The Chain of Infection

Microorganisms are transmitted from one organism (person or animal) to another in a process called the **chain of infection** (Figure 2-1). Six elements or conditions must be present for the infection to be transmitted:

1. The microorganism is capable of causing an infectious disease.
2. The microorganism resides in a **reservoir** (person, animal, or environment).
3. It leaves the reservoir via a **portal of exit** (route of transmission)
4. It travels via a **mode of transmission** (the means by which it is transferred).
5. It reaches a **portal of entry** (the place where it enters the second organism)
6. It enters a **susceptible host** (the person or animal who is at risk of developing an infection from the microorganism).

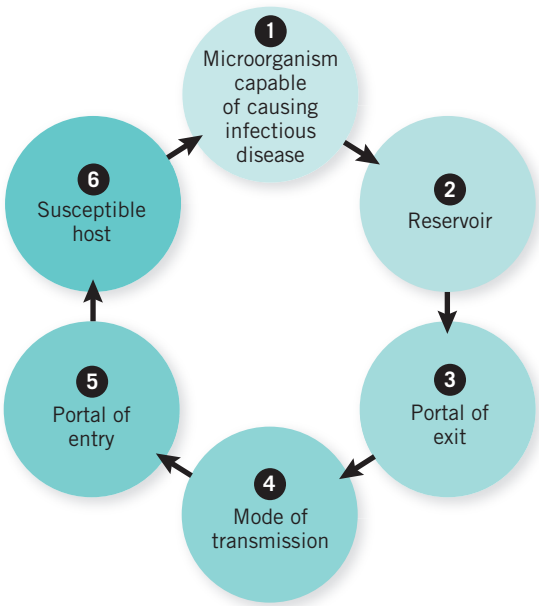

Figure 2-1 The chain of infection. Transmission of microorganisms involves six links.

The Microorganism

The first link in the chain is the microorganism that causes the infection. Many types of viruses, bacteria, and fungi cause infections. Microorganisms that cause infections are called **pathogens**; those that do not are called **nonpathogenic**. Without a pathogenic microorganism, there can be no infection.

The Reservoir

The second link is the reservoir. This is where the microorganisms live. The human body is a reservoir for many different types of microorganisms. They also live in animals, plants, soil, food, and water as well as on surfaces in the environment.

Portal of Exit

The portal of exit is the route by which the microorganism leaves the reservoir. Microorganisms must exit from an infected person or another reservoir to be transmitted to another person. Portals of exit include all natural body openings and breaks in the skin such as tears or wounds.

They also include openings made during medical, dental, and surgical procedures. For example, microorganisms in the lungs can exit the body when a person coughs or sneezes. Microorganisms in the bladder exit in urine, and those in the intestinal tract exit in stool.

Modes of Transmission

Organisms are transmitted from the portal of exit of one person to the portal of entry of a susceptible person. This can happen in several way (modes), including direct, indirect, and airborne transmission:

- **Direct transmission** of microorganisms from one person to another can occur via physical contact such as kissing, skin-to-skin contact, and sexual intercourse. Direct transmission also occurs through **droplet spread**. This occurs when a direct spray of mucus from coughing, sneezing, or talking comes in contact with another person's eyes, nose, or mouth when people are within three feet of each other. Droplet-transmitted diseases such as chicken pox and measles spread quickly among children. Direct transmission also occurs when one person's infected blood or other body fluids come in direct contact with another person's broken skin or mucous membranes.
- **Indirect transmission** occurs when a microorganism is transferred from one person to another via a **vehicle** (some type of inanimate object) or a **vector** (living agent that transmits infection) such as a tick or mosquito. Infectious organisms may be transmitted via soiled linen or dressings and contaminated surfaces, water, and food.
- **Airborne transmission** occurs when microorganisms are carried in aerosols (tiny particles suspended in air) and a susceptible host inhales the particles. The bacteria that cause tuberculosis (TB) are transmitted in this way. TB microorganisms can live in the air, but airborne transmission can be prevented if the facility has proper ventilation and air exchange systems. The measles virus can also be spread this way; it can live up to two hours suspended in air.

Portal of Entry into Host

Most often, the portal of entry is a natural opening in the body. For example, a susceptible host may breathe in microorganisms through the nose and mouth when a nearby person coughs or sneezes. The portal of entry may also be an open wound. This includes skin tears and pressure ulcers. Microorganisms that cause diarrhea can enter a susceptible host's digestive system when a person preparing or handling food did not wash their hands after using the bathroom. Bacteria and viruses that cause sexually transmitted disease can enter through the mouth, vagina, penis, or anus.

Susceptible Host

We are all susceptible to infections caused by viruses, bacteria, fungi, and other pathogens. A resident can become more susceptible to infection due to existing diseases or health conditions. For example, a person with respiratory disease may be more susceptible to inhaled pathogens. Other reasons for increased risk of infection include treatment with steroids or chemotherapeutic agents that weaken the immune system, breaks in the skin, use of invasive devices such as catheters, an unclean environment, or simply advanced age.

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