cultures, families sleep in a single bed; therefore, contact agents and body lice can be easily spread. The contact with pets or other animals present in the home is also important. Measures should be taken to protect against disease carriers, such as flies, mosquitoes, and rodents. It is also important to ensure good sanitation in the home and proper family food handling.

Occupation/recreation

The risk of acquiring certain diseases can be directly related to an individual's occupation or recreational activities. Workers may be exposed to many toxic agents (e.g., lead, mercury, asbestos, and radioactive materials) in their jobs. These toxic agents may have an adverse effect on the body. Construction workers, farmers, and other outdoor workers have an increased risk of developing skin cancer as a result of prolonged exposure to the sun. Others may be exposed to zoonotic diseases from contact with animals or arthropod vectors.

Recreation in itself is good, but some of our recreational habits increase the chance of contracting a disease. Recreation activities may cause an increase in accidents as well as expose us to unfriendly aspects of nature (e.g., poison ivy, oak, etc.) and certain disease vectors. Likewise, travel may take us to foreign areas where a wide variety of diseases may be widespread.

Other behaviors

Certain individual behaviors within a society, such as overindulgence in, and addiction to, alcohol, tobacco, and drugs, increases the chances of getting certain diseases, such as lung cancer, and makes the individual more susceptible to other infections. For example, drug users are at greater risk of acquiring the AIDS virus or hepatitis B when they use contaminated needles.

204. Environmental factors

The host and agent environment can have a dramatic impact on the occurrence of disease. When considering environmental effects, it is useful to think in terms of physical, biological, and social environments.

Physical environment

When talking about the physical environment, we are referring to two related factors, climate and geography.

Climate

The climate of an area is a key factor in the transmission of certain diseases. Respiratory diseases occur more frequently in colder months. During this time, people are generally crowded indoors, making person-to-person transmission of respiratory viruses easier. Also, the body's resistance may be lower due to the stress of colder temperatures. Enteric infections tend to increase in the summer months. Warmer temperatures bring more picnics with a greater chance for food spoilage and growth of food pathogens.

Hay fever sufferers know the effects of climate on their condition, which is the environmental factor with the greatest effect since the amount of plant pollen in the air is determined, in most cases, by the climate. Climate can also affect the survival of disease agents. Humidity, radiation from the sun, and temperature are very important in the survival of many disease agents; however, the physical effect of too much heat, radiation, or excessive drying is deadly to many disease agents, such as bacteria. Temperature and humidity are extremely important in the development of intestinal parasites. For example, roundworm eggs are very dependent on adequate humidity and warm temperature in the soil to become infective.

Geography

The occurrence of disease is also determined by the geography of an area. You can read in the Centers for Disease Control and Prevention's (CDC) morbidity and mortality reports how certain diseases seem to be restricted to certain areas. In part, diseases may be confined to areas where the reservoir or vector for the disease agent can survive. Distance and such geographic features as mountains and rivers, act as natural barriers or can aid in spreading disease. Lastly, of course, geography also influences climate.

Biological environment

The biological environment includes all living things. Adequate nutrition provided by the environment that helps our body resist many disease agents. Some plants are harmful. These include poison ivy, toxic mushrooms, and even the pollen-producing plants that make the lives of hay fever sufferers miserable. On the other hand, some plants are medicine sources, such as quinine, which is used to treat malaria and comes from tree bark. As you can see, plant and animal life can have both harmful and beneficial effects. The biological environment can affect us, and the spread of disease, by providing homes and food for vectors and be reservoirs of disease.

Social environment

The social environment includes many factors that are important in the occurrence of disease. These factors include the economic development or wealth of the society, culture and customs, level of education, availability of public health services, and rural versus urban communities. For example, chronic diseases such as obesity and heart disease occur more frequently in industrialized nations than in less developed countries. Infectious diseases such as malaria, tuberculosis, and diarrheal diseases prevail in poorer, less developed nations. Eating raw or undercooked fish, a social or ethnic custom, increases exposure to seafood parasites.

Differences in exposure to disease agents can be related to urban versus rural lifestyles. Think of the different styles of living (e.g., occupations, recreations, methods of waste disposal, etc.) and the plants and animals (sources of infection) found in each area. Tuberculosis and typhus have been historically associated with crowded industrial centers. On the other hand, certain zoonotic diseases, such as leptospirosis, are more commonly found in rural agricultural areas.

205. Operational importance

We can see cases of emerging/reemerging diseases that are causing massive amounts of sick or dying individuals, such as the ebola outbreak in Africa in 2014 killing thousands of people with thousands more ill from this reemerging problem in this country. With an ever-changing world, countries can change dramatically in the way people live their lives. If the change is drastic enough, it could have a dramatic role on the possibility of a new, infectious disease appearing, or an old one reemerging, though it may have been eradicated or controlled.

The term "emerging infectious disease" is applied to those conditions in which the incidence in humans has increased within the past two decades, or threatens to increase in the future. In general, it can be a completely new disease or an old disease occurring in a new place, with new presentation, or is newly resistant to available treatments. Emerging infections have plagued our service personnel during training and operational deployments. Military relevant emerging infections not only include

previously unrecognized agents, such as those causing HIV, Lyme disease, human ehrilichiosis, or new influenza strains, but also, better established infectious agents that have become resistant to antibiotic therapy. It becomes more critical to recognize and understand emerging diseases that compromise military readiness and national security as the military forces are reduced and moving to new places.

Concept of emergence

Many factors contribute to disease emergence. Genetic changes may be responsible for the emergence of new, infectious diseases from existing organisms, such as influenza. Known disease may spread to new geographic areas and populations, as has been observed with raccoon rabies in the northeastern part of the US. Previously unknown infections may occur when humans enter certain environments that increase exposure to insect vectors and other reservoirs, or when environmental sources of new agents are present. Activity in once remote tropical rainforests is an example of how humans might come into contact with previously unknown infectious agents.

Factors in disease emergence

Many factors contribute to the emergence of new infectious disease or the reemergence or old diseases.Societal disruptions (i.e., urban decay, refugee migration, displaced persons, or poverty) may lead to the emergence or reemergence of infectious diseases. Advances in healthcare also contribute to the development of emerging infections. In addition to the effects of drugs causing immunosuppression, the widespread and unrestricted availability of antibiotics in much of the world is an important consideration. The concern is not only the acquisition of antibiotic resistant organisms while US Forces receive healthcare during operations overseas, but also the importation of these infections to US health care facilities.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

203. Host factors

1. How does the skin and mucous membranes protect the body?

2. What are three protective structures that help the body against physical forces and aid in thermal regulation?

3. How is the abdominal cavity designed to protect the vital organs?

4. How does the respiratory tract protect itself?

5. In what functional ways does the gastrointestinal tract protect the body?

6. How does the body defend itself against living pathogens?

7. How does the age of a population affect the occurrence of disease?

8. What are the three gender factors affecting the distribution of disease?

9. What effect does an inadequate intake of nutrients have on the body?

10. What effect does stress have on host defenses?

11. What are seven human behaviors that affect disease transmission?

204. Environmental factors

1. What are two *physical* environmental factors in the transmission of disease?

2. What are two *geographical* features that can act as barriers or can aid the spread of disease?

3. What factors are included in the social environment that affects the occurrence of disease?

205. Operational importance

1. What does the term “emerging infectious diseases” mean?

2. In what settings have emerging and reemerging diseases plagued service members?

3. Name three, military relevant, emerging infections that were previously unrecognized.

4. What are some factors that contribute to the emergence or reemergence of diseases?

1–3. Biostatistics

Would it interest you is someone said you only a 10 percent chance of passing this course? Would you be interested if you were told that chances are one in three that you will get a foodborne illness while stationed at your base? Whether you realize it or not, these types of statistics play a large part in your life—especially in your work.

Statistics are used in all areas of our lives. The Consumer Price Index (CPI), percent chance of rain, and advertising (e.g., the number of dentists who recommend their patients chew sugarless gum to reduce cavities) are only three examples of sources using statistics. As a Public Health journeyman, you'll use statistics to help analyze disease incidence, to predict future disease trends, and to summarize data.

206. Statistical measurements of central tendency

Statistics are numeric facts or data that have been assembled, classified, and tabulated to present significant information about a given subject. For example, biostatistics is the statistics concerning life.

There are several ways these facts may be assembled, classified, and tabulated. One of the ways to present data is through measurements of central tendency. The measurement of central tendency used to present public health data is the one most accurate method of portraying a situation. (**NOTE:** Statistics can be misused in many ways, and you must ensure the message you convey with your statistical data is a correct one.)

Mean

The number most commonly used as a measurement is the expression of *central tendency*, which is the mean. The mean for a sample is the sum of all the observations divided by the number of observations.

Example:

> You are asked to give the mean age of children exposed to *Haemophilus influenza* B meningitis at the base child development center. At the end of the month, there were four reported cases: two of the children were a year old, one was two years old, and one was eight years old.
>
> Month's data: 1, 2, 8, 1 (each child's age).
>
> Step 1—Add all the values of the data: 1 + 2 + 8 + 1 = 12.
>
> Step 2—Count the number of items: 4.
>
> Step 3—Divide the sum of the items by the number of items: 12 ÷ 4 = 3.
>
> Solution: The mean age is 3 years old.

Mode

Another number used to describe the center of a distribution is the mode. The mode is the number *occurring most often* in a group or set of numbers:

Example #1:

> Problem: During a foodborne illness outbreak investigation, the following patient ages were recorded in the emergency room log: 6, 9, 12, 15, 12, 92, and 34. What is the mode for this illness?
>
> Solution: The mode is 12 because there are two twelve-year-olds and only one of each of the other ages.

Example #2:

Problem: During a second foodborne illness outbreak investigation, the following patient ages were recorded in the emergency room log: 2, 4, 6, 8, 2, 6, and 22. What is the mode for this illness?

Solution: This set of data has two modes and is called "bimodal." The modes are 2 and 6 because they occur the same number of times.

Example #3:

Problem: During a third foodborne illness outbreak investigation, the following patient ages were recorded in the emergency room log: 4, 9, 16, 12, 13, 7, and 13. What is the mode for this outbreak?

Solution: The mode is 13.

Median

A final measurement of central tendency is the median. To find the median of a group of observations or data, first arrange the data from the smallest number to the largest number. This ordered arrangement is called an "array." When there is an odd number of observations, the median is the *middle number* in the array. However, when there is an even number of observations, the median is equal to the mean of the two middle numbers in the array

Example #1:

Problem: During a foodborne illness outbreak investigation, the following patient ages were recorded in the emergency room log (an even number of observations): 17, 3, 9, 6, 2, and 11. What is the median age for this illness?

Solution:

Step 1: Arrange the data from the smallest to the largest: 2, 3, 6, 9, 11, and 17.

Step 2: Count the number of items: 6.

Step 3: Choose the two middle values: third and fourth items (6, 9).

Step 4: Find the mean of the two middle values ($6 + 9 = 15$ and $15 \div 2 = 7.5$).

Step 5: The median age is 7.5.

Example #2:

Problem: During a foodborne illness outbreak investigation, the following number of cases was recorded in the emergency room log for five consecutive weeks (an odd number of observations): 108, 110, 104, 103, and 100. What is the median for the weekly occurrence of this illness?

Solution:

Step 1: Arrange data from smallest to largest: 100, 103, 104, 108, and 110.

Step 2: Count the number of items: 5.

Step 3: Choose the middle value: third item.

Step 4: The median is 104 cases per week.

Summary

Remember, if there are an odd number of items in an array of data, or set of numbers, there will be a middle number. If there is an even number of items, you must find the mean of the two middle numbers to make a middle value. Don't forget, the first thing you must do is arrange the numerical data from the smallest to largest. For populations that are approximately symmetric (same on either side), the median and mean are very close together, so that it makes little difference whether you use the mean or median as the measure of central tendency. If the distribution of the population is highly

skewed (i.e., some of the data are vastly different from the rest), the mean and median may be quite different.

207. Noneffectiveness rate, incidence rate, and attack rate

In Public Health, we use rates to help us describe disease events. Rates not only allow us to monitor disease events, such as influenza outbreaks, but also to predict future disease trends and their possible impact on the Air Force mission.

Rates

Rates are some of the most important statistical tools used by Public Health. They are more than just numbers; rates measure the probability of occurrence of some particular event. They give meaningful statistics, even when the base population varies. Note the example below that describes rates:

$$\text{Rate} = \frac{X}{Y} \times K$$

X = number of times an event has occurred during a specific interval of time.

Y = number of persons exposed to the risk of the event during the interval.

K = some power of 10 (e.g., 10; 100; 1,000; 10,000; 100,000; etc.) depending upon the relative magnitude of X and Y. The selection of a value for K is usually made so that the "Rate" is a whole number (i.e., the "Rate" has at least one digit to the left of the decimal). For example, you would want the rate to be 4.2 per 100, not 0.42 (there is not a digit to the left of 0) per 1,000.

Some of the rates commonly used in monitoring disease are the noneffectiveness rate (NER), incidence rate (IR), and attack rate (AR).

Noneffectiveness rate

Noneffectiveness is the temporary loss of manpower from duty. The NER is a measure of noneffectiveness due to illness or injury. It is a daily rate that indicates the number of people not physically or mentally fit for duty. Specifically, the NER represents the number of active duty individuals sick in the medical treatment facility (MTF), or in quarters, per 1,000 personnel (strength) for the day on which it is calculated; or it may be calculated over a number of days to determine the average daily noneffectiveness rate. The formula follows:

$$\text{NER per 1,000 per day} = \frac{\text{Total days lost in period} \times 1000}{\text{Average strength} \times \text{number of days in period}}$$

Workdays lost

A workday lost is the same as a patient-day in the hospital. The total workdays lost may be obtained from the weekly statistical report, or it may be developed by totaling the number of people sick in the hospital and in quarters each day for the period under consideration. For example, one person in the hospital for one day represents one day lost; two people sick in quarters and two people sick in the hospital for two days is eight days lost, meaning a total of four individuals who lost two days each. Days lost following transfer to another medical facility and days lost on convalescent leave should also be included. (**NOTE:** Only days lost due to active duty military being hospitalized, or placed on quarters, are used to calculate the NER.)

Average strength

Average strength refers to the average active duty military strength during the time under consideration. The average strength figure may be obtained from Patient Affairs, or from the manpower section at the military personnel flight (MPF).

Example 1:

Substitute the following values in the formula and calculate the NER.

Number of active duty military hospitalized or on quarters: 21.

Population: 840 average strength.

Period: 1 day.

$$\text{Noneffectiveness rate per 1000 per day} = \frac{21 \times 1000}{840 \times 1} = \frac{21000}{840} = 25$$

Example 2:

Number of active duty military hospitalized or on quarters:

1st day: 8.
2nd day: 10.
3rd day: 7.
4th day: 5.
5th day: 5.
6th day: 7.
7th day: 10.
Total days lost in 7 days: 52 (the seven days added together).
Population: 1,600 average strength.
Period: 7 days.

$$\text{Noneffectiveness rate per 1000 per day} = \frac{52 \times 1000}{1600 \times 7} = \frac{52000}{11200} = 4.6$$

Incidence rate

The IR is a measure indicating the frequency of new cases of a particular disease, or group of diseases, occurring in a population during a given period.

Probability

Incidences measure the probability, or likelihood, that healthy people will develop a given disease in a given period. More simply, incidence is the number of *new* cases of a disease in a specific population over a period. Incidence is not the same as *prevalence*. Prevalence is the number of disease cases, old and new, occurring at a point of time.

Prevalence rates are frequently used to measure the occurrence of chronic disease. Incidence rates are a direct measure of the risk of disease; you can use incidence to examine the risk factors and the magnitude of the disease in a population.

The formula is calculated as follows:

$$\text{Incidence of disease X} = \frac{\text{Number of new cases occurring in a given period} \times \text{K}}{\text{Population at risk in a given period}}$$

The denominator

One important point about calculating incidence rates is determining the denominator for the formula (the population at risk in a given period). In our communicable disease programs, we usually use the active duty population as the population at risk. If you are concerned about a disease outbreak at the child development center; however, your population at risk could include only those children who attend the center, not the active duty population.

The accurate estimate

The population at risk must be defined as accurately as possible to ensure you get a true estimate of disease risk. For example, in an outbreak of hepatitis A virus (HAV), Base A has 50 cases and Base B has 50 cases. Both bases seem to be equally affected until you look at the population at risk. Base A has 50 cases in a population of 1,500 people, while Base B has 50 cases in a population of 7,000 people. What are the incidence rates for Bases A and B? Which has the more serious outbreak?

$$\text{IR HAV Base A per 1000 persons} = \frac{50 \times 1000}{1500} = 33.3$$

$$\text{IR HAV Base B per 1000 persons} = \frac{50 \times 1000}{7000} = 7.14$$

Base A has the higher incidence of HAV infection; therefore, you could say personnel assigned to Base A have a higher risk of HAV infection. Note that in the example above, we used K=1,000 so that the rate would be a whole number.

NOTE: You may use any power of 10 for the K value, but you must make clear which value is being used.

Example:

Calculate the incidence rate of influenza from 1 January to 31 March per 1,000 active duty personnel:

Number of cases: Jan = 20, Feb = 35, Mar = 15.

Active duty population: 7,500.

$$\text{Incidence rate for influenza per 1000 Jan through Mar} = \frac{(20 + 35 + 15) \times 1000}{7500} = 9.33$$

Attack rate

An AR is a special type of incidence rate used in outbreaks. Attack rates are applied to narrowly defined populations observed for limited periods, such as foodborne illness outbreaks or epidemics. This rate is usually expressed as a percentage; therefore, the value of K would be equal to 100.

AR use

We use attack rates in the investigation of foodborne illness outbreaks to determine the food (or foods) most likely responsible for the outbreak.

AR determination

Attack rates may be determined for the entire population at risk, or you may calculate attack rates by gender or age.

The formula for AR is as follows:

$$\text{Attack rate of disease X} = \frac{\text{number of cases} \times 100}{\text{population at risk}}$$

Example 1:

In an outbreak of salmonellosis, there were 37 ill persons in a group of 96 attending a picnic. What is the attack rate per 100 persons?

Number of cases: 37.

Population at risk: 96.

$$\text{Attack rate per 100 persons} = \frac{37 \times 100}{96} = 38.5$$

Example 2:

In the same outbreak, there were 16 ill males out of a total of 43 males present. What is the attack rate for males per 100 persons?

Number of cases: 16.

Population at risk: 43.

$$\text{Attack rate per100 persons} = \frac{16 \times 100}{43} = 37.2$$

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

206. Statistical measurements of central tendency

1. What does the term "statistics" mean?

2. For the aerospace medicine report, you are asked to report the number of mosquitoes trapped and identified as medically important. Your counts of mosquitoes trapped each day for 13 days are 0, 0, 3, 6, 0, 9, 3, 6, 9, 11, 2, 0, and 60. What is the mean, mode, and median number of mosquitoes trapped over these 13 days?

3. Calculate the mean, mode, and median using the data in question #2 above, except on day 13 use 600 for the daily count instead of 60.

4. Briefly describe the process for calculating the median of an array of numbers.

207. Noneffectiveness rate, incidence rate, and attack rate

1. With an average strength of 1,200, you lost 45 workdays during a 7-day period. What was your NER?

2. With an average strength of 2,400, you lost 38 workdays during a 30-day period. What was your NER?

3. With an average annual (365 days) population of 5,200, you had 36 cases that lost workdays. What was your NER?

4. With an average annual (365 days) population of 4,200 (average strength), you had 48 cases that lost workdays. What was your NER?

5. With an average active duty population of 4,200 (average strength), you had 14 new cases of gonorrhea occurring within one month (30 days). What was your monthly IR?

6. Ninety-six persons attended the base picnic—87 males and 9 females. There were 26 cases of staphylococcal food poisoning—19 males and 7 females. What was the AR?

1–4. Epidemiological Investigations

In public health programs, we use epidemiology for many purposes. One is to determine the significance and impact of disease on the military mission in an effort to focus on investigative efforts and preventive measures. We also use epidemiologic studies to learn more about how a given disease progresses in patients and the effect of disease on the patients and the community. Probably the most common use of epidemiologic studies; however, is to determine the disease risk factors or causative agents.

There are two types of epidemiologic studies or investigations: experimental and observational. It is important that you have a working knowledge of these two types of studies and know their advantages and limitations in order to select the best method for the circumstances and disease.

208. Study methods

In order to determine the reason for disease presence, whether endemic or epidemic, you can use various study methods. These methods can be broadly classified as either experimental or observational. The experimental method is more accurate than the observational method, but the latter method is the one most often used.

Experimental method

Ethics do not permit indiscriminate disease experimentation on human populations, so the experimental method is usually performed on small groups of individuals or animals. An example of the experimental method would be gathering two groups of equally susceptible people, matched by age, gender, and other factors; then administering a vaccine, special diet, or some other factor to one group while withholding the factor from the other group. By observing the results, a determination is made of the effect, or lack of effect, of the added factor. An experiment is not valid without a control group from which the factor is withheld.

Suppose you take 50 basic military trainees and divide them into two groups of 25 each. The first group is the control group. This group is allowed to eat only three meals a day in the dining facility. The second group, the experimental group, is allowed to consume liquids only, such as fruit juices, milk, and water. The experiment lasts for the entire time they are in basic training.

All 50 students will be weighed daily. Do you think the average weight of the experimental group goes up or down in comparison with the control group? This is an example of using the experimental method.

Observational method

By contrast, the observational method involves studying different groups under natural conditions. With this method, nature selects the groups—individuals who are exposed and individuals who are not exposed to a particular factor. You only observe, record, and state the result. The observational method, unlike the experimental method, can be carried out more easily on large numbers of individuals or communities. The two types of observation methods are controlled and uncontrolled.

Controlled observation

The controlled observation uses two similar populations or communities, except for the factor under observation. A case-control is one example of this type of observation. Using case controlled observation; a control group (a group of individuals not having the disease) is chosen to match the group that is under observation in such characteristics as age, gender, and ethnic group. The "control" group is used as a standard. The actions or results of the group that is under observation are compared to those of the control group.

Here is an example of a case-control study: select 10 people for observation who have been diagnosed with lung cancer. Then select 10 people who do not have lung cancer, and match the age, gender, ethnic group, occupation, and so forth, with the group to be observed. The lung cancer patients are your case group and the healthy people are your control group. Next, you look for differences between the groups such as diet, number of cigarettes smoked per day, and previous illnesses.

Uncontrolled observation

Uncontrolled observation includes studies during which there are no explicit controls (i.e., same gender, ethnic group, age), but a judgment is made as to whether or not the cases are different from the rest of the population. This is the method usually used for such things as tracing the source of a food poisoning outbreak or serious epidemics, or examining STI incidence and prevalence. Here is an example of an uncontrolled observation study: suppose 300 people eat at a church picnic and 75 of those people developed a foodborne illness. The 225 are not matched for age, gender, ethnic group, or similar characteristics; however, you would compare the foods 75 people ate with the foods the other 225 ate.

Variations in study design

In addition to different study methods, there are also different designs for epidemiologic studies. These different study designs are often called prospective, retrospective, and cross-sectional.

Prospective (looking forward)

This is a plan of study in which a group under observation is divided into two groups; one having a factor believed to contribute to a disease and the other without the factor. The groups are then observed over time to identify which individuals develop the condition or disease under study. This type of study is usually spread over an extended period of months or years; with the chance that none of the chosen individuals will develop the condition under study. This type of study is appropriate for determining the attack rate per unit of time and per number of people for a given disease.

Retrospective (looking back)

This is, for all practical purposes, the same as the case-control method previously described. In this design, you study persons who already have the disease; you also study people who are free of the disease. Then you compare them and try to identify a factor, or factors, that are more common to people who became cases than to people who became controls. Advantages of this design are ability to study rare diseases, to draw immediate conclusions, and less chance of the subjects' leaving the jurisdiction of the observer.

Cross-sectional survey

This is simply observing, questioning, and studying a population at one point in time in order to detect cases of a disease. The use of laboratory screening procedures or complete diagnostic evaluation may be helpful. Simple items of information, such as age, gender, ethnic group, and occupation, are gathered on all persons, including those who do not have the disease. This way, the prevalence of disease can be determined, and any correlation between factors such as age, gender, ethnic group, and disease frequency may be identified.

209. Conducting epidemiological investigations

An *outbreak* occurs when the frequency of a disease in a given population during a given time interval is clearly in excess of what is expected or is normal. This may include infectious and noninfectious conditions, such as an occupational illness. In public health, we monitor and report the occurrence of certain diseases and use rates such as incidence or attack rates to estimate the risk of diseases. We use routine surveillance to identify the normal occurrence, or frequency, of disease in our base population. By knowing what is normal, we can identify and investigate unusual occurrences or disease outbreaks.

The term outbreak is broad and there is no general rule about the number of cases that must occur before an event is considered an outbreak. The purposes of an outbreak investigation is to control the outbreak if it is still occurring; to identify the source, mode of transmission, and population at risk (chain of infection); and to identify measures to prevent future occurrences.

There is a logical sequence to outbreak investigation involving a series of steps. However, the steps are not an exact sequence in which you conduct an investigation; in practice, several steps may be done simultaneously. In this lesson, you will examine these steps and learn how to follow them during outbreak investigations.

Step 1—Prepare for field work

As with any type of procedure you complete on or off the job, preparation is the first step and should be considered carefully. With regard to the outbreak investigation itself, you'll need to have the scientific knowledge to conduct it, or find a way to get it. Use all the resources available to you, including your supervisory chain and the reference library maintained in the office. You should know where your laboratory consultation support is coming from and be sure that you have the necessary supplies to conduct the investigation. From an administrative standpoint, you will need to review applicable operating instructions and local directives. Finally, know your role in the investigation, especially if you're working off-base.

Step 2—Establish existence of an outbreak

To decide whether an outbreak exists, compare the current incidence and the usual, or expected, incidence. Local disease surveillance (base, community, or state) gives you an idea of disease occurrence for your population, during a given time or season. If the current incidence is significantly greater than usual, then an epidemic or outbreak exists. For example, if the incidence of chickenpox in your base population has been highest in January and February among children attending the base child development center, you would be alarmed to see a significant increase in the summer months.

Early detection

What constitutes a significant increase is sometimes a problem to determine. Large, common-course outbreaks are usually no problem to recognize; however, early detection of propagated source, or vectorborne disease outbreaks, is more difficult. In some instances, the Air Force defines a disease outbreak. For example, a single case of botulism constitutes an "outbreak" and should be investigated.

Outbreak

Once you think you have an outbreak, be on the lookout for other cases—cases not reported or newly developing cases. The emergency room logbook or reports, laboratory logs, clinic reports, and family or friends of known cases are very good sources for *case finding.* Finding these additional cases can help confirm the existence of an outbreak.

Step 3—Take steps to establish or verify the diagnosis

Always consider whether initial reports or diagnoses are correct. The initial diagnosis may be wrong; for example, leptospirosis reported as hepatitis A. As you have seen, different diseases have different reservoirs, modes of transmission, and so forth. Knowing what disease you are looking at is important so you know where to concentrate your investigative efforts. In your investigation, you will be

comparing cases and noncases. Background illness exists, but you do not want this to confuse your findings. Being able to confirm the diagnosis in each of your cases helps separate cases from noncases.

The diagnosis may be confirmed, or verified, by laboratory tests if they are available. However, it usually takes time to verify or confirm the diagnosis. For example, culture results often take days to come back from the lab. If you cannot confirm the diagnosis right away, you still need to separate cases from noncases.

Step 4—Define and identify cases

A case definition can be used until the diagnosis can be confirmed, that is, if it can be confirmed. A case definition is a set of specific criteria. If a person meets the criteria, the person is a case. If not, the person is a noncase. AIDS is a good example of using a case definition. In the early 1980s, the causative agent for AIDS had not been identified, so patients were counted as cases if they had specific symptoms and no other disease affecting the immune system. After the HIV was identified in 1985, the diagnosis of AIDS by symptoms could be verified by an antibody test for HIV.

Step 5—Perform descriptive epidemiology

Use time, place, and people to characterize data and identify patterns. This helps develop a hypothesis, or explanation, as to why the outbreak occurred.

Time

You need to describe the exact period of the outbreak in hours, days, or weeks, depending upon the agent. Then you construct a graph of cases plotted according to the time of the onset. This graph is called an “epidemic curve.”The two purposes for constructing the epidemic curve are: (1) to determine if the source is most likely common, propagated (person to person), or both, and (2) to identify the probable time of exposure to the source of infection.

Place

To characterize the outbreak by place, make a spot map of the base. You can create a spot map by putting a pin, dot, or other mark at the defined place where a case occurs. You may define *place* as the residence, work area, hospital floor, ward or service, school, or other. After the spot map is created, look for clustering. When clusters occur, determine an association with possible sources of infection, such as water, milk or food supplies, or agricultural or industrial exposures. Don’t forget to consider the population at risk in a particular place. There may be differences in the size of the populations. Calculate incidence rates to eliminate the effects of population differences.

People

People are described in terms of characteristics such as age, ethnic group, immune status, or marital status. You may also characterize people in terms of lifestyle and behavior (e.g., work, recreation, and religious customs). Such characteristics and activities are important since they determine who is at greatest risk of getting specific infections or diseases. You can describe an outbreak in terms of a person by using characteristic-specific rates such as age-specific or gender-specific attack rates. Once you have determined attack rates according to characteristics, look for significant differences among persons with and without one or more specific characteristics.

Step 6—Develop a hypothesis

This step involves developing a hypothesis, or explanation, for the outbreak. A hypothesis is really a *best guess*. Typically it includes the suspected causative agent, source of infection, period of exposure to the source, means of transmission, and the population at risk of infection (now or in the future). Consider the usual reservoirs and the known risk factors of your population to figure out the exposures that may have caused the disease.

Look at person, place, and time for clues. This requires familiarity with the disease. Once you generate a hypothesis, you usually must gather additional information in order to confirm or reject it. Your hypothesis should be testable. If you are having trouble developing a hypothesis, again review the information you gathered from the people who were ill and who were not ill. It may also be helpful to talk with these people again, particularly the outliers. Remember that the outliers may have information that will provide clues as to the cause of the outbreak.

Step 7—Evaluate hypothesis

There are two ways to evaluate your hypothesis: (1) using descriptive epidemiology, which uses person, place, and time, or (2) using analytic epidemiology, which uses statistics and a comparison group. In either case, compare your hypothesis with established facts to test your own hypothesis.

Step 8—Reconsider and refine your hypothesis

As necessary, reconsider/refine hypotheses and execute additional epidemiological studies. This often means getting assistance from laboratories outside of your installation, and it may mean considering additional environmental concerns as well.

Step 9—Implement prevention and control measures

Think about the components of your hypothesis—the agent, source, means of transmission, and susceptible population. These components are the same as those in the chain of infection discussed earlier. By determining the chain of infection in the outbreak, you can implement measures against specific links to either control the present outbreak or prevent future ones.

When the source and means of transmission have been confirmed, you can identify persons who are at increased risk of exposure. Exactly who is at increased risk depends on the agent, the nature of the source, how the agent is transmitted, and the characteristics of the susceptible individuals that increase the likelihood of exposure. For example, children under age five are the most susceptible persons for *Haemophilus influenza* B (HIB) meningitis. In an outbreak of HIB meningitis at the day care center, the population at increased risk of infection (high-risk group) is children under five. You would not include adult caregivers in the high-risk group. The identification of populations at increased risk of infection or disease is important when implementing prevention or control measures, the ninth step.

Step 10—Communicate your findings

This important step is frequently overlooked. Remember, part of the purpose of an investigation is to prevent future outbreaks. Be sure to include in you report recommendations for prevention of similar episodes in the future. A report helps you share with others what you have learned and, thus, enhances prevention. A report improves the likelihood experiences gained and discoveries made are put to the best possible use. The Air Force requires reports in certain cases, such as foodborne illness outbreak investigations, and you will see more about this in the next unit.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

208. Study methods

1. Administering a vaccine or special duty to one group and withholding it from another group to determine its effect is an example of which kind of study method?

2. Which study method are you using when nature provides the data for your investigation and you only observe, record, and state the result?

3. Generally, which study method is used to trace the source of food poisoning outbreaks?

4. Which type of study design is used to look back in time to compare individuals with a disease to individuals without the disease to identify factors more common to the cases?

5. Which study method gets information about disease and other factors in a population at one point in time?

209. Conducting epidemiological investigations

1. What are five purposes of an outbreak investigation?

2. What are steps two and three of an outbreak investigation?

3. What is an epidemic curve? Why is an epidemic curve constructed?

4. What is included in the epidemiological hypothesis when considering prevention and control measures?

Answers to Self-Test Questions

201

1. As a living person or animal that is harboring a disease agent.
2. As a person or animal that harbors a disease agent but has no clinical signs of the disease.
3. Organisms that live on or in the body of a host and can produce disease or illness.
4. The ability of the agent to invade and multiply, or to produce infection in the host.
5. The ability of an agent to produce clinical disease in a host.
6. Agent unable to penetrate a host's body or unable to stay in host's body (nowhere to lodge); an agent may enter a host's body but not cause signs and symptoms (no effect); and an agent may invade a host's body, multiply, and cause signs and symptoms of disease (great effect).
7. Ingestion, inhalation, and penetration.

202

1. Source or reservoir, mode of transmission, and a susceptible person or host.
2. Person, animal, inanimate object, or substance.
3. Direct contact and contact with droplets.
4. Vehicleborne, vectorborne, and airborne transmission.

5. Breaking the chain of infection at the source includes diagnosis, treatment, isolation, source destruction, and education. Breaking the chain at the means of transmission includes preventing contact with the source (direct contact transmission) or vehicle, environmental sanitation, water treatment, food hygiene, waste treatment, vector control, and education. Breaking the chain of infection at the susceptible person includes personal hygiene, immunization, prophylaxis, and education.

203

1. By providing a protective covering against living organisms and many chemicals.
2. Hair, sweat glands, and fat pads.
3. It is well lubricated so the organs will slide out of line with direct pressure and sharp objects.
4. When coughing or sneezing is initiated, and with the cilia's constant beating to remove harmful substances.
5. By initiating vomiting and diarrhea to move unwanted objects out of the system.
6. White blood cells attack and destroy pathogens at a site, causing inflammation, and are moved to the lymphatic system.
7. The very young have poorly developed immune systems, while the very old have defense systems that are starting to weaken.
8. Anatomical differences, hormonal factors, and exposure potential.
9. There is less energy that can be used to produce antibodies and white blood cells.
10. It does not allow the body's defense system to work at its fullest.
11. Diet, disposal of human wastes, personal hygiene, personal contact, household hygiene, occupation/recreation, and other behaviors.

204

1. Climate and geography.
2. Mountains and rivers.
3. Economic development, culture or customs, education level, public health services availability, and whether rural or urban.

205

1. Those conditions where the incidence in humans has increased within the past two decades or threatens to increase in the future.
2. Name any three:

   (1) HIV.

   (2) Lyme disease.

   (3) Human ehrilichiosis.

   (4) New influenza strains.
3. Training and operational deployments.
4. Urban decay, refugee migration, displaced persons, or poverty.

206

1. Numeric facts or data assembled, classified, and tabulated to present significant information about a given subject.
2. Mean=8.3846, Mode=0 (occurs four times, others once), and Median=3.
3. Mean=49.923, Mode=0, and Median=3.
4. Arrange the data from smallest to largest. Determine if you have an odd or even number of samples. If you have an odd number of samples, the median is the middle number; if you have an even number of samples, the median is the mean of the middle two numbers.

207

1. $\frac{45 \times 1000}{1200 \times 7} = \frac{45000}{8400} = 5.357$

2. $\frac{38 \times 1000}{2400 \times 30} = \frac{38000}{72000} = 0.52777$

3. $\frac{36 \times 1000}{5200 \times 365} = \frac{36000}{1898000} = 0.018967$

4. $\frac{48 \times 1000}{4200 \times 365} = \frac{48000}{1533000} = 0.031$

5. $\frac{14 \times 1000}{4200} = \frac{14000}{4200} = 3.33$

6. $\frac{26 \times 100}{96} = \frac{2600}{96} = 27.08$

208

1. Experimental.
2. Observational.
3. Uncontrolled observation.
4. Retrospective.
5. Cross-sectional survey.

209

1. Control the outbreak if it is still occurring; identify the source, mode of transmission, and population at risk; and identify measures to prevent future occurrences.
2. Step 2: Establish the existence of an outbreak by comparing the current incidence and normal incidence. Step 3: Establish or verify the diagnosis by knowing what disease you are looking at and not confusing background issues.
3. A graph of cases plotted according to time of onset of illness. The curve is used to determine if the source is common, propagated (person-to-person), or both, and to identify the probable time of exposure.
4. Suspected causative agent, source of infection, means of transmission, and the population at risk.

Do the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to Air Force Career Development Academy (AFCDA).

1. (201) A *primary*, or definitive, host is one in which a disease organism
   a. attains its maturity and goes through its sexual or reproductive stage.
   b. becomes most easily identified by laboratory tests.
   c. has not yet invaded an intermediate host.
   d. enters the larval stage.

2. (201) The person or animal that harbors a disease agent, but has no *clinical* signs of the disease is known as a/an
   a. host.
   b. agent.
   c. carrier.
   d. organism.

3. (201) In a host-agent relationship, the ability of an agent to produce *clinical* disease in a host is its
   a. virulence.
   b. infectivity.
   c. penetrability.
   d. pathogenicity.

4. (201) In a host-agent relationship, all of the following are types of agents *except*
   a. fungi.
   b. metazoa.
   c. virulence.
   d. rickettsia.

5. (202) Diseases such as rabies are spread using this type of *direct* transmission mode.
   a. Direct contact.
   b. Airborne contact.
   c. Vectorborne contact.
   d. Vehicleborne contact.

6. (203) This is *not* a general health status factor for determining disease occurrence.
   a. Preexisting disease.
   b. Physiological state.
   c. Behavioral factors.
   d. Nutritional status.

7. (203) In countries where pork is eaten, individuals may be at risk of trichinosis infection when the pork is undercooked. Which *intrinsic* disease occurrence factor is this an example of?
   a. Diet.
   b. Personal hygiene.
   c. Physiological state.
   d. Preexisting disease.

8. (203) Using what is called night soil as a fertilizer allows the transmission of such diseases as typhoid, dysentery, amebiasis, and hepatitis. Preventing the transmission of these diseases involves
   a. proper human waste disposal.
   b. good household hygiene.
   c. good personal hygiene.
   d. occupational hazards.

9. (204) This *environmental* factor has the greatest effect on hay fever sufferers.
   a. Social.
   b. Climate.
   c. Geography.
   d. Physiological.

10. (204) Which *environmental* factor is a medicinal source, such as Quinine that comes from tree bark and is used to treat malaria?
   a. Social.
   b. Climate.
   c. Biological.
   d. Geography.

11. (205) Which factor contributes to the emergence of new infectious disease or the reemergence of old diseases?
   a. Financial stability.
   b. Societal disruptions.
   c. Geographic stabilization.
   d. US Air Forces durability.

12. (206) Which term is used to define numeric facts or data that have been assembled, classified, and tabulated to present *significant* information about a given subject?
   a. Statistics.
   b. Median.
   c. Mode.
   d. Mean.

13. (206) Which statistical term is most commonly used as a measurement of central tendency?
   a. Rate.
   b. Mean.
   c. Mode.
   d. Median.

14. (206) Using statistics, the *mode* for numbers 6, 18, 26, 14, 12, 19, 20, and 26 is
   a. 17.625.
   b. 18.5.
   c. 19.25.
   d. 26.

15. (206) Using statistics, the *median* of the numbers 3, 3, 5, 7, 8, 9, and 12 is
   a. 3.
   b. 6.71.
   c. 7.
   d. 8.21.

16. (207) Public health uses rates as one of its most important statistical tools. What does the noneffectiveness rate tell you about individuals' illnesses or injuries?
    a. Permanent loss from duty.
    b. Temporary loss from duty.
    c. Where the loss occurred.
    d. How the loss occurred.

17. (207) This statistical rate is used to determine the probability of new disease cases affecting *healthy* people during a given time.
    a. Incidence.
    b. Prevalence.
    c. Average strength.
    d. Noneffectiveness.

18. (207) If 30 out of 90 people who ate at a base picnic became ill, the attack rate per 100 persons is
    a. 3.33.
    b. 33.30.
    c. 333.00.
    d. 333.30.

19. (208) A method that is used to study two similar groups by administering a vaccine, special diet, or some other factor to one group while withholding it from the other group is called
    a. prospective.
    b. experimental.
    c. retrospective.
    d. observational.

20. (208) This method is used to study different groups under *natural* conditions.
    a. Prospective.
    b. Experimental.
    c. Retrospective.
    d. Observational.

21. (208) Which disease study method traces the source of a food poisoning outbreak or examines sexually transmitted infection (STI) incidence and prevalence?
    a. Controlled method.
    b. Experimental method.
    c. Prospective observation.
    d. Uncontrolled observation.

22. (209) In this step of an outbreak investigation, it is important for you to know what disease to look for and you *must* separate cases from noncases.
    a. Define and identify cases.
    b. Communicate your findings.
    c. Establish or verify the diagnosis.
    d. Perform descriptive epidemiology.

Please read the unit menu for unit 2 and continue. ➔

Student Notes

Unit 2. Communicable Disease

IT IS VITAL to the success and functional fulfillment of our mission that we survey, anticipate, act against, and prevent the various vectors, animals, and accompanying complications of the many diseases that threaten any active duty military population. For us, this requires knowledge of a variety of airborne/respiratory diseases, sexually transmitted diseases, hepatitis, and enteric diseases. Also, we must have knowledge of communicable disease reporting, infection control, foodborne illnesses, and the rabies control program. All of these areas are discussed in this unit.

2–1. Respiratory Diseases

Respiratory, or airborne, diseases are the most important of the communicable diseases occurring among the active duty population because of their effect on Air Force operations and activities. Respiratory diseases are readily transmitted by casual contact, and they are difficult to control or prevent. Although vaccines have been developed for common respiratory diseases, such as mumps and rubella, others still pose a threat to the health and effectiveness of our highly mobile force. While there are many respiratory or airborne diseases, you will learn about only a few of the more common diseases in this section.

210. Influenza

Influenza is an acute, febrile respiratory infection that may exhibit systemic manifestations. The agents are viruses of three distinct subtypes: A, B, and C. Each influenza virus has two identifying surface antigens (protein substances on the virus): hemagglutinins (H) and neuraminidase (N). Influenza viruses change rapidly because of changes in the H and N antigens. “Antigenic drift” refers to minor changes; and “antigenic shift” refers to major changes. The “antigenic shifts” often result in epidemics.

Incubation period

The average influenza incubation period is one to three days. Symptoms include a sudden onset of chills, fever, headache, generalized aching, and malaise. Fever may last from one to seven days, with three days being the average. Most patients recover in a few days. However, the elderly and people with chronic diseases are prone to complications such as pneumonia.

Air Force concern

Why is the Air Force so concerned about influenza if most people fully recover? The answer is because large outbreaks threaten operational readiness and severely compromise the Air Force's ability to accomplish the mission. Therefore, the Air Force instituted Project Gargle. Because of the success of Project Gargle, the program, now called the Influenza Surveillance Program, and the Air Force is the lead agent. The Global Emerging Infections System administers the program.

Influenza Surveillance Program

The purpose of this program is to identify new strains of influenza virus. The program identifies emerging influenza strains, provides timely input to vaccine composition, and limits the impact of influenza on the Air Force mission.

The Air Force Institute for Operational Health, Safety and Occupational Health Risk Analysis, Risk Analysis Directorate, Risk Assessment Division, Epidemiology Services Branch (USAFSAM/PHR) directs the Influenza Surveillance Program. The influenza team monitors influenza cases that have been isolated by the Epidemiological Surveillance Division (USAFSAM/PHR) from sentinel sites around the world. This information is provided on a worldwide basis; information is also provided to the Surgeon General, Department of Defense, national, and international health authorities.

Public health concern

As a public health journeyman, you actively support the Influenza Surveillance Program. If you're stationed at a sentinel base, you will monitor the collection of throat swabs (using virus-specific swabs) on patients who have upper respiratory infections and meet the Influenza case definition. If you are stationed at a nonsentinel base, you may submit specimens if it is deemed important. Specimens are sent to the Virology Section at USAFSAM/PHR. PHR provides collection materials on request.

211. Pulmonary tuberculosis

Tuberculosis is a communicable disease affecting the lungs and in some cases, other parts of the body. It's not a new disease. Hippocrates recorded the first clinical description around 400 BC. However, it was not until 1882 that Edward Koch identified the tubercle bacillus that causes the infection in humans.

Causative agent

Mycobacterium tuberculosis (M. TB*)* is the organism that causes pulmonary tuberculosis in humans. In addition to being found in the lungs, the bacillus can be found in other organs of the body, including the kidneys, spine, and lymph nodes. Tuberculosis in the lungs; however, poses the greatest threat for human-to-human disease transmission.

Transmission mode

Tuberculosis is a respiratory disease transmitted by the inhalation of droplet nuclei containing live *M. TB.* Not all droplets are harmful; the droplets need to be small enough (one to five microns) to reach the alveoli of the lungs. The probability that TB will be transmitted depends on these three factors:

1. The infectiousness of the person with TB.
2. The environment in which exposure occurred.
3. The duration of exposure.

Nasal hairs and bronchial cilia act as protective devices in the respiratory tract and filter out larger particles. Evidence supports the theory that dried residues of droplet nuclei remain suspended in air for a prolonged period. Once droplet nuclei settle to the ground, they can no longer cause infection. A single exposure to tuberculosis is not likely to result in infection. It takes repeated, prolonged

exposures to develop infection, as those occurring in close quarters such as homes, dormitories, nursing homes, classrooms, or offices. Outdoor exposures rarely lead to infection.

Incubation period

The incubation period from infection to an obvious lesion or tuberculin reaction is about four to 12 weeks.

Pathogenesis

Tuberculosis is a disease of highly variable character, which consists of three stages: infection, dormant, and active. Initial infection usually goes unnoticed. If a susceptible person inhales tubercle droplets and the droplets reach the alveoli of the lungs, tuberculin sensitivity usually appears within a few weeks.

Infection stage

The disease spreads when a susceptible person inhales the droplets containing the tubercle bacilli, and they reach the alveoli of the lungs. This is the beginning of the infection stage. The bacilli multiply slowly, with some remaining in the lungs, while others travel to the lymph nodes and the blood stream. Usually the white blood cells attack and destroy the bacilli in the blood stream. Active disease; therefore, is usually confined to the lungs since bacilli in the lungs are not destroyed. Lesions caused by this primary infection usually heal and calcify, and the infection proceeds to the dormant stage.

Dormant stage

Ninety percent of infected individuals never progress beyond the dormant stage. During this stage, bacilli encapsulate and remain in the alveoli of the lung until conditions favor further growth and progression to the active stage: usually later in life or during a period of altered immunity. Conditions that favor growth include diabetes, alcoholism, silicosis, immunosuppression due to cancer therapy, and AIDS.

Active stage

The active stage follows either the infection or the dormant stage. If lesions do not heal properly during the infection stage, bacilli “spill out” and become engulfed by macrophages. During this process, macrophages and other tissues form a soft, caseous (cottage cheese-like) mass. This mass slowly disintegrates and discharges bacilli in droplet form. The infected person then transmits the disease while coughing.

Signs and symptoms

Most patients have no symptoms during the infection stage, and do not seek medical attention. Patients may experience a slight fever or a feeling of discomfort shortly after infection, but these symptoms disappear as the infection enters the dormant stage. The onset of *active* tuberculosis is insidious, with vague symptoms, such as fatigue, weight loss, fever, chills, night sweats, loss of appetite, and a persistent cough, that go unnoticed. Most patients do not seek medical attention until they develop a persistent, productive cough, cough up blood, or experience chest pains.

Diagnostic techniques

Tuberculosis is a difficult disease to diagnose. Early symptoms are vague and mimic other diseases. Patients often blame their symptoms on stress or overwork, and do not seek medical treatment until symptoms become severe. When considering a pulmonary tuberculosis diagnosis, a provider needs to gather a complete medical history, perform a physical examination, administer a tuberculin skin test (TST), get a chest X-ray, and conduct a bacteriological exam (smear/culture).

Skin tests

TSTs are used (1) to identify infected persons at high risk of developing TB disease who would benefit from preventive therapy, and (2) to identify persons with TB disease who need treatment. Refer to Air Force Instruction (AFI) 48–105, *Surveillance, Prevention, and Control of Disease and Conditions of Public Health or Military Significance*, to determine when to test and who to test.

The Air Force uses the Mantoux test to confirm tuberculosis infection. It is the most effective and accurate test procedure available, and it is the standard. It uses a solution of purified protein derivative (PPD) tuberculin stabilized with a biologic assay solution to five tuberculin units (TU). The solution is injected intracutaneously (just beneath the surface of the skin). Positive reactions (delayed tuberculin hypersensitivity) occur within 48 to 72 hours after injection. Although redness may occur, the area of induration is the basis for measurement.

Bacille Calmette-Guerin vaccinations

Two French scientists prepared the vaccine from a strain of *Mycobacterium bovis*. Albert Calmette and Camille Guerin weakened the virulence of the original organisms over a period of many years. In 1921, the first live vaccine against tuberculosis, bacille Calmette-Guerin (BCG), was tested in humans. Today's vaccines are made from the same strains.

The purpose of the BCG vaccination is to prevent the recipient from experiencing a natural, primary infection by artificially inducing a harmless primary infection. BCG was designed to enhance a person's resistance to a subsequent, more virulent infection. Its ability to protect vaccine recipients varies with effectiveness rates ranging from zero to 70 percent. Experts agree that the vaccine is most valuable in areas with high incidence of tuberculosis, such as developing countries. In these areas, BCG may not prevent infection, but it may prevent severe cases and reduce complications. The vaccine's relative ineffectiveness is the reason it is not used in the United States.

Most BCG vaccines have a positive TST after the vaccination. However, after 10 years or more, most recipients revert to negative. Therefore, it is impossible to predict the TST outcome for BCG vaccines. Providers treat these patients the same as any other positive or negative reactor.

Reactors and converters

Under current CDC guidelines, a positive reactor is a person who reacts positively to skin testing. Each measurement varies depending on the individual risk factors of the person being tested. The area of induration is the area of palpable swelling around the injection site. All reactions should be recorded in millimeters of induration, even those with a negative reaction. The size of the reaction and the patient's individual risk factors are the basis for determining the need for preventive therapy. The size of the reaction refers to the induration (or raised area), not redness.

A converter is a person whose PPD within a 2-year period shows a 10-millimeter (or greater) increase in induration for those under age 35; or a 15-millimeter (or greater) increase in induration for those over age 35. The conversion period is significant because it helps define the exposure period for the converter to a potential case.

Skin test reactions are considered positive indefinitely, unless the positive reaction is the result of a BCG vaccination. The TST indicates exposure to tuberculosis; however, it does not confirm active tuberculosis. The patient requires a full medical history, chest X-rays, laboratory tests, and an evaluation by a provider. The provider makes a determination after evaluating the patient's laboratory tests and physical findings.

Chest X-rays

Since the absence of a lesion is necessary to rule out active disease, chest x-rays are performed on all reactors and converters to rule out pulmonary TB. As mentioned earlier, the lungs are the most common site for TB disease—approximately 85 percent of TB cases are pulmonary. Since it is

difficult to identify a lesion on X-ray, a chest X-ray by itself does not confirm a diagnosis of tuberculosis. If active disease is strongly suspected, a culture should be performed.

Sputum cultures

The growth of *M. TB* by laboratory culture is essential for a provider to confirm a diagnosis of an active case of tuberculosis. Cultures are obtained by asking the patient to cough up sputum or fluid from the lungs over a 3-day period. If a patient is unable to cough up sputum, it is possible to recover bacilli from stomach secretions. If the patient is symptomatic, has a positive TST, shows a chest lesion on X-ray, and is culture positive, a positive diagnosis of active tuberculosis can be made.

Treatment

Asymptomatic patients with positive TSTs are at higher risk for developing active TB. Therefore, these people receive preventive therapy with isoniazid (INH). Patients take this medication daily for nine months. The purpose of the medication is to render the bacteria harmless. The patient's provider makes the decision to treat the patient with INH. Public Health usually has a healthcare provider in the MTF that is appointed by the MTF commander as the consultant for tuberculosis patients.

If the patient's provider has questions regarding the treatment, the program consultant should be contacted. Patients taking INH require close monitoring because of the side effects associated with the medication, the most serious of which is drug-induced hepatitis.

Signs and symptoms of INH toxicity

Public Health instructs all patients on the signs and symptoms associated with liver damage and INH toxicity. Signs and symptoms of hepatitis or INH toxicity include unexplained loss of appetite, nausea, vomiting, fatigue, unexplained weakness or fever for more than three days, dark urine, jaundice, rash, or numbness and tingling in the hands and feet. Public Health instructs patients to stop taking the INH and call their healthcare provider immediately if they experience such symptoms. The healthcare provider conducts a complete battery of liver function tests (LFT) and removes the patient from INH therapy if any LFT exceeds three times the upper limit of normal for that test.

Not all patients are able to take INH. Contraindications to treatment with INH include a history of liver damage associated with previous INH treatment, drug reactions such as fever, rash, and arthritis. Treatment of pregnant women is sometimes delayed until after delivery.

Special attention required

Some patients require special attention to ensure they do not develop INH-induced hepatitis. These patients include those on long-term medications, epileptic patients on medication, daily alcohol users, patients who suffer from chronic liver disease, and anyone who has been taken off INH without related side effects. Patients suffering from peripheral neuropathy or a contributing condition, such as diabetes or alcoholism, which predisposes them to peripheral neuropathy, also bear close monitoring. These patients require LFTs more often than once a month. Patients with active tuberculosis receive a combination of drugs under the direction of a provider.

Administrative requirements

In accordance with requirements of the Tuberculosis Detection and Control Program, Public Health has two primary responsibilities: (1) monitor the administration of the program and (2) educate personnel about the disease. Patients with positive skin test reactions require education about tuberculosis, the meaning of test results, and medical follow-up. Public Health monitors patients to ensure they receive prescribed medication (INH) and follow-up LFTs as necessary, if placed on INH. You do not want patients to "fall through the cracks" by receiving less than quality care and education.

Follow-up

After Public Health personnel educate the patient about the disease, the patient gets a baseline chest x-ray and LFT before the initial appointment with the provider. The provider determines the most

appropriate follow-up for the patient. Public Health does not diagnose or treat patients! However, they do ensure the paperwork is complete and accurate.

Forms

During the initial interview, Public Health personnel initiate the AF Form 2453, Tuberculosis Detection and Control Data. This form is used to record personal information, skin test history, chest X-ray reports, and the provider's recommendations for medical management of the patient. The provider reviews laboratory and chest X-ray results. The provider also closes out the AF Form 2453 when the patient completes the required follow-up. The original form is filed in each patient's outpatient medical record. PH will monitor the program at least monthly.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

210. Influenza

1. What is influenza?

2. What are *minor* changes to an influenza virus commonly called?

3. What is the average influenza incubation period?

4. Which project did the Air Force institute in response to influenza?

5. What is the purpose of the Influenza Surveillance Program?

211. Pulmonary tuberculosis

1. What is tuberculosis?

2. What is the causative pulmonary tuberculosis organism?

3. How is tuberculosis spread or transmitted?

4. Name the three stages of tuberculosis.

5. What occurs during the dormant phase of tuberculosis?

6. What are the symptoms of active tuberculosis?

7. What test is used to screen Air Force personnel for tuberculosis?

8. When do positive reactions to the Mantoux test occur?

9. What does the acronym BCG stand for and what is it?

10. What is the purpose of a BCG vaccination?

11. What is the effect of a BCG vaccination on TSTs?

12. What test is performed to *confirm* active tuberculosis?

13. What medication is used to prevent active tuberculosis?

14. What is the most serious side effect of INH?

15. What are two of Public Health's primary responsibilities for managing the Tuberculosis Detection and Control Program?

2–2. Sexually Transmitted Infections

An important part of the communicable disease program is the prevention and control of STIs. Before you can educate other people about a disease and inform them how to protect themselves, you must also be knowledgeable about the disease. This section provides some basic information about STIs. Do not use this volume as your only source of information on the clinical aspects of the diseases. There are many good resources for further study; however, material provided in this section is a good beginning.

212. Syphilis

Syphilis is a STI that occurs in both an acute and chronic form. Primary stage lesions, known as chancres, characterize the acute form; the secondary stage has characteristic skin rashes and mucous membrane eruptions, as well as long periods of latency, without symptoms. The late stage of syphilis may be present as a chronic disease involving the central nervous system and the cardiovascular system. It is also possible for a pregnant woman to pass the infection to her unborn baby.

Causative agent

The spirochete, *Treponema pallidum* causes syphilis. It is a thin, corkscrew-like organism with a characteristic motion that is recognizable during laboratory examination. It penetrates intact mucous membranes easily; however, it does not invade intact skin successfully.

Transmission mode

Transmission occurs during close sexual contact with a person who has an infectious lesion or chancre. The organism requires the moisture and warmth of the human body, is short-lived outside the human body, and is killed easily by soap and water. Therefore, inanimate objects are not significant in the transmission of the organism. It is possible to acquire the infection by accidental inoculation of the organism or by blood transfusion. However, since all blood donations are screened for syphilis, it is not a usual source of infection in this country. Because pregnant women pass the infection on to their unborn children through the fetal circulation, they are normally screened for syphilis during the prenatal period.

Incubation period

The incubation period for syphilis varies from 10 to 90 days, with an average of 21 days. Unfortunately, syphilis is not detectable by laboratory testing until the primary stage. During the incubation period, patients usually have a negative blood test.

Diagnostic techniques

There are three different methods of diagnosing syphilis. They include dark field microscopy, serological testing, and cerebrospinal fluid examination.

Dark field microscopy

The most specific, effective means of identifying syphilis in the primary stage is through dark field microscopy. *T. pallidum* is not easy to stain by ordinary laboratory methods, and the bacterium is similar to other spirochetes. *T. pallidum* must be in its living state to observe its structure and motility. The dark field microscope is used since the organism cannot be seen with an ordinary microscope. Spirochetes are very fragile and require immediate examination. Only specially trained laboratory personnel should perform dark field microscopy since the bacteria are easy to misidentify. This method is useful in confirming a diagnosis of syphilis only if the patient has a chancre with spirochetes. A negative examination does not mean the individual is free of syphilis. The numbers of spirochetes may be low or the individual may be in the latent stage.

Serologic tests

The body forms two types of antibodies in response to *T. pallidum* infection. One antibody develops against the organism itself, and the other antibody, known as reagin, results from the interaction of the organism with the body tissue. As a result, there are two types of serologic tests for syphilis (STS). Nontreponemal tests measure reagins and treponemal tests measure antibodies to the organism itself.

Nontreponemal tests

There are several types of nontreponemal tests. One of the most effective tests is the test developed by the Venereal Disease Research Laboratories (VDRL).This test is well controlled, easy to perform, inexpensive, and widely available. The results are reported as reactive, weakly reactive, and nonreactive. A second test that is similar to the VDRL is the Rapid Plasma Reagin (RPR) Circle Card Test, which is a modified VDRL test that introduces charcoal into an antigen suspension making the reaction between the antibody and the antigen visible to the naked eye.

Treponemal tests

These tests are more specific than nontreponemal tests, more useful in confirming a diagnosis of syphilis, and in identifying individuals with false positive nontreponemal tests. These tests are more complicated and expensive and are not meant to replace the VDRL or RPR as a screening test. The two types of treponemal tests used in the United States are the fluorescent treponemal antibody-absorption (FTA-ABS) test and the microhemagglutination assay for *T. pallidum* antibodies (MHA-TP) test. The FTA-ABS is more popular and reported as reactive, nonreactive, and borderline. However, the MHA-TP test is cheaper, simpler to use and read, and does not require fluorescent microscopy. Yet, the MHA-TP is less sensitive in the primary stage of syphilis than the FTA-ABS.

The FTA-ABS is used to confirm infection with *T. palladium*. Because it is an antibody test, patients who were adequately treated for syphilis will have a positive FTA-ABS for life. The treponemal tests are of little help in identifying active infection in patients who have had prior syphilis infections. Healthcare providers use test results (VDRL and RPR) along with clinical symptoms to diagnose new syphilis infections.

Cerebrospinal fluid examination

If syphilis is suspected of attacking the central nervous system (CNS), a cerebrospinal fluid examination is necessary. The examination includes three parts: a VDRL, a cell count, and a total protein. All three tests must be performed to arrive at an accurate diagnosis.

Stages and symptoms

Syphilis occurs in stages classified as primary, secondary, latent, late, and congenital. As a public health journeyman, it is your responsibility to conduct patient and contact interviews, conduct follow-up, and educate patients and contacts about their infections and how to prevent reinfection in the future. Consequently, you must have a very thorough understanding of the stages of the infection if you are to conduct a good interview.

Primary

The incubation period for the primary stage of the infection is 10 to 90 days, with an average of 21 days after exposure to an infected partner. The first clinical sign of syphilis is a lesion that forms at the site where the spirochete entered the body. This lesion (or chancre) occurs anywhere in the genital area. In men, the chancre is usually visible as a single, painless lesion on the penis, meatus, or scrotum. However, for women, it is painless, and goes unnoticed if located in the vagina or on the cervix. Chancres occur around the anus of people who practice anal intercourse and on the lips or inside the mouth of those practicing oral sex. Because the chancre is painless and there are no symptoms of systemic infection, many people ignore the lesion, or treat themselves with home remedies. Some people never realize they have a lesion and progress to the secondary stage of the infection.

Chancres resolve within one to four weeks, with or without treatment; and it is not unusual for the serologic test for syphilis to be negative during this stage. However, during this primary stage, syphilis is not confined to the chancre. Spirochetes travel throughout the body including the lymphatics, blood, and other body organs.

Secondary

Usually within four to six weeks after the primary lesion appears, the patient enters the second stage of syphilis. However, this stage could begin as soon as the primary lesion disappears, or as much as several months after the lesions disappear. The clinical signs of the second stage vary and may affect any organ of the body. The diagnosis usually is dependent on identification of skin and mucous membrane lesions. These lesions may simulate any type of skin lesion. The syphilis lesions are usually symmetrical and found bilaterally, commonly on the palms of the hands and the soles of the feet. Secondary manifestations resolve spontaneously within weeks, up to 12 months, leading to latency.

Other manifestations

Other manifestations sometimes present during this stage are mucous patches, condylomata lata, alopecia, and adenitis.

1. Mucous patches consist of slight erosion on the mucous membranes of the mouth, usually on the inside of the lips. Other mucous membranes affected are in the throat and cervix. These patches are loaded with the bacteria and are highly infectious.
2. Condylomata lata is a raised, tabletop or mushroom-like papule, occurring on the genitals or rectum. It is usually pale in color, with a whitish, soggy appearance, and should not be confused with the drier, velvety surface of venereal warts. These lesions are very infectious.
3. Alopecia is a thinning of the scalp hair, usually described as “moth eaten.” The hair on the eyebrows and eyelashes is also thinned or falls out. This condition is only temporary, as the hair growth returns after the second stage is over.
4. Adenitis is an enlargement of lymph nodes in the inguinal, epitrochlear, axillary, and cervical regions. The nodes are not inflamed or tender.

Other clinical signs

Along with these manifestations, other clinical signs of secondary stage consist of a mild fever, slight malaise, anorexia, headache, sore throat, myalgia, arthralgia, and aching bones. These signs may be overlooked during the diagnosis. The symptoms usually disappear after about four to 12 weeks, usually without scarring.

Latent

In this stage, the patient has no clinical signs of infection. This stage is divided into two parts. First, the *early* latent stage starts when the secondary lesions disappear. This early latent stage continues for four years, with 75 percent of the patients remaining asymptomatic. Twenty-five percent of the patients have relapses into the secondary stage and can infect other individuals. Because of these relapses, this early latent stage is included in the definition of infectious syphilis. Most of these relapses occur within the first year after secondary syphilis. The *late* latent stage starts at the four-year mark after the latent stage first began. The patient may live with the late latent stage and remain asymptomatic for life, or this late latent stage could last until the late stage of syphilis begins.

Late

The late stage of syphilis is considered the destructive stage of the disease. It is noninfectious and involves any organ or tissue in the body. It has been called the “great imitator” since it can produce signs of almost any other disease; however, it usually involves the cardiovascular and central nervous systems. The late stage in the CNS can be diagnosed and managed, but late cardiovascular syphilis is

usually identified too late for the patient to survive. The late stage also can affect the skin and bones; however, these two forms of late-stage syphilis are less common.

Congenital

The term "congenital" is not as accurate as the term "prenatal" in describing the transfer of the disease to a fetus. The spirochete usually crosses the placenta between the sixteenth and eighteenth week of pregnancy. Prior to this time, the Langhan's cell layer of the placenta acts as a barrier to the spirochetes. This layer breaks down after the eighteenth week, allowing the bacteria to infect the fetus.

Congenital syphilis is divided into two basic stages, early and late congenital syphilis. There is no primary stage since the bacteria is transferred directly into the blood stream of the fetus.

1. The early congenital syphilis stage produces signs and symptoms before the child is two-years old. If the symptoms appear within the first few weeks of life, a poor prognosis usually results. The signs include cutaneous lesions, mucous membrane lesions, poor development of the long bones, anemia, and an enlarged liver or spleen. Almost 50 percent of the patients have CNS problems related to the disease.
2. The late congenital syphilis stage is defined as congenital symptoms persisting beyond two years of age. This stage is not infectious and can be similar to latent syphilis in adults. However, some symptoms might appear. These symptoms include dulling of the cornea, Hutchinson's teeth, and maldevelopment of the first molar teeth, eighth nerve deafness, neurosyphilis, and bone development problems, such as saddle nose configuration or a poorly developed hard palate. Other signs include cracks or fissures around the mouth, cardiovascular lesions, and painless swelling of the joints. These signs may develop before puberty or as late as middle age.

Treatment

The treatment of choice for syphilis is penicillin, except for patients who are allergic to the medication. Providers should refer to the *Sexually Transmitted Disease Treatment Guidelines* published by the CDC for the most current treatment recommendations. The guidelines include medication alternatives for patients who cannot take penicillin. All tests, treatments, and follow-up actions are documented on a Standard Form 600, Chronological Record of Medical Care.

Follow-up

Post-treatment follow-up is essential to the proper management of syphilis patients. Unfortunately, many providers believe that if a patient is treated with the recommended dosage of penicillin, a cure is assured and follow-up is unnecessary. Although penicillin is effective, treatment failures does occur, making retreatment necessary. Additionally, alternative antibiotics can be less effective, making follow-up essential.

Follow-up for syphilis consists of periodic serological testing. Quantitative VDRLs are performed at one-, three-, and six-month intervals after treatment for primary and secondary syphilis. Patients treated during the latent phase are also tested at six and 12 month intervals. Most patients treated during the primary stage revert to a nonreactive state within six to 12 months after treatment, although some take as long as one to two years after treatment. Late latent or late syphilis patients may have a high titer (called sero-fast) although the titer may reduce some over time.

In such cases, a VDRL should be performed on the spinal fluid. If the titer rises during follow-up, this may indicate treatment failure or reinfection. The distinction may be difficult to prove. A patient interview and investigation may be helpful in determining whether treatment failed or reinfection occurred.

Prevention and control measures

Since syphilis is only communicable during the primary and secondary stages (and relapses during early latent stage), the emphasis of Public Health should be placed on identifying and treating all cases of primary and secondary syphilis. The emphasis should be placed on any case of syphilis that is less than two years' duration, all cases of early congenital syphilis, and all women having syphilis during pregnancy. Early diagnosis and treatment is difficult since early syphilis rarely causes acute illness and the lesions often heal spontaneously. Many patients with primary syphilis treat themselves with nonprescription drugs and do not see a healthcare provider. Other prevention and control procedures are similar to any other STI.

213. Gonorrhea

Gonorrhea is one of the most common STIs. It is complex and dangerous because the medical and laboratory aspects keep changing. For example, the organism has developed resistance to many antibiotics; therefore, the laboratory testing has changed over the years. This makes it difficult to keep current with the patient education information and the treatment guidelines for the disease.

Causative agent

The organism causing this infection is *Neisseria gonorrhoeae,* which is a spherical or oval gram-negative bacterium known as a gonococcus. In the discharge fluid, these organisms appear as ovoid diplococci; they rarely appear as single cells.

Transmission mode

Gonorrhea is spread from one individual to another by intimate penile, vaginal, oral, or rectal contact with an infected person. *N. gonorrhoeae* attacks mucous membranes of the penis, vagina, rectum, urethra, or throat. The gonococcus dies quickly in air; thus, it is almost impossible to contract gonorrhea from inanimate objects used by an infected person. The gonococcus travels from the mucous membranes of the infected partner to the uninfected partner's mucous membranes; however, it does not always infect the uninfected partner. Organisms often die during sexual contact, making the chances of catching gonorrhea during a single exposure about 50 percent. Of course, repeated sexual contact with an infected person greatly increases the chances of becoming infected.

Symptoms

It is necessary to separate the symptoms into three areas: male genital, female genital, and nongenital infections.

Male genital

Common terms often used to describe urethral gonorrhea are drip, burn, and clap, which actually explain how the disease affects the penis. The two categories of male genital gonorrhea are uncomplicated and complicated.

Uncomplicated

When the gonococcus enters the mucous membranes of the penis, the body responds with white blood cells to attack and consume most of the bacteria. However, the bacteria quickly overpower the body's natural defenses. About two to seven days after contact, the incubation period, gonorrhea causes a thick, whitish-yellowish pus discharge from the penis. This discharge consists of dead urethral cells, bacteria, and white blood cells. The meatus becomes swollen, causing the lips of the meatus to come closer together (clap), making urination difficult and painful (burn). Sometimes a drip without burning or burning without a drip will occur. Either should be reported to a healthcare provider. Some men are asymptomatic or do not show signs or symptoms. These men do not seek medical attention and are a major factor in the continual spread of the disease.

Complicated

If untreated, the typical symptoms of gonorrhea will eventually disappear, but the individual is still infected with the disease. The bacterium travels up the urethra and infects other organs in the reproductive system, such as the prostate gland. Pain during urination becomes more severe and is felt in the entire penis, not just the meatus. In some cases, an abscess may form in the prostate gland causing a feeling of heat, pain, or swelling in the lower pelvis or around the anus. Other symptoms include severe pain when moving the bowels and a high fever. The enlarged prostate presses on the bladder, making it difficult or impossible to urinate. The abscess eventually breaks down into the urethra or rectum, releasing pus.

However, most men do not develop the prostatic abscess, and the untreated disease can continue for a long time causing only minor symptoms. Listed are the results of untreated and treated complicated gonorrhea:

- Untreated—in about 20 percent of the men who remain untreated for longer than a month, the bacteria spread down the vas deferens (the tube leading from the prostrate to the testicles), reach the epididymis on the back of one, or both, testicles and cause gonococcal epididymitis. Epididymitis, which occurs more commonly on the left side, causes pain in the groin, a heavy sensation in the affected testicle, and the formation of a small, hard, painful swelling at the bottom of the testicle. The overlying skin of the scrotum becomes red, hot, and painful.
- Treated—even when treated, gonococcal epididymitis leaves scar tissue that closes off the passage of sperm from the affected testicle. Since epididymitis is usually restricted to only one testicle, even such advanced gonococcal infection does not often lead to sterility. However, if the infection is left untreated, both testicles become involved, and the man is left sterile. Complications of gonorrhea in the male are extremely rare, and even when treatment is delayed, total recovery is the rule.

Female genital

Gonococcal infections in females are more difficult to identify based on symptoms. Both uncomplicated and complicated gonorrhea infection can occur in females.

Uncomplicated

The infection may cause an unusual vaginal discharge; however, this discharge is hard to distinguish from that which normally occurs during sexual excitement, ovulation, a few days before menses, or during pregnancy. Occasionally a burning sensation may occur during urination. Approximately 80 percent of cases in women are asymptomatic. Therefore, it is very important for men with symptoms to notify their female sexual partners immediately and for women to seek a medical examination for gonorrhea.

Complicated

Complications can also occur in the female if the infection goes untreated. Gonorrheal pelvic inflammatory disease (PID) is the most common and most serious complication of gonorrhea infections, occurring in about 50 percent of the untreated cases of uncomplicated gonorrhea. Because uncomplicated gonorrhea does not produce noticeable symptoms in most women, the infection is often not treated. If treatment is delayed for more than eight to ten weeks, the bacteria may travel into the uterus.

During menstruation, the bacteria can multiply rapidly in the dead cells and blood of the uterine lining, spreading quickly up the sides of the uterus and attacking the inner walls of the fallopian tubes. This infection of the fallopian tubes is called “salpingitis.” Infection may block the fallopian tubes, allowing pus to collect. As infection builds, the tubes become grossly enlarged. Even after the infection resolves, the fallopian tubes frequently remain blocked with scar tissue, often resulting in sterility.

The infection can also travel out of the fallopian tubes and invade the pelvic cavity. When this occurs, the pelvic tissues become swollen and inflamed. A woman with gonococcal PID may experience one

or more of the following symptoms: lower abdominal pain, pelvic tenderness, elevated temperature, dysuria (painful or difficult urination), vaginal discharge, nausea, and vomiting. Below are the types of treatment for women with varied PID symptoms:

- Treatment—antibiotics are the treatment for PID. However, the damage already done cannot be repaired, and the pelvic organs never fully recover. Some women may have chronic mild to moderate lower abdominal pain, which may worsen during menstruation or sexual intercourse, fatigue, or constipation.
- Pain and surgery—some women who suffer from PID may experience repeated attacks of severe lower abdominal pain and may ultimately require a hysterectomy (removal of uterus), salpingectomy (removal of tubes), or oophorectomy (removal of ovaries) for relief.

Nongenital

Gonorrhea can attack organs other than the genitals. It can infect the rectum, pharynx, conjunctiva, and the bloodstream. In females, infective heavy discharge or menstrual blood may be manually transferred to the rectum and result in infection. Although it usually does not cause symptoms, rectal gonorrhea may produce rectal mucous discharge, intense rectal irritation, a feeling of incomplete evacuation after defecation, and burning pain during defecation or anal intercourse. However, these symptoms are also often associated with men who practice anal intercourse and do not have gonorrhea. Rectal contacts of persons with penile gonorrhea should receive treatment since medical examination and diagnostic cultures may not detect rectal gonorrhea.

Pharyngeal

Another form of gonorrhea is pharyngeal gonorrhea, or oral gonorrhea. People with this form of gonorrhea are usually asymptomatic. However, if symptoms develop, they may include a mild to severe sore throat, fever, and chills.

Opthalmia

The third type of nongenital gonorrhea is gonococcal opthalmia neonatorum, which occurs in newborn infants. The infant's eyes are infected as the infant passes through the birth canal of the infected mother. Symptoms include intense redness, swelling, and a discharge usually occurring within three days of birth. The infection usually occurs bilaterally, and if untreated, may lead to corneal ulceration or orbital cellulitis (inflamed tissues of the eye orbit). To prevent infection, all newborns in the United States hospitals have silver nitrate drops placed into their eyes immediately after birth.

Septicemia

When the gonorrhea bacteria leave the genital area, or anal canal, and enter the bloodstream, gonococcal septicemia develops. This form of gonorrhea is rare, but it does occur in women and homosexual males who are more likely to be asymptomatic and not seek medical treatment. The presence of the bacteria in the bloodstream can cause symptoms such as fever, malaise, loss of appetite, arthritis, and dermatitis. Arthritis is common in asymptomatic cases. Eventually, the bacteria may invade the heart, liver, and central nervous system, even though only a few of these cases have been reported in the past few decades.

Diagnostic techniques

Making the diagnosis of gonorrhea usually involves getting a history of signs and symptoms and identifying *N. gonorrhoeae* in body secretions. The most reliable method of diagnosis is to find the organisms by smear or culture.

The gram-stain is the preferred method for evaluating smears. The diagnosis can be made if gram-negative intracellular diplococci are found in stained films of the discharge sample.

Although the smear is sufficient to identify the presence of gonorrhea in symptomatic patients, cultures are generally necessary to confirm the diagnosis, especially in asymptomatic patients and contacts. Smears are not as reliable as cultures in female patients. Cultures are grown in a selective medium specifically designed to prohibit the growth of organisms such as *Proteus* species, which are normal flora in the rectum. Routine culture sites for males are the urethra, rectum, and pharynx. Routine culture sites for females are the cervix, rectum, and pharynx. If no *N. gonorrhoeae* is identified after 48 hours, the culture is considered negative.

Treatment

If a culture is positive, the patient needs treatment. All cases of gonorrhea are treated according to the latest edition of *Sexually Transmitted Disease Treatment Guidelines* published by the CDC. When a new version of the treatment guidelines is published, someone in your office should ensure that all professional staff members are aware of the changes in treating STIs. Everyone in PH should review this publication to be aware of the current treatment regimens. This is necessary to educate the patient properly about their treatment and follow-up.

There are several factors the healthcare provider considers prior to selecting a course of treatment and they are as follows:

- Patient acceptability.
- Patient reliability.
- Medication effectiveness.
- Medication side effects.
- Presence of other diseases.

Many antibiotics can be effectively used against the different types of gonorrhea. These antibiotics include procaine penicillin, tetracycline, ampicillin, amoxicillin, spectinomycin, and cefoxitin for penicillin resistant strains.

Patient acceptability

Patients may not want to comply with the instructions for taking their medication. This may make your surveillance and follow-up very difficult to conduct. The patient's attitude may influence the provider's selection of oral or injectable antibiotics.

Patient reliability

If a patient indicates difficulty in taking multi-dose medications or the reliability of the patient is in question, a single-dose injection may be ordered by the healthcare provider.

Medication effectiveness

The antibiotic must be effective for the type of gonorrhea encountered. Some antibiotics are effective against urogenital gonorrhea, but are not effective against pharyngeal infections. Also, some strains of gonorrhea are resistant to penicillin. Resistant strains are called penicillinase-producing *Neisseria gonorrhae* (PPNG). These strains produce beta lactamase; an enzyme that makes them totally resistant to penicillin. The military population is at an increased risk of exposure to PPNG due to assignments to areas of the world where these strains are endemic.

Medication side effects

Some medications, such as tetracyclines, create side effects in some individuals. For example, using tetracycline for treating young children would cause yellowing of the teeth and in pregnant women, it creates a possibility of teratogenic side effects. Alternative antibiotics should be used for people who are allergic to penicillin.

Presence of other diseases

Some medications are effective against gonorrhea, but not against syphilis. If a patient is positive for more than one STI, the healthcare provider should carefully select the antibiotics.

Follow-up

Persons who have uncomplicated gonorrhea and who are treated in accordance with the CDC *Sexually Transmitted Disease Treatment Guidelines* need not return for a test of cure. Only those patients with symptoms persisting after treatment should be reevaluated.

Prevention and control

Since gonorrhea is a widespread disease, it is important to pursue prevention and control measures. Many of the prevention and control measures are the same as for many other STIs. The goals are to make sure that all active cases are identified and treated appropriately and that all sexual partners have been contacted, tested, and treated. Another goal is to educate as many people as possible about the disease, including how the disease is spread, prevented, and treated.

Prevention

Although abstaining from sexual contact is the only 100 percent effective way to prevent STIs, this is not a very realistic approach. The next best thing is to use a condom. If a condom is used properly, gonorrhea, as well as most STIs, can be prevented.

Control

Other preventive measures include decreasing the number of sexual partners; keeping the name and telephone number of all sexual contacts (even casual sexual contacts) so that if an infection develops, all sexual contacts can be informed and treated for the disease; and restricting specific activities such as oral-anal sex, oral-genital sex, and anal and vaginal penetration to a few well known partners (who should restrict themselves as well). One additional preventive measure is visually checking a partner's sexual areas for signs of a discharge, sore, rash, or lesions that would warrant a delay until the partner is medically treated. One of your jobs is to educate patients to follow these preventive measures and to check themselves for bumps, sores, rashes, and discharges and to seek medical treatment if any signs of the disease are discovered.

Other measures

Other preventive measures, although not as effective, are also recommended. These include washing the genitals before and after each sexual encounter; urinating or douching after intercourse; and using topical spermicidal or bactericidal agents during intercourse.

Education

Educating the population on preventive measures and encouraging them to use these preventive and control measures will reduce the spread of disease.

214. Chlamydia

A chlamydia infection can affect the urogenital and reproductive tract of both men and women and the conjunctiva and lungs of newborn infants. This infection is just as serious as a gonococcal infection. Chlamydia infection in men is often called nongonococcal urethritis (NGU), and is discussed later in this unit.

Causative agent

The microorganism that causes the genital infection is *Chlamydia trachomatis;* it is classified as a bacterium. However, chlamydiae share properties with both bacteria and viruses. Like viruses, chlamydiae only grow intracellularly, which makes culturing difficult and expensive. Consequently, some MTFs do not have the capability to culture it. Like bacteria, chlamydia contains both DNA and RNA, they divide by binary fission, and they have cell walls similar to gram-negative bacteria.

Chlamydia infections are not always apparent, and many infected men and women may be asymptomatic.

Transmission mode

Chlamydia trachomatis can be transmitted from one person to another during sexual intercourse with either the penis or vagina becoming infected. It has been isolated also from the pharynx and rectum for both heterosexual and homosexual men and women. The organism is also transmitted from the mother's birth canal to the newborn's conjunctiva during delivery.

Incubation period

The incubation period is one to three weeks, with an average of seven to 14 days.

Genital chlamydia

Symptoms in men include an opaque discharge of small or moderate quantity, urethral itching, and burning on urination; women experience endocervicitis with a discharge of mucous and pus. These usually appear within one to three weeks after exposure. One of every two infected women and one of every four infected men may have no symptoms whatsoever. As a result, the disease is often not diagnosed until complications develop. Complications in men include epididymitis and urethral syndrome; complications in women include acute salpingitis and PID. It should be noted that the symptoms associated with PID caused by *C. trachomatis* are usually less severe than those caused by gonorrhea; however, the damage to the reproductive tract may be more severe than that caused by gonorrhea; thus, increasing the risk of infertility and ectopic pregnancy.

Nongenital chlamydia

Conjunctivitis is the disease of the conjunctiva caused by *C. trachomatis*. In adults, there are variations of the infection, such as acute follicular conjunctivitis. These diseases, if untreated, may persist for a few months until trachoma develops. Trachoma is a chronic infectious disease of the conjunctiva and cornea, producing photophobia, pain, and excessive tearing.

Infants exposed to *C. trachomatis* in the mother's infected birth canal during birth may develop a number of diseases, such as conjunctivitis and pneumonia. Although conjunctivitis develops in a few days, the symptoms of pneumonia do not appear until the second month of life. Conjunctivitis and pneumonia are easily treated once the symptoms are noticed.

Diagnostic techniques

There are many techniques for diagnosing chlamydial infections. These include tissue cultures, cytology, and antigen detection by serologic testing.

Tissue cultures

Isolation in tissue culture is the standard test for chlamydia in the genitals. Since the bacteria grow intracellularly, a cell must be available for growth. Tissue cultures treated with specific chemicals to aid the growth of chlamydia are inoculated with a sample of tissue suspected of infection. The culture is incubated for 48 to 72 hours.

Cytologic diagnosis

Another method to identify chlamydia is to take skin scrapings from the patient and stain them to identify the organism. The skin scraping allows a quick diagnosis, because the results are known in a few moments and a culture does not have to be grown. The sample examined must be from the skin scrapings and not from any discharge to ensure enough epithelial cells are examined.

Antigen detection

The antigen-antibody reactions of the patient can be measured using an enzyme-linked immunosorbant assay (ELISA). This test does not depend upon a specially trained observer and has

the ability to test large numbers of specimens at one time. This method is used to diagnose chlamydial infections in infants.

Treatment

The most common treatment for chlamydial infections is Doxycycline (100 milligram) twice a day (b.i.d.) for seven days, or Azithromycin (1 gram) orally in a single dose. According to the CDC, either medication is at least 95 percent effective.

Follow-up

Since the medication is so effective, and antimicrobial resistance to recommended treatments has not been observed, test-of-cure cultures are not necessary when treatment has been completed.

Prevention and control

Chlamydial infections are widespread and it is important to pursue prevention and control measures. The prevention and control measures are generally the same as for many other STIs. The goal is to ensure all active cases are treated effectively and that all sexual partners are contacted and treated as well. Again, the best preventive measure is the use of a condom. It is also important to check a partner's sexual areas for signs of a discharge, sores, rash, or lesions visually. As with other STIs, additional precautions include washing the genitals before and after each sexual encounter, urinating or douching after intercourse, and using topical spermicidal or bactericidal agents during intercourse.

215. Other common sexually transmitted diseases

Other common sexually transmitted diseases are genital herpes, NGU, vaginitis, lymphogranuloma venereum, and pediculosis. You need to know about these diseases, so let's begin by learning about genital herpes.

Genital herpes

Genital herpes is a viral disease that usually affects sexually active people and newborns infected during birth. Herpes is a Greek word meaning, "to creep." The virus has been around for centuries.

Causative agents

The herpes simplex virus (HSV) causes herpes. There are two types of HSV: type one (HSV1) usually causes cold sores or fever blisters on the mouth and type two (HSV2) usually causes genital herpes. HSV2 invades the nerve cells of the genital area. After the initial infection, the HSV2 leaves the infected genital area and travels to the nerve cells that lie next to the lower part of the spinal cord. The virus lives here for the rest of the person's life.

Periodically thereafter, reactivation of the virus within these nerve cells causes the virus to retrace its path back to the nerves of the initially infected site. It is possible for this relapse to occur years after the initial infection. Furthermore, such relapses may recur frequently or rarely. Due to the antibodies produced by the body to fight off the first invasion of the virus, the repeat episodes are generally not as painful and do not last as long as the initial infection.

Transmission mode

The initial infection is contracted by close physical contact, usually intimate contact, with a person who has an active infection. The infection usually begins as small, painful blisters that contain clear fluid. Some clear blisters become cloudy with pus. The blisters may break open to form shallow, painful sores, which eventually scab over and heal completely. When these blisters or sores are present, a person is considered to be infectious and can transmit the disease. However, it is not known exactly when the virus is shed.

The virus may be shed before, during, and after the blisters or sores are present. Generally, the person should be considered safe only after the sores have completely healed. Care should be taken if the sores have scabs, since the scabs can be rubbed off during sexual activity and the virus sheds. The HSV2 has

also been isolated in seminal fluid, cervical secretions, and in saliva of infected people. Herpes can be transmitted from any form of sexual contact including intercourse and oral-genital contact. Even the HSV1 has been found in the genital areas of infected patients.

Incubation period

After the initial infection, the virus incubates for about two to 12 days, with six to seven days being the average incubation time.

Symptoms

As mentioned already, the first sign is usually blisters forming on the genitals, even though they can form anywhere. These blisters may break open, especially those in moist areas. The groin area may be swollen and painful. Surrounding areas may itch, and urination may be painful. There may be an increase in vaginal fluid discharge in women and generalized aches, pain, and possibly fever associated with the infection. These symptoms last for about three weeks for the first episode, while subsequent episodes may last for two to nine days each.

Subsequent episodes can exhibit symptoms ranging from a mild tingling sensation from ½ to 48 hours prior to an eruption, to shooting pains in the buttocks, legs, and hips from one to five days before the blisters appear. Complications may occur such as encephalitis. Newborn infants who passed through an infected birth canal are susceptible to infection, which can cause blindness, permanent nervous system damage including mental retardation, and possibly death. Even after the symptoms subside, the virus can be reactivated when the body's defense system has been weakened due to stress, illness, trauma, and overexposure to the sun. The triggering device for subsequent episodes is not yet understood.

Diagnosis

Viral isolation in tissue culture is the most specific and sensitive method of confirming a diagnosis of herpes. A serological test is available. However, this test is not as accurate, and it is usually only used for patients with the first (primary) herpes infection since all patients seroconvert, meaning, they build antibodies against the virus.

Treatment and prevention

There is no cure for this disease. However, the symptoms can be treated with a variety of medications. There are also a few medications used to slow or stop the transmission of the disease. Acyclovir is used to stop the virus from replicating or making new virus cells. It does not cure the infection nor does it prevent a reactivation. The best form of prevention, currently, is education and to *not* be sexually active during or near episodes of blisters or sores.

Nongonococcal urethritis

NGU is similar to gonorrhea in almost every respect except that the causes are different. This disease primarily affects men.

Causative agents

There are many causes of NGU including *Chlamydia trachomatis, Ureaplasma urealyticum*, HSV, and *Trichomonas vaginalis*.

Transmission mode

These organisms are transmitted sexually. Women become carriers of the disease and can infect the male partner through vaginal, anal, or oral-genital intercourse.

Incubation period

Unlike gonorrhea, NGU takes approximately one to five weeks to incubate with an average of two to three weeks. Some men are asymptomatic for months while the bacterium travels to the prostate or epididymis causing complications.

Symptoms

Common symptoms are urethral discharge, dysuria, and urethral itching. The discharge associated with NGU is usually noticed in the morning, as a crusted substance at the meatus or as stains on the underwear. The clinical examination is very important. A smear should be taken first thing in the morning prior to urinating. This guarantees a sufficient sample to identify the causative agent. The sample is taken either from the discharge, or for more accurate results, take the sample from a urethral swab and stain it for identification. If *C. trachomatis* is found, the patient is considered infected.

However, if *U. urealyticum* is found, the patient does not necessarily have urethritis. The diagnosis must be based on the clinical symptoms as well as the laboratory findings. The treatment for NGU is usually 1 gram of Azithromycin orally, as a single dose, or Doxycycline for seven days.

Vaginitis

Vaginitis is an inflammation of the vagina and is one of the most common conditions associated with the female sexual organs. Although it may not be dangerous, vaginitis deserves immediate medical attention.

Causative agents

The cause of vaginitis is commonly either *Trichomonas vaginalis* or *Gardnerella vaginalis. T. vaginalis* is a flagellated protozoan; *G. vaginalis* is an anaerobic bacteria. *T. vaginalis* infection in women is known as trichomoniasis.

Transmission mode

The organism is transmitted through sexual contact. A male can maintain it either in the foreskin of the penis or in the prostate gland, without producing any symptoms. Infection is transmitted when the organism is rubbed off the penis onto the vaginal walls during intercourse. *T. vaginalis* can survive outside the body for up to 24 hours in tap water or other body fluids such as urine, semen, and vaginal exudates. In theory, if infectious material, such as urine is deposited on a toilet seat and the next user's vagina makes contact with the contamination, infection might develop. However, this has never been documented. Also, if infected people share towels or wash cloths during or after showers, there might be a chance of spreading the organisms.

Incubation period

The incubation periods vary with each organism, the dose of organism received, and the patient's susceptibility.

Symptoms

Symptoms usually include a heavy, foul discharge that is white, yellowish, or greenish, and often frothy. Irritation of the vagina and vulva causing soreness and itching with frequent burning during urination are also symptoms associated with this condition. The pain and froth is less severe or not present with *G. vaginalis*. Treatment of trichomoniasis is usually metronidazole in a single dose. Again, check with the current *CDC Sexually Transmitted Disease Treatment Guidelines* for treatment updates. If sexual partners are not treated at the same time as the patient, reinfection can occur. Cultures are not effective for diagnosing *G. vaginalis*. Thus, the diagnosis is usually based on clinical symptoms. Metronidazole is also used to treat *G. vaginalis*.

Lymphogranuloma venereum

Lymphogranuloma venereum (LGV) is a sexually transmitted disease of the lymphatic system affecting both males and females.

Causative agent

Several types of C. trachomatis cause LGV. This organism is the same as the one causing the disease, chlamydia. The location of the infection along with the symptoms creates a variation of the disease.

Transmission mode

LGV is transmitted through sexual contact such as with vaginal and anal intercourse.

Incubation period

The incubation period is variable, with a range of three to 30 days for a primary lesion; however, if bubo (lymph node swelling and inflammation) is the first symptom, the incubation period is from 10 to 30 days, to several months.

Symptoms

A small, painless pimple-like sore appears on the sexual organs but disappears in a few days. Since the sore is painless, it often goes unnoticed if hidden in the foreskin of the penis or in the vagina. If untreated, in about 10 to 30 days, the chlamydiae travel to the lymph nodes of the groin area. The affected lymph node swells due to inflammation forming a bubo. The individual then may experience fever, chills, abdominal pains, loss of appetite, and joint pains. The bubo is obvious and painful, making most people seek medical attention.

If the bubo does not form, or in those individuals who do not seek medical attention, complications that are more serious could develop. These complications may develop anytime between one and 10 years later. These complications include rectal stricture and tremendous swelling of the sexual organs, creating LGV elephantiasis.

Diagnosis and treatment

The diagnosis is based on clinical signs, as well as serological testing and/or tissue cultures of pus withdrawn from the bubo. LGV is usually treated with doxycycline (100 milligram) orally, b.i.d. for 21 days. Sometimes, surgical intervention is required for relief of a rectal stricture.

Pediculosis

Pediculosis is not *always* a sexually transmitted disease; however, it could be. Let's take a look at the various types of human pediculosis (louse infestation).

Causative agent

Lice are parasites that feed on human blood; and they are found everywhere, from the cold climates to the hottest parts of the world. They infest all types of people, and are found in crowded conditions where people cannot keep themselves and their clothing clean. There are three distinct varieties of lice that affect humans: *Pediculosis humanus capitis* (the head louse), *P. humanus corporis* (the body louse), and *Phthirus pubis* (the crab or pubic louse). All three varieties are similar anatomically. Each is small, flat, and wingless. The life cycle for the louse goes from ova (egg) to nymph (young louse) to adult.

Transmission mode

Adult lice and nymphs are excellent travelers. Body and head lice can travel to other people very quickly by direct contact, or by contact with an infested person's personal items (e.g., a hat, hair brush, comb, clothing, or bedding). Body lice need a rough surface to grasp and are usually found in the seams of clothing, when they're not on a body. The pubic or crab lice only travel for short distances and hold onto the hair shafts with their powerful claws. Transmission of the crab lice is usually restricted to sexual contact.

Incubation period

Lice spend approximately eight to nine days in the ova stage. The nymph stage takes about 10 to 15 days. The life span of the head louse is about 30 days while body and pubic lice live for about 35 days.

Diagnosis

While biting a person, a louse sucks blood from the individual. This bite wound becomes itchy and sometimes sore. Diagnosis is made by visually identifying the louse or by identifying the bite left by

the louse. Head and pubic lice are found on an individual's body, while the body louse is found on their clothing. Nits (the egg case), regardless of the species involved, are tiny, white, cylinder shaped pods that attach to the hair shafts next to the skin.

To check for head lice, start looking at the back of the head and behind the ears and then check the entire scalp. For body lice, check any body part that comes into contact with clothing, since the body louse spends very little time on the body to feed and spends the rest of the time on the person's clothing. Usually, you can see tiny bite marks on the victim's shoulders, between the shoulders, and around the waist. Pubic lice bites are most often present on the abdomen, lower thighs, and genitals. Pubic lice occasionally can be found in the armpits and on the eyelashes or eyebrows causing inflammation of the eyelids.

Other associated signs and symptoms include mild fever, muscular aches, and occasionally, swelling of the cervical glands. Pubic lice frequently exist with other STIs such as gonorrhea, syphilis, and trichomoniasis.

Associated problems

When discussing the incubation period of pediculosis, you cannot forget the problems associated with lice infestations. These problems, known as "lousy" diseases, could easily cause epidemics throughout a population if crowded conditions exist. Places where crowded conditions may exist include hospitals, jails, nursing homes, schools, summer camps, and dormitories. Different diseases associated with lice are typhus fever (a rickettsia), trench fever (a rickettsia), and relapsing fever (a spirochete). Louse-borne typhus outbreaks are most frequent during wars and natural disasters.

The spread of this typhus is dependent on sanitation, abundance of lice, and crowded living conditions. There has not been an outbreak of typhus in the United States since the 1930s; however, there have been major outbreaks in many other parts of the world. Under wartime conditions, such an outbreak could be a major threat for the military population since we are required to respond worldwide.

Control

Lice infestations can be controlled by treating the infested people and cleaning personal items and bedding. There are shampoos, lotions, or creams containing lindane that can be used to treat head or pubic lice. It is important to use a nit comb or other fine-tooth comb to remove the nits attached to the hair shafts. However, treating the individual alone will not control the lice.

It is important to remove the lice from the clothing, bedding material, hats, combs, and hair brushes. These items can be cleaned using hot water and detergents. Lice can be removed from clothing by washing, dry cleaning, or ironing, giving extra attention to the seams. Fumigation of buildings is not necessary to control lice.

216. Human immunodeficiency virus

HIV is the term used to describe a group of symptoms that is a result of an infection with a virus. This disease has affected many people around the world and even created a panic situation in some places. The effects of this disease have singlehandedly changed the sexual conduct of many people in our society.

Causative agent

The virus initially was called human T-lymphotrophic virus type III (HTLV-III) in the United States and lymphadenopathy associated virus (LAV) in France. At present, the universally accepted name is HIV. HIV stores its genetic material in the RNA. HIV infected cells use an enzyme called reverse transcriptase to copy the viral genetic material from RNA into DNA. This genetic information stays in the infected cell and continues to replicate more viruses that can infect other cells. HIV destroys the body's ability to defend against invading organisms since it attacks and destroys the T_4 (T-helper or CD_4) cells and the macrophages/monocytes.

Transmission mode

HIV can be transmitted by sexual contact (penis/vagina, penis/rectum, mouth/vagina, mouth/penis, or mouth/rectum) with an infected individual. The use of contaminated intravenous injection equipment such as needles and syringes can also infect a person. The virus can also be transmitted from an infected mother to infant child before, during, and after birth (in breast milk).

Risk groups

The groups at risk for acquiring HIV include heterosexuals; homosexual and bisexual men; intravenous drug users; heterosexual partners of bisexuals or persons with HIV infection; institutional prisoners (due to homosexuality and IV drug use); prostitutes (due to sexual contact and IV drug use); and hemophiliacs who received blood products prior to 1985.

Symptoms

Since HIV infection usually affects the body's immune system, it allows many other diseases to invade the body and cause death. The 1987 revised CDC case definition for AIDS reads:

> AIDS is a disabling or life-threatening illness caused by HIV that is characterized by HIV encephalopathy, HIV wasting syndrome, or certain diseases due to immunodeficiency in a person with laboratory evidence for HIV infection or without certain other causes of immunodeficiency."

Diagnostic techniques

The Air Force currently uses two laboratory tests to confirm exposure to the HIV: the ELISA and the Western blot test. Both tests detect HIV antibodies, but the Western blot is more specific. Neither test can detect the virus itself. These tests are highly sensitive when used for testing high-risk groups such as homosexuals and intravenous drug users, but less predictive for low-risk groups. If the ELISA test is positive on a blood sample, the sample is then tested with a Western blot test.

Preventive measures

Education is the key factor in preventing the spread of HIV. People must be educated about safe sex and the dangers associated with intravenous drug use. Avoiding the exchange of body fluids is a very effective means of preventing HIV.

Other methods include the correct use of latex condoms from start to finish of each sexual act.The condom, when used properly, provides the best protection for people who do not maintain a mutually monogamous relationship with an uninfected partner. Some spermicides may also offer some protection against the virus when used in conjunction with a condom.

The CDC, in conjunction with the Public Health Service, offers free information about preventing AIDS to anyone who wants it. Since our knowledge of the disease is ever changing, you can obtain current disease information from the Centers for Disease Control in Atlanta, Georgia, or from your local or state public health departments.

217. Managing sexually transmitted infected patients

In order for the prevention and control program to work effectively, people must seek medical attention. The provider must suspect an STI and order proper tests, the results must be reported, the patient must be properly treated, and all contacts must be identified and treated. This program is very involved and complicated. Public Health briefs providers on the incidence of STIs in the area and on how to report all cases to Public Health.

Not all diseases must be reported to the local, state, or federal governments. Follow local, state, and Air Force policy when reporting STIs. For Air Force reporting requirements, we use the Disease Reporting System internet (DSRi) module to track and report to the Air Force Institute for Operational Health, Safety and Occupational Health Risk Analysis, Risk Analysis Directorate, Risk Assessment Division, Epidemiology Services Branch (USAFSAM/PHR) monthly.

Public Health must make sure the patient has been treated and a follow-up test performed to ensure effective treatment. Our job also includes interviewing, investigating, and contacting those who had sexual contact with the patient during the period of communicability. These contacts must be identified, notified, and treated to interrupt the spread of an STI.

Sexually transmitted infection interviews

Once the provider has notified the patient of the diagnosis, the patient should be referred to Public Health for an interview. This interview is extremely important and necessary as it has several purposes. During these interviews, you have an important role in breaking this chain of infection in the community and controlling the spread of disease through your efforts in educating the patient. Another purpose of interviewing is to ensure that all patients and contacts are effectively treated so that complications are prevented. You also gather information that epidemiologists use to find cures and prevention techniques for the different STIs. All of the information given to patients and taken from patients must be factual and accurate in order for the control program to work.

Basic elements

Just like a lesson plan, the interview is divided into three parts. First is the introduction where you establish rapport, assess the patient's knowledge, and build the patient's confidence. During the body of the interview, you educate the patient about the disease, treatment, complications, and follow-up. You should also gather information about contacts and explain the importance of treating contacts. During the conclusion, summarize what was talked about, the importance of contact notification, treatment, and the follow-up appointment. The key to a successful interview is two-fold: first, the interviewer must be knowledgeable, and secondly, the interviewer must control the conversation.

Patients may try to manipulate the interviewer and control the conversation, releasing only certain information. To gain full confidence and encourage the patient to "tell all," the interviewer must be prepared.

Privacy

To conduct a successful interview, a private room must be available. Patients are more likely to give you intimate information if privacy is assured. It is unprofessional for medical personnel to discuss STIs and sexual contacts with a patient in a less than a private room. This room should have a telephone, diagrams, references, pictures, forms, worksheets, a calendar, maps, phone book, and tissues. If these items are on hand, there is less chance for interruptions.

Knowledge of the disease

You are considered to be the expert, and the patient needs to have confidence that you know what you are talking about. At a minimum, you should know how the disease is transmitted, the incubation period, the signs and symptoms, the treatment, and complications of the disease.

It usually takes time to prepare for the STI interviews. You should be thoroughly trained in STIs prior to performing your first STI interview. You may want to use an interview checklist that outlines specific information needed as you go through an interview session.

Establishing patient confidence

During the introduction, try to establish rapport and assure the patient that you are there to help. Try to get the patient to relax and be as comfortable as possible. You must exhibit a good attitude, be sympathetic, and nonjudgmental; and above all else, you must be professional. These characteristics will build the patient's confidence in your abilities.

Educating the patient about the disease

During the introduction portion of your interview, you must determine the patient's knowledge of the disease and its treatment. This may be the patient's first STI. On the other hand, this may be the patient's third STI. In either case, find out what the patient knows and adjust the education portion of

the interview accordingly. Explain how the disease is transmitted, symptoms usually associated with the disease, the course of treatment the provider has prescribed, and most importantly, how to prevent reinfection when the patient resumes sexual activity. Answer patient questions, obtaining assistance if necessary, and ensure the patient is sufficiently educated to prevent further spread of the disease. Stress the importance of the follow-up visit and the test of cure (if necessary).

Contacting, notifying, and educating the patients' sexual contacts

The next step in the interview is to identify all sexual contacts of the patient from the beginning of the incubation period to the present. Explain the importance of treating all partners and stress that Public Health is concerned only about the health and well-being of the persons involved. Some patients may not want to identify their sexual partners, and elect to notify their partners themselves. They may also give you false information. You must assume all contact information is true and attempt to notify contacts yourself or through the health department. Every contact deserves to be notified and treated if necessary.

Educating the patient regarding preventive measures

At the conclusion of the interview, preventive measures should be explained in detail. It is important to stress the use of condoms as the most effective method of preventing sexually transmitted diseases among sexually active people. It may be necessary to have a condom available to show the patient. Other preventive measures include decreasing the number of sexual partners; checking partners for signs of disease; maintaining personal hygiene, especially after sexual contact; urinating after sexual contact (vagina/penis contact); knowing the partners and where/how to get in touch with them; getting regular medical checkups; and using jellies, foams, and spermicides that offer some protection against infection.

Air Force sexually transmitted infection policy

AFI 48–105, *Surveillance, Prevention, and Control of Disease and Conditions of Public Health or Military Significance*, Centers for Disease Control, *STD Treatment Guidelines*, and *Control of Communicable Diseases Manual* are references you should have on hand to conduct the STI control program.

Support

It will be important to receive support from both your base commander and the MTF commander in managing the program. Sometimes, providers do not report all cases of STIs and do not refer STI patients to Public Health. The MTF commander may need to educate the professional staff on the local STI policy and Air Force policy. The base commander may choose to place a local establishment off limits because of its known connection with prostitution.

Consultation

Due to your experience with STI patients, healthcare providers may consult with you prior to making a diagnosis. However, you must keep in mind that Public Health personnel are not qualified to make a diagnosis, and it is illegal for you to do so.

Documenting and reporting

The patient's diagnosis is documented on a Standard Form (SF) 600, Chronological Record of Medical Care, by the provider.

NOTE: You will learn about the format for making medical entries on this form later in this volume.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

212. Syphilis

1. What are the three different stages of syphilis?

2. What is the causative agent for syphilis?

3. What is the *average* incubation time for syphilis?

4. What is the most effective method used to identify syphilis in the primary stage?

5. What is one of the most effective nontreponemal serological tests?

6. What does FTA-ABS stand for and how is it used?

7. What occurs during the early latent stage of syphilis?

213. Gonorrhea

1. What agent causes gonorrhea?

2. What are the symptoms associated with uncomplicated male genital gonorrhea?

3. What is the term used to describe a gonorrheal infection of the fallopian tubes?

4. What are the symptoms of oral, or pharyngeal, gonorrhea?

5. What is gonococcal septicemia and how does it develop?

6. Where are gram-negative diplococci found within a discharge sample in order to be defined as gonorrhea?

7. What does a physician consider when deciding on a patient's treatment for gonorrhea?

8. When should a test of cure be performed for gonorrhea patients?

214. Chlamydia

1. What microorganism causes chlamydia?

2. How are chlamydia organisms like viruses? Like bacteria?

3. On average, how long does the chlamydia organism take to incubate?

4. Which two common conditions can infants develop from chlamydia exposure at birth?

5. What method is the *standard* test for identifying chlamydia in genital infections?

6. When should a test-of-cure culture be performed for follow-up treatment?

215. Other common sexually transmitted diseases

1. What body parts are usually affected with an HSV2 infection?

2. When can the herpes virus be shed?

3. What is the average incubation period for herpes?

4. What are four causative agents for NGU?

5. What is the average incubation period for NGU?

6. What is vaginitis?

7. What are the symptoms associated with vaginitis?

8. What is LGV?

9. What usually happens if LGV is not treated within about 30 days?

10. Which three types (species) of lice infect humans?

11. What three diseases may be found with lice infestations?

216. Human immunodeficiency virus

1. How do the HIV cells work?

2. What cells in the immune response system does HIV kill?

3. How can HIV be transmitted?

4. Who are the HIV risk groups?

5. Which two diagnostic tests does the Air Force use to diagnose HIV?

6. What provides the best method of protection against HIV for people who do not maintain a mutually monogamous sexual relationship?

217. Managing sexually transmitted infected patients

1. What are the purposes of an STI interview?

2. What are two keys to a successful interview?

3. What supplies are recommended for an interview room?

2–3. Viral Hepatitis

Hepatitis is another important disease that has many variations and serious consequences. It is a disease that is often misunderstood. A great deal has been learned about hepatitis in the past 20 to 30 years, and researchers continue to learn more about the viruses that cause hepatitis. It is important for you to keep up with the most current information about this disease.

218. Types of hepatitis

Hepatitis is an inflammation of the liver that may be caused by bacteria, viruses, protozoa, helminths, chemicals, or drugs. In this section, you will study the different viruses that cause hepatitis. There are many types of viral hepatitis. Two primary forms you may be familiar with are hepatitis A and hepatitis B. However, there are other forms of hepatitis that may resemble or mimic these two. Hepatitis C, D, and E are newer forms, each type will be discussed individually.

Hepatitis A

Hepatitis A is usually a mild disease lasting one to two weeks, but it can be debilitating and last for several months. The symptoms include fever, malaise, anorexia, nausea, and abdominal discomfort, followed within a few days by jaundice. Children under 2 years of age usually are asymptomatic; children above two years of age are more likely to have symptoms. The fecal-oral route transmits the disease. The incubation period is 15 to 50 days, with an average of 28 to 30 days. The infected individual usually sheds the virus in the feces during the last half of the incubation period, and the virus usually disappears from the feces within a week after the onset of symptoms.

As a common problem

Hepatitis A is a common problem in child development centers because of the poor hygiene of young children and because 90 percent of infected children are asymptomatic. This is why diapered and toilet-trained children are separated in child development centers. Also, it can be a problem for the military members who are assigned or deployed to an area of endemic disease. This virus is transmitted through contaminated food and water (including milk, sliced meats, salads, and raw or undercooked mollusks) and by direct contact.

Diagnosis

Hepatitis A is diagnosed by checking for HAV antibodies in the serum of acutely or recently ill patients. The ELISA (also known as enzyme immunoassay or EIA) or the radioimmunoassay (RIA) test is used to assist with the diagnosis of hepatitis A. Presently, it is not possible to identify the HAV antigen.

Hepatitis B

The effects of hepatitis B can be more severe than hepatitis A. Symptoms include anorexia, vague abdominal discomfort, nausea, and vomiting. Sometimes a rash is present. Ultimately jaundice

develops. Fever is usually either mild or absent. Hepatitis B virus (HBV) may infrequently result in chronic infection in carriers, chronic active hepatitis, and cirrhosis of the liver. It is the primary cause of hepatocellular carcinoma, a form of liver cancer.

Body fluids

Although the HBV has been found in all body fluids, such as blood, saliva, and semen, only the blood- or serum-derived fluids are known to be infectious. Contaminated needles, syringes, and other intravenous equipment are important vehicles for transmitting the disease, especially among intravenous drug users. The infection may be spread through contamination of wounds or lacerations, or by exposure of mucous membranes to infective blood, which is an important source of transmission in healthcare occupations. The virus is also transmitted through sexual contact.

Incubation

Hepatitis B incubates for about 45 to 180 days, with an average of 60 to 90 days. However, the HBV antigen can be found as early as 2 weeks after exposure. Usually, the individual becomes infective within a month or two after exposure.

Diagnosis

Either the EIA test or the RIA test is used to diagnose HBV. In a hepatitis B panel, the markers measured for hepatitis B are surface antigen and antibody, core antigen and antibody, and e antigen and antibody. The diagnosis is confirmed by finding hepatitis B surface antigen, or recent development of antibody to core and/or surface antigens.

Hepatitis C

Hepatitis C is similar to hepatitis B with symptoms of anorexia, vague abdominal discomfort, nausea, and vomiting; however, jaundice occurs less frequently. Severity ranges from unnoticeable to severe; fatality is rare. Transmission may occur within the body from exposure to contaminated blood and plasma derivatives, which accounts for approximately 90 percent of cases with this disease. Many virologists refer to this hepatitis as “posttransfusion hepatitis.” However, “community acquired” cases are also important to consider, so contaminated needles and syringes are important vehicles of spread that must be controlled.

Incubation

The incubation period ranges from 2 weeks to 6 months; most commonly, it is within six to nine weeks. The period of communicability is 1 or more weeks before onset of the first symptoms through the acute clinical course of the disease, and indefinite in the chronic carrier stages.

Prevention

Preventive measures are the general control measures against hepatitis B, as you will learn about in the next section. In blood bank operations, it is advisable to discard units from donors who have elevated liver enzymes or test positive for core antibodies.

Hepatitis D

This form of hepatitis seems to be caused by two viruses, the hepatitis B virus and the delta virus. Although transmissible as an independent agent, delta viruses can only infect and cause illness when hepatitis B viruses are present. Therefore, a co-infection with hepatitis B must exist for virus synthesis. During this synthesis, the hepatitis B viral components are temporarily suppressed.

Hepatitis D is transmitted like HBV, with an estimated incubation period of two to eight weeks. Onset is usually abrupt and severe, with signs and symptoms resembling those of hepatitis B infection. The RIA and ELISA tests are the methods of choice for confirming the delta hepatitis diagnosis.

Hepatitis E

The course and symptoms of this form of hepatitis are similar to hepatitis A; there is no evidence of a chronic form. The fatality rate is very low, except in pregnant women where the rate may reach 20 percent during the third trimester of pregnancy. The mode of transmission is contaminated water and probably from person to person via the fecal-oral route. The incubation period is 15 to 64 days, with an average of 26 to 42 days. General preventive measures are similar for those of hepatitis A and include basic measures to prevent fecal-oral transmission, which are education that stresses the sanitary disposal of feces, and careful hand washing after defecation and before handling food.

219. Hepatitis prevention and control measures

Although there are no cures for any type of hepatitis, there are measures that individuals can take to prevent infection or the spread of hepatitis.

Hepatitis A

Individuals at risk for hepatitis A can be educated about the importance of sanitation. For example, caregivers at the child development center can be at risk of acquiring hepatitis A if they care for diapered children. Children under the age of two years usually do not show symptoms when infected with HAV. If hand washing and diaper changing procedures are not rigidly adhered to, it is possible to pass the infection on to other children and caregivers. You will not be aware of a problem until infected caregivers or parents become symptomatic. By the time adults show symptoms, you may have a full-scale epidemic on your hands. Therefore, it is very important for the child development center director to enforce strict sanitation and hand washing procedures at the center.

Prophylaxis

Education is not the only preventive measure you can take to protect people from being exposed to the HAV. Individuals exposed to hepatitis A can be given an injection of hepatitis A vaccine to prevent hepatitis A infection, or to lessen their symptoms. Only close contacts, such as child development center workers exposed to infected individuals and household contacts should be given the injection as a precaution. The decision whether to administer injections is made by the provider after consulting with PH or the Infection Control Committee. However, for this type of injection to be effective, it must be administered within two weeks of exposure.

Surveillance

The prophylactic treatment of contacts and education of risk groups on the spread of HAV are only two of the preventive measures available. There may also be a need to conduct closer surveillance of food and water supplies.

Hepatitis B

This disease is transmitted through contaminated blood products and body fluids. Risk groups must be educated about the disease and its mode of transmission. Individuals exposed to HBV should be given hepatitis B immune globulin (HBIG) within one week of exposure.

Since HBV is transmitted through body fluids, people such as healthcare providers, laboratory, blood bank workers, and dental personnel are at risk for occupational exposure to HBV. Examples of exposures might be from needle sticks or exposure to an infected patient’s mucous membranes.

The hepatitis B series is an effective vaccine used to prevent HBV infection. The vaccine is a series of three injections, given over six months, with the follow-up injections given at intervals of one month and six months after the initial injection. Vaccination of military members at high risk for occupational exposure to hepatitis B virus is now mandatory.

Prevention

Preventive measures for the other forms of hepatitis are the same as, or similar to, those used for hepatitis A and B. Education and sanitary controls are the keys to effectively controlling and preventing the spread of viral hepatitis.

Sanitation

Equipment, such as surgical instruments, that come into contact with body fluids must be completely sanitized to preclude the transmission of the disease. Procedures for handling body fluids, such as blood, saliva, and semen, must be evaluated carefully.

Prophylaxis

The CDC has published guidelines on pre- and post-exposure prophylaxis for exposure to all types of hepatitis.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

218. Types of hepatitis

1. What is the incubation period for hepatitis A?

2. How can hepatitis A be transmitted?

3. What makes hepatitis A more severe than hepatitis B?

4. What is the incubation period for hepatitis B?

5. Which two tests are used to diagnose hepatitis B?

6. Which disease coexists with an infection of hepatitis D?

219. Hepatitis prevention and control measures

1. What can people who have been exposed to Hepatitis A be injected with as a prophylaxis measure?

2. What is the prophylaxis for people exposed to hepatitis B?

3. What can laboratory workers, healthcare workers, and blood bank workers be given to prevent hepatitis B infection?

2–4. Rabies Control Program

With the threat of rabies existing in the United States, the Air Force has developed a program designed to control the spread of the disease. The program consists of pet vaccination, stray animal control, public education, and an animal bite control program. First, let us look at the disease of rabies.

220. Rabies

Rabies is a widespread viral disease that affects any warm-blooded animal. It is usually fatal in affected animals, including humans. The disease is found in animals in most parts of the world; however, it is rarely found in humans in the United States, although animals in many of the states carry the disease and could easily transmit it to humans.

Causative agent

Rabies is a virus that affects the central nervous system, and results in fatal encephalitis. The incubation period is variable in different species of animals; it depends on the severity of the wound, site of the wound in relation to the richness of nerve supply and its distance from the brain, amount and strain of virus introduced, and protection provided by clothing and other factors. It also varies from animal to animal within the same species. In the dog, the incubation period usually lasts 15 to 25 days, but may exceed 120 days, which is why most rabies-free countries insist on a 180-day quarantine period for incoming dogs.

Symptoms

Symptoms in humans are divided into five stages. The *first* stage is the incubation period, which usually is between 14 and 90 days after exposure. The *second* stage is the Prodrome phase and is when individuals show the first clinical symptoms. These symptoms can be fever, headache, malaise, sore throat, and a cough or abdominal pain. These symptoms last for two to four days. Then the *third* stage, which is known as the acute neurological phase, begins. The symptoms for the third stage may include aseptic meningitis, encephalitis, or neuropathies. This phase is also accompanied by periods of hyperactivity, excitability, and increased salivation.

Patients may have pharyngeal spasms when trying to drink water, or even with the sight of water (this is why the term “hydrophobia” is associated with rabies). This third neurological phase lasts from two to seven days, and ends with the onset of a coma. The coma (or *fourth* stage) may last up to 14 days. Death or recovery is the *fifth* stage.

NOTE: The clinical signs of rabies infection in animals may also vary depending with the disease stage.

Transmission mode

The saliva of infected animals usually transmits the disease. Usually a break in the skin such as a cut or scratch is necessary for infection to occur.

Domestic animals

Rabies is usually associated with the bite of an infected animal. Saliva of infected dogs, cats, and even ferrets may contain the virus for several days before they appear clinically ill. This is why domestic animals involved in biting incidents are held in quarantine for 10 days; if the virus was in the saliva at the time of the bite, then the animal will appear ill within 10 days. Then the bitten person can begin antirabies immunization. If the biting animal remains healthy for 10 days, then the bitten

person need not receive antirabies immunizations. If the biting animal is not found and observed for 10 days, then the bitten person often begins receiving the antirabies immunizations.

These immunizations, which are categorized as artificial active immunity, are a necessary precautionary measure since the disease is so severe. An important point to remember—the treatment has to be given before the person starts showing signs of encephalitis. After that, the immunizations will not work.

Unusual transmissions

The rabies virus may also be transmitted by aerosol in unusual circumstances. A few human cases have occurred after exploring infected bat caves. Infection may also occur following ingestion of infected animals. Neither of these routes is very likely for humans. Rabies also has been transmitted by corneal transplantation from one human to another.

Wild animals

Various wild species serve as reservoirs of rabies infection in the United States. Skunks are important reservoirs in the Mississippi River Valley; foxes are important along the eastern seaboard; raccoons in Florida, Virginia, and Georgia; and bats in various locales containing bat caves. In most foreign countries, dog rabies is the main reservoir due to large stray dog populations that maintain the infection. Rabies may be diagnosed at various laboratories using brain tissue from suspected animals. This is why the heads of suspected animals are shipped to a laboratory for testing.

Treatment for infected animals

There is no treatment for infected animals. This is also true for humans once the encephalitis signs appear. In fact, the usual recommendation is euthanasia for any exposed pet, vaccinated or not. The disease is just too serious to take any chances. Pets are vaccinated primarily to prevent them from transmitting the disease to humans, not just for their own protection.

221. Animal Bite Control Program

As noted above, rabies can be a fatal disease if the proper precautions are not taken and the program is not managed effectively. You, along with a team of individuals, will be responsible for ensuring personnel receive the appropriate medical care if they are potentially exposed to rabies.

Responsibilities

Before explaining the process of administering the Rabies Control Program, you need to know who is involved and understand their jobs.

Healthcare provider

The healthcare provider (HCP) has one of the hardest jobs in this program. The HCP is responsible for the treatment of the patient. If bitten people do not receive the antirabies immunization soon enough after exposure, their chances of dying are greater. The decision to receive antirabies immunizations is very difficult without further information. This information is necessary and is provided by other offices.

Emergency room technicians

You will be dealing with technicians in the emergency room, as well as other clinics, to determine if any animal bite cases were reported but the paperwork never made it to your office. The emergency room keeps logbooks on all patients, which is a good source of information if you need it.

Public Health

One of the “other” offices is your Public Health office. Your office is responsible for monitoring the overall program, ensuring that the patients receive treatment, determining if the animals have been found and placed in quarantine by qualified individuals, and determining the risk of active rabies in the biting animals.

Army veterinarian

The Army veterinarian is responsible for making certain that the biting animals are quarantined and determining whether the animals have rabies. If a biting animal cannot be found, the Army veterinarian provides information for the local area about the incidence of rabies in the species of biting animal. The veterinarian also assists the provider in determining appropriate treatment for exposed patients.

Local public health agency

This agency handles all off-base bite cases in place of the Army veterinarian, who is responsible for the quarantine process and for submitting samples for laboratory testing, if required.

Security Forces

The Security Forces members are responsible for retrieving stray animals that are involved in bite cases on base and for ensuring on-base residents follow quarantine procedures as prescribed by the MTF commander and base commander.

Purpose and importance of control

Only a handful of patients have ever survived rabies once they developed the clinical signs of encephalitis, because treatment is almost useless once these signs begin. This fact alone makes it extremely important that all people who are bitten by an animal receive a medical examination to determine if they have been exposed to rabies. If someone has been exposed to rabies, the success of antirabies immunization is directly related to how soon after the exposure the immunizations are started. In other words, the longer the person waits to get treated after being bitten by a rabid animal, the greater the chance of dying.

Treatment

On the other hand, no one should get treated unless it’s necessary. Antirabies immunizations, like all medication, can cause medical problems. They can be painful, and there is a slight chance someone may have a severe reaction to the antirabies vaccine.

Prevention

Prevention of human rabies is provided by administering the human rabies immune globulin (HRIG) as soon as possible after exposure to neutralize the virus in the bite wound, and then by giving vaccine to elicit active immunity. The human diploid cell vaccine (HDCV) has been licensed for use as an antirabies immunization since 1980. The HDCV should be given as soon as possible after the bite and may be given at the same time as the rabies HRIG. Other doses of HDCV are administered at three-, seven-, and 14-day intervals. If immesuppression, it causes the patient to receive a dose at 28-day intervals after the first dose.

Problem/decision

Rabies treatment is a problem like a two-edged sword. If someone is bitten, the doctor who tends to the victim has to decide if the patient needs antirabies treatment. If the patient has been exposed to rabies and the doctor does not give antirabies treatment, the patient may die. If, on the other hand, the patient has not been exposed to rabies and the doctor gives the antirabies treatment, the patient may experience an unnecessary reaction.

The attending physician must make a decision whether or not to give treatment. This is where the problem gets complicated. The provider needs to know if the animal is rabid. As mentioned earlier, the way to determine if an animal has rabies or not is through either quarantine or by examining the brain tissue at a laboratory. The latter would require the animal be killed and the head sent to a laboratory. If the brain tissue is positive for rabies, the patient should receive the antirabies treatment. If the tissue is negative for rabies, the patient does not need the treatment.

Other questions

Some other questions the provider might need to know: Where is the animal? Is it dead or alive? If it's alive, can it be killed and the head sent to a laboratory? How long will it take for the results of the specimen? Is the biting animal a dog, cat, or ferret? Can the animal be quarantined for 10 days? Is the animal apparently healthy? Was the animal provoked? Who will quarantine the animal and notify the doctor of the animal's health at the end of quarantine?

These and other questions need to be answered so the doctor can provide the patient with the best possible care. All of the agencies involved must work together as a team to ensure the patient receives proper treatment.

Program administration

A DD Form 2341, Report of Animal Bite – Potential Rabies Exposure, is used to transmit animal bite information from the emergency room to PH, the quarantine officials, and back to be filed in the patient's medical records. When time is critical, use the telephone to ensure the patient receives prompt, accurate care from the provider. Once the DD Form 2341 is completed, the original is filed in the patient's medical record.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

220. Rabies

1. How many stages are there for human symptoms of rabies?

2. What are the symptoms of the second stage (Prodrome phase) of rabies?

3. What is the fourth stage of rabies?

4. The antirabies immunizations are given before symptoms of what condition?

5. What is the usual recommendation for exposed pets whether vaccinated or not?

221. Animal Bite Control Program

1. What are the responsibilities of the Army veterinarian in the Rabies Control Program?

2. Which two immunizations are recommended for individuals who have been exposed to rabies?

3. What tissue in an animal is examined for the rabies virus?

4. What form is completed for animal bite victims reporting to MTFs?

5. Where is the original of the DD Form 2341 placed once completed?

Answers to Self-Test Questions

210

1. An acute, febrile respiratory infection that may exhibit systemic manifestations with three subtypes.
2. Antigenic drift.
3. 1 to 3 days.
4. Project Gargle.
5. To identify new strains of influenza virus.

211

1. A communicable disease mainly affecting the lungs.
2. Mycobacterium tuberculosis.
3. By inhaling droplet nuclei.
4. Infection, dormancy, and active.
5. Bacilli encapsulate and remain in the alveoli of the lung until conditions favor further growth and progression to the active stage.
6. Fatigue, weight loss, fever, chills, night sweats, loss of appetite, and a persistent cough.
7. Mantoux.
8. 48 to 72 hours after initiating the test.
9. Bacille Calmette-Guerin and it is the first live vaccine against TB, which today's strains also use.
10. To prevent the recipient from experiencing a natural primary TB infection by artificially inducing a harmless, primary infection.
11. Positive skin tests for about 10 years and after 10 years, negative.
12. Sputum cultures.
13. INH.
14. Drug-induced hepatitis.
15. Manage the administration of the program and educate personnel about the disease.

212

1. Primary, secondary, and late.
2. The spirochete *Treponema pallidum*.
3. 21-days.
4. Dark field microscopy.
5. VDRL.
6. Fluorescent treponemal antibody-absorption and is used to confirm infection with T. palladium.
7. The secondary lesions disappear and the stage continues for four years where 75 percent of patients are asymptomatic.

213

1. Neisseria gonorrhoeae.

2. Thick, whitish-yellowish discharge of pus, swollen meatus, and difficulty urinating with a painful burn that occurs two to seven days after contact.
3. Salpingitis.
4. Mild to severe sore throat, fever, and chills.
5. Gonorrhea of the bloodstream and develops when the gonorrhea bacteria leaves the genital area or anal canal.
6. Intracellular.
7. Patient acceptability, patient reliability, medication effectiveness, side effects of the medication, and the presence of other diseases.
8. When symptoms persist after treatment.

214

1. Chlamydia trachomatis.
2. Like viruses, they grow intracellularly and are like bacteria where they contain both RNA and DNA, divide by binary fission, and have cell walls similar to gram-negative bacteria.
3. 7 to 14 days or longer.
4. Conjunctivitis and pneumonia.
5. Tissue cultures.
6. They are not recommended.

215

1. Genitals.
2. It is not known exactly when the virus may be shed and can be shed before, during, and after blisters or sores are present.
3. 6 to 7 days.
4. *Chlamydia trachomatis*, *Ureaplasma urealyticum*, HSV, and *Trichomonas vaginalis*.
5. 2 to 3 weeks.
6. An inflammation of the vagina.
7. Heavy, foul discharge that is white, yellowish, or greenish and often frothy as well as irritation of the vagina and vulva that causes soreness and itching with frequent burning during urination.
8. A sexually transmitted disease of the lymphatic system that affects males and females.
9. The lymph nodes in the groin swell forming a painful bubo.
10. The head louse (*Pediculosis humanus capitis*), the body louse (*P. humanus corporis*), and the crab or pubic louse (*Phthirus pubis*).
11. Typhus fever, trench fever, and relapsing fever.

216

1. They use an enzyme called reverse transcriptase to copy the viral genetic material from RNA into DNA.
2. T_4 and macrophages/monocytes.
3. By sexual contact with an infected individual, by using infected intravenous injection equipment and an infected mother can transmit to her child before, during, and after birth (in the breast milk).
4. Heterosexuals, homosexual and bisexual men, intravenous drug users, heterosexual partners of bisexuals or persons with HIV infection; institutional prisoners, prostitutes; and hemophiliacs who received blood prior to 1985.
5. The ELISA and Western blot test.
6. Proper use of a condom.

217

1. To break the chain of infection in the community, control the spread of disease by educating patients, and ensure that all patients and contacts are effectively treated so that complications are avoided.
2. Interviewer knowledgeable and controlling the conversation.

3. Telephone, diagrams, references, pictures, forms, worksheets, a calendar, maps, phone book, and tissues.

218

1. 15 to 50 days, with an average of 28 to 30 days.
2. Through contaminated food and water, milk, sliced meats, salads, and raw or undercooked mollusks or through direct contact.
3. Its effect on the body, which can include anorexia, abdominal discomfort, nausea, and vomiting with jaundice ultimately developing.
4. 45 to 180 days, with an average of 60 to 90 days.
5. The EIA or RIA.
6. Hepatitis B.

219

1. Hepatitis A vaccine (Immune globulin).
2. Injection with HBIG within 1 week of exposure.
3. HBV vaccine administered in series of three injections given over 6 months.

220

1. Five.
2. Fever, headache, malaise, sore throat, and cough or abdominal pain.
3. Coma.
4. Encephalitis.
5. Euthanasia.

221

1. Ensures that the biting animal has been quarantined and that the decision of whether the animal has rabies or not is answered. The veterinarian also provides information on the incidence of rabies to any healthcare provider and assists the provider with treatment recommendations for exposed patients.
2. HRIG and HDCV.
3. Brain tissue.
4. DD Form 2341.
5. In the patient’s medical records.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to AFCDA.

23. (210) A *major* change in the antigens of Influenza is referred to as a/an
    a. antigenic drift.
    b. antigenic shift.
    c. genetic evolution.
    d. epidemic change.

24. (211) How is tuberculosis transmitted from one individual to another?
    a. Through droplet nuclei suspended in air for prolonged periods.
    b. By contact with nasal hairs and bronchial cilia.
    c. Through droplet nuclei settled to the ground.
    d. With a single exposure to the disease.

25. (211) During which stage of tuberculosis do bacilli encapsulate and remain in the alveoli of the lung until conditions favor growth?
    a. Active.
    b. Infection.
    c. Dormant.
    d. Incubation.

26. (211) Which tuberculin skin test is used by the Air Force to screen members for tuberculosis?
    a. Mantoux test.
    b. Sputum culture.
    c. Tuberculin tine test.
    d. Bacille Calmette-Guerin (BCG).

27. (211) For a provider to confirm an *active* tuberculosis diagnosis, it is essential to perform this test.
    a. Chest X-ray.
    b. Tine skin test.
    c. Sputum culture.
    d. Mantoux skin test.

28. (212) During which stage of development is syphilis *first* detectable through laboratory testing?
    a. Initial.
    b. Latent.
    c. Primary.
    d. Incubation.

29. (212) This type of test is more popular for use in confirming a syphilis infection and results in reports that are reactive, nonreactive, and borderline.
    a. Fluorescent Treponemal Antibody-Absorption (FTA-ABS).
    b. Microhemagglutination Assay for T. Pallidum (MHA-TP).
    c. Rapid Plasma Reagin (RPR) Circle Card Test.
    d. Cerebrospinal fluid examination.

30. (212) Which type of syphilis manifestation are you seeing if there is a raised, tabletop or mushroom-like papule with a pale, white soggy appearance on the genitals or rectum?
    a. Adenitis.
    b. Alopecia.
    c. Mucous patch.
    d. Condylomata lata.

31. (212) In which stage of syphilis do the secondary lesions disappear?
    a. Primary.
    b. Secondary.
    c. Late latent.
    d. Early latent.

32. (213) All of the following are modes of gonorrhea transmission *except*
    a. air.
    b. oral.
    c. penile.
    d. vaginal.

33. (213) What is the most common, and most serious, complication of female gonorrhea infections?
    a. Sterility.
    b. Salpingitis.
    c. Genital lesions.
    d. Pelvic inflammatory disease.

34. (214) Which diagnostic method is the *quickest* for identifying chlamydia infections?
    a. Skin scraping.
    b. Serological testing.
    c. Tissue culture.
    d. Antigen-antibody tests.

35. (214) For chlamydial infections, using a topical spermicidal or bactericidal agent during intercourse is an example of
    a. treatments.
    b. follow-ups.
    c. diagnostic techniques.
    d. prevention and controls.

36. (215) The herpes simplex virus (HSV) 2 *mainly* causes this in an infected person.
    a. Nerve cells invasion in genital area.
    b. Condylomata lata in genital area.
    c. Fever blisters on the mouth.
    d. Cold sores on the mouth.

37. (215) Which diagnostic method is the most specific and sensitive to confirming herpes?
    a. Antigen-antibody testing.
    b. Serological testing.
    c. Tissue culture.
    d. Skin scraping.

38. (215) Which sexually transmitted disease (STD) starts with a pimple-like sore and, if left untreated, forms a *bubo* in most patients?
    a. Herpes virus type 1 (HSV1).
    b. Herpes virus type 2 (HSV2).
    c. Lymphogranuloma venereum.
    d. Nongonococcal urethritis (NGU).

39. (216) Which diagnostic method is more specific for detecting human immunodeficiency virus (HIV) antibodies?
    a. Tissue culture.
    b. Skin scraping.
    c. Western blot.
    d. ELISA test.

40. (216) This method is a *key* factor in preventing the spread of the human immunodeficiency virus (HIV).
    a. Minimize shared drug paraphernalia.
    b. Avoid exchanging bodily fluids.
    c. Spermicides.
    d. Education.

41. (217) There are two keys to conducting a successful interview concerning sexually transmitted infections (STI). The first key is the interviewer must be knowledgeable, and second, the
    a. patient must control the conversation.
    b. interviewer must control the conversation.
    c. interviewer ensures that all contacts are treated and followed up.
    d. interviewer ensures that pictures, tissues, and telephone are available.

42. (218) Which form of hepatitis has an *average* incubation period of 60 to 90 days?
    a. A.
    b. B.
    c. C.
    d. D.

43. (218) What must be present for the Delta virus to infect an individual and cause illness?
    a. Hepatitis A.
    b. Hepatitis B.
    c. Hepatitis C.
    d. Hepatitis D.

44. (219) In order for the hepatitis A vaccine (immune globulin) to be effective, how soon must it be given after exposure to hepatitis?
    a. Within 2 weeks.
    b. Within 2 months.
    c. Immediately after exposure.
    d. Never, because it is ineffective.

45. (219) Which group of workers is at risk for occupational exposure to hepatitis B?
    a. Child development center.
    b. Water treatment.
    c. Food service.
    d. Dental.

46. (219) What are keys to effectively controlling and preventing the spread of viral hepatitis?
    a. Isolate all patients with hepatitis.
    b. Vaccinate all personnel for hepatitis.
    c. Provide education and sanitary controls.
    d. Administer immune globulin to high-risk employees.

47. (220) Immunizations for rabies after exposure to the disease must be given *prior* to the onset of encephalitis. The onset of encephalitis occurs in this stage of rabies.
    a. Stage 1, Incubation period.
    b. Stage 2, Prodrone phase.
    c. Stage 3, Acute neurological phase.
    d. Stage 4, Coma leading to death or recovery.

48. (220) Which type of animals are the primary reservoirs of rabies in *most* foreign countries?
    a. Bats.
    b. Dogs.
    c. Foxes.
    d. Raccoons.

49. (221) When an animal is suspected of having rabies in a bite case on base, which individual or agency is responsible for determining if the animal is rabid?
    a. Public Health.
    b. Army veterinarian.
    c. Healthcare provider.
    d. Chief, Rabies Advisory Committee.

50. (221) Which immunization is given to treat personnel exposed to rabies?
    a. Immune globulin.
    b. Duck embryo vaccine.
    c. Human diploid cell vaccine.
    d. Animal rabies virus vaccine.

Student Notes

Glossary

Abbreviations and Acronyms

AIDS	Acquired Immunodeficiency Syndrome
AFI	Air Force Instruction
AFIOH	Air Force Institute for Operational Health
AR	attack rate
BCG	bacille Calmette-Guerin
b.i.d.	two times per day (dosage)
CDC	Centers for Disease Control and Prevention
CNS	central nervous system
CPI	Consumer Price Index
DNA	deoxyribonucleic acid
DRSi	Disease Reporting System internet
EIA	enzyme immunoassay
ELISA	enzyme-linked immunosorbant assay
FTA-ABS	fluorescent treponemal antibody-absorption
HAV	hepatitis A virus
HBIG	hepatitis B immunoglobulin
HBV	hepatitis B virus
HCP	healthcare provider
HDCV	human diploid cell vaccine
HIB	*Haemophilus influenza* B
HIV	human immunodeficiency virus
HRIG	human rabies immune globulin
HSV	herpes simplex virus
HSV1	herpes simplex virus type one
HSV2	herpes simplex virus type two
HTLV-III	human T-lymphotrophic virus type III
INH	isoniazid
IR	incidence rate
LAV	lymphadenopathy associated virus
LFT	liver function test
LGV	lymphogranuloma venereum

M. TB	*Mycrobacterium tuberculosis*
MHA-TP	microhemagglutination assay for *T. pallidum* antibodies
MTF	medical treatment facility
NER	noneffectiveness rate
NGU	nongonococcal urethritis
PID	pelvic inflammatory disease
PPD	purified protein derivative
PPNG	penicillinase-producing *Neisseria gonorrhea*
RIA	radioimmunoassay
RNA	ribonucleic acid
RPR	Rapid Plasma Reagin Circle Card Test
SF	Standard Form
STD	sexually transmitted disease
STI	sexually transmitted infection
STS	serologic tests for syphilis
TST	tuberculin skin test
TU	tuberculin units
USAFSAM	United States of Air Force School of Aerospace Medicine
VDRL	Venereal Disease Research Laboratories
WBC	white blood cells

Student Notes

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