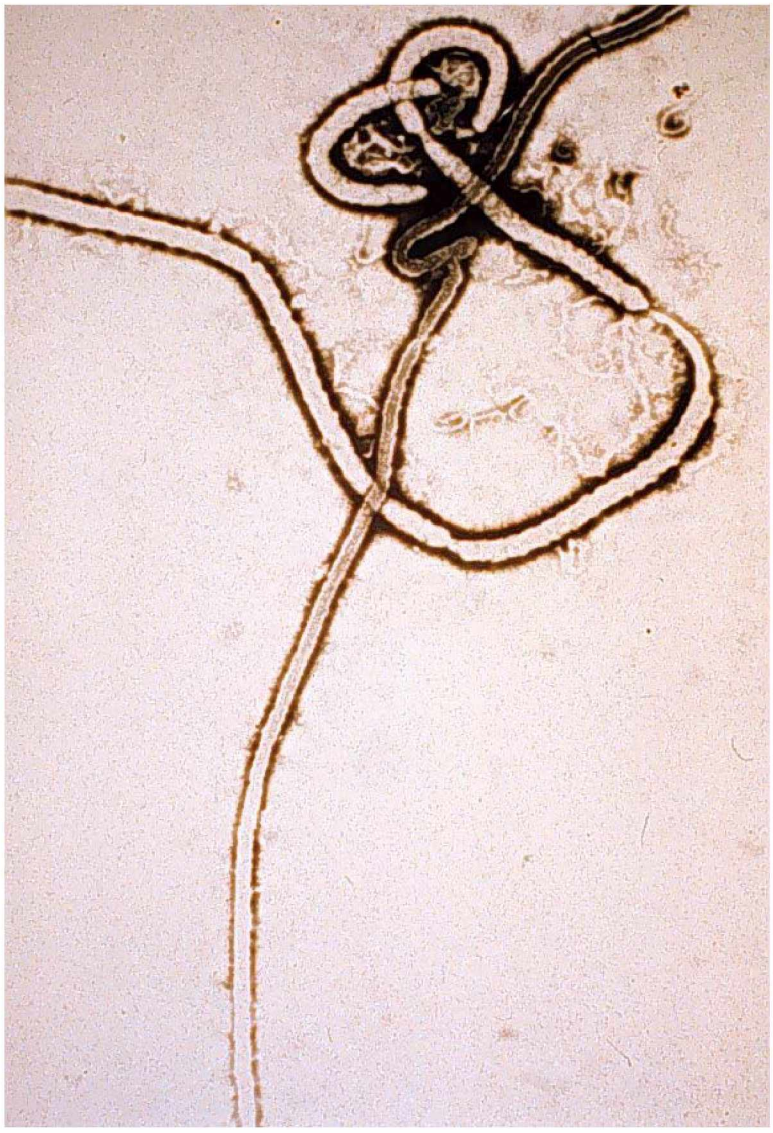
Ebola Hemorrhagic Fever Information Packet



Picture: an Electron Micrograph of the Ebola Virus
Courtesy: Centers for Disease Control and Prevention

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Ebola Hemorrhagic Fever
Fact Sheet

What is Ebola hemorrhagic fever?

Ebola hemorrhagic fever (Ebola HF) is a severe, often-fatal disease in humans and nonhuman primates (monkeys, gorillas, and chimpanzees) that has appeared sporadically since its initial recognition in 1976. The disease is caused by infection with Ebola virus, named after a river in the Democratic Republic of the Congo (formerly Zaire) in Africa, where it was first recognized. The virus is one of two members of a family of RNA viruses called the Filoviridae. There are five identified subtypes of Ebola virus. Four of the five have caused disease in humans: Ebola-Zaire, Ebola-Sudan, Ebola-Ivory Coast and Ebola-Bundibugyo. The fifth, Ebola-Reston, has caused disease in nonhuman primates, but not in humans.

Where is Ebola virus found in nature?

The exact origin, locations, and natural habitat (known as the "natural reservoir") of Ebola virus remain unknown. However, on the basis of available evidence and the nature of similar viruses, researchers believe that the virus is zoonotic (animal-borne) with four of the five subtypes occurring in an animal host native to Africa. A similar host, most likely in the Philippines, is probably associated with the Ebola-Reston subtype, which was isolated from infected cynomolgous monkeys that were imported to the United States and Italy from the Philippines. The virus is not known to be native to other continents, such as North America.

Where do cases of Ebola hemorrhagic fever occur?

Confirmed cases of Ebola HF have been reported in the Democratic Republic of the Congo, Gabon, Sudan, the Ivory Coast, Uganda, and the Republic of the Congo. No case of the disease in humans has ever been reported in the United States. Ebola-Reston virus caused severe illness and death in monkeys imported to research facilities in the United States and Italy from the Philippines; during these outbreaks, several research workers became infected with the virus, but did not become ill.

Ebola HF typically appears in sporadic outbreaks, usually spread within a health-care setting (a situation known as amplification). It is likely that sporadic, isolated cases occur as well, but go unrecognized. A table showing a chronological list of known cases and outbreaks is available below.

How is Ebola virus spread?

Infections with Ebola virus are acute. There is no carrier state. Because the natural reservoir of the virus is unknown, the manner in which the virus first appears in a human at the start of an outbreak has not been determined. However, researchers have hypothesized that the first patient becomes infected through contact with an infected animal.

After the first case-patient in an outbreak setting is infected, the virus can be transmitted in several ways. People can be exposed to Ebola virus from direct contact with the blood and/or secretions of an infected person. Thus, the virus is often spread through families and friends because they come in close contact with such secretions when caring for infected persons. People can also be exposed to Ebola virus through contact with objects, such as needles, that have been contaminated with infected secretions.

Nosocomial transmission refers to the spread of a disease within a health-care setting, such as a clinic or hospital. It occurs frequently during Ebola HF outbreaks. It includes both types of transmission described above. In African health-care facilities, patients are often cared for without the use of a mask, gown, or gloves. Exposure to the virus has occurred when health care workers treated individuals with Ebola HF without wearing these types of protective clothing. In addition, when needles or syringes are used, they may not be of the disposable type, or may not have been sterilized, but only rinsed before reinsertion into multi-use vials of medicine. If needles or syringes become contaminated with virus and are then reused, numerous people can become infected.

How is Ebola virus spread? (continued)

Ebola-Reston appeared in a primate research facility in Virginia, where it may have been transmitted from monkey to monkey through the air. While all Ebola virus species have displayed the ability to be spread through airborne particles (aerosols) under research conditions, this type of spread has not been documented among humans in a real-world setting, such as a hospital or household.

What are the symptoms of Ebola hemorrhagic fever?

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, and stomach pain. A rash, red eyes, hiccups and internal and external bleeding may be seen in some patients.

Researchers do not understand why some people are able to recover from Ebola HF and others are not. However, it is known that patients who die usually have not developed a significant immune response to the virus at the time of death.

How is Ebola hemorrhagic fever clinically diagnosed?

Diagnosing Ebola HF in an individual who has been infected only a few days is difficult because early symptoms, such as red eyes and a skin rash, are nonspecific to the virus and are seen in other patients with diseases that occur much more frequently. However, if a person has the constellation of symptoms described above, and infection with Ebola virus is suspected, isolate the patient and notify local and state health departments and the CDC.

What laboratory tests are used to diagnose Ebola hemorrhagic fever?

Antigen-capture enzyme-linked immunosorbent assay (ELISA) testing, IgM ELISA, polymerase chain reaction (PCR), and virus isolation can be used to diagnose a case of Ebola HF within a few days of the onset of symptoms. Persons tested later in the course of the disease or after recovery can be tested for IgM and IgG antibodies; the disease can also be diagnosed retrospectively in deceased patients by using immunohistochemistry testing, virus isolation, or PCR.

How is Ebola hemorrhagic fever treated?

There is no standard treatment for Ebola HF. Patients receive supportive therapy. This consists of balancing the patient's fluids and electrolytes, maintaining their oxygen status and blood pressure, and treating them for any complicating infections.

How is Ebola hemorrhagic fever prevented?

The prevention of Ebola HF in Africa presents many challenges. Because the identity and location of the natural reservoir of Ebola virus are unknown, there are few established primary prevention measures.

If cases of the disease do appear, current social and economic conditions often favor the spread of an epidemic within health-care facilities. Therefore, health-care providers must be able to recognize a case of Ebola HF should one appear. They must also have the capability to perform diagnostic tests and be ready to employ practical viral hemorrhagic fever isolation precautions, or barrier nursing techniques. These techniques include the wearing of protective clothing, such as masks, gloves, gowns, and goggles; the use of infection-control measures, including complete equipment sterilization; and the isolation of Ebola HF patients from contact with unprotected persons. The aim of all of these techniques is to avoid any person's contact with the blood or secretions of any patient. If a patient with Ebola HF dies, it is equally important that direct contact with the body of the deceased patient be prevented.

How is Ebola hemorrhagic fever prevented? (continued)

CDC has developed a set of tools to meet health-care facilities' needs. In conjunction with the World Health Organization, CDC has developed practical, hospital-based guidelines, entitled Infection Control for Viral Haemorrhagic Fevers in the African Health Care Setting. The manual describes how to recognize cases of viral hemorrhagic fever, such as Ebola HF, and prevent further nosocomial transmission by using locally available materials and few financial resources. Similarly, a practical diagnostic test that uses tiny samples from patients' skin has been developed to retrospectively diagnose Ebola HF in suspected case-patients who have died.

What challenges remain for the control and prevention of Ebola hemorrhagic fever?

Scientists and researchers are faced with the challenges of developing additional diagnostic tools to assist in early diagnosis of Ebola HF and conducting ecological investigations of Ebola virus and its possible reservoir. In addition, one of the research goals is to monitor suspected areas to determine the incidence of the disease. More extensive knowledge of the natural reservoir of Ebola virus and how the virus is spread must be acquired to prevent future outbreaks effectively.

Unsure about some of the terms used above? See the **glossary of terms** enclosed in the packet.

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For more information on viral hemorrhagic fevers,
see the SPB web page at http://www.cdc.gov/ncidod/dvrd/spb/index.htm.

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Ebola Hemorrhagic Fever
Case Count and Location List

Year	Ebola Species	Country	No. of Human Cases	Reported no.(%) of Deaths Among Cases	Situation
1976	Ebola-Zaire	Zaire	318	280(88%)	Occurred in Yambuku and surrounding area. Disease was spread by close personal contact and by use of contaminated needles and syringes in hospitals/clinics. This was the first recognition of the disease.
1976	Ebola-Sudan	Sudan	284	151(53%)	Occurred in Nzara, Maridi and the surrounding area. Disease was spread mainly through close personal contact within hospitals. Many medical care personnel were infected.
1976	Ebola-Sudan	England	1	0(0%)	Laboratory infection by accidental stick of contaminated needle.
1977	Ebola-Zaire	Zaire	1	1(100%)	Noted retrospectively in the village of Tandala.
1979	Ebola-Sudan	Sudan	34	22(65%)	Occurred in Nzara. Recurrent outbreak at the same site as the 1976 Sudan epidemic.
1989	Ebola-Reston	USA	0	0(0%)	Ebola-Reston virus was introduced into quarantine facilities in Virginia and Pennsylvania by monkeys imported from the Philippines.
1990	Ebola-Reston	USA	4 (Asymptomatic)	0(0%)	Ebola was introduced once again into quarantine facilities in Virginia and Texas by monkeys imported from the Philippines. Four humans developed antibodies but did not get sick.
1989-1990	Ebola-Reston	Philippines	3 (asymptomatic)	0(0%)	High mortality among cynomolgus macaques in a primate facility responsible for exporting animals in the USA. Three workers in the animal facility developed antibodies but did not get sick.
1992	Ebola-Reston	Italy	0	0(0%)	Ebola-Reston was introduced into quarantine facilities in Sienna by monkeys imported from the same export facility in the Philippines that was involved in the episodes in the United States. No humans were infected.
1994	Ebola-Zaire	Gabon	52	31(60%)	Occurred in Mékouka and other gold-mining camps deep in the rain forest. Initially thought to be yellow Fever; identified as Ebola hemorrhagic fever in 1995.
1994	Ebola-Ivory Coast	Ivory Coast	1	0(0%)	Scientist became ill after conducting an autopsy on a wild chimpanzee in the Tai Forest. The patient was treated in Switzerland.
1995	Ebola-Zaire	Zaire	315	250(81%)	Occurred in Kikwi and surrounding area. Traced to index case-patient who worked in forest adjoining the city. Epidemic spread through families and hospitals.
1996 (Jan-Apr)	Ebola-Zaire	Gabon	37	21(57%)	Occurred in Mayibout area. A chimpanzee found dead in the forest was eaten by people hunting for food. Nineteen people who were involved in the butchery of the animal became ill; other cases occurred in family members.
1996 (Jul-Jan)	Ebola-Zaire	Gabon	60	45(74%)	Occurred in Booué area with transport of patients to Libreville. Index case-patient was a hunter who lived in a forest camp. Disease was spread by close contact with infected persons. A dead chimpanzee found in the forest at the time was determined to be infected.
1996	Ebola-Zaire	South Africa	2	1(50%)	A medical professional traveled from Gabon to Johannesburg, South Africa, after having treated Ebola virus-infected patients and thus having been exposed to the virus there. He was hospitalized, and a nurse who took care of him became infected and died.

Year	Ebola Species	Country	No. of Human Cases	Reported No.(%) of Deaths Among Cases	Situation
1996	Ebola-Reston	USA	0	0(%)	Ebola-Reston virus was introduced into a quarantine facility in Texas by monkeys imported from the Philippines. No human infections were identified.
1996	Ebola-Reston	Philippines	0	0(0%)	Ebola-Reston virus was identified in a monkey export facility in the Philippines. No human infections were identified.
2000-2001	Ebola-Sudan	Uganda	425	224(53%)	Occurred in Gulu, Masindi, and Mbarara districts of Uganda. The three most important risks associated with Ebola virus infection were attending funerals of Ebola hemorrhagic case-patients, having contact with case-patients in one's family, and providing medical care to Ebola case-patients without adequate personal protective measures.
2001-2001 (Oct'01-Mar'02)	Ebola-Zaire	Gabon	65	53(82%)	Outbreak occurred over the border of Gabon and the Republic of the Congo.
2001-2002 (Oct'01-Mar'02)	Ebola-Zaire	Republic of the Congo	57	43(75%)	Outbreak occurred over the border of Gabon and the Republic of the Congo. This was the first time Ebola hemorrhagic fever was reported in the Republic of the Congo.
2002-2003 (Dec'02-Apr'03)	Ebola-Zaire	Republic of Congo	143	128(89%)	Outbreak occurred in the districts of Mbomo and Kéllé in Cuvette Ouest Département.
2003 (Nov-Dec)	Ebola-Zaire	Republic of Congo	35	29(83%)	Outbreak occurred in Mbomo and Mbandza villages located in the Mbomo district, Cuvette Ouest Département
2004	Ebola-Sudan	Sudan	17	7(41%)	Outbreak occurred in Yambio county of southern Sudan. This was concurrent with an outbreak of measles in the same area, and several suspected EHF cases were later reclassified as measles cases.
2007	Ebola-Zaire	Democratic Republic of the Congo	264	187(71%)	Outbreak occurred in Kasai Occidental Province. The outbreak was declared over November 20. Last confirmed case on October 4 and last death on October 10.
Dec 2007 -Jan 2008	Ebola-Bundibugyo	Uganda	149	37(25%)	Outbreak occurred in Bundibugyo District in Uganda. First reported occurrence of a new strain.
Nov 2008	Ebola-Reston	Philippines	6 (asymptomatic)	0(0%)	First known occurrence of Ebola-Reston in pigs. Strain closely related to earlier strains. Six workers from the pig farm and slaughterhouse developed antibodies but did not become sick.
Dec 2008-Feb 2009	Ebola-Zaire	Democratic Republic of the Congo	32	15(47%)	Outbreak occurred in the Mweka and Luebo health zones of the Province of Kasai Occidental.

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Glossary of Terms

Below you will find an alphabetical listing of common terms used in articles about viral hemorrhagic fevers. These terms occur frequently in epidemiological and health prevention literature.

aerosol:
A fine mist or spray which contains minute particles.

antibody:
Proteins produced by an organism's immune system to recognize foreign substances.

antigen:
Any substance that stimulates an immune response by the body. The immune system recognizes such substances as being foreign, and produces cellular antibodies to fight them. Antigen/antibody response is an important part of a person's immunity to disease.

assay:
Quantitative or qualitative evaluation, or test, of a substance. Frequently used to describe tests of the presence or concentration of infectious agents, antibodies, etc.

biosafety level:
Specific combinations of work practices, safety equipment, and facilities, which are designed to minimize the exposure of workers and the environment to infectious agents. Biosafety level 1 applies to agents that do not ordinarily cause human disease. Biosafety level 2 is appropriate for agents that can cause human disease, but whose potential for transmission is limited. Biosafety level 3 applies to agents that may be transmitted by the respiratory route which can cause serious infection. Biosafety level 4 is used for the diagnosis of exotic agents that pose a high risk of life-threatening disease, which may be transmitted by the aerosol route and for which there is no vaccine or therapy.

carrier:
A person or animal that harbors a specific infectious agent without visible symptoms of the disease. A carrier acts as a potential source of infection.

case-fatality proportion:
The number of cases of a disease ending in death compared to the number of cases of the disease. Usually expressed as a percentage. While deaths from other diseases are often expressed as mortality rates, SPB normally uses case-fatality proportions. The is due to the fact that rates include a time determinant - for example, 100 deaths per 1000 cases per year. However, the diseases with which SPB works break out sporadically, and occur as brief epidemics.

case-to-infection ratio or proportion:
The number of cases of a disease (in humans) compared to the number of infections with the agent that causes the disease (in humans).

disease:
Formally speaking, a disease is the condition in which the functioning of the body or a part of the body is interfered with or damaged. In a person with an infectious disease, the infectious agent that has entered the body causes it to function abnormally in some way or ways. The type of abnormal functioning that occurs is the disease. Usually the body will show some signs and symptoms of the problems it is having with functioning. Disease should not be confused with infection.

Glossary of Terms

ELISA (enzyme-linked-immunosorbent serologic assay):
A technique that relies on an enzymatic conversion reaction. It is used to detect the presence of specific substances, such as enzymes, viruses, antibodies or bacteria.

endemic:
Disease that is widespread in a given population.

enzootic:
A disease which is constantly present in the animal community, but only occurs in a small number of cases.

epidemic:
The occurrence of cases of an illness in a community or region which is in excess of the number of cases normally expected for that disease in that area at that time.

epizootic:
An outbreak or epidemic of disease in animal populations.

host:
An organism in which a parasite lives and by which it is nourished.

IgG:
One of many antibodies present in blood serum which is usually indicative of a recent or remote infection. IgG is most prevalent about 3 weeks after an infection begins.

IgM:
One of many antibodies present in blood serum which is usually indicative of an acute infection.

immunohistochem istry:
A type of assay in which specific antigens are made visible by the use of fluorescent dye or enzyme markers.

infection:
The entry and development of an infectious agent in the body of a person or animal. In an apparent "manifest" infection, the infected person outwardly appears to be sick. In an apparent infection, there is no outward sign that an infectious agent has entered that person at all. For example, although humans have become infected with Ebola-Reston, a species of Ebola virus, they have not shown any sign of illness. By contrast, in recorded outbreaks of Ebola hemorrhagic fever caused by Ebola-Zaire, another species of Ebola virus, severe illness followed infection with the virus, and a great proportion of the case-patients died. Infection should not be confused with disease.

noscomial infection:
An infection occurring in a patient which is acquired at a hospital or other healthcare facility. Commonly called a cross infection.

report of a disease:
An official report that notifies an appropriate health authority of the occurrence of a disease in a human or in an animal. Human diseases usually are reported first to the local health authority, such as a county health department.

reservoir:
Any person, animal, arthropod, plant, soil or substance in which an infective agent normally lives and multiplies. The infectious agent primarily depends on the reservoir for its survival.

Glossary of Terms

risk:

A) The chance of being exposed to an infectious agent by its specific transmission mechanism.
B) The chance of becoming infected if exposed to an infectious agent by its specific transmission mechanism.

RT-PCR (reverse transcriptase polymerase chain reaction):

Powerful technique for producing millions of copies of specific parts of the genetic code of an organism so that it may be readily analyzed. More specifically, RT-PCR produces copies of a specific region of complementary DNA that has been converted from RNA. The technique is often used to help in the identification of an infectious agent.

surveillance of disease:

The ongoing systematic collection and analysis of data and the provision of information which leads to action being taken to prevent and control an infectious disease.

transmission of infectious agents (such as a virus):

Any mechanism through which an infectious agent, such as a virus, is spread from a reservoir (or source) to a human being. Usually each type of infectious agent is spread by only one or a few of the different mechanisms.

There are several types of transmission mechanisms:

a) Direct transmission:

This type of transmission is, at base, immediate. The transfer of the infectious agent is, as the name implies, directly into the body. Different infectious agents may enter the body using different routes. Some routes by which infectious diseases are spread directly include personal contact, such as touching, biting, kissing or sexual intercourse. In these cases the agent enters the body through the skin, mouth, an open cut or sore, or sexual organs. Infectious agents may spread by tiny droplets of spray directly into the conjunctiva (the mucus membranes of the eye), or the nose or mouth during sneezing, coughing, spitting, singing or talking (although usually this type of spread is limited to about within one meter's distance.) This is called droplet spread.

b) Indirect transmission:

Indirect transmission may happen in any of several ways:

Vehicle-borne transmission:

In this situation, a vehicle—that is, an inanimate object or material called in scientific terms a "fomite"—becomes contaminated with the infectious agent. The agent, such as a virus, may or may not have multiplied or developed in or on the vehicle. The vehicle contacts the person's body. It may be ingested (eaten or drunk), touch the skin, or be introduced internally during surgery or medical treatment. Examples of vehicles that can transmit diseases include cooking or eating utensils, bedding or clothing, toys, surgical or medical instruments (like catheters) or dressings. Water, food, drinks (like milk) and biological products like blood, serum, plasma, tissues or organs can also be vehicles.

Vector-borne transmission:

When researchers talk about vectors, often they are talking about insects, which as a group of invertebrate animals carry a host of different infectious agents. (However, a vector can be any living creature that transmits an infectious agent to humans.)

Vectors may mechanically spread the infectious agent, such as a virus or parasite. In this scenario the vector—for instance a mosquito— contaminates its feet or proboscis ("nose") with the infectious agent, or the agent passes through its gastrointestinal tract. The agent is transmitted from the vector when it bites or touches a person. In the case of an insect, the infectious agent may be injected with the insect's salivary fluid when it bites. Or the insect may regurgitate material or deposit feces on the skin, which then enter a person's body, typically through a bite wound or skin that has been broken by scratching or rubbing. In the case of some infectious agents, vectors are only capable of transmitting the disease during a certain time period. In these situations,

Vector-borne transmission (continued):
vectors play host to the agent. The agent needs the host to develop and mature or to reproduce (multiply) or both (called cyclopropagative). Once the agent is within the vector animal, an incubation period follows during which the agent grows or reproduces, or both, depending on the type of agent. Only after this phase is over does the vector become infective. That is, only then can it transmit an agent that is capable of causing disease in the person.

c) Airborne transmission:

In this type of transmission, infective agents are spread as aerosols, and usually enter a person through the respiratory tract. Aerosols are tiny particles, consisting in part or completely of the infectious agent itself, which become suspended in the air. These particles may remain suspended in the air for long periods of time, and some retain their ability to cause disease, while others degenerate due to the effects of sunlight, dryness or other conditions. When a person breathes in these particles, they become infected with the agent—especially in the alveoli of the lungs. (see also "aerosolization")

How do infectious aerosols get into the air?

Small particles of many different sizes contaminated with the infective agent may rise up from soil, clothes, bedding or floors when these are moved, cleaned or blown by wind. These dust particles may be fungal spores—infective agents themselves—tiny bits of infected feces, or tiny particles of dirt or soil that have been contaminated with the agent.

Droplet nuclei can remain in the air for a long time. Droplet nuclei are usually the small residues that appear when fluid emitted from an infected host evaporates. In the case of the virus causing hantavirus pulmonary syndrome, the rodent carriers produce urine. The act of spraying the urine may create the aerosols directly, or the virus particles may rise into the air as the urine evaporates. In other situations, the droplets may occur as an unintended result of mechanical or work processes or atomization by heating, cooling, or venting systems in microbiology laboratories, autopsy rooms, slaughterhouses or elsewhere.

Both kinds of particles are very tiny. Larger droplets or objects that may be sprayed or blown but that immediately settle down on something rather than remaining suspended, are not considered to belong to the airborne transmission mechanism. Such sprays are considered direct transmission.

vector:

A carrier which transmits infective agent from one host to another.

virus:

A virus is an extremely tiny infectious agent that is only able to live inside a cell. Basically, viruses are composed of just two parts. The outer part is a protective shell made of protein. This shell is often surrounded by another protective layer or envelope, made of protein or lipids (fats). The inner part is made of genetic material, either RNA or DNA. A virus does not have any other structures (called organelles) that living cells have, like a nucleus or mitochondria. These organelles are the tiny organs that maintain a cell's metabolism (life processes). A virus has no metabolism at all.

Because a virus lacks organelles, it cannot reproduce itself by itself. To reproduce, it invades a cell within the body of a human or other creature, called the host. Each type of virus has particular types of host creatures and host cells that it will invade successfully.

Once within the host cell, the virus uses the cell's own organelles to produce more viruses. In essence, the virus forces the cell to replicate the virus' own genetic material and protective shell. Once replicated, the new viruses leave the host cell and are ready to invade others.

zoonotic disease or infection:

An infection or infectious disease that may be transmitted from vertebrate animals (such as a rodent) to humans.

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