Introduction

One January recently, dozens of people began streaming into doctors' offices in Washington State. All of the patients complained of intestinal upsets and stomach cramps. Alarmed by the unusual number of cases flooding waiting rooms, one Washington physician reported the outbreak to the local health department.

Public health investigators went into action. In hospital emergency rooms and physicians' offices, they talked to scores of patients, asking questions about what and where these people had eaten before becoming ill. The detective work quickly led investigators to a chain of fast-food restaurants. Most of the five hundred people who got sick had eaten hamburgers at a chain restaurant. Laboratory tests showed that contaminated and undercooked hamburger meat served by the restaurant was the source of the disease outbreak.

It turned out to be the worst case in history of *Escherichia coli* (*E. coli*) infection. *E. coli* is a kind of bacteria that lives in the large intestines of humans and other animals. Normally, it does no harm.

When people eat foods contaminated with *E. coli*, however, it can cause severe bloody diarrhea and stomach cramps. To avoid infection, foods such as hamburger meat must be thoroughly cooked. To keep contaminated meat from also contaminating other foods, raw meat must not be allowed to come into contact with other foods such as hamburger buns.

E. coli infection can be very serious. During the Washington outbreak, more than one hundred fifty people had to be hospitalized, forty-five patients developed a kidney disorder, and three people died.

To stop the *E. coli* outbreak in Washington State, health authorities immediately told the public about the infections and their source, and warned people not to eat undercooked hamburger meat. In addition, the authorities recalled thousands of potentially contaminated hamburger patties. Their quick actions controlled the outbreak and prevented hundreds of new cases of illness.

What Is Public Health?

The public health professionals who brought a quick end to the *E. coli* outbreak in Washington are like "disease detectives." They search out the sources of illness and work to protect the health of people in communities. As you can see from the Washington example, public health deals with the health and well-being of people *in communities*. It concentrates on the collective health and not on specific persons. Physicians treat patients as individuals, while public health professionals see to the health needs of an entire community.

Public health officials work to prevent disease by attacking the sources of diseases and correcting or eliminating problems. Most efforts concentrate on disease prevention. When these efforts fail, health workers seek to find and contain the source of a disease or an outbreak of illness, as in the Washington example. *Containment* can mean controlling the movements of affected people, isolating sick people, or eliminating the habitats where microorganisms breed or where disease carriers (usually insects or rodents) live.

In some ways, medical care for individuals and public health work for communities overlap. Entire communities can be endangered if some ill citizens cannot get medical care and they spread their disease to others. In the United States, it is illegal to refuse lifesaving hospital care to persons who are unable to pay for it. Such laws exist to protect the health of entire communities.

Other services, including injury prevention programs, long-term therapy, and rehabilitation, are also part of public health. Taxes support the services not paid for by individuals or insurance companies.

A technician handles serum under strict sanitary conditions.

Some public health workers also ensure that the air we breathe, the water we drink, the food we eat, and the waste we produce are all safely and efficiently handled or maintained. These workers monitor air and water quality, inspect food and restaurants, help provide clean water, and handle the processing of human and other wastes. All citizens receive these public health services.

Protecting the public health is a job we all share. Each of us can help by not polluting the air, water, or environment. Individuals can also help by having healthy lifestyles. We all should try to maintain a healthy body weight; exercise regularly; get enough sleep; not smoke; and not use or abuse other addictive substances; eat nutritious and balanced meals; and see health care professionals regularly. Communities can contribute by keeping streets and municipal properties clean and free of litter, and by providing a pure water supply and sanitary waste disposal systems.

Public health is a joint responsibility that relies on all members of the community for success. Public health efforts benefit all of the people living in a community.

Public Health Agencies

Although many types of public health agencies exist, all of them do many of the same jobs. Scientists in public health laboratories analyze food, blood, and other specimens to try to identify *pathogens* that are harmful to health. Pathogens may cause infectious diseases that can spread to entire communities. Once a pathogen is identified, scientists determine how to treat the disease. They then advise physicians of their findings so that doctors may treat individual patients.

Americans generally take food safety for granted. We can do so because public health inspectors and other professionals work hard to ensure that our food is safe and will not cause disease. Inspectors and veterinarians inspect food and animals at various points between their origin (usually a farm) and their final destination (your meal). In between, people who handle, process, store, transport, and prepare the food also are checked.

Public health educators teach people which foods are wholesome and which are not. They work in schools and the community to promote healthy lifestyles. They teach young people about the dangers of using tobacco. They inform teens about the dangers of sexually transmitted diseases. They discuss problems associated with chronic diseases such as cancer, arthritis, and Alzheimer's disease. Educators work with people of all ages to provide the knowledge people need to protect their health and guard against disease.

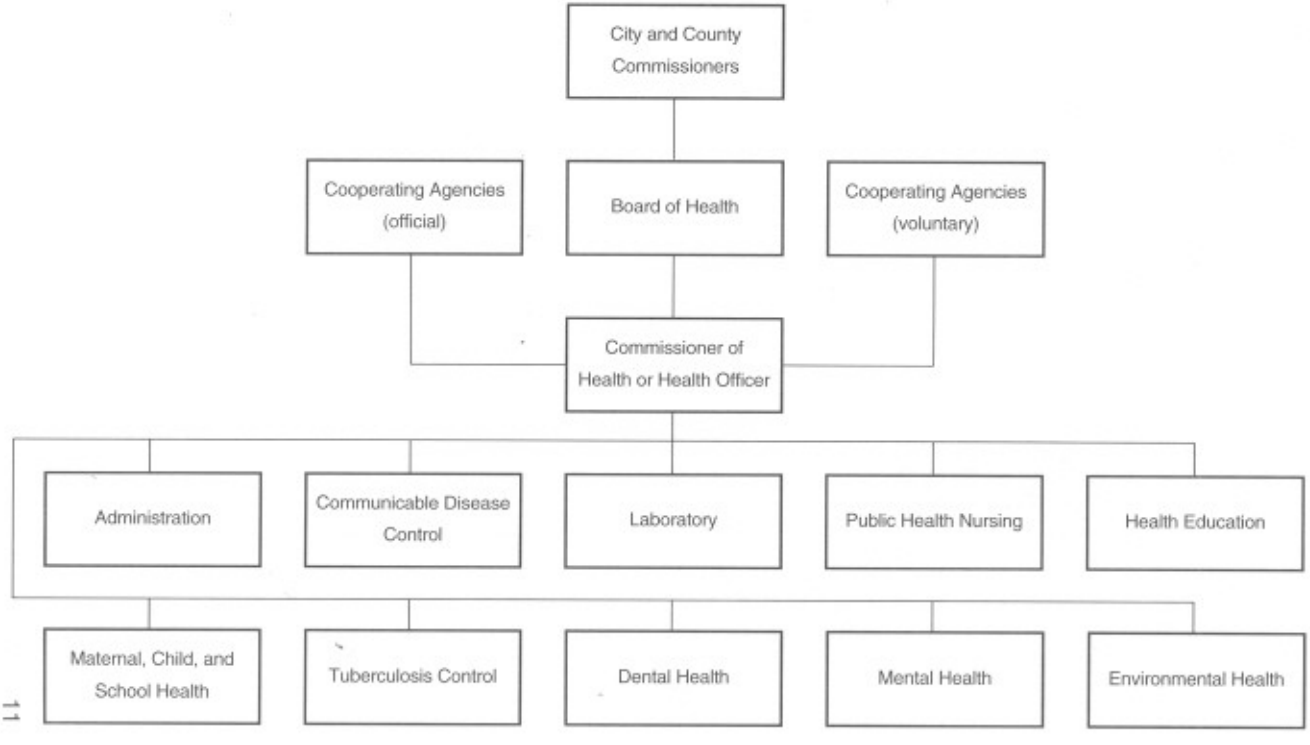
Clinics provide medical services for many individuals and families who could not otherwise afford care. Public health doctors immunize infants. Immunization protects people from diseases and relieves society of the burden of providing care for the illness and bodily damage that diseases cause. Public health nurses teach mothers proper methods of caring for their children to prevent illness.

The above are only a few of the jobs done by public health professionals. Their work is backed and reinforced by the efforts of many other kinds of public health workers who perform thousands of tasks that are equally essential to the health and well-being of Americans.

Public Health Agency Structure

Public health agencies exist at all levels of government—local, county, state, and federal. Most people who work in public health will gladly discuss their own jobs and the overall mission of their agency. Most agencies have similar organizational structures and perform similar services, although specific job descriptions will vary. A typical organizational structure appears on page 11. The department of health in most states and many large cities is headed by a physician who typically has the title of health officer or commissioner. Reporting to the administrative head are other persons with specialized skills who supervise various departments.

Organization of a Local Health Department



Every local health department has an office that handles records of *reportable* diseases. Examples of reportable diseases in the United States are polio, diphtheria, gonorrhea, syphilis, Lyme disease, typhoid fever, and Legionnaire's disease. When a physician treats a patient with a reportable disease, the doctor must report it to the local department of health. The identity of infected individuals is confidential. The local health department will summarize the number of cases and, in turn, report these to the state department of health. States notify the federal government at the Centers for Disease Control and Prevention. Health workers at all levels will take appropriate actions to keep the disease from spreading.

A local office of vital statistics maintains records of births, deaths, and marriages. These records are summarized through various levels of government to the National Institute of Vital Statistics in Bethesda, Maryland. The local office of vital statistics may issue birth and death certificates, although birth certificates are sometimes issued by hospitals.

Many local health departments sponsor clinics. Well-baby clinics promote wellness in infants; immunization or screening clinics emphasize disease prevention; other clinics may promote dental health or general health. These clinics are usually open to everybody. Local professionals—physicians, dentists, and nurses—staff these clinics. Local public health agencies often provide rabies control programs, as well.

Public health nurses provide a variety of services. They visit schools and teach health. They visit homes to assist elderly people and those who suffer from chronic diseases. They provide short-term care to people who have recently been discharged from the hospital.

A division of environmental health within the local department of health, or a department of public works, typically supervises water and sanitation services in a city. These services include delivering clean, potable water to homes, processing sewage and other household wastes, and disposing of solid wastes. This department might help to control pests that can carry diseases or endanger public health. Department employees might also inspect public swimming pools to ensure that the water is safe for swimming. Occasionally, they might investigate reports of animal bites.

Not all programs related to public health are run by the health department. Many are funded and run by the local department of welfare. The Women, Infants, and Children (WIC) program provides food and assistance to mothers with children up to age 2. Aid to Families with Dependent Children (AFDC) helps bring medical services to disadvantaged people who have children 17 and under. One important service provides regular blood tests for children who are at potential risk for lead poisoning. The food stamp program helps families serve nutritious food at prices they can afford.

The Public Health Community

Local and state public health departments are backed by the United States Public Health Service and the resources of the Centers for Disease Control and Prevention located in Atlanta, Georgia. The federal Environmental Protection Agency (EPA) and similar state agencies provide information and help for problems related to the environment. Examples of problems that involve the EPA are protecting public water supplies, disposing of normal and hazardous wastes (including biohazards—dangerous biological agents—and spent nuclear fuels), monitoring air pollution levels, and controlling noise pollution.

All public agencies are supported by taxes. Other agencies, such as the National Society for the Prevention of Blindness, for example, are supported by private funds. Private agencies typically concentrate on a single problem area, help people affected by the problem, and sponsor research that might solve the problem.

Public and private agencies may concentrate on the same problem and work together to seek solutions. Consider cancer, for example. Research has shown that there are chemicals in the environment that cause cancer. Understanding the processes that start and promote cancer is important to both the National Cancer Institute (a federal agency) and the American Cancer Society (a private organization). Both agencies sponsor cancer research, seeking more efficient methods for detecting cancer and better techniques for treating the disease.

Both public and voluntary agencies try to educate the public about new findings, controlling diseases, and maintaining good health. Together, the various agencies and organizations working in the field of public health make up the public health community.

Diseases, Causes, and Treatments

Diseases that are spread (or communicated) from one person to another are *communicable* diseases. Some diseases that we say are "caught" or "catching" are more correctly described as *contagious*. These are communicable by contact. Diseases that are communicable by infections—invasions of the body by bacteria, viruses, worms, protozoa, fungi, and other pathogens—are known as *infectious* diseases.

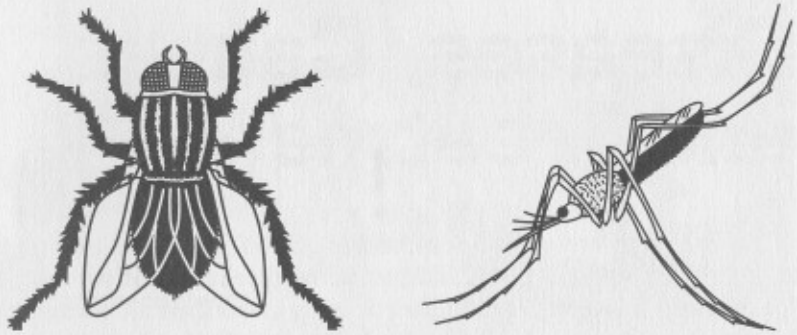
Causes of Disease

Animals and other living organisms that can be seen only with a microscope are called microorganisms or microbes. If they produce disease, they are pathogens. It is often hard to know if a given disease is due to the effects of an animal or a plant, or is the result of exposure to a chemical.

The best-known disease-causing organisms are *bacteria*. Tetanus and tuberculosis are caused by bacteria. *Rickettsias* resemble bacteria but are smaller; they cause diseases such as typhus. *Viruses* are even smaller than rickettsias. Diseases that we definitely know are caused by viruses include influenza, rabies, polio, viral hepatitis, AIDS, herpes, and viral encephalitis.

Diseases that humans can pick up (contract) from animals are called *zoonoses*. Some kinds of worms can cause disease, such as the tapeworm a person might get from eating raw fish, pork, or beef. A child might contract hookworms by going barefoot on contaminated soil. A person who eats pork (or bear or seal meat) that has not been thoroughly cooked might get the disease trichinosis, which is also caused by a worm.

The saliva of a tick may contain rickettsias, a group of organisms that can cause Rocky Mountain spotted fever (also called New



Flies and mosquitoes can be disease carriers.

World spotted fever), Lyme disease, and tickborne typhus fever. Bites by certain kinds of mosquitoes can transfer microorganisms that cause arthropod-borne viral encephalitis and other diseases such as malaria, yellow fever, and dengue fever. Flies and roaches also carry various types of bacteria.

Not all diseases are caused by microorganisms. Exposure to chemicals or minerals produces some illnesses. For example, benzene can cause leukemia. Some dyes can cause bladder cancer. Inhaling sand can cause silicosis; inhaling some types of asbestos can cause a type of lung cancer.

Some diseases (for example, some types of arthritis) result from the deterioration of the human body. The body simply wears out from a lifetime of use. Some diseases are genetic and are known as *hereditary* because parents can pass them to offspring. Examples include diabetes and heart disease. The causes of some diseases are not well understood. Most diseases that develop over long periods of time and lead to relatively permanent damage are known as *chronic* diseases.

Treatments and Cures

Medicines that kill pathogens in the body can cure most infectious diseases. In many cases, the immune system of the body produces *antibodies* that successfully fight invading organisms. Today, infectious diseases often—but not always—end with the cure and recovery of the patient. If patients receive proper treatment, they are likely to recover from most diseases.

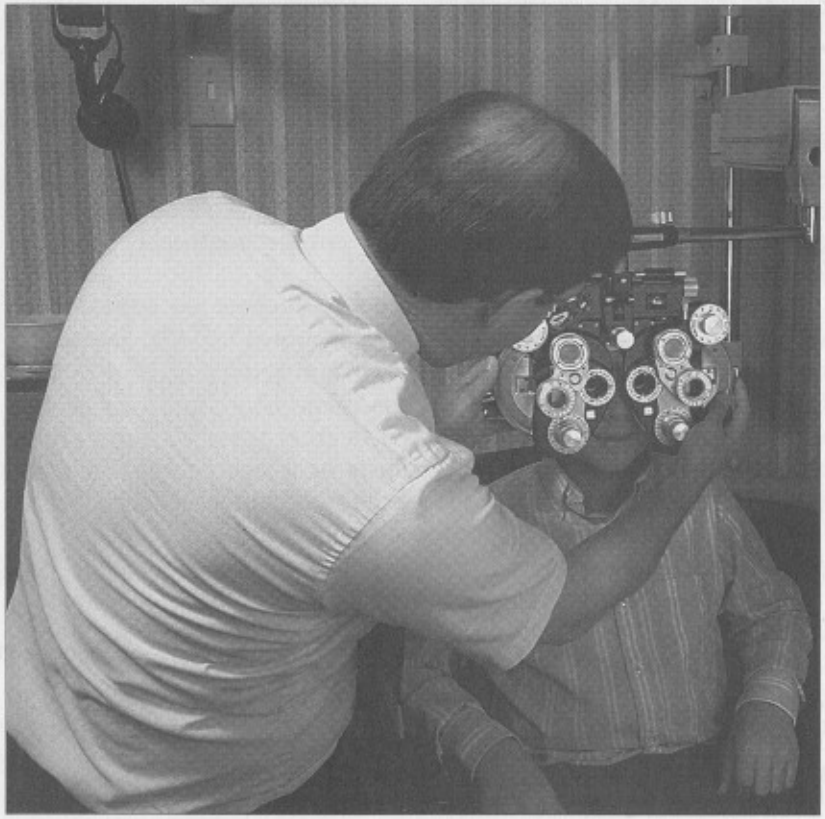
However, there are exceptions. Many pathogens are lethal—they kill their victims. For instance, no cure is known for AIDS (acquired immunodeficiency syndrome) or for the diseases caused by the Ebola or Marburg viruses. Some viruses and bacteria have become *resistant* to the drugs normally used to treat them. Treating drug-resistant diseases such as tuberculosis or gonorrhea requires the use of second-choice drugs, and recovery often takes longer. Some infectious diseases cause permanent damage to the patient's body; polio is an example.

Immunization offers protection against many infectious diseases. Immunization can prevent diphtheria, pertussis (whooping cough), tetanus, German measles (rubella), mumps, red measles (rubeola), polio, influenza, and hepatitis. (Immunization will be discussed in more detail in the section on preventing common diseases.)

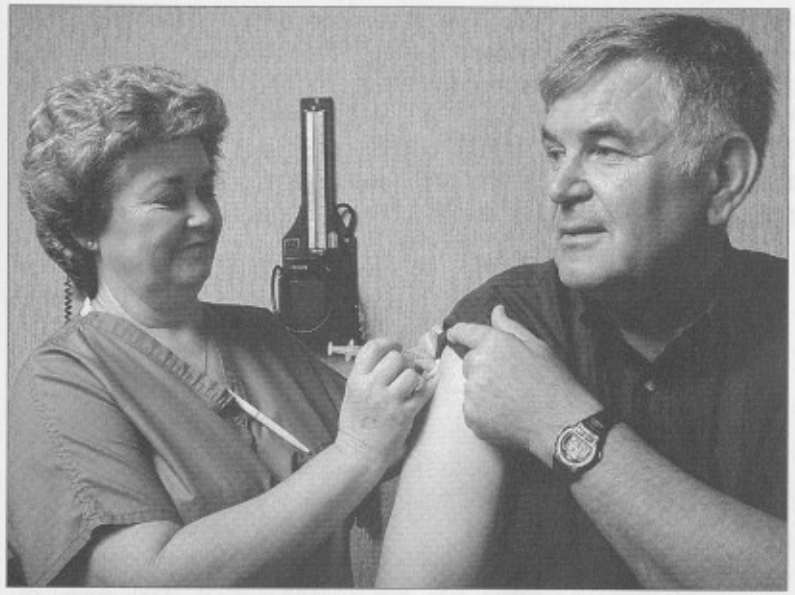
Why Checkups Are Important

Some diseases develop gradually. They are said to have a long *latent period*. In many cases, they can spread and cause great damage before their symptoms appear.

It is estimated, for example, that more than five million people in the United States have diabetes but don't know it. Left untreated, diabetes can lead to amputations, blindness, kidney disease, and death. An unknown but significant number of people in the United States have tuberculosis or AIDS, and are not aware of their infection. Tuberculosis can be debilitating, which means it saps a person's strength and vitality. AIDS is fatal. Clearly, it is important to detect all diseases as soon as possible after they develop.



Regular health checkups can detect disease in its early stages.



People get flu shots at a clinic.

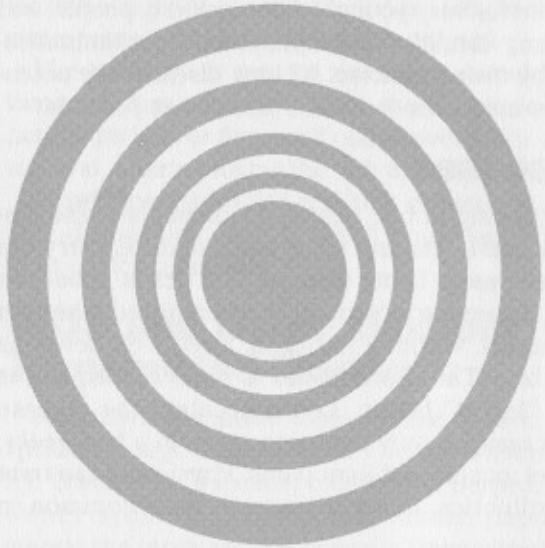
One of the best ways to avoid contracting a disease is to have regular health checkups by a physician. The earlier medical treatment begins for any disease, the earlier the condition can be corrected.

Because many people neglect this precaution and do not see their doctors until they are sick, public health workers often conduct *screening tests* to discover diseases and infections among large groups of people. Screening tests should be rapid, easy to give, as comfortable as possible for the person being screened, and relatively inexpensive. Such tests are not meant to be used to make a final diagnosis or to identify a disease. Individuals who have positive results on screening tests should have more precise tests done. Screening tests are usually given in convenient, public locations such as schools, shopping centers, neighborhood health centers, or specially equipped trailers that can easily be moved and set up.

Health screening tests are varied. Skin tests are used to detect tuberculosis or allergies. A chest X ray is used to screen for cancer, tuberculosis, and other lung diseases such as anthracosis (black lung

disease) or silicosis. A blood test is used to detect AIDS, other sexually transmitted diseases, thyroid problems, or diabetes. An eye test may show the need for glasses, or reveal color blindness or diabetes.

A tool that is now widely used is a *lifestyle assessment* or *health risk appraisal*. This is a way of asking questions about a person's health and habits. The person's answers to the questionnaire might suggest ways the individual could live a healthier life.



Preventing Common Diseases

Everyone can take steps to avoid sickness. All of us should learn about common diseases and what we can do to prevent them.

Influenza and Other Respiratory Infections

Upper respiratory infections, including influenza (flu), the common cold, pneumonia, and tuberculosis, are caused by organisms that are spread from person to person, usually by discharges from the nose and throat. Infections can spread especially rapidly if these diseases appear where people are living close together, such as in a barracks. The best protection is good general health, avoiding fatigue, staying warm and dry, and avoiding close contact with people who have these infections.

Flu shots are important for very young children, elderly people, and people with chronic lung conditions. People should get immunizations if recommended by their physician. All lung diseases are potentially serious; preventive measures should be taken when possible.

Tickborne Diseases

One of the fastest-growing public health problems is Lyme disease. Deer ticks, which infest deer and some kinds of mice, carry the rickettsia organism that causes Lyme disease. The tick is about the size of a poppy seed. The microorganism is transmitted when an infected tick bites a human. Within a few days, a red welt develops at the site of the tick bite. The red welt has a white center, and is often described as a "target" lesion. Left untreated, the disease seems to disappear. Actually, it only becomes quiet. In a few weeks, the victim begins to feel muscle and joint pains. Physicians can treat Lyme disease with antibiotics. Lyme disease is more common in summer than winter.

Rocky Mountain spotted fever is also caused by a rickettsia. Signs of the disease include a sudden fever, and a distinctive rash that begins on the hands and feet and spreads to the trunk. The tick that carries the rickettsia is up to a half-inch long and easily visible. Rocky Mountain spotted fever can usually be treated with antibiotics. Untreated, this disease is fatal for one person in five.

To remove a tick, coat its body with petroleum jelly or fingernail polish; then ease it loose with tweezers.

You have no way of knowing if a tick is infected with a rickettsia that can cause disease. The best way to prevent disease is to avoid tick bites. When you are in an area known to have ticks, check your clothes for ticks every two hours. Tuck in pant cuffs and shirttails to lessen the chances of being bitten. Using an insect repellent also helps.

Contact between tick and human for many hours (usually more than twelve) is often required to transmit a disease-causing rickettsia. That is why frequent checking of clothes and bodies is useful for preventing disease. If a tick does bite, remove the tick and, if possible, bring it to a laboratory for analysis.

The best way to remove a tick is to use slow, steady pressure with tweezers. Try to remove all of the tick, including the head. Rubbing petroleum jelly or fingernail polish over a tick may help to loosen it for removal. After removing the tick, apply an antiseptic to the bite site.

Protect pets with flea and tick collars and dusts if they roam outside during tick season. Wash your hands after any contact with ticks or tick repellents.

AIDS and Other Sexually Transmitted Diseases

Sexually transmitted diseases are caused by organisms that are spread through intimate bodily contact, mainly through sexual activity. Gonorrhea, syphilis, chlamydia, herpes, acquired immunodeficiency syndrome (AIDS), and human papilloma virus (HPV) are among the more serious sexually transmitted diseases in the United States. The spread of most of these diseases is greatest among teenagers and young adults.

Gonorrhea and chlamydia are two of the most common sexually transmitted diseases. Many people with these infections, both men and women, have no symptoms until they have suffered extensive damage. Historically, syphilis was a serious health problem that, for a time, was almost completely controlled. In recent years, however, the disease has again become a major public health concern.

Different viruses cause genital herpes, HPV, and AIDS. Genital herpes produces painful blisters in both men and women. The disease can cause spontaneous abortion or premature delivery. No cure now exists for either HPV or AIDS. HPV can cause pain and contribute to cancer. AIDS is fatal, although death typically does not occur for about ten years after a person gets the disease.

Sterility is a frequent complication of these diseases. Nearly all sexually transmitted diseases can be passed from women to their unborn babies. This can result in permanent damage or death to the newborn.

The signs of sexually transmitted diseases are many and varied. Rashes, blisters, and a discharge are common. However, many people with these infections have no signs or symptoms. Such people are called *carriers*. They can unknowingly spread disease.

If discovered in time, some sexually transmitted diseases can be treated and cured. Most cities have public clinics where people can be treated confidentially (in private) and free of charge. Self-treatment of sexually transmitted diseases is dangerous and ineffective, and should never be attempted. No vaccines offer protection against sexually transmitted diseases. The best way to avoid infection is to avoid sexual contact.

Rabies

Rabies is a viral disease (a disease caused by a virus). The bites of infected animals can spread rabies to humans. Wild mammals—bats, foxes, squirrels, coyotes, skunks, and raccoons—are the main carriers of rabies. Summer campers are most likely to be bitten by raccoons. Domestic pets such as cats and dogs can also carry and transmit rabies.

An untreated bite by a rabid animal is fatal. However, there is a treatment—a series of fourteen injections that must be started soon after the bite occurs.

The key to preventing rabies is to avoid contact with wild animals. Stray dogs and cats should be rounded up and eliminated. Have pets immunized against the disease. Veterinarians can recommend how often pets should be immunized, and give the shots.

People who are bitten by animals should get prompt medical care. Avoid the biting animal until a veterinarian can check it for rabies. Notify the police.

Tetanus

Tetanus is caused by a bacillus (bacterium) that enters the body through any type of deep wound or break in the skin, most commonly through a puncture wound. Tetanus bacteria normally live in soil, dust, or animal droppings. The disease causes painful stiffness of muscles. Death results in almost half of the untreated cases.

Tetanus is easy to avoid, because proper immunization with tetanus toxoid gives complete protection. However, the protection is not lifelong. Medical experts recommend a booster injection of tetanus toxoid every five to ten years. Most physicians will give a booster shot after any injury to a patient, if the person has been immunized. If the person has never received a tetanus shot, an injection of tetanus antitoxin immediately after a cut or puncture wound will provide protection.

Health authorities recommend that infants be given tetanus vaccine. It usually is combined with vaccines for pertussis (whooping cough) and diphtheria. The first of three injections is given at two months after birth, with injections repeated at four and six months.

Protection against tetanus is especially important for Scouts and others who spend considerable time outdoors. Members of the armed forces, police officers, and firefighters receive this protection at five-year intervals.

Hepatitis

Hepatitis is a viral disease that affects the liver. There are three distinct varieties: type A (also called infectious) hepatitis, type B (also called serum) hepatitis, and type C (formerly called non-A-non-B) hepatitis.

The virus invades the liver and causes *jaundice*, which appears as a yellowish color in the skin. Type A hepatitis is spread by exposure to people with the disease or to contaminated food or water. Type B is caused by exposure to contaminated blood or blood products, or to contaminated syringes or surgical instruments. Type C is spread by using illegal drugs or by sexual contact with a carrier. All types are serious and can be life threatening. Vaccines are widely available for types A and B; a vaccine for type C is now being developed.

All donated blood in the United States is screened for the three types of hepatitis. Hepatitis can be prevented by practicing good sanitation and personal hygiene, purifying water, sterilizing medical supplies and equipment, and isolating people who have hepatitis. Individuals with active hepatitis should not work in jobs that involve hand-to-hand contact with either people or food. Immunization is recommended for children and for adults who have jobs that expose them to people or animals that might have or carry hepatitis. Primates especially, such as monkeys and chimpanzees, can be carriers.

Hepatitis can also infect raw shellfish. Eating shellfish harvested only from safe beds is one way to avoid the risk of hepatitis. Local health codes usually regulate shellfish harvesting. Another way to reduce the risk of hepatitis is to cook shellfish thoroughly.

Emphysema

Emphysema, a disease of the lungs, is caused primarily by cigarette smoking or air pollution. Afflicted people experience weakness upon exertion. In advanced cases, sufferers might not be able to climb a single flight of stairs without resting halfway to catch their breath.

Emphysema causes the hot gases of cigarette smoke and acidic pollutants in the air to damage the lungs in a way that interferes with the passage of oxygen from the lungs to the blood. In advanced cases of emphysema, the *alveoli* (tiny air sacs) of the lungs may burst, causing pain and, eventually, death. A person with emphysema suffers shortness of breath and must exert more energy than normal to get oxygen to tissues that need it.

More than a million new cases of emphysema are reported each year. The easiest way to prevent emphysema is to avoid smoking cigarettes. Two out of every three cigarette smokers will develop emphysema. Lung damage due to emphysema is permanent. The damage can be halted, but it can never be repaired.

Encephalitis

Encephalitis is a viral disease found mostly in animals such as horses, mules, ponies, and donkeys. It can also be transmitted to humans, birds, and reptiles. Encephalitis causes inflammation and swelling of the brain. Its symptoms range from headache and fever to unconsciousness or coma. The disease usually does not last long, but it can lead to mental impairment or disability. Untreated, encephalitis can be fatal.

Arthropod-borne encephalitis is spread by insects (arthropods), usually mosquitoes. It is not transmitted directly from person to person. Prevention involves controlling or eradicating mosquitoes by using screening and by draining breeding sites, and teaching people about the dangers of encephalitis.

The spread of encephalitis is affected by temperature, rainfall, and the number of birds and insects infected with the disease. Under certain conditions, *epidemics* can occur. An epidemic is an excess number of cases of a disease. Illness in horses can alert health officials to watch for this disease.

Salmonellosis

Salmonellosis is a type of food poisoning caused by bacteria that are commonly found in poultry, meat, and eggs. The disease causes nausea, vomiting, abdominal pain, diarrhea, and dehydration. Salmonellosis is usually self-limiting, which means it runs its course and is gone within one to two days. In a very young child, however, it can be serious.

The bacteria that cause salmonellosis grow in animals. Direct contact with either animals or their feed can transmit the disease to humans. When infected animals are slaughtered, their blood or wastes can infect humans. The bacteria can be transferred directly to humans through infected food that is undercooked.

Salmonella bacteria are found on the outside of bird eggs. When the shell of an egg is cracked, the salmonella can get inside and grow rapidly. For this reason, you should throw away all cracked eggs. Salmonella bacteria are also carried by turtles. People with pet turtles should wash their hands thoroughly after handling their pets.

Prevention involves adequate cleaning, complete cooking, and safe storage of foods that can transmit salmonella bacteria. Wash poultry thoroughly before cooking it. Cook foods thoroughly, serve them hot, and store them at cold temperatures. Do not expose foods (especially those containing eggs, such as salads) to sunlight for more than an hour without adequate refrigeration. Keep hands, working surfaces, utensils, and foods clean to control the spread of salmonella. Properly dispose of waste products.

Mushroom Poisoning

Many kinds of mushrooms contain *mycotoxins*, which are poisonous to humans. There are three broad categories of mycotoxins: One type upsets the digestive tract, a second affects the nervous system, and the third causes liver and kidney damage. Consume enough and all mycotoxins can be fatal; mushroom poisoning can kill.

Some mushrooms are poisonous to humans.

Even experts have trouble identifying all of the thousands of varieties of mushrooms. No simple test exists to separate safe from unsafe mushrooms. Rule-of-thumb tests are unreliable. To be safe, eat mushrooms only from a known, commercial source or those collected under the supervision of a mycologist (a mushroom expert). If you suspect mushroom poisoning, get the victim to a doctor or medical facility without delay. It is very useful to have a whole specimen of the mushroom that was eaten. This will speed correct treatment.

Scabies

Scabies is an infectious disease caused by a mite that burrows into the skin to lay its eggs. Mites prefer wrists and the webs of skin between fingers, although any skin is vulnerable. Where mites burrow, the skin itches intensely, especially at night.

Treatment consists of a medicated lotion to kill the mites and their eggs. A physician must prescribe the lotion. The clothing and bedding of an infected person must be disinfected, ideally by washing in hot water.

Scabies is transmitted by close personal contact and can also be spread by contact with the bedding and clothing of affected people. Poor hygiene contributes to the disease. Prevention consists of proper personal hygiene, keeping bedding and clothing clean, and avoiding contact with people who have scabies or with the belongings of infected people.

Lice

Lice are small, crablike insects that like to live at the base of hair follicles. All hairs—the eyelashes, eyebrows, and hair of the head, chest, armpits, and groin—can attract lice. Lice are transmitted by direct contact with an infected person. Lice infestations itch; scratching the skin can cause sores and scarring.

A simple treatment for lice is to cut or remove affected hair, which also removes eggs (called nits) and immature lice. Then apply a medicated lotion obtained from a doctor, pharmacist, school nurse, or camp medical director. Clothing and bedding must be washed in hot water as part of the treatment. Also disinfect personal items such as combs, brushes, and headgear. Isolate infested people and their personal belongings until the problem clears. Prevention requires good hygiene and cleanliness.

How Diseases Are Contracted and Prevented

Disease	How Contracted	Prevention
Emphysema	Chronic illness due to cigarette smoking or air pollution	Do not smoke.
Hepatitis A	Exposure to food and water with contaminated fecal material	Proper sanitation and avoidance of crowding; immunization.
Hepatitis B	Exposure to infected blood or blood products	Avoid contact with infected persons, use of intravenous drugs, and intimate contact with known carriers; always use a protective latex product when having intimate contact with another person; immunization.
Hepatitis C	Intravenous drug usage; rarely by blood transfusion	Refrain from using intravenous drugs.
Hepatitis D	In the United States, primarily by intravenous drug usage; coinfection often occurs with hepatitis B	Refrain from using intravenous drugs; immunization for hepatitis B.
Hepatitis E	Exposure to contaminated water; has caused known outbreaks in India, Burma, Mexico, Algeria, and Afghanistan	When traveling in countries where hepatitis E virus has been found, avoid drinking water that has not been boiled.
Influenza	Airborne viruses from the nose and throat of infected persons	Cover coughs and sneezes with a handkerchief; avoid close contact with people who have colds or the flu; get immunizations as recommended by a doctor.
Lice	Close contact, sometimes sexual, with an infested person or with personal articles used recently by that person, such as clothing, bedding, combs, brushes, and headgear	Maintain good personal hygiene and sanitation; avoid contact with infested persons. If infected, use powders and shampoos available from a physician or pharmacist.
Mushroom poisoning	Eating poisonous mushrooms	Eat mushrooms only from a commercial source or those approved by an expert.
Rabies	Bite from in infected dog, cat, raccoon, fox, skunk, or other infected animal	Immunize all pet dogs and cats; eliminate stray animals; contact a physician if bitten; contact the health department or police to report a bite.
Salmonellosis	Eating insufficiently cooked poultry, beef, or eggs; eating improperly stored food or contaminated foods	Adequate cooking or heat treatment of prepared foods; correct storage; good personal hygiene.
Sexually transmitted diseases	Intimate contact with infected person	Avoid sexual contact; see a doctor if infection is suspected.
Tetanus	Puncture wound	Immunization.
Tickborne diseases	Bite from an infected tick	Avoid exposure; make frequent self-inspection; use tick repellents; remove ticks carefully.

Immunizations

In most cases, having a disease causes the body's immune system to make special substances called *antibodies*. These antibodies fight the pathogen causing the disease and protect the individual. Usually, antibodies prevent the return of the disease as long as the immune system is undamaged. Once an individual develops immunity or a high degree of resistance to a disease, that person is unlikely to get the disease again.

Immunization with a vaccine can give immunity to some diseases and is one of the best ways to protect health and avoid infectious diseases. A vaccine can be made of pathogens that are alive but greatly weakened in a laboratory so that they do not cause serious illness, but will cause the body to produce antibodies. A vaccine can also be made of killed pathogens, or of related organisms that cause a similar but milder disease. Or it can be made of portions of the pathogen that do not cause the disease but can make the body's immune system respond as if the disease were present.

The idea is not new. People have long noticed that individuals who survive certain diseases rarely get the diseases a second time. Edward Jenner, an English physician who lived from 1749 to 1823, created the first modern immunization program. Dr. Jenner ground up scabs from people with cowpox and poked this material under the skin of others. The people he treated got mild cases of cowpox and became immune to the closely related smallpox virus. Before immunization became available, one-third to one-half of all smallpox victims died; survivors were usually badly scarred. In modern times, an international immunization program has made smallpox extinct.

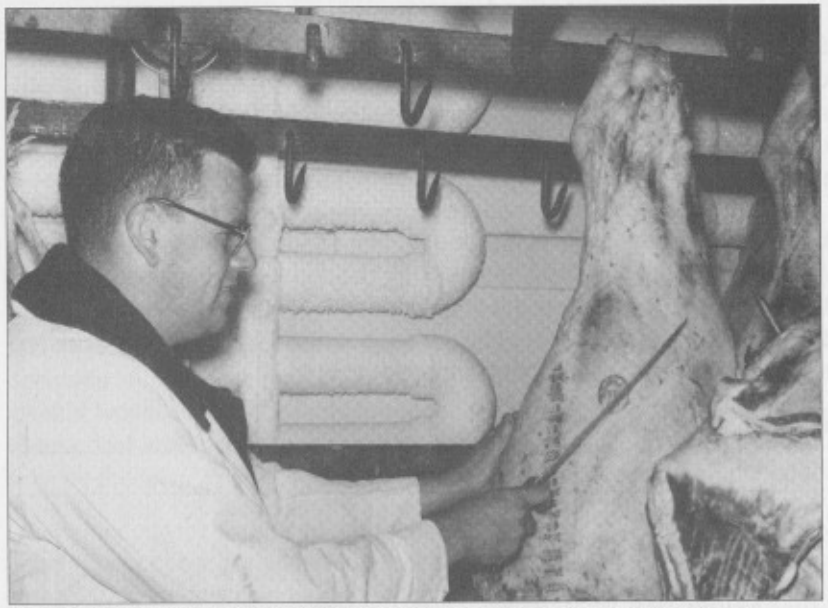
The immune system makes antibodies for each particular disease that it meets. Therefore, a different vaccine is required for each disease. Immunization is available today against many diseases found in the United States, including diphtheria, pertussis (whooping cough), tetanus, polio, mumps, red measles (rubeola), German measles (rubella), influenza, hepatitis (types A and B), and chicken pox. Immunizations are also available for yellow fever, typhoid fever, and tuberculosis, diseases that are uncommon in the United States but common in other parts of the world. People typically receive immunizations when they travel or join the armed forces. Some vaccines are swallowed; others are injected.

Today's successful immunization programs can lull people into a false sense of security, as in the case of polio. Three different viruses cause polio. Immunizations against all three viruses almost eliminated polio in the United States. Some people became careless and did not have their children immunized. As a result, the number of polio cases in the United States is slowly increasing.

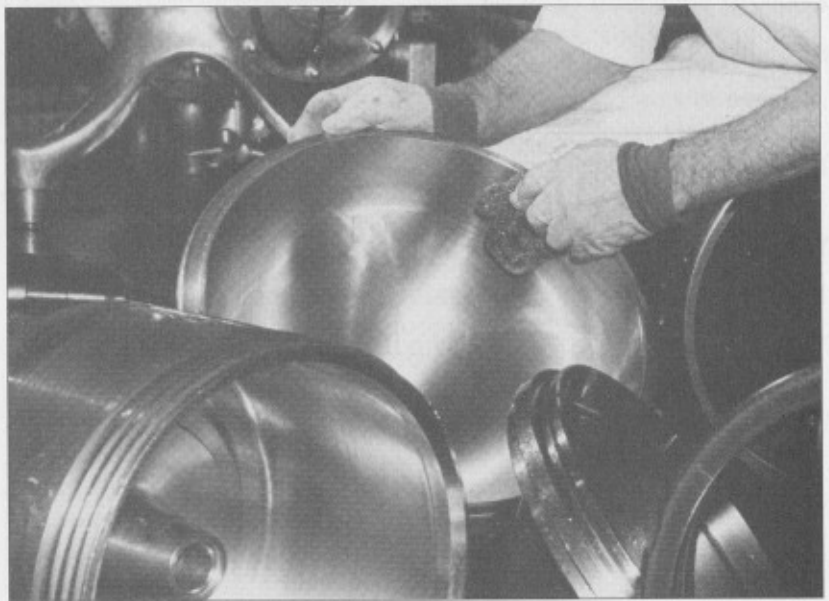
Immunization is suggested for very young children, with periodic booster injections as recommended. See the chart below. Antibodies are long lasting, but the protection they give may decrease with time. A second exposure to a pathogen will increase the level of antibodies in a person's body. Therefore, a second injection, or booster shot, is often given to boost immunity.

Immunization Schedule

Age	Immunization
2 months	First diphtheria and tetanus toxoids and pertussis (whooping cough) vaccine (DPT); first trivalent oral polio vaccine (TOPV)
4 months	Second DPT and TOPV
6 months	Third DPT; while some authorities recommend a third TOPV at this time, others wait
12 months	TB screening test if baby has been exposed to a person with tuberculosis
15 months	Measles, mumps, and rubella (MMR)
18 months	Fourth DPT and third TOPV
At school entry (4 through 6 years)	Fifth DPT and fourth TOPV
14 through 16 years (and at 10-year intervals thereafter)	Tetanus and diphtheria (TD) boosters



Above: Meat being inspected at a wholesale market. *Below:* All equipment through which milk is processed must be thoroughly cleaned each day.



Food Sanitation

The purity of foods is an important factor in public health. Foods and drinks can spread illness if they become contaminated. To protect food purity, Congress passed the Pure Food and Drug Act in 1906, and has amended the act several times. One aspect of this legislation is to provide standards of purity for foods we eat, inspectors to check foods, and penalties for failure to maintain minimum standards. Milk and other foods are inspected for physical and microbiological contamination.

Nutrition

Good nutrition means eating enough of the right foods to ensure good health. Well-nourished people are better able to resist disease and infections. Unfortunately, many young people neglect their diets. They eat more "junk" foods and not enough healthy foods.

The U.S. Department of Agriculture recommends that a person eat the following each day:

- 6 to 11 servings of bread, cereal, rice, or pasta
- 3 to 5 servings of vegetables
- 2 to 4 servings of fruit
- 2 to 3 servings of milk, yogurt, or cheese
- 2 to 3 servings of meat, poultry, fish, beans, eggs, or nuts

Fats and oils should be included, but used sparingly.

So-called junk foods often contain large amounts of fat and sugar. These may taste good and provide energy, but eating a steady diet of only junk foods will lead to dietary deficiencies.

Foodborne Illness (Food Poisoning)

Food poisoning is caused by eating food that is contaminated with pathogens or by eating things that are harmful to humans, such as some varieties of mushrooms, eels, mussels, and plants. Food poisoning can occur in two ways: microbiological and chemical. Some bacteria, such as salmonella, can cause illness directly. Others, such as staphylococcus and clostridium, produce a toxin (poisonous chemical) that is harmful to humans.

Neither salmonella, which causes the disease called salmonellosis, nor staphylococcus is likely to be lethal. Certain species of clostridium produce one of the most deadly poisons known—a toxin that causes botulism. The particular type of bacteria responsible for botulism, *clostridium botulinum*, can be found on many foods but is killed by proper sterilization techniques. Proper cooking destroys both the organism and any toxin that may be present. Most cases of improperly canned or unsafely packed foods involve foods preserved at home. Boiling home-prepared foods for ten minutes before serving will kill all bacteria. Do not use food from dented containers or from containers with swollen ends.

Keeping Food Pure and Wholesome

Professionals in public health seek to improve the nutritiousness of food and to improve methods of supplying food. They also work to ensure that food is free from contamination, adulteration (dilution or impurities), dangerous additives, and spoilage that might harm consumers.

The Food and Drug Administration (FDA) is an independent agency of the United States government. One of the FDA's major responsibilities is to regulate food processing plants. The agency regularly inspects food processing plants that either receive raw food from two or more states, or that ship finished food products to two or more states.

State and local health officers and sanitarians (specialists in sanitary science) inspect restaurants and supermarkets to make sure they obey sanitation standards and regulations. Obeying some sanitation standards is voluntary, but the fines and bad publicity that follow reports of uncleanliness tend to ensure compliance with regulations. The FDA trains inspectors and restaurant operators in safe food-handling practices.

Each year, thousands of Americans become ill from eating improperly prepared foods. (Remember the story at the beginning of this pamphlet, about the undercooked hamburgers?) Most cases are not reported. The reasons for these cases are many, but most involve carelessness by someone handling food. Food should be properly processed, and stored at the correct temperature. It's important to keep hot foods hot before serving, cold during storage, and in a vacuum (cans and vacuum jars) if storage must be at room temperature.

Store nonperishable foods in clean, well-ventilated, and well-lit areas on clean shelves or pallets, not on the floor. Hold perishable foods at temperatures below 45°F (7°C). Store frozen foods at 0°F (-18°C). Do not allow foods to stay at temperatures between 45°F and 140°F (7°C and 60°C) for more than two hours.

Preventing food contamination is the most reliable way to avoid food poisoning. Use screens or other coverings to protect food from contamination by insects (such as flies and cockroaches) or rodents (mice and rats). Keep poisons used to kill pests away from food. Keep domestic animals and pets away from food to prevent them from spreading droplets from their coughs or sneezes onto food. These discharges usually contain organisms that can cause disease.

Even the best handling cannot improve poor-quality or unwholesome food. People should not serve or eat dirty or spoiled foods.

People who are sick should not prepare food. No one with a sore throat, nausea, vomiting, diarrhea, fever, abdominal pains, or an

infected wound should handle food. Anyone handling food at any point must be strict about personal cleanliness, which starts with clean hands. Food preparers must wash their hands before handling any food, after using the toilet, and after being contaminated with a cough or sneeze. Wash hands with warm water and soap; use a scrub brush if possible. Dry hands with a clean towel.

Persons preparing food should wear clean clothing (preferably light colored). Street clothes may be contaminated and should be changed. Cover hair with a net, cap, or band. Hold utensils only by their handles. These guidelines are as important for Scouts while camping as they are for food handlers in restaurants.

Make sure the water used in washing and preparing food and in cleaning utensils is safe and from an approved source. Dispose of all waste products, both from food and from humans, in a proper and safe manner. Proper disposal will eliminate places in which flies and rodents can breed. Remember that perishable foods can spoil if held at room temperature. This is especially true of salads and other foods that are made with mayonnaise or other products containing eggs.

Cleaning Dishes and Utensils

Utensils and dishes should be clean to the sight, smell, and touch. Thoroughly wash, rinse, and sanitize any dish, utensil, or pan that is used for preparing, serving, or storing food. If you use the dish, pan, or utensil more than once, then wash, rinse, and sanitize it after each use. Washing with warm water and a soap or detergent removes soil and grease. Rinsing in clear, hot water removes soap and kills pathogens. The rinse water should be boiling. The temperature can be lower if a chemical sanitizer is used. If using a chemical sanitizer such as chlorine, follow directions on the package.

Single-use utensils and plates have become common. Store them so that they are protected from contamination by dirt, splashing, insects, or rodents. Properly discard these items after use.

Water Purification

A safe water supply is vital for everyone. In the United States, municipal water supplies are inspected regularly and are safe. Scouts, however, might have problems finding safe water when camping. Most modern campgrounds and park facilities have safe water available. But surface water—even that which looks clear and inviting—might not be safe to drink.

The safest attitude is to assume that all water from an above-ground source, including lakes, streams, rivers, ponds, and creeks, is polluted. Treat any water from a surface source before drinking it or using it in cooking. Many subsurface (groundwater) sources of water, such as wells and springs, are, unfortunately, also polluted. Look for minnows, other small fish, or insects. Their presence is good evidence that the water is not poisoned. However, you must still treat the water before consuming it. Polluted water can be successfully treated in the field, unless contaminated by some chemical pollutants. (Most chemical pollutants are of human origin, but a few occur naturally.)

Giardia are protozoa that cause the disease giardiasis in humans. Some domestic and wild animals (including cats, dogs, gerbils, cattle, sheep, and beavers) carry giardia. When infected animals defecate into streams, the water becomes contaminated. Symptoms of giardiasis include diarrhea, abdominal pain and cramping, fatigue, and weight loss. To prevent exposure to giardia, fill water containers before leaving home or from approved, safe water supplies. In the wild, boil water for at least ten minutes to kill giardia. After boiling, shake the water and allow it to stand for at least thirty minutes.

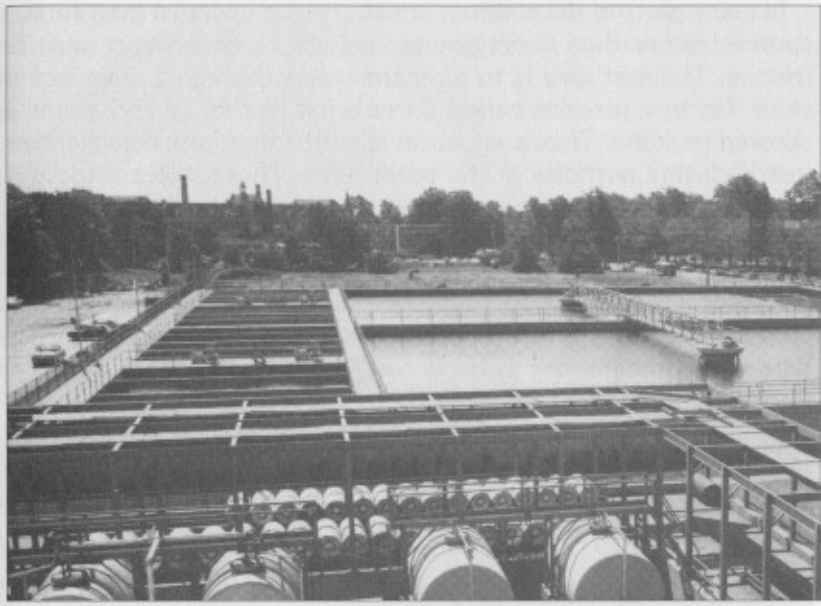
If chemical treatment is used, iodine treatment is preferred. You can use chlorine to disinfect water in the field. However, its chemistry is more complex and depends on pH (acidity), temperature, and organic content of the water to be purified. Chlorine is considered less reliable than iodine and is, therefore, a second choice.

Filter water containing silt or organic contaminants before disinfecting it. Collect water in a container and let it settle. Drive four stakes into the ground and tie the corner of a clean cloth to each stake. Gently pour the water through the cloth into a second container. Boiling is the best option to disinfect water after filtering.

Municipal Purification

Water from all city water supplies must be tested regularly. The federal and state governments have created strict standards that must be maintained for pH, color, particulates (small particles), taste, and chemicals such as lead, iron, sulfur, and fluorine.

In communities that draw their water from deep underground aquifers (groundwater), chlorination to kill pathogens might be the only treatment necessary. In many communities, fluorine is added to the water. In a concentration of one part per million, fluorine, which hardens teeth, helps teeth resist decay. Municipal water is stored in tanks—usually above the ground so that gravity will provide water pressure—and delivered to homes by a network of distribution pipes.



Above: **Water purification begins in the outdoor settling tanks at this treatment plant.** ***Right:*** **Water is further cleaned in filter beds, where it percolates through a deep layer of sand.**

In many parts of the country, drinking water is drawn from surface sources rather than underground aquifers. Surface water must be treated. The first step is to filter the water through a deep bed of sand. Or, in a process called *flocculation*, turbid (dirty) water is allowed to stand. Then a chemical is added that forms small flakes, to which tiny particles in the water stick. These flakes settle out, while the clean water is piped from the upper parts of the container. The water can then be filtered through a sand filter. It is chlorinated to kill any bacteria present. Chemicals can be added to correct local problems, such as fluorine to prevent tooth decay. The water is then stored until needed. At all points in this process, including at the taps of customers, the water is tested to ensure that it is safe to drink and that it meets all applicable standards.

A small sewage treatment plant.

Waste Disposal

Sewage contains many pathogens that cause disease. A *vector* is an animal or insect that carries a disease that is harmful to humans but not to the carrier. Rodents, flies, and other vectors of human disease live in and around waste disposal sites. Therefore, to protect public health, it is essential to properly dispose of sewage and solid waste.

Solid Waste

Disposing of solid waste is becoming one of our society's major problems. Solid waste includes paper, cardboard, cans, bottles, plastics, food scraps, floor sweepings, industrial waste, and yard clippings. Commonly called garbage, rubbish, or refuse, solid waste is often divided into *putrescible* and *nonputrescible* waste. Items that will decompose, such as food scraps and edibles from the kitchen, are putrescible. Some putrescible items, such as yard clippings, leaves, and floor sweepings, will decompose if given enough time or if cut into small pieces. Nonputrescible items—things like plastics, metals, glass, many types of paper, and construction debris—will

remain virtually unchanged in a landfill. Many nonputrescible items can be recycled.

As the amount of solid waste increases each year, so does the problem of solid-waste disposal. It's important to properly store and dispose of solid wastes, because improper or unsanitary conditions provide breeding places for insects and rodents that are vectors for disease. Other problems can also exist at waste disposal sites, including fire dangers, safety hazards, and unattractive appearance. Improper handling can sometimes lead to air and water pollution.

Remember that camps and homes, as well as communities, have waste storage or disposal sites. Most insects and rodents can be controlled if storage and disposal areas are kept clean and neat. The municipal government is responsible for community storage and disposal. All other responsibilities for cleanliness belong to homeowners and individuals.

At home and in camp, use enough approved containers to hold all solid wastes until they can be collected or properly disposed of. Make storage facilities convenient and sanitary. Use containers that are strong, rust resistant, watertight with tight-fitting lids, and easily filled, emptied, and cleaned. Keep containers clean to discourage the growth by vectors of human disease.

You can help your storage situation at home by using racks or stands that will keep containers about eighteen inches above the ground and allow easy cleaning. Storage racks are easily made from wood, pipe, or metal. Concrete pads on the ground are acceptable, but raised racks are preferable.

Wastes usually are collected and disposed of under the direction of a municipal authority. Public workers or private contractors may do the job. Most waste goes to a landfill to be buried. In urban areas, the landfill might be far from the city that generates the waste. There are accepted methods for creating and operating landfills. One difference between a landfill and a dump is that a landfill is covered with dirt at the end of each day.

Some wastes are burned, or *incinerated*. Compared with landfills, incinerators have both advantages and disadvantages. Burning reduces the volume of wastes, and the heat from incinerator facilities is often used to generate power. However, removing toxic wastes, ensuring that all waste is completely burned, and keeping harmful substances from entering the air are technically difficult. Ash from incinerators must be buried.

Recycling

Incinerators can create air pollution. Landfills take a lot of space, and no one wants to live near a landfill. One way to reduce the need for new waste disposal facilities and to make existing landfills more efficient is to recycle.

Many items that go into landfills and incinerators can be recycled. Plastics, metals, building materials, yard clippings, leaf litter, and paper can all be recycled. Recycling helps to conserve natural resources as it reduces the amount of solid waste being sent for disposal. The more material that is removed from the *waste stream* (the total volume of solid wastes produced), the longer existing landfills can operate.

In communities that aggressively recycle, the volume of waste material has been reduced by up to 25 percent. Unfortunately, communities with aggressive recycling programs are in the minority. To make recycling more common in the future, new markets will have to be opened that demand recycled materials, and financial rewards must be created to encourage people to recycle.

Solid Waste in Camp and on Trails

Properly disposing of solid wastes is as important in camp as at home. Waste disposal in camp is often more difficult than at home. Camps, however, are bound by the same regulations as any business or other establishment in the community. Waste must be disposed of correctly, while at camp or on the trail.

Camps should have enough approved containers (cans or dumpsters) to hold all wastes that are normally generated between collections. Store filled plastic bags inside metal containers for better cleanliness and to make it harder for animals to tear open the bags.

Scouts believe in low-impact use and minimum-impact camping. In the backcountry, Scouts leave no trace of their passing. This idea applies also to disposal of solid waste. Scouts *pack out* all trash for proper disposal at the base camp or at home. Burning solid waste on the trail creates both a fire hazard and odors that can attract animals. Burying trash gives animals something to dig up, or creates potential sites in which mosquitoes can breed.

Sewage and Liquid Waste

Sewage has the potential to spread disease, and so must be properly disposed of both at home and at camp. Wastewater from toilets and privies is called black water. Dirty water from washing dishes, bathing, and doing laundry is gray water. If discharged improperly, either type of wastewater can contribute greatly to water pollution.

Don't burn or bury trash. Pack all refuse compactly and carry it home from a campsite.

Most urban dwellers in the United States dispose of sewage and liquid wastes through municipal disposal systems. In rural areas of the country, many homeowners have their own septic systems for household waste.

At camp, chemical toilets, privies, or latrines may be used when usual septic treatment facilities are not available. These must be approved by the local board of health. On the trail, the "cat method" for disposing of bodily wastes is recommended. This requires digging a small hole, deep enough to allow several inches of soil covering after use. The hole should be at least two hundred feet from any body of water, and well away from the trail and campsite. After use, fill the hole, replace the sod, and tamp it down lightly, leaving the site in a natural condition.

Flies and rodents breed in human and animal waste. As noted, human waste can be buried if sanitary facilities are not available. Because flies lay eggs in manure, animal waste should be removed and properly stored for disposal to reduce the breeding habitat for flies. Proper disposal of animal wastes is important at home as well as on farms. Cats can transmit the disease toxoplasmosis in their feces. This disease can cause serious infections in adults and birth defects in unborn children.

Municipal Sewage Treatment Systems

Municipal sewage treatment systems are designed to handle large volumes of sewage and liquid wastes. The raw sewage flows to a treatment plant through underground pipes (mains). Sewage is screened, allowed to settle, processed, dried, disinfected, and disposed of.

When camping, use a cathole or latrine to dispose of human waste. With a stick, small trowel, or the heel of a boot, dig a hole 4 to 6 inches deep. When finished, cover the hole completely with loose soil. Choose secluded spots at least two hundred feet from water, trails, or campsites.

- Screening removes objects larger than an inch or two in size that have entered sewage mains. A metal screen is used, with openings of the largest allowable size. The screen is periodically cleaned. Debris is removed and taken to a landfill.
- By the time incoming waste reaches the sewage treatment plant, it consists of a liquid with particles suspended in it. Many suspended particles drop out of the liquid portion as the screened sewage is allowed to settle.
- Processing or treatment is done by two basic methods: activated sludge and trickling. In both methods, bacteria break down the sewage into harmless components that can then be safely discharged.

  In the activated sludge method, the sewage is pumped into a tank. Air is bubbled through the sewage to provide oxygen needed by the bacteria. After the bacteria have worked on the sewage long enough, the liquid contents of the tank can be pumped out. The material remaining at the bottom of the tank, called sludge, can be dried.

  Trickling involves filtering the sewage over a bed of rocks on which bacteria grow. In time, the liquid that results can be pumped out and the accumulated sludge dried.

- Treated wastewater is usually clear. At this point, the water is free of contaminants and can be pumped into a river or other body of water for disposal. The outflow from modern treatment plants is so high in quality that it can go to a chlorinating station and be reused for drinking water. The sludge, after drying, can be buried in a landfill or used as a soil conditioner.

Apartment complexes, shopping centers, camps, and similar properties will sometimes have a small sewage treatment plant on their grounds. Such a "package" plant operates on the same principles as an activated sludge plant, only on a smaller scale.

Septic Systems

Millions of homes have their own septic systems. These systems are similar to package plants, only smaller. Septic systems aerate (supply air to) sewage on the activated sludge principle.

Waste from the home flows through a pipe to a septic tank made of concrete, fiberglass, or steel. Solids settle to the bottom of the tank while bacteria decompose suspended particles of organic waste. Liquid flows out into a series of buried pipes called a leaching bed. The liquid trickles through holes in the leaching bed pipes and enters the soil. As the water seeps through soil, sand, and rocks beneath the earth's surface, it is purified before eventually entering an underground aquifer.

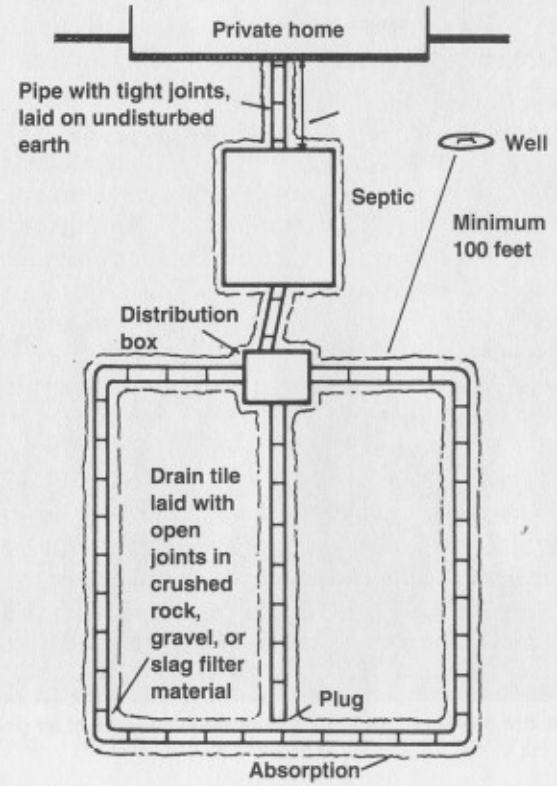
Fifty or more feet of sand or soil is enough to remove organic wastes. It is *not* enough to break down some chemicals; some chemicals will kill the bacteria that work in septic systems to decompose wastes. For these reasons, avoid putting harsh chemicals into home septic systems. Pesticides, cleaners, lubricants, and the like should be disposed of properly by an agency certified to process chemicals.

To avoid contamination, locate a leaching field at least a hundred feet from any drinking water supply. Every three to five years, have the sludge in the bottom of a septic tank removed to prevent the tank from filling. This is a task for a professional with proper equipment. Wise homeowners have their septic tanks checked every year.

Biohazardous Waste

Waste products that have been exposed to contaminated body fluids—blood, saliva, and other fluids from sick individuals—are considered biohazardous wastes. Needles and other equipment used by hospital or clinic patients are also regarded as biohazards.

Because such waste can transmit serious diseases, it must be treated carefully and processed separately. Biohazardous waste is put into distinctive, labeled containers. It is transported separately and incinerated at very high temperatures. This treatment ensures that all pathogens are killed before the residue or ash is put into a landfill.



A home septic system

Pollution and Health

Environmental pollution—including air, water, and noise pollution—affects health in complex and serious ways. These pollutants can enter the body as a person breathes, eats, or drinks, and through the eyes, nose, ears, and contact with the skin.

Air Pollution

Pollutants can enter the atmosphere naturally—ash and sulfuric acid from a volcano, for example, or ozone from lightning. Many dangerous air pollutants, however, are of human origin. The Environmental Protection Agency (EPA), a unit of the United States government, monitors seven pollutants commonly found in the air: lead, nitrates, sulfates, carbon monoxide, ozone, particulates, and hydrocarbons. The long-term effects of many of these pollutants are

unknown. What *is* known is that air pollution contributes to lung diseases such as bronchitis and emphysema.

Lead can cause mental impairment and anemia. Lead accumulation is a slow process, so changes are rarely obvious.

Nitrates and sulfates contribute to *acid rain*. The major sources of nitrates are internal combustion engines—mainly those of cars and trucks. (There are more than 195 million motor vehicles registered in the United States.) Vehicle engines produce oxides containing nitrogen, primarily nitrate (NO_2). The major source of sulfates is soft coal, which is burned to generate power. The process produces sulfur-containing oxides, primarily sulfate (SO_2). The oxides are released into the air. When oxides meet water droplets in the air, they combine and form acids—nitric acid from nitrate, and sulfuric acid from sulfate. This acid rain falls to the earth and can cause great damage to the environment.

Carbon monoxide is produced mainly by internal combustion engines and is also released when wood, natural gas, or charcoal burns. Carbon monoxide can cause headaches, blood problems, and—in high-enough concentrations—death. Home heaters that give off carbon monoxide should be used in well-ventilated areas.

Ozone is harmful to lungs and is particularly irritating to people who have asthma. Particulates come from the smoke of burning solid wastes in open fires or burning wastes in poorly designed or improperly maintained incinerators. Particulates worsen most existing lung diseases, cause coughing, and irritate the nose, throat, and lungs. Smokers are at the highest risk for damage from particulates.

Hydrocarbons are produced by improperly maintained or inefficient internal combustion engines. They can cause bronchitis or worsen existing lung diseases.

Air pollution can be dramatically deadly. In 1984, more than two thousand people in Bhopal, India, died from a lethal gas that leaked out of a chemical plant into the air. Severe pollution in London, England, killed as many as four thousand people in 1952 and took another seven hundred lives in 1962. Air pollution in Donora, Pennsylvania, in 1948 caused respiratory illness in more than six thousand people and led to the deaths of twenty victims.

Some efforts to control air pollution have been successful. In recent years, electronic or mechanical devices called "scrubbers," have removed significant amounts of sulfates, particulates, and hydrocarbons from some industrial source emissions. The lead content of gasoline has been reduced, and this has reduced the level of lead in the atmosphere. But vehicle exhausts and fossil fuel generation of electricity are two major causes of air pollution, and the number of motor vehicles has risen, as has the demand for electricity. Although air pollution has declined, it still poses a major health risk around the world. It is a problem that affects every person, and everyone must help to reduce air pollution.

Pollution contributes to "fish kills" in rivers, lakes, and the oceans.

Household and industrial detergents are water pollutants that can kill plants and animals. Strong concentrations can create foam on water.

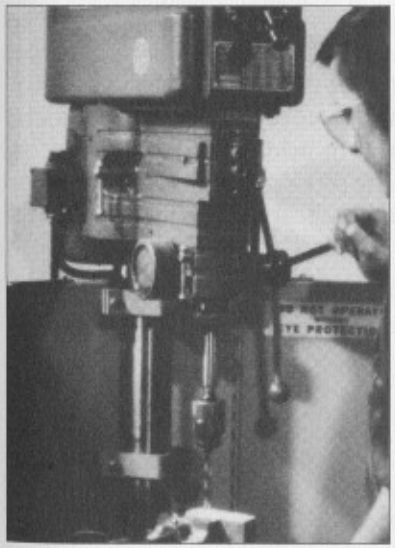
Water Pollution

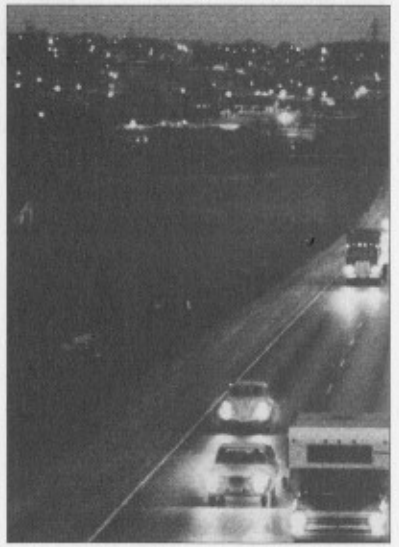
Polluted water is often unsightly, smelly, and expensive to clean for human or industrial use, and it transmits diseases. Examples of waterborne diseases include cholera, typhoid fever, and dysentery. Around the world, more than seventeen hundred infants die *each day* from diarrhea caused by consuming polluted water. In the United States, waterborne diseases are less common because our cities provide safe drinking water.

Only about 2 percent of the world's water is available for drinking. During this century, much of the world's available freshwater supply has become polluted. Fewer than half of all the people in the world have easy access to safe drinking water. As cities and populations grow, water quality is affected as sewage, chemicals, and debris are discharged into rivers. Pesticides and other farm chemicals end up in water when they are washed from the soil by rain.

Without treatment plants to purify drinking water and process sewage, the number of people suffering from intestinal diseases and diarrhea would greatly increase. Conventional treatment plants are not always effective, however, in removing chemical contaminants from water and sewage. Chemical contamination is thought to contribute to cancer. Lead, mercury, and arsenic are toxic, and deadly if consumed in large-enough quantities; all may be found in water. Some other long-term effects of chemical contamination are less well understood.

People can safeguard water supplies in many ways. We can protect watersheds (the land areas from which water drains into rivers and lakes). Controlling the problem of chemical contamination of water is a high priority. Industrial chemicals are relatively easy to control. Agricultural chemicals, however, and salt from road snow-removal operations can enter watersheds and cause health problems. (Sodium from the salt is believed to contribute to high blood pressure.) All citizens should learn about and become involved in efforts to reduce water pollution.





Three common sources of noise pollution are, *above,* airports; *left,* industrial machinery; and, *below,* highway traffic.

Noise Pollution

Unwanted or loud noises are pollutants. Excessive noise can lead to hearing loss, headaches, and stress. Unfortunately, excessive noise is everywhere. People living near airports are regularly subjected to loud noises. Trains, municipal subways, roads, machinery, and entertainment equipment are all noisy.

The latter—radios, stereos, and other entertainment equipment, especially portable devices—contribute markedly to hearing loss. Headphones are great for sparing the people around someone who's listening to music. Unfortunately, headphones concentrate noise in the ears of the listener. Significant hearing loss among teenagers has become common. Rock musicians often wear earplugs when performing to protect their hearing. Fans who sit in front of loudspeakers may suffer transient (temporary) hearing loss for a few hours to a few days after a concert. The damage caused by noise is cumulative—it adds up over time. With each exposure to loud noises, a person suffers a tiny, often unnoticeable, loss of hearing. Eventually, the hearing loss becomes significant.

Noise also happens at home. Power tools, lawn mowers, and televisions contribute to noise pollution. Indoor appliances such as garbage grinders and vacuum cleaners make noise. Some hobbies can be noisy—shooting sports, woodworking with power equipment, motorboating, snowmobiling, motorcycling—as can recreational vehicles and unmuffled cars. In addition to hearing loss, noise can contribute to stress (both physical and mental), sleep loss, cardiovascular disease, headache, gastrointestinal problems, depression, and irritability.

The technology exists to reduce noise greatly. Jet engines have become much quieter in recent years; recreational vehicles are adequately muffled when new. Buildings and their contents are being designed to limit noise. However, noise-reduction programs require commitment and money. People should wear hearing protection wherever noise can't be or isn't being controlled. Most hearing loss is permanent; most of it is also preventable. Noise is one form of pollution that everyone can help to reduce.

Tobacco and Health

Medical experts have positively linked tobacco products to health problems. Tobacco products include cigarettes, chewing tobacco, snuff, cigars, and pipes. Tobacco—or, more correctly, the *nicotine* in tobacco—is among the most addicting substances known to humans. Tobacco users—smokers and chewers—are at great risk for a variety of medical problems.

Cancer heads the list. Cancer is the third leading cause of death in the United States (behind cardiovascular disease and stroke). Lung cancer is the leading cause of death from cancer for both men and women. More than half a million new cases of lung cancer are diagnosed each year in the United States. About 360,000 people die from lung cancer each year.

Most smokers believe that they are immune to the effects of smoking. Smokers will say (correctly) that only one smoker in six develops lung cancer. Realize, however, that four of the remaining five

smokers will develop emphysema, a lung disease that severely limits one's activities. Lung cancer is rarely cured; medical authorities speak of five-year survival rates. Damage caused by emphysema can never be reversed. A person who smokes one pack of cigarettes a day is ten times more likely to develop cancer than is a nonsmoker. At two packs a day, the risk doubles to twenty times. At three packs a day, the risk quadruples to forty times.

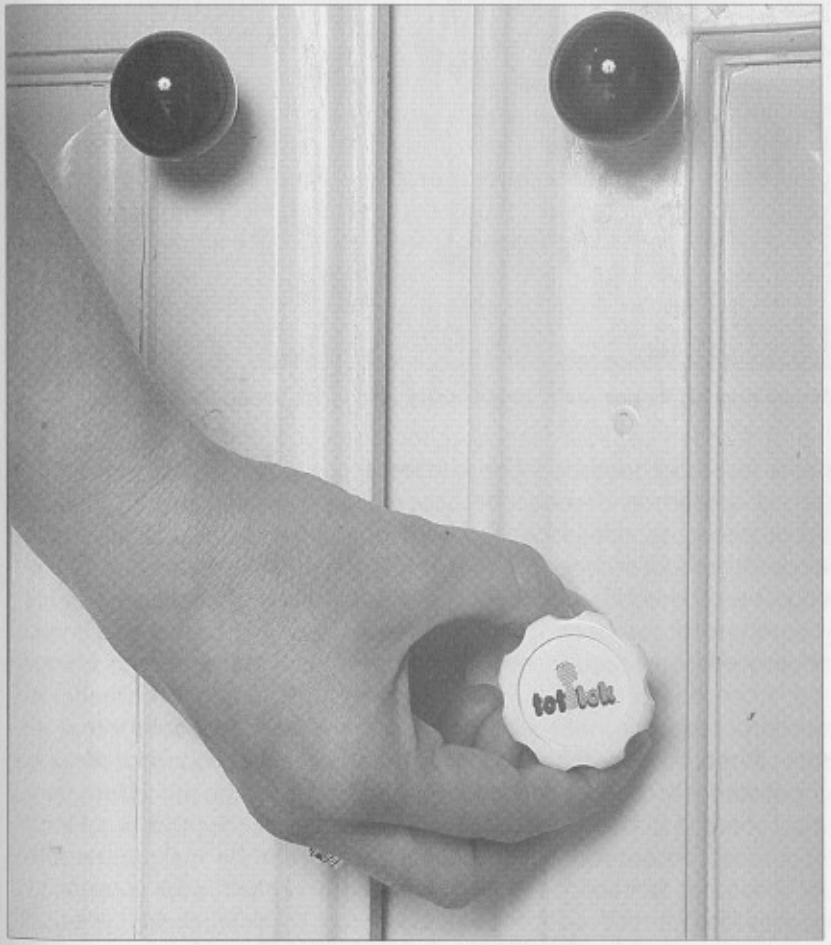
Smoking also contributes to atherosclerosis (hardening of the arteries) and heart disease. Even smokers with normal blood pressure are 70 percent more likely to have heart attacks than are nonsmokers. For smokers with high blood pressure, the risk increases to 200 percent than that of nonsmokers. Tobacco use also contributes to sinusitis and peptic ulcers, and increases the user's chances of developing influenza or a cold. Smoking affects the chemistry of the skin, causing it to age at a much faster rate than normal. Put another way, smokers get more wrinkles, earlier, than do nonsmokers.

Smoking harms the lungs in two ways. The heat of inhaled smoke burns the lining of lung tissues. This is what causes smoker's cough and makes smokers more prone to respiratory diseases, leading to emphysema. Smoke, whether inhaled directly or secondhand (from a nearby smoker), contains chemicals that cause lung cancer; these chemicals together are called *carcinogens*. Cigarette smoke contains more than twenty-five hundred different carcinogens.

Smokeless tobacco—chewing tobacco and snuff—is as dangerous to one's health and as addictive as cigarette smoke. It is *not* harmless. Smokeless tobacco contains nicotine that makes the chewer a nicotine addict. Smokeless tobacco contains carcinogens, which act on the cheek and gums at the spot where a user keeps a chaw of tobacco. While lung cancer may take fifteen to thirty years to develop, cancer of the cheek or gums may occur in only ten to fifteen years. In less time than that, smokeless tobacco contributes to tooth decay, gum disease, and early loss of teeth.

Smokeless tobacco users must spit out juice regularly. Spitting was made illegal in much of the United States in the early 1900s. The ban on spitting was intended to reduce the spread of disease, and it worked quite well. Today, smokeless tobacco users introduce an old health hazard when they spit out tobacco juice.

Tobacco-product advertisers show pictures of young, attractive people having fun with their friends. Think about why tobacco companies do not show pictures of ill, aging people who are hooked on nicotine and want desperately to quit. Advertisers don't show such pictures because those images don't sell tobacco products. These unattractive images, however, are accurate. Is such a fate what you want for yourself?



Keep all cleaning products and medicines locked up and out of the reach of young children.

Injury Control

In the United States, accidents are the leading cause of death among people between ages 1 and 44. Overall, accidents are the fourth leading cause of death. Nearly all accidents are preventable. With some study and analysis, it is usually possible to identify something in the events leading to an accident that—if corrected—could have prevented the accident. Correcting that one thing usually would have made the difference between having or preventing an accident.

As we have gotten better at understanding how accidents happen, people have been able to reduce but not eliminate accidents. After seat belts became mandatory in motor vehicles, the number of deaths and injuries from motor vehicle accidents declined. Using flame-retardant cloth in children's clothing has reduced the number of injuries from burns. Introducing safety equipment in sports has lowered the number of sports-related injuries. The federal government created the Occupational Safety and Health Administration (OSHA) to improve the safety of people while they are at their work.

But much progress is still needed to prevent injuries at home, in the community, and in recreational activities.

Accidents in the Home

Falls are the leading cause of accidents in the home. Very young and very old people are at the greatest risk. Each year, more than eight thousand people die of injuries they receive from falling in their homes. Providing handrails, steadying steps, securing rugs, placing safety rails on tubs and across upper-story windows, and installing nonslip strips in tubs and showers can help prevent falls.

The number of poisonings has dropped, but poisonings are still too common. To prevent accidental poisonings, secure cleaning products and keep all medicines out of the reach of children.

Regularly—at least once a year—inspect your home for anything that might cause an accident. Store tools safely. Put fuels such as gasoline and kerosene in metal containers. Use common sense and be alert to possible dangers in your home. Act quickly to fix safety problems. Correcting problems promptly will help prevent many injuries.

Fires and Burns

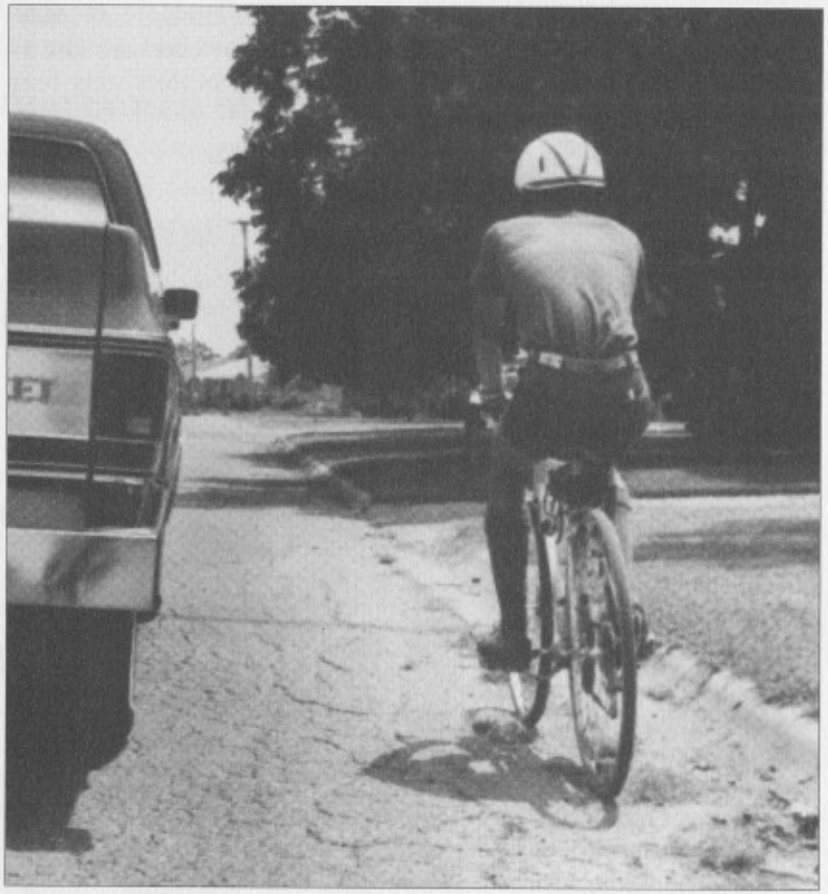
Burns are among the most painful of injuries. Spilling hot liquids, accidentally igniting improperly stored fuels such as gasoline, mishandling camp stoves, and house fires are examples of ways that burns occur. More than sixty-five hundred people die by fire each year, most in their own homes. Many more people are burned in motor vehicle accidents.

Death from fire is both horrible and unnecessary. Fires and burns can be prevented. People should be taught proper and safe handling procedures *before* they use potentially dangerous products. Keep young children away from hot liquids and out of the kitchen when meals are being prepared. Install smoke detectors on the ceilings of your home. This gives ten to fifteen minutes' more warning time than when detectors are installed on walls. The extra time may literally be the difference between life and death. Keep smoke detectors in good repair. Replace their batteries each time you reset clocks in the spring and fall.

Check electrical equipment, cords, and connections, and repair problems. Cover unused electrical outlets. Do not overload electrical outlets. Use extension cords and three-way outlets only temporarily—if at all. Overloaded extension cords feel warm to the touch; disconnect them immediately. Adding a new outlet is far safer than overloading an existing one.

Recreational Accidents

As more people spend more time outdoors, they also suffer more injuries. Some sixty-five hundred people drown each year while swimming. More than one thousand die while boating or using other equipment such as jet skis on the water; many more water-sports enthusiasts are injured. Bicycling is growing in popularity, and cycling accidents are increasing. Annually, more than thirteen hundred people die of injuries related to cycling. In addition, several



When riding a bicycle, keep to the far right, and wear a cycling helmet.

thousand cyclists receive injuries serious enough to require emergency care. Tens of thousands more injuries are not serious enough to report. All these deaths and injuries happen while people are having fun. Most recreational accidents can be minimized or prevented.

Before taking part in any sport or using any recreational equipment, get adequate training. Sports and competition, by their nature, involve some element of risk. However, you can reduce this risk by using safety equipment such as helmets and pads. Many states have laws requiring all cyclists to wear helmets. Scout councils and camps have established high standards of safety for Scouts participating in potentially dangerous sports. Adequate instruction, safety equipment, supervision, and discipline are key elements in preventing accidents.

Fractures and abrasions are among the most common types of injuries that people suffer while participating in sports. Always wear pads and a helmet while skateboarding, bicycling, or participating in motocross events. If using protective equipment seems inconvenient, and some of your friends don't use it, ask yourself which is better—a little inconvenience, or being disabled for the rest of your life because you were injured while participating in a sport without the protection of safety equipment. Ask yourself if your friends will visit you if you are in the hospital. Will they be there to help you if you are confined to a wheelchair for the rest of your life?

Camping also is a recreational activity that has some risks. Early on, Scouts learn how to safely handle knives and axes. Besides the possibility of cuts, campers face other dangers, including hypothermia, fatigue, and snakebite. It's no accident that the requirements for Second and First Class ranks include the treatment and prevention of these hazards.

Below: A nurse gives an infant an oral polio vaccine. *Right:* A technician takes a blood count. *Bottom:* A veterinarian vacinates a dog for rabies. All are examples of public health workers.

Careers in Public Health

Anyone interested in helping people or doing detective work should consider a career in public health. Public health professionals find satisfaction in working as part of a team to make their communities safer and improve life for people who live in their communities. Public health is a discipline that can be applied in almost any location in the world.

Employment Opportunities

For many people, the term "public health worker" means a physician. Medical doctors do provide many important services, but they are a minority in the field of public health. Many public health specialists are employed in hospitals, universities, and industry. Others work in consulting and research.

Public health workers are employed at all levels of government. In local communities, sanitarians and health officers inspect establishments that handle food and ensure that food handling is done safely. They enforce local ordinances (regulations) to ensure that communities stay safe and healthy. The requirements for these positions vary from state to state. To work as a sanitarian usually requires some college education; health officers must have experience and, often, an advanced degree. There are similarly trained people working at the state level.

Nationally, many agencies are involved in public health, including the departments of Agriculture, Commerce, Health and Human Services, Labor, Transportation, and Veterans Affairs. All of the armed forces have professionals to maintain the health of their members and help prevent injuries. The United States Public Health Service is part of the Department of Health and Human Services, as are the Food and Drug Administration, National Institutes of Health, and others. The Public Health Service is a uniformed, commissioned corps of professionals including physicians, dentists, nurses, engineers, scientists, veterinarians, pharmacists, dietitians, sanitarians, and therapists. Many of these positions require advanced training.

Volunteer agencies employ public health professionals. The American Red Cross helps in disasters. The American Heart Association, American Cancer Association, and American Lung Association, to name only a few, employ educators who teach people how to prevent disease and improve health. Most positions require at least a bachelor's degree.

Epidemiologists study patterns of disease in large groups of people. These professionals are true detectives and are responsible for solving health mysteries. They investigate outbreaks of disease. Their work has been vital in understanding newly emerging diseases such as Ebola fever and Legionnaire's disease. Epidemiologists typically have graduate degrees. They are employed by the federal government, all states, some larger cities, a few industrial companies, and many colleges and universities.

In the field of medicine, public health is a recognized specialty. Some doctors have advanced training in public health in much the same way that surgeons and psychiatrists have advanced, highly specialized training. It is common for a physician to head a public health team. In a few states, health officers must be physicians.

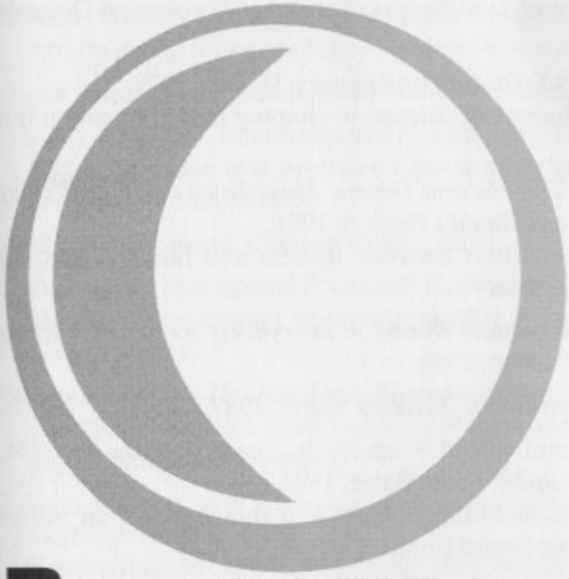
Internationally, the opportunities to apply skills in public health are almost unlimited. Basic services such as fresh water and sanitation are unavailable to many people in the world. A long list of diseases cause untold suffering worldwide. Around the world, the number of people who suffer from malaria is more than three times greater than the population of the United States; malaria is almost nonexistent in this country. Bringing good public health measures to communities worldwide could greatly reduce suffering and deaths from disease.

Qualifications

What qualities do you need to work in public health? The following list gives some important traits or attributes for a public health career.

- Most public health professionals are active and not confined to a desk.
- Many jobs include travel as a part of the usual routine.
- Most professional careers in public health require specialized education with a college degree as a minimum requirement. Many professional careers require graduate training.
- Most public health workers are part of a team and must be able to work well with colleagues.
- Most public health professionals have a sense of satisfaction that comes from helping others or doing something worthwhile.

Good sources of information about the field of public health are your merit badge counselor, school guidance counselor, library, local health department, science teacher, or a practicing public health professional. Scholarships and other programs are available to help qualified young people enter the field of public health.



Resources

Scouting Literature

Animal Science, *Chemistry*, *Cooking*, *Cycling*, *Dentistry*, *Disabilities Awareness*, *Emergency Preparedness*, *Environmental Science*, *Fire Safety*, *First Aid*, *Lifesaving*, *Medicine*, *Motorboating*, *Personal Fitness*, *Plumbing*, *Safety*, *Sports*, *Traffic Safety*, *Veterinary Medicine*, and *Weather* merit badge pamphlets

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Harris, Jacqueline L. *Drugs and Disease*. 21st Century Books, 1993.

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Hecht, Jeff. *Vanishing Life: The Mystery of Mass Extinctions*. Macmillan, 1993.

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Details public health problems and their impact on society.

Lampton, Christopher. *Epidemic*. Millbrook, 1992.

McNeill, William H. *Plagues and People*. Doubleday, 1977. An excellent historian looks at plagues and problems of public health.

Metos, Thomas H. *Communicable Diseases*. Watts, 1987.

Morgan, Monroe T. *Environmental Health*. Brown & Benchmark, 1993.
Highly readable text provides a good introduction to the subject of environmental health.

Nardo, Don. *Hygiene*. Chelsea House, 1993.

O'Shea, John. *Was Mozart Poisoned?* St. Martin's, 1990.
Stories of the impact of environmental pollution on gifted members of society.

Preston, Richard. *The Hot Zone*. Random House, 1994.
A fictional account based on true events involving Ebola fever, a highly dangerous disease.

Rathje, William, and Cullen Murphy. *Rubbish! The Archaeology of Garbage*. HarperCollins, 1992.
Fascinating, excellent source for information on solid waste disposal and landfill operation.

Roueché, Berton. *The Medical Detectives*. Dutton, 1991.
A master of descriptive epidemiology discusses how health and disease mysteries have been solved.

———. *The Man Who Grew Two Breasts and Other True Tales of Medical Detection*. Dutton, 1995.
More stories of medical detective work and solving riddles of public health.

Ryan, Frank. *The Forgotten Plague: How the Battle Against Tuberculosis Was Won and Lost*. Little, 1993.
A physician writes about an ancient disease that is again becoming a public health problem.

Salzman, Marian, and Teresa Reisgies. *150 Ways Teens Can Make a Difference*. Peterson's Guides, 1991.

Symons, Dr. James M. *Plain Talk About Drinking Water*. American Water Works Association, 1992.

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Omni

Science News