UNIT 1

Introduction to Infectious Diseases

Instructor’s Background Text

PKIDs’ Infectious Disease Workshop

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Acknowledgements

Producing this workshop has been a dream of ours since PKIDs’ inception in 1996. This project was two years in the making, and many people helped us reach our goal. It’s not done, because it is by nature a living document that will evolve as science makes strides in the research of infectious diseases, but it’s a great beginning.

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*Warning: This section contains certain disease-related images that may not be suitable for young children.*

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For educational activities and resources, please visit www.pkids.org/idw.

This publication contains the opinions and ideas of its authors. It is intended to provide helpful and informative material on the subject matter covered. Any information obtained from this workshop is not to be construed as medical or legal advice. If the reader requires personal assistance or advice, a competent professional should be consulted.

The authors specifically disclaim any responsibility for any liability, loss, or risk, personal or otherwise, which is incurred as a consequence, directly or indirectly, of the use and application of any of the contents of this workshop.
Introduction

PKIDs (Parents of Kids with Infectious Diseases) is a national nonprofit agency whose mission is to educate the public about infectious diseases, the methods of prevention and transmission, and the latest advances in medicine; to eliminate the social stigma borne by the infected; and to assist the families of the children living with hepatitis, HIV/AIDS, or other chronic, viral infectious diseases with emotional, financial and informational support.

Remaining true to our mission, we have designed the *Infectious Disease Workshop* (IDW), an educational tool for people of all ages and with all levels of understanding about infectious diseases. In this workshop, you will learn about bacteria and viruses, how to prevent infections, and how to eliminate the social stigma that too often accompanies diseases such as HIV or hepatitis C.

We hope that both instructors and participants come away from this workshop feeling comfortable with their new level of education on infectious diseases.

The IDW is designed to “train-the-trainer,” providing instructors not only with background materials but also with age-appropriate activities for the participants. Instructors do not need to be professional educators to use these materials. They were designed with both educators and laypersons in mind.

The IDW is comprised of a master Instructor’s Background Text, which is divided into six units: Introduction to Infectious Diseases, Disease Prevention, Sports and Infectious Disease, Stigma and Infectious Disease, Civil Rights and Infectious Disease, and Bioterrorism and Infectious Disease.

For each unit, instructors will find fun and helpful activities for participants in five age groups: 2 to 6 years of age, 6 to 9 years of age, 9 to 12 years of age, 13 to 18 years of age and adults.

We welcome any questions, comments, or feedback you may have about the IDW or any other issue relating to infectious diseases in children.

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PKIDs’ INFECTIOUS DISEASE WORKSHOP

About Infectious Diseases

Infectious diseases are scary—in part because most of us don’t know anything about them. They are also scary because they can be lethal. Unless we happen to be healthcare professionals, or our loved ones have been personally affected by such diseases, we only think about them when they threaten our families, our communities or ourselves.

This module helps advance our understanding of infectious diseases and provides perspective on the role they play in our lives.

What Is An Infectious Disease?

Weber State University Online explains it this way:

Although many complex factors surround the definition of infectious disease, some generalizations can be made. An infection can be defined as a state in which microorganisms, bacteria, viruses, fungi and parasites survive and reproduce in the host's tissues. In many instances no noticeable changes (or symptoms) are apparent.

When the organism produces sufficient tissue damage through many different mechanisms, the definition of infectious disease then applies. As in hepatitis, when liver cells are invaded and damaged by the virus. Symptoms then result and can be determined through clinical examination and laboratory tests.

In other words, a microorganism (an organism that’s too small to be seen with the naked eye) latches onto or inside of us, reproduces, and does some damage. Sometimes, the actual damage is done not by the microorganism, but by our own immune systems fighting the invaders.

The microorganisms can spread person-to-person, animal-to-person or insect-to-person. While there are several types of microorganisms, this workshop focuses primarily on viruses and bacteria.

How Widespread Are Infectious Diseases?

The World Health Organization (WHO) reports that:

Infectious diseases are responsible for a quarter to a third of all deaths worldwide and children under the age of five account for over half of all deaths in this group. As of 2004, five of the top ten causes of death were due to infectious diseases.
According to the Centers for Disease Control and Prevention (CDC), the United States is not immune to infectious diseases:

College students get the mumps, whooping cough is on the rise, hepatitis C and B and HIV are not under control, herpes affects young and old, meningitis maims and kills, influenza is an ongoing battle, MRSA is spreading and these are just a few of America’s challenges.

**Historic Perspective Of Infectious Diseases**

If we could see millennia into the past, before people started forming societies, we would probably see them living isolated from one another—nomadic in nature. This lifestyle was a natural barrier to the spread of infectious disease. But, when they started clustering together, planting crops and staying in one place, infectious diseases surfaced and became lethal foes of humanity.

Cities grew, people started traveling for business, soldiers traveled for war, and they were all prime candidates to be carriers of disease. Just as in the recent past, when the Native American population was decimated by the diseases brought in by the Europeans, so too have populations in the past two thousand years been seriously affected by a disease’s introduction into their society. Bayer Pharmaceutical’s *A Brief History Of Infectious Disease* illustrates this phenomenon:

- **430 BC, the plague of Athens** resulted from 200,000 inhabitants and villagers fleeing into Athens when threatened by the Spartans. An unidentified infectious agent, from Ethiopia via Egypt, killed one-third of this population and ended the Golden Age of Athens.

- **166 AD, the Antonine plague** was brought to Rome from Syria by returning Roman troops. The plague had been introduced to Syria from India by the marauding Huns. The plague (probably smallpox, bubonic plague, and measles) devastated the Roman Empire, killing 4–7 million people throughout Europe. The resulting social and political upheaval led to the collapse of the Roman Empire.

- **Circa 160 AD, bubonic plague (‘Barbarian boils’)** carried by invaders from the north, led to the collapse of the Han Empire in China.

- **1346 to 1350, the bubonic plague** pandemic started in China and moved along the trade routes through South Russia to the Crimea, which was besieged at the time. This bubonic plague killed more than one-third of the population of Europe.
• 1492, influenza, smallpox, tuberculosis and gonorrhea began when Columbus went to the Caribbean. The local inhabitants did not have immunity to these endemic European infections, and as a consequence, the 8 million people on the island of Hispaniola (where Columbus first set foot in the New World) died. Replacement of the population by African slaves introduced African infectious diseases such as malaria and yellow fever into the Caribbean and Americas, which, in turn, killed many European settlers.

• 1542, bubonic plague started in Egypt, killed 40 percent of the population of Constantinople, and spread all over Europe.

• Early trading period, blackwater fever (malaria), yellow fever, bloody flux (dysentery), and worm infestations made trading with the continent of Africa difficult. The impact on travelers and soldiers was so severe that Africa was called ‘the white man’s grave.’

• 16th century, similarly devastating epidemics with European and then African infections – introduced by the Spanish into Central and South America. After the Spanish invasion, the population of Mexico decreased by 33 percent in 10 years and by 95 percent in 75 years.

• As trade journeys lengthened, chronic infections such as tuberculosis and venereal diseases were introduced by European sailors to the Pacific islands, which lost 95 percent of their population as a result.

• Present time, even during the past few decades, there has been a resurgence of epidemics such as Lyme disease and Rocky Mountain spotted fever in the United States and AIDS, genital herpes, and chlamydia worldwide.

The Golden Age Of Microbiology (1857-1914)

Because bacteria and viruses are too small to be seen with the naked eye, until 350 years ago, humans weren’t sure what caused infectious diseases. Then, sometime in the mid-to late-1600s, a Dutchman named Antonie van Leeuwenhoek discovered microorganisms while looking through a microscope he had designed that could magnify over 200 times.

The microscope wasn’t capable of allowing van Leeuwenhoek to identify viruses, which are much smaller than bacteria. They were discovered in the late 1800s by Dmitri Iwanowski and Martinus Beijerinck, two scientists working separately who, through a process of filtering that captured anything the size of bacteria but allowed an as-yet unknown substance to filter through and cause infection, discovered what we now call viruses. Beijerinck called this substance a “soluble living germ.”

It wasn’t until 1940, with the use of electron microscopy, that viruses were actually seen.
Although it has been presumed that viruses are smaller than bacteria, an August 2002 issue of the journal *Nature* presented a finding by scientists stating they have found a bacterium they call SAR11 that is smaller than some viruses. This bacterium may be the smallest living thing on Earth. It is only half a micron across, or 1/50,000th of an inch.

The Dutchman van Leeuwenhoek discovered a world of tiny organisms, but it wasn’t until the work of Louis Pasteur and Robert Koch in the 1860s and 70s that the germ theory of disease was developed and proved. This theory states “a specific disease is caused by a specific type of microorganism.”

Around the same time, Joseph Lister, an English surgeon, demonstrated with carbolic acid that keeping open wounds, operating tables, surgical instruments, operating rooms and surgeons clean significantly reduced death by infection.

Between 1882 and 1886 Koch and a few other scientists discovered that various species of bacteria caused such diseases as tuberculosis, cholera, diphtheria, typhoid fever, gonorrhea and pneumonia.

Scientists identified a few toxins (the poison from bacteria that does cell damage) and developed some antitoxins (antibodies that can neutralize toxins). They proved how some diseases, like yellow fever, are transmitted (by mosquitos). It was a boom time for microbiologists that brought our understanding of infectious diseases a long way in a very short time.

Before these theories were established, people thought diseases were caused by such things as bad or foul smelling air, earthquakes or sin. Treatment frequently came from nature—almost any plant one could think of was boiled, brewed, smoked or eaten. Urine and animal waste were used in poultices and cuts were made in the skin to drain blood or leeches were placed on the skin to suck blood from the body. Hot baths and enemas were also favorite methods of ridding the body of disease. A patient was as likely to die from the “cure” as the disease.

Humans did reach the point where they understood that germs brought disease and that cleanliness, or asepsis, helped prevent infection from spreading. From that point, they had to find a way to “kill the germs without killing the patient.”

Unfortunately, the First World War interrupted the lives of many people around the world, including microbiologists, and temporarily derailed the Golden Age of Microbiology.
The Chemical Cures And Treatments

There was one significant find just before the Golden Age of Microbiology was interrupted by World War I—German physician Paul Ehrlich and his research team put together a chemical compound called Salvarsan 606 (salvarsan meaning “that which saves by arsenic” and 606 because it was the 606th compound they tried) that he derived from arsenic for the cure of syphilis.

Ehrlich also discovered antibodies in the blood and called them “magic bullets” because specific antibodies could kill specific bacteria.

After the war was over, the scientists returned to their work in microbiology. Many of them had seen too many deaths from infection in battlefield hospitals and were determined to find cures for these diseases.

Most people have heard the story of penicillin, the first antibiotic (meaning: destructive to life). In a London lab in 1929, while cleaning up some old petri dishes in which he’d been growing bacteria, physician Alexander Fleming noticed some mold had grown on one of the dishes and all around the mold, the bacteria had been killed. He identified the mold as being from the penicillium family. He wrote up a paper on the potential uses of penicillin, but it didn’t get much notice. He was not a chemist and was ultimately unable to thoroughly research the event he had noted. It wasn’t until World War II that scientists became interested in penicillin (now called penicillium notatum) and developed it into a useful antibiotic.

About Antibiotics

Scientists have discovered and developed a plethora of antibiotics in the last 75 years. According to Taber’s Cyclopedic Medical Dictionary, there are several types of antibiotics:

- Bactericidal—an antibiotic that kills microorganisms.
- Bacteriostatic—an antibiotic that inhibits the growth of microorganisms.
- Beta-lactam—any of the antimicrobial drugs, such as penicillins or cephalosporins, which kill germs by interfering with the synthesis of bacterial cell walls.
- Broad-spectrum—an antibiotic that is effective against a wide variety of microorganisms.
- Narrow-spectrum—an antibiotic that is specifically effective against a limited group of microorganisms.
Antibiotics are truly life-savers, but if taken improperly, they can help create super bugs, germs that are resistant to the effects of some or even all existing antibiotics. This problem can occur when someone is given an antibiotic to take for 10 days but stops taking it after six days because he or she feels better. The antibiotic had time to kill off many of the germs, but not the tough ones who were putting up a fight. So, the super-resistant germs survive and are harder to kill the next time.

Antibiotics are not effective against viruses because antibiotics stop or reduce cell construction. Taking antibiotics unnecessarily for colds, sore throats and other viral illnesses is another contributor to antibiotic resistance. Bacteria reproduce by building their own cells; viruses don’t build their own cells, instead they use our existing cells to reproduce. To kill viruses, we have to kill our own cells, which is where viruses reside.

**Humans Vs. Microbes**

To battle viruses, we develop vaccines and immunize people against various viral infections, or we develop antivirals—drugs that attempt to stop viruses from replicating or that beef up our cells’ defense systems so that viruses can’t use our cells to replicate.

According to Todar’s Textbook of Bacteriology:

> Most microbiologist[s] distinguish [between] two groups of antimicrobial agents used in the treatment of infectious disease: antibiotics, which are natural substances produced by certain groups of microorganisms, and chemotherapeutic agents, which are chemically synthesized. A hybrid substance is a semisynthetic antibiotic, wherein a molecular version produced by the microbe is subsequently modified by the chemist to achieve desired properties. Furthermore, some antimicrobial compounds, originally discovered as products of microorganisms, can be synthesized entirely by chemical means.

They might be referred to as synthetic antibiotics to distinguish them from the chemotherapeutic agents.

Humans have managed to conquer only one microbe with our science—the smallpox virus. The last natural case of smallpox infection was in Somalia in 1977. However, because we kept some of the virus in labs after natural infection was eliminated on Earth, we are in danger of it coming back as a weapon of bioterrorism.
Our Bodies As Curative Agents

We don’t always have to depend on drugs for our cures. Our bodies are capable of curing, or at least protecting, themselves. The American Museum of Natural History explains how this happens:

*When harmful microbes, or germs, enter the body, they multiply and cause disease. This is called infection. The body's defenses usually do a killer job of squelching harmful microbes. But sometimes germs multiply faster than the body can handle—and we get sick. People come in contact with germs in many ways, including:*

- **Contaminated blood**: Harmful microbes can enter the body through the bloodstream.

- **Infected food or water**: Dangerous microbes can enter through the mouth if we drink untreated water or swallow food that's uncooked or unwashed.

- **Disease-carrying creatures**: Harmful microbes can enter the body through close contact with infected creatures.

- **Germy air**: Dangerous microbes can spread through the air and enter the nose and mouth when we breathe.

*The body's first line of defense against germs includes skin, mucous membranes in the nose and throat, tears, the tiny hairs in the nose, bleeding, peeing, and sweating. These protectors either block harmful microbes from entering the body, or wash them away.*

*If germs get beyond the first line of defense, the blood has a second line of defense known as the immune system. If germs enter the bloodstream, they will be attacked by cells called macrophages (also known as white blood cells). These cells will gobble and dissolve any foreign microbes. The body also produces antibodies that go after specific diseases. For example, if we have already had chickenpox, then our body's chickenpox antibodies will make sure that we don't catch that disease again. If our doctor gives us a vaccine for a particular disease, it helps our body create antibodies for that disease. Then our body will be able to fight it in the future.*

The Problem with Microbes

It is important to note that while great strides have been made in the fight against bacteria, we’re still struggling to find ways to kill viruses once they have infected us. At best, we can sometimes control them.
Although we can kill viruses on our bodies and other surfaces with disinfectants, it’s difficult to kill them when they’re living inside our cells. When we’re infected with a virus, it takes up residence in one of our cells and uses the cell’s machinery to reproduce itself. Developing a drug that will kill the virus without disrupting the intracellular machinery of uninfected cells is no easy task.

Bacteria, on the other hand, generally live outside of our cells and are easier targets.

There are some bacteria that have developed a resistance to not just one drug, say for instance penicillin, but to many such drugs. They’re known as multi-drug resistant microorganisms such as *Streptococcus pneumoniae* and *Mycobacterium tuberculosis*, germs that we thought were very much under control and are now surging back into the population.

The folks at the University of Georgia College of Agricultural and Environmental Sciences put bacteria into perspective this way, “Bacteria vary somewhat in size, but average about 1/25,000 inch. In other words, 25,000 bacteria laid side by side would occupy only one inch of space. One cubic inch is big enough to hold nine trillion average size bacteria—about 3,000 bacteria for every person on earth.

“Bacteria make up the largest group of micro-organisms. People often think of them only as germs and the harm they do. Actually, only a small number of [the thousands of different] bacteria types are pathogenic (disease-causing). Most are harmless and many are helpful.”

Neal Rolfe Chamberlain, professor at the Kirksville College of Osteopathic Medicine, explains viruses in this manner, “Viruses are very small forms of life. In fact, people still argue over whether viruses are really alive. Viruses range in size from about 20 to 300 nanometers (nm). A nanometer is 0.000001 of a millimeter. A millimeter is 1/25 of an inch. So in other words, you can place 25,000,000 nanometers in an inch. If the biggest virus is 300 nm then you could fit 83,333 of that virus in an inch.

“Viruses are major freeloaders. They cannot make anything on their own. To reproduce they must infect other living cells. Viruses infect bacteria, parasites, fungi, plants, animals, and humans. No one escapes them. If you have had the flu, chickenpox, measles, a common cold, mono, a cold sore, or a sore throat you have been infected by a virus!”
Some viruses, like HIV and hepatitis C, tend to develop strains that can resist mono drug therapy (treating the patient with one drug at a time). We have to try and control the viruses with combination, or “cocktail” drugs (treating the patient with several drugs at once), although even that approach does not always work. Some viruses can keep mutating until we’ve run out of drugs to try.

Regional Or Geographic Occurrences Of Diseases

Some diseases occur primarily in certain climates and geographic regions. For example, African sleeping sickness is found in tropical Africa. This disease is caused by a microorganism carried by the tsetse fly that only lives in that region.

Lyme disease is not a problem in the tropics, but occurs in forested areas where infected ticks can be found.

Some diseases are more likely to happen during certain seasons, such as the flu, and other diseases occur more frequently based on crowded living conditions or access to safe drinking water. When diseases depend on a certain climate or environment or carrier/parasite, they often stay in a specific region. But some diseases are able to spread to new regions and continents, because they can be transmitted person-to-person, or because an infected bird makes it across an ocean, lands on new shores and is promptly bitten by a mosquito, which in turn passes the infection on to humans.

Some examples of global transmission include HIV, which probably originated in Africa, and the West Nile virus, which is believed to have come from the Middle East. With global travel, many diseases that were once limited to specific geographic regions such as Asia, Africa or Central Europe, can now occur on every continent.

Bacteria and Viruses—How They Work

Bacteria

There are thousands of types of bacteria and most are harmless or even beneficial. However, even “good” bacteria, if they find their way to the wrong place, can cause harm. For example, bacteria that live in our mouth can cause illness if they find their way to the middle ear and cause an ear infection. Also, some bacteria that ordinarily do not cause disease in persons with a working immune system, may do so in people with a weakened immune defense system. In general, infants and older people with a weakened immune system have more serious disease.
Most bacterial diseases occur when bacteria multiply rapidly in tissue, damaging or killing it. Boils result from the multiplication of bacteria in the skin. Other bacteria cause disease by producing toxins or poisons. Tetanus is a disease that begins after bacteria that normally live in soil enter the body through a wound. The bacteria produce a poison that affects muscles and nerves far away from the wound.

To cause illness in humans, bacteria need to be able to gain access to the human body, reach their unique place within the body and multiply there. The human body has developed several strategies to make life as difficult as possible for disease-causing or pathogenic bacteria, but bacteria have also learned how to break down our defenses.

An infection by pathogenic bacteria can be seen as a miniature battle between bacteria and host. Bacteria try to survive and feed and multiply, while the human body’s immune system tries to prevent this. The resulting infection is a process with three possible outcomes:

- The immune system wins and the bacteria are removed, possibly with the help of medications.
- The bacteria win the ultimate battle and kill their host (bacterial infections are a major cause of death, especially for children and elderly people).
- An equilibrium is reached in which host and bacteria live in relationship together and damage is minimized.

**Viruses**

All viruses live to make more viruses, and they usually make more viruses by invading a host’s cell (for instance, one of the cells in our bodies) and using the host cell’s “machinery” to churn out more of themselves.

Once the viruses mature, they leave the host cell and go find many more host cells to set up shop in so that they can start churning out more of themselves.

Sometimes, there is a hitch in the churning process. During viral replication, mutations can occur.

The mutation can be bad enough to interfere with the virus’s ability to duplicate itself. Or, it might just create a new strain of the virus. The influenza virus does this, which is why every year, each new strain of flu virus must be identified in order to make a vaccine that is effective against it.
Humans are able to fight off viruses in several ways:

- Proteins called interferons help neighboring cells resist infection by the virus.

- If interferons fail, the immune system kicks in and fights the infection by killing the virus floating around outside the host cells and killing infected host cells. (HIV is the exception, because HIV infects cells of the immune system that are necessary to kill the infected cells.)

- There are drugs that help the body fight certain viral infections. They hinder or stop the replication of the virus and are known as antivirals/retrovirals.

**Understanding**

A basic understanding of what these microbes are and how they work gives us a sense of control and helps put our fear into perspective. While we may not know everything there is to know about pathogenic microbes and the diseases they cause, we are aware of many methods for preventing infectious disease transmission. This workshop helps build the knowledge base of the participant by introducing the world of microbes, exploring methods of disease transmission and the characteristics of several infectious diseases common in the U.S., and presenting easy ways to prevent infection in ourselves and the children in our care.
Fun (And Some Not-So-Fun) Facts About Infectious Diseases

Amazing Microbe Facts & Tales
(source: American Society of Microbiology)

Microbe Saves Village from Nazis

Few real-life monsters loom as large in our memories as the ruthlessly efficient Nazis. During World War II, millions of people were murdered by the Gestapo or died under forced labor. Yet one small Polish village was largely spared thanks to the power of a humble bacterium to deceive the brutal regime.

Two Polish physicians, Dr. Eugeniusz Lazowski and Dr. Stanislav Matulewicz, had learned of a strange phenomenon involving a soil bacterium called *Proteus* 0X19. It seems this bacterium stimulates production of antibodies that mirror those generated by *Rickettsia prowazekii*, the typhus bacterium. Typhus is a disease marked by high, prolonged fever and rash. Highly contagious, it often proved fatal—in World War I typhus killed more people than did bullets. The Nazis were particularly fearful of typhus since the disease had not occurred in their country for a quarter-century.

Lazowski and Matulewicz began injecting the citizens of Rozvadow, a village about 124 miles (200 km) southwest of Warsaw, with *Proteus* 0X19. When blood samples from these individuals were sent for testing, they turned up "positive" for antibodies indicating typhus infection. As more and more tests came back "positive," German officials became convinced that a typhus epidemic was raging in this corner of Poland.

Fortunately for the good doctors and the Rozvadow citizens, the Nazis relied heavily on lab results and were either too lax or too fearful to conduct thorough examinations of the few "typhus victims" they actually saw. One team of German doctors sent to the town to investigate was shown an elderly man dying of pneumonia as "proof" of the ravages of typhus on the townspeople. Their fears of disease stoked, they hurriedly carried out only spot checks of town buildings and left certain of the epidemic.

As "typhus carriers," the Rozvadow people were not conscripted into forced labor and the Nazis avoided the vicinity for the most part. Thus, *Proteus* 0X19 fooled the Nazis and saved hundreds of lives.

*This account is drawn from Power Unseen: How Microbes Rule the World, a book of microbial vignettes by Bernard Dixon.*

Microbes Marooned on Moon—And Survive!

The castaways of Gilligan’s Island have nothing on *Streptococcus mitis*. A small colony of this common bacterium was marooned on the Moon in the late 1960s and managed to survive the hostile bleakness of outer space for nearly three years!
In April 1967, the microbial hitchhikers traveled to the moon aboard the unmanned Surveyor 3 probe, tucked away inside the craft's TV camera. A small colony of *S. mitis* survived launch, the vacuum of space, continual radiation exposure, temperatures averaging only 20 degrees above absolute zero, and no water, food or any energy source for more than two and a half years.

Parts of the Surveyor probe, including the camera, were recovered by Apollo 12 astronauts in November 1969. Back on Earth, scientists were astonished to discover the *S. mitis* in the foam insulating the camera’s circuit boards.

It seems almost too remarkable that these tiny space travelers managed to stay alive in the harsh vacuum of space. Some people involved in curating the Surveyor 3 materials suggested the possibility that the microbes were the result of accidental contamination after the camera was returned to Earth.

But since the late 1960s, microbiologists have discovered many microbes living in extreme conditions here on Earth, causing them to rethink their understanding of life and where it may live. These "extremophiles" have been found in hot springs and hydrothermal vents, Antarctic ice, the interior of an operating nuclear reactor and the crushing pressure 4.2 miles beneath the Earth’s surface. Bacteria have been noted to survive pressures of 71 tons/square inch, near zero temperature and pressure, and radiation a thousand times greater than would kill a person.

Recalling the Apollo 12 mission’s accomplishments in 1991, Commander Pete Conrad said, "I always thought the most significant thing that we ever found on the whole…Moon was that little bacteria who came back and lived."

**How a Microbe Helped Found Israel**

It may be hard to believe that something as tiny as a microscopic organism can be a mover and shaker behind policies and nations, but take the case of *Clostridium acetobutylicum*, the bacterium that helped create Israel. During World War I, the British military found itself facing a severe shortage of acetone, a chemical needed to make the highly-explosive material that propelled shells from warship guns. Acetone was then made by distilling wood. A young chemist working at the University of Manchester named Chaim Weizmann was called upon to devise a new, better method for producing acetone.

Weizmann had come to Britain after pursuing an education in Switzerland. He was compelled to leave his homeland in western Russia to pursue his fortunes, because restrictive quotas on Jews prevented him from entering a university there.

Within a few weeks of receiving the military's plea for help, Weizmann had succeeded in solving the acetone problem with the assistance of *C. acetobutylicum*, a common bacterium that grows normally on corn and other grains. Weizmann harnessed the power of this little microbe to transform the starch from grain into acetone and butyl alcohol—an efficient and inexpensive
way to produce bulk quantities of the needed chemical. When Munitions Minister David Lloyd George offered to petition the Prime Minister to honor Weizmann for his brilliant solution, the chemist declined saying his only hope and goal was the repatriation of Jewish people throughout the world. When Lloyd George later became Prime Minister, he advanced Weizmann's cause, and ultimately the State of Israel was created with Weizmann as its first president.

Had \textit{C. acetobutylicum} not presented Weizmann the ingenious solution that elicited the admiration and gratitude of Britian's influential prime minister, the Middle East might be a very different place today.

\textit{This account is drawn from Power Unseen: How Microbes Rule the World, a book of microbial vignettes by Bernard Dixon.}

**Bacterial Giants and Dwarfs**

**Bacterial Giants**

A bacterium so big you can see it with the unaided eye? It’s true!

In 1993, scientists were amazed to realize a large single-celled creature found in the guts of marine surgeonfish was actually a bacterium. Dubbed \textit{Epulopiscium fishelsoni}, this bacterial goliath can measure up to 0.5 millimeters—just big enough to be seen without the aid of a microscope. \textit{E. fishelsoni} is so unbelievably gargantuan for a microbe, it was mistakenly thought to be a huge protozoan for many years. \textit{E. fishelsoni} gets around limitations on size by growing very long but staying as thin as a hair.

But \textit{E. fishelsoni} isn't even the biggest of the big. \textit{Thiomargarita namibiensis}, or the "sulfur pearl of Namibia," is the current record holder. This sulfur-eating, nitrate-breathing bacterium found in sediments off the coast of Namibia can grow to almost 1 millimeter in diameter. If the largest \textit{T. namibiensis} cell was blown up to the size of a blue whale, then the average \textit{E. fishelsoni} would be about as big as a lion and an ordinary bacterium would be a bit smaller than a newborn mouse.

\textit{T. namibiensis} stores sulfur and nitrate in a bubble-like vacuole that takes up 97 percent of its volume and gives the bacterium its pearly, blue-green whiteness. Basically, the bacterium carries around its own food and scuba gear, which enables it to survive long periods of deprivation.

**Bacterial Dwarfs**

The smallest known bacteria are the \textit{Mycoplasma}, which measure about 150 to 200 nanometers or just one billionth of an inch. But some researchers believe they’ve found evidence of microscopic creatures even smaller.

These scientists have found filamentous structures in Australian sandstone that measure 20 to
50 nanometers. If the researchers can prove that these "nanobes" are alive, it will radically alter current thinking about what is the absolute smallest package into which the essential cellular machinery of life can be squeezed. Such findings would also lend credence to the theory that the tiny blobs found in a Martian meteorite could be fossils of extraterrestrial microbes.

Scientists have charged that the structures in the Mars rock are too tiny to be the remains of any living organism.
Diseases in the United States and Around the World  
(source: UNICEF)

Annual childhood deaths dipped below 10 million in 2006, to a record low of 9.7 million. While this is good news, most of these deaths are preventable and should not be accepted as inevitable. Some of the leading causes of death are:

- Undernutrition
- Pneumonia
- Diarrhea
- Malaria
- AIDS
- Measles

No matter where we live in this world, infectious diseases continue to cause distress, illness and even death. Small changes in our habits can make big differences:

- Wash hands
- Get immunized
- Disinfect
- Practice standard precautions

West Nile virus
Influenza or the Flu
(source: CDC)

Influenza, commonly called "the flu," is caused by the influenza virus, which infects the respiratory tract (nose, throat, lungs). The flu usually spreads from person to person when an infected person coughs, sneezes, or talks and the virus is sent into the air. Unlike many other viral respiratory infections, such as the common cold, the flu causes severe illness and life-threatening complications in many people.

What are the symptoms of the flu?
Symptoms of the flu include fever, headache, extreme tiredness, dry cough, sore throat, runny or stuffy nose, and muscle aches. Children can have additional stomach symptoms, such as nausea, vomiting and diarrhea, but these symptoms are uncommon in adults. Although the term "stomach flu" is sometimes used to describe vomiting, nausea, or diarrhea, these illnesses are caused by certain other viruses, bacteria, or possibly parasites, and are not related to influenza.

Does the flu have complications?
Yes. Some of the complications caused by the flu include bacterial pneumonia, dehydration, and worsening of chronic medical conditions, such as congestive heart failure, asthma, or diabetes. Children may get sinus problems and ear infections as complications from the flu. The elderly and persons of any age with chronic medical conditions are at highest risk for serious complications of the flu.

How can a person tell if they have the flu?
It is very difficult to distinguish the flu from other viral or bacterial causes of respiratory illnesses on the basis of symptoms alone. A test can confirm that an illness is influenza if the patient is tested within the first 2-3 days after symptoms begin. In addition, a doctor’s exam may be needed to determine whether a person has another infection that is a complication of influenza.

How soon will I get sick if I am exposed to the flu?
The time from when a person is exposed to the flu virus to when symptoms begin is about 1-4 days, with an average of about 2 days.

How long is a person with flu virus contagious?
The period when an infected person is contagious depends on the age of the person. Adults may be contagious from one day prior to becoming sick and for three to seven days after they first develop symptoms. Some children may be contagious for longer than a week.
**What can I do to protect myself against the flu?**
The single best way to prevent the flu is for individuals, especially persons at high risk for serious complications from the flu, to get a flu shot each fall.

**Who should get vaccinated?**
In general, anyone who wants to reduce their chances of getting the flu can get vaccinated. However, it is recommended by ACIP that certain people should get vaccinated each year. They are either people who are at high risk of having serious flu complications or people who live with or care for those at high risk for serious complications. During flu seasons when vaccine supplies are limited or delayed, ACIP makes recommendations regarding priority groups for vaccination.

People who should get vaccinated each year are:

- **People at high risk for complications from the flu, including:**
  - Children aged 6 months until their 5th birthday
  - Pregnant women
  - People 50 years of age and older
  - People of any age with certain chronic medical conditions
  - People who live in nursing homes and other long term care facilities

- **People who live with or care for those at high risk for complications from flu, including:**
  - Household contacts of persons at high risk for complications from the flu (see above)
  - Household contacts and out of home caregivers of children less than 6 months of age (these children are too young to be vaccinated)
  - Healthcare workers

**Who should use the nasal spray flu vaccine?**
It should be noted that vaccination with the nasal-spray flu vaccine is always an option for healthy people 2-49 years of age who are not pregnant.

**Who should not be vaccinated?**
There are some people who should not be vaccinated without first consulting a physician. These include:

- People who have a severe allergy to chicken eggs
- People who have had a severe reaction to an influenza vaccination in the past
- People who developed Guillain-Barré syndrome (GBS) within 6 weeks of getting an influenza vaccine previously
- Influenza vaccine is not approved for use in children less than 6 months of age
- People who have a moderate or severe illness with a fever should wait to get vaccinated until their symptoms lessen
Can antiviral drugs be used to treat the flu?
For treatment, influenza antiviral drugs should be started within 2 days after becoming sick and taken for 5 days. When used this way, these drugs can reduce flu symptoms and shorten the time you are sick by 1 or 2 days. They also may make you less contagious to other people.

If you become sick with flu-like symptoms this season, your doctor will consider the likelihood of influenza being the cause of your illness, the number of days you have been sick, side effects of the medication, etc. before making a recommendation about using antivirals. He or she may test you for influenza, but testing is not required in order for a physician to recommend influenza antiviral medications for you.

Can antiviral drugs prevent the flu?
Influenza antiviral drugs can also be used to prevent influenza when they are given to a person who is not ill, but who has been or may be near a person with influenza. When used to prevent the flu, antiviral drugs are about 70% to 90% effective. It’s important to remember that flu antiviral drugs are not a substitute for getting a flu vaccine. When used for prevention, the number of days that they should be used will vary depending on a person’s particular situation.

In some instances, your doctor may choose to prescribe antiviral drugs to you as a preventive measure, especially if you are at high risk for serious flu complications and either did not get the flu vaccine or may still be at risk of illness even after vaccination. Also, if you are in close contact with someone who is considered at high risk for complications, you may be given antiviral drugs to reduce the chances of catching the flu and passing it on to the high-risk person.

Who should get antiviral drugs?
CDC has provided guidelines for health care professionals on the use of antiviral drugs (see: Information for Health Care Professionals: Using Antiviral Agents for Seasonal Influenza).

In general, antiviral drugs can be offered to anyone 1 year of age or older who wants to avoid and/or treat the flu. People who are at high risk of serious complications from the flu may benefit most from these drugs.

Antiviral drugs can also be used to prevent influenza among people with weak immune systems who may not be protected after getting a flu vaccine or who haven’t been vaccinated.

Remember, a flu vaccine is the first and best defense against seasonal flu, but antiviral drugs can be an important second line of defense to treat the flu or prevent flu infection.

When is the flu season in the United States?
In the United States, the peak of flu season can occur anywhere from late December through March. The health impact (infections and deaths) of a flu season varies from year to year. CDC monitors circulating flu viruses and their related disease activity and provides influenza reports each week from October through May.
Do not give aspirin to a child or teenager who has the flu. *Never* give aspirin to children or teenagers who have flu-like symptoms—and particularly fever—without first speaking to your doctor. Giving aspirin to children and teenagers who have influenza can cause a rare but serious illness called Reye syndrome. Children or teenagers with the flu should get plenty of rest, drink lots of liquids, and take medicines that contain *no aspirin* to relieve symptoms.

**What are some of the myths about flu?**
There are several common myths about the flu, including:

- **Flu is merely a nuisance.** *Wrong.* The flu is a major cause of illness and death in the United States and leads to an average of about 20,000 deaths and 114,000 hospitalizations per year.
- **Flu shots cause the flu.** *Wrong.* The licensed flu vaccine used in the United States, which is made from inactivated or killed flu viruses, cannot cause the flu and does not cause flu illness.
- **Flu shots don’t work.** *Not exactly.* When the killed viruses in the vaccine and circulating viruses are similar, the flu shot is very effective. There are several reasons why people think flu shots don’t work. People who have gotten a flu shot may then get sick from a different virus that causes respiratory illness but is mistaken for the flu; the flu shot only prevents illness caused by the influenza virus. In addition, protection from the vaccine is not 100 percent. Studies of healthy young adults have shown flu vaccine to be 70 percent to 90 percent effective in preventing the flu. In the elderly and those with certain long-term medical conditions, the flu shot is often less effective in preventing illness. However, in the elderly, the flu vaccine is very effective in reducing hospitalizations and death from flu-related causes.
- **There is no need to get a flu shot every year.** *Wrong.* The flu viruses are constantly changing. Generally, new influenza virus strains circulate every flu season, so the vaccine is changed each year.
- **There is a “stomach flu.”** *Wrong.* Many people use the term “stomach flu” to describe illnesses with nausea, vomiting, or diarrhea that are not caused by the flu virus, but can be caused by many different viruses, bacteria, or even parasites. However, while vomiting, diarrhea, and being “sick to your stomach” can sometimes be related to the flu—particularly in children—these problems are rarely the main symptoms of influenza. The flu is a respiratory disease and not a stomach or intestinal disease.

**How many people does the flu affect?**
Every year in the United States, on average:

- 5% to 20% of the population gets the flu;
- more than 200,000 people are hospitalized from flu complications, and;
- about 36,000 people die from flu.
Pertussis (Whooping Cough)
(source: Seattle and King County Public Health Department, CDC, National Association of Pediatric Nurse Practitioners)

What is it?
Pertussis is a highly contagious bacterial infection that causes coughing and gagging with little or no fever. An infected person has cough episodes that may end in vomiting or cause a “whoop” sound when the person tries to breathe in.

What are the symptoms?
Symptoms appear between 6 to 21 days (average 7-10) after exposure to the bacteria. The disease starts with cold symptoms: runny nose and cough. Sometime in the first 2 weeks, episodes of severe cough develop that can last 1 to 2 months. The person may look and feel fairly healthy between these episodes.

During bouts of cough, the lips and nails may turn blue for lack of air. Vomiting may occur after severe coughing spells. During the severe coughing stage, seizures or even death can occur, particularly in an infant. Immunized school children and adults have milder symptoms than young children.

What are the potential complications?
Pertussis is most dangerous to children less than 1 year old. Complications for infants include pneumonia, convulsions, and in rare cases, brain damage or death. Serious complications are less likely in older children and adults.

How is it spread?
Pertussis is spread through respiratory droplets when an infected person coughs, sneezes or talks. The greatest risk of spread is during the early stage when it appears to be a cold. Those treated with antibiotics are contagious until the first 5 days of appropriate antibiotic treatment have been completed.

Who gets it?
Anyone who is exposed can get pertussis. Unimmunized or inadequately immunized people are at higher risk for severe disease. Many cases occur in adults because protection from the vaccine lasts only 5 to 10 years after the last dose.

How do we prevent and treat it?
There are four combination vaccines used to prevent diphtheria, tetanus and pertussis: DTaP, Tdap, DT, and Td. Two of these (DTaP and DT) are given to children younger than 7 years of
Children should get 5 doses of DTaP, one dose at each of the following ages: 2, 4, 6, and 15-18 months and 4-6 years. DT does not contain pertussis, and is used as a substitute for DTaP for children who cannot tolerate pertussis vaccine.

Td is a tetanus-diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus under some circumstances. Tdap is similar to Td but also containing protection against pertussis. A single dose of Tdap is recommended for adolescents 11 or 12 years of age, or in place of one Td booster in older adolescents and adults age 19 through 64.

(Upper-case letters in these abbreviations denote full-strength doses of diphtheria (D) and tetanus (T) toxoids and pertussis (P) vaccine. Lower-case “d” and “p” denote reduced doses of diphtheria and pertussis used in the adolescent/adult-formulations. The “a” in DTaP and Tdap stands for “acellular,” meaning that the pertussis component contains only a part of the pertussis organism.)

Persons with pertussis should avoid contact with others until no longer contagious. Take your full course of antibiotic treatment. If you live with someone who has pertussis or are in the same childcare classroom with someone who has had pertussis, you should take preventive antibiotics.

How many people does pertussis affect?
Pertussis is the only infectious disease for which children are routinely immunized that is on the rise. In 2004 more than 25,000 cases were reported, up from 1,010 in 1976. Often mistaken for a cold, pertussis is frequently misdiagnosed and underreported. The actual number of cases each year may be close to one million.
Rubella (German Measles)
(source: New York State Department of Health, CDC)

What is rubella?
Rubella is a viral disease characterized by slight fever, rash and swollen glands. Most cases are mild.

Who gets rubella?
In unvaccinated populations, rubella is primarily a childhood disease. Where children are well immunized, adolescent and adult infections become more evident. Rubella occurs more frequently in winter and spring.

How is rubella spread?
Rubella is spread by direct contact with nasal or throat secretions of infected individuals.

What are the symptoms of rubella?
Rubella is a mild illness which may present few or no symptoms. Symptoms may include a rash, slight fever, joint aches, headache, discomfort, runny nose and reddened eyes. The lymph nodes just behind the ears and at the back of the neck may swell, causing some soreness and/or pain. The rash, which may be itchy, first appears on the face and progresses from head to foot, lasting about three days. As many as half of all rubella cases occur without a rash.

How soon do symptoms appear?
The incubation period for rubella is 12-23 days; in most cases, symptoms appear within 16-18 days.

When and for how long is a person able to spread rubella?
Rubella may be transmitted from seven days before to seven days after rash onset.

Does past infection with rubella make a person immune?
Yes. Immunity acquired after contracting the disease is usually permanent.

What is the vaccine for rubella?
The rubella vaccine is given on or after a child's first birthday, and is usually given in combination with the measles and mumps (MMR) vaccine. Children usually receive the first dose between 12 and 15 months or age and the second dose prior to school entry at 4-6 years of age.

What can be the effect of not being immunized against rubella?
Rubella infection is dangerous because of its ability to damage an unborn baby. Infection of a
pregnant woman may result in a miscarriage, stillbirth or the birth of an infant with abnormalities which may include deafness, cataracts, heart defects, liver and spleen damage and mental retardation. Congenital rubella syndrome (CRS) occurs among at least 25 percent of infants born to women who have had rubella during the first trimester of pregnancy.

**What can be done to prevent the spread of rubella?**
Maintaining high levels of rubella immunization in the community is critical to controlling the spread. Control of the spread of rubella is needed primarily to prevent the birth defects caused by CRS. Therefore, women of childbearing age should have their immunity determined and receive rubella vaccine if needed. Infected children should not attend school during their infectious period.

**How many people does rubella affect?**
The greatest danger from rubella is to unborn babies. If a woman gets rubella in the early months of her pregnancy, there is an 80% chance that her baby will be born deaf or blind, with a damaged heart or small brain, or mentally retarded. This is called Congenital Rubella Syndrome, or CRS. Miscarriages are also common among women who get rubella while they are pregnant.

The last major rubella epidemic in the United States was in 1964–1965, when about 12.5 million people got the disease and 20,000 babies were born with CRS. Several years later a vaccine was licensed, and the disease has been disappearing ever since. Today there are fewer than 20 cases reported each year.
Hib (Haemophilus influenzae type B)

(source: New York State Department of Health, World Health Organization)

What is Haemophilus influenzae type b (Hib) disease?
Until recently, Hib was one of the most important causes of bacterial infection in young children. Hib may cause a variety of diseases such as meningitis (inflammation of the coverings of the spinal column and brain), blood stream infections, pneumonia, arthritis and infections of other parts of the body.

Who gets Hib disease?
Hib disease can occur in any age group. Due to widespread use of Hib vaccine in children, very few cases of Hib are reported each year in the U.S. Hib is diagnosed more often in the elderly, unimmunized children and people who are immunocompromised.

How is Hib disease spread?
Hib disease may be transmitted through contact with mucus or droplets from the nose and throat of an infected person.

What are the symptoms of Hib disease?
Symptoms may include fever, lethargy, vomiting and a stiff neck. Other symptoms depend upon the part of the body affected.

How soon do symptoms appear?
The incubation period for Hib disease is unknown, but is probably less than one week.

When and for how long is a person able to spread Hib disease?
The contagious period varies. Unless treated, it may be transmitted for as long as the organism is present in the nose and throat, even after symptoms have disappeared.

Does past infection with Hib disease make a person immune?
Children who had Hib disease when younger than 24 months of age may be at risk of getting Hib disease again. Children and adults who had Hib disease when 24 months of age or older are likely to be immune.

What is the treatment for Hib disease?
Antibiotics such as cefotaxime, ceftriaxone, or ampicillin with chloramphenicol, are generally used to treat serious infections. Rifampin is used in some circumstances as preventive treatment for persons who have been exposed to Hib disease.

What are the possible complications associated with Hib disease?
If Hib meningitis occurs, a certain proportion of those who recover may suffer long-lasting neurologic problems. In some instances, cases may be fatal.
**What can be done to prevent the spread of Hib disease?**

There are currently several Hib vaccines licensed by the U. S. Food and Drug Administration for use in children as early as two months of age. Immunization authorities recommend that all children be immunized with an approved Hib vaccine beginning at two months of age. Recommendations for scheduling of subsequent doses vary depending on the manufacturer. Therefore, it is important to consult with your physician.

**How many people does Hib disease affect?**

According to the World Health Organization, *Haemophilus influenzae* type b (Hib) is one of six related types of bacterium. In 2000, *H.influenzae* type B (Hib) was estimated to have caused two to three million cases of serious disease, notably pneumonia and meningitis, and 450,000 deaths in young children.
Diphtheria

*source: New York State Department of Health, CDC*

What is diphtheria?
Diphtheria is an acute bacterial disease that usually affects the tonsils, throat, nose or skin. It is extremely rare in the United States.

Who gets diphtheria?
Diphtheria is most common where people live in crowded conditions. Unimmunized children under 15 years of age are likely to contract diphtheria. The disease is often found among adults whose immunization was neglected, and is most severe in unimmunized or inadequately immunized individuals.

How is diphtheria spread?
Diphtheria is transmitted to others through close contact with discharge from an infected person’s nose, throat, skin, eyes and lesions.

What are the symptoms of diphtheria?
There are two types of diphtheria. One type involves the nose and throat, and the other involves the skin. Symptoms include sore throat, low-grade fever and enlarged lymph nodes located in the neck. Skin lesions may be painful, swollen and reddened.

How soon do symptoms appear?
Symptoms usually appear two to four days after infection, with a range of one to ten days.

When and for how long is a person able to spread diphtheria?
People who are infected with the diphtheria germ may be contagious for up to two weeks, but seldom more than four weeks. If the patient is treated with appropriate antibiotics, the contagious period can be limited to less than four days.

Does past infection with diphtheria make a person immune?
Recovery from diphtheria is not always followed by lasting immunity.

Is there a vaccine for diphtheria?
There are four combination vaccines used to prevent diphtheria, tetanus and pertussis: DTaP, Tdap, DT, and Td. Two of these (DTaP and DT) are given to children younger than 7 years of age, and two (Tdap and Td) are given to older children and adults.
Children should get 5 doses of DTaP, one dose at each of the following ages: 2, 4, 6, and 15-18 months and 4-6 years. DT does not contain pertussis, and is used as a substitute for DTaP for children who cannot tolerate pertussis vaccine.

Td is a tetanus-diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus under some circumstances. Tdap is similar to Td but also containing protection against pertussis. A single dose of Tdap is recommended for adolescents 11 or 12 years of age, or in place of one Td booster in older adolescents and adults age 19 through 64.

(Upper-case letters in these abbreviations denote full-strength doses of diphtheria (D) and tetanus (T) toxoids and pertussis (P) vaccine. Lower-case “d” and “p” denote reduced doses of diphtheria and pertussis used in the adolescent/adult-formulations. The “a” in DTaP and Tdap stands for “acellular,” meaning that the pertussis component contains only a part of the pertussis organism.)

How can diphtheria be prevented?
The single most effective control measure is maintaining the highest possible level of immunization in the community. Other methods of control include prompt treatment of cases and a community surveillance program.

What is the treatment for diphtheria?
Certain antibiotics, such as penicillin and erythromycin, can be prescribed for the treatment of diphtheria. A diphtheria antitoxin is also used for treatment.

What can be the effect of not being treated for diphtheria?
If diphtheria goes untreated, serious complications such as paralysis, heart failure and blood disorders may occur.

How many people does diphtheria affect?
According to the CDC, death occurs in approximately 5 to 10 percent of all cases, with higher death rates (up to 20 percent) in persons under the age of 5 and over the age of 40. Prior to the vaccine’s use in this country, as many as 200,000 cases of diphtheria were reported in a year and 15,000 deaths. Now only about two cases of diphtheria are reported each year. The death rate for diphtheria has changed very little during the last 50 years. Diphtheria continues to be a more serious problem in other areas of the world.

Diphtheria remains endemic in developing countries. The countries of the former Soviet Union have reported >150,000 cases in an epidemic which began in 1990.
Measles

(source: New York State Department of Health, CDC, WHO)

What is measles?
Measles is an acute, highly contagious viral disease capable of producing epidemics. Since the introduction of the measles vaccination in 1963, the number of measles cases has decreased to about 100 cases reported annually in the United States.

Who gets measles?
Although measles is usually considered a childhood disease, it can be contracted at any age. In recent years, outbreaks have mainly involved high school and college students who are unvaccinated or have received only one dose of the measles vaccine.

How is measles spread?
Measles is spread by direct contact with nasal or throat secretions of infected people or, less frequently, by airborne transmission. Measles is one of the most readily transmitted communicable diseases.

What are the symptoms of measles?
Measles symptoms generally appear in two stages. In the first stage, the individual may have a runny nose, cough and a slight fever. The eyes may become reddened and sensitive to light while the fever consistently rises each day. The second stage begins on the third to seventh day and consists of a temperature of 103-105°F and a red, blotchy rash lasting four to seven days. The rash usually begins on the face and then spreads over the entire body. Koplik spots (little white spots) may also appear on the gums and inside of the cheeks.

How soon do symptoms appear?
Symptoms usually appear in 10-12 days, although they may occur as early as seven or as late as 18 days after exposure.

When and for how long is a person able to spread measles?
An individual is able to transmit measles from five days prior to and five days after rash onset.

Does past infection make a person immune?
Yes. Permanent immunity is acquired after contracting the disease.

What is the treatment for measles?
There is no specific treatment for measles.
What are the complications associated with measles?
Pneumonia occurs in up to 6 percent of reported cases and accounts for 60 percent of deaths attributed to measles. Encephalitis (inflammation of the brain) may also occur. Other complications include middle ear infection and convulsions. Measles is more severe in infants and adults.

How can measles be prevented?
Children should be given the first dose of MMR vaccine soon after the first birthday (12 to 15 months of age). The second dose is recommended before the start of the kindergarten. Students entering middle school, high school, or college should have their vaccination records reviewed to make sure they have received both doses of the MMR vaccine.

Outbreaks continue to occur in high schools (one or two per year) and on college campuses (less than one per year). These educational institutions are potential high-risk areas for measles transmission because of large concentrations of susceptible people. That is why the CDC recommends that all states require proof of either two doses of the measles vaccine or evidence of past measles infection at the time of college or other post-high school entry. Adults born after 1957 should receive at least one dose of measles vaccine unless they have already had measles and are immune. (This vaccine can also be given as measles mumps rubella (MMR) vaccine or measles rubella (MR) vaccine.) Those at increased risk of getting measles — college students, international travelers and healthcare workers — should receive two doses, provided they are given no less than 1 month apart.

Note: Pregnant women should not receive the MMR vaccine. Also, pregnancy should be avoided 1 month following the receipt of the measles vaccine and 3 months following the MMR vaccine.

How many people does measles affect?
According to the WHO, measles remains a leading cause of death among young children, despite the availability of a safe and effective vaccine for the past 40 years. In 2006, it was estimated that there were 242,000 measles deaths globally: this translates to about 663 deaths every day or 27 deaths every hour.

Vaccination has had a major impact on measles deaths. Overall, global measles mortality decreased by 68% between 2000 and 2006. The largest gains occurred in Africa where measles cases and deaths fell by 91%.

Measles vaccination in the U.S. has decreased the number of cases to the lowest point ever reported. Widespread use of the measles vaccine has led to a greater than 99% reduction in measles compared with the pre-vaccine era when approximately 450,000 cases and 450 deaths were reported each year. In 2005 there were fewer than 100 cases of measles in the United States.
Varicella (Chickenpox)
(source: Seattle and King County Public Health Department, CDC)

What is chickenpox?
Chickenpox (varicella) is caused by the varicella-zoster virus (a type of herpes virus). It is usually a mild illness, but may be severe in infants, adults and persons with weakened immune systems. The Centers for Disease Control and Prevention (CDC) estimates that 4 million cases occur each year. The greatest number of cases of chickenpox occurs in the late winter and spring.

What are the symptoms?
Chickenpox has a characteristic itchy rash, the "pox," which then forms blisters that dry and become scabs in 4 to 5 days. The rash may be the first sign of illness, sometimes coupled with fever and general fatigue. An infected person may have anywhere from only a few pox to more than 500 pox on their body during an attack (average 300 to 400).

How is it spread?
Chickenpox virus is highly contagious and is spread by direct contact with secretions (such as saliva) from an infected individual or through the air from respiratory secretions (i.e. sneezing, coughing). It can be spread 1 to 2 days before the rash appears, and until all blisters have formed scabs, usually within 5 days from the time the blisters appear. People with weak immune systems who get chickenpox may take a longer time for their pox to scab over. Chickenpox develops within 10 to 21 days after contact with an infected person (the incubation period). Approximately 90 percent of persons in a household who have not had chickenpox will get it if exposed to an infected family member.

Who gets it?
Before the chickenpox vaccine, almost everyone got chickenpox by adulthood—more than 95 percent of American adults have already had it. A history of chickenpox is considered adequate evidence of immunity. If you aren't sure whether you've had chickenpox, you can have your blood tested for varicella antibody. A positive test means you are immune and can't get chickenpox. A negative result means you could catch chickenpox and should consider receiving chickenpox vaccine.

How is it prevented?
In June 2005 and June 2006, the CDC’s Advisory Committee on Immunization Practices (ACIP), adopted new recommendations regarding the use of live, attenuated varicella vaccines for prevention of varicella. The new recommendations include a routine 2-dose varicella vaccination program for children, with the first dose administered at age 12—15 months and the second dose at age 4—6 years; a second dose catch-up varicella vaccination for children,
adolescents, and adults who previously had received 1 dose; and routine vaccination of all healthy persons aged 13 years or older without evidence of immunity.

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The varicella vaccine has been available since March 1995. It can safely be given to most children 12 months of age or older, adolescents and adults who have not had chickenpox. The varicella vaccine is highly effective in protecting against chickenpox and its related complications, such as pneumonia and skin infections. Rarely, very mild chickenpox may occur in persons who have received the chickenpox vaccine. The varicella vaccine protection lasts for years.

What should I do if I’ve been exposed to chickenpox?

What home treatments are available for chickenpox?

Parents can do several things at home to help relieve their child’s chickenpox symptoms. Because scratching the blisters may cause them to become infected, keep your child’s fingernails trimmed short. Calamine lotion and Aveeno® (oatmeal) baths may help relieve some of the itching. Do not use aspirin or aspirin-containing products to relieve your child's fever. The use of aspirin in children with chickenpox has been associated with development of Reye’s syndrome (a severe disease affecting all organs, but most seriously affecting the liver and brain, that may cause death). Use non-aspirin medications such as acetaminophen (e.g., Tylenol®).

Are there any treatments that my doctor can prescribe for chickenpox?

Your health-care provider will advise you on treatment options. Acyclovir, famcyclovir, or valacyclovir (medicines that work against herpesviruses) are recommended for persons who are more likely to develop serious disease, including persons with chronic skin or lung disease, otherwise healthy individuals 13 years of age or older, and persons receiving steroid therapy. However, only acyclovir is currently licensed for use in treating varicella.

Persons whose immune systems have been weakened from disease or medication should contact their doctor immediately if they are exposed to or develop chickenpox. If you are pregnant and are either exposed to or develop chickenpox, you should immediately discuss prevention and treatment options with your doctor.

When is it necessary to go to the doctor for treatment for chickenpox?

If you or your child has a fever that lasts longer than 4 days or rises above 102°F, call...
your health-care provider. Also if any areas of the rash or any part of the body become very red, warm, or tender, or begin leaking pus (thick, discolored fluid), call your health-care provider since these symptoms may indicate a bacterial infection. Call your doctor immediately if the individual with chickenpox seems extremely ill, is difficult to wake up or appears confused, has difficulty walking, has a stiff neck, is vomiting repeatedly, has difficulty breathing, or has a severe cough.

**Is there any preventive treatment available after exposure to chickenpox for susceptible persons who are not eligible to receive chickenpox vaccine?**

Yes, varicella zoster immune globulin (VZIG) can prevent or modify disease after exposure to someone with chickenpox. However, because it is costly and only provides temporary protection, VZIG is only recommended for persons at high risk of developing severe disease who are not eligible to receive chickenpox vaccine. These individuals include:

- Newborns whose mothers have chickenpox 5 days prior to 2 days after delivery
- Premature babies exposed to varicella in the first month of life
- Children with leukemia or lymphoma who have not been vaccinated
- Persons with cellular immunodeficiencies or other immune system problems
- Persons receiving medications, such as high-dose systemic steroids, that suppress the immune system
- Women who are pregnant

VZIG should be administered as soon as possible, but no later than 96 hours, after exposure to chickenpox. If you have had a varicella exposure and you fit into one of these groups, contact your doctor.

The only U.S.-licensed manufacturer of VZIG discontinued production of VZIG in 2006. However, a similar product, VariZIG™ (Cangene Corporation, Winnipeg, Canada), became available under an investigational new drug application (IND) submitted to the Food and Drug Administration (FDA) in February 2006. Doctors in the U.S. can now request VariZIG from the sole authorized U.S. distributor, FFF Enterprises (Temecula, California), for their patients who have been exposed to varicella and who are at increased risk for severe disease and complications.

**What is shingles?**

Shingles is another term for the skin infection caused by the varicella-zoster virus. Shingles is a localized rash caused by reactivation of the varicella-zoster virus in a person who previously had chickenpox. The rash consists of painful blisters with a reddish base that follow the path on the skin supplied by the affected nerve, usually on one side of the body. Drainage from the blisters can carry the varicella-zoster virus.

Shingles may be contagious until lesions have crusted over. You can't get shingles unless you've had chickenpox first. If you've already had chickenpox, someone else's shingles rash
can't reinfect you. If you haven't had chickenpox before, and you're exposed to someone with shingles, you could develop chickenpox.

**How many people does chickenpox affect?**

Before introduction of varicella vaccine in the United States in 1995, varicella was endemic, with virtually all persons being infected by adulthood. Since implementation of the varicella vaccination program, incidence has declined in all age groups, with the greatest decline among children aged 1-4 years. Data from passive and active surveillance have indicated a decline in varicella cases of 70%-84% from 1995 through 2001. The downward trend in varicella has continued in the United States through 2005 with an approximately 90% decline in incidence from 1995 in active surveillance sites with high vaccine coverage (CDC, unpublished data).
**Tetanus**
*(source: New Jersey State Health Department, CDC)*

**What is tetanus?**
Tetanus is an acute, often fatal, disease caused by a toxin of the tetanus bacillus. Tetanus spores may enter the body from the environment usually at the site of an injury, puncture wound, surgical procedure, burn, trivial or unnoticed cut/abrasion, or injected street drug and can become contaminated by soil, street dust, or animal and human feces.

**Who gets tetanus?**
Persons of all ages who sustain wound injuries, who have not received either the basic tetanus toxoid series or who have not received booster doses of a tetanus toxoid containing vaccine such as Td can acquire tetanus. Tetanus is an extremely acute, life-threatening disease which is fatal in 30 percent of cases and usually affects those persons 50 years of age or older.

**How is tetanus spread?**
Tetanus exists through the environment and susceptible persons sustaining contaminated wounds or skin punctures are at risk. It is usually not directly transmitted from person to person.

**What are the symptoms of tetanus?**
The primary symptoms of tetanus are stiffness and painful muscular contractions or spasms of the jaw, neck, trunk muscles, and rigidity. Tetanus is sometimes called "lock jaw" because of the disease's frequently seen facial manifestations.

**How soon do symptoms occur?**
Symptoms usually occur within 3-21 days, usually 8 days, following exposure to tetanus spores following a minor or inapparent or known puncture wound. The majority of cases require hospitalization.

**How is tetanus diagnosed?**
Tetanus is usually diagnosed by physicians based upon clinical signs. Laboratory tests of affected tissue or blood tests are not always reliable enough to confirm diagnosis.

**What is the treatment for tetanus?**
There is no real treatment for tetanus, however, following the proper and timely physician directed wound treatment protocols and administration of additional doses of Td toxoid and/or tetanus immune globulin may help effect a positive outcome.

**How long is an infected person infectious to others?**
Tetanus is an infectious disease, but it is not usually directly communicable from one person to another.
**Should an infected person be excluded from work or school?**
Due to its non-communicable nature, isolation or exclusion of an infected person is not routinely recommended nor necessary.

**How can tetanus be prevented?**
There are four combination vaccines used to prevent diphtheria, tetanus and pertussis: DTaP, Tdap, DT, and Td. Two of these (DTaP and DT) are given to children younger than 7 years of age, and two (Tdap and Td) are given to older children and adults.

Children should get 5 doses of DTaP, one dose at each of the following ages: 2, 4, 6, and 15-18 months and 4-6 years. DT does not contain pertussis, and is used as a substitute for DTaP for children who cannot tolerate pertussis vaccine.

Td is a tetanus-diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus under some circumstances. Tdap is similar to Td but also containing protection against pertussis. A single dose of Tdap is recommended for adolescents 11 or 12 years of age, or in place of one Td booster in older adolescents and adults age 19 through 64.

(Upper-case letters in these abbreviations denote full-strength doses of diphtheria (D) and tetanus (T) toxoids and pertussis (P) vaccine. Lower-case "d" and "p" denote reduced doses of diphtheria and pertussis used in the adolescent/adult-formulations. The "a" in DTaP and Tdap stands for “acellular,” meaning that the pertussis component contains only a part of the pertussis organism.)

**How many people does tetanus affect?**
According to the CDC, prior to the vaccine’s widespread use in the ‘40s, there were about 600 cases of tetanus and 180 deaths each year. Now there are about 50 cases of tetanus each year in the United States.
Mumps

(source: *Virginia Department of Health, CDC*)

**What is mumps?**
Mumps is a viral disease that causes fever, swelling and tenderness of one or more of the salivary glands.

**Who gets mumps?**
People who do not receive mumps vaccine are the most likely to get this disease. The greatest risk of infection occurs among older children, adolescents, and adults. Mumps is more common during the winter and spring.

**How is mumps spread?**
Mumps is spread by direct contact with saliva and discharges from the nose and throat of infected persons.

**What are the symptoms of mumps?**
Symptoms of mumps include fever and swelling and tenderness of one or more of the salivary glands, usually the parotid gland (located just below the front of the ear). About one-third of infected people do not have any symptoms.

**How soon after infection do symptoms occur?**
Symptoms usually appear within 18 days after exposure, but may appear any time within 12 to 25 days.

**What complications have been associated with mumps?**
Swelling of the testicles occurs in 20-30 percent of infected males. Mumps can cause central nervous system disorders such as encephalitis (inflammation of the brain) and meningitis (inflammation of the covering of the brain and spinal column). Other complications include arthritis, kidney involvement, inflammation of the thyroid gland and breasts, and deafness.

**When and for how long is a person able to spread mumps?**
Mumps is contagious from seven days before through nine days after the onset of symptoms. A person is most contagious 48 hours before symptoms begin.

**Does past infection with mumps make a person immune?**
Yes. Immunity acquired after contracting the disease is usually permanent.
Is there a vaccine for mumps?
The mumps vaccine is found in the combination measles/mumps/rubella (MMR) vaccine. Children should get 2 doses of MMR vaccine, the first at 12-15 months of age and the second at 4-6 years of age.

These are the recommended ages. But children can get the second dose at any age, as long as it is at least 28 days after the first dose.

Some adults should also get MMR vaccine. Generally, anyone 18 years of age or older, who was born after 1956, should get at least one dose of MMR vaccine, unless they can show that they have had either the vaccines or the diseases.

Ask your doctor or nurse about whether the vaccine is right for you or your children.

What can be done to prevent the spread of mumps?
Mumps vaccine (usually MMR), is the best way to prevent mumps. Other things people can do to prevent mumps and other infections is to wash hands well and often with soap, and to teach children to wash their hands too. Eating utensils should not be shared, and surfaces that are frequently touched (toys, doorknobs, tables, counters, etc) should also be regularly cleaned with soap and water, or with cleaning wipes.

How many people does mumps affect?
Although 600 cases is the norm, in 2006 there were 5,783 confirmed or probable mumps cases reported to CDC. The jump may be attributed to close-contact living in college dormitories, as most of the cases were in college students, undervaccination in some of this group, and the reality that, although effective, this vaccine, like all others, does not produce immunity in all those who’ve been vaccinated.
Meningococcal Disease
*(source: Illinois Department of Public Health, CDC)*

**What is meningococcal disease?**
Meningococcal disease is a bacterial infection. It occurs commonly in two forms: inflammation of the membranes covering the brain and spinal cord (meningococcal meningitis) or a severe blood infection (meningococcemia).

The bacteria that causes meningococcal disease, *Neisseria meningitidis*, first infects the mucous membranes of the nose and throat, usually without any symptoms. In fact, 5 percent to 10 percent of the population may carry the bacteria at any given time without becoming ill. In a small proportion of infected persons, the bacteria passes through the mucous membrane and reaches the bloodstream, causing meningococcal meningitis or meningococcemia. When illness occurs, it does so within four days of exposure, but can develop as long as 10 days later. The disease is most common during winter and spring.

**How is meningococcal disease spread?**
Meningococcal infection is not highly contagious. Transmission from person to person occurs through direct contact with nose and throat secretions. An infected person can transmit the disease by coughing or sneezing directly into the face of others, kissing a person on the mouth, or sharing a glass or cup.

Because it is possible to harbor the bacteria in the nose and throat yet not develop symptoms, healthy persons as well as persons who are ill may spread the bacteria to others. The bacteria is not transmitted by casual contact, such as sitting in the same room as an infected person or passing an infected person in a hallway or on a sidewalk.

**What are the symptoms of meningococcal disease?**
Meningococcal disease usually starts with a sudden onset of fever and headache. A stiff neck may be present and later a red or purple rash (non-blanching) often develops. Nausea and vomiting also can occur but alone are not sufficient to suggest meningococcal disease. In newborns and small infants, the classic findings of fever, headache and neck stiffness may be absent or difficult to detect, and the infant may show only extreme listlessness, irritability, poor feeding and sometimes vomiting. In severe cases, as the disease progresses, both infants and older patients may have seizures and decreased alertness advancing to coma.

**Who is most susceptible to meningococcal disease?**
Meningococcal disease is primarily a disease of young children. About 50 percent of cases
occur in infants and children younger than 4 years of age. Adults at increased risk of meningococcal disease include those who have recently been brought together as a group and housed under crowded living conditions, such as in barracks or institutions. College freshmen, particularly those living in dormitories, are at modestly increased risk. Household contacts of cases, who are at greatest risk of meningococcal disease, have only about three to 10 chances in 1,000 of developing the disease. Most persons are not susceptible to meningococcal disease because they have had prior exposure and have become immune.

Fewer than 10 percent of all meningococcal disease cases are fatal. Death occurs more often in meningococcemia (as high as 17 percent) than in meningococcal meningitis (approximately 7 percent).

**How is meningococcal disease treated?**
Cases of meningococcal disease require immediate medical treatment by a physician. The diagnosis is usually made by growing bacteria from a sample of blood or spinal fluid. The spinal fluid is obtained by performing a spinal tap, in which a needle is inserted into an area in the lower back where fluid in the spinal canal is readily accessible. Intravenous penicillin or other antibiotics are used to treat infected persons.

**How can meningococcal disease be prevented?**
Risk of transmission of meningococcal infection can be reduced by practicing good hygiene. Persons should cover their noses and mouths when sneezing or coughing and discard used tissues promptly. Wash hands thoroughly following exposure to respiratory secretions. To avoid exposure, persons should not share cigarettes, straws, cups, glasses or eating utensils. Eating and drinking utensils can be used by others only after they have been washed.

It is recommended that household contacts and others who have had close personal contact with infected persons receive a short course of certain antibiotics, which kill bacteria living in throat secretions. Since the recommendations for use of preventive antibiotics vary according to the specific situation, it is best to consult a physician or local health department for advice. Even if an antibiotic is taken, close contacts should be observed and any sign of disease promptly evaluated by a physician.

Two meningococcal vaccines are available in the U.S.:

- Meningococcal polysaccharide vaccine (M.P.S.V.4) has been available since the 1970s.
- Meningococcal conjugate vaccine (M.C.V.4) was licensed in 2005.

Both vaccines can prevent 4 types of meningococcal disease, including 2 of the 3 types most common in the United States and a type that causes epidemics in Africa. Meningococcal vaccines cannot prevent all types of the disease. But they do protect many people who might become sick if they didn’t get the vaccine.

Both vaccines work well, and protect about 90 percent of those who get it. M.C.V.4 is expected
to give better, longer-lasting protection. M.C.V.4 should also be better at preventing the disease from spreading from person to person. M.C.V.4 is recommended for all children and adolescents 11 through 18 years of age.

This dose is normally given during the routine preadolescent immunization visit (at 11 to 12 years of age). But those who did not get the vaccine during this visit should get it at the earliest opportunity.

Meningococcal vaccine is also recommended for other people at increased risk for meningococcal disease:

- College freshmen living in dormitories
- Microbiologists who are routinely exposed to meningococcal bacteria
- U.S. military recruits
- Anyone traveling to, or living in, a part of the world where meningococcal disease is common, such as parts of Africa
- Anyone who has a damaged spleen, or whose spleen has been removed
- Anyone who has terminal complement component deficiency (an immune system disorder)
- People who might have been exposed to meningitis during an outbreak

M.C.V.4 is the preferred vaccine for people 11 to 55 years of age in these risk groups, but M.P.S.V.4 can be used if M.C.V.4 is not available. M.P.S.V.4 should be used for children 2 to 10 years old, and adults over 55, who are at risk.

**How Many Doses?**

People 2 years of age and older should get 1 dose. (Sometimes an additional dose is recommended for people who remain at high risk. Ask your provider.) M.P.S.V.4 may be recommended for children 3 months to 2 years of age under special circumstances. These children should get 2 doses, 3 months apart.

Some people should not get meningococcal vaccine or should wait:

- Anyone who has ever had a severe (life-threatening) allergic reaction to a previous dose of either meningococcal vaccine should not get another dose
- Anyone who has a severe (life threatening) allergy to any vaccine component should not get the vaccine. Tell your doctor if you have any severe allergies.
- Anyone who is moderately or severely ill at the time the shot is scheduled should probably wait until they recover. Ask your doctor or nurse. People with a mild illness can usually get the vaccine.
- Anyone who has ever had Guillain-Barré Syndrome should talk with their doctor before getting M.C.V. 4.

Meningococcal vaccines may be given to pregnant women. However, M.C.V.4 is a new vaccine and has not been studied in pregnant women as much as M.P.S.V.4 has. It should be used only if clearly needed.
How many people does meningococcal disease affect?
About 2,600 people get meningococcal disease each year in the U.S. 10 to 5 percent of these people die, in spite of treatment with antibiotics. Of those who live, another 11 to 19 percent lose their arms or legs, become deaf, have problems with their nervous systems, become mentally retarded, or suffer seizures or strokes.
Polio
(source: Massachusetts Department of Public Health, CDC)

What is polio?
Polio (poliomyelitis) is a very contagious viral disease that can cause permanent paralysis (make arms and legs unable to move) or even death. Polio is still common in some parts of the world. So, although there hasn’t been a case of polio caused by naturally-occurring virus in the U.S. since 1979, there is still a risk of the virus coming into this country.

Is polio dangerous?
Yes, before polio vaccines were developed, thousands of people a year in the U.S. were paralyzed by the disease. The polio vaccine is helping to rid the world of polio. When that happens, no one will ever get polio again, and we will not need the polio vaccine.

How is polio spread?
The virus that causes polio is spread from the throat and through stool (feces). People can also spread the virus by touch if they do not wash their hands after coughing or using the toilet. Food and liquids can be contaminated this way. People who have not been immunized can get polio disease by eating food or drinking liquids containing the poliovirus. People with polio can likely spread the disease from about 1 week before their symptoms start until about 6 weeks after. Symptoms usually start about one to three weeks after a person is exposed.

How can you prevent polio?

Children
Most people should get polio vaccine when they are children. Children get 4 doses of IPV, at these ages:
- A dose at 2 months
- A dose at 4 months
- A dose at 6-18 months
- A booster dose at 4-6 years

Adults
Most adults do not need polio vaccine because they were already vaccinated as children. But three groups of adults are at higher risk and should consider polio vaccination:
- People traveling to areas of the world where polio is common,
- Laboratory workers who might handle polio virus, and
- Healthcare workers treating patients who could have polio.

Adults in these three groups who have never been vaccinated against polio should get 3 doses of IPV:
• The first dose at any time,
• The second dose 1 to 2 months later,
• The third dose 6 to 12 months after the second.

Adults in these three groups who have had 1 or 2 doses of polio vaccine in the past should get the remaining 1 or 2 doses. It doesn't matter how long it has been since the earlier dose(s).

Adults in these three groups who have had 3 or more doses of polio vaccine (either IPV or OPV) in the past may get a booster dose of IPV.

Ask your health care provider for more information.

**How many polio vaccines are there?**
There are two kinds of polio vaccine: inactivated polio vaccine (IPV), which is the shot recommended in the United States today, and a live, oral polio vaccine (OPV), which is contained in drops that are swallowed.

**Are polio vaccines safe?**
IPV is very safe. However, as with any medicine, vaccines carry a small risk of serious harm, such as a severe allergic reaction (hives, difficulty in breathing, shock) or even death. Some people who get IPV get mild soreness where the shot was given. The risk of a polio shot causing serious harm or death is extremely small.

OPV, not used in the United States since 2000, helped us rid the country of polio, and it is still used in many parts of the world. Both OPV and IPV give immunity to polio; however, for a few people (about one in 2.4 million), OPV actually causes polio. Since the risk of getting polio in the U.S. is now extremely low, experts believe using OPV is not worth the slim risk. The polio shot (IPV) does not cause polio.

**Who should not get IPV?**
These people should not get IPV:
• Anyone who has ever had a life-threatening allergic reaction to the antibiotics neomycin, streptomycin or polymyxin B should not get the polio shot.
• Anyone who has a severe allergic reaction to a polio shot should not get another one.

These people should wait:
• Anyone who is moderately or severely ill at the time the shot is scheduled should usually wait until they recover before getting polio vaccine. People with minor illnesses, such as a cold, may be vaccinated.

Ask your health care provider for more information.

**Should travelers get polio boosters before leaving the U.S.?**
Travelers should check their records to make sure they are up-to-date on all vaccines when
planning to leave the U.S. Polio is as rare in places like Europe, Canada, Japan, Australia, and New Zealand as it is here. Children should be up-to-date for their age on all vaccines before traveling. Adults who are not completely vaccinated should get as many doses as possible before departure. Adults who have had 3 doses might need another dose before traveling to areas where polio transmission still occurs; including developing countries in Asia, Africa and the Middle East.

**What is post-polio syndrome?**
Post-polio syndrome tends to strike people 20 to 30 years after they first had the disease. (This syndrome is also called post-polio muscle atrophy or late effects of polio). Symptoms include muscle weakness, cramps and pain, increased fatigue, and trouble breathing. Up to one in four polio survivors may suffer this syndrome.

**How many people does polio affect?**
According to the CDC, there are no longer any naturally-occurring polio infections in the United States.
**Hepatitis A**

*(source: National Digestive Diseases Information Clearinghouse, CDC)*

**What is hepatitis A?**
Hepatitis A is a liver disease. Hepatitis makes your liver swell and stops it from working right. You need a healthy liver. The liver does many things to keep you alive. The liver fights infections and stops bleeding. It removes drugs and other poisons from your blood. The liver also stores energy for when you need it.

**What causes hepatitis A?**
Hepatitis A is caused by a virus.

**How could I get hepatitis A?**
Hepatitis A is spread by close personal contact with someone else who has the infection. You could also get hepatitis A by eating food that has been prepared by someone with hepatitis A or drinking water that has been contaminated by hepatitis A (in parts of the world with poor hygiene and sanitary conditions).

**Who can get hepatitis A?**
Anyone can get hepatitis A, but some people are more likely to than others:
- People who live with someone who has hepatitis A.
- Children who go to daycare.
- People who work in a daycare center.
- Men who have sex with men.
- People who travel to other countries where hepatitis A is common.

**What are the symptoms?**
Hepatitis A can make you feel like you have the flu.

You might:
- Feel tired
- Feel sick to your stomach
- Have a fever
- Not want to eat
- Have stomach pain
- Have diarrhea

Some people have:
- Dark yellow urine
- Light-colored stools
- Yellowish eyes and skin

Some people don't have any symptoms. If you have symptoms, or think you might have hepatitis A, go to a doctor. The doctor will test your blood.
**How is hepatitis A treated?**
Most people who have hepatitis A get well on their own after a few weeks. You may need to rest in bed for several days or weeks, and you won't be able to drink alcohol until you are well. The doctor may give you medicine for your symptoms.

**How can I protect myself?**
Some people should be routinely vaccinated with hepatitis A vaccine:
- All children 1 year (12 through 23 months) of age.
- Persons 1 year of age and older traveling to or working in countries with high or intermediate prevalence of hepatitis A, such as those located in Central or South America, Mexico, Asia (except Japan), Africa, and eastern Europe.
- Children and adolescents through 18 years of age who live in states or communities where routine vaccination has been implemented because of high disease incidence.
- Men who have sex with men.
- Persons who use street drugs.
- Persons with chronic liver disease.
- Persons who are treated with clotting factor concentrates.
- Persons who work with H.A.V.-infected primates or who work with H.A.V. in research laboratories.

Other people might get hepatitis A vaccine in special situations. Hepatitis A vaccine might be recommended for children or adolescents in communities where outbreaks of hepatitis A are occurring.

Hepatitis A vaccine is not licensed for children younger than 1 year of age.

**When?**
For children, the first dose should be given at 12 through 23 months of age. Children who are not vaccinated by 2 years of age can be vaccinated at later visits.

For travelers, the vaccine series should be started at least one month before traveling to provide the best protection.

Persons who get the vaccine less than one month before traveling can also get a shot called immune globulin (I.G.). I.G. gives immediate, temporary protection.

For others, the hepatitis A vaccine series may be started whenever a person is at risk of infection.

Two doses of the vaccine are needed for lasting protection. These doses should be given at least 6 months apart.

Hepatitis A vaccine may be given at the same time as other vaccines.
Some people should not get hepatitis A vaccine or should wait:

- Anyone who has ever had a severe (life-threatening) allergic reaction to a previous dose of hepatitis A vaccine should not get another dose.
- Anyone who has a severe (life threatening) allergy to any vaccine component should not get the vaccine. Tell your doctor if you have any severe allergies. All hepatitis A vaccines contain alum and some hepatitis A vaccines contain 2-phenoxyethanol.
- Anyone who is moderately or severely ill at the time the shot is scheduled should probably wait until they recover. Ask your doctor or nurse. People with a mild illness can usually get the vaccine.
- Tell your doctor if you are pregnant. The safety of hepatitis A vaccine for pregnant women has not been determined. But there is no evidence that it is harmful to either pregnant women or their unborn babies. The risk, if any, is thought to be very low.

You can protect yourself and others from hepatitis A in these ways, too:

- Always wash your hands after using the toilet and before fixing food or eating.
- Wear gloves if you have to touch other people's stool. Wash your hands afterwards.
- Drink bottled water when you are in another country. (And don't use ice cubes or wash fruits and vegetables in tap water.)

**How many people does hepatitis A affect?**

According to the CDC, hepatitis A is cyclical in nature. During epidemic years, the numbers have reached 35,000 infections per year. One-third of Americans have been infected at some time with hepatitis A. Death or long-term disability from hepatitis A is a rare occurrence.
What is hepatitis?
Hepatitis is an inflammation of the liver caused by certain viruses and other factors, such as alcohol abuse, some medications and trauma. Its various forms affect millions of Americans. Although many cases of hepatitis are not a serious threat to health, infection with certain hepatitis viruses can become chronic (long-lasting) and can sometimes lead to liver failure and death.

What is hepatitis B and how is it transmitted?
Infection with the hepatitis B virus (HBV) may be without any symptoms, mild or severe. Among adults infected with HBV, 90 percent to 94 percent recover completely and have no long-term effects. Six percent to 10 percent will become chronic carriers of HBV and will be at risk of developing cirrhosis or liver cancer. [Ninety percent of infants born to hepatitis B infected mothers will develop chronic infections without vaccine intervention.]

HBV is spread by direct contact with blood or other body fluids of infected people. Since the disease is not easily spread, persons with HBV do not pass the virus to others through casual contact, such as shaking hands or sharing a work space or bathroom facility. HBV is most commonly transmitted by sharing drug needles, by engaging in high-risk sexual behavior (especially anal sex), from a mother to her baby during childbirth and in the healthcare setting.

What are the symptoms of hepatitis B?
Many people infected with viral hepatitis have no symptoms. For example, about one-third of people infected with HBV have a completely “silent” disease. When symptoms are present, they may be mild or severe. The most common early symptoms are mild fever, headache, muscle aches, fatigue, loss of appetite, nausea, vomiting and diarrhea. Later symptoms may include dark coffee-colored, rather than dark yellow, urine, clay-colored stools, abdominal pain, and yellowing of the skin and whites of the eyes (jaundice).

About 15 percent to 20 percent of patients develop short-term arthritis-like problems. Another one-third of those with hepatitis B develop only mild flu-like symptoms without jaundice. Very severe hepatitis B is rare, but it is life-threatening. Signs and symptoms, which require immediate medical attention, include prolonged blood clotting time, personality changes and agitated behavior.
Can people with no symptoms pass hepatitis B to others?
Some people infected with HBV become chronic carriers of the virus, although they may have no symptoms. There are an estimated 1.25 million HBV carriers in the United States and about 350 million carriers worldwide. Children, when exposed to HBV, are at greatest risk of becoming carriers. Up to 90 percent of babies who become infected at birth with HBV, and up to half of youngsters who are infected before 5 years of age, become chronic carriers.

How is hepatitis B diagnosed?
Several blood tests can detect signs of HBV even before symptoms develop. These tests measure liver function and identify HBV antigens (certain portions of the hepatitis B virus) or antibodies (proteins produced by the body in response to the virus) in the blood.

How is hepatitis B treated?
There are no specific treatments for the acute symptoms of viral hepatitis B. Doctors recommend bed rest, preventing dehydration, a healthy diet and avoidance of alcoholic beverages.

There are treatment options available for those chronically infected with the hepatitis B virus. Please check with your provider for information and visit PKIDs’ Pediatric Hepatitis Report (www.pkids.org/pedheprep) for pediatric-specific information.

Many chronic carriers remain symptom free or develop only a mild condition, chronic persistent hepatitis. However, approximately 25 percent go on to develop the most serious complications of viral hepatitis: cirrhosis of the liver, liver cancer and immune system disorders.

How can hepatitis B be prevented?

Children and Adolescents
- All children should get their first dose of hepatitis B vaccine at birth and should have completed the vaccine series by 6 through 18 months of age.
- Children and adolescents through 18 years of age who did not get the vaccine when they were younger should also be vaccinated.

Adults
All unvaccinated adults at risk for HBV infection should be vaccinated. This includes:
- Sex partners of people infected with HBV
- Men who have sex with men
- People who inject street drugs
- People with more than one sex partner
- People with chronic liver or kidney disease
- People with jobs that expose them to human blood
• Household contacts of people infected with HBV
• Residents and staff in institutions for the developmentally disabled
• Kidney dialysis patients
• People who travel to countries where hepatitis B is common
• People with HIV infection

Anyone else who wants to be protected from HBV infection may be vaccinated.

Who should not get hepatitis B vaccine?
• Anyone with a life-threatening allergy to baker’s yeast, or to any other component of the vaccine, should not get hepatitis B vaccine. Tell your provider if you have any severe allergies.
• Anyone who has had a life-threatening allergic reaction to a previous dose of hepatitis B vaccine should not get another dose.
• Anyone who is moderately or severely ill when a dose of vaccine is scheduled should probably wait until they recover before getting the vaccine.

Your provider can give you more information about these precautions.

Pregnant women who need protection from HBV infection may be vaccinated.

How many people does hepatitis B infection affect?
The number of new infections per year has declined from an average of 260,000 in the 1980s to about 60,000 in 2004, with the highest rate of disease occurring in 20-49-year-olds. The greatest decline has happened among children and adolescents due to routine hepatitis B vaccination. An estimated 1.25 million chronically infected Americans, of whom 20-30% acquired their infection in childhood. Each year, 3,000 to 5,000 people die from cirrhosis or liver cancer caused by hepatitis B virus.
Hepatitis C
(source: CDC/NCIDOD)

What is hepatitis C?
Hepatitis C is a liver disease caused by the hepatitis C virus (HCV), which is found in the blood of persons who have this disease. The infection is spread by contact with the blood of an infected person.

How serious is hepatitis C?
Hepatitis C is serious for some persons, but not for others. Most persons who get hepatitis C carry the virus for the rest of their lives. Most of these persons have some liver damage but many do not feel sick from the disease. Some persons with liver damage due to hepatitis C may develop cirrhosis (scarring) of the liver and liver failure, which may take many years to develop. Others have no long-term effects.

What can I do now that my hepatitis C test is positive?
Contact your doctor. Additional tests may be needed to check your diagnosis and to see if you have liver damage.

What if I don't feel sick?
Many persons with long-term hepatitis C have no symptoms and feel well, but should still see their doctor. For some persons, the most common symptom is extreme tiredness.

How can I take care of my liver?
• See your doctor regularly.
• Do not drink alcohol.
• Tell your doctor about all medicines that you are taking, even over the counter and herbal medicines.

Is there a treatment for hepatitis C?
Drugs are licensed for the treatment of persons with long-term hepatitis C. About 4-5 out of every 10 patients who are treated get rid of the virus.

How could I have gotten hepatitis C?
HCV is spread primarily by exposure to human blood. You may have gotten hepatitis C if:
• You ever injected street drugs, even if you experimented a few times many years ago.
• You were treated for clotting problems with a blood product made before 1987.
• You received a blood transfusion or solid organ transplant (e.g., kidney, liver, heart) from an infected donor.
• You were ever on long-term kidney dialysis.
• You were ever a healthcare worker and had frequent contact with blood in the work place, especially accidental needlesticks.
• Your mother had hepatitis C at the time she gave birth to you.
• You ever had sex with a person infected with HCV.
• You lived with someone who was infected with HCV and shared items such as razors or toothbrushes that might have had blood on them.

**How can I prevent spreading HCV to others?**
• Do not donate your blood, body organs, other tissue, or sperm.
• Do not share toothbrushes, razors, or other personal care articles that might have your blood on them.
• Cover your cuts and open sores.
• If you have one long-term, steady sex partner, there is a very low chance of giving HCV to that partner and you do not need to change your sexual practices. If you want to lower the small chance of spreading HCV to your sex partner, you may decide to use latex condoms. (The efficacy of latex condoms in preventing infection with HCV is unknown, but their proper use may reduce transmission.) Ask your doctor about having your sex partner tested.

**What if I am pregnant?**
Five out of every 100 infants born to HCV infected women become infected. This occurs at the time of birth, and there is no treatment that can prevent this from happening. However, infants infected with HCV at the time of birth seem to do very well in the first few years of life. More studies are needed to find out if these infants will have problems from the infection as they grow older.

*Persons should not be excluded from work, school, play, childcare or other settings on the basis of their HCV infection status.*

**Hepatitis C is NOT spread by:**
• Breast feeding.
• Sneezing.
• Hugging.
• Coughing.
• Sharing eating utensils or drinking glasses.
• Food or water.
• Casual contact.

**If you use or inject street drugs:**
• Stop and get into a drug treatment program.
• If you cannot stop, do not reuse or share syringes, water, or drug works.
• Get vaccinated against hepatitis B and hepatitis A.

**If you are having sex, but not with one steady partner:**
• You and your partners can spread diseases by having sex (e.g., HIV, hepatitis B, gonorrhea or chlamydia). Use latex condoms correctly and every time. (The efficacy of latex condoms in preventing infection with HCV is unknown, but their proper use may reduce transmission.) The surest way to prevent the spread of any disease by sex is not to have sex at all.
- Get vaccinated against hepatitis B.

There is no vaccine available to prevent hepatitis C.

A person who has hepatitis C can still get other types of viral hepatitis, such as hepatitis A or hepatitis B. Most people two years of age or older with chronic hepatitis C should be immunized against hepatitis A and hepatitis B. A dual infection with two types of hepatitis viruses can accelerate liver disease.

**How many people does hepatitis C affect?**
The number of new infections per year has declined from an average of 240,000 in the 1980s to about 26,000 in 2004, with most infections due to illegal injection drug use.

Transfusion-associated cases occurred prior to blood donor screening; now occurs in less than one per 2 million transfused units of blood.

An estimated 4.1 million (1.6%) Americans have been infected with HCV, of whom 3.2 million are chronically infected.

The risk for perinatal HCV transmission is about 4 percent, but if coinfected with HIV, the risk for perinatal infection is about 19 percent.
Tuberculosis (TB)
(source: New York State Department of Health, CDC)

What is tuberculosis?
Tuberculosis is a bacterial disease usually affecting the lungs (pulmonary TB). Other parts of the body can also be affected, for example lymph nodes, kidneys, bones, joints, etc. (extrapulmonary TB).

Who gets tuberculosis?
Tuberculosis can affect anyone of any age. People with weakened immune systems are at increased risk.

How is tuberculosis spread?
Tuberculosis is spread through the air when a person with untreated pulmonary TB coughs or sneezes. Prolonged exposure to a person with untreated TB usually is necessary for infection to occur.

What is the difference between latent tuberculosis infection and tuberculosis disease?
Latent tuberculosis infection (LTBI) means the person has the TB germ in their body (usually lungs), but has yet to develop obvious symptoms. In latent TB, the person has a significant reaction to the Mantoux skin test with no symptoms of tuberculosis, and no TB organisms found in the sputum. Tuberculosis disease indicates the person has symptoms, a significant reaction to a Mantoux skin test and organisms found in the sputum. In order to spread the TB germs, a person must have TB disease. Having latent TB infection is not enough to spread the germ. Tuberculosis may last for a lifetime as an infection, never developing into disease.

What are the symptoms of tuberculosis?
The symptoms of TB include a low-grade fever, night sweats, fatigue, weight loss and a persistent cough. Some people may not have obvious symptoms.

How soon do symptoms appear?
Most people infected with the germ that causes TB never develop active TB. If active TB does develop, it can occur two to three months after infection or years later. The risk of active disease lessens as time passes.

When and for how long is a person able to spread tuberculosis?
A person with TB disease may remain contagious until he/she has been on appropriate treatment for several weeks. However, a person with latent TB infection, but not disease, cannot spread the infection to others, since there are no TB germs in the sputum.
**What is the treatment for tuberculosis?**
There are treatment options, but they vary depending on co-infection status, latent or active infection and other factors. Speak with a healthcare provider to discover what’s best for you.

**What can be the effect of not being treated for tuberculosis?**
In addition to spreading the disease to others, an untreated person may become severely ill or die.

**What can be done to prevent the spread of tuberculosis?**
The most important way to stop the spread of tuberculosis is for TB patients to cover the mouth and nose when coughing, and to take all the TB medicine exactly as prescribed by the physician.

**What is multiple drug resistant tuberculosis (MDR-TB)?**
This refers to the ability of some strains of TB to grow and multiply even in the presence of certain drugs which would normally kill them.

**Who gets MDR-TB?**
TB patients with drug sensitive disease may develop drug resistant tuberculosis if they fail to take antituberculosis medications as prescribed, as well as TB patients who have been prescribed an ineffective treatment plan. TB cases diseased with MDR-TB can transmit the drug resistant infection to other individuals.

**What is the treatment for multiple drug resistant tuberculosis?**
For patients with disease due to drug resistant organisms, expert consultation from a specialist in treating drug resistant TB should be obtained. Patients with drug resistant disease should be treated with drugs to which their organisms are susceptible. The effectiveness of treatment for latent infection with MDR-TB is uncertain.

**What can be done to prevent the spread of MDR-TB?**
Ensuring people with MDR-TB take all their medication and teaching patients to cover their mouth and nose when coughing and sneezing can reduce the risk of spread of MDR-TB. In addition, Directly Observed Therapy should be used to ensure patients complete the recommended course of therapy. Sometimes isolation of the infected person for a period of time is necessary to prevent the spread of this disease.

**How many people does tuberculosis affect?**
According to the WHO, nearly 2 billion persons – about one third of the world’s population – are infected with tuberculosis (TB) bacteria. Each year, nearly 9 million people go on to develop active TB, the infectious form of the disease, and 2 million people experience TB-related deaths each year. The CDC reports that there were more than 14,000 cases of tuberculosis reported in 2005 in the United States.
**Cytomegalovirus**  
*source: Utah Department of Health, CDC*

**What is cytomegalovirus (CMV)?**  
Human CMV is a common virus that infects most people some time during their lives, but rarely causes illness. It is a member of the herpesvirus group and can be present in your body without causing illness; it can be reactivated later and cause illness.

**Who gets CMV?**  
Anyone. Many adults may have been infected at some time during their life.

**How is CMV spread?**  
CMV is spread from person to person by contact with urine, saliva, breast milk, blood, semen, and possibly other body fluids. The virus can spread from an infected mother to her fetus or newborn baby. CMV can also be spread by blood transfusion and organ transplants.

**What are the symptoms of CMV infection?**  
Most children and adults infected with CMV do not have symptoms. Those who do may have fever, swollen glands, and feel tired. Immunocompromised people (such as AIDS patients or those receiving cancer treatments) may have a more serious illness such as pneumonia or inflammation of the eye. The most severe form of the disease occurs when a mother infects her fetus. Most of these infections are without symptoms, however, about 10 percent of these babies later have some type of disability such as hearing loss, learning disabilities, or mental retardation.

**How soon after infection do symptoms appear?**  
Information about this is not exact. Illness following transfusion with infected blood begins three to eight weeks after the transfusion. Infections acquired during birth may occur three to twelve weeks after delivery. The time frame for onset of symptoms following person to person transmission is unknown, since most people never become ill.

**How long can an infected person carry CMV?**  
CMV may remain in the body throughout a person's lifetime. The virus may be found in the urine or saliva of infected people who may or may not be ill.

**How is CMV diagnosed?**  
Diagnosis is made by finding the virus in the blood, urine, saliva, semen, breast milk, or other body fluids or tissues.
What is the treatment for CMV infections?
Scientists are working on CMV vaccines and are looking for other ways to prevent congenital (meaning present at birth) CMV. For now, there are no treatments for pregnant women whose fetuses might be infected with CMV. Current drugs that are effective against CMV have serious side effects and are not approved for use in pregnant women.

There is some evidence that ganciclovir, an antiviral drug, may prevent hearing loss in infants born with congenital CMV. However, this drug has serious side effects and was only tested in children with severe congenital CMV symptoms. If your child has symptoms of congenital CMV, you should consult with your doctor to decide whether to try treatment.

Should an infected person be excluded from school or work?
No.

What precautions should pregnant women take?
Pregnant women should be careful to wash their hands after changing diapers or having contact with urine or saliva. Those working in daycare centers should not kiss babies or young children on the mouth. Pregnant women should ask their doctor about CMV infections.

What can be done to stop the spread of CMV?
Good handwashing is the best way to prevent infection with CMV. Healthcare workers should wear disposable gloves when handling sheets or clothes soiled with feces or urine.

How many people does CMV affect?
Between 50% and 80% of adults in the United States are infected with CMV by 40 years of age.

CMV is the most common virus transmitted to a pregnant woman's unborn child, with approximately 1 in 150 children born with congenital CMV infection and approximately 1 in 750 children born with or developing permanent disabilities due to CMV.

Approximately 8,000 children each year suffer permanent disabilities caused by CMV. Congenital CMV (meaning present at birth) is as common a cause of serious disability as Down syndrome, fetal alcohol syndrome, and neural tube defects.
Herpes
*(source: Utah Department of Health)*

**What is herpes?**
Herpes is caused by one of two viruses: herpes simplex type 1 (HSV1) and herpes simplex type 2 (HSV2). Herpes is a common infection that causes "cold sores" or "fever blisters" on the mouth or face (known as oral herpes) and similar symptoms in the genital region (known as genital herpes).

**How is herpes spread?**
Herpes is transmitted by direct skin-to-skin contact, directly from the site of infection to the site of contact. For example, if you have a cold sore and kiss someone, the virus can infect your partner's mouth. Herpes can also be spread sexually when there are no visible signs or symptoms.

**What are the symptoms?**
First episodes of the disease tend to be more severe than recurrences. Symptoms of an infection may include a burning or tingling sensation, followed by multiple painful vesicles at the site of infection (e.g., cervix, vulva, penis, mouth, hands). A low percentage of patients experience symptoms so severe that they must be hospitalized. Women often have more severe first episodes than men. Subsequent recurrences of infection vary from person to person. Some people who have an HSV infection never experience symptoms.

**How soon do the symptoms appear?**
The first symptoms appear within 2 to 12 days after infection.

**How long can an infected person spread the virus?**
Patients with primary genital lesions are infectious for about 7-12 days, and with recurrent disease from 4-7 days. Asymptomatic viral shedding is probably common.

**How is herpes diagnosed?**
If you have symptoms, the most common test is a viral culture. To perform this test, your physician must take a sample from a lesion, preferably on the first day.

**What is the treatment for herpes?**
There is no cure for herpes, but there are medications which help to keep the virus in check. Current medications are safe and have few side effects. Suppressive therapy greatly reduces the number of outbreaks for most people, and can prevent outbreaks altogether for some.

**How can one reduce the risk of spreading herpes?**
- Abstain from sex when signs and symptoms of genital herpes are present.
- Tell your partner if you have herpes. Use condoms between recurrences of herpes.
• Condoms offer useful protection against unrecognized herpes by protecting the mucous membranes that are the most likely sites of transmission.
• Wash your hands after touching sores or using the bathroom.
• Avoid kissing others when you have active cold sores to prevent the spread of oral herpes.

**What are some complications?**
Although rare, during delivery a newborn can contract herpes if the mother has active herpes at the time. Herpes infections in the newborn are often quite severe and may result in permanent neurologic (nervous system) or ocular (eye) damage, or even death of the newborn. It is possible to move the virus from the location of the outbreak to other places on the body by touching the sore(s). The fingers, eyes, and other body parts can become infected in this manner. Encephalitis (inflammation of the brain) may result from primary or recurrent infection and is associated with fever, alterations in the state of consciousness, and convulsions.

**How many people does herpes affect?**
According to the CDC, 45 million people nationwide ages 12 and older, or one out of five of the total adolescent and adult population, are infected with HSV-2 (genital herpes). HSV-1 (oral herpes) has a vast presence in humans. It has been estimated that 90 percent of humans experience oral herpes infections by the age of 10.
HIV/AIDS
(source: National Institute of Allergy and Infectious Diseases)

Overview
AIDS was first reported in the United States in 1981 and has since become a major worldwide epidemic. AIDS is caused by the human immunodeficiency virus, or HIV. By killing or damaging cells of the body’s immune system, HIV progressively destroys the body’s ability to fight infections and certain cancers. People diagnosed with AIDS may get life-threatening diseases called opportunistic infections. These infections are caused by microbes such as viruses or bacteria that usually do not make healthy people sick.

Since 1981, more than 980,000 cases of AIDS have been reported in the United States to the Centers for Disease Control and Prevention (CDC). According to CDC, more than 1,000,000 Americans may be infected with HIV, one-quarter of whom are unaware of their infection. The epidemic is growing most rapidly among minority populations and is a leading killer of African-American males ages 25 to 44. According to CDC, AIDS affects nearly seven times more African Americans and three times more Hispanics than whites. In recent years, an increasing number of African-American women and children are being affected by HIV/AIDS.

Transmission
HIV is spread most often through unprotected sex with an infected partner. The virus can enter the body through the lining of the vagina, vulva, penis, rectum, or mouth during sex.

Risky behavior
HIV can infect anyone who practices risky behaviors such as:
- Sharing drug needles or syringes
- Having sexual contact, including oral sexual contact, with an infected person without using a condom
- Having sexual contact with someone whose HIV status is unknown

Infected blood
HIV also is spread through contact with infected blood. Before donated blood was screened for evidence of HIV infection and before heat-treating techniques to destroy HIV in blood products were introduced, HIV was transmitted through transfusions of contaminated blood or blood components. Today, because of blood screening and heat treatment, the risk of getting HIV from blood transfusions is extremely small.
Contaminated needles
HIV is often spread among injection drug users when they share needles or syringes contaminated with very small quantities of blood from someone infected with the virus.

It is rare for a patient to be the source of HIV transmitted to a healthcare provider or vice versa by accidental sticks with contaminated needles or other medical instruments.

Mother to child
Women can transmit HIV to their babies during pregnancy or birth. Approximately one-quarter to one-third of all untreated pregnant women infected with HIV will pass the infection to their babies. HIV also can be spread to babies through the breast milk of mothers infected with the virus.

- If the mother takes certain drugs during pregnancy, she can significantly reduce the chances that her baby will get infected with HIV.
- If healthcare providers treat HIV-infected pregnant women and deliver their babies by cesarean section, the chances of the baby being infected can be reduced to a rate of 1 percent.

HIV infection of newborns has been almost eradicated in the United States because of appropriate treatment.

A study sponsored by the National Institute of Allergy and Infectious Diseases (NIAID) in Uganda found a highly effective and safe drug for preventing transmission of HIV from an infected mother to her newborn. Independent studies have also confirmed this finding. This regimen is more affordable and practical than any other examined to date. Results from the study show that a single oral dose of the antiretroviral drug nevirapine (NVP) given to an HIV-infected woman in labor and another to her baby within 3 days of birth reduces the transmission rate of HIV by half compared with a similar short course of AZT (azidothymidine).

Saliva
Although researchers have found HIV in the saliva of infected people, there is no evidence that the virus is spread by contact with saliva. Laboratory studies reveal that saliva has natural properties that limit the power of HIV to infect, and the amount of virus in saliva appears to be very low. Research studies of people infected with HIV have found no evidence that the virus is spread to others through saliva by kissing.

The lining of the mouth, however, can be infected by HIV, and instances of HIV transmission through oral intercourse have been reported.

Scientists have found no evidence that HIV is spread through sweat, tears, urine, or feces.

Casual contact
Studies of families of HIV-infected people have shown clearly that HIV is not spread through
casual contact such as the sharing of food utensils, towels and bedding, swimming pools, telephones, or toilet seats.

HIV is not spread by biting insects such as mosquitoes or bedbugs.

Sexually transmitted infections
People with a sexually transmitted infection, such as syphilis, genital herpes, chlamydia, gonorrhea, or bacterial vaginosis, may be more susceptible to getting HIV infection during sex with infected partners.

Symptoms
Early symptoms
Many people will not have any symptoms when they first become infected with HIV. They may, however, have a flu-like illness within a month or two after exposure to the virus. This illness may include
- Fever
- Headache
- Tiredness
- Enlarged lymph nodes (glands of the immune system easily felt in the neck and groin)

These symptoms usually disappear within a week to a month and are often mistaken for those of another viral infection. During this period, people are very infectious, and HIV is present in large quantities in genital fluids.

Later symptoms
More persistent or severe symptoms may not appear for 10 years or more after HIV first enters the body in adults, or within 2 years in children born with HIV infection. This period of asymptomatic infection varies greatly in each person. Some people may begin to have symptoms within a few months, while others may be symptom-free for more than 10 years.

Even during the asymptomatic period, the virus is actively multiplying, infecting and killing cells of the immune system. The virus can also hide within infected cells and be inactive. The most obvious effect of HIV infection is a decline in the number of CD4 positive T (CD4+) cells found in the blood—the immune system’s key infection fighters. The virus slowly disables or destroys these cells without causing symptoms.

As the immune system becomes more debilitated, a variety of complications start to take over. For many people, the first signs of infection are large lymph nodes, or swollen glands, that may be enlarged for more than 3 months.

Other symptoms often experienced months to years before the onset of AIDS include:
- Lack of energy
- Weight loss
• Frequent fevers and sweats
• Persistent or frequent yeast infections (oral or vaginal)
• Persistent skin rashes or flaky skin
• Pelvic inflammatory disease in women that does not respond to treatment
• Short-term memory loss

Some people develop frequent and severe herpes infections that cause mouth, genital, or anal sores, or a painful nerve disease called shingles. Children may grow slowly or get sick frequently.

**Diagnosis**
Because early HIV infection often causes no symptoms, a healthcare provider usually can diagnose it by testing blood for the presence of antibodies (disease-fighting proteins) to HIV. HIV antibodies generally do not reach noticeable levels in the blood for 1 to 3 months after infection. It may take the antibodies as long as 6 months to be produced in quantities large enough to show up in standard blood tests. Hence, to determine whether a person has been recently infected (acute infection), a healthcare provider can screen blood for the presence of HIV genetic material. Direct screening of HIV is extremely critical to prevent transmission of HIV from recently infected individuals.

Anyone who has been exposed to the virus should get an HIV test as soon as the immune system is likely to develop antibodies to the virus—within 6 weeks to 12 months after possible exposure to the virus. By getting tested early, a healthcare provider can give advice to an infected person about when to start treatment to help the immune system combat HIV and help prevent the emergence of certain opportunistic infections (see section on treatment). Early testing also alerts an infected person to avoid high-risk behaviors that could spread the virus to others.

Most healthcare providers can do HIV testing and will usually offer counseling at the same time. Of course, testing can be done anonymously at many sites if a person is concerned about confidentiality.

Healthcare providers diagnose HIV infection by using two different types of antibody tests: ELISA (enzyme-linked immunosorbent assay) and Western blot. If a person is highly likely to be infected with HIV but has tested negative for both tests, a healthcare provider may request additional tests. A person also may be told to repeat antibody testing at a later date, when antibodies to HIV are more likely to have developed.

**Diagnosis in Babies**
Babies born to mothers infected with HIV may or may not be infected with the virus, but all carry their mothers’ antibodies to HIV for several months. If these babies lack symptoms, healthcare providers cannot make a definitive diagnosis of HIV infection using standard antibody tests. Instead, they are using new technologies to detect HIV and more accurately determine HIV infection in infants between ages 3 months and 15 months. Researchers are
evaluating a number of blood tests to determine which ones are best for diagnosing HIV infection in babies younger than 3 months.

Treatment
When AIDS first surfaced in the United States, there were no drugs to combat the underlying immune deficiency, and few treatments existed for the opportunistic diseases that resulted. Researchers, however, have developed drugs to fight both HIV infection and its associated infections and cancers.

HIV infection
The Food and Drug Administration (FDA) has approved a number of drugs for treating HIV infection.

RT Inhibitors
The first group of drugs, called reverse transcriptase (RT) inhibitors, interrupts an early stage of the virus, making copies of itself. Nucleoside/nucleotide RT inhibitors are faulty DNA building blocks. When these faulty pieces are incorporated into the HIV DNA (during the process when the HIV RNA is converted to HIV DNA), the DNA chain cannot be completed, thereby blocking HIV from replicating in a cell. Non-nucleoside RT inhibitors bind to reverse transcriptase, interfering with its ability to convert the HIV RNA into HIV DNA. This class of drugs may slow the spread of HIV in the body and delay the start of opportunistic infections.

Protease Inhibitors
FDA has approved a second class of drugs for treating HIV infection. These drugs, called protease inhibitors, interrupt the virus from making copies of itself at a later step in its life cycle.

Fusion Inhibitors
FDA also has introduced a third new class of drugs, known at fusion inhibitors, to treat HIV infection. Fuzeon (enfuvirtide or T-20), the first approved fusion inhibitor, works by interfering with the ability of HIV-1 to enter into cells by blocking the merging of the virus with the cell membranes. This inhibition blocks HIV’s ability to enter and infect the human immune cells. Fuzeon is designed for use in combination with other anti-HIV treatments. It reduces the level of HIV infection in the blood and may be effective against HIV that has become resistant to current antiviral treatment schedules.

HAART
Because HIV can become resistant to any of these drugs, healthcare providers must use a combination treatment to effectively suppress the virus. When multiple drugs (three or more) are used in combination, it is referred to as highly active antiretroviral therapy, or HAART, and can be used by people who are newly infected with HIV as well as people with AIDS. Recently, FDA approved the first one-a-day, three-drug combination pill called Atripla.

Researchers have credited HAART as being a major factor in significantly reducing the number
of deaths from AIDS in this country. While HAART is not a cure for AIDS, it has greatly improved the health of many people with AIDS, and it reduces the amount of virus circulating in the blood to nearly undetectable levels. Researchers, however, have shown that HIV remains present in hiding places, such as the lymph nodes, brain, testes, and retina of the eye, even in people who have been treated.

Side effects
Despite the beneficial effects of HAART, there are side effects associated with the use of antiviral drugs that can be severe. Some of the nucleoside RT inhibitors may cause a decrease of red or white blood cells, especially when taken in the later stages of the disease. Some may also cause inflammation of the pancreas and painful nerve damage. There have been reports of complications and other severe reactions, including death, to some of the antiretroviral nucleoside analogs when used alone or in combination. Therefore, health experts recommend that anyone on antiretroviral therapy be routinely seen and followed by their healthcare provider.

The most common side effects associated with protease inhibitors include nausea, diarrhea, and other gastrointestinal symptoms. In addition, protease inhibitors can interact with other drugs, resulting in serious side effects. Fuzeon may also cause severe allergic reactions such as pneumonia, difficult breathing, chills and fever, skin rash, blood in urine, vomiting, and low blood pressure. Local skin reactions are also possible since it is given as an injection underneath the skin. People taking HIV drugs should contact their healthcare providers immediately if they have any of these symptoms.

Opportunistic infections
A number of available drugs help treat opportunistic infections. These drugs include:

- Foscarnet and ganciclovir to treat CMV (cytomegalovirus) eye infections
- Fluconazole to treat yeast and other fungal infections
- TMP/SMX (trimethoprim/sulfamethoxazole) or pentamidine to treat PCP (Pneumocystis carinii pneumonia)

Cancers
Healthcare providers use radiation, chemotherapy, or injections of alpha interferon—a genetically engineered protein that occurs naturally in the human body—to treat Kaposi’s sarcoma or other cancers associated with HIV infection.

Prevention
Because there is no vaccine for HIV, the only way people can prevent infection with the virus is to avoid behaviors putting them at risk of infection, such as sharing needles and having unprotected sex.

Many people infected with HIV have no symptoms. Therefore, there is no way of knowing with certainty whether a sexual partner is infected unless he or she has repeatedly tested negative for the virus and has not engaged in any risky behavior.
Abstaining from having sex or using male latex condoms or female polyurethane condoms may offer partial protection, during oral, anal, or vaginal sex. Only water-based lubricants should be used with male latex condoms.

Although some laboratory evidence shows that spermicides can kill HIV, researchers have not found that these products can prevent a person from getting HIV.

Recently, NIAID-supported two studies that found adult male medical circumcision reduces a man’s risk of acquiring HIV infection by approximately 50 percent. The studies, conducted in Uganda and Kenya, pertain only to heterosexual transmission. As with most prevention strategies, adult male medical circumcision is not completely effective at preventing HIV transmission. Circumcision will be most effective when it is part of a more complete prevention strategy, including the ABCs (Abstinence, Be Faithful, Use Condoms) of HIV prevention.

**Research**

NIAID-supported investigators are conducting an abundance of research on all areas of HIV infection, including developing and testing preventive HIV vaccines, prevention strategies, and new treatments for HIV infection and AIDS-associated opportunistic infections.

Researchers also are investigating exactly how HIV damages the immune system. This research is identifying new and more effective targets for drugs and vaccines. NIAID-supported investigators also continue to trace how the disease progresses in different people.

Scientists are investigating and testing chemical barriers, such as topical microbicides, that people can use in the vagina or in the rectum during sex to prevent HIV transmission. They also are looking at other ways to prevent transmission, such as:

- Control of sexually transmitted infections
- Modification of personal behavior
- Pre-exposure prophylaxis (PrEP)
- Ways to prevent transmission from mother to child

**How many people in the world does HIV/AIDS affect?**

New WHO data show global HIV prevalence—the percentage of people living with HIV—has levelled off and that the number of new infections has fallen, in part as a result of the impact of HIV programmes. However, in 2007 33.2 million [30.6 – 36.1 million] people were estimated to be living with HIV, 2.5 million [1.8 – 4.1 million] people became newly infected and 2.1 million [1.9 – 2.4 million] people died of AIDS.

There were an estimated 1.7 million [1.4 – 2.4 million] new HIV infections in sub-Saharan Africa in 2007—a significant reduction since 2001. However, the region remains most severely affected. An estimated 22.5 million [20.9 – 24.3 million] people living with HIV, or 68% of the global total, are in sub-Saharan Africa. Eight countries in this region now account for almost one-third of all new HIV infections and AIDS deaths globally.
Since 2001, when the United Nations Declaration of Commitment on HIV/AIDS was signed, the number of people living with HIV in Eastern Europe and Central Asia has increased by more than 150% from 630 000 [490 000 – 1.1 million] to 1.6 million [1.2 – 2.1 million] in 2007. In Asia, the estimated number of people living with HIV in Viet Nam has more than doubled between 2000 and 2005 and Indonesia has the fastest growing epidemic.

These findings were released today by the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) in the report 2007 AIDS Epidemic Update.
Smallpox
(source: World Health Organization)

Historical Significance
Smallpox is an acute contagious disease caused by variola virus, a member of the orthopoxvirus family.

Smallpox, which is believed to have originated over 3,000 years ago in India or Egypt, is one of the most devastating diseases known to humanity. For centuries, repeated epidemics swept across continents, decimating populations and changing the course of history.

In some ancient cultures, smallpox was such a major killer of infants that custom forbade the naming of a newborn until the infant had caught the disease and proved it would survive.

Smallpox killed Queen Mary II of England, Emperor Joseph I of Austria, King Louis I of Spain, Tsar Peter II of Russia, Queen Ulrika Elenora of Sweden, and King Louis XV of France.

The disease, for which no effective treatment was ever developed, killed as many as 30% of those infected. Between 65 –80% of survivors were marked with deep pitted scars (pockmarks), most prominent on the face.

Blindness was another complication. In 18th century Europe, a third of all reported cases of blindness was due to smallpox. In a survey conducted in Viet Nam in 1898, 95% of adolescent children were pockmarked and nine-tenths of all blindness was ascribed to smallpox.

As late as the 18th century, smallpox killed every 10th child born in Sweden and France. During the same century, every 7th child born in Russia died from smallpox.

Edward Jenner's demonstration, in 1798, that inoculation with cowpox could protect against smallpox brought the first hope that the disease could be controlled.

In the early 1950s – 150 years after the introduction of vaccination – an estimated 50 million cases of smallpox occurred in the world each year, a figure which fell to around 10–15 million by 1967 because of vaccination.

In 1967, when WHO launched an intensified plan to eradicate smallpox, the "ancient scourge" threatened 60% of the world's population, killed every fourth victim, scarred or blinded most survivors, and eluded any form of treatment.
Through the success of the global eradication campaign, smallpox was finally pushed back to the horn of Africa and then to a single last natural case, which occurred in Somalia in 1977. A fatal laboratory-acquired case occurred in the United Kingdom in 1978. The global eradication of smallpox was certified, based on intense verification activities in countries, by a commission of eminent scientists in December 1979 and subsequently endorsed by the World Health Assembly in 1980.

Forms of the Disease
Smallpox had two main forms: variola major and variola minor. The two forms showed similar lesions. The disease followed a milder course in variola minor, which had a case-fatality rate of less than 1 per cent. The fatality rate of variola major was around 30%.

There are two rare forms of smallpox: haemorrhagic and malignant. In the former, invariably fatal, the rash was accompanied by haemorrhage into the mucous membranes and the skin. Malignant smallpox was characterized by lesions that did not develop to the pustular stage but remained soft and flat. It was almost invariably fatal.

Clinical Features
The incubation period of smallpox is usually 12–14 days (range 7–17) during which there is no evidence of viral shedding. During this period, the person looks and feels healthy and cannot infect others.

The incubation period is followed by the sudden onset of influenza-like symptoms including fever, malaise, headache, prostration, severe back pain and, less often, abdominal pain and vomiting. Two to three days later, the temperature falls and the patient feels somewhat better, at which time the characteristic rash appears, first on the face, hands and forearms and then after a few days progressing to the trunk. Lesions also develop in the mucous membranes of the nose and mouth, and ulcerate very soon after their formation, releasing large amounts of virus into the mouth and throat.

The centrifugal distribution of lesions, more prominent on the face and extremities than on the trunk, is a distinctive diagnostic feature of smallpox and gives the trained eye cause to suspect the disease. Lesions progress from macules to papules to vesicles to pustules. All lesions in a given area progress together through these stages. From 8 to 14 days after the onset of symptoms, the pustules form scabs which leave depressed depigmented scars upon healing.

In the past, smallpox was sometimes confused with chickenpox, a worldwide infection of children that is seldom lethal. Chickenpox can be distinguished from smallpox by its much more superficial lesions, their presence more on the trunk than on the face and extremities, and by the development of successive crops of lesions in the same area.

Smallpox is a disease which can be easily diagnosed by trained health workers without the need for laboratory support. During the eradication campaign, WHO produced training materials...
designed to help health staff recognize smallpox, distinguish it from chickenpox, and avoid common diagnostic errors. These materials are now available electronically.

**Infectivity**
Persons carrying the virus during the incubation period cannot infect others.

The frequency of infection is highest after face-to-face contact with a patient after fever has begun and during the first week of rash, when the virus is released via the respiratory tract.

Although patients remain infectious until the last scabs fall off, the large amounts of virus shed from the skin are not highly infectious. Exposure to patients in the late stages of the disease is much less likely to produce infection in susceptible contacts.

As a precaution, WHO isolation policy during the eradication campaign required that patients remain in isolation, in hospital or at home, until the last scab had separated.

**Transmission**
In the absence of immunity induced by vaccination, human beings appear to be universally susceptible to infection with the smallpox virus.

There is no animal reservoir. Insects play no role in transmission.

Smallpox is transmitted from person to person by infected aerosols and air droplets spread in face-to-face contact with an infected person after fever has begun, especially if symptoms include coughing. The disease can also be transmitted by contaminated clothes and bedding, though the risk of infection from this source is much lower.

In the past, patients suffering from variola major (the more severe form of the disease) became bedridden early (in the phase before the eruption of rash) and remained so throughout the illness. Spread of infection was limited to close contacts in a small vicinity. Variola minor, however, was so mild that patients infected with this form frequently remained ambulatory during the infectious phase of their illness and thus spread the virus far more widely.

During the eradication campaign, investigations of outbreaks caused by importations of cases into industrialized countries in temperate areas showed that, in a closed environment, airborne virus could sometimes spread within buildings via the ventilation system and infect persons in other rooms or on other floors in distant and apparently unconnected spaces. This mode of transmission is not important in those tropical areas where houses and hospitals do not use ventilation systems.

Epidemics develop comparatively slowly. The interval between each generation of cases is 2–3 weeks.
When natural outbreaks occurred, the initial, or "index", case rarely infected as many as 5 other persons, even during the peak transmission season. On some occasions, such as the outbreak that followed importation of a case into Yugoslavia in 1972, index cases infected more than a dozen people.

Unfortunately, historical data are available only from periods with substantial population immunity either from vaccination or from having survived natural infection. In the absence of natural disease and vaccination, the global population is significantly more susceptible. Some experts have estimated today's rate of transmission to be more on the order of 10 new infections per infected person.

**Treatment**
Vaccine administered up to 4 days after exposure to the virus, and before the rash appears, provides protective immunity and can prevent infection or ameliorate the severity of the disease.

No effective treatment, other than the management of symptoms, is currently available.

A number of compounds are under investigation as chemotherapeutic agents. One of these, Cidofovir, has produced promising results in laboratory studies.

**Management of an Outbreak**
Emphasis must be placed on preventing epidemic spread. In doing so, it should be kept in mind that smallpox patients are not infectious during the early stage of the disease but become so from the first appearance of fever and remain so, though to a lesser degree, until all scabs have separated. Also, immunity develops rapidly after vaccination against smallpox (see above).

Surveillance of smallpox infection is probably easier than for any other infectious disease. A distinctive rash is produced (see above) which is wholly characteristic in the great majority of cases. The rash is most dense over the face and hands – unclothed and readily visible portions of the body.

Experiences from the eradication campaign indicate that, in the presence of a strong surveillance system sensitive to smallpox cases and backed by an adequate infrastructure, small but rapid and thorough containment actions can break the transmission chain and halt a smallpox outbreak within a relatively short time. Containment involves efficient detection of cases and identification and vaccination of contacts.

Patients diagnosed with smallpox should be physically isolated. All persons who have or will come into close contact with them should be vaccinated. As hospitals have proven to be sites of epidemic magnification during smallpox outbreaks, patient isolation at home is advisable where hospitals do not have isolation facilities. Whatever the policy, isolation is essential to break the chain of transmission.
Patients who developed rash before their isolation should be asked to recount all recent contacts. Contacts should be vaccinated. If it is not feasible to vaccinate contacts, they should be placed on daily fever watch, which should continue up to 18 days from the last day of contact with the case. If these contacts have two consecutive readings of 38 degrees centigrade or above, they should be isolated.

All specimen collectors, care givers and attendants coming into close contact with patients should be vaccinated as soon as smallpox is diagnosed as the cause of an outbreak.

In the case of a widespread outbreak, people should be advised to avoid crowded places and follow public health advice on precautions for personal protection.

**Infection control in Facilities**
Medical care givers, attendants, and mortuary workers, even if vaccinated, should wear gloves, caps, gowns, and surgical masks.

All contaminated instruments, excretions, fluids and other materials should be decontaminated chemically or by heat or incineration.

Contaminated clothing and bedding, if not incinerated, should be autoclaved or washed in hot water containing hypochlorite bleach.

Fumigation of premises may be done with formaldehyde.

Cadavers should be cremated, in a properly designed facility, whenever possible and all persons coming in contact with them should be vaccinated or at least placed on daily fever watch. Body bags treated with hypochlorite bleach can also be used.

Laboratory manipulations with infective materials should be done in high containment facilities at Biosafety Level IV, authorized only at two WHO designated laboratories in the United States and the Russian Federation.

**Vaccines**
Smallpox vaccine contains live vaccinia virus, a virus in the orthopoxvirus family and closely related to variola virus, the agent that causes smallpox. Immunity resulting from immunization with vaccinia virus (vaccination) protects against smallpox.

In December 1999, a WHO Advisory Committee on Variola Virus Research concluded that, although vaccination is the only proven public health measure available to prevent and control a smallpox outbreak, current vaccine supplies are extremely limited. The Committee also noted that, at that time, several countries were contemplating the need to produce more vaccine stocks. Now, a number of governments have chosen to examine their stocks, test their potency, and consider whether more vaccine is required.
A WHO survey conducted in 1998 indicated that approximately 90 million declared doses of the smallpox vaccine were available worldwide. Storage conditions and potency of these stocks are not known.

Most existing vaccine stocks and the vaccine used in the WHO eradication campaign consist of pulp scraped from vaccinia-infected animal skin, mainly calf or sheep, with phenol added to a concentration sufficient to kill bacteria but not so high as to inactivate the vaccinia virus. The vaccine is then freeze dried and sealed in ampoules for later re-suspension in sterile buffer and subsequent intradermal inoculation by multiple puncture with a bifurcated needle.

The seed virus (vaccinia virus strain Lister Elstree) used to produce the vaccine is being held for WHO by the WHO Collaborating Centre for Smallpox Vaccine in Bilthoven, the Netherlands.

This Centre also tests batches of the smallpox vaccine for potency every five years. Vaccines properly stored for as long as 18 years have not lost their potency.

**Duration of protection following vaccination**
Vaccination usually prevents smallpox infection for at least ten years.

If symptoms appear, they are milder and mortality is less in vaccinated than in nonvaccinated persons.

Even when immunity has waned, vaccinated persons shed less virus and are less likely to transmit the disease.

**Complications of vaccination**
Existing vaccines have proven efficacy but also have a high incidence of adverse side-effects.

The risk of adverse events is sufficiently high that vaccination is not warranted if there is no or little real risk of exposure.

Vaccine administration is warranted in individuals exposed to the virus or facing a real risk of exposure (see above).

A safer vaccinia-based vaccine, produced in cell culture, is expected to become available shortly. There is also interest in developing monoclonal anti-variola antibody for passive immunization of exposed and infected individuals, which could also be administered to persons infected with HIV.

**Contraindications**
Vaccination is contraindicated for certain groups. These include pregnant women, persons with immune disorders or experiencing therapeutically-induced immunosuppression, persons with
HIV infection, and persons with a history of eczema.

Should national authorities decide that the risk of epidemic spread is so great that such groups should receive protection, it may be advisable to attempt to limit adverse effects through intramuscular administration of vaccinia immune globulin, if available, from vaccinia-infected sheep or calves.

About the Virus
The causative agent, variola virus, is a member of the genus Orthopoxvirus, subfamily Chordopoxvirinae of the family Poxviridae. Other members of the genus include cowpox, camelpox, and monkeypox. Monkeypox virus has caused the most serious recent human poxvirus infections.

Variola virus is relatively stable in the natural environment. If aerosolized, it probably retains its infectivity for at least several hours if not exposed to sunlight or ultraviolet light.

The variola virus measures 260 by 150 nanometers and contains a molecule of double-stranded DNA putatively coding for some 200 different proteins, one of the largest viral genomes known. The size of the genome makes it especially difficult to create a synthetic copy of the virus.

The WHO Orthopoxvirus Committees meeting in 1994 and 1999 have recommended that no one other than the two WHO collaborating centres in the United States and the Russian Federation may have in possession at one time more than 20% of the viral DNA for variola virus.

WHO instructions for vaccine administration using the bifurcated needle (multipuncture technique)
1. Site of vaccination. Outer aspect of upper arm over the insertion of deltoid muscle.

2. Preparation of skin. None. If site is obviously dirty, a cloth moistened with water may be used to wipe the site. Use of a disinfectant can kill the vaccine virus.

3. Withdrawal of vaccine from ampoule. A sterile bifurcated needle (which must be cool) is inserted into the ampoule of reconstituted vaccine. On withdrawal, a droplet of vaccine, sufficient for vaccination, is contained within the fork of the needle.

4. Application of vaccine to the skin. The needle is held at a 90 degree angle (perpendicular) to the skin. The needle then touches the skin to release the droplet of vaccine. For both primary and revaccination, 15 up and down (perpendicular) strokes of the needle are rapidly made in the area of about 5mm in diameter (through the drop of vaccine deposited on the skin). The strokes should be sufficiently vigorous so that a trace of blood appears at the vaccination site. If a trace of blood does not appear, the strokes have not been sufficiently vigorous and the procedure
should be repeated. Although it is desirable not to induce frank bleeding, the proportion of successful takes is not reduced if bleeding does occur.

5. Dressing. No dressing should be used after vaccination.


7. Unused vaccine. Unused, reconstituted freeze-dried vaccine should be discarded at the end of each working day.

Complications of vaccination
Four main complications are associated with vaccination, three of which involve abnormal skin eruption.

Eczema vaccinatum occurred in vaccinated persons or unvaccinated contacts who were suffering from or had a history of eczema. In these cases, an eruption occurred at sites on the body that were at the time affected by eczema or had previously been so. These eruptions became intensely inflamed and sometimes spread to healthy skin. Symptoms were severe. The prognosis was especially grave in infants having large areas of affected skin.

Progressive vaccinia (vaccinia necrosum) occurred only in persons who suffered from an immune deficiency. In these cases the local lesion at the vaccination site failed to heal, secondary lesions sometimes appeared elsewhere on the body, and all lesions spread progressively until – as was likely – the patient died, usually 2–5 months later. As vaccination ceased in most countries prior to the emergence of HIV/AIDS, the consequences of the currently much larger pool of persons suffering from immunodeficiency were not reflected in recorded cases of progressive vaccinia.

Generalized vaccinia occurred in otherwise healthy individuals and was characterized by the development, from 6–9 days after vaccination, of a generalized rash, sometimes covering the whole body. The prognosis was good.

Postvaccinial encephalitis, the most serious complication, occurred in two main forms. The first, seen most often in infants under 2 years of age, had a violent onset, characterized by convulsions. Recovery was often incomplete, leaving the patient with cerebral impairment and paralysis. The second form, seen most often in children older than 2 years, had an abrupt onset, with fever, vomiting, headache, and malaise, followed by such symptoms as loss of consciousness, amnesia, confusion, restlessness, convulsions and coma. The fatality rate was about 35%, with death usually occurring within a week.

The best estimates of the frequency of these complications come from a 1968 study conducted by the United States involving over 14 million vaccinated persons. Altogether nine deaths occurred.
• Progressive vaccinia occurred in 11 persons, with 4 deaths.
• Eczema vaccinatum was more common, with 74 cases and no deaths. Sixty additional cases of eczema vaccinatum occurred in contacts of vaccinated persons, with one death.
• Generalized vaccinia occurred in 143 cases, with no deaths.
• Encephalitis was observed in 16 persons, with 4 deaths.

On the basis of this study, it was estimated that approximately one death per million resulted from complications following primary vaccination and one death per four million following revaccination.

**How long does immunization remain effective – a lifetime or only a certain number of years?**

This is difficult to answer with great precision, as all available data come from the time prior to the global eradication of smallpox, which was certified in 1979. When smallpox was still occurring naturally, populations in endemic countries were exposed to the virus. In some countries, subclinical infection with the virus occurred rather frequently among vaccinated persons, thus boosting their immunity.

Edward Jenner, who developed the vaccine in 1798, believed that successful vaccination produced lifelong immunity to smallpox. That view was clearly wrong.

Data from the eradication campaign make it clear that immunity wanes with time. This is why, prior to the certification of eradication, periodic revaccination was recommended, for example, for international travellers. For the general population, revaccination at a 5–10-year interval for non-endemic countries and at a 3-year interval for endemic countries was recommended. In certain high-risk groups requiring maximum protection, such as staff working in smallpox diagnostic laboratories, revaccination every year was recommended by WHO as a precaution.

Vaccination five years prior to exposure provides a high level of protection against smallpox. High levels of protection are generally believed to last 10 years after vaccination. Beyond this 10-year interval, where the evidence of protection is strong, the data are conflicting and difficult to interpret. Some studies found some degree of protection against smallpox for as long as 30 years after vaccination. However, other studies demonstrated very little or no immunity 20 years after vaccination. A large study, published in 1913, found substantial protection even in persons, vaccinated as children, aged more than 50 years.

One study of smallpox following the importation of cases into Europe and Canada (1950–1971) showed that mortality was 52% in unvaccinated persons, 1.4% in those vaccinated up to 10 years before exposure, and only 11% in those vaccinated over 20 years before exposure. For the age group of 10–49 years, the mortality rate was 49% in the unvaccinated and 4.3% in those vaccinated 20 years earlier.
What age groups would need to worry about vulnerability to smallpox if an outbreak occurred today?

Smallpox eradication was a global campaign, and populations were protected by vaccination in every country. However, during the campaign, different forms of smallpox occurred, and different vaccines and vaccination techniques were used. The duration of protection can be influenced by the potency of the vaccine and the inoculation procedure used. These factors make it difficult to give firm, precise estimates that are relevant today, where populations no longer have widespread immunity, either from vaccination or from having survived the disease (patients who survived smallpox were immune for life).

Another factor that makes it difficult to make projections today based on historical data is the much larger pool of persons suffering from weakened immune systems. This can be because of immune disorders, therapeutically-induced immunosuppression, as in the case of chemotherapy, or clinical AIDS. A person's immune status affects both susceptibility to infection and the risk of adverse outcomes following vaccination.

Immunization stopped in many countries, such as the US, in 1972. In 1979, WHO recommended that vaccination against smallpox be stopped in all countries, the only exception being special groups, such as researchers working with smallpox and related viruses. By 1982, routine vaccination had been officially discontinued in 149 of the 158 member countries of WHO. By 1986, routine vaccination had ceased in all countries.

It is particularly important to understand that when vaccinated persons nonetheless contracted smallpox, the illness was usually considerably milder than that seen in unvaccinated persons. We know from experiences in early 19th century Europe, when natural smallpox was still widespread, that when the disease appeared in adults who had been vaccinated as children, the mortality rate was much lower and the symptoms were different and milder than in unvaccinated persons. Patients also appeared to be less infectious and thus less likely to spread the disease to close contacts. This would certainly affect the dynamics of a smallpox outbreak today all over the world, where the vast majority of adults were vaccinated as children.

Vaccination also influenced the frequency of different clinical types of smallpox among persons who did contract the disease. Among vaccinated persons who subsequently contracted the disease, a mild form of smallpox (modified-type smallpox), which was hardly ever fatal, was much more common.
What is West Nile virus?
West Nile Virus is a flavivirus commonly found in Africa, West Asia, and the Middle East. It is closely related to St. Louis encephalitis virus which is also found in the United States. The virus can infect humans, birds, mosquitoes, horses and some other mammals.

What are West Nile encephalitis, West Nile meningitis and “neuroinvasive disease” and West Nile fever?
The most severe type of disease due to a person being infected with West Nile virus is sometimes called “neuroinvasive disease” because it affects a person’s nervous system. Specific types of neuroinvasive disease include: West Nile encephalitis, West Nile meningitis or West Nile meningoencephalitis. Encephalitis refers to an inflammation of the brain, meningitis is an inflammation of the membrane around the brain and the spinal cord, and meningoencephalitis refers to inflammation of the brain and the membrane surrounding it. West Nile Fever is another type of illness that can occur in people who become infected with the virus. It is characterized by fever, headache, tiredness, aches and sometimes rash. Although the illness can be as short as a few days, even healthy people have been sick for several weeks.

How long has West Nile virus been in the U.S.?
It is not known how long it has been in the U.S., but CDC scientists believe the virus has probably been in the eastern U.S. since the early summer of 1999, possibly longer.

I understand West Nile virus was found in "overwintering" mosquitoes in the New York City area in early 2000. What does this mean?
One of the species of mosquitoes found to carry West Nile virus is the Culex species which survive through the winter, or "overwinter," in the adult stage. That the virus survived along with the mosquitoes was documented by the widespread transmission the summer of 2000.

Is West Nile virus now established in the Western Hemisphere?
The continued expansion of West Nile virus in the United States indicates that it is permanently established in the Western Hemisphere.

Is the disease seasonal in its occurrence?
In the temperate zone of the world (i.e., between latitudes 23.5° and 66.5° north and south), West Nile encephalitis cases occur primarily in the late summer or early fall. In the southern climates where temperatures are milder, West Nile virus can be transmitted year round.
Cases of West Nile Human Disease

How many cases of West Nile disease in humans have occurred in the U.S.?
CDC’s Statistics, Surveillance, and Control page contains maps showing the distribution of West Nile virus-related human disease cases, by state, in the United States.

No reliable estimates are available for the number of cases of West Nile encephalitis that occur worldwide.

What proportion of people with severe illness due to West Nile virus die?
Among those with severe illness due to West Nile virus, case-fatality rates range from 3% to 15% and are highest among the elderly. Less than 1% of people who become infected with West Nile virus will develop severe illness -- most people who get infected do not develop any disease at all.

How can a person test positive for WNV infection at a blood bank, but not be considered a "case" by CDC?
A WNV "case" is a person who has become ill and been confirmed to have WNV infection. This infection might be either West Nile Fever, a mild illness with fever, or West Nile encephalitis or meningitis, more severe illnesses. Blood donors who do not become ill and do not develop symptoms are counted in a separate category because they are not considered "cases."

Understanding the Numbers Posted for West Nile Virus Cases

Why do the media, my state health department, and the CDC sometimes report different statistics on the number of human West Nile virus cases?
The CDC human case count, as reported in our ArboNET Surveillance System, is based on the number of West Nile virus cases that have been officially reported by each state health department to CDC. Before a state makes its report to CDC, follow-up laboratory testing is often conducted. CDC believes it is important to report the most accurate information possible, so our numbers may be lower than those reported in the media until official case reports are received from the states.

As West Nile virus has become more familiar in the US, many private labs are now able to do early testing on suspected human cases of disease. Physicians often send samples to private labs in order to get quick preliminary results to know if they need to look for another source of illness that may need treatment. Some states and often the media may incorporate these early test results in their total case count.

How are human cases of WNV diagnosed?
West Nile virus (WNV) infection can be suspected in a person based on clinical symptoms and patient history. Laboratory testing is required for a confirmed diagnosis.
The most commonly used WNV laboratory test measures antibodies that are produced very early in the infected person. These antibodies, called IgM antibodies, can be measured in blood or cerebrospinal fluid (CSF), which is the fluid surrounding the brain and spinal cord. This blood test may not be positive when symptoms first occur; however, the test is positive in most infected people within 8 days of onset of symptoms.

A test for WNV IgM-antibody is used by CDC, state and local public health labs and increasingly at private laboratories. When testing is conducted at private laboratories the health department or CDC will often confirm results in their own laboratories before officially reporting WNV cases.

In some instances, health departments may conduct or request additional testing before officially reporting a case to CDC’s Arbonet Surveillance System. The state or the CDC reference laboratory may repeat the initial IgM-antibody testing.

A state may also perform or ask CDC to perform an additional, different test on a specimen. This latter test (plaque reduction neutralization test - PRNT) is usually performed when:
- The state finds its initial case(s) of human WNV illness
- IgM results are not definitive due to equivocal laboratory testing results or insufficient specimens the patient might have been exposed to other closely related viruses (like St. Louis encephalitis virus) which may result in a "false" positive laboratory test for WNV

These additional tests require growth of the virus and may take a week or longer (plus shipping time) to conduct. The results from the PRNT are often needed before CDC considers a human WNV infection confirmed.

**How does CDC decide when to report a case of WNV?**

CDC reports a case of WNV infection once a state officially reports that case to CDC. The timing of the official report to CDC, relative to onset of symptoms in a person, is variable and depends on when an individual first seeks medical care and the extent of the laboratory testing, as described above, that the state determines is necessary before reporting.

At any given time, in addition to the official case count reported by CDC, there may be additional suspect cases under investigation or in various stages of testing, including supplemental or confirmatory laboratory testing.

**How many of the human WNV cases are being confirmed by the CDC laboratories?**

When WNV was first found in the United States in 1999, the CDC reference laboratory confirmed all human cases of WNV. Through a comprehensive CDC-sponsored laboratory training program, most states are now able to perform the initial blood tests to identify IgM antibodies in the blood or CSF of suspect human WNV infections, and many state laboratories are also able to perform the more involved PRNT. The CDC reference lab is called upon for confirmatory testing by fewer and fewer states; although the increased activity of WNV still require that many tests be performed at the CDC reference laboratory.
West Nile Virus and Dead Birds

What should I do if I find a dead bird?
Check with your local or state health department for instructions on reporting and disposing of a dead bird. If you need to pick up a dead bird, or local authorities tell you to simply dispose of it: Avoid bare-handed contact with any dead animals, and use gloves or an inverted plastic bag to place the bird carcass in a garbage bag and dispose of it with your routine trash.

Do birds infected with West Nile virus die or become ill?
In the 1999 New York area epidemic, there was a large die-off of American crows. Since then, West Nile virus has been identified in more than 200 species of birds found dead in the United States. Most of these birds were identified through reporting of dead birds by the public.

How can I report a sighting of dead bird(s) in my area?
State and local health departments start collecting reports of dead birds at different times in the year. Some wait until the weather becomes warm before initiating their surveillance (disease monitoring) program. For information about reporting dead birds in your specific area, please contact your state or local health department.

Why do some areas stop collecting dead birds?
Some states and jurisdictions are no longer collecting dead birds because they have sufficiently established that the virus is in an area, and additional testing will not reveal any more information. Shifting resources away from testing of dead birds allows those resources to be devoted elsewhere in surveillance and control.

Who’s at Risk for West Nile Virus

Who is at risk for getting West Nile encephalitis?
All residents of areas where virus activity has been identified are at risk of getting West Nile encephalitis; persons over 50 years of age have the highest risk of severe disease. It is unknown if immunocompromised persons are at increased risk for WNV disease.

Transmission

How do people get infected with West Nile virus (WNV)?
The main route of human infection with West Nile virus is through the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds, which may circulate the virus in their blood for a few days. The virus eventually gets into the mosquito's salivary glands. During later blood meals (when mosquitoes bite), the virus may be injected into humans and animals, where it can multiply and possibly cause illness.

Additional routes of human infection became apparent during the 2002 West Nile epidemic. It is important to note that these other methods of transmission represent a very small proportion of cases. Investigations have identified WNV transmission through transplanted organs and
through blood transfusions. For more information about blood transfusions and disease transmission, visit the CDC’s website.

There is one reported case of transplacental (mother-to-child) WNV transmission. This case is detailed in MMWR Dec 20, 2002. There is also one reported case of transmission of WNV through breast-milk. The CDC website has more information on WNV and breastfeeding.

Although transmission of WNV and similar viruses to laboratory workers is not a new phenomenon, two recent cases of WNV infection of laboratory workers have been reported. These cases are detailed in MMWR Dec 20, 2002.

**What is the basic transmission cycle of West Nile virus?**
Mosquitoes become infected when they feed on infected birds, which may circulate the virus in their blood for a few days. Infected mosquitoes can then transmit West Nile virus to humans and animals while biting to take blood. The virus is located in the mosquito's salivary glands. During blood feeding, the virus may be injected into the animal or human, where it may multiply, possibly causing illness.

**If I live in an area where birds or mosquitoes with West Nile virus have been reported and a mosquito bites me, am I likely to get sick?**
No. Even in areas where the virus is circulating, very few mosquitoes are infected with the virus. Even if the mosquito is infected, less than 1% of people who get bitten and become infected will get severely ill. The chances you will become severely ill from any one mosquito bite are extremely small.

**Can you get West Nile encephalitis from another person?**
No. West Nile encephalitis is NOT transmitted from person-to-person. For example, you cannot get West Nile virus from touching or kissing a person who has the disease, or from a health care worker who has treated someone with the disease.

**Is a woman's pregnancy at risk if she gets infected with West Nile virus?**
There is one documented case of transplacental (mother-to-child) transmission of WNV in a human. Although the newborn in this case was infected with WNV at birth and had severe medical problems, it is unknown whether the WNV infection itself caused these problems or whether they were coincidental. More research will be needed to improve our understanding of the relationship - if any - between WNV infection and adverse birth outcomes.

Nevertheless, pregnant women should take precautions to reduce their risk for WNV and other arboviral infections by avoiding mosquitoes, using protective clothing, and using repellents containing DEET (Visit the CDC website for more information on using repellent safely). When WNV transmission is occurring in an area, pregnant women who become ill should see their health care provider, and those whose illness is consistent with acute WNV infection, should undergo appropriate diagnostic testing.
**Besides mosquitoes, can you get West Nile virus directly from other insects or ticks?**
Infected mosquitoes are the primary source for West Nile virus. Although ticks infected with West Nile virus have been found in Asia and Africa, their role in the transmission and maintenance of the virus is uncertain. However, there is no information to suggest that ticks played any role in the cases identified in the United States.

**How many types of animals have been found to be infected with West Nile virus?**
Although the vast majority of infections have been identified in birds, WN virus has been shown to infect horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits.

**Can you get West Nile virus directly from birds?**
There is no evidence that a person can get the virus from handling live or dead infected birds. However, persons should avoid bare-handed contact when handling any dead animals and use gloves or double plastic bags to place the carcass in a garbage can.

**Can you get infected with West Nile virus by caring for an infected horse?**
West Nile virus is transmitted by infectious mosquitoes. There is no documented evidence of person-to-person or animal-to-person transmission of West Nile virus. Normal veterinary infection control precautions should be followed when caring for a horse suspected to have this or any viral infection.

**Can you get WNV from eating game birds or animals that have been infected?**
There is no evidence that WNV virus can be transmitted to humans through consuming infected birds or animals. In keeping with overall public health practice, and due to the risk of known food-borne pathogens, people should always follow procedures for fully cooking meat from either birds or mammals.

**How does West Nile virus actually cause severe illness and death in humans?**
Following transmission by an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of brain tissue.

**How long does the West Nile virus remain in a person’s body after they are infected?**
There is no scientific evidence indicating that people can be chronically infected with West Nile virus. What remain in a person’s body for long periods of time are antibodies and “memory” white blood cells (T-lymphocytes) that the body produces to the virus. These antibodies and T-lymphocytes last for years, and may last for the rest of a person’s life. Antibodies are what many diagnostic tests look for when clinical laboratories testing is performed. Both antibodies and “memory” T-lymphocytes provide future protection from the virus.

**If a person contracts West Nile virus, does that person develop a natural immunity to future infection by the virus?**
It is assumed that immunity will be lifelong; however, it may wane in later years.
Symptoms

What are the symptoms of West Nile virus (WNV) infection?
Infection with WNV can be asymptomatic (no symptoms), or can lead to West Nile fever or severe West Nile disease.

It is estimated that about 20% of people who become infected with WNV will develop West Nile fever. Symptoms include fever, headache, tiredness, and body aches, occasionally with a skin rash (on the trunk of the body) and swollen lymph glands. While the illness can be as short as a few days, even healthy people have reported being sick for several weeks.

The symptoms of severe disease (also called neuroinvasive disease, such as West Nile encephalitis or meningitis or West Nile poliomyelitis) include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. It is estimated that approximately 1 in 150 persons infected with the West Nile virus will develop a more severe form of disease. Serious illness can occur in people of any age, however people over age 50 and some immunocompromised persons (for example, transplant patients) are at the highest risk for getting severely ill when infected with WNV.

Most people (about 4 out of 5) who are infected with West Nile virus will not develop any type of illness (an asymptomatic infection), however you cannot know ahead of time if you'll get sick or not when infected.

What is the incubation period in humans (i.e., time from infection to onset of disease symptoms) for West Nile disease?
Usually 2 to 15 days.

How long do symptoms last?
Symptoms of West Nile fever will generally last a few days, although even some healthy people report having the illness last for several weeks. The symptoms of severe disease (encephalitis or meningitis) may last several weeks, although neurological effects may be permanent.

What is meant by West Nile encephalitis, West Nile meningitis, West Nile poliomyelitis, “neuroinvasive disease” and West Nile fever?
The most severe type of disease due to a person being infected with West Nile virus is sometimes called “neuroinvasive disease,” because it affects a person's nervous system. Specific types of neuroinvasive disease include: West Nile encephalitis, West Nile meningitis, West Nile meningoencephalitis and West Nile poliomyelitis. Encephalitis refers to an inflammation of the brain, meningitis is an inflammation of the membrane around the brain and the spinal cord, meningoencephalitis refers to inflammation of the brain and the membrane surrounding it, and poliomyelitis refers to an inflammation of the spinal cord.

West Nile Fever is another type of illness that can occur in people who become infected with the virus. It is characterized by fever, headache, tiredness, aches and sometimes rash. Although
the illness can be as short as a few days, even healthy people have been sick for several weeks.

**If I have West Nile Fever, can it turn into West Nile encephalitis?**
When someone is infected with West Nile virus (WNV) they will typically have one of three outcomes: No symptoms (most likely), West Nile fever (WNF in about 20% of people) or severe West Nile disease, such as meningitis or encephalitis (less than 1% of those who get infected). If you develop a high fever with severe headache, consult your health care provider. West Nile fever is characterized by symptoms such as fever, body aches, headache and sometimes swollen lymph glands and rash. West Nile fever generally lasts only a few days, though in some cases symptoms have been reported to last longer, even up to several weeks. West Nile fever does not appear to cause any permanent health effects. There is no specific treatment for WNV infection. People with West Nile fever recover on their own, though symptoms can be relieved through various treatments (such as medication for headache and body aches, etc.).

Some people may develop a brief, WNF-like illness (early symptoms) before they develop more severe disease, though the percentage of patients in whom this occurs is not known. Occasionally, an infected person may develop more severe disease such as “West Nile encephalitis,” “West Nile meningitis” or “West Nile meningoencephalitis.” Encephalitis refers to an inflammation of the brain, meningitis is an inflammation of the membrane around the brain and the spinal cord, and meningoencephalitis refers to inflammation of the brain and the membrane surrounding it. Although there is no treatment for WNV infection itself, the person with severe disease often needs to be hospitalized. Care may involve nursing IV fluids, respiratory support, and prevention of secondary infections.

**West Nile Virus Poliomyelitis**

**What is the “acute flaccid paralysis” that sometimes occurs with WNV infection?**
In addition to West Nile fever, meningitis, or encephalitis, some people who become infected with WNV can develop “acute flaccid paralysis”—a sudden onset of weakness in the limbs and/or breathing muscles. In most persons, acute flaccid paralysis is due to the development of West Nile poliomyelitis—an inflammation of the spinal cord that causes a syndrome similar to that caused by the poliovirus. West Nile poliomyelitis was first widely recognized in the United States in 2002. Persons with West Nile poliomyelitis may develop sudden or rapidly progressing weakness. The weakness tends to affect one side of the body more than the other, and may involve only one limb. The weakness is generally not associated with any numbness or loss of sensation, but may be associated with severe pain. In very severe cases, the nerves going to the muscles that control breathing may be affected, resulting in rapid onset of respiratory failure. It is important to recognize that this weakness may occur in the absence of meningitis, encephalitis, or even fever or headache—there may be few other clues that the weakness is due to WNV infection.

**How often does West Nile poliomyelitis occur?**
We don’t know for sure how often West Nile poliomyelitis occurs, but it does occur less
frequently than meningitis or encephalitis. Scientists are continuing to monitor persons with West Nile poliomyelitis to get a better understanding of how often, and in whom, it occurs.

**Are there other types of weakness or “acute flaccid paralysis” caused by WNV infection?**
The vast majority of persons with WNV “acute flaccid paralysis” suffer from West Nile poliomyelitis (an inflammation of the spinal cord). Some persons with WNV infection may instead develop an illness similar to Guillain-Barré syndrome, which is a disease of the peripheral nerves and not the spinal cord. Weakness of the facial muscles may also develop in persons with WNV infection. While many persons with WNV infection experience fatigue and feel weak all over, this is not the same as “acute flaccid paralysis”.

**Who tends to be affected by West Nile poliomyelitis?**
People of any age can be affected by West Nile poliomyelitis. While persons over the age of 65 are at highest risk for all forms of WNV neuroinvasive disease, including poliomyelitis, persons of younger age groups (e.g., in their 30’s and 40’s) can also develop West Nile poliomyelitis. West Nile poliomyelitis may affect people who are otherwise healthy and without prior medical conditions.

**What is the likelihood that people who experience weakness due to West Nile poliomyelitis will recover?**
It is not yet clear the extent to which people who develop weakness due to West Nile poliomyelitis will recover. Some people do recover completely, others recover partially, and there are still others who have not shown significant recovery in over one year. Researchers continue to monitor patients who have been affected in order to better understand the long-term outcome of West Nile poliomyelitis and to determine whether there are any treatments that are beneficial.

**Prevention**

**What can I do to reduce my risk of becoming infected with West Nile virus?**
Here are preventive measures that you and your family can take:

Protect yourself from mosquito bites:
- Apply insect repellent to exposed skin. Generally, the more active ingredient a repellent contains the longer it can protect you from mosquito bites. A higher percentage of active ingredient in a repellent does not mean that your protection is better—just that it will last longer. The CDC website has more information on the active ingredients of insect repellents. Choose a repellent that provides protection for the amount of time that you will be outdoors.
  - Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands of children.
  - Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer’s DIRECTIONS FOR USE, as printed on the product.
For detailed information about using repellents, see the CDC’s webpage on Insect Repellent Use and Safety questions.

- Spray clothing with repellents containing permethrin or another EPA-registered repellent since mosquitoes may bite through thin clothing. Do not apply repellents containing permethrin directly to exposed skin. Do not apply repellent to skin under your clothing.
- When weather permits, wear long-sleeved shirts and long pants whenever you are outdoors.
- Place mosquito netting over infant carriers when you are outdoors with infants.
- Consider staying indoors at dawn, dusk, and in the early evening, which are peak mosquito biting times.
- Install or repair window and door screens so that mosquitoes cannot get indoors.

Help reduce the number of mosquitoes in areas outdoors where you work or play, by draining sources of standing water. In this way, you reduce the number of places mosquitoes can lay their eggs and breed.

- At least once or twice a week, empty water from flower pots, pet food and water dishes, birdbaths, swimming pool covers, buckets, barrels, and cans.
- Check for clogged rain gutters and clean them out.
- Remove discarded tires, and other items that could collect water.
- Be sure to check for containers or trash in places that may be hard to see, such as under bushes or under your home.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

**Kids can learn** how to protect themselves from mosquito bites by visiting the CDC’s "The Buzz-z-z-z on West Nile Virus" page on the BAM! website, the CDC site for kids.

**What can be done to prevent outbreaks of West Nile virus?**
Prevention and control of West Nile virus and other arboviral diseases is most effectively accomplished through integrated vector management programs. These programs should include surveillance for West Nile virus activity in mosquito vectors, birds, horses, other animals, and humans, and implementation of appropriate mosquito control measures to reduce mosquito populations when necessary. Additionally, when virus activity is detected in an area, residents should be alerted and advised to increase measures to reduce contact with mosquitoes. Details about effective prevention and control of West Nile virus can be found in CDC’s *Guidelines for Surveillance, Prevention, and Control*.

**Is there a vaccine against West Nile encephalitis?**
No, but several groups are working towards developing a vaccine.

**Where can I get information about the use of pesticide sprays that are being used for mosquito control?**
The federal agency responsible for pesticide evaluation is the Environmental Protection Agency (EPA). See the EPA Web site for detailed answers to the questions about pesticides used for mosquito control.
Insect Repellent Use and Safety

General Questions

Why should I use insect repellent?
Insect repellents can help reduce exposure to mosquito bites that may carry viruses such as West Nile virus that can cause serious illness and even death. Using insect repellent allows you to continue to play and work outdoors with a reduced risk of mosquito bites.

When should I use mosquito repellent?
Apply repellent when you are going to be outdoors. Even if you don’t notice mosquitoes there is a good chance that they are around. Many of the mosquitoes that carry West Nile virus bite between dusk and dawn. If you are outdoors around these times of the day, it is especially important to apply repellent. In many parts of the country, there are mosquitoes that also bite during the day, and some of these mosquitoes have also been found to carry West Nile virus.

How often should repellent be reapplied?
In general you should re-apply repellent if you are being bitten by mosquitoes. Always follow the directions on the product you are using. Sweating, perspiration or getting wet may mean that you need to re-apply repellent more frequently.

Repellents containing a higher concentration (higher percentage) of active ingredient typically provide longer-lasting protection.

How does mosquito repellent work?
Female mosquitoes bite people and animals because they need the protein found in blood to help develop their eggs. Mosquitoes are attracted to people by skin odors and carbon dioxide from breath. The active ingredients in repellents make the person unattractive for feeding. Repellents do not kill mosquitoes. Repellents are effective only at short distances from the treated surface, so you may still see mosquitoes flying nearby.

Active Ingredients (Types of Insect Repellent)

Which mosquito repellents work best?
CDC recommends using products that have been shown to work in scientific trials and that contain active ingredients which have been registered with the US Environmental Protection Agency (EPA) for use as insect repellents on skin or clothing. When EPA registers a repellent, they evaluate the product for efficacy and potential effects on human beings and the environment. EPA registration means that EPA does not expect a product, when used according to the instructions on the label, to cause unreasonable adverse effects to human health or the environment.

Of the active ingredients registered with the EPA, CDC believes that two have demonstrated a higher degree of efficacy in the peer-reviewed, scientific literature. Products containing these
active ingredients typically provide longer-lasting protection than others:
- DEET (N,N-diethyl-m-toluamide)
- Picaridin (KBR 3023)

Oil of lemon eucalyptus [active ingredient: p-menthane 3,8-diol (PMD)], a plant-based repellent, is also registered with EPA. In two recent scientific publications, when oil of lemon eucalyptus was tested against mosquitoes found in the US, it provided protection similar to repellents with low concentrations of DEET.

**How does the percentage of active ingredient in a product relate to the amount of protection it gives?**

Typically, the more active ingredient a product contains the longer it provides protection from mosquito bites. The concentration of different active ingredients cannot be directly compared (that is, 10% concentration of one product doesn’t mean it works exactly the same as 10% concentration of another product.)

DEET is an effective active ingredient found in many repellent products and in a variety of formulations. Based on a 2002 study (Fradin and Day, 2002.):
- A product containing 23.8% DEET provided an average of 5 hours of protection from mosquito bites.
- A product containing 20% DEET provided almost 4 hours of protection
- A product with 6.65% DEET provided almost 2 hours of protection
- Products with 4.75% DEET were both able to provide roughly 1 and a half hour of protection

These examples represent results from only one study and are only included to provide a general idea of how such products may work. Actual protection will vary widely based on conditions such as temperature, perspiration, and water exposure.

Choose a repellent that provides protection for the amount of time that you will be outdoors. A product with a higher percentage of active ingredient is a good choice if you will be outdoors for several hours while a product with a lower concentration can be used if time outdoors will be limited. Simply re-apply repellent (following label instructions) if you are outdoors for a longer time than expected and start to be bitten by mosquitoes.

**Why does CDC recommend certain types of insect repellent?**

CDC recommends products containing active ingredients which have been registered with US Environmental Protection Agency (EPA) for use as insect repellents on skin or clothing.

All of the EPA-registered active ingredients have demonstrated repellency however some provide more longer-lasting protection than others. Additional research reviewed by CDC suggests that repellents containing DEET (N,N-diethyl-m-toluamide) or picaridin (KBR 3023) typically provide longer-lasting protection than the other products and oil of lemon eucalyptus (p-menthane-3,8-diol) provides longer lasting protection than other plant-based repellents.
Permethrin is another long-lasting repellent that is intended for application to clothing and gear, but not directly to skin. In general, the more active ingredient (higher concentration) a repellent contains, the longer time it protects against mosquito bites.

People who are concerned about using repellents may wish to consult their health care provider for advice. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or npic.orst.edu

How can you know which active ingredient a product contains?
Check the product label if you have questions—repellents must specify their active ingredients. In some cases you will note the chemical name in addition to/instead of the “common” name:
- DEET is N,N-diethyl-m-toluamide
- Picaridin is KBR 3023, sometimes known as “Bayrepel” outside the US
- The active ingredient in oil of lemon eucalyptus is p-menthane 3,8-diol (PMD)

What is permethrin?
Certain products which contain permethrin are recommended for use on clothing, shoes, bed nets, and camping gear, and are registered with EPA for this use. Permethrin is highly effective as an insecticide and as a repellent. Permethrin-treated clothing repels and kills ticks, mosquitoes, and other arthropods and retains this effect after repeated laundering. The permethrin insecticide should be reapplied following the label instructions. Some commercial products are available pretreated with permethrin.

Where can I find these repellents?
Most of these repellents are sold at multiple retail, discount and drug stores. A wider selection may be available at “outdoor” stores or in hunting and camping sections. At this time picaridin is not yet registered with the state pesticide programs in NY and CA, and thus is not available in those areas.

Where can I find more information about picaridin?
A technical fact sheet covering picaridin is available from EPA.

Using Repellents Properly

What are some general considerations to remember when using insect repellents?
Always follow the recommendations appearing on the product label.
- Use enough repellent to cover exposed skin or clothing. Don't apply repellent to skin that is under clothing. Heavy application is not necessary to achieve protection.
- Do not apply repellent to cuts, wounds, or irritated skin.
- After returning indoors, wash treated skin with soap and water. (This may vary depending on the product. Check the label.)
- Do not spray aerosol or pump products in enclosed areas.
- Do not spray aerosol or pump products directly to your face. Spray your hands and then rub them carefully over the face, avoiding eyes and mouth.
**What are some reactions to be aware of when using insect repellents?**

Use of repellents products may cause skin reactions in rare cases. Most products also note that eye irritation can occur if product gets in the eye. If you suspect a reaction to a product, discontinue use, wash the treated skin, and call a poison control center. If product gets in the eyes flush with water and consult health care provider or poison control center. If you go to a doctor, take the product with you.

There is a national number to reach a Poison Control Center near you: 1-800-222-1222.

**Children**

**Can insect repellents be used on children?**

Repellent products must state any age restriction. If there is none, EPA has not required a restriction on the use of the product.

According to the label, oil of lemon eucalyptus products should NOT be used on CHILDREN UNDER 3 YEARS.

In addition to EPA’s decisions about use of products on children, many consumers also look to the opinion of the American Academy of Pediatrics (AAP). The AAP does have an opinion on the use of DEET in children (see below). AAP has not yet issued specific recommendations or opinion concerning the use of picaridin or oil of lemon eucalyptus for children. CDC will post a link to such information from the Academy when/if it becomes available.

Since it is the most widely available repellent, many people ask about the use of products containing DEET on children. No definitive studies exist in the scientific literature about what concentration of DEET is safe for children. No serious illness has been linked to the use of DEET in children when used according to manufacturer’s recommendations.

The American Academy of Pediatrics (AAP) Committee on Environmental Health has updated their recommendation for use of DEET products on children in 2003, citing: "Insect repellents containing DEET (N,N-diethyl-m-toluamide, also known as N,N-diethyl-3-methylbenzamidine) with a concentration of 10% appear to be as safe as products with a concentration of 30% when used according to the directions on the product labels." AAP recommends that repellents with DEET should not be used on infants less than 2 months old.

Parents should choose the type and concentration of repellent to be used by taking into account the amount of time that a child will be outdoors, exposure to mosquitoes, and the risk of mosquito-transmitted disease in the area.

If you are concerned about using repellent products on children you may wish to consult a health care provider for advice or contact the National Pesticide Information Center (NPIC) through their toll-free number, 1-800-858-7378 or npic.orst.edu
What guidelines are available for using a repellent on children?
Always follow the recommendations appearing on the product label when using repellent:

- When using repellent on a child, apply it to your own hands and then rub them on your child.
- Avoid children's eyes and mouth and use it sparingly around their ears.
- Do not apply repellent to children's hands. (Children may tend to put their hands in their mouths.)
- Do not allow young children to apply insect repellent to themselves; have an adult do it for them.
- Keep repellents out of reach of children.
- Do not apply repellent under clothing.
- If repellent is applied to clothing, wash treated clothing before wearing again. (May vary by product, check label for specific instructions.)

How else can I protect children from mosquito bites?
Using repellents on the skin is not the only way to avoid mosquito bites. Children (and adults) can wear clothing with long pants and long sleeves while outdoors. DEET or other repellents such as permethrin can also be applied to clothing (but is not registered for use on skin), as mosquitoes may bite through thin fabric.

Mosquito netting can be used over infant carriers.

Finally, it may be possible to reduce the number of mosquitoes in the area by getting rid of containers with standing water that provide breeding places for mosquitoes.

Can insect repellents be used by pregnant or nursing women?
Other than the routine precautions noted earlier, EPA does not recommend any additional precautions for using registered repellents on pregnant or lactating women. Consult your health care provider if you have questions.

Insect Repellents containing DEET and Sunscreen

Can I use an insect repellent and a product containing sunscreen at the same time? What are the recommendations for combination sunscreen/insect repellent products?
Yes. People can, and should, use both a sunscreen and an insect repellent when they are outdoors. Follow the instructions on the package for proper application of each product. In general, the recommendation is to apply sunscreen first, followed by repellent.

It is recommended NOT to use a single product that combines insect repellent containing DEET and sunscreen, because the instructions for use of insect repellents and use of sunscreen are different. In most situations, insect repellent does not need to be reapplied as frequently as sunscreen. While no recommendations are available at this time regarding products that combine other active ingredients and sunscreen, it is important to always follow the label on whatever product you are using.
To protect from sun exposure and insect bites, you can also wear long sleeves and long pants. You can also apply insect repellent to your clothing, rather than directly to your skin.

More Information

**Where can I get more information about repellents?**
For more information about using repellents, please consult the Environmental Protection Agency (EPA) Web site or consult the National Pesticide Information Center (NPIC), which is cooperatively sponsored by Oregon State University and the U.S. EPA. NPIC can be reached at: npic.orst.edu or 1-800-858-7378.

**West Nile virus vaccine**

**Is there a vaccine available to protect humans from West Nile virus?**
No. Currently there is no WNV vaccine available for humans. Many scientists are working on this issue, and there is hope that a vaccine will become available in the next few years.

**Should people take the West Nile virus vaccine that is licensed for use in horses?**
No. This vaccine has not been studied in humans and could be harmful. The effectiveness of this vaccine in preventing West Nile virus infections in horses has yet to be fully evaluated, and its effectiveness in humans is completely unknown. Veterinary vaccines are not manufactured with the same rigorous quality and purity standards required of human vaccines, nor are they required to undergo the extensive field testing required of human vaccines before they are licensed. For these reasons, veterinary vaccines and other veterinary drugs should never be used in humans.

**Testing and Treating West Nile Virus in Humans**

**I think I have symptoms of West Nile virus. What should I do?**
Contact your health care provider if you have concerns about your health. If you or your family members develop symptoms such as high fever, confusion, muscle weakness, and severe headaches, you should see your doctor immediately.

**How do health care providers test for West Nile virus?**
Your physician will first take a medical history to assess your risk for West Nile virus. People who live in or traveled to areas where West Nile virus activity has been identified are at risk of getting West Nile encephalitis; persons older than 50 years of age have the highest risk of severe disease. If you are determined to be at high risk and have symptoms of West Nile encephalitis, your provider will draw a blood sample and send it to a commercial or public health laboratory for confirmation.

**How are human cases of WNV diagnosed?**
West Nile virus (WNV) infection can be suspected in a person based on clinical symptoms and patient history. Laboratory testing is required for a confirmed diagnosis.
The most commonly used WNV laboratory test measures antibodies that are produced very early in the infected person. These antibodies, called IgM antibodies, can be measured in blood or cerebrospinal fluid (CSF), which is the fluid surrounding the brain and spinal cord. This blood test may not be positive when symptoms first occur; however, the test is positive in most infected people within 8 days of onset of symptoms.

A test for WNV IgM-antibody is used by CDC, state and local public health labs and increasingly at private laboratories. When testing is conducted at private laboratories, the health department or CDC will often confirm results in their own laboratories before officially reporting WNV cases.

In some instances, health departments may conduct or request additional testing from CDC before officially reporting a case to CDC's ArboNET Surveillance System. The state or CDC reference laboratory may repeat the initial IgM-antibody testing.

A state may also perform or ask CDC to perform an additional, different test on a specimen. This latter test (plaque reduction neutralization test [PRNT]) is usually performed when:
- the state finds its initial case(s) of human WNV illness,
- IgM results are not definitive due to equivocal laboratory testing results or insufficient specimens,
- the patient might have been exposed to other closely related viruses (like St. Louis encephalitis virus) which may result in a "false" positive laboratory test for WNV.

These additional tests require growth of the virus and may take a week or longer (plus shipping time) to conduct. The results from the PRNT are often needed before CDC considers a human WNV infection confirmed.

**How does CDC decide when to report a case of WNV?**

CDC reports a case of WNV once a state officially reports and verifies that case to CDC.

The timing of the official report to CDC, relative to onset of symptoms in a person, is variable and depends on when an individual first seeks medical care and the extent of the laboratory testing, as described above, that the state determines is necessary before reporting.

At any given time, in addition to the official case count reported by CDC, there may be additional suspect cases under investigation or in various stages of testing, including supplemental or confirmatory laboratory testing.

**How many of the human WNV cases are being confirmed by the CDC laboratories?**

When WNV was first found in the United States in 1999, the CDC reference laboratory confirmed all human cases of WNV. Through a comprehensive, CDC-sponsored laboratory training program, most states are now able to perform the initial blood tests to identify IgM-antibody in the blood or CSF of suspect human WNV infections, and many state laboratories
are also able to perform the more involved PRNT. The CDC reference lab is called upon for confirmatory testing by fewer and fewer states; although the increased activity of WNV still requires that many tests be performed at the CDC reference laboratory.

How is West Nile encephalitis treated?
There is no specific treatment for West Nile virus infection. In more severe cases, intensive supportive therapy is indicated, often involving hospitalization, intravenous fluids, airway management, respiratory support (ventilator), prevention of secondary infections (pneumonia, urinary tract, etc.), and good nursing care.

What role do commercial laboratories play in diagnosing people with West Nile virus infection?
When a person goes to see a health care provider, and has symptoms of a West Nile illness a specimen may be sent to a commercial laboratory to determine if the person has been infected by West Nile virus. The tests used in commercial labs check for antibodies to the virus (the body’s response to infection). The results of the test will be sent to the doctor and the state health department will be informed if the results are positive. There is no specific treatment available for West Nile virus infection, so the diagnosis will not necessarily change the way the person is being treated but it will let the doctor know that he/she does not have to investigate another cause of illness, and it will help the health department know where the virus is active in order to focus prevention measures.

The state health department may choose to accept the positive results from the commercial lab, or they may choose to test the sample again in the state health department laboratory for confirmation of the infection. The state health department will report the case to CDC.

How accurate are the tests used in commercial labs?
The tests used in commercial labs are modeled on the tests created by CDC and used at CDC and in state public health laboratories. This is the first year that many of these tests have been widely used in commercial labs, and laboratories are learning more about the specific measurements used in each test. Often, a second test will be done to confirm the infection. State health departments, the FDA (which licenses and regulates medical tools such as these tests), the association of Public Health Laboratories and CDC are all engaged in monitoring new commercial tests, and are committed to working with industry to make these tests as accurate and useful as possible.

If a test is a “false positive” what does that mean?
A “false positive” occurs when an initial tests indicates that a person does have a West Nile infection, but a later, more specific tests indicates that the person does not actually have the infection. While it is important to health department and CDC to get an accurate idea of where people are being infected in order to focus prevention and control efforts, the result does not have a great impact on the individual person. There is no specific treatment that the person would receive due to West Nile virus infection. The person may want to work with their physician to see if another cause of the illness needs to be identified.
West Nile Virus, Pregnancy and Breastfeeding

What risk does West Nile virus illness during pregnancy present to an unborn child? Based on the limited number of cases studied so far, it is not yet possible to determine what percentage of West Nile virus infections during pregnancy result in infection of the unborn child or medical problems in newborns.

In 2002, one case of transplacental (mother-to-child) transmission of West Nile virus was reported. In this case, the infant was born with West Nile virus infection and severe medical problems. However, it is unclear whether West Nile virus infection caused these problems or whether they were due to other causes (see MMWR Dec 20, 2002).

After the report of this case, CDC and state and local health departments started a registry to monitor birth outcomes among women with West Nile virus illness in pregnancy. Three additional pregnancies in which the expectant mother became infected with West Nile virus were detected and evaluated in 2002; none of these 3 resulted in fetal infection. In one additional case it remains unclear whether the fetus was infected because testing was incomplete.

In 2003 and 2004, the registry identified 77 women who acquired West Nile virus illness while pregnant. Seventy-one of these women delivered live infants, 2 had elective abortions, and 4 miscarried in the first trimester.

From 2005 through 2008, CDC will continue to gather clinical and laboratory information on birth outcomes of women with West Nile virus illness during pregnancy. Pregnant women who think they may have become infected with West Nile virus should contact their private health care providers. Clinicians who are aware of West Nile virus infections of pregnant women are encouraged to report such cases by calling their state or local health departments, or by contacting CDC, telephone 970-221-6400.

Due to concerns that mother-to-child West Nile virus transmission can occur with possible adverse health effects, pregnant women should take precautions to reduce their risk for West Nile virus and other mosquito-borne infections. This can be done by avoiding mosquitoes, using protective clothing, and using an EPA-registered repellent (one that has been reviewed for safety and efficacy by the US EPA). CDC recommends repellents containing DEET or picaridin on skin and clothing, and permethrin on clothing. Oil of lemon eucalyptus (active ingredient: p-menthane-3,8-diol [PMD]) is another recommended option, but is not as long-lasting.

Pregnant women who become ill should see their health care provider, and those who have an illness consistent with acute West Nile virus infection should undergo appropriate diagnostic testing.
Are infants at higher risk than other groups for illness with West Nile virus?
No. West Nile virus illnesses in children younger than 1 year old are infrequent. Since 1999 only 18 of the 15,401 cases reported to CDC were in children younger than one year of age.

Can West Nile virus be transmitted through breast milk?
Based on a 2002 case in Michigan, it appears that West Nile virus can be transmitted through breast milk. A new mother in Michigan contracted West Nile virus from a blood transfusion shortly after giving birth. Laboratory analysis showed evidence of West Nile virus in her breast milk. She breastfed her infant, and three weeks later, her baby's blood tested positive for West Nile virus. Because of the infant's minimal outdoor exposure, it is unlikely that infection was acquired from a mosquito. The infant was most likely infected through breast milk. The child was healthy, and did not have symptoms of West Nile virus infection.

If I am pregnant or breastfeeding, should I use insect repellents containing DEET or picaridin?
Yes. Insect repellents help people reduce their exposure to mosquito bites that may carry potentially serious viruses such as West Nile virus, and allow them to continue to play and work outdoors. In pregnant or breastfeeding women, there are no reported adverse events following use of repellents containing DEET or picaridin. See the CDC website for more information about using repellents safely.

Should I continue breastfeeding if I am symptomatic for West Nile virus?
Because the health benefits of breastfeeding are well established, and the risk for West Nile virus transmission through breastfeeding is unknown, the new findings do not suggest a change in breastfeeding recommendations.

Lactating women who are ill or who are having difficulty breastfeeding for any reason should, as always, consult their physicians.

Should I continue breastfeeding if I live in an area of West Nile virus transmission?
Yes. Because the health benefits of breastfeeding are well established, and the risk for West Nile virus transmission through breastfeeding is unknown, the new findings do not suggest a change in breastfeeding recommendations.

If I am breastfeeding, should I be tested for West Nile virus?
No. There is no need to be tested just because you are breastfeeding.

Blood Transfusion, Organ Donation and Blood Donation Screening Information


How were these cases identified?
After unexplained neurological illnesses occurred in two organ recipients from one donor,
serum and plasma collected from the donor were retrieved and tested. The samples tested positive for WNV IgM and IgG antibodies, but were negative for WNV RNA by PCR.

**How was the organ donor infected?**
It is likely that the organ donor was infected by the bite of an infected mosquito, as he was reported to have spent time outdoors and infected mosquitoes were collected from a site near the person’s home approximately 10 days before he died.

**What is the current protocol for testing donors or organs before a transplant is conducted?**
Organ donors are screened to identify infectious risks on the basis of national organ-procurement standards. Screening of all organ donors with WNV NAT is not currently required or routinely performed due to:
- the length of turnaround time to obtain WNV NAT testing, and
- the unproven test performance in the organ-donation setting. National guidelines for organ-donor screening are continuously reevaluated by the Health Resources and Services Administration in consultation with FDA, CDC, and organ-procurement organizations.

**Which agencies regulate transplant and blood issues?**
The US Health Resources and Services Administration (HRSA) and Centers for Medicare and Medicaid Services (CMS) have oversight over organ procurement and transplantation, while the Food and Drug Administration (FDA) regulates tissue and blood.

**You have stated that the system of testing donated blood for WNV by nucleic acid-amplification test (NAT) has markedly reduced the risk of transfusion transmission. How is the testing of organs before transplantation different?**
There are several issues to consider: (a) time, (b) type of test and (c) potential biological differences.

(a) Time is a critical factor in organ donation; one analysis suggested that WNV NAT screening might result in a net loss of years of life among certain types of potential transplant recipients because screening might exclude healthy donors from an already limited donor pool. The time pressure to test and process donated blood is not as extreme.

(b) Additionally, NAT has not yet been proven as an effective test in the organ-donation setting—it is not known at this time that it would prove as useful as it has in identifying blood donations that pose a risk.

(c) It has been learned through limited retrospective studies that transfused viremic donations did not transmit WNV infection if IgM antibody was present, and investigation of all 30 cases of WNV transmitted by blood transfusion documented to date indicated that the donors’ viremias can be of low titer and that all resulted from IgM antibody-negative donations. This instance of organ-transplant-associated WNV transmission suggests that transmission through solid organ transplantation can occur from donors with IgM and IgG antibodies and without...
detectable nucleic acid by PCR in their serum. Experimental evidence in humans and animals suggests that WNV might persist in organs after clearance of viremia (e.g., when virus is no longer circulating in the bloodstream.) This would present a different scenario, requiring different testing, than the case of NAT testing of donated blood.

**Is there testing available that would have been able to identify the risk of WNV infection before the organs were transplanted?**
It is currently unknown whether NAT would have detected West Nile virus in this donor.

**What will be done to follow up these cases, and to reduce the risk of WNV infection through transplanted organs in the future?**
Clinicians should be aware that transplant-associated infectious disease transmission can occur and should be vigilant for unexpected outcomes in transplant recipients, particularly when they occur in clusters.

Cases of suspected WNV infection through organ transplant should be reported promptly to local and state health departments and CDC.

We will continue the evaluation of the blood donor to the organ donor to look for evidence of WNV infection, and the evaluation of the organ donor serum. When done with our investigation, HRSA, CMS, FDA, CDC, state and city authorities and organ procurement organizations will be working together closely to see if evidence in these cases might be used to develop protocols to reduce risks of WNV infection associated with transplanted organs.

**What type of treatment is being given to the organ recipients? Is that treatment available to other people with WNV disease?**
The organ recipients were treated with Omr-IgG-am, an intravenous immunoglobulin product with high-titered neutralizing antibody to WNV available through a Food and Drug Administration (FDA)-approved IND compassionate release protocol. No proven effective treatment or prophylaxis for WNV infection exists; a randomized placebo-controlled, double-blind trial of Omr-IgG-am is underway, and more information on participation can be obtained at ClinicalTrials.gov.

Information on other randomized placebo-controlled, double-blind trials for WNV infection is also available at the CDC website.

**If I recently had a transfusion or transplant, should I be concerned about getting West Nile virus?**
You should be aware of the potential risk for West Nile virus infection and the need to monitor your health. If you have symptoms of West Nile virus or other concerns you should contact your physician. If a patient who recently received a blood transfusion or organ transplantation develops a West Nile virus infection, that does not necessarily mean that the transfusion/transplantation was the source of infection.
Pesticides Used in Mosquito Control

What are "larvicides" and "adulticides"?
Larvicides are products used to kill immature mosquitoes. They can be either biological (such as toxin from specific bacteria that is lethal to mosquito larvae but not to other organisms) or chemical products, such as insect growth regulators, surface films, or organophosphates. Larvicides are applied directly to water sources that hold mosquito eggs or larvae. When used well, larvicides can help to reduce the overall mosquito by limiting the number of new mosquitoes that are produced.

Adulticides are products used to kill adult mosquitoes. Adulticides can be applied from hand-held sprayers, truck-mounted sprayers or using airplanes. Adulticides, when used well, can have an immediate impact to reduce the number of adult mosquitoes in an area, with the goal of reducing the number of mosquitoes that can bite people and possibly transmit West Nile virus.

Both larvicides and adulticides are regulated by the US Environmental Protection Agency.

What is CDC’s position regarding the use of chemical mosquito control?
Chemical control measures are one part of a comprehensive and integrated mosquito management program. An integrated program is the most effective way to prevent and control mosquito-borne disease. An integrated mosquito management program should include several components: (1) surveillance (monitoring levels of mosquito activity, and where virus transmission is occurring), (2) reduction of mosquito breeding sites, (3) community outreach and public education, and (4) the ability to use chemical and biological methods to control both mosquito larvae and adult mosquitoes.

Control measures, including the decision to use chemical adulticides (pesticides to kill adult mosquitoes) should be based on surveillance data and the risk of human disease. CDC's Revised Guidelines for Surveillance, Prevention, and Control of West Nile Virus in the US, 2003 provides detailed guidance about the use of control measures, including a suggestions for a phased response and the actions that are possible at different levels of virus activity.

Are pesticides harmful to people?
Effect on human health is one of the primary factors considered in regulation of pesticides. Pesticides that can be used for mosquito control have been judged by the EPA not to pose an unreasonable risk to human health. People who are concerned about exposure to a pesticide, such as those with chemical sensitivity or breathing conditions such as asthma can reduce their potential for exposure by staying indoors during the application period (typically nighttime).

A published study, (MMWR, July 11, 2003) examined illnesses in nine states associated with exposure to pesticides used to control mosquito populations from 1999-2002. This study found that "application of certain insecticides poses a low risk for acute, temporary health effects among person in areas that were sprayed and among workers handling and applying insecticides." This article can be viewed online at the CDC’s MMWR website.
For more information on pesticides and health, consult the US Environmental Protection Agency, which oversees the registration of these chemicals. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or online.

What should I do if I think that I am having health problems because of pesticides used in my area?
If you are experiencing health problems for any reason it is important to see your health care provider promptly. If you are experiencing severe health problems go immediately to an Emergency Room.

How does pesticide spraying affect the environment?
A great deal of research must be done before pesticides can be used in the environment. The best source for finding out about the pesticides used in your area, and their effect on specific types of wildlife, is with the US Environmental Protection Agency, which oversees the registration of these products. The National Pesticide Information Center (NPIC) can also provide information through a toll-free number, 1-800-858-7378 or online.

What training is required for workers who apply pesticides?
Each state has mandated training and experience requirements that must be met before an individual can commercially apply pesticides. In New York state, for example, certified pesticide apprentices must be at least 16 years of age, have completed an 8-hour core training course on safety issues and the use of pesticides, and have at least 40 hours of pesticide use experience in the field under the direct supervision of a certified pesticide applicator. In addition, these applicators must follow the instructions and precautions that are printed on the pesticide label. All pesticide products are required to have a label which provides information, including instructions on how to apply the pesticide and precautions to be taken to prevent health and environmental effects. All labels are required to be approved by U.S. EPA.

Where can I get information regarding the safety of specific pesticides?
Questions concerning specific pesticides can be directed to the U.S. Environmental Protection Agency, as this agency has responsibility for registration of pesticides. Many issues are addressed on the EPA's Mosquito Control Web site.

The National Pesticide Information Center (NPIC) provides pesticide information and questions about the impact of pesticide use on human health. NPIC is cooperatively sponsored by Oregon State University and the U.S. Environmental Protection Agency. NPIC can be reached online or toll-free: 1-800-858-7378.

How can I find out what type of pesticides are being used in my area?
Your local mosquito control program or health department can give information about the type of products being used in an area. Mosquito control activities are most often handled at the local level, such as through county or city government. Check with your health department or in the "blue" (government) pages of the phone book for the contacts in your area.
West Nile Virus and Dogs and Cats

An article (Austgen et al. Experimental Infection of Cats and Dogs with West Nile Virus, EID, Vol. 10, no.1 Jan 2004) in the journal Emerging Infectious Diseases discusses WNV infection in dogs and cats in detail.

Can West Nile virus (WNV) cause illness in dogs or cats?
A relatively small number of WNV infected dogs (<40) and only 1 WNV infected cat have been reported to CDC during 2003. Experimentally infected dogs* showed no symptoms after infection with WNV. Some infected cats exhibited mild, nonspecific symptoms during the first week after infection--for the most part only showing a slight fever and slight lethargy.

It is unlikely that most pet owners would notice any unusual symptoms or behavior in cats or dogs that become infected with WNV.

How can my veterinarian treat my cat or dog if they are/may be infected with WNV?
There is no specific treatment for WNV infection. Full recovery from the infection is likely. Treatment would be supportive (managing symptoms, if present) and consistent with standard veterinary practices for animals infected with a viral agent.

Does my dog/cat becoming infected pose a risk to the health of my family or other animals?
There is no documented evidence of dog or cat-to-person transmission of West Nile virus. The evidence suggests that dogs do not develop enough virus in their bloodstream to infect more mosquitoes. Cats develop slightly higher levels of virus in their bloodstream, but it is unclear if this would be enough to infect mosquitoes. It is very unlikely that cats would be important in furthering the spread of the virus.

If your animal becomes infected with WNV, this suggests that there are infected mosquitoes in your area. You should take measures to prevent mosquitoes from biting you (use repellent and wear protective clothing.)

Veterinarians should take normal infection control precautions when caring for any animal (including birds) suspected to have this or any viral infection.

How do cats and dogs become infected with West Nile virus?
Dogs and cats become infected when bitten by an infected mosquito. There is also evidence that cats can become infected with the virus after eating experimentally infected mice. *

Can I become infected with WNV if a dog with the virus bites me?
Preliminary studies have not been able to detect virus in the saliva of infected dogs. This suggests that dog bites pose a low risk, if any, of transmission of WNV from dogs to other animals or people.
Is there a vaccine for cats or dogs?
No.

Should a dog or cat infected with West Nile virus be destroyed?
No. There is no reason to destroy an animal just because it has been infected with West Nile virus. Full recovery from the infection is likely. Treatment would be supportive and consistent with standard veterinary practices for animals infected with a viral agent.

Can I use insect repellent on my pets?
DEET-based repellents, which are recommended for humans, are not approved for veterinary use (largely because animals tend to ingest them by licking.) Talk with your veterinarian for advice about the appropriate product for use on your pet.

West Nile Virus and Horses

Has West Nile virus caused severe illness or death in horses?
Yes, while data suggest that most horses infected with West Nile virus recover, results of investigations indicate that West Nile virus has caused deaths in horses in the United States.

How do the horses become infected with West Nile virus?
The same way humans become infected—by the bite of infectious mosquitoes. The virus is located in the mosquito's salivary glands. When mosquitoes bite or "feed" on the horse, the virus is injected into its blood system. The virus then multiplies and may cause illness. The mosquitoes become infected when they feed on infected birds or other animals.

How does the virus cause severe illness or death in horses?
Following transmission by an infected mosquito, West Nile virus multiplies in the horse's blood system, crosses the blood brain barrier, and infects the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain.

Can I get infected with West Nile virus by caring for an infected horse?
West Nile virus is transmitted by infectious mosquitoes. There is no documented evidence of person-to-person or animal-to-person transmission of West Nile virus. Normal veterinary infection control precautions should be followed when caring for a horse suspected to have this or any viral infection.

Can a horse infected with West Nile virus infect horses in neighboring stalls?
No. There is no documented evidence that West Nile virus is transmitted between horses. However, horses with suspected West Nile virus should be isolated from mosquito bites, if at all possible.

My horse is vaccinated against eastern equine encephalitis (EEE), western equine encephalitis (WEE), and Venezuelan equine encephalitis (VEE). Will these vaccines
Can I vaccinate my horse against West Nile virus infection?
A West Nile virus vaccine for horses is available through veterinarians. Horse owners throughout the US should consider vaccinating their equines. Consult your veterinarian for more details on timing of vaccination.

How long will a horse infected with West Nile virus be infectious?
We do not know if an infected horse can be infectious (i.e., cause mosquitoes feeding on it to become infected). However, previously published data suggest that the virus is detectable in the blood for only a few days.

What is the treatment for a horse infected with West Nile virus? Should it be destroyed?
There is no reason to destroy a horse just because it has been infected with West Nile virus. Data suggest that most horses recover from the infection. Treatment would be supportive and consistent with standard veterinary practices for animals infected with a viral agent.

Where can I get more information on horses and West Nile virus?
Visit the USDA Web site Animal and Plant Health Inspection Service (APHIS).

West Nile Virus and Squirrels

Can squirrels infected with West Nile virus transmit the virus to humans?
A small number of squirrels have tested positive for the West Nile virus. There is no evidence that people could become infected with the West Nile virus by being near an infected squirrel or in the yard with a dead one. However, the presence of an infected squirrel does mean that there could be infected mosquitoes nearby, and people should use protective clothing and repellent, and avoid maintaining mosquito-breeding sites on their property.

West Nile Virus and Wild Game/Meat

Is there a risk of getting infected with West Nile virus (WNV) if I eat turkey or another animal that has been infected with the virus?
There is no evidence that people can become infected with WNV from eating infected meat. The small, theoretical risk of infection can be eliminated by proper handling and thorough cooking of meat before it is consumed.

What is known about the risk of West Nile virus infection from dried, uncooked meat (jerky)?
There are no published studies that directly address this question. Most studies indicate that while mammals can become infected with West Nile virus, they do not develop high concentrations of virus in their blood or tissues. Although it is unlikely that dried meat from
mammals would have much virus present, and probable that gastrointestinal digestion would further limit the possibility of infectiousness, there is insufficient evidence to determine whether dried meat presents a risk of West Nile virus infection to humans or other animals.

If you have questions about this topic it may be advisable to contact local wildlife authorities and/or health authorities to find out whether the area where the animal was harvested has West Nile virus activity, and whether animals of the species in question were affected.

**Are duck and other wild game hunters at risk for West Nile virus infection?**

Because of their outdoor exposure, game hunters may be at risk if they are bitten by mosquitoes in areas with West Nile virus activity. The extent to which West Nile virus may be present in wild game is unknown.

**What should wild game hunters do to protect against West Nile virus infection?**

Hunters should follow the usual precautions when handling wild animals. If they anticipate being exposed to mosquitoes, they should apply insect repellent to clothing and skin, according to label instructions, to prevent mosquito bites. Hunters should wear gloves when handling and cleaning animals to prevent blood exposure to bare hands and meat should be cooked thoroughly.

**Who should wild game hunters contact for information about the risk for West Nile virus infection in specific geographic areas?**

Hunters should check with their local area department of wildlife and naturalist resources, state epidemiologist at the state health department, or the US Geological Survey (USGS) National Wildlife Health Center, Madison, WI, 608-270-2400 for information on local area risk.
Anthrax
(source: CDC)

What is anthrax?
Anthrax is an acute infectious disease caused by the spore-forming bacterium Bacillus anthracis. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, camels, antelopes, and other herbivores), but it can also occur in humans when they are exposed to infected animals or to tissue from infected animals or when anthrax spores are used as a bioterrorist weapon.

How is anthrax transmitted?
Anthrax is not known to spread from one person to another. B. anthracis spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected animals in the United States. Anthrax spores can be used as a bioterrorist weapon, as was the case in 2001, when Bacillus anthracis spores had been intentionally distributed through the postal system, causing 22 cases of anthrax, including 5 deaths.

What are the types of anthrax infection?
Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal.

- **Cutaneous:** Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

- **Inhalation:** Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

- **Gastrointestinal:** The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

What are the case fatality rates for the various forms of anthrax?
Early treatment of cutaneous anthrax is usually curative, and early treatment of all forms is
important for recovery. Patients with cutaneous anthrax have reported case fatality rates of 20% without antibiotic treatment and less than 1% with it. Although case-fatality estimates for inhalation anthrax are based on incomplete information, the rate is extremely high, approximately 75%, even with all possible supportive care including appropriate antibiotics. Estimates of the impact of the delay in postexposure prophylaxis or treatment on survival are not known. For gastrointestinal anthrax, the case-fatality rate is estimated to be 25%-60% and the effect of early antibiotic treatment on that case-fatality rate is not defined.

What are the symptoms for anthrax?
These symptoms can occur within 7 days of infection:
- Fever (temperature greater than 100 degrees F). The fever may be accompanied by chills or night sweats.
- Flu-like symptoms.
- Cough, usually a non-productive cough, chest discomfort, shortness of breath, fatigue, muscle aches
- Sore throat, followed by difficulty swallowing, enlarged lymph nodes, headache, nausea, loss of appetite, abdominal distress, vomiting, or diarrhea
- A sore, especially on your face, arms or hands, that starts as a raised bump and develops into a painless ulcer with a black area in the center.

For help distinguishing influenza symptoms from inhalational anthrax, see the CDC MMWR report titled “Notice to Readers: Considerations for Distinguishing Influenza-Like Illness from Inhalational Anthrax.”

How can I know my cold or flu is not anthrax?
Many human illnesses begin with what are commonly referred to as “flu-like” symptoms, such as fever and muscle aches. However, in most cases anthrax can be distinguished from the flu because the flu has additional symptoms. In previous reports of anthrax cases, early symptoms usually did not include a runny nose, which is typical of the flu and common cold.

Which antibiotics does CDC recommend for prevention of inhalation anthrax?
In selecting an antibiotic, we will be guided by the organism's culture and sensitivity results, history of allergic reactions, age and health status factors and antibiotic availability. When no information is available about the antimicrobial susceptibility of the implicated strain of *B. anthracis*, initial therapy with ciprofloxacin or doxycycline is recommended for adults and children, or levofloxacin for adults.

If an anthrax event occurs, should people buy and store antibiotics?
There is no need to buy or store antibiotics, and indeed, it can be detrimental to both the individual and to the community. First, only people who are exposed to anthrax should take antibiotics, and health authorities must make that determination. Second, individuals may not stockpile or store the correct antibiotics. Third, under emergency plans, the federal government can ship appropriate antibiotics from its stockpile to wherever they are needed.
What drugs are FDA-approved for treatment of anthrax?
Ciprofloxacin, doxycycline and penicillin are FDA-approved for the treatment of anthrax in adults and children.

Is there a vaccination for anthrax?
A protective vaccine has been developed for anthrax; however, it is primarily given to military personnel. Vaccination is recommended only for those at high risk, such as workers in research laboratories that handle anthrax bacteria routinely. The antibiotics used in post exposure prophylaxis are very effective in preventing anthrax disease from occurring after an exposure.

Is the anthrax vaccine available to the public?
A vaccine has been developed for anthrax that is protective against invasive disease, but it is currently only recommended for high-risk populations. CDC and academic partners are continuing to support the development of the next generation of anthrax vaccines.

Who should be vaccinated against anthrax?
The Advisory Committee on Immunization Practices (ACIP) has recommended anthrax vaccination for the following groups:
- Persons who work directly with the organism in the laboratory.
- Persons who work with imported animal hides or furs in areas where standards are insufficient to prevent exposure to anthrax spores.
- Persons who handle potentially infected animal products in high-incidence areas; while incidence is low in the United States, veterinarians who travel to work in other countries where incidence is higher should consider being vaccinated.
- Military personnel deployed to areas with high risk for exposure to the organism.

Can I get screened or tested to find out whether I have been exposed to anthrax?
There is no screening test for anthrax; there is no test that a doctor can do for you that says you've been exposed to or carry it. The only way exposure can be determined is through a public health investigation. Nasal swabs and environmental tests are not tests to determine whether an individual should be treated. These kinds of tests are used only to determine the extent of exposure in a given building or workplace.

What is a nasal swab test?
A nasal swab involves placing a swab inside the nostrils and taking a culture. The CDC and the U.S. Department of Health and Human Services do not recommend the use of nasal swab testing by clinicians to determine whether a person has been exposed to Bacillus anthracis, the bacteria responsible for anthrax, or as a means of diagnosing anthrax. At best, a positive result may be interpreted only to indicate exposure; a negative result does not exclude the possibility of exposure. Also, the presence of spores in the nose does not mean that the person has inhalation anthrax. The nose naturally filters out many things that a person breathes, including bacterial spores. To have inhalation anthrax, a person must have the bacteria deep in the lungs, and also have symptoms of the disease.
Another reason not to use nasal swabs is that most hospital laboratories cannot fully identify anthrax spores from nasal swabs. They are able to tell only that bacteria that resemble anthrax bacteria are present.

**If patients are suspected of being exposed to anthrax, should they be quarantined or should other family members be tested?**

Anthrax is not known to spread from one person to another person. Therefore, there is no need to quarantine individuals suspected of being exposed to anthrax or to immunize or treat contacts of persons ill with anthrax, such as household contacts, friends, or coworkers, unless they also were exposed to the same source of infection.

**What is the treatment for patients with inhalation and cutaneous anthrax?**

CDC made treatment recommendations for cases of inhalation and cutaneous anthrax associated with the bioterrorism attack of 2001. These recommendations can be found in the MMWR, 10/26/2001; 50(42), 909-919.

**What drugs are FDA-approved for treatment of anthrax?**

Ciprofloxacin, doxycycline and penicillin are FDA-approved for the treatment of anthrax in adults and children.

**How can mail get cross-contaminated with anthrax?**

CDC does not have specific studies to address this, however, cross-contamination of the mail could occur during the processing, sorting, and delivery of mail when an envelope comes in contact with an envelope, piece of equipment (e.g., an electronic sorting machine), or other surface that is contaminated with *Bacillus anthracis* spores. In addition, airborne spores in contaminated postal facilities before they were cleaned might play a role.

**When there is a known incident, how can I prevent anthrax exposure from cross-contaminated mail?**

There are no scientifically proven recommendations for preventing exposure. However, there are some common-sense steps people can take:

- Do not open suspicious mail
- Keep mail away from your face when you open it
- Do not blow or sniff mail or mail contents
- Avoid vigorous handling of mail, such as tearing or shredding
- Wash your hands after handling the mail
- Discard envelopes after opening mail.

**What should people do when they get a letter or package with powder?**

- Do not shake or empty the contents of any suspicious package or envelope.
- Do not carry the package or envelope, show it to others or allow others to examine it.
- Put the package or envelope down on a stable surface; do not sniff, touch, taste, or look closely at it or at any contents which may have spilled.
• Alert others in the area about the suspicious package or envelope. Leave the area, close any doors, and take actions to prevent others from entering the area. If possible, shut off the ventilation system.
• WASH hands with soap and water to prevent spreading potentially infectious material to face or skin. Seek additional instructions for exposed or potentially exposed persons.
• If at work, notify a supervisor, a security officer, or a law enforcement official. If at home, contact the local law enforcement agency.
• If possible, create a list of persons who were in the room or area when this suspicious letter or package was recognized and a list of persons who also may have handled this package or letter. Give this list to both the local public health authorities and law enforcement officials.

These recommendations were published on October 26, 2001, in “Update: Investigation of bioterrorism-related anthrax and interim guidelines for exposure management and antimicrobial therapy” MMWR 2001; 50(42):909-919.

What is the risk for getting anthrax from handling my own mail?
If there is a risk for inhalation anthrax associated with exposure to cross-contaminated mail, it is very low. For example, about 85 million pieces of mail were processed on the few days in 2001 after envelopes containing Bacillus anthracis (addressed to two U.S. senators) passed through the New Jersey and District of Columbia sorting facilities until they were closed. Despite the fact that both of these facilities had evidence of widespread environmental contamination with B. anthracis spores and the fact that public health officials had been aggressively looking for anthrax cases, no new cases of anthrax were identified during that time.

When the possibility of cross-contamination of the mail exists, should I take antibiotics?
Preventive antibiotics are not recommended for persons who routinely open or handle mail, either at home or at the workplace. Antimicrobial prophylaxis is recommended only in certain specific situations such as for persons exposed to an air space known to be contaminated with aerosolized Bacillus anthracis or for persons in a postal sorting facility in which an envelope containing B. anthracis spores was processed. CDC's complete recommendations on antimicrobial prophylaxis are contained in the November 9, 2001 MMWR. Additional recommendations for use of vaccine as part of post-exposure prophylaxis are contained in the November 15, 2002 MMWR 51(45):1024-1026.

What kinds of anthrax worker safety guidelines have been issued?
The recommendations are divided into four categories. They are engineering controls, administrative controls, housekeeping controls, and personal protective equipment for workers. The guidelines describe measures that should be implemented in mail-handling/processing sites to prevent potential exposures to B. anthracis spores.

How is anthrax diagnosed?
Anthrax is diagnosed by isolating B. anthracis from the blood, skin lesions, or respiratory secretions or by measuring specific antibodies in the blood of persons with suspected cases.
In patients with symptoms compatible with anthrax, providers should confirm the diagnosis by obtaining the appropriate laboratory specimens based on the clinical form of anthrax that is suspected (i.e., cutaneous, inhalation, or gastrointestinal).

- Cutaneous - vesicular fluid and blood
- Inhalation - blood, cerebrospinal fluid (if meningeal signs are present) or chest X-ray
- Gastrointestinal - blood

**What are the standard diagnostic tests used by the laboratories?**

Presumptive identification to identify to genus level (*Bacillus* family of organisms) requires Gram stain and colony identification.

Presumptive identification to identify to species level (*B. anthracis*) requires tests for motility, lysis by gamma phage, capsule production and visualization, hemolysis, wet mount and malachite green staining for spores.

Confirmatory identification of *B. anthracis* carried out by CDC may include phage lysis, capsular staining, and direct fluorescent antibody (DFA) testing on capsule antigen and cell wall polysaccharide.

**When is a nasal swab indicated?**

Nasal swabs and screening may assist in epidemiologic investigations, but should not be relied upon as a guide for prophylaxis or treatment. Epidemiologic investigation in response to threats of exposure to *B. anthracis* may employ nasal swabs of potentially exposed persons as an adjunct to environmental sampling to determine the extent of exposure.

**Is there an X-ray for detecting anthrax?**

A chest X-ray can be used to help diagnose inhalation anthrax in people who have symptoms. It is not useful as a test for determining anthrax exposure or for people with no symptoms.

**Can someone get anthrax from contaminated mail, equipment or clothing?**

In the mail handling processing sites, *B. anthracis* spores may be aerosolized during the operation and maintenance of high-speed, mail sorting machines potentially exposing workers. In addition, these spores could get into heating, ventilating, or air conditioning (HVAC) systems. CDC interim guidelines have been issued to advise workers on how best to protect themselves in the workplace.

**How are microbiological materials, such as bacterial cultures, kept safe for legitimate laboratory use only?**

On June 10, 1996, CDC and the Department of Health and Human Services (HHS) issued a Notice of Proposed Rulemaking (NPRM) to implement Section 511 of Public Law 104-132, "The Antiterrorism and Effective Death Penalty Act of 1996," which requires the Secretary of HHS to regulate the transfer of select agents. Current regulations specify requirements for the packaging, labeling, and transport of select agents shipped in interstate commerce. This final rule places additional shipping and handling requirements on facilities that transfer or receive
select agents listed in the rule that are capable of causing substantial harm to human health.

Can I get screened or tested to find out whether I have been exposed to anthrax?
There is no screening test for anthrax; there is no test that a doctor can do for you that says you've been exposed to or carry it. The only way exposure can be determined is through a public health investigation. Nasal swabs and environmental tests, are not tests to determine whether an individual should be treated. These kinds of tests are used only to determine the extent of exposure in a given building or workplace.

If patients are suspected of being exposed to anthrax, should they be quarantined or should other family members be tested?
Anthrax is not known to spread from one person to another person. Therefore, there is no need to quarantine individuals suspected of being exposed to anthrax or to immunize or treat contacts of persons ill with anthrax, such as household contacts, friends, or coworkers, unless they also were also exposed to the same source of infection.

Does CDC collect samples to test the bacteria?
CDC is engaging its partners in the Laboratory Response Network (LRN) in states all across the United States. The LRN is a collaborative partnership and multilevel system linking state and local public health laboratories with advanced capacity laboratories—including clinical, military, veterinary, agricultural, water, and food-testing laboratories—to rapidly identify threat agents, including anthrax. Local clinical laboratory testing is confirmed at state and large metropolitan public health laboratories. CDC conducts the definitive or highly specialized testing for major threat agents. There are 100 laboratories in the network; none of them are commercial labs.

When an area is tested for the presence of Bacillus anthracis, how long does it take to get the results?
Before testing can begin, samples must be collected in a form suitable for testing. The length of time it takes to get test results depends on both the kind of test to be performed and the laboratory’s workload. Some tests may take only a short time to perform, but confirmation takes longer. It may take many days to get the test results.

Testing is a two-step process. The first test, a screening test, may be positive within 2 hours if the sample is large and contains a lot of Bacillus anthracis, the organism that causes the disease anthrax. However, a positive reading on this first test must be confirmed with a second, more accurate test. This confirmation test, conducted by a more sophisticated laboratory, takes much longer. The length of time needed depends in part on how fast the bacteria grow, but results are usually available 1 to 3 days after the sample is received in the laboratory.

Does CDC recommend the use of home test kits for anthrax?
Hand-held assays (sometimes referred to as “Smart Tickets”) are sold commercially for the rapid detection of Bacillus anthracis. These assays are intended only for the screening of environmental samples. First responder and law enforcement communities are using these as
instant screening devices and should forward any positive samples to authorities for more sensitive and specialized confirmatory testing. The results of these assays should not be used to make decisions about patient management or prophylaxis. The utility and validity of these assays are unknown.

At this time, CDC does not have enough scientific data to recommend the use of these assays. The analytical sensitivity of these assays is limited by the technology, and data provided by manufacturers indicate that a minimum of 10,000 spores is required to generate a positive signal. This number of spores would suggest a heavy contamination of the area (sample). Therefore a negative result does not rule out a lower level of contamination. Data collected from field use also indicate specificity problems with some of these assays. Some positive results have been obtained with spores of the non-anthrax Bacillus bacteria that may be found in the environment.

For these reasons, CDC has been asked to evaluate the sensitivity and specificity of the commercially available, rapid, hand-held assays for B. anthracis. When this study is completed, results will be made available. Conclusions from this study are not expected in the near future.

**Is a nasal swab test an approved diagnostic tool for determining whether a person has been exposed to anthrax?**

No. At present, CDC does not recommend the use of nasal swab testing on a routine basis to determine whether a person has been exposed to B. anthracis or as a diagnostic tool. At best, a positive result may be interpreted only to indicate exposure; a negative result does not exclude the possibility of exposure. Nasal swab screening may be used by public health officials to assist in an epidemiological investigation of potentially exposed persons to evaluate the dispersion of spores.

**Are health department laboratories capable of conducting testing?**

All state health departments are capable of obtaining results of tests on suspected infectious agents. Laboratories are usually classified as Level A, B, C, or D. Level A laboratories are those typically found in community hospitals, and these laboratories should be able to perform initial testing on all clinical specimens (usually blood or some other body fluid). Public health laboratories are usually Level B; these laboratories are valuable for confirming or refuting preliminary test results and can usually perform antimicrobial susceptibility tests on bacteria and viruses. Level C laboratories, which are reference facilities and can be public health laboratories, can perform more rapid identification tests. Level D laboratories are designed to perform the most sophisticated tests and are located in federal facilities such as CDC.

Every state has a Laboratory Response Network (LRN) contact. The LRN links state and local public health laboratories with advanced-capacity laboratories, including clinical, military, veterinary, agricultural, water, and food-testing laboratories. Laboratorians should contact their state public health laboratory to identify their local LRN representative. CDC’s Emergency Preparedness and Response website provides access to CDC’s Centers for Public Health Preparedness, a national network of academic institutions and local health departments whose
goal is to ensure that local public health workers are fully prepared to respond to current and emerging health threats, including bioterrorism.

**How effective and reliable are anthrax tests?**
There are many kinds of tests, and the reliability of each has not been determined. In general, findings from culturing environmental samples are specific; that is, a positive result reflects the true presence of *Bacillus anthracis*, and a negative result likely means that no *B. anthracis* is present.

**What is subtyping?**
Subtyping is a laboratory process to identify different subtypes of organisms, which is not possible with standard microbiological testing. Most *Bacillus anthracis* subtyping is done by examining the organism’s molecular structure for certain genetic characteristics that can then be compared with those of other *B. anthracis* organisms to determine whether they are the same or different. Differences between these two organisms would indicate different strains.

**Is subtyping different from polymerase chain reaction (PCR)?**
Polymerase chain reaction (PCR) is a laboratory method used to detect and amplify genetic material from organisms. It can be used to diagnose disease by identifying genetic material (DNA) commonly found in all *Bacillus anthracis* strains or it can be used to subtype the organism by amplifying specific genetic material and comparing it with known strains of *B. anthracis* to see if it matches or if it is different. When PCR is used for subtyping, the amplified genetic material is usually further analyzed by other molecular methods, such as DNA sequencing.

**What method does CDC use to subtype Bacillus anthracis?**
CDC uses a method called MLVA, which is the acronym for multi-locus variable-number of tandem (consecutive) repeat analysis.

**How does MLVA (multi-locus variable-number of tandem [consecutive] repeat analysis) identify different strains of anthrax?**
MLVA examines a number of DNA segments within the chromosome or plasmids of *Bacillus anthracis* that have specific repeat patterns of nucleotides (fundamental DNA units). These repeats may differ by sequence and length, as well as the number of times that they are repeated. Different types of these repeats and the number of times that they are repeated provide a specific pattern that will identify different strains of the organism. More than 100 different strains of *B. anthracis* have been identified using this method.

**When is environmental sampling performed?**
Environmental sampling is the sampling of the air, soil, dust, water, and physical surfaces to identify the presence or absence of bacteria, chemicals, and radiological materials (see “Procedures for Collecting Surface Environmental Samples for Culturing *Bacillus anthracis*“). In the case of anthrax, this is used to identify its location and presence in the environment. Environmental sampling would be conducted if there were a threat or possibility of *Bacillus*
anthracis contamination. However, the presence of B. anthracis in an environmental sample does not mean the person will get the disease.

Why is environmental sampling performed?
- To identify the site or source of B. anthracis that could lead to exposure and disease,
- To trace the route of an exposure (e.g., a letter),
- To guide clean-up efforts in a facility with known exposure, and
- To assess biosafety procedures in laboratories processing anthrax specimens.

What is a nasal swab test?
A nasal swab involves placing a swab inside the nostrils and taking a culture. The CDC and the U.S. Department of Health and Human Services do not recommend the use of nasal swab testing by clinicians to determine whether a person has been exposed to Bacillus anthracis, the bacteria responsible for anthrax, or as a means of diagnosing anthrax. At best, a positive result may be interpreted only to indicate exposure; a negative result does not exclude the possibility of exposure. Also, the presence of spores in the nose does not mean that the person has inhalation anthrax. The nose naturally filters out many things that a person breathes, including bacterial spores. To have inhalation anthrax, a person must have the bacteria deep in the lungs, and also have symptoms of the disease.

Another reason not to use nasal swabs is that most hospital laboratories cannot fully identify anthrax spores from nasal swabs. They are able to tell only that bacteria that resemble anthrax bacteria are present.

What is the turnaround time for an anthrax test of an environmental sample?
Before testing can begin, samples must be collected and arrive in a form suitable for testing. The length of time necessary to get results of tests depends on transportation to the laboratory and the specific tests to be done. Testing is a two-step process. Initial screening tests (such as Gram stain) may be positive within two hours if the sample is large and the concentration of bacteria is high. These tests are used to narrow the definition of the sample. The confirmation tests take much longer, depending in part on how fast the bacteria grow, but are usually available 24-48 hours after the sample is received by the laboratory.

Is the Mayo Clinic/Roche Rapid Anthrax Test a new test?
This is not a "new test." The Laboratory Response Network (LRN) has been using a validated real-time polymerase chain reaction (PCR) assay on the LightCycler for some time. CDC has also developed and validated real-time PCR assays for Bacillus anthracis for the SmartCycler™, ABI/PE 7700 and 5700. In addition, Idaho Technology has a real-time PCR assay for B. anthracis that can be used with the R.A.P.I.D.™, which is similar to the LightCycler™. SmartCycler is a trade name of Cepheid; R.A.P.I.D. is a trade name of Idaho Technology; LightCycler is a trade name of Roche; Idaho Technology is the name of a company.
**Is the Mayo Clinic assay the same as the assay available to Laboratory Response Network (LRN) laboratories?**
No. The Mayo Clinic assay targets the Lethal Factor (*lef*) gene on the virulence plasmid p0X1 and the Protective Antigen gene (*pag*) on p0X2. This assay has been tested with DNA from 32 strains of *Bacillus anthracis*, 26 *Bacillus* species, and 21 different bacterial genera commonly encountered in human specimens. The Mayo Clinic assay has not been validated in multiple laboratories.

The CDC assay uses targets on p0X1, p0X2, and the chromosome. A total of 100 *Bacillus anthracis* isolates were used to evaluate the sensitivity of the assay. Of the 100, 77 were selected to provide the best possible representation with respect to geographic origin and date isolated. The strains were obtained from infected animals, humans, and from industrial sites associated with anthrax outbreaks; they span 58 years (1939-1997) and are from various countries. In addition, five p0X1-cured strains (including the Sterne strain) and one p0X2-cured strain (Pasteur strain) were included. For evaluation of the specificity of the assay, 54 *Bacillus* species were used (*B. subtilis*, 9; *B. cereus*, 23; *B. thuringiensis*, 12; and *B. megaterium*, 10) as well as 250 other DNAs of various viruses and bacteria from human, animal, and insect sources. The assay was validated in a multicenter study by using state public health laboratories that had the specific platform.

**What are the limitations of the Mayo Clinic test?**
Because the Mayo Clinic assay uses only two plasmid targets, it cannot identify *Bacillus anthracis* strains such as Sterne or Pasteur that may be present in environmental specimens. This would not be a problem if the assay were used to confirm the identity of a gram-positive, non-motile, non-hemolytic rod.

**Is CDC going to validate this assay?**
CDC is testing samples from the current anthrax outbreak. When we have sufficient time, we will study this and other anthrax assays.

**Are we aware of any sensitivity or specificity issues with the Mayo Clinic test? Should we expect a large number of false positive/negative results?**
On the basis of the data provided by the Mayo Clinic, the assay appears to be sensitive and specific. However, the results are only as good as the method used to prepare the sample for analysis. There have been no data provided to indicate the types of samples that can be assayed or how they are to be processed. The Food and Drug Administration (FDA) has not seen the package insert for this test. The CDC assay has been validated for different types of samples and sample processing methods.

**Are we furnishing CDC-tested equipment and reagents to laboratories?**
Through the bioterrorism cooperative agreement, CDC has funded the purchase of platforms for real-time polymerase chain reaction (PCR) assays for the Laboratory Response Network (LRN). To date, 61 instruments have been purchased or ordered. Among these are 17 LightCyclers™, 23 SmartCyclers™, 13 7700s, and 5 5700s. Reagents for real-time anthrax
assays are made at CDC and placed in inventory. They are available at no charge to LRN laboratories. Currently, reagents for the LightCycler™ anthrax assay are available; reagents for the other platforms will be available soon. All of the assays have undergone the same rigorous validation procedure.

If a laboratory asks our opinion on whether to use Mayo Clinic/Roche Rapid test, what is our answer?
The Food and Drug Administration (FDA) considers this an investigational assay. As such it should be used only in conjunction with other tests, such as culture tests. Currently, polymerase chain reaction (PCR) assays are not considered confirmatory assays.

Will CDC accept results from laboratories that use this assay?
Currently, polymerase chain reaction (PCR) assays are not considered confirmatory tests for anthrax. PCR-positive specimens (or cultures) should be forwarded to the nearest LRN laboratory for confirmation.

I'm taking medication to prevent anthrax, and I just found out that I'm pregnant. What should I do?
It is very important that you continue to take as directed the medication you have been prescribed. You should also contact your doctor or local public health officials right away to let them know that you are pregnant. They will want to discuss which medicine would be the best choice for you—to prevent anthrax and to be safe for both you and the fetus.

I'm pregnant. What medicine should I take to prevent anthrax?
You should take medication to prevent anthrax only if a public health official confirms that you have had a potential exposure to anthrax. You and your doctor will want to discuss the risks and benefits of the various antibiotics that can be used to prevent anthrax. Which medicine is most appropriate for you will depend on the specific place and situation of your exposure and on your general medical history (including other medicines you may be taking and any medication allergies you may have). Currently, there are three main antibiotics used to prevent anthrax: ciprofloxacin, amoxicillin, and doxycycline. Ciprofloxacin is effective against anthrax and is unlikely to cause major problems for the fetus, but there is not enough experience or data involving ciprofloxacin during pregnancy to say for certain that there is no risk to the fetus. Doctors are more confident about the safety of amoxicillin for the fetus, but amoxicillin may not always be effective against anthrax. Before prescribing amoxicillin for you, your doctor would want to make sure that the anthrax you were exposed to is not resistant to amoxicillin. Doxycycline can sometimes cause tooth and bone problems in the fetus. Therefore, you should not take doxycycline unless there is a specific reason why you cannot take either ciprofloxacin or amoxicillin.

I've heard that doctors don’t generally prescribe ciprofloxacin to pregnant women. Why is that? Why are they recommending it for anthrax prevention?
Ciprofloxacin is not likely to cause major problems for a fetus, but there is not enough experience and data involving ciprofloxacin during pregnancy to say for certain that there is no
risk to the fetus. Ciprofloxacin is not commonly used during pregnancy because most infections that pregnant women get can be treated with other drugs whose safety for pregnant women and their fetuses is better documented. However, because anthrax is a life-threatening disease, the benefits of using ciprofloxacin may outweigh potential risks to the fetus.

I was started on ciprofloxacin to prevent anthrax. I've heard that amoxicillin may be a safer drug for me to take during my pregnancy. How do I know if I can be switched to amoxicillin?

Doctors are often more confident about using amoxicillin than ciprofloxacin in pregnancy because they have more information on the safety of amoxicillin for the mother and the fetus. But in some situations, amoxicillin may not be effective against anthrax; this is because the bacteria that cause anthrax can sometimes develop resistance to penicillins such as amoxicillin. Before prescribing amoxicillin for you, your doctor will want to learn more about the specific place and situation of your exposure to anthrax and also about your general medical history. (For instance, some women cannot take amoxicillin because they are allergic to it.)

Doxycycline is being recommended for my coworkers who aren't pregnant. Is doxycycline a better medicine against anthrax than ciprofloxacin?

No. There are no data to suggest that doxycycline is better than ciprofloxacin for preventing anthrax.

I'm having a lot of heartburn during my pregnancy. Can I take ciprofloxacin at the same time as I take antacids?

No. Antacids should not be taken at the same time as ciprofloxacin because they may make ciprofloxacin less effective. (They can interfere with the absorption of ciprofloxacin.) You should not take antacids in the 6 hours before you take a ciprofloxacin pill or for 2 hours after you take ciprofloxacin.

I've been trying to get pregnant and have just started taking medication to prevent anthrax. Can I continue to try to get pregnant while taking this medication?

Whether to try to become pregnant while taking medication to prevent anthrax is your personal decision. When making this decision, you should discuss the possible risks and benefits with your family and your doctor. Some women may prefer to wait until after completing the full course of antibiotics before becoming pregnant. If you decide not to wait, it may be best not to take doxycycline unless there is a specific reason why you cannot take either ciprofloxacin or amoxicillin.

I just recently found out I'm pregnant, and I was exposed to anthrax at work. I want to take the best medication for my fetus and me, but I don't yet want my employer to know that I'm pregnant. What should I do?

It is very important that you tell your doctor or local public health officials that you are pregnant. They will not be required to tell your employer.
In the event that persons are exposed to potentially aerosolized *Bacillus anthracis* spores, what will CDC recommend to prevent inhalation anthrax?

CDC will recommend 60 days of selected oral antibiotics in conjunction with a 3-dose regimen (0, 2 weeks, 4 weeks) of anthrax vaccine (BioThraxT, formerly known as AVA) as an emergency public health intervention. Two major U.S. national advisory bodies have considered strategies for post-exposure prophylaxis for prevention of inhalation anthrax among individuals exposed to potentially aerosolized *B. anthracis* spores. Both groups, the Advisory Committee on Immunization Practices (ACIP) and the John Hopkins Working Group on Civilian Biodefense, concluded that based on available data, the best means for prevention of inhalation anthrax is prolonged antibiotic therapy in conjunction with anthrax vaccination. In addition, a recent Institute of Medicine Report on anthrax vaccine safety and efficacy also concluded that based on limited animal studies, anthrax vaccine administered in combination with antibiotics following exposure to *B. anthracis* spores may help to prevent the development of inhalation anthrax. BioThraxT is not licensed for post-exposure prophylaxis for prevention of inhalation anthrax, or for use in a 3-dose regimen; therefore, this program would be conducted under an Investigational New Drug (IND) application.

**Why does CDC recommend 60 days of antibiotics?**

Anthrax spores grow like plant seeds. If you plant seeds and give them sun and water, they will grow into plants. If you give anthrax spores the right environment, such as the human body, they can grow into the harmful form of the bacteria that can cause anthrax disease. It takes anthrax spores an average of 7 days to grow into the harmful form of the bacteria, but it can take longer. For this reason, CDC recommends preventive antibiotics for the full 60 days.

**Which antibiotics does CDC recommend for prevention of inhalation anthrax?**

In selecting an antibiotic, we will be guided by the organism's culture and sensitivity results, history of allergic reactions, age and health status factors and antibiotic availability. When no information is available about the antimicrobial susceptibility of the implicated strain of *B. anthracis*, initial therapy with ciprofloxacin or doxycycline is recommended for adults and children, or levofloxacin for adults.

**What drugs are FDA-approved for postexposure prophylaxis (PEP)?**

Ciprofloxacin and doxycycline are FDA-approved for PEP in adults and children, and levofloxacin is FDA-approved for PEP in adults ages 18 and older.

**Are there special instructions for taking ciprofloxacin or doxycycline?**

As with all antibiotics, take the medication according to the schedule you were instructed, and even if you begin to feel better, continue taking it for the full number of days.

**What is cipro (ciprofloxacin)?**

Ciprofloxacin, or cipro as it is commonly known, is a broad-spectrum, synthetic antimicrobial agent active against several microorganisms. The use of ciprofloxacin is warranted only under the strict supervision of a physician.
**Does ciprofloxacin have an expiration date?**
Yes. Antibiotics, just like all medicines, have expiration dates. If you received your ciprofloxacin through a pharmacist, the expiration date should be listed on the bottle. If you can't find it or have questions about the expiration date, contact your pharmacist directly.

**What side effects could I get from taking cipro?**
Common side effects of Cipro include an upset stomach, vomiting, diarrhea, fatigue, dizziness, or headache. If you have problems with any of these symptoms, tell your doctor. Less common side effects include pain in arms or legs, changes in vision, restlessness, ringing in the ears, or mental changes. If any of these symptoms occur, call your doctor right away.

**Can other fluoroquinolones be used instead of ciprofloxacin for postexposure prophylaxis (PEP)/treatment?**
Other fluoroquinolones, such as ofloxacin and levofloxacin, are not specifically recommended as alternatives to ciprofloxacin because of a lack of sufficient data on their efficacy. However, if first-line drugs were not available, these other fluoroquinolones may be effective.

**Besides anthrax, what else is ciprofloxacin prescribed for? Has there been resistance to ciprofloxacin when used in other instances (historically)?**
Ciprofloxacin is a broad-spectrum, highly effective antibiotic that has been part of the "international traveler's" kit at CDC for at least a year. It can be used against most bacterial infections. However, ciprofloxacin is frequently overused for many diseases that can be treated with less powerful, narrower-spectrum drugs. Right now, most bacteria are susceptible to ciprofloxacin, which is why we want to be cautious about its use. Overuse of ciprofloxacin could lead to the development of resistance.

**Is there a generic form of ciprofloxacin?**
No, there is currently no generic form of ciprofloxacin in the United States.

**What side effects could I get from taking doxycycline?**
Common side effects of doxycycline include an upset stomach, vomiting, or diarrhea. If you have problems with any of these symptoms, tell your doctor. Less common side effects include dark urine, yellowing of the eyes or skin, sore throat, fever, unusual bleeding or bruising, fatigue, white patches in the mouth. If any of these symptoms occur, call your doctor right away.

**What side effects could I get from taking amoxicillin?**
Common side effects of amoxicillin include an upset stomach, vomiting, and diarrhea. If you have problems with any of these symptoms, tell your doctor.

**What side effects are serious enough that I should go to a doctor?**
Any side effect that forces you not to take your medicine is serious enough that you should consult or see your doctor. Serious side effects of ciprofloxacin include seizures, mental confusion, rash that does not go away, or excessive diarrhea. If you have any of these effects, call your doctor.
Serious side effects of doxycycline include jaundice (yellow eyes or skin), rash that does not go away, or excessive diarrhea. If you have any of these effects, call your doctor. Any reaction that causes a rapid swelling of the lips and face, shortness of breath, or hives is a medical emergency. You should call 911. These types of reactions are extremely rare.

Ciprofloxacin and doxycycline look different and come in different doses. Is one better than the other?
Ciprofloxacin 500 mg and doxycycline 100 mg both have the same killing power in your bloodstream and are equally effective against anthrax bacteria. Both have similar side effects. Doxycycline is available in both tablet and capsule form. Both will give you the same amount of medicine in your bloodstream to kill the bacteria.

What if the antibiotics I take gives me headaches? Is there anything I can do to help this?
If you don't have a history of headaches, then your headache may be related to the medicine. Changing the time of day that you take the ciprofloxacin or eating after you take the medicine may help. Pain relievers such as acetaminophen may help your headache. If your headache does not go away, you should consult your doctor.

What if the antibiotics I take makes me feel sick to my stomach? Is there anything I can do to help this?
Taking your antibiotic with food may help reduce this sick feeling. Ciprofloxacin and doxycycline should not be taken within 2 hours of taking antacids. Ciprofloxacin and doxycycline should not be taken with dairy or calcium-fortified products (such as ice cream or calcium-fortified orange juice).

What if the antibiotics I take give me diarrhea? Is there anything I can do to help this?
Antibiotics may disrupt bacteria in the gastrointestinal tract, causing diarrhea. Food may help relieve the diarrhea. If the diarrhea does not go away, your doctor may recommend another antibiotic. If you develop severe, long-lasting diarrhea, you may have a serious condition and should consult your doctor.

If taking one of the recommended antibiotics makes me feel terrible, can I switch to another of these antibiotics?
If you have tried taking the medicine with food or changing the time of your dose but still feel terrible, you should ask your doctor about switching antibiotics.

What if I get a yeast infection while taking antibiotics? Is there anything I can take for this?
Occasionally, women develop yeast infections while taking amoxicillin. You may treat the infection with over-the-counter medicines such as clotrimazole. If the symptoms do not go away, you should consult your doctor.

What if the antibiotics I am taking make me feel itchy all over. Is there anything I can do to help this?
Rashes that appear suddenly or do not go away after a few days may be signs of an allergic
reaction. You should see your doctor immediately.

**What if the antibiotics give me an allergic reaction and I stop taking them? What should I do?**
If the allergic reaction was severe or rapid, you should notify your doctor before taking another antibiotic. Your doctor will prescribe a different antibiotic that will kill the bacteria without causing an allergic reaction. Remember: you should complete the entire 60 days of treatment even if you change antibiotics.

**Why can't I take a shot, wear a patch, or take one large dose of the medicine instead of taking it for 60 days?**
Spores can stay in your body for some time before they start growing and causing you to become ill. When the spores are not growing, antibiotics are not effective. Only after the spores start to grow can the antibiotics work. Therefore, you need a constant level of antibiotic in your body for 60 days to make sure that when the spores start to grow, the antibiotic is there to kill them.

**I think I may feel much better if I take only one pill of ciprofloxacin, doxycycline, or amoxicillin each day. Is that okay?**
No. The drug must be taken twice a day to kill the bacteria. If your body contains anthrax bacteria and you do not take the full dose, the bacteria may start to grow again and become harder to kill.

**Can I drink alcohol if I am taking antibiotics?**
Social drinking of alcohol (fewer than 2 drinks a day) should not cause any side effects unless you already have a liver problem. However, drinking too much alcohol can cause the medicine to leave your body faster, which will decrease the effectiveness of the medicine. If you drink more than two drinks a day, you should tell your doctor so that different medicines can be prescribed.

**If I was exposed to Bacillus anthracis and was prescribed antibiotics, but took the medicine only for a couple weeks, wouldn't that weaken any anthrax that's in my body?**
Inhaled anthrax spores become lodged in the body and may activate after initial exposure. Antibiotics have little or no effect when the spores are inactive. To be effective in preventing inhalation anthrax, the antibiotics must be in your system when the spores activate. It is necessary to take the medicine for at least 60 days to ensure the best protection against inhalation anthrax.

**If an anthrax event occurs, should people buy and store antibiotics?**
There is no need to buy or store antibiotics, and indeed, it can be detrimental to both the individual and to the community. First, only people who are exposed to anthrax should take antibiotics, and health authorities must make that determination. Second, individuals may not stockpile or store the correct antibiotics. Third, under emergency plans, the federal government can ship appropriate antibiotics from its stockpile to wherever they are needed.
Will antibiotics protect me from a bioterrorist event? Should I stockpile them?

CDC does not recommend using antibiotics unless a specific disease has been identified. There are several different agents that could be used for bioterrorism, such as bacteria, viruses, and toxins. Not a single antibiotic (or vaccine) works for all of these agents. Antibiotics only kill bacteria, not viruses or other agents that could also be used in a bioterrorist event. Antibiotics are not harmless drugs. They can cause serious side effects and drug interactions. National and state public health officials have large supplies of needed drugs and vaccines if a bioterrorism event should occur. These supplies can be sent anywhere in the United States within 12 hours.

When is a 60-day prescription of prophylactic antibiotics not needed?

People who are determined not to be at risk for inhalation anthrax do not need to take the 60-day course of prophylactic antibiotics. Prophylactic antibiotics are not indicated for the prevention of cutaneous anthrax, for hospital personnel caring for patients with anthrax, or for persons who routinely open or handle mail if there has not been a credible threat.

If tests confirm that I was potentially exposed to *Bacillus anthracis* or have anthrax, how will it be reported to the proper authorities?

Your doctor should IMMEDIATELY report any suspected isolate of *Bacillus anthracis* or any suspected case of anthrax to your local or state public health department. The state public health department is available to your doctor for consultation 24 hours a day. If local or state health department officials suspect that cases of illness may be due to a bioterrorist incident, they will notify CDC and an investigation will be conducted. If the investigation confirms that a bioterrorist incident has occurred or is thought probable, the FBI will be notified. Public health officials will also involve other response partners using a preestablished notification list. The CDC bioterrorism Web site displays the protocol that health officials will use for further reporting: emergency.cdc.gov/emcontact/protocols.asp.

How should healthcare workers respond to suspected exposure to a bioterrorist agent?

Who should healthcare workers call first, second, third? CDC, FBI, local police, local health department?

Healthcare providers, clinical laboratory personnel, and infection control professionals who notice illness patterns and diagnostic clues that might indicate an unusual infectious disease outbreak associated with intentional release of a biologic agent should report any clusters or findings to their local or state health department. (Guidelines for recognizing a number of biologic agents, including anthrax, plague, botulism, smallpox, inhalation tularemia, and hemorrhagic fever, are described in CDC’s Morbidity and Mortality Weekly Report, Vol. 50, No. 41, dated October 19, 2001.)

What is the risk for an individual if he or she is treated with antibiotics and is exposed to *Bacillus anthracis* again?

Because inhalation anthrax in humans is so rare, we cannot be certain about the risk of reinfection; therefore, CDC recommends that another course of antibiotic treatment be given promptly if a person is reexposed to *Bacillus anthracis*. In animal studies of inhalation anthrax, animals given anthrax vaccine and antibiotics after exposure did not develop anthrax when
reexposed 4 months after the original exposures, while animals treated with antibiotics alone became ill when reexposed.

**Can the spores that cause anthrax multiply outside of a human or animal host?**
We do not think so, but we are not certain.

**What are the odds of my getting anthrax? (What is the average risk of contracting anthrax in the United States?)**
In an average year, the chance that any one individual in the United States will contract anthrax is extremely low—about one case in nearly 300 million. In 2001, even with the intentional release of *Bacillus anthracis* spores in some environments, the nationwide risk was still extremely low—about 23 cases in nearly 300 million people.

**Can anthrax affect pregnancy? Should pregnant women exposed to anthrax take antibiotics?**
Anthrax is a serious illness in all humans, including pregnant women. Inhalation anthrax has a high fatality rate, and cutaneous (skin) anthrax also is serious, but less frequently fatal. Because these infections are potentially fatal, it has been recommended that ciprofloxacin, or similar antibiotic drugs, be prescribed for pregnant women believed to have been exposed to anthrax. Clinical studies of the use of the ciprofloxacin in pregnant women have not been conducted, so ciprofloxacin and related drugs are not generally recommended for pregnant women with less serious illnesses.

**Can anthrax be transmitted by handling money?**
The Department of the Treasury sponsored a study to investigate this risk, and it revealed no evidence that anthrax can be spread by handling money.

**What is the risk for anthrax in employees of a facility with a positive environmental sample?**
The risk would depend on where the environmental sample was, the amount (quantity) of material, and if it was collected in an air sample or on a surface. The risk would also depend on the person’s contact with the type of sample in terms of breathing or touching the sample. Finding a positive surface or air sample does not mean that employees of a facility are at risk for anthrax. Heavily contaminated surfaces may pose a small risk for cutaneous anthrax, which can be minimized by clean-up. Laboratory test results of environmental surface samples should not be the only criterion for starting, continuing, or stopping preventive antibiotic therapy for inhalation disease.

**SIGNS AND SYMPTOMS**

**What are the types of anthrax infection?**
Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal.
**Cutaneous anthrax:** Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

**Inhalation anthrax:** Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

**Gastrointestinal anthrax:** The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

**What are the symptoms for anthrax?**
These symptoms can occur within 7 days of infection:
- Fever (temperature greater than 100 degrees F). The fever may be accompanied by chills or night sweats.
- Flu-like symptoms
- Cough, usually a non-productive cough, chest discomfort, shortness of breath, fatigue, muscle aches
- Sore throat, followed by difficulty swallowing, enlarged lymph nodes, headache, nausea, loss of appetite, abdominal distress, vomiting, or diarrhea
- A sore, especially on your face, arms or hands, that starts as a raised bump and develops into a painless ulcer with a black area in the center.

**Is anthrax contagious?**
No. Anthrax is not contagious; the illness cannot be transmitted from person to person.

**What are the case fatality rates for the various forms of anthrax?**
Early treatment of cutaneous anthrax is usually curative, and early treatment of all forms is important for recovery. Patients with cutaneous anthrax have reported case fatality rates of 20% without antibiotic treatment and less than 1% with it. Although case-fatality estimates for inhalation anthrax are based on incomplete information, the rate is extremely high, approximately 75%, even with all possible supportive care including appropriate antibiotics. Estimates of the impact of the delay in postexposure prophylaxis or treatment on survival are not known. For gastrointestinal anthrax, the case-fatality rate is estimated to be 25%-60% and the effect of early antibiotic treatment on that case-fatality rate is not defined.
Can the presence of *Bacillus anthracis* spores be detected by a characteristic appearance, odor, or taste?

*Bacillus anthracis* spores do not have a characteristic appearance (e.g., color), smell, or taste. Spores themselves are too small to be seen by the naked eye, but have been mixed with powder to transport them. The U.S. Postal Service advises that individuals be suspicious of letters or packages with any powdery substance on them, regardless of color.

**What would be the approximate size of enough *Bacillus anthracis* spores to cause infection?**

They could not be seen by the naked eye but could be seen under a microscope.

**How can I know my cold or flu is not anthrax?**

Many human illnesses begin with what are commonly referred to as “flu-like” symptoms, such as fever and muscle aches. However, in most cases anthrax can be distinguished from the flu because the flu has additional symptoms. In previous reports of anthrax cases, early symptoms usually did not include a runny nose, which is typical of the flu and common cold.

**If I have the flu, can I still get anthrax?**

Yes, a person could theoretically get both the flu and anthrax, either at the same time or at different times.

**SOURCES**

**How long do anthrax spores live?**

Anthrax spores can survive for decades in soil.

**What is the importance of knowing the genetic information about anthrax?**

Genetic information about *B. anthracis*, particularly to determine genetic similarity among strains, is an important part of a disease investigation, but it is not immediately required for taking action to prevent or treat anthrax in those who may have been exposed to or infected by *B. anthracis*. Genetic information is often used to determine the similarity of strains if a common source is suspected.

**TREATMENT**

**What is the treatment for patients with inhalation and cutaneous anthrax?**

CDC made treatment recommendations for cases of inhalation and cutaneous anthrax associated with the bioterrorism attack of 2001. These recommendations can be found in the MMWR, 10/26/2001; 50(42), 909-919.

**How do doctors treat inhalation anthrax to reduce the risk of death in patients?**

When inhalation anthrax is suspected, physicians prescribe antibiotics to treat the disease. To be effective, antibiotic therapy should be initiated as soon as possible after exposure. Other treatment includes supportive care in hospital. *Bacillus anthracis* usually responds effectively to
several antibiotics including penicillin, doxycycline, and fluoroquinolones (such as ciprofloxacin).

**What drugs are FDA-approved for treatment of anthrax?**
Ciprofloxacin, doxycycline and penicillin are FDA-approved for the treatment of anthrax in adults and children.

**What if I develop side effects from antibiotics that I'm taking?**
If you develop side effects from the antibiotic, call your healthcare provider immediately. Depending on the type of side effects, you may be able to continue taking the medicine, or may be switched to an alternative antibiotic. If necessary, your physician may contact your State Department of Health for consultation on possible alternate antibiotics.

**What are the risks of using tetracyclines and fluoroquinolones (such as ciprofloxacin) in children? Are alternatives available?**
Risks of using tetracyclines and fluoroquinolones in children must be weighed carefully against the risk for developing a life-threatening disease due to *Bacillus anthracis*. Both agents can have adverse health reactions in children. If adverse reactions are suspected, therapy may be changed to amoxicillin or penicillin.

**Are there different strains of *B. anthracis*? Do they all respond to antibiotics?**
Yes, there are different strains of *Bacillus anthracis*. Some strains of *B. anthracis* may be naturally resistant to certain antibiotics and not others. In addition, there may be biologically mutant strains that are engineered to be resistant to various antibiotics. A laboratory analysis can help to define which strain of *B. anthracis* is present and which antibiotic would be the most effective in treating the resulting anthrax.

**Does a patient have immunity after recovering from anthrax infection?**
We do not have enough data at this time to make this determination. However, it is theoretically possible to gain post-infection immunity.

**VACCINATION**

**Is the anthrax vaccine available to the public?**
A vaccine has been developed for anthrax that is protective against invasive disease, but it is currently only recommended for high-risk populations. CDC and academic partners are continuing to support the development of the next generation of anthrax vaccines.

**Who should be vaccinated against anthrax?**
The Advisory Committee on Immunization Practices (ACIP) has recommended anthrax vaccination for the following groups:

- Persons who work directly with the organism in the laboratory.
- Persons who work with imported animal hides or furs in areas where standards are insufficient to prevent exposure to anthrax spores.
• Persons who handle potentially infected animal products in high-incidence areas; while incidence is low in the United States, veterinarians who travel to work in other countries where incidence is higher should consider being vaccinated.
• Military personnel deployed to areas with high risk for exposure to the organism.

What is the protocol for anthrax vaccination?
The immunization consists of three subcutaneous injections given 2 weeks apart, followed by three additional subcutaneous injections given at 6, 12, and 18 months. Annual booster injections of the vaccine are recommended thereafter.

Are there adverse reactions to the anthrax vaccine?
Mild local reactions occur in 30% of recipients and consist of slight tenderness and redness at the injection site. Severe local reactions are infrequent and consist of extensive swelling of the forearm in addition to the local reaction. Systemic reactions occur in fewer than 0.2% of recipients.

Is there a vaccination for anthrax?
A protective vaccine has been developed for anthrax; however, it is primarily given to military personnel. Vaccination is recommended only for those at high risk, such as workers in research laboratories that handle anthrax bacteria routinely. The antibiotics used in post exposure prophylaxis are very effective in preventing anthrax disease from occurring after an exposure.

WORKER SAFETY

What are CDC’s recommendations for protecting mail handlers?
CDC and the U.S. Postal Service are collaborating to ensure that all mail handlers and postal workers are protected against exposure to anthrax. Detailed guidelines may be found on these Web sites:
• emergency.cdc.gov/documentsapp/anthrax/10312001/han51.asp
• www.cdc.gov/mmwr/preview/mmwrhtml/mm5043a6.htm

If these recommendations are followed does it mean workers will stop getting sick with anthrax?
The interim recommendations that have been developed are based on the limited information available on ways to avoid infection and the effectiveness of various prevention strategies. As new information becomes available the guidelines will be updated. These recommendations do not address instances where a known or suspected exposure has occurred. Workers should be trained in how to recognize and handle a suspicious piece of mail (emergency.cdc.gov/documentsapp/anthrax/10312001/han51.asp). In addition, each work site should develop an emergency plan describing appropriate actions to be taken when a known or suspected exposure to B. anthracis occurs.

What kinds of anthrax worker safety guidelines are being issued?
The recommendations are divided into four categories. They are engineering controls,
administrative controls, housekeeping controls, and personal protective equipment for workers. The guidelines describe measures that should be implemented in mail-handling/processing sites to prevent potential exposures to \textit{B. anthracis} spores.

\textbf{Is CDC telling all mail handling operations to adopt these anthrax worker safety guidelines immediately?}

Every facility is different and should be evaluated based on the recommendations in the guidelines, and the recommendations implemented should be selected on the basis of an initial evaluation of the work site. This evaluation should focus on determining which processes, operations, jobs, or tasks would be most likely to result in an exposure should a contaminated envelope or package enter the work site. Many of these measures (e.g., administrative controls, use of HEPA filter-equipped vacuums, wet-cleaning, use of protective gloves) can be implemented immediately; implementation of others will require additional time and efforts.

\textbf{What kinds of engineering controls should mail-handling/processing operations consider implementing for detecting anthrax spores?}

\textit{B. anthracis} spores can be aerosolized during the operation and maintenance of high-speed, mail-sorting machines, potentially exposing workers and possibly entering heating, ventilation, or air-conditioning (HVAC) systems. Engineering controls can provide the best means of preventing worker exposure to potential aerosolized particles, thereby reducing the risk for inhalation anthrax, the most severe form of the disease. In settings where such machinery is in use, the following engineering controls should be considered:

- An industrial vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter for cleaning high-speed, mail-sorting machinery
- Local exhaust ventilation at pinch roller areas
- HEPA-filtered exhaust hoods installed in areas where dust is generated (e.g., areas with high-speed, mail-sorting machinery)
- Air curtains (using laminar air flow) installed in areas where large amounts of mail are processed
- HEPA filters installed in the building’s HVAC systems (if feasible) to capture aerosolized spores. (Note: Machinery should not be cleaned using compressed air [i.e., blow-down/blow-off].)

\textbf{What administrative controls should mail-handling/processing sites consider implementing to protect workers from exposure to \textit{B. anthracis} spores?}

Strategies should be developed to limit the number of people working at or near sites where aerosolized particles may be generated, such as mail-sorting machinery and places where mailbags are unloaded or emptied. In addition, restrictions should be in place to limit the number of people including support staff and nonemployees entering areas where aerosolized particles may be generated. This recommendation applies to contractors, business visitors, and support staff.
What housekeeping controls in mail-handling/processing sites are recommended to protect workers from exposure to *B. anthracis* spores?
In the mail-handling work-site, dry sweeping and dusting should be avoided. Instead, the area should be wet-cleaned and vacuumed with HEPA-equipped vacuum cleaners.

What personal protective equipment for workers in mail-handling/processing sites is recommended to protect workers from exposure to *B. anthracis* spores?
Personal protective equipment for workers in mail-handling/processing work sites must be selected on the basis of the potential for cutaneous or inhalation exposure to *B. anthracis* spores. Handling packages or envelopes may result in skin exposure. In addition, because certain machinery such as electronic mail sorters can generate aerosolized particles, people who operate, maintain, or work near such machinery may be exposed through inhalation. People who hand sort mail or work at other sites where airborne particles may be generated such as where mailbags are unloaded or emptied may also be exposed through inhalation.

What are some examples of personal protective equipment and clothing that could be used to protect workers who handle mail from exposure to *B. anthracis* spores?

- Protective, impermeable gloves should be worn by all workers who handle mail. In some cases, workers may need to wear cotton gloves under their protective gloves for comfort and to prevent dermatitis. Skin rashes and other dermatological conditions are a potential hazard of wearing gloves. Latex gloves should be avoided because of the risk of developing skin sensitivity or allergy.
- Gloves should be provided in a range of sizes to ensure proper fit.
- The choice of glove material such as nitrile or vinyl should be based on safety, fit, durability, and comfort. Sterile gloves such as surgical gloves are not necessary.
- Different gloves or layers of gloves may be needed depending on the task, the dexterity required, and the type of protection needed. Protective gloves can be worn under heavier gloves such as leather, heavy cotton for operations where gloves can easily be torn or if more protection against hand injury is needed.
- For workers involved in situations where a gloved hand presents a hazard such as those who work close to moving machine parts, the risk for potential injury resulting from glove use should be measured against the risk for potential exposure to *B. anthracis*.
- Workers should avoid touching their skin, eyes, or other mucous membranes since contaminated gloves may transfer *B. anthracis* spores to other body sites.
- Workers should consider wearing long-sleeved clothing and long pants to protect exposed skin.
- Gloves and other personal protective clothing and equipment can be discarded in regular trash once they are removed or if they are visibly torn, unless a suspicious piece of mail is recognized and handled. If a suspicious piece of mail is recognized and handled for anthrax, the worker’s protective gear should be handled as potentially contaminated material (see “Guidelines for Hand Hygiene and Environmental Infection Control,” 2002 and 2003, available at http://www.cdc.gov/handhygiene).
- Workers should wash their hands thoroughly with soap and water when gloves are removed.
before eating, and when replacing torn or worn gloves. Soap and water will wash away most spores that may have contacted the skin; disinfectant solutions are not needed.

**Are there some areas in the postal setting that present a greater risk to some workers than others for anthrax exposure?**

- People working with or near machinery capable of generating aerosolized particles, such as electronic mail sorters, or at other work sites where such particles may be generated should be fitted with NIOSH-approved respirators that are at least as protective as an N95 respirator.
- People working in areas where oil mist from machinery is present should be fitted with respirators equipped with P-type filters.
- Because facial hair interferes with the fit of protective respirators, workers with facial hair like beards or large moustaches may require alternative respirators such as powered air-purifying respirators [PAPRs] with loose-fitting hoods.
- Workers who cannot be fitted properly with a half-mask respirator based on a fit test may require the use of alternative respirators, such as full facepiece, negative-pressure respirators, PAPRs equipped with HEPA filters, or supplied-air respirators.
- If a worker is medically unable to wear a respirator, the employer should consider reassigning that worker to a job that does not require respiratory protection.
- In addition, the use of disposable aprons or goggles by persons working with or near machinery capable of generating aerosolized particles may provide an extra margin of protection.

**How can I recognize suspicious packages that have anthrax?**

Only specially trained personnel can distinguish between a real bioterrorism attack and a false one. If you suspect that a package, letter, or anything else contains a harmful biological agent, call 911 to activate the local emergency response system; in communities without 911 systems, notify local law enforcement authorities. Guidance on identifying suspicious packages and letters and what to do until the authorities arrive are available on CDC’s Web site at emergency.cdc.gov/agent/anthrax/mail/suspiciouspackages.asp.

**What can the consumer buy to protect against germ or chemical warfare such as anthrax?**

Currently, the CDC does not recommend consumers buy any particular product to protect against biological or chemical attacks.

**What should be done with clothing contaminated with anthrax? Is washing in a regular home washer and dryer ok? Does CDC recommend adding bleach to the wash?**

Contact your state or local public health department for advice. Clothing can be decontaminated using soap and water, and 0.5% hypochlorite solution (one part household bleach to 9 parts water).

**Are other solutions used at hospitals for cleaning blood spills also effective against anthrax?**

(Source: Interim Recommendation for Firefighters and other First Responders) The
recommendation for decontaminating equipment is a 0.5% hypochlorite solution (1 part household bleach to ten parts water). emergency.cdc.gov/documentsapp/anthrax/protective/10242001protect.asp.

What actions need to be taken if a facility is found to have an environmental sample positive for anthrax?
The number and location of positive environmental samples will be used to guide clean-up efforts. Positive environmental samples alone do not indicate the need for antibiotics or the need to close a facility. Employees, visitors, and family members of employees at these facilities are advised to monitor their own health carefully and report any unusual symptoms to a physician.

ANTHRAX AND ANIMAL HIDES

Am I at risk for anthrax from animal hides or hair, or from making a drum from these products?
Animal hides pose a low risk of cutaneous (skin) anthrax, and an extremely low risk of inhalation anthrax. Exotic animal hides may pose a higher risk for exposure than domestic (U.S.-origin) hides. The risk of contracting *Bacillus anthracis* from handling individual hides is believed to be very low; however, the industrial processing of hides or hair has historically been associated with increased risk of anthrax. Such industrial handling of large numbers of hides or hair from multiple animals results in prolonged direct contact with contaminated materials, often in enclosed or poorly ventilated settings. Among the 236 cases of anthrax reported to CDC from 1955 to 1999, 153 (65%) were associated with industrial handling of animal hide or hair. Only 9 of the 153 cases (6%) associated with industrial handling of hair or hide were inhalation anthrax.

Am I at risk for anthrax from my souvenir animal hide drum?
The risk of acquiring anthrax from an animal hide drum is very low. Of 236 cases of anthrax reported to CDC from 1955 through 1999, only one case of cutaneous anthrax was associated with a goat hide bongo drum purchased in Haiti. No cases of inhalation anthrax in the US have ever been associated with animal hide drums. The New York patient's exposure occurred when he was making and finishing drums made from untanned animal hides, and was not associated with playing finished drums. His exposure was similar to that experienced during industrial handling of hides, which has previously been associated with an increased risk of anthrax. CDC does not currently recommend prophylaxis for persons who have had contact with animal hide drums. However, drum owners or players should report any unexplained fever or new skin lesions to their healthcare provider, and describe their recent contact with animal hide drums.

Why did the New York City resident get anthrax?
The drum maker in NYC mechanically removed the hair from untanned animal hides using a razor in a small and poorly ventilated workspace and without respiratory protection. This process can aerosolize spores present on the hides. Therefore, this appears to be an isolated case
of naturally occurring anthrax. There is no evidence of bioterrorism or risk to the general public.

**Is there a way to treat cattle or goat hides to render them safe for use in making drums?**
Certain processing methods may reduce the risk of disease from handling animal hides, including:
- Heat (heated to an internal temperature of 70 degrees Celsius (158 degrees Fahrenheit) or placed in boiling water for a minimum of 30 minutes)
- Preservation in 2 percent formaldehyde
- Chemically treating in acidic or alkaline solutions (soaking in a solution below pH 3.0 or above pH 11.5 for 24 hours)
- The use of hypertonic salts.
- Traditional tanning methods

**How can I further protect myself if I work with hides that may be potentially contaminated with anthrax spores?**
Persons engaged in making drums should only use animal hides that have been processed to reduce the chance of infectious disease transmission. Persons with ongoing exposure to untreated animal hides should consult with a professional to determine appropriate personal protective equipment and risk mitigation measures. While these measures may help reduce the risk of acquiring anthrax infection, they cannot be presumed to eliminate it. Any unexplained febrile illness or skin lesions should immediately be reported to a healthcare professional, and the history of contact with untanned or untreated animal hides should be explained.

**What if I worked with hides and I am concerned about exposure to anthrax?**
If you are concerned that you may have handled an animal hide contaminated with anthrax spores, contact your state or local health department. Any unexplained febrile illness or skin lesions should immediately be reported to a healthcare professional, and the history of contact with untreated or untanned animal hides should be explained.

**May I import souvenir animal hide drums?**
Haitian goat hide drums have been previously linked to a case of cutaneous anthrax, and the CDC restricts entry of animal hide drums from Haiti if they have not been processed in a way that renders them non-infectious. Persons should be aware that untanned animal hide drums from Africa may pose a similar but low risk for cutaneous anthrax.

**May I import animal hides?**
Importation of animal products, including processed and unprocessed cattle and goat hides, is currently regulated by the United States Department of Agriculture (USDA). Cattle or goat hides that have been tanned, hard-dried, pickled (soaked in a salt solution), or treated with lime are considered to pose less of a risk for infectious diseases and may be imported under certain conditions. For more information, consult the USDA website at www.aphis.usda.gov and http://www.aphis.usda.gov/vs/ncie/biofacts.html
ANTHRAX AND THE MAIL

How can mail get cross-contaminated with anthrax?
CDC does not have specific studies to address this, however, cross-contamination of the mail could occur during the processing, sorting, and delivery of mail when an envelope comes in contact with an envelope, piece of equipment (e.g., an electronic sorting machine), or other surface that is contaminated with *Bacillus anthracis* spores. In addition, airborne spores in contaminated postal facilities before they were cleaned might play a role.

When there is a known incident, how can I prevent anthrax exposure from cross-contaminated mail?
There are no scientifically proven recommendations for preventing exposure. However, there are some common-sense steps people can take:

- Do not open suspicious mail
- Keep mail away from your face when you open it
- Do not blow or sniff mail or mail contents
- Avoid vigorous handling of mail, such as tearing or shredding
- Wash your hands after handling the mail
- Discard envelopes after opening mail.

What is the risk for getting anthrax from handling my own mail?
If there is a risk for inhalation anthrax associated with exposure to cross-contaminated mail, it is very low. For example, about 85 million pieces of mail were processed on the few days in 2001 after envelopes containing *Bacillus anthracis* (addressed to two U.S. senators) passed through the New Jersey and District of Columbia sorting facilities until they were closed. Despite the fact that both of these facilities had evidence of widespread environmental contamination with *B. anthracis* spores and the fact that public health officials had been aggressively looking for anthrax cases, no new cases of anthrax were identified during that time.

As a postal employee, am I at risk for getting anthrax from handling mail on the job when there is an anthrax cross-contaminated mail event?
If there is a risk for inhalation anthrax associated with exposure to cross-contaminated mail, it is very low, even for postal employees and persons who work in company mailrooms. CDC has published interim recommendations that are intended to assist personnel responsible for occupational health and safety in developing a comprehensive program to reduce potential cutaneous or inhalation exposures to *Bacillus anthracis* spores among workers in work sites where mail is handled or processed. Detailed guidelines may be found on these Web sites:

- emergency.cdc.gov/documentsapp/anthrax/10312001/han51.asp
- www.cdc.gov/mmwr/preview/mmwrhtml/mm5043a6.htm
ANTHRAX AND INFLUENZA

Influenza (flu) and inhalation anthrax can have similar symptoms. Does CDC recommend that I get a flu shot to help diagnose anthrax?
You should get a flu shot only to prevent the flu. CDC does not recommend you get the flu shot so doctors can tell whether you have the flu or anthrax. Many illnesses (including anthrax) begin with flu-like symptoms, which include fever, body aches, tiredness, and headaches. In fact, most illnesses with flu-like symptoms are not either the flu or anthrax.

The flu vaccine is the best protection you can get to prevent the flu and its severe complications, especially among those who are at the highest risk (e.g., people older than 65 years old or younger people with chronic disease such as diabetes or heart disease). The flu shot can prevent 70%-90% of flu infections, but it will not prevent illnesses with flu-like symptoms caused by anything other than influenza.

Is there a way to distinguish between early inhalation anthrax and flu?
Early inhalation anthrax symptoms can be similar to those of much more common infections. However, a runny nose is a rare feature of anthrax. This means that a person who has a runny nose along with other common influenza-like symptoms is by far more likely to have the common cold than to have anthrax.

In addition, most people with inhalation anthrax have high white blood cell counts and no increase in the number of lymphocytes. On the other hand, people with infections such as flu usually have low white blood cell counts and an increase in the number of lymphocytes.

Chest X-rays are also critical diagnostic tools. Chest X-rays showed that all patients with inhalation anthrax have some abnormality, although for some patients, the abnormality was subtle. CT scans can confirm these abnormalities.

Is there a quick test that doctors can do to tell whether I have anthrax or an illness like the flu?
Some influenza detection tests give results fairly quickly. However, these tests are not perfect and are not appropriate for every patient. Rapid influenza tests can provide results within 24 hours; viral culture provides results in 3-10 days. However, as many as 30% of samples that test positive for influenza by viral culture may give a negative rapid test result. And, some rapid test results may indicate influenza when a person is not infected with influenza.
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