# Methods of disease transmission

<table>
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<tr>
<th>CDC threat category</th>
<th>Environmental Aerosol</th>
<th>Person-to-Person</th>
<th>Animal-to-Person</th>
<th>Contaminated Food/Water</th>
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**Methods of disease transmission**

**What Construction Workers Need to Know**

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<td>Aerosolized pathogens that can survive for extended periods in the atmosphere making inhalation the primary threat.</td>
<td>Transmission requires direct physical contact with an infected person or body fluids/tissues or indirect contact by touching contaminated objects.</td>
<td>Transmission requires direct physical contact with infected animals or animal products (e.g. carcasses or hides, saliva, blood, feces, contaminated dust).</td>
<td>Transmission requires eating, drinking, or otherwise ingesting contaminated products, including sewage contaminated water or food (fecal/oral transmission).</td>
<td>Transmission requires absorption of pathogens through broken skin or wounds, or the mucous membranes that cover the eyes, nose, mouth, and ears.</td>
<td>Typically transmitted from one host to another through the bites of insect vectors or contact with vector products including saliva and feces.</td>
</tr>
</tbody>
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**Aerosol**

- Anthrax
- Bird Flu
- Botulism
- Cholera
- Dengue Fever
- Ebola
- EEE/WEE/VEE
- Epidemic Typhus
- Gastroenteritis
- Glanders
- Hanta Fever
- Hepatitis A
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- Q Fever
- Rabies
- Ricin
- Smallpox
- SEB Poisoning
- T2 Mycotoxin
- Tularemia
- Typhoid Fever
DISEASE FACT SHEETS

The cover sheet on this handout is a chart that shows the different ways the diseases identified in this training can be transmitted. All of the diseases on that chart are described in the one-page fact sheets that follow. These fact sheets review:

- **Transmission**—how the disease spreads
- **Epidemiology**—what are the patterns or distribution of the disease world-wide
- **Threat**—how or where it might threaten the health of disaster response workers
- **Symptoms**
- **Outcomes**—in particular, death rates
- **Prevention** measures
- **Treatment**

The information in these summaries was drawn primarily from the websites of the Centers for Disease Control (CDC) and the World Health Organization (WHO). When you are called to respond to a disaster where the agent of attack has been identified, these sources as well as disaster response authorities should be consulted directly for more comprehensive, current information on the identified agents. Two types of diseases/agents have been included here:

- **Naturally occurring diseases/agents** you are likely to encounter in various disaster situations;
- **Bioterrorism agents listed as A-C priorities by the Centers for Disease Control** and/or covered by the CDC’s Select Agents Program that regulates the possession, use, and transfer of biological agents and toxins that could pose a severe threat to public health and safety.

**CDC’s Category A includes high priority organisms that pose a risk to national security because they:**

- can be easily disseminated or transmitted from person-to-person
- result in high mortality rates and major public health impact
- might cause public panic and social disruption
- require special action for public health preparedness

**CDC’s second highest priority or Category B agents are:**

- moderately easy to disseminate
- result in moderate morbidity and low mortality
- require enhancements of CDC’s diagnostic capacity and enhanced disease surveillance

**Finally, Category C includes emerging pathogens that could be engineered for mass dissemination because of their:**

- availability
- ease of production and dissemination
- potential for high morbidity and mortality and major public health impact

A-C designations are noted on the attached chart.
Anthrax

Also known as Wool sorter's disease; Rag picker's disease

AGENT The spore-forming bacterium *Bacillus anthracis*

TRANSMISSION There are three types of anthrax: cutaneous anthrax that enters through open skin; inhalational anthrax from breathing aerosolized spores; and gastrointestinal anthrax transmitted by eating contaminated meat. Anthrax is not known to spread person-to-person unless one person’s anthrax sore contacts another person’s broken skin.

EPIDEMIOLOGY Anthrax is found on every continent and commonly affects hoofed animals that ingest dormant spores in the soil. Spores can survive for decades in conditions that would kill most bacteria. Humans have been infected by handling infected animals or their products (skin, wool, meat). In an aerosol, however, spores can form a colorless, odorless cloud that could travel miles from the point of release.

THREAT The agent that produces anthrax is classified by CDC as a Category A bioterrorism threat. Because of its availability, stability, and lethality, it has been part of the biological weapons program of numerous countries. It was weaponized by the U.S. in the 1950s and 1960s and has been a major emphasis of programs in the former Soviet Union and Iraq. In the U.S. in 2001, intentional exposures occurred through spores contained in powder form in letters mailed through the U.S. Postal Service, resulting in 22 infections and five deaths.

SYMPTOMS Symptoms can appear within 7 days of contact with the bacterium for all three types of anthrax. For inhalation anthrax, symptoms can take as short as 7 days or as long as 42 days to appear. For cutaneous anthrax, the first symptom is a small sore that develops into a blister and then a blackened skin ulcer (photo). The first symptoms of gastrointestinal anthrax are nausea, loss of appetite, bloody diarrhea, and fever, followed by severe stomach pain. The first signs of inhalation anthrax are cold or flu-like symptoms followed by cough, chest discomfort, shortness of breath, tiredness and muscle aches.

OUTCOMES In most cases, early treatment with antibiotics can cure cutaneous anthrax. Even if untreated, 80 percent of people who become infected with cutaneous anthrax do not die. Gastrointestinal anthrax is more serious with fatalities in 25% to 60% of cases. Inhalation anthrax is the most deadly with case fatality rates of 50% to 75%.

PREVENTION There is a vaccine to prevent anthrax, but it is not yet available to the general public.

TREATMENT Antibiotics are used to treat all three types of anthrax. Success depends on early identification and treatment.
Bird Flu

Also known as Avian Influenza, Avian Flu

AGENT Influenza virus subtype H5N1 (HPAI H5N1)

TRANSMISSION Influenza A viruses occur naturally among birds. The risk is high when many birds are held in close quarters such as a poultry farm. Most cases of avian influenza infection in humans result from contact with infected poultry (e.g., domesticated chicken, ducks, and turkeys) or surfaces contaminated with secretion/excretions from infected birds. Person to person spread has been reported very rarely but experts worry that mutations of the virus may be able to pass from human to human in droplets from a cough or sneeze.

EPIDEMIOLOGY The first avian influenza virus to infect humans occurred in Hong Kong in 1997. The epidemic was linked to chickens and classified as avian influenza A (H5N1). Human cases of avian influenza A (H5N1) have since been reported in Asia, Africa, and Europe. WHO reports a total of 566 human cases between 2003 and 2011. Most cases have resulted from direct or close contact with H5N1-infected poultry or H5N1-contaminated surfaces.

THREAT Given its human fatality rate, the virus could pose a significant threat particularly if a mutation of the virus enables it to pass from person to person. Some experiments suggest that a small change in the virus could lead to a new strain that could be extremely lethal and contagious and that this change could be intentionally implemented by a scientist with ill intentions.

SYMPTOMS Symptoms include cough, diarrhea, difficulty breathing, fever, headache, malaise, muscle aches, runny nose, and sore throat.

OUTCOMES The outlook depends on the severity of infection and the type of avian influenza virus. Of the 566 reported cases between 2003 and 2011, sixty percent have been fatal. The actual death rate may be lower since non-fatal cases are less likely to be reported.

PREVENTION Seasonal flu shots are recommended to reduce the chance of an avian flu virus mixing with a human flu virus to create a new virulent strain. The U.S. FDA has approved an avian flu vaccine which could be used if the current H5N1 virus begins to spread among people. People who work with birds that might be infected are urged to use protective clothing and special breathing masks. There is currently a ban on the importation of birds and bird products from H5N1-affected countries.

TREATMENT Treatment varies depending on the type of virus. Antiviral therapy (oseltamivir (Tamiflu) or zanamivir (Relenza)) may lessen symptoms if taken within 48 hours of becoming symptomatic.
Botulism

AGENT Botulinum Toxin (abbreviated either as BTX or BoNT) made by the bacterium *Clostridium botulinum*

TRANSMISSION Botulinum toxin, which can be aerosolized, is the most lethal toxin known to man. Foodborne botulism occurs when a person ingests pre-formed toxin that leads to illness within a few hours to days. Infant botulism occurs in a small number of susceptible infants each year who harbor *C. botulinum* in their intestinal tract. Wound botulism occurs when a wound or open skin is infected with *C. botulinum* that secretes the toxin. All forms of botulism produce a paralytic illness that can be fatal and is considered a medical emergency.

EPIDEMIOLOGY In the United States, on average 145 cases of botulism are reported each year. Of these, approximately 15% are foodborne, 65% are infant botulism, and 20% are wound. Outbreaks of foodborne botulism involving two or more persons occur most years and are usually caused by home-canned foods. Most wound botulism cases are associated with black-tar heroin injection.

THREAT Easy to produce and transport, the botulinum toxin is classified by CDC as a category A bioterrorism threat. Between 1990-1995, aerosols were dispersed in downtown Tokyo and military installations in Japan by the Japanese cult, Aum Shinrikyo. During the Gulf War, Iraq produced the toxin to fill warheads. The toxin could also be used to contaminate food supplies, which may sicken or kill thousands of victims. Water contamination is less likely due to the large amount of toxin needed and the neutralizing effects of common water treatment methods.

SYMPTOMS With foodborne botulism, symptoms begin within 6 hours to 10 days (most commonly between 12 and 36 hours) after eating food that contains the toxin and include double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, and muscle weakness that moves down the body, usually affecting the shoulders first, then the upper arms, lower arms, thighs, calves, etc.

OUTCOMES Most patients eventually recover after weeks to months of supportive care. Botulism can result in death due to respiratory failure. However, in the past 50 years the proportion of patients with botulism who die has fallen from about 50% to 3-5%.

TREATMENT The respiratory failure and paralysis that occur with severe botulism may require a patient to be on a ventilator for weeks or months, plus intensive medical and nursing care. To reduce the severity of symptoms, botulism can be treated with an antitoxin available for infants from the California Department of Public Health, and for older children and adults through CDC. Hospitalization and good supportive care is the main therapy for all forms of botulism.
Cholera

AGENT  The bacterium *Vibrio cholerae*

TRANSMISSION  The cholera bacterium is usually found in water or food sources that have been contaminated by feces from an infected person. The disease is an infection of the small intestine that produces watery diarrhea; it is most likely to be found and can spread rapidly in places with inadequate treatment of sewage and drinking water, poor sanitation, and inadequate hygiene. The cholera bacterium may also live in the environment in brackish rivers and coastal waters. Shellfish eaten raw have been a source of cholera, and a few persons in the United States have contracted cholera after eating raw or undercooked shellfish from the Gulf of Mexico. The disease is not likely to spread directly from one person to another.

EPIDEMIOLOGY  From its original reservoir in the Ganges delta in India, cholera spread across the world in the nineteenth century. Six subsequent pandemics killed millions of people across all continents. The current (seventh) pandemic started in South Asia in 1961, and reached Africa in 1971 and the Americas at its conclusion in 1991. An estimated 3-5 million cases and over 100,000 deaths occur each year around the world. In the U.S., cholera was prevalent in the 1800s but water-related spread has been eliminated by modern water and sewage treatment systems.

THREAT  The primary risk for disaster response teams is working in areas where water treatment and sanitation facilities have been destroyed by natural disasters. Because intentional release in food or water supplies is also possible, it is classified by CDC as a category B bioterrorism agent.

SYMPTOMS  The infection is often mild or without symptoms, but can sometimes be severe. Approximately one in 20 (5%) infected persons will have severe disease characterized by profuse watery diarrhea, vomiting, and leg cramps. In these cases, rapid loss of body fluids leads to dehydration and shock. Without treatment, death can occur within hours.

OUTCOMES  With prompt rehydration, fewer than 1% of cholera patients die. When untreated, fatality rates—especially among children and infants-- are high (25 to 50%) due to severe dyhydration. Death can occur in otherwise healthy adults within hours. Those who recover usually have long-term immunity against reinfection.

PREVENTION  A vaccine is available but due to its serious limitations, it is not recommended by public health authorities. The best prevention is to maintain a sanitary environment, including a safe water supply.

TREATMENT  Cholera can be simply and successfully treated by immediate replacement of the fluid and salts lost through diarrhea. Antibiotics shorten the course and diminish the severity of the illness, but they are not as important as receiving rehydration through oral or intravenous fluids.
Dengue Fever and Dengue Hemorrhagic Fever (DHF)

AGENT Dengue is a disease caused by any one of four closely related dengue viruses (DENV 1, DENV 2, DENV 3, or DENV 4). DHF is a more severe form of dengue infection. It can be fatal if unrecognized and not properly treated in a timely manner. DHF is caused by infection with the same viruses that cause dengue fever.

TRANSMISSION Dengue is transmitted by the bite of an *Aedes* mosquito that becomes infected with a dengue virus after biting an infected person. A little over one week after biting an infected, symptomatic human, the mosquito can then transmit the virus while biting a healthy person. Dengue cannot be spread directly from person to person.

EPIDEMIOLOGY Today about 2.5 billion people, or 40% of the world’s population, live in areas where there is a risk of dengue transmission. Dengue is endemic in at least 100 countries in Asia, the Pacific, the Americas, Africa, and the Caribbean. WHO estimates that 50 to 100 million infections occur yearly, including 500,000 DHF cases and 22,000 deaths, mostly among children. Most dengue cases in U.S. citizens occur in Puerto Rico, the U.S. Virgin Islands, Samoa and Guam, which are endemic for the virus. An outbreak in South Texas occurred near the Mexican border in 2005. After an absence of 75 years, in 2009, the disease re-emerged in the Florida Keys where 1,000 people were exposed. This generated concern that dengue may become endemic in the U.S. and travel to other southern states.

THREAT A natural disaster affecting areas endemic for the virus could expose unprotected workers to dengue. The disease could also be transmitted in a biological attack through the intentional introduction of infected mosquitoes or the release of an aerosol of the virus. The offensive biological weapons programs of several countries involved the rearing and infection of mosquitoes for covert release into enemy territory.

SYMPTOMS The principal symptoms of dengue fever are high fever, severe headache, severe pain behind the eyes, joint pain, muscle and bone pain, rash, and mild bleeding (e.g., nose or gums bleed, easy bruising). Symptoms of infection usually begin 4-7 days after the mosquito bite and typically last 3-10 days.

OUTCOMES Dengue Fever is rarely fatal. Mortality of 1-2.5 percent has been reported, mostly occurring among DHF cases.

PREVENTION There is no vaccine for preventing dengue. The best preventive measures are to eliminate the places where mosquitoes lay eggs, and to use repellants and physical barriers (screens and nets) to prevent exposure.

TREATMENT There are no anti-viral drugs for a dengue infection. Treatment is supportive care in the form of fluid replacement and pain management.
Ebola

Also known as Ebola Virus, Ebola Virus Disease (EVD), Ebola hemorrhagic fever (Ebola HF)

AGENT There are five identified subtypes of Ebola virus: Zaire ebolavirus (ZEBOV), Sudan ebolavirus (SEBOV), Reston ebolavirus (REBOV), Côte d'Ivoire ebolavirus (CIEBOV) – also referred to as Tai Forest ebolavirus (TAFV), Bundibugyo ebolavirus, and Reston ebolavirus (REBOV), The latter has caused disease in non-human primates but not in humans.

TRANSMISSION The exact origins of Ebola virus are unknown, but outbreaks of Ebola among human populations generally result from handling infected wild animal carcasses. Ebola virus has been found in African monkeys, chimps and other nonhuman primates. A milder strain of Ebola has been discovered in monkeys and pigs in the Philippines. There is no evidence that the virus can be spread via insect bites. After the first patient in an outbreak setting is infected, the virus can be transmitted from direct contact with the blood and/or secretions of an infected person or through contact with objects, such as needles, that have been contaminated with infected secretions.

EPIDEMIOLOGY No case of the disease in humans has ever been reported in the United States. Confirmed cases of Ebola HF have been reported in the Democratic Republic of the Congo (DRC), Gabon, Sudan, the Ivory Coast, Uganda and the Republic of the Congo. Most recent outbreaks include 32 cases in DRC in 2008, 264 cases also in DRC in 2007, and 149 cases in Uganda in 2007. Ebola-Reston virus caused severe illness and death in monkeys imported to research facilities in the United States and Italy from the Philippines. Ebola HF typically appears in sporadic outbreaks, usually spread within a health-care setting.

THREAT The fact that Ebola Fever is highly contagious and its quick disease course (short time to death) make the disease a major concern. The virus could be aerosolized for an attack and is classified as a Category A bioterrorism agent by CDC. The Japanese cult Aum Shinrikyo allegedly sent its members to Africa, posing as medical personnel, to attempt to acquire this virus from infected patients.

SYMPTOMS The incubation period for Ebola HF ranges from 2 to 21 days. The onset of illness is abrupt and is characterized by fever, headache, joint and muscle aches, sore throat, and weakness, followed by diarrhea, vomiting, stomach pain, and severe, uncontrollable internal and external bleeding.

OUTCOMES Ebola has an extremely high mortality rate (up to 90%).

PREVENTION No vaccine is yet available, although several candidate vaccines are being tested.

TREATMENT Therapeutic drugs are under development, but current treatment is supportive therapy to manage symptoms.
Eastern/Western/Venezuelan equine encephalitis

AGENT  Virus, EEEV, EEE (subtype) WEEV, WEE VEEV, VEE

TRANSMISSION  EEE, VEE, and WEE are transmitted to humans by the bite of an infected mosquito. Transmission to humans requires mosquito species capable of creating a "bridge" between infected birds and uninfected mammals. Horses are susceptible to EEEV infection and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses (like humans) are considered to be "dead-end" hosts.

EPIDEMIOLOGY  Human EEEV cases occur relatively infrequently (an average of 6 per year in the U.S.), largely because the primary transmission cycle takes place in and around fresh water swampy areas where human populations tend to be limited. Most cases of EEE have been reported from Florida, Georgia, Massachusetts, and New Jersey. In the U.S. WEE is seen primarily in states west of the Mississippi River. There have been 639 confirmed cases in the U.S. since 1964 (average of 14 per year). Although predominantly a disease found in Central and South America, VEE spread to Texas in 1969-1972 resulting in infection of 1,500 horses and several hundred humans.

THREAT  A natural disaster affecting areas endemic for the virus could expose unprotected workers to viral encephalitis transmission. Exposure through an intentional aerosol release is also possible. EEEV/WEEV/VEEV are categorized as Category B bioweapons as they can be produced in large amounts, stored with ease and are highly infectious when aerosolized.

SYMPTOMS  It takes 4 to 10 days after the bite of an infected mosquito to develop symptoms of EEE, an inflammation of the brain. Severe cases of EEEV begin with the sudden onset of headache, high fever, chills, and vomiting. The illness may then progress into disorientation, seizures, and coma. WEE symptoms range from mild flu-like illness to inflammation of the brain, coma and death. Most Venezuelan equine encephalitis virus infections in humans are relatively mild, with symptoms lasting 3-5 days. Children are at particular risk to progress to clinical CNS involvement, especially inflammation of the brain.

OUTCOMES  Approximately a third of patients who develop EEE die, and many of those who survive have mild to severe brain damage. The overall mortality of WEE is low (approximately 4%) and is associated mostly with infection in the elderly. Overall mortality for VEE is less than 1% but the fatality rate is approximately 20% in older children and young adults who develop acute encephalitis, and as high as 35% in persons aged 0-5 years.

PREVENTION  There is no vaccine against Eastern, Western, or Venezuelan equine encephalitis. Reducing exposure to mosquitoes is the best defense.

TREATMENT  There are no effective anti-viral drugs. Severe illnesses are treated by supportive therapy which may include hospitalization, respiratory support, IV fluids, and prevention of other infections.
Epidemic Typhus

Also known as Camp fever, jail fever, hospital fever, ship fever, historic typhus, epidemic louse-borne typhus, and louse-borne typhus

AGENT The causative organism is a bacterium, *Rickettsia prowazekii*. The disease is carried by some rodents, but it is normally spread between humans using the louse or flea as a vector.

TRANSMISSION The infection is transmitted when the rickettsiae present in louse feces enter bite wounds or other skin abrasions.

EPIDEMIOLOGY A form of typhus so named because the disease often causes epidemics following wars and natural disasters. It affected the course of every war from the liberation of Spain to Napoleon's failure in Russia. In World War I, it decimated the armies of the Eastern front. In the aftermath of World War I and during the Russian civil war between the White (Royalist) and Red (Communist) armies that followed the Bolshevik Revolution, typhus killed three million and reportedly came closer to toppling Lenin than the White Army. Currently prevalent in the mountainous regions of Africa, South America, and Asia, epidemic typhus is uncommon in the United States. As it is usually seen in areas where hygiene is poor and the weather is cold, it has occasionally been found among homeless populations in the U.S.

THREAT Situations with potential for a typhus epidemic would include camps set up for survivors of a natural disaster. The fact that typhus is relatively easy to treat makes this agent less attractive to those wishing to inflict many deaths.

SYMPTOMS Clinical manifestations of typhus include intense headache, chills, fever, and myalgia. A characteristic rash develops on the fourth to seventh day of disease, first appearing on the upper trunk, then involving the whole body.

OUTCOMES Without treatment, death may occur in 10-60% of patients with epidemic typhus. Patients over age 60 have the highest risk of death. Patients who receive treatment typically recover quickly.

PREVENTION Good sanitation and public health measures that reduce the rat population are primary prevention strategies. Personal protective measures and proper personal hygiene to reduce exposures to rat fleas or lice are also essential. A typhus vaccine is available but it only lessens the severity and shortens the course of the disease, it does not protect against infection.

TREATMENT Fatalities are rare if intracellular antibiotics such as doxycycline or tetracycline are used during the first eight days following infection. Intravenous oxygen and fluids may be needed.
Gastroenteritis

Also known as stomach flu

AGENT Many different viruses can cause gastroenteritis including rotaviruses; noroviruses; adenoviruses, types 40 and 41; sapoviruses; and astroviruses. Viral infections are the most common cause of gastroenteritis but bacteria, parasites, and toxins can also be the offending agents.

TRANSMISSION The viruses that cause gastroenteritis are spread through close contact with infected persons. Individuals may also become infected by eating or drinking contaminated foods or beverages. Food may be contaminated by sewage or by food preparers or handlers who have viral gastroenteritis and do not wash their hands regularly after using the bathroom. Drinking water can also be contaminated by sewage and be a source of transmission.

EPIDEMIOLOGY Viral gastroenteritis affects people of all ages and backgrounds in all parts of the world. Each virus has its own seasonal activity. Norovirus outbreaks can occur in institutional settings, such as schools, child care facilities, and nursing homes, or other group settings, such as banquet halls, cruise ships, dormitories, and campgrounds.

THREAT The primary threat for disaster response workers is gastroenteritis due to contaminated water supplies following a natural disaster. Category B agents that cause gastroenteritis and could be used to intentionally infect the food supply are bacterial agents and toxins rather than viral agents. These include C.perfringens toxin, *Salmonella* bacteria, *Escherichia coli*, *Shigella*, and Staphylococcal enterotoxin B. In 1984 *Salmonella typhimurium* was intentionally introduced into salad bars in restaurants in The Dalles, Oregon, by followers of Baghwan Shree Rajneesh. In this attack, 751 people developed gastroenteritis and 45 were hospitalized.

SYMPTOMS The main symptoms of gastroenteritis are watery diarrhea and vomiting. The affected person may also have headache, fever, and abdominal cramps ("stomach ache"). In general, the symptoms begin 1 to 2 days following infection and may last for 1 to 10 days, depending on which agent causes the illness.

OUTCOMES With sufficient replacement of lost fluids, people normally experience complete recovery with no long-term problems.

PREVENTION Frequent hand washing, prompt disinfection of contaminated surfaces, prompt washing of soiled articles of clothing, and avoidance of contaminated food or water are primary preventive measures.

TREATMENT The most important treatment is preventing dehydration by drinking replacement fluids.
Glanders

Also known as Equinia, Farcy, Malleus

AGENT Caused by the bacterium *Burkholderia mallei*

TRANSMISSION Glanders is primarily a disease affecting horses but also affects donkeys and mules, and can be naturally contracted by other mammals such as goats, dogs, and cats. The bacteria that cause glanders are transmitted to humans through contact with tissues or body fluids of infected animals. The bacteria enter the body through cuts or abrasions in the skin and through mucosal surfaces such as the eyes and nose. The agent may also be inhaled via infected aerosols or dust contaminated by infected animals. Infection may also occur if contaminated meat is ingested. Cases of human-to-human transmission have not been reported in the U.S., but could occur if respiratory secretions are inhaled.

EPIDEMOLOGY Glanders is extremely rare in humans. In 2000, one case occurred in a research laboratory worker in the U.S. after accidental exposure. Sporadic cases have been reported from Africa, Asia, Central America and South America. Those who care for infected animals or handle infected specimens may face increased risk.

THREAT *B. mallei* was one of the first agents to be used in biowarfare. During World War I, German agents targeted horses and livestock. Since then, several countries have experimented with glanders as part of their weapon programs and U.S. Health and Human Services (HHS) has prioritized glanders for the development of medical countermeasures.

SYMPTOMS The particular symptoms experienced depend on the type of infection. If there is a cut or scratch in the skin, a localized infection with ulceration may develop within 1 to 5 days at the site where the bacteria entered the body. Swollen lymph nodes may also be apparent. In pulmonary infections, pneumonia, pulmonary abscesses, and pleural effusion can occur. Glanders bloodstream or septicemic infections can cause fever, shivers, sweats, lack of energy, chest pain and diarrhea. Without treatment, these infections are usually fatal within 7 to 10 days. The chronic form of glanders involves multiple abscesses within the muscles and skin of the arms and legs or in the lungs, spleen, and/or liver.

OUTCOMES While data are limited, the case-fatality rate is over 50% with traditional antibiotic treatment.

PREVENTION There is no vaccine available for glanders. In countries where glanders is endemic in animals, prevention of the disease in humans involves identification and elimination of the infection in the animal population.

TREATMENT Initial treatment typically consists of a course of intravenous antibiotics for 14 days followed by oral therapy for 3 months.
Hanta Virus

Also called Hanta Fever. Infection with hantavirus can progress to Hantavirus Pulmonary Syndrome (HPS). Old World hantaviruses, found in Asia and also transmitted by rodents, can cause Hemorrhagic Fever with Renal Syndrome (HFRS).

AGENT Hantaviruses are a group of viruses. One of them, Sin Nombre virus, is found in deer mice in North America. Sin Nombre virus is the cause of Hantavirus Pulmonary Syndrome (HPS) in people.

TRANSMISSION The types of hantavirus that cause HPS in the U.S. cannot be transmitted from person to person. People become infected through contact with infected rodents or their urine and droppings. The virus is mainly transmitted by inhaling air containing dust contaminated with the virus. Rodent bites or touching a surface or eating food contaminated with rodent urine, droppings or saliva can also transmit the virus.

EPIDEMIOLOGY Between 1993 and 2010, CDC reported 531 cases of HPS. Cases occur sporadically, usually in rural areas where forests, fields, and farms offer suitable habitat for the virus's rodent hosts. Peridomestic settings (for example, barns, outbuildings, and sheds) are potential sites where people may be exposed to the virus. In the U.S. and Canada, the Sin Nombre hantavirus is responsible for the majority of cases of HPS. The host of the Sin Nombre virus is the deer mouse, present throughout the western and central U.S. and Canada. Construction, utility and pest control workers can be exposed when they work in crawl spaces, under houses, or in vacant buildings that may have a rodent population.

THREAT The availability of rodents harboring the virus, the possibility of aerosol transmission, the lack of a treatment or vaccine, and a high case fatality rate, make the hantavirus a potentially potent biological agent. As an emerging pathogen that could be engineered for mass dissemination, CDC classifies hantavirus as a Category C bioterrorism agent.

SYMPTOMS Based on the limited number of HPS cases, it appears that symptoms may develop between 1 and 5 weeks after exposure. Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups. About half of HPS patients also experience headaches, dizziness, chills, and abdominal problems such as nausea, vomiting, diarrhea, and abdominal pain. Late symptoms of HPS include coughing and shortness of breath as the lungs fill with fluid.

OUTCOMES Case fatality rates range from less than one percent to 60 percent, depending on the hantavirus strain and the availability of health care services.

PREVENTION As there is no vaccine, rodent control remains the primary strategy for preventing hantavirus infection.

TREATMENT As there is no specific treatment or cure for hantavirus infection, the primary recourse is supportive therapy to manage symptoms—especially the severe respiratory distress that accompanies HPS.
Hepatitis A

AGENT  Hepatitis A virus (HAV)

TRANSMISSION  The most common of hepatitis infections, HAV is found in the feces of persons infected with the virus. Most infections result from close personal contact with an infected household member or sex partner. HAV can also be spread by eating or drinking contaminated food or water, sharing eating utensils that are contaminated or touching contaminated surfaces and then placing your hands near or in the mouth. HAV replicates in the liver and is shed in high concentrations in feces from 2 weeks before to 1 week after the onset of clinical illness.

EPIDEMIOLOGY  In 2007, about 3,000 people in the U.S. were diagnosed with acute Hepatitis A. However the estimate of all new cases – reported and unreported – is thought to be about 20,000 per year. Rates of infection are particularly high among men who have sex with men, people who use illicit drugs, and people, especially children, living in or traveling to areas that have high rates of Hepatitis A, particularly Africa, Asia, and Latin America.

THREAT  Exposure to contaminated water in the aftermath of a disaster that disrupts sewage or water treatment facilities is the primary threat to disaster response workers.

SYMPTOMS  A hepatitis virus is one that lives in liver cells and causes inflammation. Symptoms may not appear but, if they do, may include jaundice (photo), tiredness, stomach pain, lack of appetite, dark urine, nausea, diarrhea, and low grade fever.

OUTCOME  Most people infected with the virus get well within six months. However, HAV can be serious for older people and those who already have liver disease. Death is possible, although very rare. In 2007, HAV was the primary cause of death of 85 people.

PREVENTION  Vaccination is the best way to prevent Hepatitis A. HAV rates in the United States have declined by 92% since the vaccine first became available in 1995. Other preventive measures include: boiling water or drinking bottled water in areas where there is a risk for HAV contamination; avoiding eating raw or steamed shellfish, such as oysters that live in contaminated waters; using condoms correctly every time you have sex.

TREATMENT  There are no special treatments for HAV. Most people with Hepatitis A recover without treatment within a few months by getting sufficient rest and drinking plenty of fluids.
Hepatitis B

AGENT  Hepatitis B virus (HBV)

TRANSMISSION  Hepatitis B is a disease of the liver usually spread by sexual contact (two thirds of acute cases) or sharing needles, syringes, or other drug-injection equipment with a person infected with HBV. Hepatitis B can also be passed from an infected mother to her baby at birth. Acute Hepatitis B is a short-term illness that occurs within the first 6 months after exposure. Acute infection can, but does not always, lead to chronic infection. Chronic HBV is a serious disease that can result in long-term health problems, and even death. Hepatitis B cannot be spread through sneezing, coughing, hugging or coming in contact with the feces of someone who is infected.

EPIDEMIOLOGY  Rates of acute Hepatitis B in the U.S. have declined by approximately 82% since 1990. At that time, routine Hepatitis B vaccination of children was implemented and has dramatically decreased incidence in the U.S. In 2007, there were an estimated 43,000 new Hepatitis B virus infections in the U.S.; an estimated 800,000 to 1.4 million persons have chronic Hepatitis B virus infection. Globally, chronic Hepatitis B affects approximately 350 million people each year.

THREAT  Exposure to the blood of bodily fluids of an infected person or needle stick from contaminated medical waste are the primary risks and would typically occur during a disaster affecting health care facilities.

SYMPTOMS  HBV is similar to HAV in its symptoms but is more likely to cause long term illness and liver damage if untreated. Symptoms of acute Hepatitis B usually appear between 4-6 weeks after infection and can include fever, fatigue, loss of appetite, nausea, vomiting, abdominal pain, dark urine, clay-colored bowel movements, joint pain and jaundice.

OUTCOMES  Hepatitis B can range in severity from a mild illness lasting a few weeks (Acute Hepatitis B) to a serious, lifelong illness (Chronic Hepatitis B). Symptoms of Acute Hepatitis B usually last a few weeks, but some people can be ill for as long as 6 months. The disease contributes to an estimated 620,000 deaths worldwide each year.

PREVENTION  Vaccination is the best preventive measure and is required by OSHA if you anticipate contact with blood or other potentially infectious material on the job. Immunizations are given over 3-6 months and immunity typically lasts five years.

TREATMENT  There is no medication available to treat acute Hepatitis B. During this short-term infection, doctors usually recommend rest, adequate nutrition, and fluids, although some people may require hospitalization. Antiviral treatment may be administered to those with chronic symptoms to help prevent further liver damage.
HIV-AIDS

AGENT  HIV is the human immunodeficiency virus that can lead to acquired immune deficiency syndrome or AIDS.

TRANSMISSION  HIV is spread primarily by unprotected heterosexual or homosexual sex with a person who has HIV or sharing needles, syringes, rinse water, or other equipment used to prepare illicit drugs for injection. HIV cannot reproduce outside the human body. It is not spread by air or water, by insects, by saliva, tears, or sweat, by casual contact, or by closed-mouth or “social” kissing.

EPIDEMIOLOGY  CDC estimates that about 56,000 people in the U.S. contracted HIV in 2006. Gay and bisexual men remain the population most heavily affected by HIV. CDC estimates men who have sex with men represent approximately 2% of the U.S. population, but accounted for more than 50% of all new HIV infections annually from 2006 to 2009. African Americans and Hispanic/Latinos were also disproportionately affected.

THREAT  Exposure to blood or other potentially infectious material during a disaster affecting a hospital or other treatment facilities is the primary risk to disaster response workers.

SYMPTOMS  The incubation period of the virus (before a positive test result) is up to six months but symptoms may not appear for several years. Main symptoms are rapid weight loss, dry cough, recurring fever or profuse night sweats, swollen lymph glands, diarrhea, white spots on the tongue, mouth or throat, pneumonia, blotches on or under the skin or inside the mouth, nose or eyelids, and memory loss, depression, and other neurological disorders.

OUTCOMES  AIDS is the late stage of HIV infection, when the immune system is severely compromised and has difficulty fighting diseases and certain cancers. With the development of highly active combinations of medications introduced in the 1990s, people can live much longer - even decades - with HIV before they develop AIDS. In 2007, 35,962 new cases of AIDS were diagnosed and 14,110 deaths among people living with HIV were reported in the U.S.

PREVENTION  Because the most common ways HIV is transmitted is through anal or vaginal sex or sharing drug injection equipment with a person infected with HIV, it is important to take steps to reduce the risks associated with these behaviors.

TREATMENT  At this time, there is no cure for HIV infection. Medications can limit or slow down the destruction of the immune system and improve the health of people living with HIV; they may also reduce their ability to transmit the infection.
Influenza

Also known as the Flu or Seasonal Flu

AGENT Influenza family of viruses

TRANSMISSION Most experts believe that flu viruses are spread mainly by droplets made when infected individuals cough, sneeze or talk. Less often, the disease may be transmitted by touching a surface or object touched by an infected person and then touching the eyes, mouth, or nose. Most healthy adults may be able to infect others beginning 1 day before symptoms develop and up to 5 to 7 days after becoming sick. Some people, especially young children and people with weakened immune systems, may be able to infect others for an even longer time.

EPIDEMIOLOGY Certain groups are at greater risk for serious complications if they get the flu. This includes older people, young children, pregnant women, people with certain health conditions (such as asthma, COPD diabetes, or heart disease), and persons who live in group facilities such as nursing homes.

THREAT Over time, humans gradually adapt to the influenza virus and develop increasing immunity. Eventually, a new strain that conquers the immunity evolves, triggering the next pandemic. This cycle has occurred throughout history. The influenza pandemic of 1918 killed more people worldwide (estimated between 20 and 40 million) than World War I. Between April 2009 and April 2010, the CDC estimates there were 43 to 89 million U.S. cases of H1N1 (“swine flu”) and 8870 to 18,300 H1N1-related deaths. International air travel and increased population density in cities has increased the speed of disease transmission. Conditions that foster mutations of the virus—e.g. humans living in close proximity to chicken and pigs—have also increased in recent decades. Avian influenza (see Bird Flu) threatened to become the next pandemic but so far, human to human transmission has not occurred, though laboratory experiments suggest this may be possible.

SYMPTOMS Fever, cough, sore throat, runny or stuffy nose, muscle or body aches, headaches, fatigue, vomiting and diarrhea.

OUTCOMES Flu seasons are unpredictable and can be severe. Over a period of 30 years, between 1976 and 2006, estimates of flu-associated deaths in the U.S. range from a low of about 3,000 to a high of about 49,000 people.

PREVENTION The best way to prevent the flu is by annual vaccinations. Influenza strains are constantly evolving bringing new variations and new vaccines each year. The seasonal flu vaccine protects against the three influenza viruses that research suggests will be most common. Social distancing practices and good hand hygiene are key precautionary measures during an outbreak.

TREATMENT Anti-viral drugs can be used to treat influenza. These prescription drugs can lessen symptoms and may shorten the duration of illness. They also can prevent serious flu complications, such as pneumonia.
Lyme disease

AGENT Lyme disease is caused by the bacterium Borrelia burgdorferi

TRANSMISSION The blacklegged tick (or deer tick, Ixodes scapularis) spreads the disease in the northeastern, mid-Atlantic, and north-central U.S., and the western blacklegged tick (Ixodes pacificus) spreads the disease on the Pacific coast. Ticks can attach to any part of the human body but are often found in hard-to-see areas such as the groin, armpits, and scalp. In most cases, the tick must be attached for 36-48 hours or more before the Lyme disease bacteria can be transmitted. Most humans are infected through the bites of immature ticks called nymphs. Nymphs are tiny (less than 2 mm) and difficult to see; they feed during the spring and summer months. Adult ticks can also transmit Lyme disease bacteria, but they are much larger and may be more likely to be discovered and removed before they have had time to transmit the bacteria. Adult Ixodes ticks are most active during the cooler months of the year. There is no evidence that Lyme disease is transmitted from person-to-person or through air, food, water, or from the bites of mosquitoes, flies, fleas, or lice.

EPIDEMIOLOGY The highest incidence of Lyme disease in the U.S. occurs in Delaware, New Hampshire, Vermont, Connecticut, Massachusetts, Wisconsin, Minnesota, West Virginia, New Jersey, Maryland, and Pennsylvania. Total infected in the U.S. has ranged from 17,000 to 30,000 people per year since 2000.

THREAT Appropriate precautions need to be taken in any outdoor work site where Lyme disease is endemic.

SYMPTOMS The dominant symptom is a characteristic skin rash called erythema migrans (EM) rash occurs in approximately 70-80% of infected persons and gradually expands over a period of several days, reaching up to 12 inches (30 cm) across. Parts of the rash may clear as it enlarges, resulting in a “bull's-eye” appearance (photo). Other symptoms are fever, chills, headache, fatigue, muscle and joint aches and swollen lymph nodes.

OUTCOMES If left untreated, infection can spread to joints, the heart, and the nervous system. When treated with appropriate antibiotics in the early stages of the disease, recovery is typically complete. In later stages, response to treatment may be slower, but the majority of patients recover. In rare cases, Lyme disease can be fatal.

PREVENTION Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, applying pesticides, reducing tick habitat (clearing brush and keeping grassy areas mown) and wearing protective clothing (tucking pant legs into socks and shirt into pants).

TREATMENT Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics.
Malaria

AGENT Caused by parasites of the genus *Plasmodium*: *Plasmodium falciparum* and *Plasmodium vivax* are the most common; *Plasmodium malariae* is the most benign and *Plasmodium falciparum* is the most deadly.

TRANSMISSION Malaria is transmitted exclusively through the bites of *Anopheles* mosquitoes. About 20 different *Anopheles* species are locally important for malaria transmission around the world. All of the important vector species bite at night. *Anopheles* mosquitoes breed in water and each species has its own breeding preference; for example some prefer shallow collections of fresh water, such as puddles, rice fields, and hoof prints.

EPIDEMIOLOGY In 2008, an estimated 190-311 million cases of malaria occurred worldwide. About 1,500 cases of malaria are diagnosed in the United States each year, the majority among travelers and immigrants, many from sub-Saharan Africa and South Asia. Thirty-five countries (30 in sub-Saharan Africa and 5 in Asia) account for 98% of global malaria deaths. Malaria is the 5th leading cause of death from infectious diseases worldwide.

THREAT Weaponization is unlikely as the disease cannot be transmitted person-to-person, is not infectious via aerosol or by food, and is not highly lethal. Nonetheless, dissemination of disease by *Anopheles* mosquitoes could be highly disruptive. In both World War II and Vietnam, more personnel time was lost to malaria than to enemy action.

SYMPTOMS The incubation period varies from 7-30 days but anti-malarial drugs can delay the appearance of symptoms even further. Fever, headache, chills, vomiting, enlarged liver and spleen, and general malaise are all symptoms of malaria. For both *P. vivax* and *P. ovale*, clinical relapses may occur weeks to months after the first infection, even if the patient has left the malarious area. These new episodes arise from "dormant" liver forms (absent in *P. falciparum* and *P. malariae*), and special treatment – targeted at these liver stages – is mandatory for a complete cure.

OUTCOMES When properly treated, most patients with malaria can expect a complete recovery. In 2008, an estimated 708,000 - 1,003,000 people died, most of them young children in sub-Saharan Africa.

PREVENTION There are currently no licensed vaccines against malaria or any other human parasite. However, the incidence of infection can be greatly reduced with an antimalarial prophylaxis regimen. Recommended drugs differ by country of travel and health of the recipient. None are 100% effective and must be combined with vector control and personal protection, including repellants and protective clothing.

TREATMENT Many anti-malarial drugs are available that act against the parasite forms in the blood. The choice of drug and length of treatment depend on the species of parasite, incidence of drug-resistance in the region, severity of symptoms, and age of the patient.
Marburg Fever

Also called Marburg hemorrhagic fever (Marburg HF), a viral hemorrhagic fever similar to Ebola

AGENT Marburg fever is caused by a genetically unique, animal-borne RNA virus of the filovirus family, similar to the agent that causes Ebola.

TRANSMISSION Historically, persons who have handled infected monkeys and have come in direct contact with their fluids or who have handled infected cell cultures have become infected. Spread of the virus between humans has occurred in a setting of close contact, often in a hospital. Other likely sources of disease include droplets of body fluids, or direct contact with persons, equipment, or other objects contaminated with infectious blood or tissues.

EPIDEMIOLOGY Recent studies implicate the African fruit bat (Rousettus aegyptiacus), widely distributed across Africa, as the reservoir host of the Marburg virus (photo). Further study is needed to determine if other species may also host the virus. Confirmed cases of Marburg HF have been reported in Uganda, Zimbabwe, the Democratic Republic of the Congo, Kenya, and Angola. Cases of Marburg HF have occurred outside Africa, though infrequently.

THREAT Hemorrhagic fever viruses, including Ebola and Marburg, have been weaponized by the former Soviet Union, Russia, and the U.S. prior to the cessation of its offensive bioweapons program. Soviet Union researchers determined that no more than a few particples are required to cause infection and several studies demonstrated successful infection of non-human primates by aerosol preparations of Ebola and Marburg.

SYMPTOMS After an incubation period of 5-10 days, the onset of disease is sudden and is marked by fever, chills, headache, and muscle pain. Symptoms become increasingly severe and may include jaundice, inflammation of the pancreas, severe weight loss, delirium, shock, liver failure, massive hemorrhaging, and multi-organ dysfunction. Because many of the signs and symptoms are similar to those of other infectious diseases, diagnosis of the disease can be difficult.

OUTCOMES Recovery from Marburg hemorrhagic fever may be prolonged and accompanied by numerous complications including recurrent liver inflammation. The case-fatality rate for Marburg hemorrhagic fever is between 23-25%.

PREVENTION Measures to prevent transmission from the original animal host have not yet been established. Measures for prevention of secondary transmission are similar to those used for other hemorrhagic fevers. If a patient is either suspected or confirmed to have Marburg HF, barrier nursing techniques are used to prevent direct physical contact with the patient. These precautions include wearing protective gowns, gloves, and masks; placing the infected individual in strict isolation; and sterilization or proper disposal of needles, equipment, and patient excretions.

TREATMENT There is no treatment other than supportive hospital therapy.
Measles

Also known as English Measles, Rubeola, Morbilli

AGENT The disease of measles and the virus that causes it share the same name, a virus in the paramyxovirus family. The measles virus normally grows in the cells that line the back of the throat and lungs. Measles is a human disease and is not known to occur in animals.

TRANSMISSION The highly contagious virus is spread by coughing and sneezing, close personal contact or direct contact with infected nasal or throat secretions. The virus remains active and contagious in the air or on infected surfaces for up to two hours. It can be transmitted by an infected person from four days prior to the onset of the rash to four days after the rash erupts.

EPIDEMIOLOGY WHO reports that measles remains one of the leading causes of death among young children globally, despite the availability of a safe and effective vaccine. In North and South America, Finland, and some other areas, endemic measles transmission has been interrupted through vaccination. However, worldwide, there are estimated to be 20 million cases and 197,000 deaths each year. More than half of the deaths occur in India, many among children under the age of five.

THREAT As measles is one of the most highly contagious diseases known, it is often considered a candidate for a pandemic, particularly if rates of vaccination were to drop. A falsely claimed link between the MMR Vaccine (Measles, Mumps, and Rubella) and autism that was reported in the British journal Lancet in 1998 resulted in a decline in rates of vaccination in the English speaking world, which puts the population at greater risk.

SYMPTOMS The first sign of measles is usually a high fever, which begins about 10 to 12 days after exposure to the virus, and lasts four to seven days. A runny nose, a cough, red and watery eyes, and small white spots inside the cheeks can develop in the initial stage. After several days, a rash erupts, spreads, and fades after 5 or 6 days.

OUTCOMES Most measles-related deaths are caused by complications which include blindness, encephalitis, severe diarrhea and related dehydration, ear infections, or severe respiratory infections such as pneumonia.

PREVENTION Routine measles vaccination for children, combined with mass immunization campaigns in countries with high case and death rates, are key public health strategies to reduce global measles deaths.

TREATMENT Severe complications from measles can be avoided though supportive care that ensures good nutrition, adequate fluid intake and treatment of dehydration with oral rehydration solution. Antibiotics are prescribed to treat eye and ear infections, and pneumonia.
Melioidosis
Also known as Whitmore's disease

AGENT  The disease is caused by the bacterium *Burkholderia pseudomallei*

TRANSMISSION  The bacteria are found in contaminated water and soil. The disease is spread to humans and animals through direct contact with the contaminated source. Transmission from person to person is very rare. Many animal species are susceptible to melioidosis, including: sheep, goats, horses, swine, cattle, dogs and cats.

EPIDEMIOLOGY  Melioidosis is predominately a disease of tropical climates, especially in Southeast Asia, including Thailand, Malaysia, Singapore, and northern Australia where it is widespread. In the U.S., confirmed cases reported in previous years have ranged from zero to five, and have occurred among travelers and immigrants.

THREAT  According to WHO, naturally occurring melioidosis is a sporadic disease that does not have significant epidemic or disaster implications. However, because it is highly infectious, especially by inhalation, and resistant to routine antibiotics, the causative bacteria for melioidosis has been classified as a Category B agent by the CDC.

SYMPTOMS  There are several types of melioidosis infection, each with its own set of symptoms. Acute localized infection produces fever, and general muscle aches. Acute bloodstream infection produces fever, headache, respiratory distress, abdominal discomfort, joint pain, muscle tenderness, disorientation. Pulmonary infection produces high fever, headache, anorexia, general muscle soreness, chest pain, and cough. Widespread or disseminated infection results in fever, weight loss, stomach or chest pain, muscle or joint pain, headache, seizures. The time between an exposure to the bacteria and emergence of symptoms may range from one day to many years. Generally symptoms appear two to four weeks after exposure.

OUTCOMES  Untreated, melioidosis is fatal. When treated with antibiotics, severe forms of the illness have a 50% chance of recovery with an overall mortality rate of 40%.

PREVENTION  There is no vaccine to protect against melioidosis. Persons with open skin wounds and those with diabetes or chronic renal disease are at increased risk and should avoid contact with soil and standing water in areas where the disease is widespread. Those who perform agricultural work should wear boots to prevent infection through the feet and lower legs. Health care workers can use standard contact precautions (mask, gloves, and gown) to help prevent infection.

TREATMENT  Treatment generally starts with intravenous antimicrobial therapy for 10-14 days, followed by 3-6 months of oral antimicrobial therapy. Relapses can occur after apparently successful treatment, and lifelong monitoring is often recommended.
Monkeypox

AGENT The disease is caused by monkeypox virus, which belongs to the orthopoxvirus group of viruses. Other orthopoxviruses that can cause infection in humans include variola (smallpox), vaccinia (used in smallpox vaccine), and cowpox viruses.

TRANSMISSION People can get monkeypox from an infected animal through a bite or direct contact with the infected animal’s blood, body fluids, or lesions. The disease also can be spread from person to person, but it is much less infectious than smallpox. The virus is thought to be transmitted by large respiratory droplets during direct and prolonged face-to-face contact. In addition, monkeypox can be spread by direct contact with body fluids of an infected person or with virus-contaminated objects, such as bedding or clothing.

EPIDEMIOLOGY Monkeypox is found mostly in the rainforest countries of central and west Africa. In 1970, monkeypox was identified as the cause of a rash illness in humans in remote African locations. In early June 2003, monkeypox was reported among several residents in the U.S. who became ill after having contact with sick pet prairie dogs co-housed with African rodents.

THREAT The discontinuation of general vaccination for smallpox in the 1980s has produced increasing susceptibility to monkeypox virus infection among humans. This has led to fears that monkeypox virus could be used as a bioterrorism agent.

SYMPTOMS In humans, the signs and symptoms of monkeypox are like those of smallpox, but usually milder and, unlike smallpox, monkeypox causes the lymph nodes to swell. About 12 days following infection, symptoms of the virus include fever, headache, muscle aches, and backache, swollen lymph nodes and general malaise. One to 3 days (or longer) after the fever starts, a rash develops—often starting on the face and turning into raised bumps filled with fluid. The bumps go through several stages before they get crusty, scab over, and fall off.

OUTCOMES The illness typically lasts for 2 to 4 weeks. In Africa, monkeypox has killed between 1 percent and 10 percent of those infected.

PREVENTION Smallpox vaccine has been reported to reduce the risk of monkeypox among previously vaccinated persons. Vaccination after exposure may help prevent the disease or lessen its severity. Limiting contact with infected patients or animals and limiting respiratory exposure to infected patients are important precautionary measures.

TREATMENT Currently, there is no proven treatment for monkeypox.
**MRSA**

**AGENT** Methicillin-resistant *Staphylococcus Aureus* (MRSA) is a type of staph bacteria that is resistant to certain antibiotics called beta-lactams, which are commonly used to treat staph infections. *S. aureus* is a common type of bacteria.

**TRANSMISSION** In about 1 out of every 4 healthy people, the staph germ lives on the skin or in the nasal passages, but it does not cause any problems or infections. The biggest risk factor for MRSA infection is open or broken skin (such as a wound or surgical site); however, MRSA infections can occur even on areas of the skin where there is no obvious wound or break. As with all staph, infections are usually spread via contact with infected skin or contaminated personal items such as towels, bandages, or razors that touched infected skin.

**EPIDEMIOLOGY** MRSA infections can occur anywhere and can affect anyone. People may be more at risk in crowded living conditions, especially those with poor hygiene. Historically, MRSA infections occurred in hospitalized patients, but now these infections are common in the community.

**THREAT** The main threat of exposure for disaster response workers will occur in a disaster site involving a hospital or other medical facility or a site involving crowded living conditions such as a corrections facility.

**SYMPTOMS** Most MRSA infections are skin infections that may appear as pustules or boils which often are red, swollen, painful, or have pus or other drainage. These skin infections commonly occur at sites of visible skin trauma or areas of the body covered by hair. Infections may also occur in the bloodstream, heart, lungs, or urine. Symptoms of these severe infections include chest pain, chills, cough, fatigue, fever, malaise, headache, muscle aches, rash and shortness of breath.

**OUTCOMES** In 2005, there were an estimated 478,000 hospitalizations with a diagnosis of *S. aureus* infection. Of these approximately 278,000 hospitalizations were related to MRSA. In 2005, there were approximately 11,500 *S. aureus*-related deaths, of which about 6,500 were MRSA-related.

**PREVENTION** Good hygiene is key. To prevent spreading MRSA skin infections to others, cover any wounds, clean your hands, do not share personal items, and maintain a clean environment.

**TREATMENT** Draining the wound under a doctor’s supervision may be the only treatment needed for a local skin infection. Keep any sore or wound covered. More serious MRSA infections are becoming harder to treat. Your doctor will follow guidelines about which antibiotics should be used.
**Perfringens Food Poisoning**

Also known as Epsilon toxin

**AGENT** The bacterium *Clostridium Perfringens*

**TRANSMISSION** The illness is not passed from one person to another. *C. perfringens* is commonly found on raw meat and poultry. The bacteria produce a toxin that causes illness. If released in a biological attack *C. perfringens* can be contracted through inhalation, absorption through an open wound, or ingestion of contaminated food or water.

**EPIDEMIOLOGY** *C. perfringens* is one of the most common causes of foodborne illness in the U.S. The CDC estimates that about 10,000 actual cases occur annually in the U.S. Nearly a million cases may occur each year worldwide. The very young and elderly are most at risk of *C. perfringens* infection and can experience more severe symptoms that may last for 1-2 weeks. Complications including dehydration may occur in severe cases. Beef, poultry, gravies, and dried or pre-cooked foods are common sources of *C. perfringens* infections. Infections most often occur when foods are prepared in large quantities and kept warm for a long time before serving. Outbreaks often happen in institutions such as hospitals, school cafeterias, prisons, and nursing homes, or at events with catered food.

**THREAT** As a weapon, *C. perfringens* toxins can be purified into a concentrated form. The toxin could be aerosolized but most likely would be used to contaminate water or food. The epsilon toxin produced by *C. perfringens* is classified as a Category B bioterrorism agent by the CDC. *C. perfringens* has been used in the offensive arsenal of a few states on weapons intended to inflict wounds on the enemy that would then fester due to the action of the bacterium.

**SYMPTOMS** Persons infected with *C. perfringens* develop watery diarrhea and abdominal cramps within 6 to 24 hours (typically 8-12). The illness usually begins suddenly and lasts for less than 24 hours. Fever or vomiting is rare.

**OUTCOMES** The disease generally lasts 24 hours. Infection from *C. perfringens* is rarely fatal. A few deaths have been reported as a result of dehydration and other complications.

**PREVENTION** Foods such as beef, poultry, gravies, and other foods commonly associated with *C. perfringens* infections should be cooked thoroughly. Meat dishes should be served hot, immediately after cooking.

**TREATMENT** Oral rehydration or, in severe cases, intravenous fluids and electrolyte replacement can be used to prevent or treat dehydration. Antibiotics are not recommended.
Plague

There are three main variations: pneumonic plague in lungs, bubonic plague in nodes, and septicemic plague in blood vessels.

**AGENT** *Yersinia pestis*, a bacterium found in rodents and their fleas.

**TRANSMISSION** All three forms of plague are caused by *Y. pestis*, but they are transmitted differently and their symptoms differ. Pneumonic plague can be transmitted from person to person, bubonic plague cannot, and septicemic plague only rarely. Pneumonic plague affects the lungs and is transmitted when a person breathes *Y. pestis* particles in the air. Bubonic plague and septicemic plague are transmitted through the bite of an infected flea or exposure to infected material through a break in the skin. Both bubonic and pneumatic plague can develop into septicemic plague.

**THREAT** Several global pandemics have been attributed to *Yersinia pestis*. The so-called Black Death in the 14th century decimated a third to a half of the population of Europe. In the 20th century, several countries have explored the use of plague as a bioweapon and the Japanese filled bombs with plague infected fleas and attempted to use them on invading US forces in the island campaign. As the disease still occurs naturally throughout the world, the bacterium, classified as a Category A bioterrorism agent, may be relatively easy to obtain. Bioweapons to date have involved bubonic plague spread by disease-carrying fleas. However, aerosolized plague bacteria is considered one of the most deadly biological weapons agents due to universal susceptibility to the disease, its high morbidity and mortality, and rapid person-to-person transmission of the pneumonic form of disease.

**EPIDEMIOLOGY** WHO reports 1,000 to 3,000 cases of plague worldwide every year. An average of 5 to 15 cases occur each year in the western United States. Most cases are the bubonic form of the disease. Naturally occurring pneumonic plague is uncommon, although small outbreaks do occur.

**SYMPTOMS** Bubonic plague produces enlarged, tender lymph nodes, fever, chills and prostration. Septicemic plague results in fever, chills, prostration, abdominal pain, shock and bleeding into skin and other organs. Pneumonic plague produces fever, chills, weakness, and rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery sputum.

**OUTCOMES** Without early treatment, pneumonic plague usually leads to respiratory failure, shock, and rapid death. The mortality rate is 50-90% if untreated, 15% when diagnosed and treated. Without prompt treatment, septicemic plague is nearly always fatal and bubonic plague has a fatality rate of 50-60%.

**PREVENTION** People having direct and close contact with someone with pneumonic plague should observe standard precautions, particularly tightly fitting masks.

**TREATMENT** Treatment consists of antibiotics for at least 7 days, ideally starting within 24 hours of the first symptoms.
Psittacosis

Also known as parrot disease, parrot fever, ornithosis. In birds, *Chlamydia psittaci* infection is referred to as avian chlamydiosis.

**AGENT** *C. psittaci*, a bacterium

**TRANSMISSION** Infection is acquired by inhaling dried secretions from infected birds. Infected birds shed the bacteria through feces and nasal discharges, and humans become infected from exposure to these materials. The incubation period is 5 to 19 days. Although all birds are susceptible, pet birds (parrots, parakeets, macaws, and cockatiels) and poultry (turkeys and ducks) are most frequently involved in transmission to humans.

**Epidemiology** The largest outbreak in the U.S. occurred in 1929-1930 and affected 750-800 individuals. This epidemic led to the isolation of *C. psittaci* in several laboratories in Europe and the United States as well as greater controls on the import of parrots. The handling of this case reportedly contributed to the development of the National Institutes of Health. Since 1996, fewer than 50 confirmed cases have been reported in the U.S. each year. Many more cases may occur that are not correctly diagnosed or reported. Psittacosis is found worldwide. The incidence seems to be increasing in developed countries, which is correlated to the import of exotic birds. Bird owners, pet shop employees, and veterinarians are at the highest risk. Outbreaks of psittacosis in poultry processing plants have been reported.

**THREAT** *C. psittaci* has previously been part of several country’s bioweapons research programs and is classified by CDC as a Category B bioterrorism agent. Characteristics that may make it a viable bioweapon include its stability in the environment, ease of aerosolization, and worldwide availability.

**Symptoms** In humans, symptoms include fever, chills, headache, muscle aches, and a dry cough. Pneumonia is often evident on chest x-ray. Psittacosis can affect the lungs and may cause inflammatory illness of the lungs (pneumonia). Additional common symptoms include fever, chills, muscle pain, headaches and a dry cough.

**Outcomes** Endocarditis (inflammation of the heart), hepatitis (liver inflammation), and neurologic complications may occasionally occur. Severe pneumonia requiring intensive-care support may also occur. The mortality rate prior to the advent of antimicrobial treatment was approximately 15-20%. The mortality rate is less than 1% with appropriate antibiotic therapy.

**Prevention** Avoid purchasing or selling birds that have signs consistent with avian chlamydiosis. Signs are nonspecific and may include lethargy, ocular or nasal discharge, diarrhea, ruffled feathers or low body weight.

**Treatment** Most Psittacosis infections are responsive to antibiotics within 1-2 days; however, relapses can occur. Treatment should continue for at least 10–14 days after fever abates.
Q Fever

Also known as Query fever

AGENT The bacterium Coxiella burnetii.

TRANSMISSION Cattle, sheep, and goats are the primary reservoirs although a variety of species may be infected. Organisms are excreted in milk, urine, feces, and birth products of infected animals. Infection of humans usually occurs by inhalation of contaminated droplets released by infected animals or inhalation of the bacteria from air that contains barnyard dust contaminated by dried placental material, birth fluids, and excreta of infected animals. Drinking raw milk has also caused infection in rare cases.

EPIDEMIOLOGY There were approximately 130 reported Q fever cases in the United States in 2008, most frequently reported from western and plains states where ranching and rearing of cattle are common. Seven states (California, Colorado, Illinois, Kentucky, Missouri, Tennessee, and Texas) accounted for more than half (52%) of all cases since it was mandated that all cases of human Q fever be reported. Q fever can cause acute or chronic illness in about 5% of acutely infected patients.

THREAT Because this agent is among the most infectious known (as even a single organism can cause disease), C. burnetii is considered a bioterrorist threat and is classified by the CDC as a Category B agent. In addition to its virulence, it can be contagious (via reproductive fluids or urine), is very stable in aerosols in a wide range of temperatures, and may survive on surfaces up to 60 days.

SYMPTOMS The acute symptoms caused by infection usually develop within 2-3 weeks of exposure, but vary greatly from person to person with as many as half of humans infected with C. burnetii not showing any symptoms. Common symptoms include: high fevers, severe headache, malaise, myalgia, chills and/or sweats, non-productive cough, nausea, vomiting, diarrhea, abdominal pain and chest pain.

OUTCOMES The estimated case fatality rate is less than 2% of hospitalized patients. Endocarditis (inflammation in the heart) is the major form of chronic disease, comprising 60-70% of all reported cases. The estimated case fatality rate in untreated patients with endocarditis is 25%-60%.

PREVENTION A vaccine for Q fever has been developed and has successfully protected humans in occupational settings in Australia, but is not available in the U.S. where Q fever outbreaks have resulted mainly from occupational exposure involving veterinarians, meat processing plant workers, sheep and dairy workers, livestock farmers, and researchers at facilities housing sheep. Respiratory protection and good hygiene are primary protective measures.

TREATMENT Doxycycline is the first line treatment. If the patient is treated within the first 3 days of the disease, fever generally subsides within 72 hours. Patients with endocarditis require early diagnosis and long-term antibiotic treatment (at least 18 months) for a successful outcome.
**Rabies**

Also known as Lyssa, mad dog disease

**AGENT** Rabies virus

**TRANSMISSION** The rabies virus is transmitted through saliva or brain/nervous system tissue of an infected animal. The disease can only be acquired by coming in contact with these specific bodily excretions and tissues and is most often transmitted through the bite of a rabid animal.

**EPIDEMIOLOGY** Rabies is found on all continents except Antarctica. Any mammal can get rabies. The most common wild reservoirs of rabies are raccoons, skunks, bats, foxes, and coyotes. Cats, cattle, and dogs are the most frequently reported rabid domestic animals in the U.S. Annually, more than 15 million people receive post-exposure treatment to avert the disease.

**THREAT** The primary threat to disaster response workers is encountering rabid animals whose habitat has been disturbed in a natural disaster. Of the thousands of cases of human rabies that occur yearly, only one has ever survived once symptoms appear, demonstrating how dangerous this disease can be if vaccination does not occur soon after exposure.

**SYMPTOMS** The early symptoms of rabies in people are similar to that of many other illnesses, including fever, headache, and general weakness or discomfort. As the disease progresses, more specific symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hyper salivation, difficulty swallowing, and hydrophobia (fear of water).

**OUTCOMES** Rabies in humans is 100% preventable through prompt appropriate medical care. Yet, more than 55,000 people, mostly in Africa and Asia, die from rabies every year. The number of rabies-related human deaths in the U.S. has declined to one or two per year since the 1990's. The most recent fatality, in 2012 in Massachusetts, was due to contact, while sleeping, with an infected bat.

**PREVENTION** Disease prevention includes administration of both passive antibody, through an injection of human immune globulin and a round of injections with rabies vaccine. Rabies vaccinations should be kept up-to-date for all cats, ferrets, and dogs. If a human exposure is suspected, wash the wound with soap and water and seek immediate medical attention as it is essential to treat before symptoms appear.

**TREATMENT** In the U.S., post-exposure prophylaxis consists of a regimen of one dose of immune globulin and four doses of rabies vaccine over a 14-day period. Treatment before symptoms appear usually prevents infection. Once clinical signs of rabies appear, the disease is nearly always fatal, and treatment is typically supportive.
Ricin poisoning

AGENT  Ricin toxin from *Ricinus communis* (castor beans)

TRANSMISSION  Ricin is a poison found naturally in castor beans and is the waste product in the production of caster oil. Accidental exposure to ricin is highly unlikely, except through the ingestion of castor beans. As a biowarfare agent, ricin could be released through the air, food, or water. Ricin poisoning is not contagious and cannot be spread from person to person through casual contact.

EPIDEMIOLOGY  Although there has been relatively little human experience with the ricin toxin, poisoning can occur following inhalation, ingestion, or injection of the toxin. Ricin poisoning has occurred in suicide attempts, following accidental ingestion of castor beans, and in acts of bioterrorism and assassination.

THREAT  A Category B agent, Ricin is produced easily and inexpensively, is highly toxic, relatively stable in aerosolized form, and has no treatment or approved vaccine. However, its toxicity when compared to living replicating biological agents limits its use as a bioweapon because a large amount of ricin is necessary to produce a weapon of mass destruction. Ricin would, however, be effective as an agent of assassination or sabotage. If used as a food or water contaminant it could kill many and overwhelm local healthcare resources. In the US, radical survivalists produced ricin and used it to assassinate some law enforcement officials.

SYMPTOMS  Effects of ricin poisoning depend on whether the agent is inhaled, ingested, or injected. Within a few hours of inhaling significant amounts of ricin, the likely symptoms would be respiratory distress, fever, cough, nausea, and tightness in the chest. Heavy sweating may follow as well as fluid building up in the lungs resulting in respiratory failure. Ingestion of a significant amount of ricin results in vomiting and diarrhea that may become bloody followed by severe dehydration and organ failure. Ricin is unlikely to be absorbed through normal skin. Contact with ricin powders or products may cause redness and pain of the skin and the eyes.

OUTCOMES  Death from ricin poisoning could take place within 36 to 72 hours of exposure, depending on the route of exposure (inhalation, ingestion, or injection) and the dose received.

PREVENTION  Because no antidote exists, avoiding exposure is the only effective precautionary measure. If exposed, remove clothing, rapidly wash the entire body with soap and water, and get medical care as quickly as possible.

TREATMENT  Symptomatic ricin poisoning is treated by giving victims supportive medical care to minimize the effects of the poisoning. Care could include such measures as helping victims breathe, administering intravenous fluids and medications to treat conditions such as seizure and low blood pressure, flushing stomachs with activated charcoal (if the ricin has been very recently ingested), or flushing irritated eyes with water.
Smallpox

AGENT Variola virus

TRANSMISSION There are two clinical forms of smallpox. Variola major is the severe and most common form of smallpox, with a more extensive rash and higher fever. Variola minor is a less common presentation of smallpox, and a much less severe disease. There are four types of variola major smallpox: ordinary (the most frequent type, accounting for 90% or more of cases); modified (mild and occurring in previously vaccinated persons); flat; and hemorrhagic (both rare and very severe). Generally, direct and fairly prolonged face-to-face contact is required to spread smallpox from one person to another. Smallpox also can be spread through direct contact with infected bodily fluids or contaminated objects such as bedding or clothing. Rarely, smallpox has been spread by virus carried in the air in enclosed settings such as buildings, buses, and trains.

EPIDEMIOLOGY Smallpox outbreaks have occurred from time to time for thousands of years, but the disease is now eradicated after a successful worldwide vaccination program. The last case of smallpox in the U.S. was in 1949. The last naturally occurring case in the world was in Somalia in 1977. After the disease was eliminated, routine vaccination against smallpox among the general public was stopped because it was no longer necessary for prevention.

THREAT Although naturally occurring smallpox has been eradicated, laboratory or genetically engineered strains of the virus could be used by a rogue nation or acquired by a terrorist. The smallpox virus is classified as a Category A agent due to its high mortality, contagiousness, and potential for aerosolization. While a smallpox vaccine exists, typically only medical and military personnel undergo vaccination — so the population at large is at risk.

SYMPTOMS Following exposure, the incubation period averages about 12 to 14 days but can range from 7 to 17 days. Thereafter, symptoms are flu-like with fever, occasionally vomiting, mouth sores and blisters, and a skin rash that starts with flat red sores that become raised bumps that turn into fluid-filled blisters that become pustules that crust over and scab, eventually falling off. The person is contagious until all the scabs have fallen off.

OUTCOMES Historically, variola major has an overall fatality rate of about 30%; however, flat and hemorrhagic smallpox are usually fatal. Historically, death rates of variola minor have been 1% or less.

PREVENTION Vaccination is the only preventive strategy.

TREATMENT There is no specific treatment. Vaccination within 3-4 days of exposure may help reduce the severity of smallpox disease, and in some cases even prevent it. There are drugs that have shown efficacy in animal models that are likely to be used in humans if an outbreak should occur.
Staphylococcal enterotoxin B (SEB) poisoning

Also known as classic food poisoning

**AGENT** SEB is a toxin excreted by the *Staphylococcus aureus* bacterium.

**TRANSMISSION** Staphylococcal enterotoxin B is toxic by inhalation and ingestion. In nature, *Staphylococcus* species thrive and produce toxins in unrefrigerated meats, dairy, and bakery products. SEB is the toxin most commonly associated with classic food poisoning.

**EPIDEMIOLOGY** The actual incidence of SEB-related food poisoning is unknown; many cases are so mild that patients do not seek treatment. Very young and elderly persons are the most susceptible.

**THREAT** SEB is an incapacitating biowarfare toxin classified by the CDC as a Category B agent. SEB is considered a potent biological warfare agent because it can easily be produced and aerosolized; is very stable; difficult to diagnose, is incapacitating at low doses and may cause death when inhaled or ingested at very high dosages. Being very stable, the toxin remains active even after the contaminating bacteria are killed, and it can withstand boiling at 100°C for a few minutes.

**SYMPTOMS** After either gastrointestinal or inhalational exposure, a nonspecific flu-like illness may develop, with symptoms to include headache, chills, and fever. After ingestion, the incubation period is usually 4 to 10 hours. After an aerosol exposure, the symptoms usually appear after 3 to 12 hours. In inhalation of aerosolized SEB, patients are acutely and significantly short of breath and complain of severe substantial chest pain. Respiratory symptoms may include nonproductive cough and chest pain. Fevers can range from 103º-106ºF and may last up to 5 days. The cough may last up to 4 weeks.

**OUTCOMES** Significant morbidity occurs after either ingestion or aerosol exposure. The estimated morbidity rate after inhalation could be 50 to 80% or greater. The clinical signs and outcome depend on the dose of toxin and route of exposure. High mortality rates are not expected to occur after ingestion; in natural cases of food poisoning, death is very rare but may be seen in infants, the elderly or those who are severely debilitated. Most treated patients are also expected to survive aerosol exposure, although deaths may occur in severe cases.

**PREVENTION** A protective mask is currently the best method to prevent aerosol exposure.

**TREATMENT** The treatment is supportive; respiratory support may be necessary after aerosol exposure. Vaccines and antisera are not currently available, but have been promising in animal studies.
**Typhoid Fever**

Also called Typhoid

**AGENT** The bacterium *Salmonella enterica* subsp. *enterica* serovar Typhi

**TRANSMISSION** *S.Typhi* lives only in humans. Persons with typhoid fever carry the bacteria in their bloodstream and intestinal tract. In addition, a small number of persons, called carriers, recover from typhoid fever but continue to carry the bacteria. Both ill persons and carriers shed *S. Typhi* in their feces. The disease is transmitted by eating food or drinking beverages that have been handled by a person who is shedding *S.Typhi* or if sewage contaminated with *S. Typhi* bacteria enters the water you use for drinking or washing food. Typhoid fever is more common in areas of the world where hand washing is less frequent and water supplies are likely to be contaminated with sewage.

**EPIDEMIOLOGY** Typhoid fever is common in most parts of the world except in industrialized regions such as the U.S., Canada, Western Europe, Australia, and Japan. In the developing world it affects about 21.5 million persons each year. In the U.S. about 400 cases occur each year, and 75% of these are acquired while traveling internationally. Worldwide there are approximately 200,000 deaths from typhoid fever every year.

**THREAT** A natural or intentional disaster that compromises sewage and water treatment facilities is the primary threat to disaster response workers.

**SYMPTOMS** Persons with typhoid fever usually have a sustained fever. They may also feel weak, or have stomach pains, headache, or loss of appetite. In some cases, patients have a rash of flat, rose-colored spots.

**OUTCOMES** Without therapy, the illness may last for 3 to 4 weeks and death rates range between 12% and 30%. With antibiotics and supportive care, mortality has been reduced to 1%-2%.

**PREVENTION** Getting vaccinated and avoiding risky foods and drinks are primary preventive measures. During a disaster, where the public water sources have been contaminated, use bottled or purified water for drinking and washing.

**TREATMENT** With appropriate antibiotic therapy, there is usually improvement within one to two days and recovery within seven to 10 days. Even if symptoms seem to go away, patients may still be carrying *S.Typhi*. If so, the illness could return, or be transmitted to others. As a result, workers who handle food or care for small children, may be barred from returning to work until a doctor has determined that the typhoid bacteria have been eliminated.
Tularemia

Also known as Rabbit fever, deerfly fever, Pahvant Valley plague, Ohara disease

AGENT The bacterium *Francisella tularensis* (*tularensis* 
tularensis and tularensis holarctica)

TRANSMISSION The bacterium that causes tularemia is highly infectious and can enter the human body through the skin, eyes, mouth, throat, or lungs. Humans can become infected through several routes, including: tick and deer fly bites; broken skin or mucous membrane contact with infected animals; ingestion of contaminated water or animal products; laboratory exposure; inhalation of contaminated dusts or aerosols. Transmission of tularemia from person to person has not been reported, however infectious organisms can be found in blood, lesions, and tissues.

EPIDEMIOLOGY In the U.S., naturally occurring infections have been reported from all states except Hawaii. Approximately 120 cases of tularemia are reported each year in the U.S..

THREAT The agent for tularemia is one of the most infectious bacteria known. A small number of organisms are required for infection and, if untreated, more than a quarter of those infected may die. It was incorporated in the biological arsenal of the U.S. during the 1950s and 60s. As a result, the agent is classified as a Category A biological weapon. The disease is an occupational hazard for landscapers, hunters, butchers, farmers, veterinarians and others in contact with infected animals or animal products.

SYMPTOMS The signs and symptoms of tularemia vary depending on how the bacteria enter the body. Illness ranges from mild to life-threatening. Main forms of this disease include: (1) Ulceroglandular, the most common form that usually occurs following a tick or deer fly bite or after handling an infected animal. A skin ulcer appears at the exposure site accompanied by swelling of regional lymph glands; (2) Glandular is similar to ulceroglandular but without an ulcer. (3) Oculoglandular occurs when the bacteria enter through the eye. Symptoms include irritation and inflammation of eye and swelling of lymph glands in front of the ear. (4) Oropharyngeal results from eating or drinking contaminated food or water producing sore throat, mouth ulcers, tonsillitis, and swelling of lymph glands in the neck. (5) Pneumonic is the most serious form of tularemia that results from breathing dusts or aerosols containing the bacteria. Symptoms include cough, chest pain, and difficulty breathing.

OUTCOMES *F. tularensis* tularensis is the most virulent strain, causing disease that is fatal in between 5% and 30% of untreated cases. Antibiotics have reduced the overall case fatality rate to 1-3%.

PREVENTION Steps to prevent tularemia include the use of insect repellent and wearing protective clothing; wearing gloves when handling sick or dead animals; and using respiratory protection against aerosols.

TREATMENT Although tularemia can be life threatening, most infections can be treated successfully with antibiotics and most patients completely recover. Treatment usually lasts 10 to 21 days depending on the stage of illness and the medication used.
T-2 Mycotoxicosis

T-2 Mycotoxin poisoning

AGENT  In the family of trichothecene mycotoxins

TRANSMISSION  Mycotoxins are naturally occurring toxins produced by the *Fusarium* species fungi and are common in many household molds. Unlike most biological agents that do not affect the skin, T-2 mycotoxin is a potent dermal irritant that can be absorbed through intact skin. It is the only known biologically active toxin that can cause disease through dermal, gastrointestinal and inhalational exposure.

EPIDEMIOLOGY  Trichothecene mycotoxin exposures in the U.S. have largely been due to accidental ingestion of contaminated foods such as moldy wheat or corn grain. No well-documented epidemiologic information is available for exposure to T-2 mycotoxin as a result of bioweapon deployment other than alleged uses in some military conflicts.

THREAT  Although proof is lacking, allegations of the use of T2 mycotoxins are common. T-2 mycotoxin was reportedly used during the military conflicts in Laos (1975-81), Kampuchea (1979-81), and Afghanistan (1979-81) to produce lethal and nonlethal casualties, however, most authorities consider the allegations propaganda. T-2 mycotoxins can be delivered in food or water sources, as well as through droplets, aerosols, or smoke from various dispersal systems and exploding munitions.

SYMPTOMS  Exposure causes skin pain and redness. Effects on the airway include nose and throat pain, nasal discharge, itching and sneezing, cough, wheezing and chest pain. Toxin also produces effects after ingestion or eye contact. Severe poisoning results in prostration, weakness, collapse and shock.

OUTCOMES  No human mortality or morbidity data are reported for T-2 mycotoxin use as a bioweapon. Information regarding mortality from ingestion of contaminated food is quite varied, ranging from 10 to 60%.

PREVENTION  The best defense is to wear a protective mask and clothing during an attack.

TREATMENT  No specific antidote exists for this toxin. General supportive care is used to treat most symptoms. Washing the contaminated area of the skin within 6 hours post exposure can remove 80-98% of the toxin and has been demonstrated to prevent skin lesions and death in experimental animals.