Avian Influenza, including Influenza A (H5N1), in Humans: WHO Interim Infection Control Guideline for Health Care Facilities

Date of most recent amendment: 9 February 2006

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Avian Influenza, including Influenza A (H5N1), in Humans: WHO Interim Infection Control Guidelines for Health Care Facilities (9 February 2006)

Purpose of document

- The purpose of this document is to provide infection control guidance for health care workers (HCWs)* in health care facilities evaluating or providing care for patients with suspected or confirmed avian influenza (AI) infection, including AI A (H5N1).
- This guideline is intended for use in the current inter-pandemic period, in which there are human AI infections, but no evidence for sustained human-to-human transmission.
- Although this guidance may be modified as the epidemiology of AI evolves, health care facilities may use this guidance, in addition to guidance in national pandemic influenza plans, to assist with pandemic influenza planning.

Intended audience

- This guidance is intended to be used by government planners, health care facility administrators, infection control practitioners, occupational health specialists, direct care providers, and other professionals involved in patient care.
- Although these recommendations are targeted for inpatient health care facilities, they may be applicable to other patient care settings.
- WHO recognizes that the recommendations in this guideline may need to be adapted due to the local setting, local needs, and limitations due to lack of resources.
- Health care facilities are encouraged to review the recommendations and to modify them according to what is possible, practical, and prudent.

Updates to guidance

- The present guideline replaces the document "Influenza A (H5N1): WHO Interim Infection Control Guidelines for Health Care Facilities" published by WPRO on 10 March 2004.
- Case surveillance and case and contact investigation are critical in defining and identifying changes in the epidemiology of human AI infection and will continue to inform AI infection control recommendations. Modifications to this guideline will be made, as necessary, as additional information becomes available. Please make sure the version being used is the most recent version available at: http://www.who.int/csr/disease/avian_influenza/guidelinestopics/en/index3.html.
- In the event of an AI pandemic, additional recommendations will be forthcoming, including recommendations for the care of patients in non-hospital settings.

Additional information

- This guideline does not include information on the laboratory diagnosis and clinical management of patients with AI infection. Please reference WHO guidance related to these topics at: http://www.who.int/csr/disease/avian_influenza/guidelinestopics/en/index1.html
- WHO laboratory biosafety guidelines related to AI A virus can be accessed at: http://www.who.int/csr/disease/avian_influenza/guidelines/handlingspecimens/en/index.html

*Any person working in a health care facility, e.g., medical officer, nurse, physiotherapist, cleaner, psychologist, laboratory worker, ambulance driver, etc. whether or not they are an employee of the facility.

I. Executive summary

Normally, AI viruses do not infect humans because of host barriers to infection, such as cell receptor specificities. However, they can occasionally cross the species barrier and directly infect humans, including highly pathogenic strains that have caused fatal disease in humans.[1] In 1997, AI A(H5N1) caused an outbreak in domestic poultry in Hong Kong and also infected humans, hospitalizing 18 people and causing 6 deaths.[2, 3] Since then, other AI outbreaks (e.g., H9N2 in 1999, H7N2 in 2002, and H7N7 in 2003) have resulted in human infections.[4] For more details on AI and the significance of its transmission to humans see Annex 1.

Since the last pandemic in 1968-1969, the risk of an influenza pandemic has not been considered greater than at the present time. As of the date of this document, AI A (H5N1) is endemic in birds in many parts of the world. The widespread persistence of H5N1 in bird populations poses two main risks to human health. The first is the risk of infection when the virus spreads directly from birds to humans. The second risk, which is of even greater concern, is that there will be increased possibilities for the widely circulating virus to infect humans and possibly reassort into a strain that is both highly infectious for humans and spreads easily from human-to-human. Such a change could mark the start of a pandemic.

The present document comprises three parts: I. Executive summary; II. Infection control recommendations; and III Annexes. The first part provides a summary of the main recommendations and rationale; the second part provides a detailed description of the recommendations; the annexes provide some background information for the recommendations in Part II and some practical tools.

Rationale

In an era of emerging and reemerging communicable diseases, basic infection control precautions are the cornerstone of the approach to prevent transmission of communicable diseases in health care facilities. The basic level of infection control precautions (standard precautions), when used as recommended, will be effective in preventing transmission of most communicable diseases in health care facilities. Facilitating compliance with these basic precautions should be emphasized in all health care facilities at all times.

WHO regards every case of transmission of an AI virus to humans as a cause for concern, heightened vigilance, and increased surveillance. During the 1997 human AI A(H5N1) outbreak in Hong Kong, no nosocomial spread was observed when droplet and contact precautions were used,[5, 6] and there is no evidence to suggest that airborne human-to-human transmission of AI A(H5N1) has occurred thus far.[7] However, although it is not unanticipated that there is little evidence of nosocomial transmission of AI A (H5N1) thus far because the virus has apparently not yet developed the ability to be readily transmitted between humans, it is concerning that recent publications have disclosed that HCWs have been exposed to AI-infected patients without **any** specific protection.

This could have resulted in transmission of AI A (H5N1) infection to HCWs with consequences for the health of individual HCWs, as well as for public health. HCWs are first responders, and it

is of utmost importance to provide them with protection against the hazards associated with the provision of health care.

Available evidence suggests that transmission of human influenza viruses occurs through multiple routes including large droplets, direct and indirect contact, and droplet nuclei.[8-12] However, observational studies conducted in health care facilities suggest that droplet transmission is the major mode of transmission in that setting [8, 9, 11] and standard precautions plus droplet precautions are recommended for the care of patients infected with seasonal influenza (Annex 2).

However, as of the date of this document, sound evidence on exact modes of transmission of AI viruses is still missing. Given the uncertainty about the exact modes by which AI, including influenza A (H5N1) may first be transmitted between humans, due to the high mortality of the disease, and the possibility that the virus could mutate or reassort at any time into a strain capable of efficient human-to-human transmission, enhanced infection control precautions for patients with suspected or confirmed AI infection appear warranted.

Summary of WHO recommendations:

- Standard and droplet precautions should be the minimum level of precautions to be used in all health care facilities when providing care for patients with acute respiratory illness, regardless of whether AI infection is suspected. The most critical elements of these precautions include facial protection (eyes, nose, and mouth) and hand hygiene and these precautions should be prioritized (Annex 3).
- Full barrier precautions, which include standard, contact, and airborne precautions (plus eye protection) should be used, when possible, when providing care for suspected or confirmed AI-infected patients with close patient contact and during aerosol-generating procedures.
- Because some elements of full barrier precautions (particularly those related to airborne precautions) may not be available in all health care facilities, minimal requirements for caring for AI-infected patients should include standard, contact, and droplet precautions (plus eye protection when within 1 meter of patient and for all aerosol-generating procedures). Additional elements should be prioritized and pursued when resources permit.

Personal protective equipment (PPE) recommendations for HCWs providing care to AI-infected patients

- The use of PPE is mandatory if direct close contact with the patient is anticipated and when entering the room where aerosol-producing procedures in AI-infected patients are being performed.
- Particulate respirators that are at least as protective as U.S. NIOSH-certified N95, EU FFP2, or equivalent (Annex 4).
    - Appropriate procedures should be used to select a particulate respirator that fits well and a user seal check should be performed each time a disposable particulate respirator is worn.

  - Disposable particulate respirators, although similar in appearance to surgical masks, differ significantly from surgical masks because they are specifically designed to protect the wearer from exposure to airborne infectious diseases by sealing tightly to the face and filtering infectious particles from the air.
  - If a particulate respirator is not available, a tightly fitting surgical or procedure mask should be used.
  - Surgical and procedure masks do not provide protection against small-particle aerosols (droplet nuclei) and aerosol-generating procedures (Annex 4) should not be performed if a particulate respirator is not available;
- Eye protection (face shield, visor, or goggles) if close contact with the patient is anticipated and for all aerosol-generating procedures;
- Clean, nonsterile, ambidextrous gloves, which should cover the cuffs of the gown.
- Clean, nonsterile long sleeved gowns (fluid-resistant, if available);
  - If cloth gowns are used, a waterproof apron should also be used if splashing of blood, body fluids, excretions, or secretions is anticipated.

PPE is an integral part of routine infection control practice and is an important component of prevention and control activities that are intended to reduce the risk of healthcare-associated infections, including avian influenza, in health care facilities. However, use of PPE on its own does not prevent acquisition of any pathogen associated with the process of care. Compliance with the use of recommended infection control precautions (Annexes 3 and 4) is critical to prevent the possible transmission of AI and other infections to HCWs, patients, and visitors.

- HCWs should receive training on the use of recommended infection control precautions as well as on the underlying concepts that form the basis for these recommendations;
- Hand hygiene is an important component of infection control precautions (Annex 3);
- HCWs must also be trained to use PPE correctly. Incorrect use of PPE may fail to protect HCWs against the acquisition of healthcare-associated infections and may also lead to self-contamination and inoculation with infectious agents; and
- PPE placement should be carefully done before entering the isolation room or area and careful removal of PPE is critical to avoid self-contamination. Follow recommended procedures for PPE placement and removal (section II, 4).

Infection control precautions and PPE are just some of the components of an overall programme of infection prevention and control in health care facilities. All health care facilities should establish an infection control programme and it is also important that there is an infection control programme at the national level to support these activities in health care facilities (Annex 5).

II. Infection control recommendations

1. Standard infection control precautions for all health care facilities

Standard precautions[10] (Annex 3) include:

a) Hand hygiene:

- Before and after patient contact;
- After removing gloves or any other PPE item;
- Routine hand hygiene is performed either by using an alcohol-based hand rub (preferably) or by washing hands with soap and water, using a single-use towel for drying hands;
- If hands are visibly dirty or soiled with blood or other body fluids, or if broken skin might have been exposed to potentially infectious material hands should be washed thoroughly with soap and water. Hands should also be washed after using the restroom.

b) Use PPE based on risk assessment and avoid contact with blood, body fluids, excretions, and secretions.
c) Appropriately handle patient care equipment and soiled linen.
d) Prevent needlestick/sharp injuries.
e) Appropriate environmental cleaning and spills-management.
f) Appropriate handling of waste.

Rationale

The SARS outbreak illustrated the critical importance of basic infection control precautions in health care facilities. Nosocomial transmission of SARS was often associated with noncompliance with the basic level of infection control precautions (standard precautions). Standard precautions include the use of facial protection (nose, mouth, and eye protection) by HCWs when they are providing care to coughing/sneezing patients. However, it has not been the routine practice of HCWs in many health care facilities worldwide to use this protection or to ask patients with respiratory symptoms to wear masks. In addition, numerous studies have documented the lack of compliance with hand hygiene, a major component of standard precautions. The use of alcohol-based hand rubs in health care facilities has been implemented in recent years in an attempt to increase compliance with hand hygiene. Standard precautions, including appropriate use of facial (eyes, nose, and mouth) protection when caring for respiratory symptomatic patients and hand hygiene, should be a priority in all health care facilities.

For additional information on standard precautions, see:
"Practical Guidelines for Infection Control in Health Care Facilities", SEARO/WPRO, 2004, at:
http://www.wpro.who.int/publications/PUB_9290222387.htm

"Prevention of hospital-acquired infections: A practical guide." WHO, 2002, 2nd edition, at:
http://www.who.int/csr/resources/publications/drugresist/WHO_CDS_CSR_EPH_2002_12/en/

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For additional information on hand hygiene, see:
"WHO guidelines on hand hygiene in health care (advanced draft): a summary", at
http://www.who.int/patientsafety/events/05/global_challenge/en/index.html

2. Respiratory hygiene/cough etiquette for all health care facilities

a) Persons with respiratory illness should be educated to:

- cover their mouth and nose with a tissue when coughing and dispose of used tissue in waste containers;
- use a mask if coughing, when a mask can be tolerated;
- perform hand hygiene (use an alcohol-based hand rub or wash hands with soap and water) after contact with respiratory secretions; and
- stand or sit at least 1 meter (3 feet) from other persons, if possible.

b) Health care facilities should promote respiratory hygiene/cough etiquette by:

- Educating HCWs, patients, family members, and visitors on the importance of containing respiratory aerosols and secretions to help prevent the transmission of influenza and other respiratory viruses.
- Posting signs requesting that patients and family members immediately report symptoms of respiratory illness and use respiratory hygiene/cough etiquette.
- Posting signs requesting that persons with respiratory illness refrain from visiting the health care facility.
- Considering making masks, tissue, and alcohol-based hand rubs available so that source control measures can be used in common areas and areas used for the evaluation of patients with respiratory illness.

Rationale

Respiratory hygiene/cough etiquette procedures should be used for all patients with respiratory symptoms (e.g., coughing, sneezing). The impact of covering coughs and sneezes and/or placing a mask on a coughing/sneezing patient on the containment of respiratory droplets and secretions or on the transmission of respiratory infections has not been systematically studied. In theory, however, any measure that limits the dispersal of respiratory aerosols should reduce the opportunity for transmission. Masking of some patients may be difficult, in which case the emphasis should be on cough etiquette.

For additional information, see Respiratory Hygiene/Cough Etiquette in Healthcare Settings
http://www.cdc.gov/flu/professionals/infectioncontrol/resphygiene.htm

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3. Early recognition, isolation, and reporting of possible AI cases

a) Health care facilities should:

- Make it a facility priority to establish methods to ensure early recognition and investigation of possible AI cases;
- Promptly initiate infection control precautions when AI infection is suspected; and
- Link the hospital-based surveillance system to the public health surveillance system and report immediately all available essential information regarding possible AI cases to public health authorities via the local surveillance system, as per Annex 1 of the International Health Regulations 2005 (see: http://www.who.int/csr/ihr/One_pager_update_new.pdf). Although the IHR (2005) will not enter into force until June 2007, they are cited here as the recommended best practice. At the national level the IHR (2005) will require the international notification to WHO by States Parties of "human influenza caused by a new subtype" [Annex 2 of the IHR(2005)].

b) In countries* **with** known AI infections in animals or humans, consider the diagnosis of AI:

- In all patients who present with severe acute febrile respiratory illness (e.g., fever > 38° C, cough, shortness of breath) or other severe unexplained illness (e.g., encephalopathy or diarrhoea),[13] particularly in patients with a history of bird exposure, exposure to known or suspected AI-infected patients, or exposure to other severely ill people.
- Family members who accompany suspected AI-infected patients to the health care facility can be assumed to have been potentially exposed to AI and should also be evaluated for AI infection.
- If symptoms and exposure history support the possibility of AI infection, such patients should be put under isolation precautions and should be moved away from other persons and evaluated as soon as possible.

c) In countries* **without** known AI infections in animals or humans:

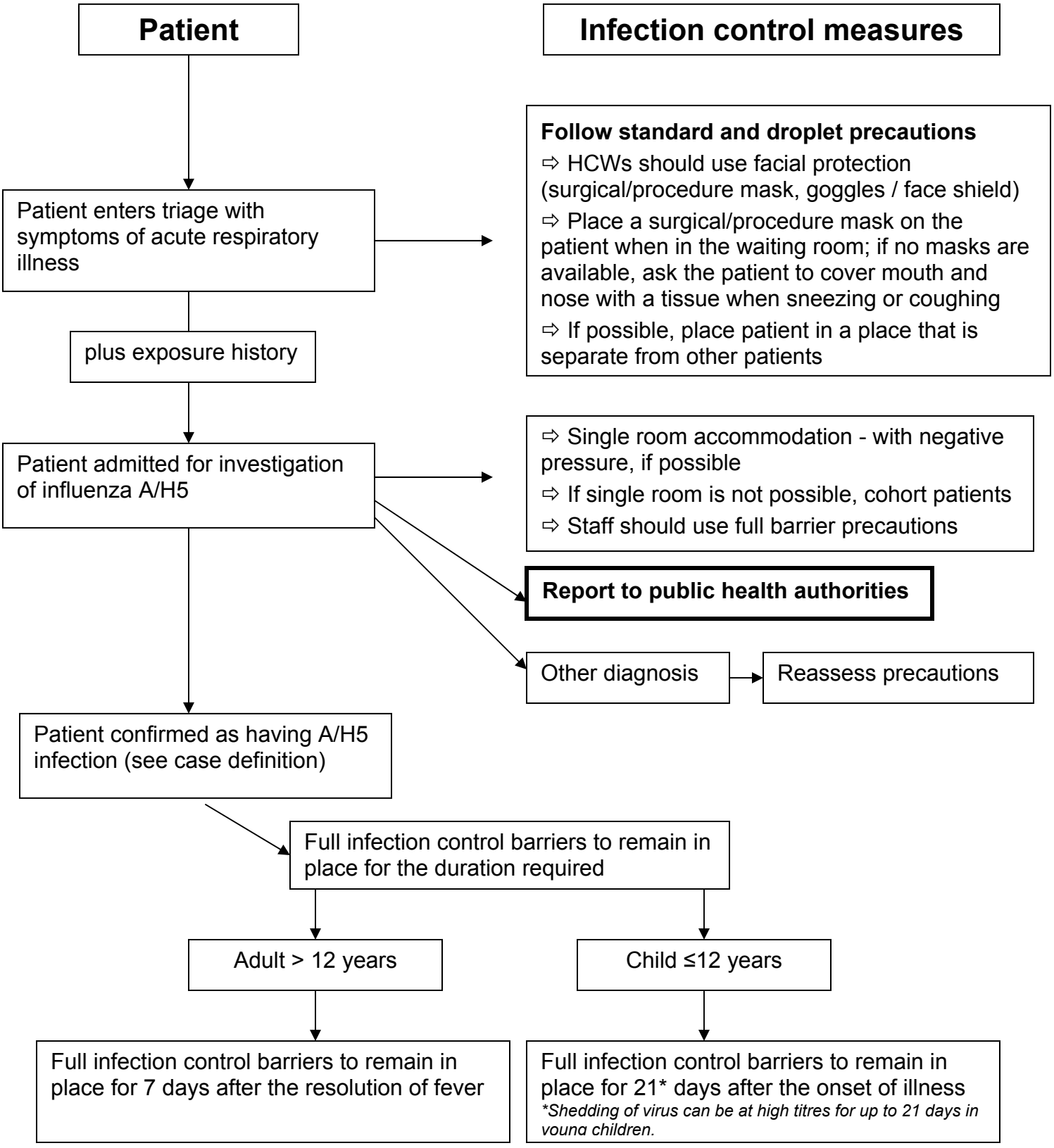
- Query patients with severe acute febrile respiratory illness (e.g., fever > 38° C, cough, shortness of breath) or other severe unexplained illness (e.g., encephalopathy or diarrhoea),[13] about travel to AI affected countries within the prior two weeks.
- Consider the diagnosis of AI in patients with acute febrile respiratory illness who have travelled to an AI affected country within the prior two weeks and who have had bird exposure, exposure to known or suspected AI-infected patients, or exposure to other severely ill people while in an AI affected country during this time period.
- If symptoms, travel, and exposure history support the possibility of AI infection, such patients should be put under isolation precautions and should be moved away from other persons and evaluated as soon as possible.

*To access updated information about AI affected countries, please see: http://www.who.int/csr/disease/avian_influenza/en/

Rationale

Prompt identification and isolation of patients, HCWs, or visitors who may be infected with AI is critical to minimize the risk of nosocomial transmission and to enable an efficient public health response.

Figure 1: Initiation of AI infection control precautions in health care facilities



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4. Isolation precautions for suspected or confirmed AI-infected patients

a) Patient placement:

- Place patient in a negative pressure room (airborne infection isolation room) or area, if available (Annex 6).
- If a negative pressure room is not available or cannot be created with mechanical manipulation of the air, place patient in a single room.
- If a single room is not available, suspected and confirmed AI-infected patients may be cohorted separately in designated multi-bed rooms or wards.
- Doors to any room or area housing suspected or confirmed AI-infected patients must be kept closed, when not being used for entry or egress.
- To facilitate cleaning and to reduce the potential for virus aerosolisation via vacuuming, house AI-infected patients in uncarpeted rooms/areas, if possible.
- When possible, isolation rooms should have their own hand washing sink, toilet, and bath facilities.
- The number of persons entering the isolation room should be limited to the minimum number necessary for patient care and support.

b) Cohorting

- If single rooms are not available, patients infected with the same organisms can be cohorted (share rooms). These rooms should be in a well-defined area that is clearly segregated from other patient care areas used for uninfected patients.
- Designated units or areas should be used for cohorting AI-infected patients (suspected and confirmed cases should be housed separately).
- The distance between beds should be > 1 meter. Increasing spatial distance between patients may theoretically be helpful in preventing transmission of respiratory aerosols.
- Whenever possible, HCWs assigned to cohorted patient care units should be experienced house staff and should not "float" or otherwise be assigned to other patient care areas.
- The number of persons entering the cohorted area should be limited to the minimum number necessary for patient care and support.
- Consider having portable x-ray equipment available in cohort areas.
- HCWs assigned to cohorted patient care units should be aware that AI-infected patients may be concurrently infected or colonized with other pathogenic organisms (e.g., *Staphylococcus aureus, Clostridium difficile*) and should use standard and applicable transmission-based infection control precautions to prevent transmission of healthcare-associated infections.

c) Barrier precautions for the care of patients with respiratory illness or suspected or confirmed AI infection. In addition to hand hygiene, all individuals providing care for patients with respiratory illness or suspected or confirmed AI infection should use PPE as indicated in Table 1 below.

d) PPE for the care of suspected or confirmed AI-infected patients includes:

- A particulate respirator that is at least as protective as a U.S. NIOSH-certified N95, EU FFP2, or equivalent (Annex 4).

- Appropriate procedures should be used to select a particulate respirator that fits well and, whenever possible, a user seal check should be performed each time a disposable particulate respirator is worn.
- If particulate respirators are not available or if the number is limited, tightly fitting surgical or procedure masks should be used when providing direct care and particulate respirators should be reserved for aerosol-generating procedures (Annex 4).
- Clean, non-sterile ambidextrous gloves if direct contact with the patient is anticipated.
- Long-sleeved gown, if contact with patients anticipated.
- Protective eyewear (face shields/goggles/visors) if close contact with respiratory symptomatic patients and for all aerosol-generating procedures.
- If a gown that is not fluid-resistant is worn, a waterproof apron should be worn over the gown if splashing or spraying of potentially infectious material is anticipated as per standard precautions.
- Follow recommended steps for placement and removal of PPE and performance of hand hygiene after PPE removal (see next paragraph).
- Aerosol-generating procedures increase the potential for dissemination of small-particle aerosols (droplet nuclei) and should only be performed:
    - when absolutely essential;
    - with the fewest number of personnel necessary;
    - with the most experienced personnel available;
    - under elective, controlled conditions, if possible (e.g., earlier intubation with patient sedated/paralysed); and
    - in a negative pressure room, if available.

e. PPE placement and removal procedures

- If possible, have an observer monitor placement and removal of PPE.
- **Entering the isolation room/area**
    1. Collect all equipment needed.
    2. **Perform hand hygiene with an alcohol-based hand rub (preferably) or soap and water.**
    3. Put on PPE:
        - Put on fluid-resistant gown.
        - Put on disposable particulate respirator.
        - Perform user seal check of particulate respirator.
        - Put on hair cover (if used, e.g. during an aerosol generating procedure).
        - Put on face shield or goggles.
        - Put on gloves (make sure gloves cover cuff of gown sleeves)
    4. Enter the room and shut the door.

- **Leaving the isolation room/area**
    1. Remove PPE in a manner that prevents self-contamination or self-inoculation with contaminated PPE or hands. The procedure listed below is suggested to remove PPE (if possible, have an observer monitor PPE removal to minimize the risks further):
        - Leave the isolation room/area

- Remove PPE either in the anteroom or if there is no anteroom make sure that neither the environment outside the isolation room/area nor other persons can get contaminated.
- Remove protective eyewear and discard in rubbish bin. If reusable, place face shield in container for decontamination.
- If worn, remove hair cover and discard in rubbish bin.
- Remove gown and discard in rubbish bin.
- Remove gloves and discard in rubbish bin (gloves may be peeled from hands when gown is removed).
- Perform hand hygiene with an alcohol-based hand rub (preferably) or soap and water.
- Remove particulate respirator by grasping elastic bands, **do not touch front of particulate respirator** (front of particulate respirator may be contaminated) and discard in rubbish bin.

2. **Perform hand hygiene with an alcohol-based hand rub (preferably) or soap and water**.

f. Preparation of the isolation room/area

- Ensure infection control precautions through appropriate signage on the door.
- Place a recording sheet at the entrance of the isolation room/area. All HCWs and visitors entering the isolation room/area should print their names (visitors should also provide contact information) on the recording sheet so that follow up/contact tracing is possible, if necessary.
- Remove all nonessential furniture. The remaining furniture should be easy to clean and should not conceal or retain dirt or moisture, either within or around it.
- Stock linen as needed outside the isolation room (e.g., in the change room).
- Stock the sink area with suitable supplies for hand washing, as well as with alcohol-based hand rub near point of care and room door.
- Place appropriate waste bags in a foot-operated bin.
- Place a puncture-proof container for sharps inside the isolation room.
- Keep the patient's personal belongings to a minimum. Keep water pitcher and cup, tissue wipes, and all items necessary for attending to personal hygiene within the patient's reach.
- Non-critical patient care equipment (e.g., stethoscope, thermometer, blood pressure cuff, sphygmomanometer) should be dedicated to the patient. Any patient care equipment that is required for use by other patients should be thoroughly cleaned and disinfected prior to use.
- Set up a trolley outside the door to hold PPE. A checklist may be useful to ensure that all equipment is available (see sample checklist in Annex 6).
- Place an appropriate container with a lid outside the door for equipment that requires disinfection and sterilization. Once equipment has been appropriately cleaned it can be sent to the sterilizing service department.
- Keep adequate equipment required for cleaning and disinfection inside the patients' room and ensure scrupulous daily cleaning of the isolation room/area.
- A telephone or other method of communication should be set up in the patient room to enable patient or family members/visitors to communicate with HCWs to minimize the necessity for HCWs to enter the room.

Table 1. Barrier precaution recommendations for persons providing care for patients with respiratory illness/suspected or confirmed AI infection

	Close contact (< 1 meter) with patients with acute febrile respiratory illness who have no known AI risk factors*	Entry to AI isolation room/ area, but no anticipated patient contact	Close contact (< 1 meter) with AI-infected patient in or out of isolation room/area	Performance of aerosol-generating procedure on AI patient[b, c]
Hand hygiene[a]	Yes	Yes	Yes	Yes
Gloves	Not routinely	Risk assessment	Yes[e]	Yes
Apron	Not routinely	Risk assessment[d]	Not routinely[f]	Not routinely[f]
Gown	Not routinely	Risk assessment[d]	Yes[f]	Yes[f]
Hair cover	Not routinely	Not routinely	Not routinely	Yes
Surgical mask (on HCW)	Yes	Not routinely[g]	Not routinely[g]	Not routinely[h]
Particulate respirator	Not routinely	Yes	Yes	Yes
Eye protection	Risk assessment	Risk assessment[i]	Yes	Yes
Surgical mask (on patient)	Yes	No	Not routinely[j]	No

*Bird exposure in regions with AI infections in animals or exposure to AI-infected patients.

a. Standard precautions are the minimum level of precautions indicated for all patients at all times (Annex 3).
b. Aerosol-generating procedures create aerosols of different sizes (large and small-particle aerosols) (Annex 4). Examples of aerosol-generating procedures include: endotracheal intubation, aerosolized or nebulized medication administration, diagnostic sputum induction, bronchoscopy, airway suctioning, tracheostomy care, chest physiotherapy, nasopharyngeal aspiration, positive pressure ventilation via face mask (e.g., BiPAP, CPAP), high-frequency oscillatory ventilation, and postmortem excision of lung tissue.
c. Wherever possible, aerosol-generating procedures should be performed in negative pressure rooms, side rooms or other closed single-patient areas with minimal staff present (Annex 4). PPE should cover the torso, arms, and hands as well as the eyes, nose, and mouth.
d. Gloves and gown or apron should be worn during cleaning procedures.
e. Gloves should be worn in accordance with standard precautions. If glove demand is likely to exceed supply, glove use should always be prioritized for contact with blood and body fluids (ambidextrous non-sterile gloves), and contact with sterile sites (sterile gloves).
f. If splashing with blood or other body fluids is anticipated, and gowns that are not fluid-resistant are used, a waterproof apron should be worn over the gown.
g. If particulate respirator is not available, use tightly fitting surgical mask.
h. If particulate respirator is not available, use tightly fitting surgical mask and face shield.
i. Use eye protection if close contact (< l meter) with patient is possible.
j. Provide surgical mask for patient (if tolerated), when patient is outside of isolation room/area.

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Isolation rooms reduce the risk of transmission of infection from the source patient to others by reducing direct or indirect contact transmission. PPE is used as part of infection control precautions to provide the appropriate level of protection. Limiting contact between infected and uninfected persons, such as nonessential HCWs and visitors, will reduce the risk of AI transmission to susceptible persons.

5. Duration of infection control precautions

The recommended infection control precautions above should be implemented during the time the patient is infectious:

- adults and adolescents > 12 years of age – implement precautions at time of admission and continue for 7 days after resolution of fever.
- Infants and children ≤ 12 years of age – implement precautions at time of admission and continue for 21 days after illness onset (young children can shed seasonal influenza virus at high titres for up to 21 days).[14]

6. Recommendations for ambulatory care settings:

In countries **without** reported AI infections in animals or humans:

- Post signage to alert persons with severe acute febrile respiratory illness to notify staff immediately and to use respiratory hygiene/cough etiquette, see: http://www.cdc.gov/flu/protect/covercough.htm
- Evaluate patients with acute respiratory illness promptly.
- Consider scheduling clinic patients with acute respiratory illness at the end of the day or at a time separate from well patient visits.
- Patients with acute respiratory illness in waiting areas should stand or sit at least 1 meter (3 feet) from other persons or in a separate waiting area, if possible.
- Provide tissues in the waiting area to contain respiratory secretions when coughing or sneezing. Provide no-touch receptacles for disposal of used tissues.
- Provide alcohol-based hand sanitizers in waiting areas and encourage hand hygiene after contact with respiratory secretions.
- Eliminate or decrease the use of items shared by patients such as pens, clipboards, and telephones.
- Clean and disinfect environmental surfaces in waiting and patient care areas daily and when visibly soiled.
- Ensure that medical devices are appropriately cleaned and disinfected between patients.
- Mask persons with acute respiratory illness, if possible.
- Healthcare workers should use standard and droplet precautions when working with patients with acute respiratory illness.
- If a patient with an acute respiratory illness is referred to another health care facility, notify the receiving facility.

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In countries **with** AI infections in animals or humans, in addition to the above measures, **also**:

- Establish triage criteria to promptly identify persons at risk for AI infection.
- Place patients with severe acute febrile respiratory illness in a negative pressure room (if available) or in a room with a door. Keep door closed except for entry and egress until admission to hospital, discharge home, or until the possibility of AI infection has been excluded.
- If AI infection is suspected, HCWs should use full barrier PPE, if available.
- High risk aerosol-generating procedures in patients with severe acute febrile respiratory illness (Annex 4) should not be performed in the ambulatory care setting, unless they are necessary to save life and no alternative exists.
    - If such a procedure is performed in this setting, a negative pressure room should be used, if available, and participating HCWs should use full barrier precautions.
- After a suspected AI-infected patient has left the ambulatory care setting, clean and disinfect environmental surfaces in the examination room or other areas where the patient was located and clean and disinfect any patient care equipment used for the patient.
- If a suspected AI-infected patient is admitted or transferred to another facility, notify transporting HCWs and receiving staff of the necessary infection control precautions.

7. Specimen collection/transport within healthcare facilities

- Specimens for transport must be placed in leak-proof specimen bags, which have a separate sealable pocket for the specimen (i.e., a plastic **biohazard** specimen bag).
- Personnel who transport specimens should be trained in safe handling practices and decontamination procedures in case of a spill.
- Specimens should be hand delivered where possible. Pneumatic tube systems must not be used to transport specimens that may contain AI virus.
- HCWs who collect specimens from AI-infected patients should wear full barrier PPE.
- The accompanying request form should be clearly labelled as "(suspected) AI" and the laboratory notified by telephone that the specimen is "on its way."

Rationale

Following **standard precautions**, all specimens should be regarded as potentially infectious and HCWs who take, collect, or transport clinical specimens should adhere rigorously to recommended infection control precautions in order to minimize the possibility of exposure.

For further information see specimen collection guidelines at:
http://www.who.int/csr/disease/avian_influenza/guidelines/handlingspecimens/en/index.html
http://www.who.int/csr/disease/avian_influenza/guidelines/humanspecimens/en/index.html

8. Family member/visitor recommendations

Visitors should be strictly limited to those necessary for the patient's well-being and care and should be advised about the possible risk of AI transmission.

- Visitors should be provided PPE for full barrier precautions and should be instructed in the use of PPE and hand hygiene practices prior to entry to the patient isolation room/area.

- Parents/legal guardians of paediatric patients should be strongly supported to accompany the patient throughout the hospitalization.
- Parents/relatives/legal guardians may assist in providing care to AI-infected patients in special situations (e.g., lack of resources, paediatric patients, etc.) if adequate training and supervision of PPE use and hand hygiene is ensured.
- Because family members may have been exposed to AI via the patient or similar environmental exposures, all family members and visitors should be screened for symptoms of respiratory illness at entry to the facility.
- Symptomatic family members or visitors should be considered possible AI cases and should be evaluated for AI infection.

Rationale

Care of patients in isolation becomes a challenge when there are inadequate resources, or when the patient has poor hygienic habits, deliberately contaminates the environment, or cannot be expected to assist in maintaining infection control precautions to limit transmission of microorganisms (children, patients with an altered mental state, or elderly persons). Such patients should be managed on a case-by-case basis, balancing the rights of the patient with the risk they may present to others.

9. Patient transport within health care facilities

- Limit the movement and transport of patients from the isolation room/area for essential purposes only and inform the receiving area as soon as possible prior to the patient's arrival of the patient's diagnosis and of the precautions that are indicated.
- If transport outside the isolation room/area is required, the patient should wear a surgical mask and perform hand hygiene after contact with respiratory secretions.
- If there is patient contact with surfaces, these surfaces should be cleaned and disinfected afterwards.
- If patient cannot tolerate a mask (e.g., due to the patient's age or deteriorating respiratory status) instruct patient (or parent of paediatric patient) to cover nose/mouth with tissue during coughing/sneezing or use the most practical alternative to contain respiratory secretions. If possible, instruct the patient to perform hand hygiene after respiratory hygiene.
- Surgical and procedure masks are appropriate for use by AI-infected patients to contain respiratory droplets and should be worn by suspected or confirmed AI-infected patients during transport or when care is necessary outside of the isolation room/area.
- HCWs transporting AI-infected patients should use PPE as per standard precautions.

Rationale

Reduce spread of virus. AI-infected patients' respiratory secretions are the principal source of infecting material in health care settings.

10. Pre-hospital care and transport outside health care facilities

- If tolerated by the patients, place a procedure or surgical mask on all patients with respiratory illness to contain droplets expelled during coughing. If this is not possible (i.e., would further compromise respiratory status, difficult for the patient to wear), have the

patient cover the mouth/nose with tissue when coughing, or use the most practical alternative to contain respiratory secretions.
- Screen patients with severe acute febrile respiratory illness for AI risk factors.
- HCWs should use full barrier precautions if pre-hospital care is being provided for a suspected or confirmed AI-infected patient.
- Unless medically necessary to support life, aerosol-generating procedures (e.g., mechanical ventilation) should be avoided during pre-hospital care or during transport.
- Optimize the vehicle's ventilation to increase the volume of air exchange during transport. When possible, use vehicles that have separate driver and patient compartments that can provide separate ventilation to each area. In this situation, drivers do not require particulate respirators.
- Notify the receiving facility as soon as possible prior to arrival that a patient with suspected AI infection is being transported to the facility and of the precautions that are indicated.
- Use gloves for direct patient contact followed by hand hygiene. Follow recommended procedures for disposal of waste and cleaning and disinfecting the emergency vehicle and reusable patient care equipment after pre-hospital care or transport has been provided.

Rationale

Patients with severe AI infection may require emergency transport to a health care facility. The above recommendations are designed to protect health care workers, including emergency medical services personnel, during pre-hospital care and transport.

11. Waste disposal

Use **standard precautions** when working with solid waste that may be contaminated with AI virus outside of the isolation room/area. Clinical (infectious) waste includes waste directly associated with blood, body fluids, secretions and excretions; laboratory waste that is directly associated with specimen processing, human tissues, including material or solutions containing free-flowing blood, and animal tissue or carcasses used for research; and also includes discarded sharps.

- All waste generated in the isolation room/area should be removed from the room/area in suitable containers or bags that do not allow for spillage or leakage of contents.
- Waste should be classified as directed by the national laws or regulations. If waste from AI infected patients is classified as infectious, then all waste from an isolation room/area that should be treated as clinical waste and should be treated and disposed of as per facility policy and in accordance with national regulations pertaining to such waste**.**
- One waste disposal bag is usually adequate, providing waste can be placed in the bag without contaminating the outside of the bag. If the outside of the bag is contaminated, two bags should be used (double bagging). If additional bags are not available, clean and disinfect the outside of the bag before removing it from room.
- When transporting waste outside the isolation room/area, use gloves followed by hand hygiene.
- Although the possibility of transmission of AI infection via human faeces is unknown, faeces of AI-infected patients should be handled with caution and possible aerosolisation of faeces should be avoided (e.g., removal of faeces from bedpan, commode, clothing, or reusable incontinence pads by spraying with water).

- Liquid waste such as urine or faeces can be flushed into the sewer system if there is an adequate sewage system in place. Close toilet cover when flushing faeces.

12. Dishes and eating utensils

Use **standard precautions** for handling dishes and eating utensils used by suspected or confirmed AI-infected patients outside of the isolation room/area:

- Wash reusable items in a dishwasher with detergent at the recommended water temperature, when possible. If dishwashers are not available, detergent and hot water should be used to wash items. Rubber gloves should be used if washing items by hand.
- If family members are providing care for patient, they should provide designated dishes and eating utensils for the patient's use only.
- Disposable items should be discarded with other general waste.

13. Linen and laundry

The use of **standard precautions** is recommended for linen and other laundry that may be contaminated with blood, body fluids, secretions, or excretions from suspected or confirmed AI-infected patients outside of the isolation room/area.[15]

- Place soiled linen directly into a laundry bag in the isolation room/area.
- Contain linen in a manner that prevents the linen bag from opening or bursting during transport and while in the soiled linen holding area.
- Heavily soiled linen should be rolled or folded to contain the heaviest soil in the centre of the bundle. Large amounts of solid material (e.g., faeces) should be removed from linen with a gloved hand and toilet tissue and then placed into a toilet for disposal (close toilet lid when flushing), before linen is placed into the laundry bag.
- When transporting soiled linen and laundry outside the isolation room/area, use gloves followed by hand hygiene.
- Soiled linen and laundry should not be shaken or otherwise handled in a manner that might create an opportunity for contamination of the environment or reaerosolisation of virus.
- Laundry personnel should use standard precautions and perform hand hygiene after removing PPE that has been in contact with soiled linen and laundry.
- Wash and dry linen according to routine facility standards and procedures.[15]

14. Environmental cleaning and disinfection[15]

- Cleaning MUST precede disinfection.
- AI virus is inactivated by a range of disinfectants,[16] including:
  - phenolic disinfectants
  - quaternary ammonia compounds
  - peroxygen compounds
  - sodium hypochlorite (household bleach) (Annex 7)
  - alcohol (Annex 7)
  - other germicides with a tuberculocidal claim on the label
  - other registered/licensed disinfectants
- Any germicide with a tuberculocidal claim on the label (i.e., an intermediate-level disinfectant) is considered capable of inactivating influenza.[15]

- Use manufacturer's recommendations for use/dilution, contact time, and handling.
- Patient rooms/areas should be cleaned at least daily and terminally cleaned at discharge. In addition to daily cleaning of floors and other horizontal surfaces, special attention should be given to cleaning and disinfecting frequently touched surfaces (e.g., medical equipment, bedside and over-bed tables, TV controls, call buttons, safety/pull-up bars, doorknobs, commodes, ventilator surfaces).
- To avoid possible reaerosolisation of AI virus; damp, rather than dry dusting or sweeping should be performed, whenever possible. Wet-dust horizontal surfaces by moistening a cloth with a small amount of disinfectant.
- During wet cleaning, cleaning solutions and equipment soon become contaminated; clean less heavily contaminated areas first and change cleaning solutions, cleaning cloths, and mop heads frequently.
- Double bucket method (i.e., one bucket for cleaning solution, one for rinsing) is recommended.
- Equipment used for cleaning and disinfection must be cleaned and dried between uses. Mop heads should be laundered daily and dried thoroughly before storage or reuse.
- Carpeted areas should not be designated for AI infected patients. If this cannot be avoided and vacuuming is necessary, a vacuum cleaner with HEPA filtration should be used.
- Keep areas around the patient free of unnecessary supplies and equipment to facilitate daily cleaning.
- Paper sheeting that is changed between patients is appropriate for patient examination tables in outpatient areas; use disinfectant to wipe down table between patients.
- Do not spray (i.e., fog) occupied or unoccupied rooms with disinfectant. This is a potentially dangerous practice that has no proven disease control benefit.

Rationale

Environmental cleaning and disinfection is intended to remove pathogens from contaminated surfaces and items, thus breaking the chain of transmission. Disinfection is a process of killing microorganisms without complete sterilization. Cleaning MUST precede disinfection. Items and surfaces cannot be disinfected if they are not first cleaned of any kind of organic matter (patient excretions, secretions, dirt, soil, etc.). For more details on the use of alcohol and bleach, see Annex 7.

15. Patient care equipment

Use **standard precautions,** facility practices, and manufacturer's recommendations for handling and reprocessing used patient-care equipment, including medical devices:

- If possible, place contaminated patient care equipment in suitable bags or containers before removing it from isolation room/area.
- Clean heavily soiled equipment and then apply a disinfectant effective against influenza virus before containing it and removing it from the isolation room/area.
- When transporting contaminated patient care equipment outside the isolation room/area, use gloves followed by hand hygiene..
- Use standard precautions and follow current recommendations for cleaning and disinfection or sterilization of reusable patient care equipment.

- If not visibly soiled, wipe external surfaces of portable equipment that has been used for performing x-rays and other procedures in the isolation room/area with an approved hospital disinfectant upon removal from the room/area.

16. Patient discharge

- If the patient is discharged while possibly still infectious (see above), family members should be educated on personal hygiene and infection control measures (e.g., hand hygiene and the use of a surgical or procedure mask by a patient who is still coughing).
- Family members should be educated to avoid poultry and other animals that have been ill and how to self-monitor their health status (Annex 8).
- Terminal cleaning of the patient room should be performed.

17. Occupational health recommendations

17.1. Recommendations for occupational health administrators

- Vaccinate HCWs against seasonal influenza and monitor vaccine uptake. WHO guidelines for the use of seasonal influenza vaccine in humans at risk of AI infection are available at: http://www.who.int/csr/disease/avian_influenza/guidelines/seasonal_vaccine/en/
- Keep a register of HCWs who have provided care for AI-infected patients.
- Develop a HCW influenza-like illness surveillance system in the health care facility, including self-reporting and self-isolating by symptomatic HCWs.
- Develop a system to monitor work absenteeism for health reasons, especially in HCWs providing care for AI-infected patients.
- Screen all HCWs providing care AI-infected patients for influenza-like symptoms before each time they start duty. Symptomatic HCWs should be evaluated and excluded from duty.
- Contact public health officials for local policy on antiviral prophylaxis of HCWs and assistance for obtaining adequate supplies of neuraminidase inhibitors for prophylaxis of HCWs providing care for AI-infected patients (Annex 9).
- Develop a system to provide neuraminidase inhibitors to HCWs exposed to AI infected patients according to local/national policies.
- Develop methods to provide additional support (e.g., emotional and family support) to HCWs, as necessary.

17.2. Recommendations for all HCWs

- Receive the current seasonal influenza vaccine* as soon as possible (if not already vaccinated).
- Observe good respiratory and hand hygiene at all times.
- Observe all other recommended infection control precautions.
- Monitor for symptoms of influenza-like illness (cough, sore throat, difficulty breathing).

17.3. Recommendations for HCWs who have provided care for AI-infected patients

- Check temperature twice daily and monitor for symptoms of influenza-like illness (cough, sore throat, difficulty breathing) for 10 days after last possible AI exposure (Annex 10).

- In the event of fever > 38° C or the development of influenza-like symptoms, HCWs should immediately limit their interactions with others, exclude themselves from public areas, and notify the infection control/occupational health team (and/or their health care provider) that they are symptomatic and may be infected with AI.

Rationale

HCWs also are members of the community, and during seasonal influenza outbreaks they can become infected with influenza either through exposure in the community or in the health care facility (not necessarily as a result of patient exposure). Seasonal vaccine will not protect against AI, but will help prevent concurrent infection with human influenza and AI, which will minimize the possibility of reassortment of the virus. Protective levels of antibodies are usually detectable 2-4 weeks after vaccination with seasonal influenza vaccine. In addition, HCWs who provide care for AI-infected patients may potentially be exposed to AI viruses and should be monitored and supported as needed.

17.4. Other occupational health issues

- Perform serologic and other testing for AI on HCWs with influenza-like illness and who have cared for AI-infected patients;
- HCWs with serological evidence of AI A (H5N1) infection should have protective antibodies against this strain and can be prioritized for the care of AI A(H5N1) patients. These workers could also be prioritized to provide care for patients who are at risk for serious complications from influenza (e.g., transplant patients and neonates).
- HCWs who are at high risk for complications of influenza (e.g., pregnant women, immunocompromised persons, and persons with respiratory diseases) should be informed about the medical risks and offered work assignments that do not involve providing care for AI-infected patients.
- HCWs who are ill should not be involved in direct patient care since they may be more vulnerable to other infection and may be more likely to develop severe illness if infected with AI. In addition, ill HCWs can transmit their illness to vulnerable patients.

18. Administrative control strategies for health care facilities

- Develop plans for the evaluation and management of suspected or confirmed AI-infected patients, including infection control precautions.
- Develop a system to promptly identify and isolate possible human AI cases, and to promptly notify public health authorities.
- In countries with known AI infections in animals or humans post signage at all entrances and clinical evaluation areas (e.g., clinics, emergency departments, etc.) in health care facilities to alert patients and visitors to report severe acute febrile respiratory illness immediately.
- Once confirmed AI-infected patients have been admitted to the facility, nosocomial surveillance should be heightened for evidence of transmission to other patients and HCWs.
- Educate HCWs to follow combined standard and droplet precautions for all patients with acute febrile respiratory illness.
- Educate HCWs about AI and the recommended infection control precautions for suspected or confirmed AI-infected patients.

- Use evidence-based methods to increase compliance with infection control precautions, including visual aids in appropriate locations.
- Ensure that adequate supplies for infection control precautions are provided:
    - Hand hygiene facilities, soap and clean running water and alcohol-based hand rub.
    - PPE should be available for HCWs and family members/visitors
        - Gowns, gloves, eye protection, particulate respirators, and surgical masks.
        - Additional PPE items for housekeeping purposes: protective footwear, waterproof aprons, and rubber gloves.
        - Adequate supply of appropriate cleaning and disinfection materials.
- Post signage requesting that persons with acute respiratory illness not visit the facility. Educate HCWs and visitors on the correct use of PPE and hand hygiene.
    - Recommended steps for placement and removal of PPE and performance of hand hygiene.
    - Appropriate procedures should be used to select a disposable particulate respirator that fits well.
    - Train persons who will be likely to use disposable particulate respirators how to put them on and how to perform user seal checks.
- Plan for adequate staffing; use of full barrier PPE increases worker fatigue and decreases productivity. PPE breaks are necessary and it is helpful if an observer monitors placement and removal of PPE.
- To minimize the number of HCWs entering the rooms of suspected or confirmed AI-infected patients, facilities may consider primary care of such patients by selected nursing staff that will provide meals, collect specimens, clean room, and handle laundry and waste disposal.
- Develop a policy to limit visits of family members (other than parents of paediatric patients) and ensure that visitors comply with infection control precautions, including correct use of PPE and hand hygiene.
- Consider the availability of neuraminidase inhibitors for treatment of patients and prophylaxis of exposed HCWs.
- Develop risk communication strategies for HCWs, patients, and patient families/visitors
- Encourage partnerships between patients, their families, and HCWs that promote good infection control practices in the health care facility.
- Align the health care facility with the national pandemic preparedness plan, if it is available. Such plans may include consideration of AI evaluation clinics, designation of AI referral health facilities, health care facility entry controls, and other measures.

Rationale

Hospital administrators and governments play a key role in creating the necessary conditions at the institutional level to promote prevention of spread of health care-associated pathogens. The lack of written guidelines, availability of necessary conditions (staff and supplies), the lack of culture or tradition of adherence to infection control practices, as well as the lack of administrative leadership, or support are targets for improvement. Enhancing individual and institutional attitudes regarding the feasibility of making changes, obtaining active participation at both levels, and promoting an institutional safety climate, all represent major challenges. Lessons from the SARS outbreak showed that the most important factors involved with

compliance were the HCWs' perception that their facilities had clear policies and protocols, the perceived attitudes and actions of management regarding the importance of occupational health and safety, having adequate training in infection control procedures, and having specialists available.[17, 18]

Education, regular supplies and adequate staffing, institutional climate, and leadership are the cornerstone of promotion of good infection control practices.

Infection control education for HCWs

All HCWs

- Standard and droplet precautions for all patients with respiratory symptoms.
- Epidemiology of AI and the appropriate infection control precautions (Annexes 1, 2, 3, 4).

HCWs who may have contact with an AI-infected patient

- Self-monitoring for influenza-like illness
- Self-reporting to the appropriate surveillance person in the health care facility
- Training in the use of PPE; including the correct steps for placement and removal of PPE and performance of hand hygiene.

19. Prioritizing the use of PPE when supplies are limited

Provision of necessary supplies should be an institutional priority.

- Reuse of disposable PPE items should be avoided.
- Data on reuse of disposable PPE items for influenza are not available and reuse may increase the potential for contamination; however, this risk must be balanced against the need to fully provide protection for HCWs.
- If a sufficient supply of PPE items is not available, health care facilities may consider reuse of some disposable items only as an urgent, temporary solution **and** only if the item has not been obviously soiled or damaged (e.g., creased or torn).
- To avoid wastage, critically evaluate in which situations PPE is indicated using the rationale provided in Table 1.

Respiratory protection

- If AI-infected patients are cohorted in a common area or in several rooms on a nursing unit, and multiple patients will be visited over a short time, it may be practical to wear one particulate respirator for the duration of the activity.

Surgical and procedure masks

If a particulate respirator is not available, a tightly fitting surgical or procedure mask should be worn.

- Wear masks once and then discard.
- Change masks when they become moist.
- Do not leave masks dangling around the neck.

- After touching or discarding a used mask, perform hand hygiene.

Gloves

- If supplies of gloves are limited, reserve gloves for situations where there is a likelihood of contact with blood or body fluids, including during aerosol-generating procedures.
- Use other barriers (e.g., disposable paper towels, paper napkins) when there is no direct contact with patient's respiratory secretions (e.g., to touch equipment linked to the patient). Scrupulous hand hygiene is critical in this situation.

Gowns

- If supplies of gowns are limited, gown use should be prioritized for aerosol-generating procedures and for activities that involve holding the patient close (e.g., in paediatric settings), or when other extensive body surface-to-body surface contact is anticipated.
- If there is a shortage of gowns, gowns may also be worn in the care of more than one patient in a cohort area if there is no direct contact between the gown and the patients.

Eye protection

Reusable eye protective equipment poses a potential risk for cross-infection. Any such items must be cleaned and disinfected after each use when leaving an isolation room/area, using agents effective against influenza and preferably using agents recommended by the manufacturer. Cleaning must precede disinfection. Hand hygiene must be performed after disposal or cleaning of eye protective equipment.

20. Engineering control strategies for health care facilities[15]

- Keep spatial separation of $\geq$ 1 meter between patients with respiratory illness/AI and other persons.
- As an extra precaution against airborne infection transmission, some isolation rooms include a small, attached room (anteroom) at the entry to the patient room where PPE and other supplies may be stored and where HCWs can put on and remove some PPE.
    - Direction of airflow in anterooms is variable and HCWs must be educated about where to place and remove PPE based on anteroom airflow.
    - If possible, develop methods that do not require retrofitting to create negative pressure and increased air changes per hour by mechanical manipulation of the air in rooms/areas housing AI-infected patients, particularly in rooms/areas where aerosol-generating procedures may be performed (Annex 6).[19-21]
- In health care facilities without central air conditioning, consider the use of natural ventilation (open windows in isolation rooms/areas) if weather permits, keeping the door closed.[22]
- Provide "no touch" devices when possible (e.g., water that can be turned on/off with elbow or foot).

Rationale

Engineering controls may reduce the risk of AI transmission in patient care areas housing AI-infected patients or in areas used for the evaluation of patients with respiratory illness.

For more information, please consult the CDC's "Guidelines for Environmental Infection Control in Health Care Facilities" at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm

21. Care of the deceased[23]

21.1. Removal of the body from the isolation room/area

- Use standard precautions for routine care of the body
- PPE to be used by HCWs
    - Particulate respirator, if HCWs remove the body immediately after the patients's death.
    - Surgical or procedure mask is sufficient, if air in the isolation room/area has been exchanged.
    - Disposable long-sleeved, cuffed gown, (waterproof if outside of body is visibly contaminated with potentially infectious excretions or secretions). Alternatively, if no waterproof gown is available, a waterproof apron can be used.
    - Nonsterile, ambidextrous gloves (single layer): should cover cuffs of gown.
- If splashing of body fluids is anticipated:
    - Balaclava-type cap (disposable).
    - Face shield (preferably) or goggles.
- The body should be fully sealed in an impermeable body bag prior to removal from the isolation room/area and prior to transfer to pathology or to the mortuary.
- No leaking of body fluids should occur and the outside bag should be kept clean.
- After removing PPE, perform hand hygiene.
- If the family of the patient wishes to view the body, they may be allowed to do so. If the patient died in the infectious period, the family should wear gloves and gowns and perform hand hygiene.
- Transfer to pathology or to mortuary should occur as soon as possible after death.
- Cultural sensitivity should be practised when an AI patient dies.

21.2. Postmortem examination[24]

- If postmortem examination is needed, obtain family consent.
- Family should not observe the postmortem procedure.

Recommendations to reduce aerosols in the autopsy room (e.g., lung excision)[24, 25]

- Avoid the use of power saws;
- Conduct procedures under water if there is a chance of aerosolisation; and
- Avoid splashing when removing lung tissue.
- The number of HCWs present should be restricted to the minimum number necessary.
- The team should consist of at least two people wearing appropriate PPE.

Recommended PPE

- Scrub suits: tops and trousers or equivalent garments.
- Disposable, waterproof, long-sleeved, gowns (if a waterproof gown is not available, a waterproof apron can be used over a gown).
- Surgical masks, or if small particle aerosols might be generated during autopsy

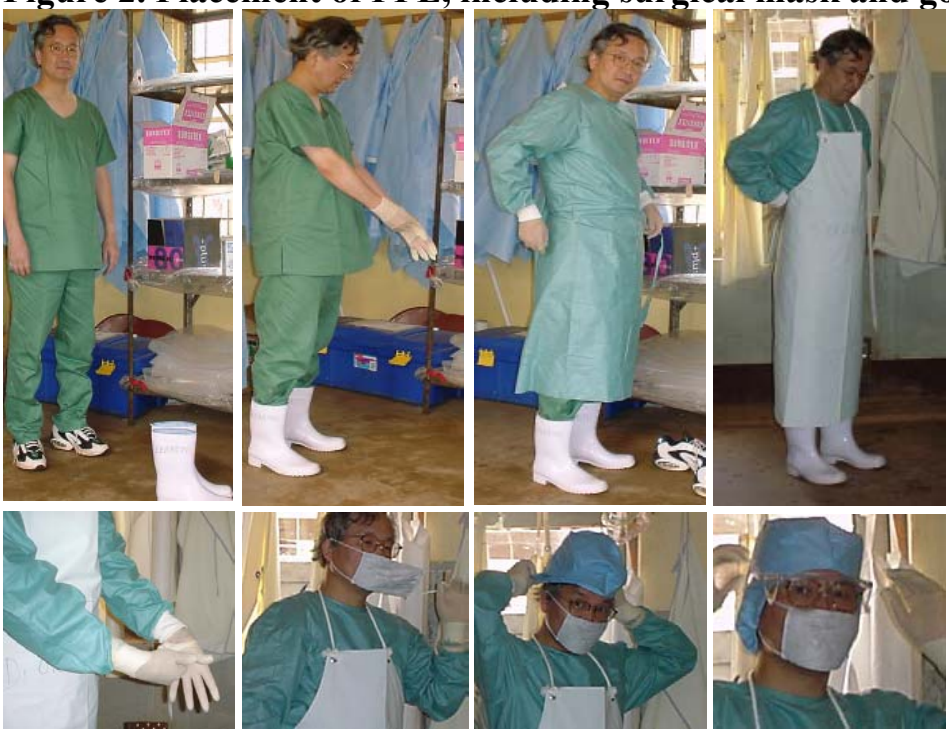
procedures, a particulate respirator at least as protective as a NIOSH-certified N95, EU FFP2 or equivalent should be used.

- Face shield (preferably) or goggles.
- Either autopsy gloves (cut-proof synthetic mesh gloves) or double layers of latex gloves
- Balaclava-type caps (disposable)
- Boots, canvas or similar slip-on shoes or overshoes (disposable) or stout plastic bags

PPE placement

1. In the change-room HCWs should replace their outer street clothes with scrub suits, or equivalent coverall garments, plus canvas or similar slip-on shoes.
2. Wear standard autopsy PPE, including a scrub suit worn under a fluid-resistant gown or a non-fluid-resistant gown plus waterproof apron, eye protection (i.e., face shield, goggles), double surgical gloves with an interposed layer of cut-proof synthetic mesh gloves, particulate respirator or surgical mask (as appropriate), and shoe covers.
3. Then, proceed to the post-mortem room where the body is located.

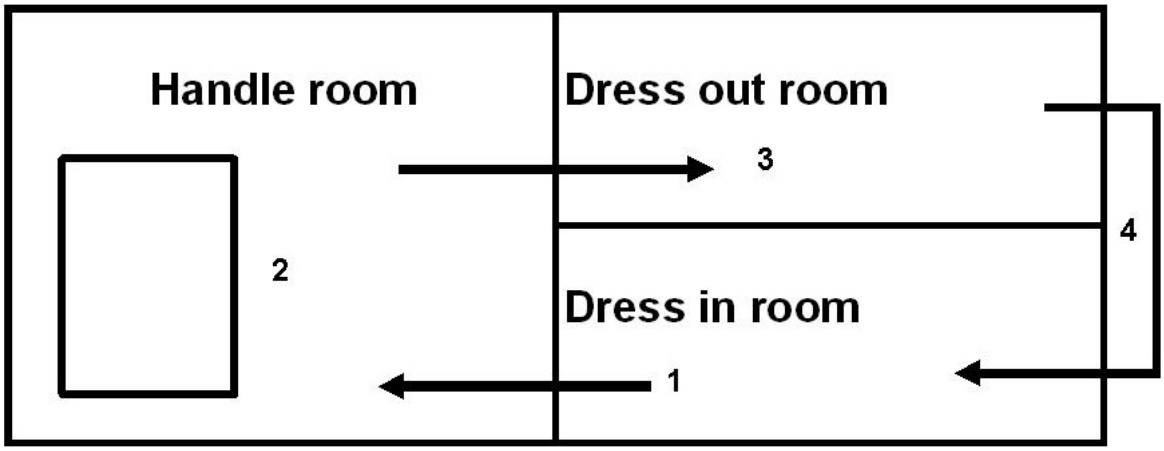
Figure 2. Placement of PPE, including surgical mask and goggles



PPE removal

Remove PPE before leaving the autopsy suite and dispose of it in accordance with recommendations. Remove PPE avoiding contamination of hands. After removal of gloves, perform hand hygiene (use an alcohol-based hand rub or wash hands with soap and water).

Figure 3. Schematic flux of the autopsy team at the health care facility



Cleaning of surfaces after autopsy

- Surfaces that have become contaminated with tissues or body fluids should be cleaned and decontaminated by:
    - removing most of the tissue or body substance with absorbent materials;
    - thorough cleaning of surfaces with water and liquid detergent;
    - wetting the surface with a sodium hypochlorite solution (Annex 7);
    - allowing at least 10 minutes contact time; and
    - rinsing thoroughly.

Engineering controls[15]

- Whenever possible, perform autopsies on AI-infected human bodies in autopsy settings that have an adequate air-handling system. This includes a minimum of 6 to 12 air changes per hour, negative pressure relative to adjacent areas, and direct exhaust of air to the outside. Exhaust systems around the autopsy table should direct air (and aerosols) away from HCWs performing the procedure (e.g., exhaust downward).
- Use containment devices whenever possible. Use biosafety cabinets for the handling and examination of smaller specimens. When available, use vacuum shrouds for oscillating saws or local exhaust ventilation to contain aerosols and reduce the volume released into the ambient air environment.

Rationale

Safety procedures for AI-infected human bodies should be consistent with those used for any autopsy procedure. In general, the acknowledged hazards of work in the autopsy room seem to depend more on contact with infected material, and particularly with splashes on body surfaces, than to inhalation of infectious material.

However, if the AI-infected patient died during the infectious period, the lungs may still contain virus and additional respiratory protection is needed during procedures performed on the lungs or during procedures that generate small-particle aerosols (e.g., use of power saws, washing

intestines). Therefore, postmortem exams of AI-infected patients should be conducted in a postmortem room using full barrier precautions.

21.3. Mortuary home care[26]

- Mortuary home staff should be informed that the deceased had AI.
- If mortuary staff are responding to the death of an AI-infected patient who died at home, full barrier PPE should be used while in the home.
- In the mortuary, mortuary staff and the burial team should use standard precautions when caring for the body. This includes appropriate use of PPE and performance of hand hygiene to avoid unprotected contact with blood, body fluids, secretions, or excretions.
- Embalming may be conducted as per routine.
- Hygienic preparation of the deceased (e.g., cleaning, tidying of hair, trimming of nails, and shaving) may also be conducted.
- The body in the body bag can be safely removed for storage in the mortuary, sent to the crematorium, or placed in a coffin for burial.
- If autopsy is being considered, the body may be held under refrigeration in the mortuary. Standard infection control precautions should be followed; there is no further risk of airborne or droplet spread of AI.
- If the family of the patient wishes to touch the body, they may be allowed to do so. If the patient died in the infectious period, the family should wear gloves and gowns and follow with hand hygiene.
- If family members want to kiss the dead body (hands, face) these body parts should be disinfected, using a common antiseptic (e.g., 70% alcohol).
- If the family wants only to view the body and the face of the deceased, but not touch it, there is no need to wear any kind of PPE.

Annex 1

Avian influenza background

1. Avian influenza

AI is an infectious disease of birds caused by type A strains of the influenza virus. The disease, which was first identified in Italy more than 100 years ago, occurs worldwide.[27] All birds are thought to be susceptible to infection with AI. Infection in birds causes a wide spectrum of symptoms, ranging from mild illness (low pathogenicity) to a highly contagious and rapidly fatal disease resulting in severe epidemics, which is known as "highly pathogenic AI" (HPAI). This form is characterized by sudden onset, severe illness, and rapid death of affected birds/flocks, with a mortality rate that can approach 100%.

Direct or indirect contact between domestic flocks and wild migratory waterfowl has been implicated as a frequent cause of epidemics in poultry populations. It is generally accepted that migratory waterfowl, most notably wild ducks, are the natural reservoir of AI viruses, which can be transmitted to domestic bird populations and to commercial poultry. In the absence of good surveillance and prompt control measures, AI epidemics can last for years.

The current outbreak of highly pathogenic AI A(H5N1), which began in Southeast Asia in mid-2003, is the largest and most severe on record. Never before in the recorded history of this disease have so many countries been simultaneously affected. The AI A(H5N1) virus has also proved to be especially tenacious. Despite the death or destruction of an estimated 150 million birds, the virus is now considered endemic in many parts of Indonesia and Viet Nam and in some parts of Cambodia, China, Thailand, and possibly the Lao People's Democratic Republic. The risk of a pandemic will persist until the disease is controlled in birds, which may take several years.

2. Avian-to-human AI A (H5N1) transmission

The first human cases of AI A (H5N1) associated with the current outbreak in birds were confirmed in January 2004, after clinical samples taken from two children and one adult admitted to hospital in Hanoi with severe respiratory illness tested positive for this strain.[28] Since then, additional human cases have occurred in several countries, and the clinical spectrum of AI A (H5N1) infection in humans ranges from asymptomatic infection to severe disseminated disease.[7] For updated information on affected countries, see at http://www.who.int/csr/disease/avian_influenza/country/en.

3. Human-to-human AI A (H5N1) transmission

Although assessment of possible human-to-human transmission of AI A (H5N1) is complicated by the likelihood that close contacts often have similar exposure histories (e.g., poultry exposures), available evidence indicates that limited human-to-human transmission

may have occurred. However, sustained transmission has not been demonstrated and there is no evidence that there has been more than one generation of human-to-human transmission. In the 1997 AI A(H5N1) outbreak in Hong Kong, there was evidence of possible human-to-human transmission between infected persons and household contacts and HCWs, but social contact was not associated with AI A (H5N1) infection.[5, 6, 29]

In the current AI outbreak, investigation of human AI A (H5N1) cases suggests that human-to-human transmission may have occurred in household clusters[28] and in one case of apparent child to mother transmission.[30] Thus far, all secondary cases appear to have had close contact with cases without the use of precautions and human-to-human transmission via the airborne route has not been identified.[31]

Human conjunctivae and ciliated nasal epithelial cells contain cellular receptors that are preferentially recognized by avian, rather than human, influenza hemagglutinin.[32, 33]Therefore, the contribution of the possible routes of transmission in humans may differ between AI A (H5N1) and seasonal human influenza. Although it is unknown at this time whether inoculation of the eye or nose will be important in the acquisition of human AI A (H5N1) infection, it seems prudent to protect these sites from inoculation. Also, since diarrhoea has been frequently noted in AI A(H5N1) infected patients[7] and AI A(H5N1) has been isolated from the faeces of a human case,[13]faeces may also prove to be a source of infection.

Disease transmission and severity may also be related to viral load, viral strain, and host immune response.[31, 34]Although the theory advanced during the SARS outbreak that "superspreading" events may occur[35] is unproven and it is unknown if superspreading-like events will occur with AI A(H5N1).

Although human-to-human transmission of AI A (H5N1) has been rare to date, the accumulation of point mutations or reassortment with a human influenza virus could lead to increased transmissibility of the virus at any time. Infections in HCWs could signal such a change.

4. AI A (H5N1) transmission of in health care facilities

Although complicated by different definitions of "exposure," and limited data, studies to date indicate that AI A (H5N1) is not easily transmitted between humans in health care facilities at this time. Thus far in the current (animal) outbreak, the risk of nosocomial transmission of AI A (H5N1) to HCWs has been very low, even when no specific infection control precautions were used, and no cases have been detected among HCWs who observed droplet and contact precautions. However, because AI A (H5N1) is not easily transmissible between humans at this time, nosocomial transmission would not be expected to be common, irrespective of the precautions used.

So far, there is no evidence of sustained human-to-human transmission of AI A (H5N1). In 1997, serologic studies of HCWs exposed to AI A (H5N1) infected patients suggested that if transmission occurred, it was inefficient.[5, 6]

In a report on the first 10 human cases admitted to two hospitals in Vietnam during the current outbreak, no influenza-like illness was reported in health care or laboratory workers even though two of the patients were managed with standard precautions only and neither facility was equipped with airborne infection isolation (negative pressure) rooms.[28]

In another report, no evidence of transmission was found among HCWs who provided care for two very ill AI A (H5N1) infected patients although the implementation of droplet and contact precautions was delayed and no negative pressure rooms were available.[36].

In two additional seroprevalence studies, no evidence of infection with AI A (H5N1) was identified in HCWs exposed to infected patients or their clinical samples.[37, 38] In one of these studies, most HCWs reported wearing PPE when providing care for AI A (H5N1) infected patients with 73% reported using a surgical mask.[37]. The possible use of negative pressure rooms was not reported.

The other study involved HCWs who were exposed to an AI A (H5N1) infected patient without the use of appropriate PPE.[38] None of these HCWs were infected, despite the fact that surgical masks, gloves, and gowns were not implemented until after the infected patient had been admitted for 48 hours. After that time, HCWs performing aerosol-generating procedures used N95 particulate respirators, hair covers and/or hoods, and goggles, in addition to gowns and gloves.[38] This facility did not have negative pressure rooms or any special ventilation system.

In the current outbreak, patients from Thailand, Viet Nam, and Cambodia were admitted a median of 6-8 days (range 3-8) after illness onset so it is possible that some patients may have been less infectious during their hospitalization, minimizing the risk of AI A(H5N1) transmission to HCWs.[7, 37]

In February 2005, a case of severe respiratory illness was reported in a nurse who provided care to an AI A (H5N1) infected patient in Viet Nam.[7] This case has not been confirmed, and the route of transmission is unclear because it was reported that the nurse had also visited a village where the poultry were ill. Similarly, in an Indonesian nurse, who developed respiratory symptoms on 31 December 2005 after providing care for an H5N1 infected patient, occupational exposure is considered unlikely, since she also had potential exposure to infected poultry.

Annex 2.

Human-to-human seasonal influenza A transmission

Most of our present knowledge on the transmission of seasonal influenza to humans is based on epidemiological studies of human influenza and some experimental studies in animals.

The recommendations to prevent and control human-to-human transmission are based on the following rationale.

1. Infectious respiratory aerosols

Coughing, sneezing, and talking can generate respiratory aerosols, which contain particles of varying sizes.[39] Particle size is determined by the force and pressure involved in the generation of the particles. The greater the force and pressure, the smaller the particle size will be. The length of time particles remain suspended in the air is determined by particle size, settling velocity, relative humidity and airflow. Larger particles ($\geq$5 μm) typically remain suspended in the air for limited period of time and settle within 1 meter (3 feet) of the source. The smallest particles (< 5 μm) evaporate quickly and the dried residues that remain (droplet nuclei) settle from the air slowly. Because the velocity of the air movement in a room can be greater than the settling velocity, droplet nuclei may be carried on air currents for some distance and remain suspended in the air for considerable lengths of time.[39] There is no predictable size for droplet nuclei; the final size depends on the nature of the fluid that contained the organism/s, the initial size of the aerosol, environmental conditions (e.g., temperature, relative humidity, and airflow), the time spent airborne, and the size of the organism/s within a droplet.

Infection control guidelines frequently cite a particle size of 5 μm as a break point, which distinguishes between diseases spread by droplet transmission (larger particles $\geq$ 5 μm) and diseases spread by airborne transmission (small particles < 5 μm).[10]

2. Human influenza A routes of transmission[10]

Available evidence suggests that transmission of human influenza viruses occurs through multiple routes including large droplets, direct and indirect contact, and droplet nuclei.[8-12] Airborne (droplet nuclei) transmission may be more likely to occur in situations in which droplet nuclei particles are generated (i.e., aerosol-generating procedures in infected patients).

Using current transmission-based terminology, influenza is transmitted between humans via droplets (droplet transmission), by direct and indirect contact (contact transmission), and small-particle aerosols (airborne transmission).[8-11] However, the importance of each route of transmission, particularly in settings where there are adequate air changes per hour, remains unclear. Observational studies conducted in health care facilities suggest that droplet transmission may be the major mode transmission in that setting.[8, 9, 12]

2.1 Droplet transmission

Droplets are generated primarily during coughing, sneezing, and talking. Droplet transmission occurs when larger particles (≥5 μm) containing the infectious agent are propelled through the air and deposited on the host's conjunctivae, nasal mucosa, or mouth. Larger particles spread in this manner typically do not remain suspended in the air for long periods, therefore, special air handling and ventilation are not required. Large droplet transmission has been considered a major mode of transmission of influenza based on epidemiologic patterns of disease transmission.

Evidence for droplet transmission of human influenza A

The main source of information on transmission of human influenza comes from observational studies.[9] During the 1957-1958 H2N2 influenza pandemic, an acutely ill patient was admitted to a four-person hospital room with no precautions. The following day, roommates and HCWs became ill. Subsequently, additional HCWs and scattered patients in other wards became ill. The epidemiological investigation suggested that HCWs helped disseminate infection to patients in other wards through either droplet or contact spread.[40]

More recently, nosocomial influenza experiences at two U.S. hospitals were described. In one hospital, transmission of influenza was rarely noted. In this facility, most rooms were private, but had positive pressure.[8] In the other hospital, transmission of influenza in paediatric patients was most often observed among patients in the same room, particularly those in adjacent cribs. Patients in other rooms in the same ward were less likely to become infected, even though room doors were open and influenza patients were not housed in negative pressure rooms.[9] These two studies suggest that the predominant mode of transmission was either through large droplets or by direct or indirect contact.

2.2 Contact transmission

Contact transmission may occur through either direct skin-to-skin contact or through indirect contact with virus in the environment and inoculation of the conjunctivae, nose, and mouth typically occurs via contaminated hands.

- Direct contact involves a direct body surface-to-body surface contact and physical transfer of microorganisms between an infected or colonized person and a susceptible host, such as occurs when a HCW turns a patient, bathes a patient, or performs other patient care activities that require direct personal contact. Direct-contact transmission can also occur between two patients, with one serving as the source of the infectious microorganisms and the other as a susceptible host.
- Indirect contact involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, such as contaminated surfaces, patient care equipment, instruments, or dressings, and contaminated hands that are not cleaned or contaminated gloves that are not changed between patients.

Evidence for contact transmission of human influenza A

Influenza infection has been induced by the application of nasal drops,[41]suggesting a possible role for contact transmission (e.g., intranasal inoculation by contaminated fingers).

Human influenza virus has been found to survive < 24-48 hours on nonporous surfaces and < 8-12 hours on cloth, paper, and tissues at 35-49% humidity and a temperature of 28° C. Virus can be transferred from nonporous surfaces to hands for 24 hours and from paper tissues to hands for 15 minutes. However, influenza virus could only be recovered from hands for five minutes, and only if viral titres were high.[42] Survival of AI virus also is dependent on environmental conditions.[43]

2.3 Airborne transmission

Airborne transmission occurs by dissemination of either airborne droplet nuclei (particles <5 μm of evaporated droplets containing microorganisms that can remain suspended in the air for long periods of time) or dust particles containing the infectious agent.

Airborne transmission can result in wide dispersal of the infectious agent by air currents and inhalation by a susceptible host within the same room or a longer distance from the source patient, depending on environmental factors; therefore, special air handling and ventilation are required to prevent airborne transmission.

Evidence for airborne transmission of human influenza A

To this point, the available studies have not definitely demonstrated the role of airborne transmission in human influenza. The best evidence of airborne transmission of influenza in humans comes from a 1979 study of influenza transmission on an aircraft.[44] Passengers, including a passenger who became acutely ill with a new H3N2 influenza strain, were detained on a runway for 4.5 hours. During this time the ventilation system was turned off for 2-3 hours. Although the ill passenger stayed on the plane the entire time, the other passengers and crew were free to come and go. The passengers (including the index case) were eventually separated into two groups and flown to their destination on two other planes. Within 72 hours, 72% of the passengers and crew subsequently developed influenza-like-illness (91% with confirmed influenza). The risk of illness was dependent on the amount of time spent on board. However, there were no differences in attack rates between the groups on the two subsequent planes, suggesting that additional exposure in an airplane with standard ventilation did not increase the risk of illness. Although airborne transmission is a possible explanation, droplet and contact spread cannot be excluded because passengers and crew would have passed within 1 meter of the coughing passenger on their way to various aircraft facilities.

Experimental studies in animals provide evidence for airborne transmission of influenza.[34, 45-47] However, it is unclear whether the results of these animal studies can be extrapolated to humans.

Annex 3.

Standard and transmission-based precautions

1. Standard precautions[10]

Background
Standard precautions should be used for all patients receiving care in hospitals, regardless of their diagnosis or presumed infection status. Standard precautions apply to 1) blood; 2) all body fluids, secretions, and excretions except sweat, regardless of whether or not they contain visible blood; 3) non-intact skin; and 4) mucous membranes. Standard precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.

Hand hygiene
Hand hygiene, which includes hand washing with soap and water and the use of alcohol-based hand rubs is critical to prevent possible self-inoculation of the nose, mouth, and conjunctivae and the transfer of microorganisms to the environment or other patients by contaminated hands. Hands should be washed with either a plain or antimicrobial soap and water when visibly soiled or contaminated with proteinaceous material. The use of an alcohol-based hand rub for routine hand antisepsis is recommended in the health care setting for all other clinical situations.

Perform hand hygiene after touching blood, body fluids, secretions, excretions, and contaminated items, whether or not gloves are worn. Perform hand hygiene immediately after gloves are removed, between patient contacts, and when otherwise indicated to avoid transfer of microorganisms to other patients or environments. It may be necessary to perform hand hygiene between tasks and procedures on the same patient to prevent cross-contamination of different body sites.

Alcohol-based hand rubs
Alcohol-based hand rubs have been recommended for hand hygiene in health care settings when hands are not visibly soiled or contaminated with proteinaceous material. If hands are visibly soiled or contaminated with proteinaceous material, hand washing with soap and water must be performed. When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. Follow the manufacturer's recommendations regarding the volume of product to use.[48]

Many studies have demonstrated that influenza, an enveloped virus, is susceptible to alcohols when tested *in vitro*[49] and *in vivo* testing with a 95% ethyl alcohol hand disinfectant reduced influenza virus on hands by a $\log_{10}$ reduction > 2.5.[50] Ethyl alcohol has greater activity against viruses than isopropyl alcohol,[51] therefore, ethyl alcohol-based hand disinfection products may be preferred over isopropyl alcohol products in settings where transmission of AI is likely.

Hand washing
When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet.[48]

Gloves
Wear gloves (clean, non-sterile gloves are adequate) when touching blood, body fluids, secretions, excretions, and contaminated items. Put on clean gloves just before touching mucous membranes and non-intact skin. Change gloves between tasks and procedures on the same patient after contact with material that may contain a high concentration of microorganisms. Remove gloves promptly after use, before touching non-contaminated items and environmental surfaces, and before going to another patient, and wash hands immediately to avoid transfer of microorganisms to other patients or environments.

Mask, eye protection, face shield
Wear a mask and eye protection or a face shield to protect mucous membranes of the eyes, nose, and mouth during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, and excretions.

Eye protection/face shield
As per standard precautions, eye protection should be used, regardless of the diagnosis, when there is a risk of contamination of the eyes/conjunctivae by splashes and sprays of blood, body fluids, secretions, and excretions generated through patient care. The use of eye protection should be based on an individual risk-assessment at the time of providing care:

- Eye protection should always be worn during aerosol-generating procedures (Annex 4).
- Eye protection should be used when working within 1 meter of suspected or confirmed AI-infected patients.

Eye protection can be achieved by the use of any one of the following:

- face shield;
- visor;
- goggles; or
- full face piece particulate respirator.

Gown
Wear a gown (a clean, non-sterile gown is adequate) to protect skin and to prevent soiling of clothing during procedures and patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions. Select a gown that is appropriate for the activity and amount of fluid likely to be encountered. Remove a soiled gown as promptly as possible and wash hands to avoid transfer of microorganisms to other patients or environments.

Foot protection
Although not typically referenced as an element of standard precautions, adequate foot protection is an important element of HCW protection. Health care facilities should ensure that

all HCWs wear appropriate footwear (i.e., fluid-resistant shoes that cover all parts of the feet) while working in the health care facility (no sandals).

Patient care equipment
Handle used patient-care equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately. Ensure that single-use items are discarded properly.

Environmental control
Ensure that the hospital has adequate procedures for the routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment, and other frequently touched surfaces, and ensure that these procedures are being followed.

Linen
Handle, transport, and process used linen soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures and contamination of clothing, and that avoids transfer of microorganisms to other patients and environments.

Occupational health and bloodborne pathogens
Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; and when disposing of used needles. Never recap used needles, or otherwise manipulate them using both hands, or use any other technique that involves directing the point of a needle towards any part of the body; rather, use either a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath. Do not remove used needles from disposable syringes by hand, and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers, which are located as close as practical to the area in which the items were used. Avoid use of reusable syringes, but if it is necessary, place reusable syringes and needles in a puncture-resistant container for transport to the reprocessing area. Use mouthpieces, resuscitation bags, or other ventilation devices as an alternative to mouth-to-mouth resuscitation methods in areas where the need for resuscitation is predictable.

Patient placement
Place a patient who contaminates the environment or who does not (or cannot be expected to) assist in maintaining appropriate hygiene or environmental control in a private room. If a private room is not available, consult with infection control professionals regarding patient placement or other alternatives.

Resource for standard and transmission-based precautions
"Practical Guidelines for Infection Control in Health Care Facilities", SEARO/WPRO, 2002, at: http://www.wpro.who.int/publications/PUB_9290222387.htm

Avian Influenza, including Influenza A (H5N1), in Humans: WHO Interim Infection Control Guidelines for Health Care Facilities (9 February 2006)

"Prevention of hospital-acquired infections: A practical guide." WHO, 2002, 2nd edition, at: http://www.who.int/csr/resources/publications/drugresist/WHO_CDS_CSR_EPH_2002_12/en/

Resources for hand hygiene
WHO. Guidelines on Hand Hygiene in Health Care (Advanced Draft): A Summary
http://www.who.int/patientsafety/events/05/HH_Guidelines_10Oct2005_AdvDraft_FINAL.pdf

2. Transmission-based precautions[10]

Transmission-based precautions (droplet, contact, and airborne) are to be used **in addition to** standard precautions when providing care for patients who are suspected or confirmed to be infected with highly transmissible or epidemiologically important pathogens for which additional precautions beyond standard precautions are needed to interrupt transmission in health care facilities.

Droplet precautions

- Patient placement: private room, if possible; if not available, use cohorting, keeping at least 1 meter between patients' beds.
- Use surgical or procedure mask when entering the patient room; masking is mandatory if working within 1 meter of the patient.
- Patient transport: limit patient movement, use of surgical mask by the patient.

Contact precautions
Use for all contact with the patient or the patient's environment:

- **Gloves**
  - Clean non-sterile, ambidextrous gloves are adequate.
  - Gloves should cover the cuff of the gown.
  - Gloves should be worn only once and then placed in a waste receptacle.
- **Gown**
  - A disposable gown made of synthetic fibre or a washable cloth gown may be used.
  - Ensure that gowns are of the appropriate size to fully cover the area to be protected.
  - Gowns should preferably be worn once and then placed is a waste or laundry receptacle, as appropriate, and hand hygiene performed.
- Use either disposable equipment or dedicate equipment such as stethoscopes, blood pressure cuffs, thermometers, etc. to specific patients. If equipment needs to be shared among patients, it must be cleaned and disinfected between uses.
- It is critical that HCWs refrain from touching their eyes, nose, or mouth with potentially contaminated gloved or ungloved hands.
- Avoid contaminating environmental surfaces that are not directly related to patient care (e.g., door handles, light switches).

Airborne precautions

- When entering the isolation room/area or when providing care to a patient with an airborne infectious disease in other settings, use a particulate respirator that is at least as protective as a U.S. NIOSH-certified N95, EU FFP2, or equivalent (Annex 4).[10]
- Appropriate procedures should be used to select a particulate respirator that fits well and a user seal check should be performed each time a particulate respirator is worn.
- Airborne precautions also include engineering controls, such as placing the patient in an airborne infection isolation (negative pressure) room or area.[15]

Resource for transmission-based precautions

CDC. Guideline for Isolation Precautions in Hospitals

"Practical Guidelines for Infection Control in Health Care Facilities", SEARO/WPRO, 2002, at: http://www.wpro.who.int/publications/PUB_9290222387.htm

"Prevention of hospital-acquired infections: A practical guide." WHO, 2002, 2nd edition, at: http://www.who.int/csr/resources/publications/drugresist/WHO_CDS_CSR_EPH_2002_12/en/

Resource for airborne infection isolation rooms

CDC. Guideline for Environmental Infection Control in Health-Care Facilities, 2003 http://www.cdc.gov/ncidod/dhqp/gl_environinfection.html

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Annex 4.

Respiratory protection

1. High risk aerosol-generating procedures

It is likely that aerosol-generating procedures could increase the potential for dissemination of small-particle respiratory aerosols (droplet nuclei) in the immediate vicinity of an AI patient. Examples of aerosol-generating procedures include:

- endotracheal intubation
- administration of aerosolized or nebulized medication (this administration route should be strongly discouraged in AI-infected patients if appropriate airborne precautions are not guaranteed).
- diagnostic sputum induction
- bronchoscopy
- airway suctioning
- tracheostomy care
- chest physiotherapy
- nasopharyngeal aspiration
- positive pressure ventilation via face mask (e.g., BiPAP, CPAP)
- high-frequency oscillatory ventilation
- resuscitation manoeuvres
- postmortem excision of lung tissue

Transmission of SARS to HCWs in Toronto was associated with intubation, suctioning before intubation, and manipulation of oxygen masks.[52, 53] Transmission to health care workers in Hong Kong was associated with the use of a medication nebulizer.[54] Although the risk of aerosol-generating procedures has not been evaluated for influenza, additional precautions for HCWs performing aerosol-generating procedures on AI-infected patients appear warranted.[55] PPE should cover the torso, arms, and hands as well as the eyes, nose, and mouth. A hair cover can be used optional.

2. Respiratory protection for aerosol-generating procedures

During aerosol-generating procedures, there must be minimal particulate respirator face-seal leakage to fully protect HCWs from exposure to small-particle respiratory aerosols. The following respiratory protection options should be considered:

- A particulate respirator at least as protective as a NIOSH-certified N95, EU FFP2 or equivalent is the minimum level of respiratory protection required for HCWs performing aerosol-generating procedures.
- Appropriate procedures should be used to select a particulate respirator that fits well and a user seal check should be performed each time a disposable particulate respirator is worn, before entering the isolation room/area.

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3. **Engineering controls for aerosol-generating procedures**
    - Perform the procedure in a negative pressure room (if available).
    - If a negative pressure room/area is not available:
        - Perform the procedure in a private room away from other patients.
        - If possible, increase air changes, create negative pressure relative to the hallway, and avoid recirculation of the room air (exhaust air outside).[19-21]
        - If recirculation of air from such rooms is unavoidable, pass the air through a HEPA filter before recirculation.
        - Keep doors closed except when entering or leaving the room, and minimize entry and egress to the room during the procedure.
    - Closed ventilation systems for intubated patients may also be used.

4. **Selection of respiratory protection equipment**

Particulate respirators

- HCWs working with AI-infected patients should select the highest level of respiratory protection equipment available, preferably a particulate respirator. Particulate respirators are designed to protect the wearer from respiratory aerosols expelled by others, regardless of particle size.
- Use a particulate respirator that is at least as protective as U.S. NIOSH-certified N95, EU FFP2, or an equivalent.[10] Examples of acceptable disposable particulate respirators in various parts of the world include:
    - U.S. NIOSH-certified N95 (95%), N99 (99%), N100 (99.7%)
    - Australia/New Zealand: P2 (94%), P3 (99.95%)
    - China: II (95%), I (99%)
    - Japan: 2nd class (95%), 3rd class (99.9%)
    - Korea: 1st class (94%), Special (99.95%)
    - EU: FFP2, FFP3
- The fit and seal of disposable particulate respirators is critical for effective function. If possible, it is recommended that fit testing be performed prior to the first use of a disposable particulate respirator determine if an acceptable fit and seal can be achieved.
- A user seal check should be performed each time a disposable particulate respirator is worn. If there is not a good fit and seal the particulate respirator will not be effective.
- HCWs with facial hair should not use a disposable particulate respirator because a good seal cannot be obtained. HCWs with facial structure abnormalities may also be unable to obtain a good seal.
- Some factors to consider when choosing particulate respirators in this setting include affordability, availability, impact on mobility, impact on patient care, potential for exposure to higher levels of aerosolized respiratory secretions, and potential for reusable particulate respirators to serve as fomites for transmission.

For information on particulate respirators, fit testing, and user seal checks, see:

- http://www.cdc.gov/niosh/npptl/topics/respirators
- http://www.osha.gov/SLTC/respiratoryprotection/standards.html

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Surgical and procedure masks

- Surgical or procedure masks are indicated when providing care for patients infected by droplet transmitted diseases and/or as part of facial protection during patient-care activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions.
- Surgical and procedure masks do not offer appropriate respiratory protection against small-particle aerosols (droplet nuclei) and should not be used unless particulate respirators are not available when dealing with airborne transmitted diseases.[56-58] If a particulate respirator is not available, use a tightly fitting mask.
- There are no minimum standards or standardized testing methods for surgical mask filter efficiency, and there are a wide variety of filter efficiencies among available masks.
- Surgical and procedure masks are not designed for fit and thus do not prevent leakage around the edge of the mask when the user inhales, which is a major limitation for protection against droplet nuclei.[59]
- Surgical masks come in two basic types: one type is affixed to the head with two ties, conforms to the face with the aid of a flexible adjustment for the nose bridge, and may be flat/pleated or duck-billed in shape; the second type is pre-moulded, adheres to the head with a single elastic band and has a flexible adjustment for the nose bridge.
- Procedure masks are flat/pleated and affix to the head with ear loops. All masks have some degree of fluid resistance, but those approved as surgical masks must meet specified standards for protection from penetration of blood and body fluids.

Annex 5

National infection control programmes

The responsible health authority should develop a national (or regional) infection control programme to support health care facilities in reducing the risk of healthcare-associated infections.

More information on infection control programmes can be found in the document "Prevention of hospital-acquired infections: A practical guide." WHO, 2002, 2nd edition, at: http://www.who.int/csr/resources/publications/drugresist/WHO_CDS_CSR_EPH_2002_12/en/

Such programmes must:

- set relevant national objectives consistent with other national health care objectives;
- develop and continually update guidelines for recommended health care surveillance, prevention, and infection control practices;
- develop a national system to monitor selected infections and assess the effectiveness of interventions;
- harmonize initial and continuing training programmes for HCWs;
- facilitate access to materials and products essential for hygiene and safety;
- encourage health care establishments to promote infection control best practices, and
- encourage health care establishments to monitor health-care associated infections and to provide feedback to the HCWs concerned.

The national or regional health authority should designate an agency to oversee the programme (a ministerial department, institution, or other body), and plan national activities with the help of a national expert committee.

The National infection control committee should:

- review risks associated with new technologies, and monitor the risk of acquiring an infection from new devices and products, before their approval for use;
- review and provide input into investigation of outbreaks and epidemics; and
- communicate and cooperate with other health care facility committees with common interests, such as pharmacy and therapeutics or antimicrobial use committee, biosafety or health and safety committees, waste management committee, and blood transfusion committee.

Each health care facility should:

- develop an infection control programme to ensure the well being of patients, HCWs, and visitors;
- develop an annual work plan to assess and promote good health care, appropriate isolation; sterilization; and other infection control practices, HCW training, and epidemiological surveillance;

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- provide sufficient resources to support the infection control programme.

Risk prevention for patients and HCWs is the concern of everyone in the facility, and must be supported by the senior administration.

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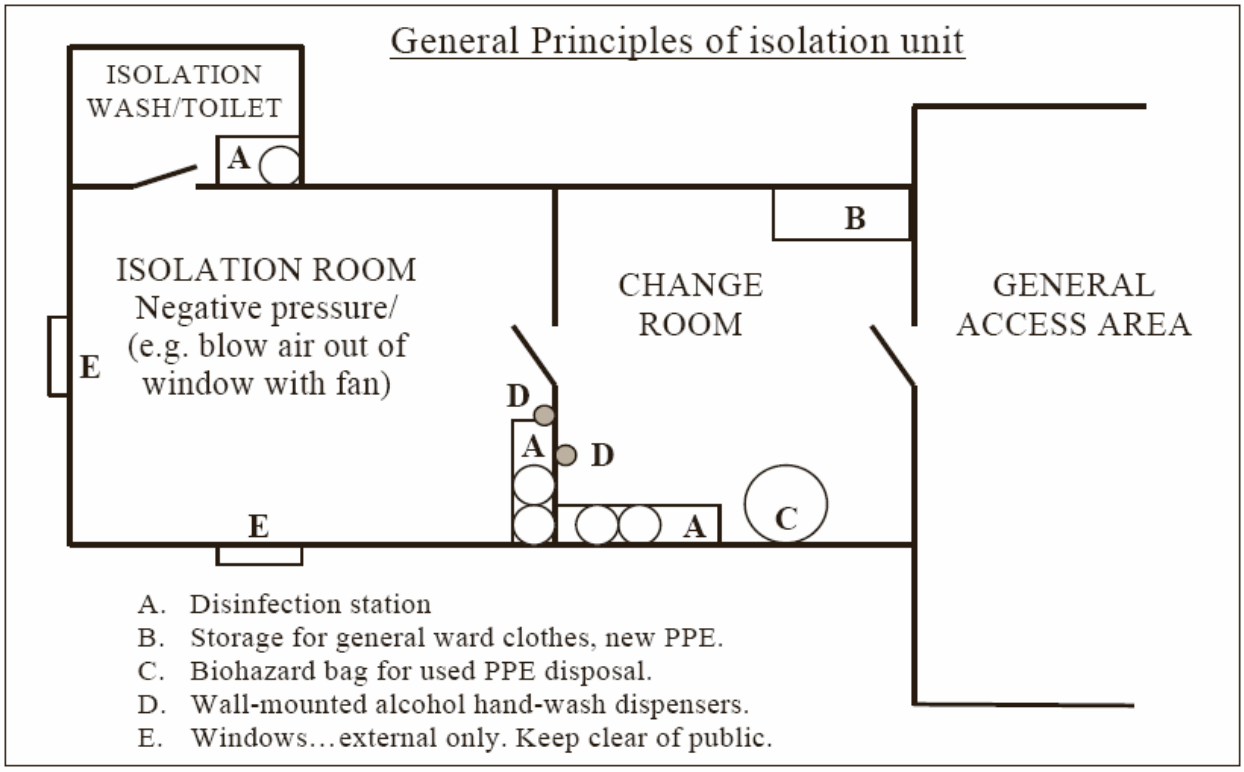
Annex 6.

Airborne infection isolation rooms

Characteristics of airborne infection isolation rooms

Airborne precautions also include engineering controls, such as placing the patient in an airborne infection isolation (negative pressure) room or area. It is recommended that such rooms have: [15]

- a door that closes;
- monitored negative air pressure (exhaust air volume > supply air volume) in relation to the adjacent space (i.e., the direction of the air flow is from outside the adjacent space, such as a corridor, into the room);
- 6 to 12 air changes (ACH) per hour; [19-21] and
- room/area air exhausted directly outside (ensuring that it does not expose others) or recirculated after filtration by a high-efficiency particulate air (HEPA) filter.



For more information on airborne infection isolation rooms, see:
http://www.cdc.gov/ncidod/dhqp/gl_environfection.html

Suggested checklist for isolation room/area trolley/table

The following items should be kept on the trolley at **all times** so that personal protective equipment is always available for health care workers.

Equipment	**Stock present**
Face shield/visor/goggles	
Single use gloves for clinical use (sizes: small, medium, and large)	
Gloves (reusable for environmental cleaning)	
Hair covers (optional for high risk procedures, but should be available)	
Particulate respirators (N95, FFP2, or equivalent)	
Surgical or procedure masks	
Single-use long sleeved fluid-resistant gowns	
Single-use plastic aprons (optional if splashing is anticipated)	
Alcohol-based hand rub **or** alternative method for washing hands in clean water Plain soap (liquid if possible) Disinfectant Clean single-use towels	
Appropriate disinfectant for environmental cleaning	
Large plastic bags	
Appropriate clinical waste bags	
Linen bags	
Collection container for used equipment	

For more information on isolation precautions see:

"Practical Guidelines for Infection Control in Health Care Facilities", SEARO/WPRO, 2002, at: http://www.wpro.who.int/publications/PUB_9290222387.htm

"Prevention of hospital-acquired infections: A practical guide." WHO, 2002, 2nd edition, at: http://www.who.int/csr/resources/publications/drugresist/WHO_CDS_CSR_EPH_2002_12/en/

For additional information on hand hygiene, see:

"WHO guidelines on hand hygiene in health care (advanced draft): a summary", at: http://www.who.int/patientsafety/events/05/global_challenge/en/index.html

Annex 7.

Use of disinfectants

Alcohol and Bleach

Health care facilities with limited resources may not have access to standard hospital disinfectants. Alcohol and bleach are acceptable alternatives when used as directed below.

Alcohol

Alcohol is effective against influenza virus.[49]Ethyl alcohol (70%) is a powerful broad-spectrum germicide and is considered generally superior to isopropyl alcohol. Alcohol is often used to disinfect small surfaces (e.g., rubber stoppers of multiple-dose medication vials, and thermometers) and occasionally external surfaces of equipment (e.g., stethoscopes and ventilators). Because alcohol is flammable, its use as surface disinfectant should be limited to small surface areas and it should be used in well-ventilated spaces only. Alcohol may also cause discoloration, swelling, hardening, and cracking of rubber and certain plastics after prolonged and repeated use.

Sodium hypochlorite (bleach)

Bleach is a strong and effective disinfectant, but it is readily inactivated in the presence of organic material. Its active ingredient, sodium hypochlorite, is effective in killing bacteria, fungi, and viruses, including influenza virus.

Diluted household bleach works at variable contact times (from 10 to 60 min), is widely available at a low cost, and can be recommended for disinfection in health care facilities. However, bleach irritates mucous membranes, the skin and the airway, decomposes under heat or light, and reacts readily with other chemicals. Therefore, caution is advised when bleach is used. Improper use of bleach may reduce its effectiveness for disinfection and can also result in health care worker injury.

Procedures for preparing/using diluted bleach

- Use mask, rubber gloves, and waterproof apron. Goggles are also recommended to protect the eyes from splashes.
- Mix and use bleach solutions in well-ventilated areas.
- Mix bleach with cold water because hot water decomposes the sodium hypochlorite and renders it ineffective.
- Bleach containing 5% sodium hypochlorite should be diluted as in the table below:

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Table: Sodium hypochlorite: concentration and use.

Solution	Recommended dilution	Available chlorine after dilution	Uses	Contact time
Most household bleach preparations contain 5% sodium hypochlorite (50,000 parts per million of available chlorine). However, because concentrations can vary, please check bleach labels carefully to determine the concentration of sodium hypochlorite.	Usually a 1:100 dilution of 5% sodium hypochlorite is recommended. For bleach containing 5% sodium hypochlorite, use 1 part bleach to 99 parts cold tap water (1:100 dilution) for disinfection of surfaces.[15] Adjust ratio of bleach to water as needed to achieve appropriate concentration of sodium hypochlorite, e.g., for bleach preparations containing 2.5% sodium hypochlorite, twice as much bleach should be used (2 parts bleach to 98 parts water).	For bleach preparations containing 5% sodium hypochlorite, a 1:100 dilution will yield 0.05% or 500 parts per million available chlorine. Bleach solutions containing other concentrations of sodium hypochlorite will contain differing amounts of available chlorine when diluted.	Disinfection by wiping of nonporous surfaces. **Surfaces must be cleaned of organic materials, such as secretions, mucous, vomitus, faeces, blood, or other body fluids prior to disinfection.** .	A contact time of ≥ 10 minutes is recommended.
			Disinfection by immersion of items. **Items must be cleaned of organic materials, such as secretions, mucous, vomitus, faeces, blood, or other body fluids prior to immersion** .	A contact time of 30 minutes is recommended.

Bleach precautions

- Bleach can be corrosive to metals and damage painted surfaces.
- Avoid touching the eyes. If bleach gets into the eyes, immediately rinse with water for at least 15 minutes and consult a doctor.
- Bleach should not be used together or mixed with other household detergents because this reduces its effectiveness and can cause chemical reactions.
- A toxic gas is produced when bleach is mixed with acidic detergents such as those used for toilet cleaning and this gas can cause death or injury. If necessary, use detergents first and rinse thoroughly with water before using bleach for disinfection.
- Undiluted bleach liberates a toxic gas when exposed to sunlight and should be stored in a cool and shaded place out of the reach of children.
- Sodium hypochlorite decomposes with time. To ensure its effectiveness, it is advised to purchase recently produced bleach and avoid over-stocking.
- Diluted bleach should be made fresh daily, labeled, dated, and unused portions discarded 24 hours after preparation.
- Organic materials inactivate bleach; surfaces must be cleaned of organic materials prior to disinfection with bleach.
- Keep diluted bleach covered, protected from sunlight, in a dark container (if possible) and keep out of the reach of children.

Annex 8.

Information about contact with chickens, ducks, and other animals

- Avoid contact with chicken farms, duck farms, or any farm where animals have been ill, slaughtered, or are thought to harbour AI
- If you inadvertently come into contact with an environment that has had sick/dead poultry, wash your hands thoroughly and monitor your temperature for 7 days. If you develop a sudden high fever (> 38º C) or signs of respiratory illness, consult your doctor regarding whether or not you should receive antiviral medication.
- If you have had contact with poultry that have died from AI or if you have had contact with the faeces of these poultry, consult your health care adviser for advice regarding self-monitoring of temperature and where to obtain treatment/ prophylaxis if needed.

Annex 9.

Antiviral prophylaxis after AI exposure

Antiviral drugs have demonstrated efficacy in the treatment and prevention of seasonal influenza A.[60, 61] Additional data are needed on the role of antivirals in the treatment and prophylaxis of AI. Older M2 inhibitor antivirals (amantidine and ramantidine) are ineffective against AI A(H5N1) *in vitro,* [62] but AI A(H5N1) is susceptible *in vitro* to neuraminidase inhibitors (oseltamivir and zanamivir).[63-65] The optimal dose and duration of treatment for AI with neuraminidase inhibitors are unknown.

Of 25 AI A(H5N1) patients who received oseltamivir, 19 died. However, treatment may have been started too late to be effective.[7, 28] The development of antiviral resistance is also a concern and oseltamivir resistance has been detected in AI A(H5N1) isolates from several patients treated with oseltamivir.[66, 67] Even if proven effective for treatment or prophylaxis of AI A(H5N1), neuraminidase inhibitors are expensive and current supplies are limited.

Health care facilities should follow the national policy on antiviral prophylaxis of HCWs providing care for AI infected patients.

Antiviral prophylaxis for potentially exposed HCWs[7]

- Although the efficacy of neuraminidase inhibitors as prophylaxis for AI A(H5N1) is unknown, prophylaxis is suggested for exposed HCWs because of the high mortality of the disease.
- When used for potentially exposed HCWs, the HCW should take 75 mg oseltamivir phosphate each day for at least 7 days beginning immediately or as soon as possible after unprotected exposure (< 48 hours) to a AI A(H5N1) infected patient. When used, prophylaxis should continue until 1 week after the last unprotected exposure. **[7]**

Annex 10.
Sample HCW influenza-like illness monitoring form

Name: _____ Home telephone number: _____

Job title: _____ Work location: _____

Date/s of exposure (list all, use back of page if necessary): ____/____/_____ ____/____/_____

Type of contact with AI patient, patient environment, or virus:

_____

Was personal protective equipment (PPE) used: No _____ Yes _____

If yes, list PPE used (e.g., gown, gloves, particulate respirator, surgical mask, eye protection, etc):

_____

List any non-occupational exposures (i.e., exposure to birds or persons with severe acute respiratory illness):

_____

Please check your temperature twice a day for 10 days after providing care for an AI-infected patient, including 10 days after your last exposure, and also monitor yourself for any of the following influenza-like illness (ILI) symptoms:

- Fever > 38° C
- Cough
- Acute onset of respiratory illness
- Sore throat
- Arthralgia
- Myalgia or prostration
- And/or gastrointestinal symptoms (e.g., diarrhea, vomiting, abdominal pain)

If any symptoms of influenza-like illness occur, immediately limit your interactions with others, exclude yourself from public areas, and notify _____at _____ immediately.

Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**
Date ____/____/_____	Date ____/____/_____	Date ____/____/_____	Date ____/____/_____	Date ____/____/_____
AM temperature: _____	AM temperature: _____	AM temperature: _____	AM temperature: _____	AM temperature: _____
PM temperature: _____	PM temperature: _____	PM temperature: _____	PM temperature: _____	PM temperature: _____
ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____

Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Date ____/____/_____	Date ____/____/_____	Date ____/____/_____	Date ____/____/_____	Date ____/____/_____
AM temperature: _____	AM temperature: _____	AM temperature: _____	AM temperature: _____	AM temperature: _____
PM temperature: _____	PM temperature: _____	PM temperature: _____	PM temperature: _____	PM temperature: _____
ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____	ILI symptoms: No ____ Yes ____

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