MEDICAL ENVIRONMENT

Gwen M. Rogers, RN, BS, MS, CIC

Infection Control Manual for the Physician's Office

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About the author

Gwen M. Rogers MS, RN, CIC is the manager of epidemiology at Maine Medical Center in Portland. A nurse for 25 years, she has held certification in infection control for 13 years. She is the founder of Medical Insight, LCC, a consulting service, and is co-founder of RNC NurseWork, Inc. She is a former president for the Association of Professionals in Infection Control and Epidemiology, Inc., Pine Tree Chapter, and is currently involved in the Maine Health Infection Control Consortium.

CHAPTER 1

Pathogens

Providing safe patient care is the goal of every patient encounter, whether that encounter is within an acute care facility, a long-term care facility, or a private physician's office. A basic part of that care is the prevention of the spread of infectious agents, from patient to patient, healthcare worker to patient, or equipment to patient. For most healthcare settings, comprehensive national guidelines exist for the practice of infection prevention and control. Yet there are no such guidelines for the physician's office, even though there are documented cases of transmission of infectious agents in this setting. For example, in 1982, an unusual outbreak of measles occurred in a pediatrician's office in Michigan.[1] Three children, who arrived at the physician's office 60 to 75 minutes after a child with measles had been seen and left, developed measles. Hepatitis B and hepatitis C were transmitted in another private physician's office in New York after multidose vials were contaminated from unsafe injection practices.[2]

This book will help you to set up proper infection control procedures in your office for the protection of workers and patients.

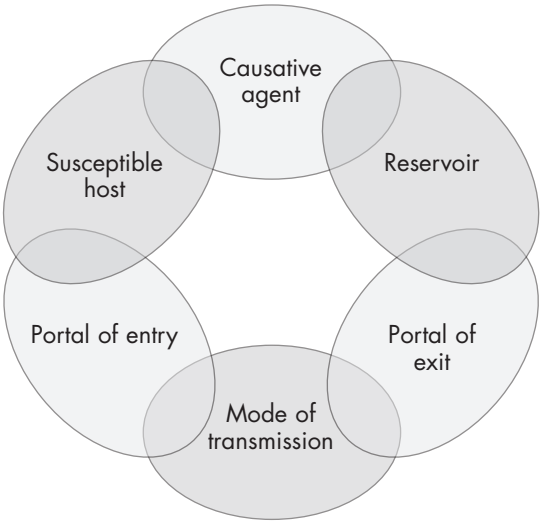
Microorganisms and spreading infection

We all carry bacteria on the outside and inside of our bodies, but we don't all become sick. We get sick when the chain of infection completes itself. Several things need to occur or change to create a condition in which we either are exposed to something new or are not able to control what microorganisms we already have (see Figure 1.1).

Figure 1.1

Chain of infection

We all carry bacteria on the outside and inside of our bodies, but we don't all become sick. We get sick when the chain of infection completes itself.



Infection control glossary

You should become familiar with certain words and phrases that are common to infection control, especially as we progress through the steps of implementing infection control practices in a physician's office.

- *Transmission*: any mechanism by which a pathogen is spread by a source or reservoir to a person
- *Susceptible host*: a person or animal lacking effective resistance to a particular infectious agent
- *Infectious agent*: the first link in the chain; a biological, physical, or chemical entity capable of causing disease
- *Reservoir*: the place the infectious agent can survive
- *Portal of exit*: the path by which the infectious agent leaves the reservoir
- *Mode of transmission*: the method by which the infectious agent reaches the susceptible host
- *Portal of entry*: the means by which the infectious agent enters the susceptible host

The goal of infection control is to break the chain and stop the process before an infection occurs in the new host. Millions of nonpathogenic bacteria live on human skin and mucous membranes. They are there to support bodily functions, such as digestion, and are referred to as normal flora. At times, organisms are found in bodily secretions such as sputum, but they do not comprise an infection. This is called colonization. By definition, **colonization** is the presence of an infectious agent on skin, mucous membranes (e.g., nose, throat, vagina, intestinal tract), or wounds, or in urine, stool, or secretions, without signs or symptoms of infection. The colonizing agent may later cause disease in its host or may be transmitted to other persons and cause disease.

An **infection** is caused when organisms invade the body and start to replicate, causing the body to mount a defense against their invasion. This causes the patient to have symptoms such as redness, fever, pain, and so on. Organisms that cause disease are called pathogens. Some of the categories of pathogens are:

- **Bacteria:** single-celled organism, without a true nucleus, that has a rigid cell wall composed of carbohydrates and other chemicals that provide the basis for the Gram stain. Bacteria can reproduce independently but may need a host to provide food and a favorable environment. Examples of bacteria are *Staphylococcus aureus*, *Streptococcus*, *Escherichia coli*, *Pseudomonas aeruginosa*, anaerobic organisms, mycoplasma, *Chlamydia trachomatis*, and mycobacteria (such as tuberculosis, or TB).

- **Viruses:** a pathogen made up of nucleic acid inside a protein shell that can grow and reproduce only after infecting a host cell. Examples of viruses are influenza; common cold viruses such as adenovirus; rhinovirus; measles; mumps; chickenpox (varicella); hepatitis A, B, and C; HIV; and respiratory syncytial virus.

- **Fungi:** single-cell or multicellular filamentous colonies. They obtain nourishment from dead organic matter or living organisms. Examples of fungi include yeasts such as *Candida*, and mold such as *Aspergillus*. Most fungi are not pathogenic and the body's normal flora contains many fungi. Patients with impaired defenses may have a range of illnesses, from minor to lethal, caused by pathogenic fungi.

- **Parasite:** an organism that lives within, upon, or at the expense of another organism. Examples of parasitic disease include malaria, toxoplasmosis, pneumocystis, worms, and insects such as lice and scabies.

- **Prion:** a small, proteinaceous, infectious particle that is believed to be responsible for some central nervous system diseases in humans. It is different from a virus because of its apparent lack of nucleic acid. Prions collect in the brain and spinal fluid in patients with Creutzfeldt-Jakob disease, a degenerative brain disorder.

Three common reservoirs are associated with infection: human, animal, and environment. Humans who have an infection or are colonized with a microorganism may serve as a means of exposure to a susceptible host. For example, patients who are carrying a disease but are not yet sick from it (i.e., they are incubating the disease) may be able to spread the disease without even knowing it. Mumps is a good example of this. Animals may carry microorganisms that cause disease in humans, such as toxoplasmosis, which may be found in the feces of cats and is dangerous to unborn babies and immunosuppressed patients. The environment may act as a reservoir in the soil of plants, in the water of flowers, or in the air shared with an infectious patient.

Additional examples of reservoirs: Insects, or animals such as skunks, foxes, and bats, are reservoirs of rabies, which is transmitted by bites. Mice and deer are reservoirs of Lyme disease, which is transmitted to humans from ticks that have fed off these reservoirs. Inanimate objects such as food, countertops, sinks, and medical equipment may serve as contaminated reservoirs, as can sources such as stagnant water, which can be a source of *Legionella* (Legionnaires' disease) or *Pseudomonas aeruginosa*. The soil and dust from construction sites may contain *Aspergillus*.

To infect anther person, the microorganism must find a **portal of exit** from the infected host. Some common portals of exit are:

- Coughing, sneezing and respiratory and oral secretions
- Draining skin sores
- Stool or urine
- Drainage of blood and other bodily fluids

Transmission of organisms

Organisms can be transmitted through several possible routes during patient care. If you remember all the potential reservoirs that you as a healthcare worker may be in contact with, you can imagine the possible ways that a microorganism can get from one location to another and find a susceptible host. In this section, we will discuss the basic routes of transmission. We will discuss ways to break that transmission route in just a minute.

Some organisms are spread by **contact**, such as by touching skin to skin with another person, with subsequent movement of microorganisms between the person who has the microorganism and the other person who now acquires it. Transmission can also occur from indirect contact, which is contact of a susceptible host with an item that was previously contaminated; for example, a doorknob, a used needle, an unclean endoscope, or the unwashed hands of a caregiver.

Some organisms are spread through the air via **droplets**. These are relatively large particles that remain in the air for approximately 3 to 5 feet once they leave the infected host. The susceptible host acquires the microorganisms by breathing in the droplets or getting mucous membrane (nose or eye) exposure.

Airborne-spread organisms are a little different from droplet-spread organisms. They are much smaller organisms and are expelled into the air as aerosols (small infectious particles). They remain suspended in the air for longer periods of time and travel longer distances. For example, sharing air with a person who has active TB or measles may put you at risk of the disease even if the person has already left the area. Because of the size of the organism, it can remain in the air longer than other organisms, depending on the exchange and circulation of fresh air in the setting.

Vehicles are the ways the infectious agent is moved from one place to another if there has been no contact of the susceptible host with the infectious source. A vehicle could be contaminated food, water, liquid medication, or vaccine. Another example of vehicle transmission is the contaminated multidose vial that caused the hepatitis B and hepatitis C infections in the physician's office in New York, discussed earlier.

A **vector** is an insect or animal carrier, such as a tick, mosquito, or mouse, that spreads disease from a bite or sting. In an animal vector, the disease-causing organism multiplies or develops prior to becoming infective for a susceptible host.

Portals of entry are the routes and mechanisms of an exposure.

The human body has many defenses against the invasion of microorganisms. However, every time we perform an intervention to a patient that disrupts normal bodily functions or breaks the skin, we put that patient at risk for infection. Body sites that may serve as entry points for microorganisms include nonintact skin; mucous membranes; and the gastrointestinal, respiratory, and genitourinary tracts. Microorganisms can also pass from a placenta to a fetus. The mechanisms of entry may be by ingestion, inhalation, insertion of catheters into the bladder, intravenous catheters, injections through the skin, or surgical incisions, among others.

Risk factors

Despite performing identical procedures on several patients, you will find that not everyone is at the same risk for developing an infection. Several factors influence the outcome of an exposure:

- **Host susceptibility:** A patient may already have immunity from past infections or from immunization, which decreases susceptibility. Impaired host defenses, such as advanced age, prematurity, chronic disease, malignancy, malnutrition, trauma, chemotherapy, and steroids, increase a patient's susceptibility.

  If your patient's natural barriers to infection are present—for example, intact skin, stomach acid, respiratory tract cilia, and cough mechanisms—your patient will be less likely to develop an infection if exposed. If your patient's immune system—for instance, humoral immunity (antibodies), cell-mediated immunity, or inflammatory response—is functioning, he or she may be able to fight off an exposure to an infectious agent without becoming very ill. If your patient's natural barriers are not intact or if his or her immune system is not functioning, your patient may not be able to fight off an infection once he or she is exposed.

- **Virulence of the pathogen:** Some microorganisms have a greater ability to produce disease and become invasive. Other, weaker microorganisms may be thwarted by the body's defenses and never develop into an infection.

- **Dose or inoculum size:** This is the amount of the infectious agent in the exposure. Some diseases require that a large amount of the organism be present to cause an infection, whereas others require a very small amount.

- **Route of exposure:** This needs to be appropriate to the method of transmission. For example, you won't "catch" TB from contact with an environmental surface. It is spread only person to person through airborne exposure.

- **Duration of exposure:** Much like the inoculum size, some diseases need prolonged contact between the infectious agent and the susceptible host to spread effectively. Others are spread quickly from very little exposure.

Endnotes

1. Remington, PL, Hall WN, Davis IH et al. Airborne transmission of measles in a physician's office. JAMA 1985 Mar 15;253 (11):1574-7

2. Transmission of Hepatitis B and C Viruses in Outpatient Settings – New York, Oklahoma, and Nebraska, *MMWR*. 2000 – 2002 52 (38): 901-906, 2003

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