21.4: Sexually Transmitted Infections

Columbian Exchange

This artwork is entitled “Columbus and the Indian Maiden.” It was painted around 1875 by Constantino Brumidi, an Italian-American historical painter. It is a good image to represent the concept of Columbian exchange. This concept refers to the exchange of pathogens during initial contacts between Europeans and Native Americans, starting when Columbus arrived in the New World in 1492. One of those pathogens may have been the sexually transmitted bacterium that causes syphilis. Syphilis is thought to have originated in the New World, and there is some evidence that Columbus himself was infected with it. The first recorded European outbreak of syphilis occurred in 1494. The outbreak began in Italy and quickly swept across the entire European continent. When Europeans were first exposed to syphilis, it was a much more virulent disease than it would eventually become. Back then, pustules covered the body of people with syphilis, and they caused the flesh to fall away from the face. The disease was also usually quickly fatal. In that first European epidemic, syphilis killed an estimated 5 million people.
Introduction to Sexually Transmitted Infections (STIs)

Syphilis is one of many sexually transmitted infections. A sexually transmitted infection (STI) is an infection caused by a pathogen that spreads mainly through sexual contact. This generally involves direct contact between mucous membranes or their secretions. To be considered an STI, an infection must have only a small chance of spreading naturally in other ways. Some infections that can spread through sexual contact, such as the common cold, spread much more commonly by other means, such as airborne transmission. These infections are not considered STIs.

You may have heard sexually transmitted infections (STIs) referred to as sexually transmitted diseases (STDs). The disease terminology is no longer used to avoid the misconception that STIs cannot be transmitted unless one has symptoms of the disease. In fact, many STIs do not cause symptoms but can still be spread by infected people, most of whom are unlikely to even realize they are infected. An even older term for STIs is venereal disease (VD). The term comes from Venus, the Roman goddess of love. The World War I-era anti-VD poster shown below appeals to patriotism to encourage soldiers to avoid becoming infected. During that war, STIs caused the U.S. Army to lose the services of 18,000 servicemen per day.
Transmission of STIs

Most of the pathogens that cause STIs are either bacteria or viruses that enter the body through mucous membranes of the reproductive organs and often through the oral and anal mucosa as well. Pathogens that can only infect the body via direct contact between mucous membranes generally cannot spread through non-sexual skin contact, such as touching, hugging, or shaking hands. All sexual behaviors that involve contact between mucous membranes put a person at risk for infection with STIs. This includes vaginal, anal, and oral sexual behaviors. Some of the pathogens that cause STIs can also be transmitted through body fluids such as blood and breast milk. Therefore, sharing drug injection needles as well as the processes of childbirth and breastfeeding are other ways these STIs can potentially be spread.

Symptoms of STIs

Common symptoms of STIs include sores or rashes on the genitals, a vaginal or penile discharge, and painful urination. Many STIs are asymptomatic or cause such mild symptoms that they go unnoticed. Such infections are called “silent” infections. However, even in asymptomatic people, the pathogens can usually be transmitted to other people. Asymptomatic infections may also eventually cause serious health problems if they go untreated.

Diagnosis and Treatment of STIs

Most STIs are treatable if not curable, but the correct treatment depends on diagnosing the pathogen that is causing the infection. STIs caused by bacteria can generally be cured with antibiotics, although some bacteria may be evolving antibiotic resistance. STIs caused by viruses cannot be successfully treated or cured with antibiotics. Instead, viral STIs are treated with antiviral drugs, which may help control but usually not eliminate the virus. If the immune system cannot eliminate the virus, it may remain in the body for life.
Prevention of STIs

Vaccinations are available to prevent just a few STIs (including human papillomavirus and hepatitis infections). The only completely effective way to prevent other STIs is to avoid all sexual contact and other risky behaviors. Safe sex practices — such as using condoms, having few sexual partners, and maintaining mutually monogamous relationships — can reduce the risk of STIs but not prevent them for certain. Condoms, for example, are not foolproof. Pathogens may be present on areas of the body not covered by condoms, and condoms can also break or be used incorrectly. (See the Feature: My Human Body for the correct way to use condoms.) Practices that cannot prevent the transmission of STIs include washing the genitals, urinating, and/or douching after sexual contact.

Pathogens that Cause STIs

STIs are caused by many different types of pathogens. More than 30 different pathogens have been identified. Most are bacteria or viruses. A few of the pathogens are sexually transmitted parasites.

Parasites that Cause STIs

A very common sexually transmitted parasite is the crab louse (*Pthirus pubis*), pictured below. It lives in human pubic hair where it bites the skin and sucks on blood. This may cause itching and irritation.

Another common sexually transmitted parasite is the single-celled protozoan named *Trichomonas vaginalis*. It infects the vagina in females and urethra in males, causing the STI called trichomoniasis. It may cause burning and itching at the site of infection but is often asymptomatic. It is easily cured with prescription drugs.

![Crab Louse](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/21%3A_Disease/21.4_Vaccinations_for_STIs_(Wakim_and_Grewal)/Figure_21.4.1.jpg)

### Figure 21.4.1: This magnified crab louse is actually only about 2 mm (0.08 in.) long. (public domain; US government via [wikimedia.org](http://www.wikimedia.org)).

Bacterial STIs

Many STIs are caused by bacteria. Some of the most common bacterial STIs are chlamydia, gonorrhea, and syphilis.

Chlamydia

*Chlamydia* is an STI caused by infection with the bacterium *Chlamydia trachomatis*. It is the most frequently reported bacterial STI in the United States. In 2015, an estimated 2.9 million chlamydia infections occurred in the United States.
Chlamydia is most common among young people, with about two-thirds of new cases occurring in people between the ages of 15 and 24. The high rates in young people are apparent in the graph below. More young females than young males are diagnosed with chlamydia each year, largely because of sex differences in testing for the infection.

Chlamydia is transmitted through sexual contact with the penis, vagina, mouth, or anus of an infected sexual partner. Ejaculation of semen does not have to occur for chlamydia to be transmitted or acquired. People who have been treated and cured of chlamydia do not become immune to the bacteria and may become infected again if they have sexual contact with an infected person. Chlamydia can also spread from an untreated mother to her baby during childbirth. In infants infected at birth, the bacteria may infect the eyes, lungs, anus, or genitals.

In women, chlamydia bacteria usually infect the cervix and sometimes the urethra. If symptoms occur, they are likely to include vaginal or urethral discharge or bleeding. Urination may also be painful. The infection may spread from the cervix to the upper reproductive tract, including the uterus and Fallopian tubes, causing pelvic inflammatory disease (PID). PID may also be asymptomatic, but even without symptoms, it can lead to permanent damage and increase the risk of ectopic pregnancy (in which the embryo implants outside of the uterus) or infertility. In men, chlamydia bacteria usually infect the urethra and sometimes the epididymis. If symptoms occur, they typically include a urethral discharge and pain on urinating. Occasionally, there is pain, tenderness, or swelling in one of the testes. In both sexes, the rectum can also be infected. If there are rectal symptoms, they may include rectal discharge, bleeding, or pain.

Chlamydia is easily cured with antibiotics. Because chlamydia is usually asymptomatic; screening is necessary to identify most infections so they can be treated and cured. Screening programs routinely test as many people as possible in high-risk groups using lab tests of patient specimens, such as urine samples or swabs of vaginal, oral, or anal discharge. Screening programs have been shown to reduce the adverse sequela of chlamydia in women (PID, ectopic pregnancy, infertility), so annual chlamydia testing is recommended for women in high-risk groups. These include all sexually active women younger than 25 as well as older women with certain risk factors, such as a new sexual partner, multiple sexual partners, or a sexual partner who has an STI. Pregnant women are also tested during their first prenatal care visit and sometimes again during the third trimester. Routine chlamydia screening is not generally recommended for men because the costs are thought to outweigh the potential benefits.
Gonorrhea is a common STI caused by the bacterium *Neisseria gonorrhoeae*. An estimated 820,000 new cases of gonorrhea occur in the United States each year, but fewer than half of them are actually diagnosed and reported. Approximately 70 percent of cases occur in people aged 15 to 24 years, as indicated by the graph below for the year 2014. Again, sex differences in testing for the disease are reflected in higher rates for females.

Gonorrhea is transmitted through sexual contact with the penis, vagina, mouth, or anus of an infected partner. Ejaculation does not have to occur for gonorrhea to spread. After being cured of gonorrhea, a person can get the disease again through sexual contact with an infected partner. Gonorrhea can also be transmitted from an untreated mother to her baby when the infant passes through the birth canal. The bacteria may infect the baby’s eyes (see photo below) and possibly cause blindness. The baby can also develop a joint infection or a life-threatening blood infection.
Gonorrhea is often asymptomatic, especially in females. If symptoms do occur, they typically include a discharge from the penis or vagina and painful urination. Even when women do not have symptoms of gonorrhea, they are at risk of developing complications from the infection, such as PID and infertility. If left untreated, gonorrhea can also spread to the blood and cause a life-threatening systemic disease.

Because gonorrhea is so often asymptomatic, the majority of cases are diagnosed during routine screening. The Centers for Disease Control and Prevention (CDC) recommend annual gonorrhea screening for all sexually active females younger than 25 years old, as well for older women with risk factors such as new or multiple sex partners. Gonorrhea bacteria are detected with lab analysis of urine or of genital, oral, or rectal specimens. Gonorrhea usually can be cured with proper treatment. Successful treatment has become more difficult as the bacteria have started to evolve resistance to the most commonly used antibiotics. The CDC advises taking two different antibiotics concurrently for the best chances of a cure.

**Syphilis**

*Syphilis* is an STI caused by the bacterium *Treponema pallidum*. During 2015, there were almost 75,000 new cases of syphilis reported in the United States. In some of these cases, the disease was diagnosed for the first time in people with long-term infections.

Syphilis is transmitted from person to person by direct contact with a syphilitic sore, known as a chancre. Chancres occur mainly on the external genitals or in the vagina or anus, but they may also occur on the lips or in the mouth (as shown in the photo below). Transmission of syphilis can occur during vaginal, anal, or oral sex. After being cured of syphilis, a person can get the disease again through sexual contact with an infected partner. A pregnant woman with untreated syphilis can pass the disease to her unborn child at any time during pregnancy or childbirth. Depending on when the bacteria are transmitted to the fetus, the outcome may be stillbirth or early infant death. Untreated syphilis in pregnant women results in infant death in up to 40 percent of cases.
Without treatment, syphilis typically progresses through several stages. The progression of the disease is likely to be stopped only if a person receives appropriate antibiotic therapy. Barring such treatment, an infected person may eventually progress through all of the stages of the disease, a process that may take a decade or more.

1. **Primary syphilis** is the first stage of the disease. It begins with the appearance of at least one chancre. The chancre is usually firm, round, and painless. It appears at the location where the syphilis bacteria entered the body. The chancre lasts from 3 to 6 weeks and then heals, regardless of whether the person is treated.

2. **Secondary syphilis** is the second stage of the disease. It is the most contagious of all the stages and is characterized by the spread of the bacteria throughout the body, causing systemic symptoms such as skin rashes (shown in the photo below) and/or sores on the mucous membranes. Other symptoms may include fever and swollen lymph glands. This stage typically begins about 4 to 10 weeks after the initial infection and generally lasts 3 to 6 weeks.

3. **Latent syphilis** is the third stage of the disease. This stage begins when the symptoms of secondary syphilis resolve, which generally occurs even without treatment. There are no symptoms during the latent stage, but the bacteria are still present in the body. The latent stage of syphilis can last for years.

4. **Tertiary syphilis** is the final stage of the disease. In this stage, the disease may infect and damage internal organs, such as the brain, heart, liver, or bones. A severe joint infection in a person with tertiary syphilis is pictured below. Symptoms of the tertiary stage may include paralysis, blindness, seizures, and dementia. The damage may be serious enough to cause death.
Syphilis is usually diagnosed on the basis of a blood test that detects antibodies that are specific for the syphilis bacterium. Because of the severity of infection in fetuses and the high risk of fetal death, it is recommended that all pregnant women be tested for syphilis at the first prenatal visit. Women at high risk of syphilis should be tested again during the third trimester and at the time of delivery. If a pregnant woman tests positive for syphilis, she is prescribed the antibiotic penicillin, which has a 98 percent success rate at preventing mother-to-fetus transmission. If the pregnant woman is allergic to penicillin, desensitization is required before treatment is given.

Penicillin is also the drug of choice for treating syphilis in the general population. A single intramuscular injection of long-acting penicillin can cure primary, secondary, or early latent syphilis. For people with late latent or tertiary syphilis, three doses of penicillin administered at weekly intervals are generally required for a cure. If patients are allergic to penicillin, other antibiotics may be used, but they tend to be less effective and require retesting for syphilis after treatment to ensure that a cure has occurred. Antibiotics kill the syphilis bacteria and prevent further damage, but they do not repair any damage that is already done.

Viral STIs

Two very common viral STIs are described below: genital herpes and HPV infection. Another important viral STI is HIV infection, which causes the disease known as AIDS. HIV infection is covered in the concept HIV and AIDS.

Genital Herpes

Genital herpes is a viral STI caused by a herpes simplex virus. The cause of genital herpes is most often herpes simplex virus type 2 (HSV-2). Increasingly, however, genital herpes is caused by herpes simplex virus type 1 (HSV-1). HSV-1 more commonly causes herpes infections of the mouth, resulting in "cold sores," and is typically acquired during childhood. Genital herpes infections are very common in the United States, with about three-quarters of a million new cases occurring each year. HSV-2 infection is more common in women than men due to sex differences in transmission of the virus: genital herpes is more easily transmitted from males to females than from females to males.

Generally, a person can get an HSV-2 infection only through sexual contact with someone who has an infection with the virus. Transmission occurs through contact with lesions, mucosal surfaces, or genital or oral secretions. Transmission can occur even when the infected person does not have visible sores because the virus can be shed from body surfaces.
that appear normal. Genital herpes can also be passed from mother to child during pregnancy, childbirth, or shortly after birth.

Most people who are infected with genital herpes are unaware of their infection. In fact, in the United States, almost 90 percent of 14-49-year-olds infected with HSV-2 have never received a clinical diagnosis. That's because most genital herpes infections are asymptomatic or have very mild symptoms that go unnoticed. When noticeable symptoms do occur, they typically appear as one or more blisters on or around the genitals (see the photo below), rectum, or mouth. When the blisters break, they leave painful ulcers that take up to a month to heal. Sometimes the initial outbreak is accompanied by systemic symptoms such as fever and swollen lymph nodes. Recurrent outbreaks of blisters are common, especially during the first year of infection. Although the virus is likely to stay in the body indefinitely, the number, duration, and severity of outbreaks tend to decrease over time. Rare but serious complications of HSV-1 or HSV-2 infections may include blindness, encephalitis, or meningitis.

Figure \(\PageIndex{10}\): The appearance of blisters on the vulva and in the vagina (black arrow) is a sign of genital herpes. (CC0; Mikael Häggström via Wikimedia Commons).

Herpes infections can be diagnosed with blood tests that detect antibodies to the virus. There is no cure for herpes infections, but antiviral medications can prevent or shorten outbreaks and lessen the risk of transmission during the time the patient is taking the medicine. Several clinical trials have tested vaccines against genital herpes, but none has yet been found to be effective. Pregnant women with genital herpes are usually prescribed antiviral medication during the last month of pregnancy to reduce the risk of an outbreak around the time of birth when the transmission is most likely. If an outbreak does occur, a cesarean delivery is recommended to prevent HSV transmission to the infant.

**HPV Infection**

The most common sexually transmitted infection in the United States is infection with the human papillomavirus (HPV). Almost 80 million Americans are estimated to be infected with HPV, and about 14 million people are thought to
become infected each year. HPV is so common that nearly all sexually active people are eventually infected by it. There are more than 40 different types of HPV, but only some of them are likely to cause health problems.

HPV is acquired through vaginal, anal, or oral sex with someone who is infected with the virus. The infected person can transmit the virus even without showing any signs or symptoms of infection. In most cases, the immune system naturally clears HPV from the body before it causes any symptoms — generally within a couple of years of the original infection. However, in some cases, HPV is not naturally cleared. These cases may develop health problems years after the infection was first acquired. Some types of HPV can cause genital warts, and certain other types can cause cancer.

- Genital warts appear as one or more bumps on the skin or mucosa in the genital area. Warts may be small, like the genital wart in the photo below, or they may be much larger. Warts may be raised or flat; sometimes they are shaped like a cauliflower.
- The primary cancer caused by HPV is cervical cancer. However, HPV can also cause other cancers, including cancer of the vulva, vagina, penis, anus, or throat and mouth. It generally takes years or even decades for cancer to develop after a person is infected with HPV.

![Genital Wart](https://image via Wikimedia.org)

There is no cure for HPV infection. Once a person is infected, if the immune system does not clear the virus, it may remain in the body for life. There is also no general screening test to determine whether someone is infected with HPV. However, there are specific HPV tests that can identify the most common types of HPV that cause cervical cancer. These tests are recommended for women aged 30 and older. Women aged 21 to 65 should also receive routine Pap tests every 3 years to screen for cervical cancer, which has a high cure rate if it is discovered early.

Genital warts can usually be diagnosed visually by a healthcare provider. There is typically no need to treat warts unless they are unsightly or bothersome. Treatment consists of topical medications that cause warts to slowly resorb and disappear. However, treatment of genital warts does not get rid of the patient’s HPV infection, and warts may return. If genital warts are not treated, they may or may not eventually go away on their own.
Unlike the other STIs described above, infection with the most common and dangerous types of HPV can be prevented with a vaccine. HPV vaccine is recommended for all girls and boys between the ages of 11 and 12 years. Young people who do not get vaccinated at those ages can still get the vaccine through age 21 (for males) or 26 (for females). The main purpose of the vaccine is to protect people from developing HPV-related cancers later in life.

Feature: My Human Body

Proper use of condoms can significantly reduce the risk of transmission of STIs. For infection protection, the best condoms to use are latex condoms, because some pathogens are able to pass through the tiny pores in natural skin condoms. When using male condoms, follow these guidelines for the most effective prevention of STI transmission:

- Always use a new condom; never reuse a condom, even if it does not contain ejaculate.
- Avoid putting on a condom tightly at the end. Leave about 1.5 cm (3/4 in.) of empty space at the tip of the condom to allow room for ejaculate. Otherwise, the force of ejaculation may cause the condom to fail.
- Avoid inverting or spilling a condom once worn, whether or not it contains ejaculate.
- If the user attempts to unroll the condom over the penis but realizes it is on the wrong side, the condom should be discarded and a new one used.
- Be careful when handling a condom, especially with long fingernails.
- Avoid using oil-based lubricants with latex condoms because the oil can weaken the latex.
- Avoid using flavored condoms, especially for vaginal intercourse, because the sugar in the flavoring may encourage yeast infections.

Summary

- A sexually transmitted infection (STI) is an infection caused by a pathogen that spreads mainly through sexual contact. This may include vaginal, anal, and/or oral contact.
- Most STIs are caused by pathogens that can infect the body only via direct contact between mucous membranes. Such pathogens generally cannot spread through non-sexual skin contact, although some can also be transmitted through body fluids such as blood and breast milk.
- Types of pathogens that are sexually transmitted include parasites, such as crab lice and the protozoa that cause trichomoniasis; bacteria, including those that cause chlamydia, gonorrhea, and syphilis; and viruses, such as those that genital herpes, genital warts, and AIDS.
- Common symptoms of STIs include genital sores, genital discharge, and painful urination. However, many cases of STIs are asymptomatic.
- Bacterial STIs can generally be cured with antibiotics. Viral STIs can be treated with anti-viral drugs, but the viruses may not be completely eliminated.
- If STIs go untreated, some may eventually lead to more serious diseases, especially in females, who may develop the pelvic inflammatory disease (PID) and its sequelae of infertility or ectopic pregnancy. Untreated syphilis is dangerous in both sexes. It typically advances through several stages over the decades to invade internal organs and cause death.
- A few STIs can be prevented with vaccines. An example is a human papillomavirus (HPV) infection, which sometimes leads to genital warts or cervical cancer. The HPV vaccine is recommended for all girls and boys aged 11-12 years old.
- For STIs without vaccines, avoiding sexual contact is the only sure way to prevent transmission. Practicing safe sex
behaviors — such as proper condom use — can greatly reduce but not totally eliminate the risk of transmission.

Review

1. Define the sexually transmitted infection.
2. Describe how sexually transmitted pathogens are spread.
3. Give examples of different types of sexually transmitted pathogens.
4. Describe common symptoms of STIs.
5. Contrast treatments for bacterial and viral STIs.
6. Why is it important to treat STIs even if they do not cause symptoms?
7. Discuss the role of vaccines in preventing STIs.
8. What are ways to prevent transmission of STIs for which there are no vaccines?
9. Name two STIs that often go unnoticed because they commonly do not cause symptoms, or cause only very mild symptoms.
10. True or False. Proper use of condoms can completely prevent the transmission of STIs.
11. True or False. Antibiotics can be used to treat genital herpes.
12. What is the most common STI in the United States?
13. Describe the relationship between cancer and an STI.
14. What are two reasons why the number of diagnosed cases of some STIs is higher in females than in males?

Explore More

https://bio.libretexts.org/link?17747#Explore_More

Often times there is so much shame and stigma associated with contraction of STI's that infected persons don't seek treatment. Learn more here:
Chlamydia is one of the most prevalent bacterial STI's and very easy to treat. Check out this video to learn more: