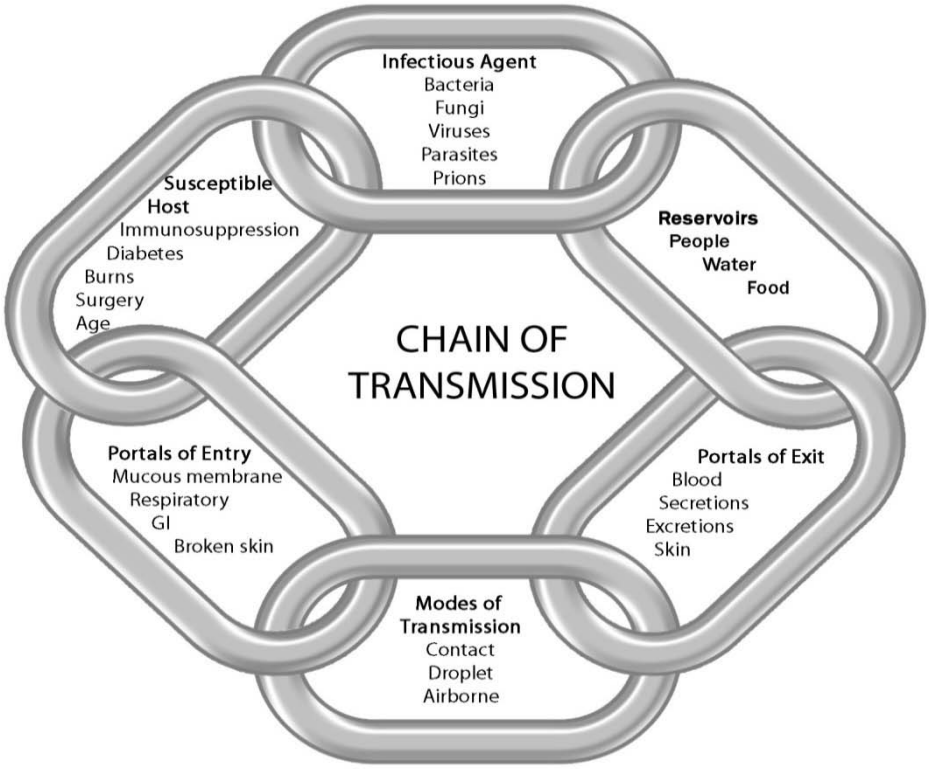
Overview of Chain of Transmission

The chain of transmission is a term or concept used to show how factors or "links" in a "chain" must be present in order for an infection or illness to occur. An infection can only happen if **all six links** in the chain are in place.

The six links in the chain of transmission are listed and shown in Figure 1. Each link of the chain is explained in more detail below the diagram.

1. Infectious agents
2. Reservoir
3. Portal of exit
4. Mode of transmission
5. Portal of entry
6. Susceptible host

Figure 1: The Chain of Transmission.



Source: PHO. (2012). Routine Practices and Additional Precautions

1. Infectious Agent

Infectious agents are capable of causing a disease after entering a person's body. The infectious agent can be a virus, bacteria, fungi, or parasite.

2. Reservoirs

The reservoir is a place where the infectious agent lives and may grow and multiply while it waits for an opportunity to be transmitted or passed along to another person or object. The reservoir can be a person, animal, insect, soil, water, or food. The most common reservoirs in the health care setting are people.

It is important to remember that you cannot always tell simply by looking at someone, whether or not they are carrying harmful germs (i.e. a "carrier"). Sometimes, people may or may not show signs of sickness or an infection. Similarly, the health care setting can be contaminated with microorganisms even when it may **look** clean. A clean appearance does not rule out the possibility that infectious agents are present. When an environment or equipment is not properly cleaned after each use, and the infectious agents are allowed to multiply, they can spread from room to room on our hands, gloves, clothing, or even on the actual cleaning equipment used.

3. Portals of Exit

The portal of exit is the path the infectious agent uses to leave the reservoir. In humans, portals of exit include blood, body fluids, and droplets of fluid expelled by coughing or sneezing.

4. Modes of Transmission

The mode of transmission is the way the infectious agent is transferred from the reservoir to the susceptible host. There are five modes of transmission and in the healthcare setting the most common modes are through direct and indirect contact:

a) Contact Transmission:

- **Direct Person to Person Contact**: This is the most common mode of transmission and can occur from skin to skin contact, especially from a person's hands following sneezing or coughing or following contact with an open wound.

- **Indirect Contact**: Hands pick up infectious agents from contaminated surfaces or equipment and then transfer the microorganisms to another person. This link in the chain of transmission can be broken with good environmental practices and the proper use of gloves and hand hygiene by all HCPs.

b) Droplet Transmission: This involves a person who sneezes or coughs and expels droplets of germs which land on the membranes of someone else's eyes, nose or mouth. These droplets are heavy and usually travel no more than two metres (six feet) before falling to a surface e.g. influenzavirus.

c) Airborne Transmission: This happens when very small particles of the infectious agent are carried and suspended in the air. Anyone breathing that air may be at risk for those infections e.g. tuberculosis.

d) Common Vehicle Transmission: This happens when items such as food, water or other substances such as medication are contaminated and multiple people are exposed to the item. In the health care environment, used cleaning cloths, bar soap, and toilets that are not cleaned properly could be common vehicles for germs to be transmitted.

e) Vector borne Transmission: This happens when an animal or insect carries the infectious agent e.g. hantavirus. HCPs should watch for signs of mice, flies, and other pests in the health care facility and notify their supervisor or the nurse-in-charge immediately if they notice any infestations.

5. Portals of Entry

The portal of entry is the path the infectious agent uses to enter the susceptible host. In humans, portals of entry include broken skin, eyes, nose, mouth, and other open areas. Portals of entry may be the same as portals of exit.

6. Susceptible Host

A susceptible person is one who does not have the proper defenses, or strong enough immune system to fight off the infectious agent. We may all be at risk depending on circumstances, but there are certain factors that increase the risk of being a susceptible host such as:

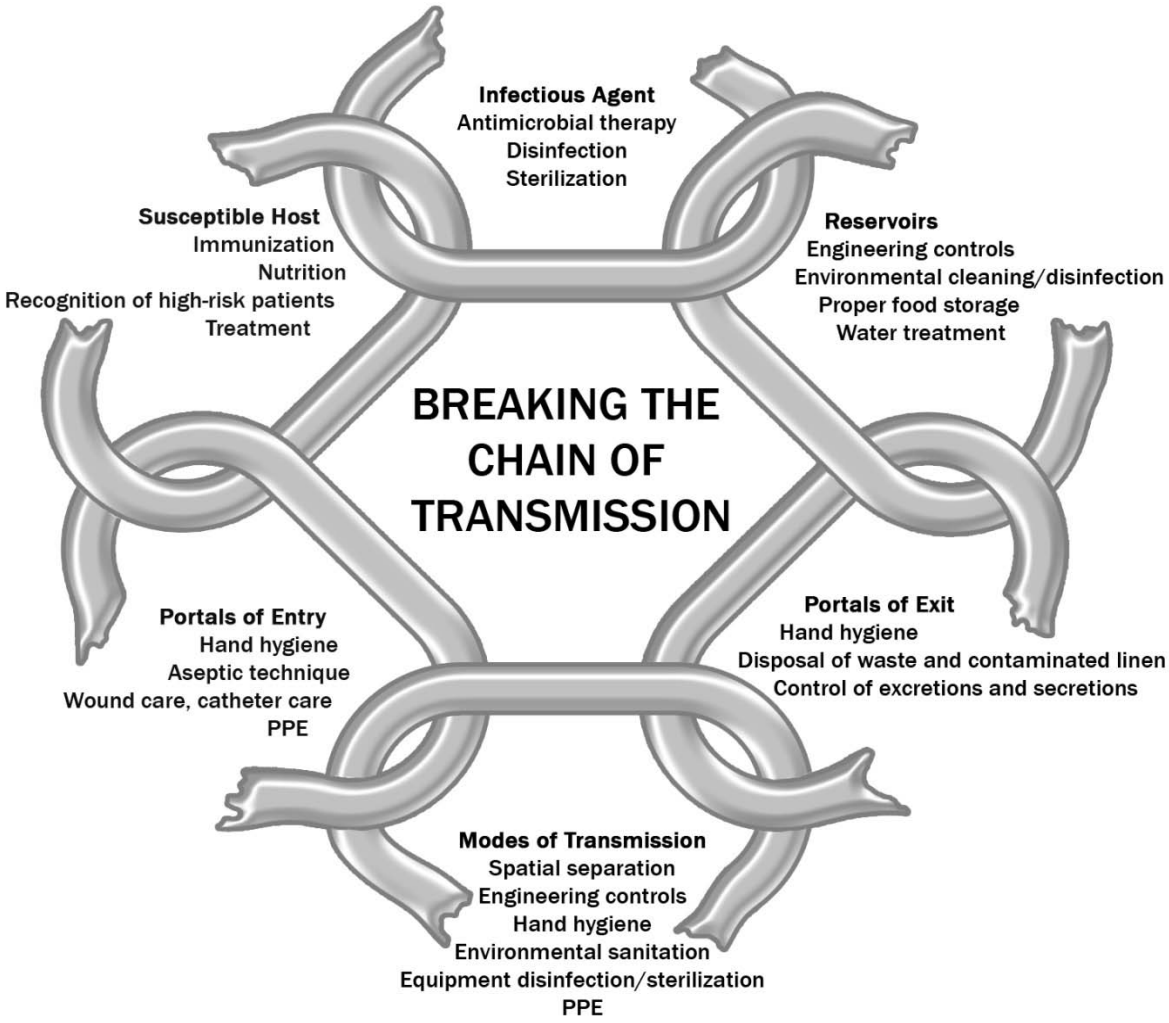
a) Age (very young or very old)
b) Underlying illness (e.g. diabetes and cancer may weaken the immune system)
c) Lifestyle (e.g. poor nutrition and general health will make a person more susceptible)
d) Inadequate immunization
e) Those requiring hands-on care

BREAKING THE CHAIN OF TRANSMISSION

The goal of correct infection prevention and control principles is to break one or more links in the chain of transmission. The chain of transmission can lead to an infection **ONLY if ALL of its links** are in place. In order to stop the transmission of infectious agents, a link in the chain needs to be broken. Good hand hygiene, through frequent use of Alcohol-Based Hand Rub (ABHR) or hand washing with soap and water together with the use of gloves and other protective equipment are some easy ways to help break a link in the chain and therefore stop the spread of microorganisms that could cause infections. The term personal protective equipment (PPE) refers to such items as disposable gloves, gowns and masks with face protection. Personal protective equipment (PPE) is worn to protect the worker from infectious agents and cleaning products, and it also helps stop the spread of microorganisms from the environment to you and to other HCPs and clients. One must be careful to wash one's hands after removing PPE, for PPE can also contaminate hands and spread microorganisms

Figure 2 shows how each of the 6 links in the chain can be broken.

Figure 2: Breaking the Chain of Transmission.



Source: PHO. (2012). Routine Practices and Additional Precautions

Breaking the Chain of Transmission

1. Infectious agent

The following practices either reduce or eliminate the number of microorganisms present:

a) Hand hygiene
b) Routine cleaning
c) Disinfection and/or sterilization of medical equipment and devices
d) Disposable of single use medical equipment and devices

2. Reservoirs

It is important to contain and control the location (or reservoir) of the infectious agent through:

a) Proper cleaning of the environment
b) Proper handling of garbage and waste
c) Disinfecting/sterilizing surfaces and equipment
d) Discarding any food that may have been left out on the counter

3. Portals of Exit

Infection control practices break the chain at the point where the infectious agent leaves the reservoir:

a) Hand hygiene
b) Environmental cleaning
c) Using personal protective equipment (PPE) to cover up portals of exit
   - Ensuring coughs/sneezes are covered
   - Covering wounds
   - Safe disposal of body fluids

4. Modes of Transmission

Creating barriers and providing effective cleaning are ways to control the spread of infectious agents at this link in the chain.

Contact transmission is controlled by:

a) Hand hygiene
b) Personal protective equipment (PPE) such as disposable gloves, gowns and masks with face protection, and hand hygiene after removal of PPE
c) Environmental cleaning
d) Staff staying home when they are sick with something that may be infectious (e.g. rash, fever, cough or diarrhea)
e) Placing clients who are coughing and sneezing in a separate room if possible

Droplet transmission is controlled by:

a) Hand hygiene
b) Covering your cough or sneeze (respiratory etiquette)
c) Placing clients who are coughing and sneezing in a separate room if possible
d) Maintaining a space of 2 metres from a coughing or sneezing person
e) Using of personal protective equipment (PPE)
f) Staff staying home when they are sick with something that may be infectious (e.g. rash, fever, cough or diarrhea)

Airborne transmission is controlled by:

a) Hand hygiene
b) Using personal protective equipment (PPE) with an N95 Respirator and eye protection. Other PPE may be required.
c) Negative pressure rooms
d) Excluding staff with an airborne infection from work
e) Placing clients with a suspected airborne disease such as chickenpox, measles or tuberculosis in a separate room if possible

5. Portals of Entry

Using an effective barrier and other techniques can block the pathway by which the infectious agent can gain entry to the body, therefore breaking the chain.

a) Hand hygiene
b) Use of personal protective equipment (PPE)
c) Prevent skin breakdown
d) Safe use/handling of all sharps (needles etc.)

6. Susceptible host

A person can improve their chances of not becoming a susceptible host by:

a) Keeping their immunizations up to date including annual influenza immunization
b) Maintaining good eating habits
c) Exercising regularly

SUMMARY

All HCPs working in all health care settings must ensure that they are aware of and practicing the proper techniques that reflect current IPAC best practices to mitigate the transfer of infectious agents within the health care setting. They must know how to handle and dispose of body fluids, biomedical waste, regular garbage, and sharps. HCPs must ensure that they are immunized against such diseases as hepatitis B, influenza, tetanus and other immunizations as recommended by the National Advisory Committee on Immunization (NACI), in order to protect themselves from getting vaccine preventable diseases. **It is important to remember that diligent hand hygiene for health care providers and environmental cleaning personnel remains the single most important element in controlling the spread of infections.** Ensuring personal protective equipment such as gloves and masks are worn when required also helps stop the spread of infectious diseases from the environment to you and to other HCPs and clients.

Ensuring that IPAC best practices are in place in each type of health care setting is the cornerstone of ensuring a safe health care environment for HCPs and clients. Preventing infection is everybody's responsibility and healthcare providers who practice good infection control principles can help break the chain of transmission.

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