Highly Pathogenic Avian Influenza (HPAI)
H5N1 Waste Management Decision Tree Guidance Document

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The Twin Cities Advanced Practice Center

The Twin Cities Metro Advanced Practice Center (APC), http://www.naccho.org/topics/demonstration/APC/MN.cfm, is a resource for local public health agencies throughout the nation as it develops plans and builds local and regional capacity for responding to an act of bioterrorism or other public health emergency.

The development of a science-based, peer-reviewed waste-management decision tree for solid wastes exposed to highly pathogenic H5N1 avian influenza virus is a current activity of the Twin Cities Metro APC. This project will be expanded to include protocols for the management of solid wastes exposed to plague, anthrax and smallpox in the coming months.

The Twin Cities Metro APC has made unique contributions to the nation's preparedness by developing a number of tools and resources for preparedness, aimed at Environmental Health Professionals, which address environmental health emergency preparedness. These include: training modules; the Emergency Handbook for Food Managers and supplemental checklists and training manual; and the development of programming for the Emergency Community Health Outreach system.

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Overview

Our intention is to create a decision-making model for the management of wastes associated with highly pathogenic avian influenza (HPAI) H5N1 that is based upon epidemiological principles and practices. In a literature search regarding risks to sanitation workers and others who may come in contact with wastes generated by people ill with a communicable disease, very little information was found regarding the relationship between waste management practices and the risk to workers in the waste management industry. Additionally, available literature suggests consulting public health authorities for advice.[1,2] This document will assist public health staff and other health professionals as they develop educational messages for professional waste handlers.

Background

Influenza A is an infectious disease of animals and humans. Human influenza A viruses start as avian (bird) influenza A viruses. The reservoir for avian influenza A is wild waterfowl. Infected waterfowl typically do not become very ill and can transmit the virus to domesticated birds and other animals such as pigs. Avian influenza A viruses circulate in birds worldwide. There are strains that have low pathogenicity and typically cause mild illness in birds, as well as highly pathogenic strains that can quickly kill flocks. Typically, avian influenza A strains do not infect humans, but occasionally a strain develops the ability to cause infection in both animals and humans.

The highly pathogenic avian influenza (HPAI) H5N1 strain that has been spreading rapidly in bird populations since 2003 has captured the attention of the global health community.[3] Although at this time H5N1 is not easily transmissible between animals and humans and is even less transmissible between humans, there is concern that it may mutate or re-assort into a strain that is easily transmissible between humans. Such a change could spark an influenza pandemic because almost all people would be susceptible to this new strain. While we recognize that there is not a pandemic at this time, we believe it is important to evaluate the hazard to waste management professionals and others who would be involved in routine housekeeping and waste management if there were human or animal cases of HPAI H5N1 in the U.S. or if an influenza pandemic were to occur.

NOTE: For simplicity, the HPAI H5N1 virus will be referred to as H5N1 in this document.

At the beginning of the AIDS pandemic in the 1980s, workers in the waste management industry became extremely concerned about their safety after exposure to medical waste. At a national level, medical waste disposed of at sea was washing up on swimming beaches, and hypodermic needles associated with intravenous drug use were being found on streets. Although such stories resulted in a great deal of media attention, it is important to note that there is no evidence that traditional medical waste treatment and management processes have contributed to increased levels of disease in the community.

However, workers at local metropolitan resource recovery facilities sought management assurance that they would be protected. The Minnesota Attorney General convened a task force to develop an appropriate response to medical waste issues, and that work led to the development of what is now known as the Minnesota Infectious Waste Control Act (MN Stat. Section 116.766 - 116.82). Subsequently, State rules based in large part on risk management practices were developed to regulate infectious and pathological waste. Since then, the health and science community has educated people about the transmission and viability of the AIDS virus. Additionally, the regulatory community now requires personal protective equipment

(PPE) and waste containment to minimize exposures in certain settings. Similar anxiety ensued when anthrax spores were released into several communities in 2001 and several people became ill.

The intent of this work is to avoid overreaction by educating waste industry professionals now about what their risks are should there be outbreaks of H5N1 in the U.S. among wild or domesticated birds or humans.

Virus Characteristics

Common Influenza Viruses

In general, human influenza viruses (which are the causal agents of seasonal influenza) are transmitted when respiratory droplets expelled by an infectious person (e.g., during coughing, sneezing, talking) are inhaled, or mucous membranes (i.e., nose, eyes, mouth) are inoculated with hands contaminated by influenza virus. The virus may persist for up to 48 hours on environmental surfaces under favorable conditions, particularly cold and low humidity and infection through direct contact with contaminated items is possible. The incubation period for seasonal influenza is typically 1 - 3 days.[4]

Infectious Agent

H5N1 is causing concern in the scientific and public health community. It is a virus of birds, and does not usually infect people. Most infections that have occurred in humans have been the result of people having direct or close contact with H5N1-infected poultry or H5N1-contaminated surfaces.[5] Scientists learn more about this virus each day and as the virus continues to evolve, updated information on the behavior of the virus will become available.

It is important to note that H5N1 virus is not more difficult to inactivate than seasonal influenza virus. Severity of the resulting infection is independent of the virus' sensitivity to chemical disinfection or inactivation via a physical process. H5N1 and the seasonal strains of influenza we see annually do not differ greatly in terms of the biophysical and biochemical properties as virus particles.

Viral Transmission

In Birds

H5N1 is transmitted through blood, mucus/respiratory fluids and feces. The relative importance of each mode of transmission is unknown.[6,7,8]

In Humans

Influenza viruses can be transmitted by 3 routes: respiratory aerosols (respiratory droplets expelled by infectious persons), direct contact with secretions or direct contact with fomites contaminated with the virus. However, the relative contribution of each route is unknown.

Transmission of seasonal human influenza is by respiratory aerosols (respiratory droplets expelled by infectious persons) that contain the virus and enter the body through the respiratory system or direct inoculation of the eyes, nose, or mouth by contaminated hands.[9,10]

In contrast, most cases of H5N1 infection in humans have resulted from direct and close contact with infected poultry or the secretions/excretions of infected birds.

The first laboratory confirmed case of human-to-human transmission occurred in a family cluster in Indonesia in which a genetic mutation probably enhanced the ability of the virus to be transmitted human-to-human. The cluster originated with a woman who contracted the virus from poultry and passed it on to six relatives; a boy from the group of six passed it to his father and all patients died.[11] Additional cases of human-to-human transmission are suspected but have not been confirmed with laboratory testing.[12]

Methods of human excreta disposal where aerosolization of virus is unlikely, such as latrines, probably represent an extremely low risk of H5N1 transmission.[13] Human and poultry waste may contain the H5N1 virus. The widespread use of untreated poultry feces as fertilizer is a possible risk factor in transmission of H5N1 in those countries with infected birds.[14]

The Food and Agriculture Organization of the United Nations has recommended that disease transmission control guidelines should be tailored to specific conditions of affected communities. [15]

Human Incubation Period
H5N1 may incubate longer than seasonal human influenza viruses before causing symptoms. The incubation period for seasonal influenza ranges from 1 to 4 days, with an average of 2 days. In H5N1 cases, the incubation period has typically been 2 to 4 days, but has possibly been as long as 8 days. [16,17]

Human Communicability
The period of human communicability of H5N1 is unknown at this time, but is expected to be similar to that of seasonal influenza.

Human Susceptibility
Human susceptibility to H5N1 is not known as very few people in the human population have been infected with the virus. Currently work is being done to develop vaccines.[18,19]

Human Vulnerability
People who handle poultry infected with H5N1 are more likely to be exposed to the virus, but at this time transmission between birds and humans is not efficient. Children in affected countries may be more at risk of becoming infected with H5N1 as a result of their normal behaviors. They may play in areas that are contaminated, they do not practice good hand hygiene and they have much more frequent hand-to-mouth contact.[20]

H5N1 Survival and Inactivation
The viability of H5N1 virus on environmental surfaces is not fully understood, but based on data for influenza virus behavior, we assume it can survive for 24 - 48 hours on non-porous surfaces such as doorknobs, countertops, keyboards and telephones. Influenza virus typically remains viable on porous surfaces, such as tissues and handkerchiefs for 8 - 12 hours.[21]

The virus survives:

- Over 30 days at 0ºC (32ºF) (over one month at freezing temperature)
- 6 days at 37ºC (98.6ºF) (approximately one week at human body temperature)

H5N1 can survive for extended periods of time in a favorable environment at a temperature below freezing. These temperatures are common in the northern-most geographic areas frequented by migratory birds.

Heat kills H5N1 (i.e., inactivates the virus):

- 3 hours at 56ºC
- 30 minutes at 60ºC (140ºF) (half hour at a temperature that causes first and second degree burns in humans in ten seconds)
- 5 seconds at 74ºC (165ºF) (for eggs and poultry for consumption, the food must be cooked to an internal temperature of 165ºF and held at that temperature for a minimum of 15 seconds)

The virus is also inactivated in the presence of:

- Acidic pH conditions
- Oxidizing agents such as sodium dodecyl sulfate, lipid solvents, and B-propiolactone
- Most disinfectants, e.g. chlorine bleach, alcohol, quaternary ammonium, formalin, and iodine compounds[22,23,24,25]

Viral Reservoir and the Spread of Disease
H5N1 has been found in wild and domestic waterfowl and shorebirds, including but not limited to swans, geese and ducks in Asia, Africa and Europe. The virus is shed in the feces or respiratory secretions of the birds. The birds may be asymptomatic, but still shed virus that can make other birds ill.[26] Wild birds are able to infect domestic poultry and the virus is also found among birds in live bird markets.[27] It is also possible that infected domestic poultry are able to spread the virus to uninfected wild birds.[28]

Risk to Public Health During Management of Waste

What are medical and infectious wastes?
Medical waste includes all waste materials generated at healthcare facilities, such as hospitals, clinics, physician's offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories. The Federal Medical Waste Tracking Act of 1988 defines medical waste as "any solid waste that is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals."[29] This definition includes, but is not limited to:

- blood-soaked bandages
- culture dishes and other glassware
- discarded surgical gloves
- discarded surgical instruments
- discarded needles used to give shots or draw blood (e.g., medical sharps)
- cultures, stocks, swabs used to inoculate cultures
- removed body organs (e.g., tonsils, appendices, limbs)
- discarded lancets

Medical wastes generally fall into one of four categories — infectious, hazardous, radioactive, and other general wastes from healthcare and medical facilities. Infectious, hazardous, and radioactive wastes represent only a small portion of all medical waste generated each year, but garner the greatest amount of concern. It is important to note that not all medical waste is infectious. The U.S. Environmental Protection Agency estimates that infectious wastes constitute between 10 and 15 percent of the medical waste stream. The vast majority of medical waste, in fact is very similar to wastes generated in households and offices across the country.

What wastes are defined as infectious in the MN Infectious Waste Control Act (MN Stat. Section 116.766 - 116.82)?

Infectious waste is defined as waste that has the potential to transmit disease that has not been decontaminated. Infectious wastes include all of the following that have not been decontaminated:

Laboratory waste is defined as waste cultures and stocks of agents that are generated from a laboratory and are infectious to humans; discarded contaminated items used to inoculate, transfer, or otherwise manipulate cultures or stocks of agents that are infectious to humans; wastes from the production of biological agents that are infectious to humans; and discarded live or attenuated vaccines that are infectious to humans.

Blood includes waste human blood and blood products in containers, or solid waste saturated and dripping human blood or blood products (including serum, plasma, and other blood components);

Regulated body fluids include cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid that are in containers or that drip freely from body fluid soaked solid waste items;

Sharps are defined as discarded items that can induce subdermal inoculation of infectious agents, including needles, scalpel blades, pipettes, and other items derived from human or animal patient care, blood banks, laboratories, mortuaries, research facilities, and industrial operations; and discarded glass or rigid plastic vials containing infectious agents; and

Research animal waste, as defined by the Infectious Waste Control Act, includes carcasses, body parts, and blood derived from animals knowingly and intentionally exposed to agents that are infectious to humans for the purpose of research, production of biologicals, or testing of pharmaceuticals.

Infectious waste, also called biohazardous or red bag waste, cannot be placed in the normal trash for disposal at a landfill or industrial burner. Infectious waste must be segregated and go through a decontamination process before it is considered safe for routine handling as a solid waste. For this reason, infectious waste is routinely collected in special containers – sharps containers and red bags, for example, to indicate the need for decontamination before disposal. After decontamination, the waste can be handled by haulers, storage, treatment and disposal facilities that have submitted solid waste management plans to the MPCA according to Minnesota Solid Waste Rules. The management plans address packaging and labeling, handling and segregation, storage, transportation, spill response, treatment and disposal.

Infectious waste is **not** the same as hazardous waste. This distinction is important because decontaminated infectious waste is safer to handle than hazardous waste, and therefore, may be deposited in a Class II solid waste landfill (municipal landfill). Traditional methods of decontaminating infectious waste are steam autoclaving or incineration. More recently, a technique known as chemical immersion, where waste items are immersed in disinfecting chemicals, has been used. Landfill disposal of untreated infectious waste is prohibited by law. Additional information on the regulation of infectious waste can be found in the MN Rules 7035.

A standard practice in the regulated health-care community is to consider wastes that are saturated or dripping with blood or regulated body fluids to be infectious.[30] These wastes are labeled and managed as infectious waste according to regulation outside of the municipal solid waste stream.

Does the scientific literature indicate that wastes not defined as infectious waste by law pose a risk to public health?

Workers in the solid waste industry may theoretically be at increased risk of acquiring infectious diseases occupationally. However, at present no studies could be found which have documented this risk.[31]

No evidence suggests that most of the solid or liquid wastes from hospitals, other healthcare facilities, or clinical/research laboratories is any more infective than residential waste. It is also important to note that blood-borne pathogens, particularly blood-borne viruses, are not stable in the environment for long periods of time.[32]

The State of Louisiana offers advice to sanitation workers that states that unless the wastes are saturated and the worker is exposed to the infectious agent through direct contact such as skin

lesions, needle stick, inoculation of the mucous membranes of the eyes, nose, or mouth or other pathways, there is a very limited public health risk.[33]

In addition, there is no evidence that blood-borne diseases have been transmitted from contact with raw or treated sewage. The World Health Organization (WHO) issued a report in March of 2006 that evaluates the routes of exposure and risks related to water and sewage.[34] The report states that assuming humans are not infected with and excreting H5N1, there will be little risk to sewage workers. In the case of human infection of H5N1, this statement will need to be reevaluated based on the mode of transmission of H5N1 in humans.

Anything coming into contact with feces, blood and respiratory secretions from an H5N1 infected bird would be considered by federal agencies including Centers for Disease Control and Prevention (CDC) and Animal and Plant Health Inspection Service (APHIS) contaminated until time, temperature or chemical treatment has rendered the virus inactive or destroyed.[35,36,37]

Wastes Associated with HPAI H5N1

In preparing this document, we attempted to list the types of waste that an ill person or ill animal may generate. We have determined, based on a review of state and local regulations, standard infection control practices and scientific literature that the following wastes are not likely to be a risk to public health, even if they have come into contact with sputum, saliva, feces and other bodily fluids if they are handled and disposed of according to existing rules and best practices. However, if wastes are wet, saturated or dripping with bodily fluids, the wastes would be considered infectious and subject to additional regulatory standards.

Residential Settings
Paper tissues
Masks (patient/caretakers)
Gloves (caretakers)
Clothing
Bed linens
Leftover food/beverages
Drinking straws
Napkins
Bed pads (disposable)
Plastic ware/utensils
Water/beverage bottles (single serving sized)
Home sharps
Cleaning rags and other cleaning supplies

If infected animals are in a residential setting, additional wastes may include:
Bird feces
Bedding
Cages
Food and water dishes
Perches
Dead animals
Feathers
Innards
Egg crates
Other equipment

Commercial/Industrial Sites
Custodial supplies (e.g., cleaning rags, buckets, brushes, mops, sponges)
Personal protective equipment (such as respirator, safety glasses/goggles, faceshield, gloves, safety shoes, shoe coverings and coveralls)

Healthcare Facilities
Note: Healthcare workers using full-barrier precautions (airborne and contact precautions plus eye protection) should dispose of personal protective equipment according to facility policy and applicable regulation.

Paper tissues
Masks and respirators (used by patients and healthcare workers)
Gloves (used by caretakers)
Personal protective equipment, e.g., respirator, eye protection (goggles, faceshield), gown and gloves
Bed linens
Leftover food/beverages
Drinking straws
Paper napkins
Supplies/equipment packaging materials
Bed pads (disposable)
Plastic ware/utensils
Water/beverage bottles (single-serving sized)
Custodial supplies

Public Places
Dead birds
Custodial supplies
Bird feces
Paper tissues
Water/beverage bottles (single-serving sized)

Public Transportation – Facilities & Conveyances
Paper tissues
Water/beverage bottles (single-serving sized)
Custodial supplies

Waste Management

Based on current information, non-infectious H5N1-contaminated wastes are not a threat to public health. The table below describes recommended practices for managing H5N1-contaminated wastes. However, as more information becomes available other agencies may develop recommendations that supercede this guidance on the disposal of non-infectious, H5N1-contaminated wastes.

Management of H5N1-contaminated wastes (not-infectious/not posing a risk to public health)	
Regulatory oversight	Manage wastes listed above as municipal solid waste (MSW) Minnesota Solid Waste Act Minn. Stat. 473.801 et seq.; 115A.80 et seq. If conditions change, the MN Department of Agriculture and the MN Board of Animal Health will provide guidance regarding the proper management of carcasses and associated wastes.
Storage	Place waste in plastic bags (recommendations may include double-bagging of waste, including animal waste) to minimize contact with insects and vermin. All sharps must be stored in rigid containers.
Collection	Routine garbage collection. Personal protective equipment (PPE) recommendations per corporate policy are recommended for normal, daily operations.
Transportation and Transfer	Routine transportation and transfer. Packing, tipping, pushing and loading would all be considered acceptable practices. Personal protective equipment (PPE) recommendations per corporate policy are recommended for normal, daily operations.
Disposal	Routine disposal at resource recovery facilities, mass-burn facilities and MSW landfills. Special guidance may be developed if H5N1 is found in seagulls that scavenge at landfills. In addition, other guidance may be issued by the receiving solid waste disposal facility.

Wastes that have come in contact with an infectious agent and are wet, saturated, or dripping from bodily fluids are considered to be infectious and a risk to public health.[38] These wastes are typically found in medical settings and are managed as infectious waste.

Management of infectious waste	
Regulatory oversight	MN Infectious Waste Control Act MN Stat. Section 116.766 - 116.82
Storage, Collection, Transportation, Transfer and Disposal	Routine management of infectious waste. In a review of the available literature, it appears that no special licensing or regulatory requirements have been put in place regarding the handling or management of infectious wastes. However, industry precautions and best management practices are common.

Are specific H5N1 precautionary measures recommended for waste handlers?
NIOSH/OSHA rules for specific industries must be followed. While there are no specific recommendations for waste handlers at this time regarding H5N1,[39] we recommend that all employees who may be exposed to H5N1 through work activities be trained on the hazards associated with H5N1 and any health and safety protocols.[40]

Personal practice of good personal hygiene, safety precautions and healthy habits will reduce the likelihood of workers becoming ill or injured. The following general recommendations for safe waste handling work practices come from the State of Louisiana[41]:

- Wear personal protective equipment under circumstances in which you might be exposed. Boots should have steel toes and puncture-resistant soles. 6" lace-up boots provide added protection for the ankles. Gloves should be worn whenever the hands may come in contact with hazards; leather provides better protection than rubber against punctures. Arms and other skin surfaces should be covered whenever the skin might be exposed to infectious agents.
- Special equipment, such as respirators, face shields, dust masks, boot covers, or impervious clothing may be necessary if a spill occurs, if splashing or splattering is expected, or if another unusual hazard arises.
- Cover all cuts, abrasions, and other areas of non-intact skin while on duty.
- Always wash your hands before eating, drinking, smoking, or putting anything in your mouth, and before leaving work.
- Change your clothes and boots immediately after work so that you do not contaminate family members.

Conclusions

Influenza viruses, regardless of type, are transmitted through inhalation of small-particle droplets expelled when an infected person coughs or sneezes, or when the mucous membranes of the eyes, nose, or mouth are inoculated by larger droplets expelled from an infected person or by contaminated hands. Based on current science and the definition of infectiousness[42], non-infectious medical wastes that may be contaminated with H5N1 virus from either animals or humans do not pose an increased risk to the waste handler when routine waste handling practices are followed. Therefore, we recommend the use of personal protective equipment (PPE) that is already a part of the normal, daily operations. We also recommend basic public health practices, including frequent hand hygiene, annual influenza vaccination and staying home when ill. As more information becomes available other agencies may develop recommendations that supercede this guidance on the disposal of non-infectious, H5N1-contaminated wastes.

Endnotes

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