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THE UNIVERSITY OF HONG KONG

Fact Sheet on Environmental Samples: Biological Risks and Cleanup Procedures

1. Introduction

Collecting environmental samples, such as soil, water, air, or biological materials, is essential for research and public health assessments. This activity poses several biosafety risks that need to be carefully managed to ensure the safety of personnel and the environment. Environmental samples may contain bacteria, viruses, fungi, or parasites that can pose health risks. Samples from wildlife or agricultural settings may harbor animal waste, toxins and zoonotic pathogens, which can be transmitted from animals to humans.

What Are the Hazards?

Bird and Bat Waste

There are several pathogens associated with bird and bat droppings, including cryptococcosis and histoplasmosis (fungi) and psittacosis (bacteria). The cryptococcosis and histoplasmosis fungi occur naturally in soil, and therefore usually develop in bird droppings associated with soil. The psittacosis bacteria are found only in bird droppings and secretions and are not associated with bats or soil.

Bird droppings also possess risk of carrying Avian influenza viruses, such as H5N1, H5N6, H7N9 virus. Avian influenza viruses although primarily affects birds, some strains capable of infecting humans and other animals.

Bats harbor a greater diversity of viruses compared to other mammalian orders, attributable to their extensive geographical distribution and high viral tolerance due to their unique adaptive immune system that mitigates excessive inflammation. The zoonotic spillover of viruses, such as SARS-CoV-2, SARS-CoV-1, rabies, Nipah, Marburg, and Hendra, to human, has raised significant public health concerns.

These pathogens could be transmitted through direct contact with infected birds or bats, droppings, contaminated surfaces and aerosols. In addition, the simple act of clean-up can cause contaminates to become aerosolized. Exposure to these diseases occurs when the spores or aerosols are inhaled. Therefore, individuals who work in or cleanup areas heavily contaminated with droppings may become exposed when the material is disturbed or dust is created. Although these diseases are very rare, they can occur, especially in the young, elderly, and immuno-compromised individuals. However, they do not pose a significant health risk to HKU employees or students provided the “precautions to prevent exposure” outlined below are observed.

Contaminated soil and muddy water

Melioidosis is an infectious disease caused by the bacterium Burkholderia pseudomallei which can be found in contaminated soil and muddy water. It primarily affects humans and animals and is particularly prevalent in tropical and subtropical regions, especially Southeast Asia and Northern Australia. The route of transmission includes through cuts, wounds, or abrasions when a person comes into contact with contaminated soil or water and inhalation of aerosols containing the bacteria. Melioidosis cases have been recorded in Hong Kong every year.

Symptoms of Diseases

Cryptococcosis is most common in individuals with compromised immune systems, and the symptoms include meningitis, severe headache, mental disturbances, fever, blurred vision, and cough. Although the majority of individuals who acquire histoplasmosis have no symptoms, when symptoms do occur, they vary widely depending on the form of the disease. The acute disease is characterized by respiratory symptoms, general malaise, fever, chest pains, and a dry, non-productive cough. The chronic form of the disease resembles pulmonary tuberculosis and progresses over months or years.

Symptoms of psittacosis may include a low-grade fever that often becomes worse as the disease progresses, anorexia, sore throat, light sensitivity, and a severe headache.

Human avian influenza symptoms can vary depending on the strain but may include conjunctivitis, fever, cough, sore throat, muscle aches, vomiting and diarrhea. Severe respiratory illness can result in multi-organ failure or even fatal.

The initial symptoms of SARS-CoV infection resemble those of influenza, followed by lower respiratory tract symptoms such as cough and difficulty breathing. In severe cases, the illness can progress to respiratory failure.

Rabies remains a significant public health concern in over 150 countries. Initial symptoms consist of fever, pain, and unusual or unexplained tingling, pricking, or burning sensations at the wound site. Once the virus infects the brain and spinal cord, the fatal rate reaches 100%.

Nipah virus disease poses a serious and sometimes fatal threat. Early symptoms include fever, headache, cough, sore throat, and difficulty breathing. As the infection progresses, some individuals may experience brain swelling or encephalitis, severe symptoms including confusion, drowsiness, and seizures.

Marburg virus disease is a severe and often fatal illness in humans. Symptoms typically include sudden high fever, severe headache, non-itchy rash, and severe hemorrhage.

Hendra virus infection, although a rare emerging zoonosis, can lead to severe and often fatal disease in both infected horses and humans. Symptoms in humans typically manifest between one to three weeks after contact with an infected horse. Initial symptoms include fever, cough, sore throat, headache, and fatigue. In some cases, meningitis or encephalitis may develop, resulting in severe headache, high fever, drowsiness, and, in some instances, convulsions and coma.

Symptoms of melioidosis include fever, headache, cough, muscle aches and skin sores. In severe cases, it may lead to pneumonia, meningoencephalitis or septicemia. The disease can affect a single body system or the entire body, it is sometimes confused for other diseases and delayed diagnosis. Vaccine for melioidosis is not available yet.

Precautions to Prevent Exposure

1. Handling environmental samples

Precautions should always be taken when collecting environmental samples. Any procedures that concentrate the environmental samples, such as filtering and centrifugation, may increase the associated risks. Samples shall be stored and labeled properly, with secondary containers to avoid accidental spillage or spread of pathogens.

When collecting environmental samples:

1.1. Wear appropriate personal protective equipment or footwear when sampling in the fields, e.g. wearing gloves, work clothes (such as task-specific apron) and boots. Wear mask or respirator if dust or aerosols will be generated.

1.2. Wash hands thoroughly with soap and water after handling soil samples, or shower after extensive exposure to contaminated water or soil;

1.3. Always clean any wounds as soon as possible and cover any cuts or grazes with waterproof dressings.

2. Handling of clean up

If there are a small amount of bird/bat droppings in a localized area, only wet cleaning methods are recommended for cleaning. Never sweep, vacuum, or disturb droppings. Full disinfection is probably not possible but a wise precaution is to use a standard disinfectant for example diluted bleach. If bleach is used handle carefully with appropriate hand and eye protection, especially concentrated solutions, as this can cause serious chemical burns. Clothing can also be damaged if bleach is accidentally splashed or spilt on it.

When cleaning bird/bat droppings:

2.1. Wear latex or non-latex type rubber gloves (Latex sensitive individuals should wear rubber gloves).

2.2. Mix a disinfectant solution of 1 part bleach to 10 parts water (or use a different appropriate disinfectant).

2.3. Surround the contaminated area by absorbent, such as paper towels, soak the droppings with the disinfectant solution.

2.4. After the droppings are thoroughly wet, clean them up with a mop, sponge, or rag that also has been soaked in the disinfectant solution.

2.5. After cleaning wash the mop, sponge or rag in the disinfectant solution and rinse in hot water.

2.6. Place any contaminated material in a plastic bag and seal. Dispose of in the regular rubbish.

2.7. Disinfect or throw away the gloves that were used.

2.8. Wash hands thoroughly with soap and warm water.

If there are a very large amount of droppings in a confined area please contact the Safety Office so that the area can be inspected and thorough cleanup and bird/bat control procedures can be recommended.

References:

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https://www.health.nsw.gov.au/Infectious/factsheets/Pages/hendra_virus.aspx#:~:text=Hendra%20virus%20symptoms%20in%20people&text=Fever%2C%20cough%2C%20sore%20throat%2C,virus%20infection%20can%20be%20fatal.

Part of the above information and procedures are modified from a Washington State University Fact Sheet