NHS

PANDEMIC INFLUENZA

Guidance for infection control in hospitals and primary care settings

Prior to a declaration by the World Health Organization that a pandemic has started, hospitals and practitioners should be alert to cases of influenza caused by a novel virus that has not yet fully adapted to humans and that may become a pandemic virus. The number of such cases is expected to be small, and they are most likely to occur in travellers returning from affected parts of the world. The infection control guidance in this document does not apply to the management of such cases, and practitioners should follow current guidance as issued by the Health Protection Agency at www.hpa.org.uk/infections/topics_az/influenza/avian/guidelines.htm

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Guidance for infection control in hospitals and primary care settings

Department of Health, England
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Executive summary

This guidance supersedes the previous guidance issued in October 2005.[1]

Acute trusts and primary care trusts (PCTs) will form the vanguard of the NHS response to an influenza pandemic. This document has been developed to facilitate planning by NHS trusts and provides guidance on infection control and tools for local public health and healthcare officials who are at the front line in managing and containing an influenza pandemic. It includes detailed sections on preparedness planning, occupational health, infection control precautions and environmental infection control. Additional sections focus separately on issues specific to hospitals and primary care. Planning now is essential and will ease the decision-making process when a pandemic occurs.

The guidance has also been summarised in a shorter document: *Pandemic flu: a summary of guidance for infection control in healthcare settings*, which is available via the Department of Health website at www.dh.gov.uk/pandemicflu

For planning purposes it is assumed that a pandemic strain of influenza will have properties of transmission, communicability and inactivation that are similar to those of 'routine' seasonal influenza. It is well established that influenza is transmitted from person to person through close contact. Most data point towards short-range transmission in nosocomial outbreaks of influenza. This pattern of transmission is known to be associated with spread by droplet and contact. In view of this, standard principles of infection control and droplet precautions are the main control strategies and should be rigorously followed. Aerosol transmission may also occur. In certain circumstances, the standard and droplet control measures may need to be augmented by respiratory protection.

Scrupulous attention to hand hygiene and containment of respiratory secretions produced by coughing and sneezing are the cornerstones of effective infection control. Other key recommendations include separation of patients with influenza or cohorting (grouping with other patients with influenza and no other infection); prompt identification and exclusion of ill staff and restriction of ill visitors from healthcare settings; wearing appropriate personal protective equipment (PPE); and educating staff, visitors and patients about the transmission and prevention of influenza, using information that is understandable and applicable to their particular situation.

During a pandemic there may be limited supplies of antiviral drugs, and an effective vaccine may not be available during the first (or only) wave. Thus, attention to the non-pharmaceutical methods of control as outlined in this guidance will be particularly important.

This guidance will be updated if epidemiological and virological information on the eventual pandemic virus indicates that adjustments in the approach to infection control are necessary. Readers are strongly urged to refer to the most up-to-date version of this guidance via the Department of Health website at www.dh.gov.uk/pandemicflu

1 Overview of the guidance document

1.1 Scope and purpose

This document provides guidance and information on infection control procedures to inform and advise local NHS planning for an influenza pandemic. It is issued jointly by the Department of Health in England and the Health Protection Agency (HPA) as official guidance.

Health is a devolved responsibility in the UK and each country has its own Chief Medical Officer. Whilst this guidance seeks to ensure a consistent and resilient UK-wide approach, some differences in operational details and organisational responsibilities apply in Northern Ireland, Scotland and Wales.

This guidance is intended for use on a UK-wide basis in the event that the World Health Organization (WHO) declares that an influenza pandemic has started,[2] and the Department of Health has declared 'UK pandemic alert level[2,3] (ie cases of pandemic influenza have been identified within the UK).[a] It should be read in conjunction with the current version of the Department of Health's *Pandemic flu: A national framework for responding to an influenza pandemic*[3] and its associated guidance, including guidance for acute hospitals,[4] guidance on healthcare in a community setting,[5] and *Pandemic flu: Clinical management of patients with an influenza-like illness during an influenza pandemic*.[6] Relevant Health and Safety Executive (HSE) legislation and guidance, including the *Control of Substances Hazardous to Health* (COSHH) Regulations 2002 (as amended),[7] *Biological agents: Managing the risk in laboratories and healthcare premises*[8] and *Respiratory protective equipment at work: A practical guide*,[9] should also be consulted.

To facilitate preparedness planning this document has been written in advance of the emergence of the next influenza pandemic, at a time when the identity of any causative virus remains unknown. It is based on the best evidence available from previous pandemic and inter-pandemic periods. Thus the guidance may evolve as information on the eventual pandemic virus emerges. **Users are strongly urged to refer to the most up-to-date version of this guidance via the Department of Health website at www.dh.gov.uk/pandemicflu**

a. Prior to a declaration by WHO that a pandemic has started, hospitals and practitioners should be alert to cases of influenza caused by a novel virus that has not yet fully adapted to humans and that may become a pandemic virus. The number of such cases is expected to be small, and they are most likely to occur in travellers returning from affected parts of the world. The infection control guidance in this document does not apply to the management of such cases, and practitioners should follow current guidance as issued by the HPA at www.hpa.org.uk/infections/topics_az/influenza/avian/guidelines.htm

1.2 Changes and amendments in this edition

This guidance should be used in place of the guidance issued in October 2005. Changes have been made in the following sections.

Who should work? (section 4.1)

- Healthcare workers who have symptoms of pandemic influenza, including those who are beginning to experience symptoms or are recovering from influenza, should not work, so as to avoid infecting patients, colleagues and others.

Personal protective equipment (section 5.3)

- Guidance is given with respect to putting on and removing PPE.

Aerosol-generating procedures (section 5.4)

- Procedures that have the potential to generate aerosols are detailed.

Patient placement, segregation and cohorting (section 7.2)

- Practical issues that have been identified during simulations of an influenza pandemic are included for consideration.

Critical care units (section 7.6)

- Advice on issues specific to critical care have been expanded to include guidance on patient ventilation and other respiratory issues.

Appendices

- The evidence base has been updated and modelling studies summarised.

1.3 Terminology

Droplet: The previous version of this document used the terms 'large droplet' and 'fine droplet'; in this version only the term 'droplet' is used. Droplets are particles propelled by coughing and sneezing and during the performance of some procedures. They are generally regarded to be larger than 5µm in diameter, although there is no consensus on size. Droplets can be deposited on the conjunctiva or mucous membranes of the nose, mouth or respiratory tract and throughout the environment. However, because of their relatively large size, droplets generally travel only short distances (typically less than one metre) before falling to the ground.

Aerosol: The previous version of this document used the terms 'fine droplet' and 'aerosol' to describe aerosols, but only the term 'aerosol' is used in this version. Aerosols are very small particles (typically thought to be less than 5µm in diameter, although there is no consensus on size) that, because of their size, can remain suspended in the air and travel over long distances. Aerosols can be generated by certain medical procedures.

Airborne: Some authors use the term 'airborne' to describe transmission only by aerosols; others use it for transmission that had any airborne phase, whether by aerosol, droplet or splash. Therefore this term has not been widely used in this document, but where other authors' intended meaning cannot be deducted, the term airborne remains and this is indicated.

Healthcare worker: Refers to all workers employed in healthcare settings. It is used in an inclusive context and is not restricted to those professions traditionally regarded as healthcare workers, such as doctors, nurses and allied health professionals (AHPs).

Influenza: Refers to cases of pandemic influenza that are either confirmed by laboratory test(s) or diagnosed according to clinical signs and symptoms. A laboratory-confirmed diagnosis of influenza is more likely to be obtained during the early stages of a pandemic. As the number of patients rapidly increases and health professionals become more proficient at making a clinical diagnosis, confirmatory laboratory testing is likely to diminish significantly, and almost all cases will be diagnosed on clinical grounds alone.

1.4 Organisation of the guidance document

The document is divided into levels of increasingly detailed information:

- an executive summary
- an overview of pandemic influenza and core principles of containment and infection control (section 2)
- detailed guidance that applies to both hospital and primary care settings on preparedness planning (section 3), occupational health (section 4), infection control precautions (section 5) and environmental infection control (section 6)
- supplementary sections on hospital settings (section 7) and primary care settings (sections 8), including key infection control issues for specialised settings within these domains
- appendices providing the evidence base underpinning this guidance and tools to aid local-level preparedness, and references, a bibliography and list of abbreviations.

By using this guidance, acute trusts and PCTs and other community healthcare settings can develop operational pandemic influenza response plans that utilise consistent infection control principles and practices.

2 Overview of pandemic influenza and infection control[b]

Key points

Health impacts of an influenza pandemic in the UK

- All age groups are likely to be affected, but children and otherwise fit adults could be at relatively greater risk.
- Clinical attack rate may be of the order of 25% to 35%, but up to 50% is possible.
- Between 55,000 and 750,000 deaths are possible.
- Substantial demand for healthcare services is likely, in both primary care and hospital settings.

Clinical features of influenza

- The most significant features are rapid onset of cough and fever.
- Headache, sore throat, a runny or stuffy nose, aching muscles and joints, and extreme tiredness are other symptoms.
- People are most infectious soon after they develop symptoms, although typically they can continue to excrete viruses for up to five days (seven days in children).

How influenza is spread

- The virus is transmitted from person to person through close contact. The balance of evidence points to transmission by droplet and through direct and indirect contact as the most important routes.
- Aerosol transmission may occur in certain situations, eg during aerosol-generating procedures.

Prevention of influenza transmission

Transmission of the influenza virus can be prevented through:

- strict adherence to infection control practices, especially hand hygiene, containment of respiratory secretions and the use of PPE

b. See Appendices for more detailed information.

- adherence to standard infection control principles and droplet precautions
- administrative controls such as separation or cohorting of patients with influenza
- instructing staff members with respiratory symptoms to stay at home and not come in to work
- restriction of symptomatic visitors
- environmental cleaning
- education of staff, patients and visitors.

2.1 Emergence of a pandemic

Seasonal influenza is a familiar infection in the UK, especially during winter. Every year strains of influenza (type A or B) circulate, giving rise to clinical consultations in primary care, episodes of hospital treatment and deaths (mainly in older people).

Pandemics arise when new infectious agents emerge that are capable of spreading in the worldwide population. Pandemic influenza will be an influenza A subtype that has become fully adapted to the human host and will be readily and efficiently transmissible between humans. It will cause significant clinical illness in a high proportion of those infected. Predictions based on previous pandemics indicate that clinical attack rates will be high (estimated to be 25% to 35% but up to 50%), and almost all the population will potentially be at risk.

The ubiquitous nature of a pandemic virus means that staff are just as likely to encounter pandemic influenza in settings associated with normal daily living, eg in the family home, as in the workplace. This is an important difference from the current situation seen with human cases of avian influenza and the previous situation observed with severe acute respiratory syndrome (SARS).

In terms of the spread within the UK, past experience of pandemics suggests that it would take only a few weeks from the initial introduction(s) to widespread influenza activity across the country. Modelling further suggests that it would take only a further seven to nine weeks before peak influenza activity was occurring in all regions of the UK.

It is also possible that more than one wave of influenza will occur within a few months of the emergence of a pandemic virus and that a subsequent wave could be worse than the first. The health impacts of a pandemic are likely to be significant, including excess morbidity and mortality, especially among older people and children. Depending on its severity, a pandemic may generate unprecedented demands for healthcare that may saturate or overwhelm normal NHS acute and primary care settings for several weeks or months.

2.2 Influenza: clinical features and transmission

Influenza is a respiratory illness characterised by sudden onset of fever and cough, with other possible symptoms being chills, headache, sore throat and aching muscles and joints. There is a wide spectrum of illness, ranging from minor symptoms through to pneumonia and death. The most common complications of influenza are bronchitis and secondary bacterial pneumonia.

The typical incubation period for non-pandemic influenza is one to four days, with an average of two to three days. People are most infectious soon after they develop symptoms, although they can continue to excrete viruses for up to five days (although longer periods have been found).[10] The period of communicability is longer in children – typically seven days. It is sometimes stated that people are infectious shortly before symptoms develop, but the evidence for this is limited. Spread from one person to another before they develop symptoms has rarely been recorded, although experimental studies have shown that some people start shedding low doses of virus in the 24 hours before symptoms occur. Severely immunocompromised persons can shed virus for weeks or months.

It is well established that influenza is transmitted from person to person through close contact with an infected coughing or sneezing person. Transmission almost certainly occurs through multiple routes, including droplets and direct and indirect contact.[11] Aerosol transmission may also occur in certain situations.[12] There is no evidence that establishes a clear hierarchy for modes of transmission. However, the patterns of transmission observed during nosocomial outbreaks often point to droplet and contact transmission as the most important and likeliest routes.

Experimental studies of survival of the influenza virus suggest that it can survive for limited periods of time in the environment, depending on the surface contaminated.[13] It can be transferred from contaminated surfaces onto hands, and is easily inactivated by commercially available alcohol handrub.[14] When the transferability of influenza A virus from contaminated surfaces onto hands was evaluated, it was found that measurable virus could be transferred to hands from hard stainless-steel surfaces for up to 24 hours after the surface had been contaminated and from soft materials (pyjamas, magazines, tissues) for up to two hours after – although only in very low quantities after 15 minutes. Therefore careful and frequent hand hygiene and environmental cleaning are important to help control spread through contact.

See appendix A for a detailed review of transmission routes.

2.3 Assumptions concerning infection control in a pandemic

The principles of containment and infection control for pandemic influenza are based on the premise that pandemic influenza has similar properties to seasonal influenza, as follows.

- Person to person spread of human influenza viruses is well established.
- The patterns of transmission observed during outbreaks of influenza in healthcare settings suggest that droplets and contact (direct and indirect) are the most important and most likely routes of spread.
- In the case of some pathogens, aerosols generated under specific circumstances may be associated with an increased risk of transmission.[15,16] While this may be possible for influenza, the general consensus is that droplet and contact transmission are of far greater importance.
- The incubation period of human influenza ranges from one to four days (typically two to three).
- How infectious an individual is depends on how severe their symptoms are; people will be most infectious just after their symptoms start.
- Adults will usually be infectious for up to five days after symptoms begin, although longer periods of virus shedding have been found.[10] Children will usually be infectious for up to seven days, although longer periods of virus shedding have been found in a small proportion of children.
- Virus excretion may be considerably longer in immunocompromised patients.
- Although virus may be recovered from infected people before they show symptoms, there is little published evidence to support person-to-person transmission of influenza from a pre-symptomatic individual to a person who does not already have the infection.
- Seasonal influenza viruses can survive on surfaces in the environment, especially hard, non-porous materials such as stainless steel.[13]
- Influenza viruses are easily deactivated by washing with soap and water or alcohol handrub and by cleaning surfaces with normal household detergents and cleaners.

2.4 Core principles of containment and infection control

During a pandemic healthcare workers can be exposed to people with influenza both in their normal daily lives (outside work) and in healthcare settings. Limiting the transmission of influenza in the healthcare setting requires:

- timely recognition of influenza cases
- instructing staff members with respiratory symptoms to stay at home and not come in to work
- segregating staff into those who are dealing with influenza patients and those who are not
- consistently and correctly implementing appropriate infection control precautions to limit transmission (standard infection control principles and droplet precautions)
- using PPE appropriately, according to risk of exposure to the virus
- maintaining separation in space and/or time between influenza and non-influenza patients
- restricting access of ill visitors to the facility and posting pertinent signage in clear and unambiguous language (including in languages other than English)
- environmental cleaning and disinfection
- educating staff, patients and visitors about the transmission and prevention of influenza
- treating patients and staff with antiviral drugs that can reduce infectivity and the duration of illness
- vaccinating patients and staff.

The UK has a stockpile of antiviral drugs that is sufficient to treat all symptomatic patients in a pandemic with a clinical attack rate of up to 25%. Higher clinical attack rates would require prioritisation of use. During the first wave of a pandemic, a specific vaccine will be largely unavailable. Prioritisation would take place in accordance with Department of Health policy. Therefore, attention to non-pharmaceutical methods of control, as outlined in this document, will be particularly important in reducing exposure to the virus.

3 Preparedness planning for pandemic infection control

Key points

- An influenza pandemic will not be 'business as usual' for the NHS.
- The way in which the NHS functions will have to be altered to accommodate exceptional infection control arrangements.
- Staff will be required to work flexibly to meet a high demand for healthcare.
- Planning in advance and stockpiling of PPE will be necessary.
- Local risk assessment will be required to determine which control measures are most suitable locally.

Although it is impossible to predict the impact of any future influenza pandemic with certainty, the available epidemiological and modelling information suggests that it will generate a demand for healthcare that will saturate or overwhelm normal NHS services for a period of time, perhaps several weeks or months. Accordingly, it should be anticipated that the NHS (in common with all health systems around the world) will need to revert to emergency arrangements. These are laid out in further detail in Department of Health guidance.[3,4,5]

Acute trusts and PCTs will form the cornerstone of the NHS response to an influenza pandemic. The NHS will face pressure to deal with large numbers of patients with pandemic influenza in addition to 'routine' medical emergencies and, where capacity exists, the continuation of non-emergency care.

The NHS must plan for the implementation of infection control measures that can accommodate the exceptional circumstances of a pandemic. For example:

- hospitals do not normally operate in a manner where large areas of the facility are segregated from other areas
- general practice surgeries and other PCT premises are not usually designed or configured to allow segregation of patients in waiting rooms
- it may rapidly become difficult to meet the high demand for PPE – therefore advance planning will be required to build up and manage adequate stock.

In addition, because every hospital and primary care setting is configured differently in terms of size and layout, the generic guidance provided in this document will need to be tailored to the particular setting or facility. Planning during the inter-pandemic period is essential and will ease the decision-making process during a pandemic. The action points in the following box are examples of issues that should be addressed immediately.

Immediate action points

- Provide general training for all staff on the implications of pandemic influenza for infection control.
- Plan for and carry out training in the use of filtering face piece 3 (FFP3) respirators and fit testing on staff who are likely to use them.
- Test local response capabilities; a tabletop exercise is strongly recommended.
- Estimate and prepare for the expected increase in demand for supplies.

Most NHS trusts already have a number of policies and plans in existence, including a major incident plan, an escalation policy, a winter pressures plan and an outbreak of infection policy. Some of these are designed to deal with 'big bang' (sudden impact) incidents, whereas an influenza pandemic will be a 'rising tide' (gradual escalation) scenario in which pressure builds more slowly but where sustainability of response becomes a key issue. Most existing emergency plans assume that routine infection control measures will be in place but do not address the likelihood of implementing augmented infection control measures and sustaining these for a period of three to four months.

Under COSHH,[7] all employers, including NHS institutions, are required to undertake local risk assessments to inform their decisions on choice of control measures. This guidance can be viewed as a generic assessment designed to ensure that infection control measures are implemented consistently across the NHS. It reflects published evidence on influenza transmission and control and the exceptional circumstances of a pandemic, where there may be:

- a large number of patients with influenza
- a high number of healthcare workers who are potentially exposed to the pandemic virus
- variability in the availability of control measures.

The local COSHH risk assessment should identify any local circumstances that should also be taken into account. To assist in this effort, checklists for issues related to infection control are included in the hospital and primary/community care sections of this document.

4 Occupational health and deployment of staff

Key points

- Prompt recognition of cases of influenza among healthcare workers is essential to limit the spread of the pandemic.
- Healthcare workers with influenza should not come to work.
- As a general principle, healthcare workers who provide care in areas for pandemic influenza patients should not care for other patients, although exceptions may be necessary.
- Healthcare workers at high risk of complications from influenza should not provide direct patient care.
- Bank and agency staff should follow the same deployment advice as permanent staff.
- Occupational health departments or providers should lead on the implementation of systems to monitor staff illness and absence.
- Occupational health departments or providers should facilitate staff access to antiviral treatment where necessary and implement vaccination of the healthcare workforce when required.
- As part of their employer's duty of care, occupational health departments or providers have a role to play in ensuring that fit testing programmes are in place for those staff who may need to wear FFP3 respirators.

4.1 Who should work?

Healthcare workers will be at risk of acquiring influenza through exposure in both community and healthcare-related settings, and staff should be aware of the symptoms of influenza. Before commencing duty, staff must report any symptoms of influenza to their line manager, who will then advise accordingly. Similarly, members of staff who develop such symptoms whilst on duty must report to their line manager immediately.

Healthcare workers who have symptoms of influenza, including those who are beginning to experience symptoms or are recovering from influenza, should not come to work, so as to avoid infecting patients, colleagues and others. All healthcare workers who have recovered from influenza should report to their line manager before resuming clinical duties, because their illness needs to be recorded and it may also affect future deployment. This group of

healthcare workers can care for people with influenza. Line managers, in turn, should ensure that sickness and absence are recorded and that this information is sent to the local occupational health department or provider.

4.2 Staff deployment

Healthcare workers who are assigned to care for patients with influenza or who work in areas of a facility that have been segregated for patients with influenza should not be assigned to care for non-influenza patients or work in non-influenza areas. Exceptions to this include:

- in hospitals, workers in occupations with a limited number of staff, eg medical staff and AHPs, although segregation of staff should be maintained as much as is practically possible
- situations in which the care and management of the patient would be compromised
- staff who have fully recovered from pandemic influenza.

In some work settings in primary care such staff segregation may not be feasible. Nevertheless, consideration should be given to developing approaches that are similar to those in hospital settings; for example, one general practitioner (GP) or district nurse could be designated to see all the patients with symptoms of influenza in a session.

In hospitals, healthcare workers from a non-influenza area may be redeployed in an area that is segregated for the care of influenza patients. However, once redeployed, such workers cannot return to their original non-influenza area for the duration of the pandemic, apart from the exceptions listed above.

Healthcare workers who have recovered from influenza, or who have received a full course of vaccination against the pandemic strain and are therefore considered unlikely to develop or transmit influenza, should be prioritised for the care of patients with influenza. In exceptional circumstances these workers may be moved within a period of duty, but this is not desirable. These workers may also be placed in units where the introduction of influenza would have serious consequences for patients (eg transplant units, special care baby units, renal units in community hospitals); such workers should not be moved within a period of duty.

4.3 Bank and agency staff

Trusts usually employ bank and agency staff on a day-to-day basis across the trust to complement existing staffing levels. For example, over five consecutive working days they may work in five different clinical environments. During a pandemic this form of work allocation must be avoided. **Bank and agency staff should follow the same deployment advice as permanent staff.**

4.4 Workers at risk of complications from pandemic influenza

Healthcare workers who are at high risk of complications of influenza (eg pregnant women and immunocompromised workers) should be considered for alternate work assignments, away from the direct care of patients, for the duration of the pandemic or until they have been vaccinated if it is clinically appropriate for them to be vaccinated. At the very least they should not provide care to patients who are known to have influenza, and neither should they enter parts of the facility segregated for the treatment of patients with influenza.

5 Infection control precautions

Key points

- Standard infection control principles and droplet precautions must be used where patients have or are suspected of having influenza (see appendix B).
- Good hand hygiene among staff and patients is vital for the protection of both parties.
- Good respiratory hygiene is essential.
- The use of PPE should be proportionate to the risk of contact with respiratory secretions and other body fluids and should depend on the type of work or procedure being undertaken.

5.1 Standard infection control principles

Standard infection control principles and droplet precautions must be used if patients have or are suspected of having influenza. Standard infection control principles are a set of broad statements of good practice to minimise exposure to and transmission of a wide variety of micro-organisms. These principles should be applied by **all** healthcare practitioners to the care of **all** patients **all** of the time. Standard infection control principles, which include hospital environmental hygiene, hand hygiene, use of PPE and safe use and disposal of sharps, have been published in full elsewhere,[17] and the recommendations are detailed in appendix B. Hand hygiene and PPE are also discussed in sections 5.1.1 and 5.3, respectively.

5.1.1 Hand hygiene

Hand hygiene is the single most important practice needed to reduce the transmission of infection in healthcare settings and is an essential element of standard infection control principles. In any outbreak of pandemic influenza strict adherence to hand hygiene recommendations should be enforced.

Patients' hands will be heavily contaminated, because of frequent contact with their nose, mouth and the tissues they have used in respiratory hygiene. Their hands will also make frequent contact with their immediate environment. Therefore good hand hygiene among staff before and after contact with patients or their close environment is vital to protect both themselves and other patients. Good hand hygiene among patients should also be encouraged.

Hand hygiene includes hand washing with soap and water and thorough drying, and the use of alcohol-based products containing an emollient that do not require the use of water. If hands are visibly soiled or contaminated (eg with respiratory secretions), they should be washed with soap and water and dried. When an alcohol handrub is used to decontaminate hands, the hands should be free of visible dirt and organic material. The handrub must come into contact with every part of the hand's surface.

Hands must be decontaminated immediately before each and every episode of direct care of or contact with patients and after any activity or contact that potentially results in hands becoming contaminated, including the removal of protective clothing and cleaning of equipment. Hands should be decontaminated between caring for different patients and between different care activities for the same patient, even if gloves have been worn. After hand washing, paper towels should be used to dry the hands thoroughly and should then be discarded in the nearest waste bin. Lined waste bins with foot-operated lids should be used whenever possible.

In addition to the placement of alcohol handrub at the point of use (eg at patients' beds, in examination rooms and on lockers), consideration should also be given to distributing personally carried alcohol handrub to certain groups of transient or migratory staff (eg hospital medical staff and community staff who undertake home visits).

All staff, patients and visitors should clean their hands when entering and leaving areas where care is delivered with either soap and water followed by drying or alcohol handrub.

5.2 Applying droplet precautions in an influenza pandemic*

In addition to the standard infection control principles, droplet precautions should be used if a patient is known or suspected to be infected with influenza and is at risk of transmitting droplets while coughing, sneezing or talking and during some procedures.

5.2.1 Placement of patients within the facility

- Ideally patients with influenza should be placed in single rooms, but during a pandemic this will not be possible. Therefore patients should be 'cohorted' (grouped together with other patients who have influenza and no other infection) in a segregated area.
- Where patients are cohorted on the basis of epidemiological and clinical information rather than on laboratory-confirmed diagnosis, beds should be at least one metre apart.
- Special ventilation is not necessary, and the doors of segregated areas can remain open (unless a patient is being isolated for another reason in addition to influenza that requires the doors to be shut).

5.2.2 Fluid repellent surgical masks

- All surgical masks should be fluid repellent. In addition to wearing a surgical mask in situations as outlined under standard infection control principles (see appendix B), staff must wear surgical masks when working in close contact (within one metre) with a symptomatic patient. For practical reasons, this is likely to mean wearing a surgical mask at all times within cohorted areas.

5.2.3 Transport of patients

- The movement and transport of patients from their rooms or the cohorted area should be limited to essential purposes only.
- If transport or movement is necessary, minimise the dispersal of droplets from the patient by masking them, if possible. The surgical mask should be worn during transport until the patient returns to the segregated area.
- If a surgical mask cannot be tolerated by the patient, then good respiratory hygiene should be encouraged.

*These guidelines are adapted from Garner JS and the Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Am J Infect Control* 1996;24:24–52. See Appendix B.

5.2.4 Duration of isolation precautions

Infection control precautions for each patient should be implemented on the patient's admission and be continued for the duration of the illness.[15]

5.2.5 Managing coughing and sneezing

Patients, staff and visitors should be encouraged to minimise potential influenza transmission through the following good hygiene measures.

- Cover nose and mouth with disposable single-use tissues when sneezing, coughing or wiping and blowing noses.
- Dispose of used tissues promptly in the nearest waste bin.
- Wash hands after coughing, sneezing, using tissues or contact with respiratory secretions and contaminated objects.
- Keep hands away from the eyes, mouth and nose.
- Some patients (eg older people and children) may need assistance with containment of respiratory secretions; those who are immobile will need a receptacle (such as a plastic bag) readily at hand for immediate disposal of tissues and a supply of hand wipes and tissues.

- Where possible, in common waiting areas or during transport (eg from the community to an acute hospital or from one area of the hospital to another), coughing or sneezing patients should wear surgical masks to assist in the containment of respiratory secretions and to reduce environmental contamination.

5.3 Personal protective equipment

PPE is worn to protect staff from contamination with body fluids and to reduce the risk of transmission of influenza between patients and staff and from one patient to another. Appropriate PPE for staff who care for patients with pandemic influenza is summarised in Table 1.

Care must be taken to ensure that PPE is worn and removed correctly, in order to avoid inadvertent contamination (see section 5.3.7 for guidance on putting on and removing PPE). All staff must remove contaminated clothing – surgical masks or respirators being removed last – and dispose of it appropriately (ie, in an NHS setting, as clinical waste, also known as infectious waste[18]) before staff leave a patient care area.

All surgical masks should be fluid repellent, and PPE should comply with the relevant British Standard (BS) EN standards (European technical standards as adopted in the UK) where these apply. Note that standard infection control principles apply at all times.

5.3.1 Gloves

Gloves are not required for the routine care of patients with pandemic influenza, but standard infection control principles require that gloves be worn for:

- invasive procedures
- contact with sterile sites, non-intact skin and mucous membranes
- all activities that carry a risk of exposure to blood, body fluids, secretions (including respiratory secretions) and excretions
- handling sharp or contaminated instruments.

If glove supplies become limited during a pandemic, priorities for glove use may need to be established. In such a circumstance, gloves should be prioritised for situations involving contact with blood and bloody fluids, invasive procedures and contact with sterile sites.

Staff must change gloves between patients and between different tasks involving a single patient. Gloves should be removed immediately after use, disposed of as clinical waste, and hand hygiene performed. **No attempt should be made to wash or disinfect gloves for subsequent reuse.**

Table 1: Personal protective equipment for staff who care for patients with pandemic influenza

	ENTRY TO COHORTED AREA BUT NO CONTACT WITH PATIENTS	CLOSE PATIENT CONTACT (WITHIN ONE METRE)	AEROSOL-GENERATING PROCEDURES[a]
Hand hygiene	✓	✓	✓
Gloves	✘[b]	✓[c]	✓
Plastic apron	✘[b]	✓	✘
Gown	✘	✘[d, e]	✓[e]
Surgical mask	✓[f]	✓	✘
FFP3 respirator	✘	✘	✓
Eye protection	✘	Risk assessment	

a Wherever possible, aerosol-generating procedures should be performed in side rooms or other closed single-patient areas with minimal staff present (see section 5.4).

b Gloves and apron should be worn during certain cleaning procedures (see section 6).

c Gloves should be worn in accordance with standard infection control principles. If glove supplies become limited or come under pressure, this recommendation may need to be relaxed. Glove use should be prioritised for contact with blood and body fluids, invasive procedures and contact with sterile sites.

d Consider a gown in place of an apron if extensive soiling of clothing or contact of skin with blood or other body fluids is anticipated (eg during intubation or when caring for babies).

e If non-fluid-repellent gowns are used, a plastic apron should be worn underneath.

f Surgical masks (fluid repellent) are recommended for use at all times in cohorted areas for practical purposes. If mask supplies become limited or come under pressure, then in cohorted areas their use should be limited to close contact with a symptomatic patient (within one metre).

5.3.2 Aprons

Disposable plastic aprons should be worn whenever there is a risk of personal clothes or a uniform coming into contact with a patient's blood, body fluids, secretions (including respiratory secretions) or excretions or during activities that involve close contact with the patient (eg examining the patient).

Plastic aprons should be worn as single-use items for one procedure or episode of patient care and then discarded and disposed of as clinical waste. In cohorted areas, aprons must be changed between patients.

5.3.3 Gowns

Gowns are not required for the routine care of patients with influenza. However, healthcare workers should wear gowns if they anticipate extensive soiling of their personal clothing or uniform with respiratory secretions, or if there is risk of extensive splashing of blood, body fluids, secretions or excretions onto their skin. Aerosol-generating procedures such as intubation and activities that involve holding the patient close (such as in paediatric settings) are examples of when a gown may be needed.

Fluid repellent gowns are preferable, but if non-fluid repellent gowns are used a plastic apron should be worn beneath.

Gowns should:

- fully cover the area to be protected
- be worn only once and then placed in a clinical waste or laundry receptacle, as appropriate.

Hand hygiene should be performed immediately after removal of the gown.

5.3.4 Eye protection

Eye protection should be considered when there is a risk of contamination of the eyes by splashes and droplets, eg by blood, body fluids, secretions or excretions. Individual risk assessments should be carried out at the time of providing care to patients to identify those at risk and decide on reasonable precautions to reduce the risk.

One potential hazard to healthcare workers is inoculation of their conjunctiva from splashes occurring during procedures involving influenza patients or from their coughs and sneezes. Reasonable precautions might include keeping the number of personnel to a minimum, ie only those essential to carrying out the care, and requiring that those who are in close contact with the patient protect their eyes.

Eye protection should always be worn during aerosol-generating procedures. This requirement extends to all those present in the room during a procedure that has the potential to produce an aerosol (see section 5.3.4).

Eye protection can be achieved by using any one of:

- a surgical mask with integrated visor
- a full-face visor
- polycarbonate safety spectacles or equivalent.

Disposable single-use eye protection is recommended. Non-disposable eye protection (eg polycarbonate safety spectacles issued to staff as personal equipment on a long-term basis) poses a potential infection risk. It is important that any such items are decontaminated after each use, by using agents recommended by the manufacturer.

5.3.5 Fluid repellent surgical masks

Surgical masks should be fluid repellent and should be worn by healthcare workers for any close contact with patients (ie within one metre). The mask will provide a physical barrier and minimise contamination of the nose and mouth by droplets.

Surgical masks should:

- cover both the nose and the mouth
- not be allowed to dangle around the neck after or between each use
- not be touched once put on
- be changed when they become moist
- be worn once only and then discarded in an appropriate receptacle as clinical waste – hand hygiene must be performed after disposal is complete.

When influenza patients are cohorted in one area and several patients must be visited over a short time or in rapid sequence (eg in cohorted areas of a hospital or nursing home, an 'influenza clinic' or a GP surgery session for influenza patients), it may be more practical for healthcare workers to wear a single surgical mask upon entry to the area and to keep it on for the duration of the activity or until the surgical mask requires replacement. This also minimises hand-to-face contact and reminds healthcare workers that they are working in a high-risk area. **However, other PPE (eg gloves and apron) must be changed between patients and hand hygiene performed.**

Depending on ward layout, it is likely that some locations within the parts of the facility segregated for influenza patients will not be designated part of a cohorted area, as there is no close contact with patients in these areas. Surgical masks will not therefore be required in such areas. Examples might include offices, rooms used for staff breaks and remote nursing or ward administration stations.

Although it may be more practical to wear a surgical mask at all times in a cohorted area, if surgical mask supplies become limited during a pandemic, surgical masks should be prioritised for use when healthcare workers are in close contact (within one metre) with a symptomatic influenza patient.

All contaminated PPE must be removed before leaving a patient care area. **Surgical masks or FFP3 respirators should be removed last, and removal should be followed by thorough hand hygiene.**

5.3.6 Respirators

A disposable respirator that provides the highest possible protection factor available (ie an EN149:2001 FFP3 disposable respirator – referred to as an FFP3 respirator in the rest of this document) should be worn by healthcare workers when they perform procedures that have the potential to generate aerosols (see section 5.4). If an FFP3 disposable respirator is not immediately available, the next highest category of respirator available should be worn (ie FFP2).

Fitting the respirator correctly is critically important for it to provide proper protection. Every user should be fit tested and trained in the use of the respirator. In addition to the initial fit test carried out by a trained fitter, a fit check should be carried out each time a respirator is worn. The respirator must seal tightly to the face, or air will enter from the sides. A good fit can be achieved only if the area where the respirator seals against the skin is clean shaven. Beards, long moustaches, and stubble may cause leaks around the respirator.

As part of their employer's duty of care, occupational health departments or providers have a role to play in ensuring that fit testing programmes are in place for staff who may need to wear FFP3 respirators. These should be organised well in advance of any influenza pandemic as part of the initial planning. Suppliers of respirators may sometimes offer fit testing or training of others to fit test. The task of fit testing should not be underestimated, as not all makes of respirator fit all faces, so a range of models may be required. The rolling out of a fit testing programme across any organisation will take a significant amount of time – likely to be months rather than weeks for an average-sized hospital.

Other types of respiratory protective equipment (eg powered hoods and helmets) are available and should be considered if a good fit cannot be achieved with disposable respirators. A powered respirator might be the only type suitable for some healthcare workers, such as someone who, perhaps for cultural reasons, prefers not to remove their beard so cannot get a good fit with a disposable respirator. Powered respirators are re-usable. Training in their use is required (which may be available from the manufacturer or supplier), and proper maintenance is necessary, eg with regard to batteries and filters. Re-usable respirators must be decontaminated between uses in accordance with the manufacturer's recommendations and stored correctly.

FFP3 respirators should be replaced after each use and changed if breathing becomes difficult, if the respirator becomes damaged, distorted or obviously contaminated by respiratory secretions or other body fluids, or if a proper fit to the face cannot be maintained. Respirators should be disposed of as clinical waste according to the local infection control policy.

5.3.7 Putting on and removing personal protective equipment

The level of PPE used will vary according to the procedure being carried out, and not all items of PPE will always be required. Standard infection control principles apply at all times.

Putting on PPE

Healthcare workers should put on PPE before they enter a single room or cohorted area (see section 7.2.3). The order given here for putting on PPE is practical, but the order for putting on is less critical than the order of removal.

1 **Gown (or apron (illustrated) if it is not an aerosol-generating procedure)**

- Fully cover the torso from the neck to knees and the arms to the end of the wrists, and wrap around the back.
- Fasten at back of neck and waist.

2 **Surgical mask (or FFP3 respirator if it is an aerosol-generating procedure)**

- Secure ties or elastic bands at middle of head and neck.
- Fit flexible band to nose bridge.
- Fit snug to face and below chin.
- Fit check the respirator.

3 **Goggles or face shield (in aerosol-generating procedures and as appropriate after risk assessment)**

- Place over face and eyes and adjust to fit.

4 **Disposable gloves**

- Extend to cover wrist of gown if a gown is worn.

Removing PPE

Healthcare workers should remove PPE upon leaving the room or cohorted area in an order that minimises the potential for cross-contamination (see section 7.2.3). If a single room has been used for an aerosol-generating procedure, those involved in the procedure should, **before** leaving the room, remove their gloves, gown and eye goggles (in that order) and dispose of them as clinical waste. **After** they leave the room they can remove the respirator and dispose of it as clinical waste. Hand hygiene should be performed after all PPE has been

removed. The order for removing PPE is important to reduce cross-contamination. The order outlined as follows always applies, even if not all items of PPE have been used.

1 Gloves

Assume that the outside of the glove is contaminated.

- Grasp the outside of the glove with the opposite gloved hand; peel off.
- Hold the removed glove in gloved hand.
- Slide the fingers of the ungloved hand under the remaining glove at the wrist.
- Peel off second glove over first glove.
- Discard appropriately.

2 Gown or apron

Assume that the front and sleeves of the gown or apron are contaminated.

- Unfasten or break the ties.
- Pull the gown or apron away from the neck and shoulders, touching the inside of the gown only.
- Turn the gown inside out.
- Fold or roll it into a bundle and discard appropriately.

3 Goggles or face shield

Assume that the outside of the goggles or face shield is contaminated.

- To remove, handle by head band or ear pieces.
- Discard appropriately.

4 Respirator or surgical mask

Assume that the front of the respirator or surgical mask is contaminated.

- Untie or break the bottom ties, followed by the top ties or elastic, and remove the respirator or mask by handling the ties only.
- Discard appropriately.

Perform hand hygiene immediately after removing all PPE.

5.4 Aerosol-generating procedures

Several medical procedures have been reported to generate aerosols, and it has been suggested that some of these are associated with an increased risk of pathogen transmission.[15,16] However, the risk associated with many aerosol-generating procedures is not yet well defined, and the understanding of the aerobiology involved in such procedures may change as further studies in this area are carried out. In a recent (2007) revised WHO document, *Infection prevention and control of epidemic-and pandemic-prone acute respiratory diseases in health care*, based on epidemiological studies on tuberculosis (TB) and/or SARS, the following aerosol-generating procedures were considered to be associated with a documented increase in risk of pathogen transmission in patients with acute respiratory disease[16]:

- intubation and related procedures, eg manual ventilation and suctioning
- cardiopulmonary resuscitation
- bronchoscopy
- surgery and post-mortem procedures in which high-speed devices are used.

The authors of the WHO document make the comment that there are other procedures that may be associated with an increased risk of pathogen transmission but that some of the studies have methodological flaws that preclude using their conclusions to make recommendations. They categorise these as procedures with only a 'controversial/possible' increase in risk of respiratory pathogen transmission. The controversial/possible procedures specified by WHO are non-invasive positive pressure ventilation, bi-level positive airway pressure, high frequency oscillating ventilation and nebulisation.

5.4.1 Infection control and personal protective equipment in aerosol-generating procedures

Only essential aerosol-generating procedures should be carried out. Aerosol-generating procedures should be carried out in well-ventilated single rooms with the doors shut; and to avoid unnecessary exposure, only those healthcare workers who are needed to perform the procedure should be present.

A gown, gloves and eye protection must be worn during such procedures. An FFP3 respirator should be worn for:

- intubation and related procedures, eg manual ventilation and suctioning
- cardiopulmonary resuscitation
- bronchoscopy.

WHO's inclusion of surgery with high-speed devices as an aerosol-generating procedure is extrapolated from a report of TB transmission after use of a high-speed saw during the post-mortem examination of a patient with lung and bone marrow TB.[19] Individual risk assessments should be used to select appropriate respiratory protection in surgery where high-speed devices are used.

In post-mortem examinations, HSE advice that stipulates the use of a powered respirator when high-speed devices are used should be followed (see section 7.7.3).[20]

For procedures with only a 'controversial/possible' increase in risk of pathogen transmission, use of an FFP3 respirator instead of a surgical mask may be considered prudent until data are available that allow better assessment of the risk associated with different procedures.

6 Environmental infection control

6.1 Clinical and non-clinical waste

The Department of Health has published guidance on the safe disposal of healthcare waste: *Health Technical Memorandum 07-01: Safe management of healthcare waste.*[18]

No special procedures beyond those required to conform with standard infection control principles are recommended for handling clinical waste (also known as infectious waste[18]) and non-clinical waste that may be contaminated with influenza virus. Waste generated within the clinical setting should be managed safely and effectively, with attention paid to disposal of items that have been contaminated with secretions or sputum (eg paper tissues and surgical masks), in addition to other routine and domestic waste management. Refer to local waste policy as needed.

Excreted waste such as urine and faeces can be safely disposed of in the sewerage system.

All waste collection bags should be tied and sealed before removal from the patient area. Healthcare staff should wear gloves when handling **all** waste and should perform hand hygiene after removing the gloves.

6.2 Linen and laundry

Linen used during care of patients should be managed safely to reduce the risk of contamination to staff, the environment and patients.

- Linen should be categorised as 'used' or 'infected' as per the NHS Executive's *Health Service Guideline (95) 18: Hospital laundry arrangements for used and infected linen.*[21] Both used and infected linen must be handled, transported and processed in a manner that prevents exposure to the skin and mucous membranes of staff, contamination of their clothing and the environment, and infection of other patients.
- Linen should be placed in appropriate receptacles immediately after use and bagged at the point of use.
- If linen appears to be heavily soiled with body fluids, including respiratory secretions, it should be treated as potentially infected and managed according to local policies.
- Linen bags must be closed before removal from the influenza patient care area.
- Gloves and aprons should be worn when handling all contaminated linen.

- Hand hygiene should be performed after removal of gloves that have been in contact with used linen and laundry.

In **primary care settings**, paper sheeting is a good alternative to linen for use on patient examination couches. It should be changed after each patient has been examined.

Specific guidance on protection of **laundry workers** is described in *Hospital laundry arrangements for used and infected linen.*[21] Laundry staff should be fully trained in appropriate infection control measures, including hand hygiene and the correct use of protective clothing.

6.3 Staff uniforms

The appropriate use of PPE will protect uniforms from contamination in most circumstances.

- During a pandemic, healthcare workers should not travel to and from work or between remote hospital residences and places of duty in uniform.
- Hospitals and other healthcare facilities should provide changing rooms or areas where staff can change into uniforms upon arrival at work.
- Ideally, hospital or other healthcare facility laundry services should be used to launder uniforms if they are available.
- If no laundry facilities are available, then uniforms should be laundered in a domestic washing machine at the optimum temperature recommended by the detergent manufacturers that is appropriate to the maximum temperature the fabric can tolerate, then ironed or tumbled dried.
- Uniforms should be transported home in a tied plastic bag and washed separately from other linen in a load not more than half the machine's capacity, in order to ensure adequate rinsing and dilution.
- NHS trusts should consider the use of theatre-type greens for staff who do not usually wear a uniform but who are likely to come into close contact with patients (eg medical staff).

The Department of Health has issued an evidence base for uniforms and work wear, which can be found at www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_078433

6.4 Crockery and utensils

The combination of hot water and detergent used in dishwashers is sufficient to decontaminate dishes and eating utensils used by patients with influenza. There is no need to use disposable plates and cutlery.

6.5 Environmental cleaning and disinfection

- Freshly prepared neutral detergent and warm water should be used for cleaning the hospital or other healthcare environment.
- As a minimum, areas used for cohorted patients should be cleaned daily.
- Clinical rooms should be cleaned at least daily and also between clinical sessions for patients with influenza and those for patients not infected with influenza, if the same clinical room is used.
- Frequently touched surfaces such as medical equipment and door handles should be cleaned at least twice daily and when known to be contaminated with secretions, excretions or body fluids.
- Domestic staff should be allocated to specific areas and not moved between influenza and non-influenza areas.
- Domestic staff must be trained in the correct methods of wearing PPE and the precautions to take when cleaning cohorted areas. They should wear gloves and aprons; and when cleaning in the immediate patient environment in cohorted areas they should wear a surgical mask as well.
- Dedicated or single-use/disposable equipment should be used when possible. Non-disposable equipment should be decontaminated or laundered after use in line with local policy.
- Any spillage or contamination of the environment with secretions, excretions or body fluids should be treated in line with the local spillage policy.

6.6 Equipment used for care of patients

Effective cleaning of equipment used for patient care is an essential prerequisite to both disinfection and sterilisation. The following standard practices for handling and reprocessing used and soiled patient care equipment, including re-usable medical devices, should be followed in both influenza and non-influenza areas of hospital and primary care settings.

- Gloves should be worn when handling and transporting used patient care equipment.
- Heavily soiled equipment should be cleaned with neutral detergent and warm water before being removed from the patient's room or consulting room.
- Reusable equipment (eg stethoscopes and patient couches in treatment and consulting rooms) must be scrupulously decontaminated between each patient; equipment that is visibly soiled should be cleaned promptly. Where applicable, follow local and manufacturers' recommendations for cleaning and disinfection or sterilisation of reusable patient care equipment.

- External surfaces of portable equipment for performing radiography and other procedures in the patient's room or consulting room should be cleaned with neutral detergent and warm water upon removal from the room.

In addition to these standard practices, non-critical patient equipment should, whenever possible, be dedicated to the use of influenza patients only.

Use of equipment that recirculates air (such as fans) should be avoided.

6.7 Furnishings

All non-essential furniture, especially soft furnishings, should be removed from reception and waiting areas in hospitals, GP consulting and treatment rooms, day rooms and lounges, and accident and emergency (A&E) departments. The remaining furniture should be easy to clean and should not conceal or retain dirt and moisture. Toys, books, newspapers and magazines should be removed from the waiting area.

7 Supplementary guidance for hospitals

This section contains information for the development of operational policies and implementation of infection control guidance in acute hospital settings.

7.1 Preparedness checklist for pandemic infection control

Trusts need to consider a number of key issues related to hospital infection control uring a pandemic and find the best way of integrating or embedding these into their organisational processes.

7.1.1 Overall coordination

- Identify a lead member of hospital staff (for example, the director of infection prevention and control (DIPC)) who will take responsibility for coordinating infection control during a pandemic.
- Ensure that the trust board and senior managers are fully informed of the critical infection control issues in relation to pandemic influenza.
- Identify whether there are existing forums within the hospital trust that can address the issues and actions required in preparing for a pandemic (including performing local risk assessments). If not, form a local hospital pandemic action group or sub-group, whose membership should comprise:
  - executive board member or DIPC
  - nursing executive
  - medical staff
  - senior representative from each clinical division
  - occupational health department
  - infection control team
  - health and safety team
  - bed manager
  - public relations/communications manager
  - estates/facilities department
  - housekeeping

- supplies
- consultant in communicable disease control (CCDC) or other member of local health protection unit (HPU)
- pharmacy
- human resources
- others as appropriate.

7.1.2 Infection control

- Identify suitable staff (eg infection control link nurses/professionals) who can supplement the existing team if needed.
- Prepare a strategy to communicate infection control information to staff.

7.1.3 Triage and patient placement

- Establish procedures and test a plan for pandemic triage and the rapid separation of patients with influenza from other patients.
- Identify areas for segregating or cohorting large numbers of patients with pandemic influenza.
- Identify a designated room in the radiology department that can be used for influenza patients only.

7.1.4 Occupational health

Develop plans and procedures to:

- assess staff with respiratory symptoms
- supervise and monitor staff deployment, including bank and agency staff
- track and document staff sickness and absence
- provide psychological and social support to staff
- administer antiviral treatment in accordance with Department of Health policy
- vaccinate staff in accordance with Department of Health policy.

7.1.5 Staffing

Ensure that plans are in place to address:

- staff allocations to influenza or non-influenza areas, considering the skill mix and the likelihood of sickness and absence
- tracking and coordination of staff movements (including agency staff)

- when an emergency staffing crisis might be declared
- the possible use of family members and lay volunteers in an ancillary capacity
- staff working outside their usual area of practice (eg medical and nursing students working as healthcare assistants).

7.1.6 Bed management

Ensure that the following are addressed in the trust's existing escalation policy:

- procedures for reviewing and revising admission criteria
- policies for expediting discharge of patients in conjunction with PCTs and local services
- adequate transportation arrangements for discharged patients
- plans for tracking bed occupancy during a pandemic
- cancellation of elective admissions at short notice
- plans to convert surgical wards into medical wards.

7.1.7 Supplies of consumables

- Evaluate current stock of essential equipment.
- Assess anticipated demand for consumables and determine a trigger point for ordering extra supplies.
- Determine the feasibility of ordering and storing extra PPE.
- Direct supplies managers to establish contingency plans in the event that primary sources of supplies become limited or exhausted.

7.1.8 Mortuary issues

- Plan for mass fatalities.
- Assess capacity for refrigeration.
- Define overflow arrangements.

7.1.9 Education and training

- Brief the senior medical and nursing staff on the procedures for infection control during a pandemic (from trust board to consultant and ward manager levels).
- Brief managers of other departments (including estates, porters, radiology, physiotherapy, occupational health).
- Test local response capabilities; a tabletop exercise is strongly recommended.

- Plan for additional training and fit testing for staff who are likely to use FFP3 respirators.
- Provide general training for all staff on the infection control implications of pandemic influenza.
- Consider how the hospital intranet could be utilised for training, education and communication on infection control issues to minimise face-to-face meetings during a pandemic.

7.2 Patient placement, segregation and cohorting

Key points

- In all healthcare settings, patients with symptoms of influenza should be segregated from non-influenza patients as rapidly as possible.
- Whenever possible, different teams of staff should care for influenza and non-influenza patients.
- Careful consideration should be given to flexible accommodation and staffing arrangements.
- Patients with influenza should be managed separately until they are discharged.

7.2.1 Selection of segregated areas for cohorting patients

Cohorting (grouping patients together who have the same infection and no other infection) in segregated areas of the hospital should be carried out from the outset of the pandemic to help contain influenza infection within one part of the hospital and reduce the risk to other patients. To achieve the desired goal of separating patients with influenza from those without, a designated self-contained area or wing of the hospital should, whenever possible, be used for the treatment and care of patients with influenza. Ideally, this area should:

- include a reception area that is separate from the rest of the hospital and should have, if feasible, a separate entrance/exit from the rest of the hospital
- not be used as a thoroughfare by other patients, visitors or staff, including patients being transferred, staff going for meal breaks, and staff and visitors entering and exiting the building
- be separated from non-segregated areas by closed doors.

To control entry, signage should be displayed warning of the segregated influenza area.

7.2.2 Segregation at ward level

Side rooms in non-influenza areas should be reserved for patients requiring isolation for other (non-influenza) reasons; side rooms in segregated influenza areas should be reserved whenever possible for performing aerosol-generating procedures.

Consideration should be given to cohorting separately patients who are infected with influenza and another pathogen (eg meticillin resistant *Staphylococcus aureus* (MRSA)), to minimise transmission in the hospital of other infectious pathogens. This will depend on availability of rooms and staff and the number of patients who are infected with both influenza and another pathogen requiring isolation.

Patients should remain in the designated segregated area until discharged to the community and should not be transferred to other areas purely for bed management purposes. However, if there is extreme pressure on beds in the segregated area of the hospital, convalescing patients with residual, non-respiratory problems (ie those who are unlikely to be secreting virus in large quantities) but who require hospitalisation for other reasons (eg because of poor mobility or non-respiratory complications) may need to be moved to another area of the hospital, an intermediate care facility, or a nursing or residential home. Such convalescing patients should, where possible, be accommodated together and away from other patients (see section 8).

7.2.3 Cohorting and segregation – practical points

The following key practical points relating to segregation and increased use of PPE arose from simulations of an influenza pandemic. They are applicable to both general wards and specialist units.

- Ideally each influenza ward or segregated area should have an area just outside the cohorted area, away from patients, for staff to safely put on and remove PPE; this area should have hand washing facilities. If such an area is not available, care should be taken to avoid contaminating other people or the environment whilst removing PPE.
- Where layout allows, consider separate entrances and exits when a whole ward or unit is segregated for influenza patients, as this allows staff to put on PPE prior to entry to a cohorted area away from where they remove PPE after leaving the cohorted area.
- Consider the practical implications when determining a cohorted area. For example, if the storeroom is not included in the segregated area, then PPE will need to be removed and replaced each time the storeroom is accessed.

7.2.4 Operational issues arising from increased PPE use

Greater use of PPE may require consideration of:

- stock replenishment
- increase in waste generation
- storage space for extra supplies
- decreased efficiency in many tasks, because of staff unfamiliarity with PPE procedures.

7.2.5 Infection control measures for segregation and cohorted care

Entry procedures

A recording sheet should be placed at the entrance of the cohorted area. All staff entering should sign in so that so that there is a record of staff working in influenza areas. Personnel should be limited to those needed for patient care and support. A sign should be placed at the entrance alerting everyone to the precautions to be adopted.

Infection control precautions

Standard infection control principles must be strictly applied in conjunction with droplet precautions (see appendix B). These precautions should be maintained for all patients in the segregated area.

Ward furnishings

For bays with four to six beds, an equipment station should be set up outside the entrance to the bay to hold PPE. For Nightingale-style wards, strategic points for equipment stations should be identified to facilitate access and encourage use. Non-essential furniture, especially soft furnishings, should be removed. Remaining furniture should be easy to clean and should not conceal or retain dirt and moisture.

Patient area

In accordance with droplet precautions, the distance between beds should be at least one metre. A physical barrier, such as curtains, will help reduce environmental contamination and droplet spread between patients, but their use must be balanced against other aspects of patient safety, and they must be cleaned in line with local policy. Patients' personal belongings should be kept to a minimum. A water jug, glass, tissues, wipes and suitable disposable containers (eg plastic bags) and all other items necessary for personal hygiene should be provided and placed within the patient's reach.

Patient equipment

Where feasible each patient should be allocated their own non-critical items of patient equipment (eg a stethoscope), or disposable items should be used. Re-usable equipment must be decontaminated between patients.

Day rooms and lounges

Consideration should be given to closing day rooms and lounges if there is a risk that these might be used by both influenza and non-influenza patients, or if the location of these rooms presents a problem for limiting patient movements.

Cleaning

Cohorted areas should be scrupulously cleaned at least once a day, with a focus on frequently touched surfaces such as bed rails, overbed tables, door handles and bathroom fixtures. Cleaning after patient discharge should be carried out as normal. Close liaison with housekeeping/domestic services will be required.

7.3 Patient transfer, transport and day care procedures

7.3.1 Inter-hospital transfers

Patients with pandemic influenza must not be automatically admitted to hospital. However, it can be anticipated that some patients who are initially managed in the community will later on require hospital admission. Patients must not be transferred from one hospital to another for routine care related to pandemic influenza, including mechanical ventilation. However, some patients may require transfer for specialist care arising out of complications or concurrent medical events (eg cardiac angioplasty, renal dialysis). If transfer is essential, the infection control team and bed manager at the receiving hospital and the ambulance staff must be advised in advance. Patients with influenza should not be admitted or transferred to specialist units for vulnerable patients (eg transplant units) where mortality is likely to be very high if influenza is introduced.

7.3.2 Intra-hospital transfers

Where possible, dedicated equipment such as x-ray equipment and electrocardiograph (ECG) recorders should be allocated to the segregated area so that all procedures and investigations can be carried out in the area.

Patients with influenza should leave the segregated care area only for urgent and essential procedures. If an influenza patient requires transfer to another department the following procedures must be followed.

- Departments must be informed in advance.
- Patients must be taken straight to and returned from the department and must not wait in communal areas.

- Patients should be placed at the end of a list to allow appropriate decontamination after any procedure.
- In some settings (eg radiology departments) a separate room should be set aside for patients with influenza, and this room should be cleaned between patients.
- Influenza patients should wear a surgical mask while in transit to help prevent droplets being expelled into the environment. If a patient cannot tolerate a surgical mask (eg because of age or deteriorating respiratory status), use the most practical measures (eg tissues) to contain respiratory secretions. Where possible, patients should also perform hand hygiene before leaving their room or cohorted area.
- The infection control team can provide advice on transferring patients to other areas of the hospital.

7.3.3 Hospital day care procedures

For patients who develop influenza and have chronic conditions that require attendance at hospital for day care procedures, options include:

- deferring the procedure and re-scheduling the next appointment
- transferring the patient to a designated hospital with isolation or cohorted facilities
- introducing physical barriers such as screens in special units to separate patients with symptoms of pandemic influenza.

7.4 Accident and emergency departments

During the peak of a pandemic, hospital A&E departments and outpatient departments may be overwhelmed with patients seeking care. Alternative approaches to triage and initial assessment will be required to:

- when patients arrive, rapidly screen and identify those who have symptoms of influenza
- separate symptomatic patients from others to reduce the risk of transmission
- determine as early as possible the type of care patients will require (ie 'see and discharge' or admit for treatment).

7.4.1 Screening and triage

Signage should be placed on the route to and at the entrance of the A&E department instructing patients with respiratory symptoms to inform the reception immediately on their arrival.

A triage practitioner should be based in the reception for managing patient flow, including deferral of patients who do not require emergency care.

Screening for signs and symptoms of influenza among patients entering the hospital may escalate from passive screening (eg signs at the entrance) to active screening (eg direct questioning), on the advice of the Department of Health and the HPA.

7.4.2 Reception area

Patients with symptoms of influenza should be triaged to a segregated waiting and assessment area immediately. Patients should be instructed to stay in this waiting area and not wander around the department or other parts of the hospital or go to public areas such as the public cafeteria. Signage and physical barriers should be used as appropriate.

If separate areas for patients with symptoms of influenza cannot be established, at a minimum an alternative site should be set up for those at highest risk of complications from influenza infection (eg outpatients presenting for dialysis, patients with a history of organ transplantation or chemotherapy, or those are immunocompromised for other reasons).

Patients who do not have symptoms of influenza but require prompt assessment for acute care should be triaged to a specific waiting and examining area that is physically separate from the influenza waiting and assessment area.

Posters should be displayed to reinforce attention to respiratory hygiene. Hand hygiene facilities, supplies of tissues and lined foot-operated waste bins should be made available.

All non-essential soft furnishings and items such as books, magazines and toys should be removed.

7.4.3 Infection control measures in waiting rooms

Patients, staff and visitors should be encouraged to minimise potential transmission of influenza through the following good hygiene measures.

- Cover nose and mouth with disposable one-use tissues when sneezing, coughing and wiping or blowing noses.
- Dispose of used tissues in nearest foot-operated waste bin.
- Wash hands after coughing, sneezing or using tissues, or after having contact with respiratory secretions and contaminated objects.
- Keep hands away from the mucous membranes of the eyes, mouth and nose.
- Some patients (eg older people and children) may need assistance with containment of respiratory secretions; those who are immobile will need a receptacle (such as a plastic bag) readily at hand for immediate disposal of tissues and a supply of hand wipes and tissues.

- As waiting rooms can become crowded, it is preferable that symptomatic patients wear surgical masks. This will help contain respiratory secretions and minimise environmental contamination.

7.4.4 Infection control in examination rooms and cubicles

All non-essential equipment in the examination room or cubicle should be removed. Stocks of consumables should be stored near to the examination rooms and not inside them.

Coughing and sneezing patients should wear surgical masks to minimise environmental contamination of the cubicle. Patients should be confined to their room or cubicle and be moved outside only for essential procedures.

Frequently touched surfaces must be cleaned between patients.

7.5 Children's units

Children's wards present special challenges because of the difficulty younger children experience in adhering to respiratory hygiene. In addition, children can shed virus for longer than most adults, and in some settings shedding may be prolonged for weeks.

7.5.1 Patient placement

When cohorting children, take into consideration:

- different age groups of children (eg infants, toddlers, adolescents)
- children's routine childhood vaccination status
- presence of immunocompromising conditions
- co-infection with another pathogen (eg respiratory syncytial virus (RSV)) – such children may be cohorted separately, although this will depend upon the availability of rooms and staff and the number of patients infected with both influenza and another pathogen who require isolation.

7.5.2 Respiratory hygiene

It is important to educate and encourage children and their families to adopt good hygiene measures to minimise potential transmission, including use of disposable tissues for wiping noses; covering nose and mouth when sneezing and coughing; cleaning hands after coughing, sneezing or using tissues; and keeping hands away from the eyes and mouth.

7.5.3 Personal protective equipment

Staff may need gowns when caring for babies and neonates, because of the close contact required. Table 1 in section 5.3 gives an overview of the type of PPE to be worn in different circumstances. Guidance on putting on and removing PPE is at section 5.3.7.

7.5.4 Environmental cleaning

The patient environment should be cleaned at least twice daily and when known to be contaminated with secretions and body fluids. Communal areas such as playrooms and schoolrooms should be closed. Toys should not be shared. All toys must be cleanable and should be cleaned regularly (preferably when the environment is cleaned).

7.6 Critical care units

7.6.1 Unit layout and patient placement

Separate guidance specifically covering pandemic influenza in critical care units has been drawn up by the Department of Health and HPA: *Pandemic influenza: Guidance for infection control in hospitals and primary care settings – specific guidance for critical care units.*[22] This section summarises the main points in this separate document, which should be read in full by those working in critical care units.

The ubiquitous nature of a pandemic virus means that critical care staff, as with other healthcare staff, are just as likely to encounter pandemic influenza in settings associated with normal daily living, eg in the family home, as they are in the workplace. This is an important difference from the current situation seen with human cases of avian influenza and the previous situation with SARS.

If the unit does not have side rooms, the main unit should be divided into two separate areas for care of patients with and without influenza. Whenever possible, staff teams should be dedicated to one area only.

Critical care units should maintain standard infection control principles in line with this guidance. Standard principles should be followed at all times and should be augmented with droplet precautions and respiratory protection as required, in addition to environmental infection control measures as outlined in section 6. Compliance with all measures is critical to ensure effective infection control. The literature indicates that failure to implement appropriate barrier precautions was responsible for most of the spread of infection among healthcare staff during the recent SARS outbreaks.[23]

Although critical care units, like anywhere else in the healthcare setting, need to address these key points, a number of additional issues are relevant to such units, owing to the nature of their work. These are covered in the following sections.

7.6.2 Aerosol-generating procedures

Only essential aerosol-generating procedures should be carried out. To avoid unnecessary exposure, only those healthcare workers who are needed to perform the procedure should be present. Aerosol-generating procedures should be carried out in a well-ventilated side rooms with doors to that room shut.

See section 5.4 for details regarding aerosol-generating procedures.

7.6.3 Respiratory care issues

A number of practical measures can be taken to reduce exposure, such as anticipating those who are likely to require respiratory support and careful preparation for procedures and modifying techniques, such as use of deep sedation with or without neuromuscular paralysis for intubation.[23] Procedures such as intubation should be carried out by experienced members of staff so as to reduce as much as possible the time required and the need for multiple attempts.[24]

Respiratory procedures

- Prepare a kit in advance for procedures such as intubation, including all necessary medical equipment.
- Only essential staff should be in a patient's room when airway management or cough-inducing activities are being carried out.
- Appropriate PPE must be worn during procedures involving airway management (see Table 1 in section 5.3).

Respiratory equipment

- Disposable patient respiratory equipment must be used wherever possible. Reusable equipment must be decontaminated in accordance with local policy and the manufacturer's guidelines.
- Closed systems should be used wherever possible (eg suction).
- All respiratory equipment used on patients, including transport ventilator circuits and manual resuscitation aids, should include a high-efficiency bacterial/viral breathing system filter (BS EN 13328-1).
- Breathing filters should be changed in accordance with the manufacturer's guidelines.
- The ventilatory circuit should not be broken unless absolutely necessary.
- Staff should be alert to the potential for unplanned breathing circuit disruption:
  - Breathing circuits should be regularly checked for tightness of fit of component parts.
  - Caution should be exercised when moving or performing other care on patients who are ventilated, so as to minimise the risk of accidental disconnections.

Current suggested best practice for delivery of non-invasive ventilation in pandemic influenza pneumonia*

- Staff should be trained in infection control.
- A gown, gloves and eye protection should be worn for all aerosol-generating procedures; an FFP3 respirator instead of a surgical mask may be prudent until data are available that allow better assessment of the risk associated with different procedures (see section 5.4).
- Ideally, patients should be managed in negative pressure single rooms with anterooms, where these are available. If such facilities are not available they should be cared for in standard single rooms or, if there is no other option, in cohorted groups.
- Bi-level pressure support non-invasive ventilation (NIV) should be used.
- A high-efficiency bacterial/viral breathing system filter (BS EN 13328-1) should be used between the non-vented mask and the expiratory port and at the outlet of the ventilator.
- Expiratory port options include a whisper swivel valve or controlled leak (each with a proximal filter as above). Ideally, expiratory flow should be directed in a single jet away from patients and staff.
- NIV masks should be applied to the patient's face and secured before the ventilator is turned on.
- Ventilators that function with double-hose tubing (an inspiratory and expiratory limb) may be advantageous.
- The ventilator should be turned off before removal of the close-fitting mask or when lifting the mask away from the face, eg for mouth care or sips of fluid.
- Water humidification should be avoided.

* Adapted from Simonds AK (ed) *Non-invasive respiratory support: a practical handbook*, 3rd edition, 2007, London: Arnold.

7.7 The dying or deceased patient

7.7.1 Ministers of religion

Ministers of religion should be instructed to wear PPE in accordance with standard infection control principles and droplet precautions.

7.7.2 Last offices

When performing last offices for deceased patients, healthcare workers must follow standard infection control principles; surgical masks should be considered if there is a risk of splashes of blood and body fluids, secretions (including respiratory secretions) or excretions onto the nose and mouth.

The body should be fully wrapped in a sheet. Transfer to the mortuary should occur as soon as possible after death. If the family wishes to view the body, they may be allowed to do so and instructed to wear PPE in accordance with standard infection control principles.

7.7.3 Post-mortem examinations

During a pandemic, questions may arise about the need for post-mortem examinations. Where clinically indicated, such examinations will yield vital clinico-pathological information that may be of importance in refining recommendations related to prevention and treatment of infection. The post-mortem examination should be conducted in a high-risk post-mortem room. In accordance with HSE guidance, a powered respirator and full PPE should be worn.

7.7.4 Mortuary and funeral staff

The mortuary staff should be informed that the deceased had influenza. Standard infection control principles should be followed; there is no further risk of droplet spread. Funeral directors should be informed of the level of infection risk (that is, a low infection risk).

7.8 Visitors

7.8.1 Family visitors

During a pandemic, visitors to all areas of the hospital should be kept to a minimum, and restriction of visiting hours should be considered. Visitors with influenza symptoms should be strongly discouraged from entering the clinical area and encouraged to return home. It is particularly important that every effort is made to ensure that people with influenza symptoms do not enter wards or units, such as haematology and transplant units, where there are immunocompromised patients.

On arrival at segregated influenza wards, all visitors should report to the ward reception. Signage should be displayed informing visitors of the ward's current segregated status and the procedures that need to be undertaken before they can enter the ward. Visitors entering a cohorted area must be instructed on standard infection control principles, including hand hygiene practice and the wearing of protective equipment, as appropriate. Visitors' use of PPE should be determined by the level of interaction. Surgical masks would be appropriate PPE for visitors who sit close to the patient but are not involved in their care. Other PPE such as gloves and plastic aprons will be required if there is contact with the patient or the patient's environment.

Using family members and volunteers to assist in patient care during a pandemic may be considered if staff shortages are extreme. When visitors become carers they will need to be instructed further on the use of PPE.

7.8.2 Other visitors

Estates department staff and other technicians should not be allowed entry into segregated influenza areas unless they are undertaking essential maintenance work. If this is necessary, PPE must be worn as detailed for healthcare workers.

Other workers who provide ward-based services, such as catering staff or those who provide and maintain patient facilities such as personal television and telephones, should be organised such that staff who work in segregated influenza areas do not also work in non-influenza areas of the hospital. They should be included in any hospital-wide education programme with regard to pandemic influenza, droplet precautions and standard infection control principles, including hand hygiene and PPE.

Unless their help is essential, the number of volunteer workers should be kept to a minimum. Volunteers should report to and sign in at the reception area. Volunteers should not move between segregated and non-segregated areas. Instruction in standard infection control principles and droplet precautions, including specific instruction on PPE and its use, will be required.

Commercial visitors such as medical sales representatives should not be allowed entry into segregated influenza areas, including patient waiting or reception areas designated for patients with symptoms of influenza.

8 Supplementary guidance for primary care settings

The infection control principles discussed so far in this document are transferable to other settings. Each PCT setting is managed differently in terms of staff and population, and the generic guidance provided in this document will need to be put into operation slightly differently in each primary care setting, after a local risk assessment has been performed. This supplementary section is appropriate for the following care settings:

- general practice premises
- primary care teams making home visits
- primary care clinics
- community hospitals
- prison medical units
- AHPs
- dental practices.

Readers should be aware that draft guidance is available for ambulance services[25] and their staff and for social care staff.[26]

Guidance is also available or under development for non-healthcare settings and personnel, including:

- prisons
- the fire and rescue service
- the police service
- universities and colleges of further education
- funeral directors.

8.1 Preparedness checklist for pandemic infection control

Key issues relating to infection control in primary care settings are set out in the following sections.

8.1.1 Overall coordination

- Identify a lead member of staff (eg the DIPC) who will take responsibility for coordinating infection control during a pandemic.

- Ensure that trust boards and senior managers are fully informed of the critical infection control issues in relation to pandemic influenza.
- Identify whether there are existing forums within the trust that can address the issues and actions required in preparing for a pandemic (including performing local risk assessments). If not, form a local pandemic action group or sub-group, which may have representation from a number of PCTs covered by the same local HPU and whose membership should comprise:
  - executive board/DIPC
  - nursing executive
  - medical staff
  - senior representative from each clinical team (eg district nurse, senior physiotherapist, occupational therapist, podiatrist)
  - occupational health provider
  - infection control team
  - health and safety team
  - bed manager
  - public relations/communications manager
  - estates/facilities department
  - domestic services/housekeeping
  - supplies
  - CCDC or other member of local HPU
  - community pharmacist
  - human resources
  - others as appropriate.

8.1.2 Infection control

- Identify suitable staff (eg infection control link nurses/professionals) who can supplement the existing team if needed.
- Prepare a strategy to communicate infection control information to staff.

8.1.3 Triage and patient placement

- Establish procedures and test a plan for configuring healthcare settings and premises during a pandemic, including, where possible, the rapid separation of patients with influenza from other patients.
- Identify areas for segregating or cohorting large numbers of waiting patients with influenza.

8.1.4 Occupational health

Develop plans and procedures to:

- ensure that managers know how to assess staff with respiratory symptoms
- supervise and monitor staff deployment, including bank and agency staff
- track and document staff sickness and absence
- provide psychological and social support to staff
- administer antiviral treatment, following Department of Health policy
- vaccinate staff, following Department of Health policy.

8.1.5 Staffing

Ensure that plans are in place to address:

- staff allocation, which should consider the skill mix and the likelihood of sickness and absence
- tracking and coordination of staff movements (including agency staff)
- when an emergency staffing crisis might be declared
- the possible use of family members and lay volunteers in an ancillary capacity
- staff working outside their usual area of practice (eg medical and nursing students working as healthcare assistants).

8.1.6 Escalation

Ensure that the following are addressed in the existing escalation policy:

- procedures for reviewing and revising referral criteria to acute hospital care, as admission thresholds are likely to be higher
- policies for expediting discharge of patients in conjunction with acute trusts and local services
- adequate transportation arrangements for discharged patients

- establishment of an intermediate care facility to free up hospital beds
- plan for frequent liaison with bed managers in acute trusts.

8.1.7 Supplies of consumables

- Evaluate the current stock of essential equipment.
- Assess anticipated demand for consumables and determine a trigger point for ordering extra supplies.
- Determine the feasibility of ordering and storing extra PPE.
- Direct supplies managers to establish contingency plans in the event that primary sources of supplies become limited or exhausted.

8.1.8 Mortuary issues

In conjunction with the Local Resilience Forum:

- plan for mass fatalities
- assess capacity for refrigeration
- define overflow arrangements.

8.1.9 Education and training

- Brief the senior PCT staff (including practice managers, district nurse managers, GPs and ambulance managers) on the procedures for infection control during a pandemic.
- Brief managers of other departments (including estates, practice nurses, physiotherapy and occupational health).
- Test local response capabilities; a tabletop exercise is strongly recommended.
- Plan for additional training and fit testing for the small number of staff who are likely to use FFP3 respirators.
- Provide general training for all staff on the infection control implications of pandemic influenza.
- Liaise with others who may require training on infection control precautions as appropriate to their respective roles (eg ministers of religion and funeral directors).
- Consider how the PCT's intranet could be utilised for training, education and communication on infection control issues during a pandemic so as to minimise face-to-face meetings.

8.2 Patient placement, segregation and cohorting

To achieve the desired goal of separating patients with influenza from those without, a designated self-contained area within all premises should be used, whenever possible, for the treatment and care of patients with influenza. Ideally this area should:

- be fully self-contained
- include reception and waiting areas that are separated from non-influenza patients
- have a separate entrance/exit door
- not be used as a thoroughfare by other patients, visitors or staff.

To control entry, signage should be displayed warning of the segregated influenza area.

While such arrangements may not be possible in some premises within a PCT, solutions should be sought that incorporate the above principles as much as possible, mixed surgeries for influenza and non-influenza should be avoided.

8.2.1 Configuration of community care premises

Once a pandemic has become established, segregation principles should be applied to address the need to handle a large number of patients with influenza whilst minimising transmission to others.

In GP surgeries and community outpatient settings, part of the surgery (or, at a minimum, a consulting room) should, where possible, be designated for influenza patients for the duration of the pandemic.

In community in-patient settings, including community hospitals, nursing homes and prison hospitals, the advice is as for acute hospital settings (see section 7.2).

In temporary care settings, arrangements at the PCT level should plan for a high number of patients being discharged from hospitals into the community. Plans should be in place to provide accommodation for segregated intermediate care (eg in a designated nursing home). As the incidence of influenza increases locally, there may be a need to establish temporary care facilities. These are likely to be situated in establishments that have not been designed or optimised for the delivery of clinical care (sports halls, schools, town halls etc).

8.2 2 Infection control practice in community inpatient areas

See section 7.2.

8.2.3 Key points for infection control practice in temporary care settings

During preparation and planning, advice must be sought from the PCT's community infection control team and from the local environmental health department so that selected areas are suitable. For example, access to hand washing facilities should be made available; if

there is a shortage of sinks, temporary sinks should be installed (this may require liaison with the local council). Supplies of PPE, hand hygiene products and cleaning materials must be secured before the facility accepts patients.

Alcohol handrub should be available at all points of patient care and at the building's entrance and exit points. Personal portable alcohol handrub may be issued to staff if hand hygiene facilities are suboptimal.

With regards to layout and configuration, a distance of one metre should be maintained between beds, and beds should be capable of being separated by a physical barrier (eg screens).

8.3 Patient transfer and transport and hospital day care procedures

See section 7.3.

8.4 Ambulance services

Key points

- Where practical, designate one or more ambulances for influenza patients.
- Standard infection control principles and droplet precautions are applicable in most circumstances.
- Crew members should wear FFP3 respirators if critically ill patients require aerosol-generating procedures (such as intubation or nasopharyngeal aspiration).
- Equipment carried should be kept to a minimum.

Where practical and possible, designate one or more ambulances for the duration of each shift for the transfer of patients with influenza.

The immediate environment – ie trolley, patient equipment and hand contact points – must be decontaminated between patients. Upon completion of transfer of patients with influenza (eg at the end of a shift) the vehicle must be thoroughly cleaned and decontaminated with detergent and warm water before further use. All disposable materials must be disposed of as clinical/infectious waste. Clinical/infectious waste bags must be sealed, labelled and sent for disposal.

Coughing and sneezing patients should be transported on their own whenever possible. However, if pressure upon the service occurs, two patients with symptoms of influenza may be transferred together. Symptomatic patients should be encouraged to wear a surgical mask to assist in the containment of respiratory secretions and reduce environmental contamination of the ambulance (see section 5.2.5).

8.5 General practices

Key points

- Non-essential clinics should be cancelled.
- Staff should be allocated to either influenza or non-influenza patients.
- A separate waiting area should be set aside for influenza patients.
- Hand hygiene facilities and paper tissues should be made available.
- The environment should be cleaned frequently with neutral detergent.

8.5.1 Organisation of work flow and appointments

The principal GP and the practice manager are together responsible for clinical and administrative infection control procedures to prevent the spread of influenza in the practice. Procedures should be established to test the practice's plan, including a 'dummy run' of converting the premises to a pandemic configuration.

Procedures for making appointments should be reviewed. All non-essential clinics should be cancelled, including routine baby clinics. Babies without symptoms of influenza, needing treatment and essential childhood immunisations, should be seen singly in the part of the health centre or surgery designated for non-influenza patients.

Where practical, a work flow should be developed so that GPs and practice nurses are designated to care for either influenza or non-influenza patients and mixed care is avoided. For example, in the morning surgery one GP could be designated to see all patients with influenza in a designated area of the premises; at the end of surgery the same GP would make house calls to patients with influenza. Other GPs within the practice would see non-influenza patients in separate areas of the surgery. Environmental cleaning should be carried out before the same facilities are used for non-influenza patients.

8.5.2 Telephone triage

Patients with symptoms of influenza who are not seriously ill should be encouraged to follow Department of Health advice, eg to use a telephone assessment service. If it is necessary to contact the GP surgery, patients should be encouraged to make contact by telephone for advice and consultation to minimise crowding in reception areas. GPs may wish to consider home visits in lieu of surgery visits in such instances.

8.5.3 Segregation

If possible a segregated area of the GP premises should be designated for influenza patients (at a minimum a consulting room). Staffing should be limited to those necessary for patient care and support, and a record should be kept of which staff work in the area. A sign should be placed at the entrance alerting staff and visitors to the segregated areas and precautions to be adopted.

All staff should be made aware of standard infection control principles and droplet precautions (see appendix B), with particular attention to hand hygiene and to the additional cleaning of consulting and treatment rooms after they have been used for seeing patients with influenza (see section 6.5). Standard infection control principles and droplet precautions should be maintained both in the surgery and during home visits.

Posters should be displayed advising on influenza and the need for good respiratory hygiene. Hand washing or handrub facilities, tissues and lined waste bins (ideally foot-operated bins) should be made available. Coughing or sneezing patients should wear surgical masks to assist in the containment of respiratory secretions and to reduce environmental contamination.

8.5.4 Cleaning

See **section 6.5** for guidance on cleaning. In summary:

- re-usable equipment (eg ECG machines, stethoscopes) should be cleaned between patients
- consulting rooms, treatment rooms and waiting areas should be cleaned as a minimum daily, and after being used for an influenza session
- frequently touched surfaces should be cleaned with warm water and detergent at least twice daily, and when known to be contaminated with secretions, excretions or body fluids.

8.5.5 Checklist for pandemic infection control in GP practices

Layout and configuration of the practice

- Create separate waiting areas for influenza and non-influenza patients.
- Designate particular clinical rooms or doctors' offices for influenza and non-influenza patients.
- Display clear signage at surgery entrances and clinical rooms and doctors' rooms indicating influenza and non-influenza areas.
- Remove extraneous items (toys, soft furnishings, magazines) from waiting areas.

Staffing

- On a daily basis assign GPs, practice nurses and other primary care staff to see either influenza patients or non-influenza patients.

Infection control

- Ensure that hand hygiene facilities (sinks, soap, alcohol handrub, paper towels) are available for staff and patient use.
- Consider use of portable alcohol handrub for GPs and practice staff when they make community and home visits.
- Ensure that tissues and waste bins (preferably lined and foot operated) are available for patients and staff.

Personal protective equipment

- Ensure that supplies of gloves, surgical masks, aprons and any other items that may be needed are available.
- Ensure that eye protection is available if needed.
- Perform local risk assessment to review the potential for aerosol-generating procedures to be performed; order FFP3 disposable respirators and fluid repellent gowns if this is likely.

Environmental cleaning

- Ensure that a cleaning rota is in place and that domestic staff have been trained in cleaning and decontamination procedures.
- Ensure that adequate supplies of cleaning materials are available.

Education and training

- Provide all staff with training in pandemic influenza infection control procedures.
- Ensure that any potential users of FFP3 disposable respirators have been fit tested and trained in their proper use and care.

Record keeping

- Track and document staff sickness and absence.
- Track and document staff assignments.

Patient information

- Display posters and provide information sheets, pamphlets etc for patients.

8.5.6 Single-handed GPs

Single-handed GPs may encounter a number of difficulties in implementing pandemic influenza infection control measures:

- creation of separate waiting areas for influenza and non-influenza patients
- designation of clinical rooms for influenza and non-influenza patients
- segregation of influenza and non-influenza patient care activities, owing to small team size
- limited resilience because of staff sickness and absence.

Single-handed GPs should seek help and advice from the PCT to help ensure that they can function effectively during a pandemic without increasing the potential for the spread of influenza in their practice. PCTs may need to consider how local services provided by single-handed GPs can be amalgamated with those provided by larger team practices for the duration of the pandemic.

8.6 District nursing teams

Team leaders may need to consider flexible and new approaches such as 'cross-working'. For example, district nursing teams or PCTs might consider sharing staff, or a designated district nurse could visit several patients in one care home.

District nurses should be designated to care for either influenza or non-influenza patients whenever possible. All non-influenza visits and appointments should be continued as long as possible, but it may be necessary to cancel routine appointments and clinics.

8.7 Health visitors

Close liaison among all members of the PCT is essential. Health visitors may be asked to work outside their normal duties, and managers should ensure that training is provided to facilitate this need.

Home visits to patients without influenza should continue for as long as possible. However, it may be necessary to cancel routine appointments and baby clinics.

Health visitors should not routinely visit families affected by influenza. However, they must ensure that alternative arrangements (eg telephone liaison) are in place to maintain contact. Health visitors performing non-deferrable essential visits (eg child protection) to households with influenza should follow the infection control precautions detailed in this document.

8.8 Allied health professionals

Close liaison with the PCT is essential. AHPs may be requested to work outside their normal duties, and managers should ensure that training is provided to facilitate this need.

It may be necessary to cancel non-essential clinics and appointments. AHPs performing non-deferrable essential visits to households with influenza should follow the infection control precautions detailed in this document.

See section 4 for further information regarding staff deployment and occupational health issues.

8.9 Dental practices

Patient appointments

It may be prudent to cancel routine dental appointments during the pandemic period. As a minimum, dental practices should put in place active screening of all patients for symptoms of influenza before they enter the clinical area. Patients with symptoms of influenza should not be seen at all, unless a dental emergency is suspected. Where possible, patients with influenza symptoms but who need to be seen because of a dental emergency should be segregated to a separate waiting room. If this is not possible they should be asked to wear surgical masks whilst in the waiting area to assist in the containment of respiratory secretions and to reduce environmental contamination.

Signage and posters should be displayed prominently to raise awareness of basic infection control measures such as hand hygiene and respiratory etiquette. Tissues should be made available to patients and the location of hand hygiene facilities indicated. A lined bin (preferably foot operated) should be located in the waiting area.

Performance of procedures on patients with influenza

Dental professionals should avoid aerosol-generating procedures on symptomatic patients as far as possible and must wear appropriate PPE where that is not possible (see Table 1 in section 5.3). Many dental procedures have the potential to generate aerosols, and risk assessments will therefore be necessary. Emergency patients should be treated at the end of a surgery session when all other patients have left, or one clinical room could be dedicated for influenza patients throughout each session. Staff in attendance should be kept to a minimum and should all wear PPE appropriate for an aerosol-generating procedure (Table 1).

Local plans should ensure that emergency care remains available throughout a pandemic, but dental practitioners may find normal demand reduced because of limits on the procedures they are able to carry out on patients with respiratory symptoms and because patients themselves will defer treatment or face travel difficulties. Opportunities to use the assessment and treatment skills of dental practitioners or other health professionals to support the wider delivery of healthcare in a pandemic should be explored in local planning.

Infection control and environmental cleaning procedures

See sections 5 and 6. Dental instruments used on patients with influenza should be decontaminated as normal.

8.10 The dying or deceased patient

See section 7.7.

In addition to this guidance, specific guidance for pandemic influenza has been written for funeral directors and is available on the National Society of Allied and Independent Funeral Directors website (http://saif.org.uk – available at this site to members only).

8.11 Visitors

The only visitors to healthcare centres, GP surgeries and nursing and residential care settings should be patients and a guardian or care giver where essential. See section 7.8 for further details.

Appendices
Appendix A: The epidemiology of pandemic influenza

Emergence of a pandemic

Seasonal influenza is a familiar infection in the UK, especially during winter. Every year strains of influenza (type A or B) circulate, giving rise to clinical consultations in primary care, episodes of hospital treatment and deaths. Treatment in primary care and hospital may be required, because of the direct effects of influenza virus infection or its possible complications, most commonly secondary bacterial pneumonia.

Pandemic influenza occurs when a new influenza A virus subtype emerges in humans that is markedly different from recently circulating subtypes and strains, and is able to spread efficiently from person to person and cause significant clinical illness in a high proportion of those infected.

Because the virus is novel in humans, a high proportion of the population will have little or no immunity, producing a large pool of susceptible persons. As a consequence, the scale and severity of illness in a pandemic are likely to be of a substantially higher order than even the most severe winter epidemics. There may also be changes in the age distribution of cases compared with non-pandemic years; mortality in typical seasonal influenza is usually confined to older age groups, but in pandemics may extend to younger age groups. The size of any increase in mortality and morbidity, and the extent to which a shift in age distribution occurs, will depend on a variety of factors, including the nature of the pandemic virus and pre-existing immunity.

The circumstances exist for a new influenza virus with pandemic potential to emerge and spread, and the longest interval so far recorded between pandemics is 39 years (1918–1957). The unpredictability of the timing of the next pandemic is underlined by the occurrence of several large outbreaks of highly pathogenic avian influenza associated with epizootic transmission to humans.[27] By far the most serious has been the massive and unprecedented outbreak, beginning in late 2003, of highly pathogenic avian influenza (A/H5N1) affecting poultry in East and South East Asia, which has spread to parts of Europe and Africa. This outbreak has so far been associated with a small number of confirmed human cases but a high proportion of deaths. Although the emergence of an A/H5N1 strain with capacity to spread efficiently between humans is neither inevitable nor imminent, international concern has increased regarding the possibility that avian influenza A/H5N1 may evolve to produce the next pandemic.

Clinical attack rate

In the previous pandemics of the 20th century, clinical attack rates (the proportion of the population with symptomatic illness) in the UK have been in the range of approximately 25–35%, compared with the usual seasonal influenza range of 5–15%. The actual extent of the clinical attack rate will only become evident as person to person transmission develops, but it should be recognised that an attack rate of up to 50% is possible.

Case fatality rate

In the previous pandemics of the 20th century, case fatality rates (the proportion of people with symptomatic illness who died) have varied widely from as much as 2–2.5% in 1918 to less than 0.5% in 1957 and 1968. Although estimates of the case fatality rate for avian influenza are high, with reported mortality in humans currently over 50%, it should be noted that this is primarily an avian virus with its own specific characteristics, and treatment has often been delayed. There are diverse views regarding the link between virulence and ability to transmit between humans, although the majority of scientists currently believe virulence to be independent of transmissibility.

Age-specific impact

The age specific impact of an influenza pandemic is difficult to predict in advance. In the UK in 1918, a dramatic shift in age-specific impact (morbidity and mortality) occurred towards younger adults, whereas the pandemics in 1957 and 1968 had an impact across the age range of the population in a fashion much more akin to seasonal influenza (ie the greatest impact was in older people). Therefore although the potential for age-specific differences in the clinical attack rate should be noted, they are impossible to predict, and a uniform attack rate across all age groups is assumed for planning purposes.

Timing and seasonality

Although pandemic viruses may emerge at any time of the year, evidence from the three pandemics of the 20th century suggests nevertheless that they inflict maximum impact during the next winter season after the pandemic breaks out. Of the influenza pandemics of the 20th century, that of 1918–19 produced three separate epidemic waves, each separated by three to six months; that of 1957 had one wave; and the A/H3N2 pandemic in 1968–69 had two. Each wave may last around 15 weeks, and a second and subsequent wave, if they occur, could possibly be more severe than the first.

Health consequences

When an influenza pandemic occurs, a substantial proportion (possibly all) of the population is likely to be non-immune, producing a large pool of susceptible persons. In past pandemics, the scale and severity of illness (and hence consequences) have been variable but broadly of a higher order than even the most severe winter epidemics. It is reasonable to expect this to be the case with the next pandemic as well.

Excess mortality

Excess mortality from influenza occurs in most winter seasons but is especially marked during epidemics. The average annual excess mortality attributable to influenza in recent years is around 12,000 deaths per annum in England and Wales,[28] although there is considerable yearly variation and some years are notably much higher than the average (an estimated 26,000 deaths in the 1989–90 epidemic). Excess mortality in England and Wales associated with the three pandemics of the 20th century has also varied widely: this was estimated at 198,000 in 1918–19 and 37,500 in 1957–58. In the winters of 1968–69 and 1969–70 (both seasons considered to be associated with the A/H3N2 pandemic) there were an estimated 31,000 and 47,000 deaths, respectively. Therefore the extent of mortality associated with the next pandemic cannot be reliably predicted, although it is reasonable to plan for a scenario worse than a severe winter epidemic of normal influenza.

Modelling for geographical and temporal spread

Mathematical models have been used to explore the possible spread and impact of pandemic influenza in the 21st century, as well as the effectiveness of potential control programmes. Recent modelling studies broadly suggest that a new pandemic might be containable at source (assumed to be in South East Asia) through rapid (almost immediate) application of a combination of stringent social distance measures, area quarantine and geographically targeted antiviral prophylaxis. However, the likelihood of success would be increased if the virus was not highly contagious, and if the initial cases were limited to a small geographic area and rapidly detected.[29,30] However, similar containment strategies to prevent a pandemic spreading in the UK are unlikely to be effective, as simultaneous, multiple importations would be expected, and antiviral drug stocks would be rapidly depleted.[31]

In terms of the spread within the UK, past experience of pandemics suggests that it would only take a few weeks from the initial introduction(s) to widespread influenza activity across the country. Modelling further suggests that it would only take a further seven to nine weeks before peak influenza activity was in all regions of the UK. Restrictions on international travel are unlikely to delay an epidemic significantly.[32] For instance, imposing a 90% restriction on travel to the UK might delay the peak of a pandemic by only one to two weeks.[31] Entrance screening at airports is unlikely to be effective at preventing or delaying an epidemic, as most of those who board a flight incubating influenza would not display symptoms until after arrival and so would not be prevented from entering the country.[33]

School closure might reduce clinical attack rates in children and slow the spread of a pandemic to some extent.[31]

Transmission of influenza virus

It is well established that influenza is transmitted from person to person through close contact. Transmission almost certainly occurs through multiple routes, including droplets and direct and indirect contact.[11] Aerosol transmission may also occur.[12]

Although the respiratory tract is the main route of infection, infection through the human eye is also possible. Receptors for human influenza are not present in the human eye, so although virus could reach the respiratory tract via the tear ducts, it is considered to be a minor route only. However, receptors for avian influenza are present in the eye, and avian influenza conjunctivitis has been reported.[34] A mechanism therefore exists for avian influenza to replicate and ultimately cause avian influenza respiratory symptoms.

Transmission of influenza has been well described in hospitals, nursing homes and community settings. Epidemiological patterns of disease occurrence in these settings strongly support close contact with an infected individual as being responsible for the vast majority of transmission. However, most reports, both in clinical and non-clinical settings, do not provide data (eg on patient bed locations, contacts between healthcare workers and patients, laboratory evaluation of healthcare workers for influenza, and clustering in time and space of illnesses in patients and healthcare workers) to determine precisely whether spread is by droplet, contact or aerosol. Furthermore, outbreaks in healthcare settings are almost always confounded by concurrent community-based epidemics, which make it difficult to pinpoint the exact source of exposure among healthcare workers and patients.

Salgado *et al* summarised the findings of 12 outbreaks of nosocomial influenza outbreaks and concluded that multiple routes of transmission were probably responsible.[35] In none of these outbreaks were isolation precautions instituted or required to halt 'airborne' (sic) transmission; instead droplet and/or contact precautions were usually implemented, along with various other approaches (eg use of antiviral drugs and vaccines and limiting the number of visitors). One of this study's authors noted that her institution had not documented any clusters of influenza among hospitalised patients in 15 years, despite placing most patients with recognised influenza in positive pressure single rooms and not in negative pressure isolation rooms. Transmission of influenza at another US hospital occurred principally among paediatric patients who were housed in the same room, especially those in cots adjacent to the index patient.[36] Infection in patients located in separate rooms off the same corridor was rarely observed, despite opportunities for airborne (sic) transmission to occur (eg through open doors and housing patients in positive pressure rooms). Blumenfeld et al described a nosocomial outbreak of A/H2N2 influenza that occurred at the beginning of the 1957–58 pandemic before evidence of widespread cases in the community.[37] The outbreak was traced to admission of a symptomatic patient who was subsequently documented to have influenza. Within 48 hours, the patient in the adjacent bed developed symptoms, and 12 other cases in healthcare workers and patients occurred soon afterwards. Isolation precautions had not been instituted and the pattern of disease was most compatible with short-range transmission, suggesting that contact and droplet transmission were likely routes. Further evidence for a role for contact transmission can be derived from experimental studies of survival of human influenza viruses which suggest that the virus can survive on some environmental surfaces for up to 72 hours.[13]

Data on transmission by aerosols are mainly derived from experimental studies of influenza in animals. In one set of experiments, Schulman and Kilbourne showed that when infected and non-infected mice were housed together in a closed chamber that permitted manipulation of air flow, the rate of transmission increased as the rate of air flow decreased.[38] When air flow was kept constant, the rate of transmission of influenza from infected to uninfected mice did not vary significantly, regardless of whether the two groups of mice were in one cage or physically separated by two wire screens, 2cm apart.[39,40] The authors concluded that these findings were compatible with transmission occurring principally via small airborne droplet nuclei (sic), since spread by droplets would have been expected to have been influenced by separation of the two groups and not have been affected by ventilation. However, the experimental design as described would have allowed transmission to have occurred via droplets as well. In other experiments, 'fine infectious particles' (<10 microns in size) were recovered from the air surrounding infected mice.[40] Similarly, studies in ferrets demonstrated transmission despite separating ill from susceptible ferrets by a 2.7m duct with two 90 degree bends, making droplet transmission unlikely.[41] However, the extent to which these data are generalisable to humans is not known.

More limited data are available to assess the possible role of aerosol transmission in humans. One source of information is from human volunteer studies. In these studies, experimental infection by inhalation of virus (aerosol) was observed to induce symptomatic illness far more readily than infection by instillation of nasal drops (direct contact) and at 10-fold to 100-fold lower doses.[42] However, it is not certain how closely experimental inoculation mimics the natural setting.

Observational data derived from a minority of outbreaks of influenza in the literature suggest a possible role for aerosol transmission. In one frequently cited report, the rate of serologically confirmed A/H2N2 pandemic influenza infection was significantly less among TB patients housed in a Veteran's Hospital ward equipped with ultraviolet lighting (four of 209 patients (2%), compared with 75 of 396 patients (19%) in a non-radiated ward), suggesting that the ultraviolet radiation had inactivated viral-laden aerosols.[43] However, interpretation of this observational report is severely limited because critical elements that could have confounded the observations were either not recorded or reported. Importantly, the study lacked suitable controls, which limits firm conclusions.[44]

In a second study, 72% of 53 airline crew and passengers developed an influenza-like illness within 72 hours of sharing a flight with a febrile coughing passenger who was subsequently documented to have influenza A.[45] The flight was delayed more than four hours on the ground, during which the ventilation system, which normally completely exchanged the air in the passenger cabin every four-and-a-half minutes, was turned off. The risk of clinical illness among passengers was found to correlate with increasing time spent aboard the grounded aircraft. Two different replacement planes flew passengers to their final destination; interestingly, passengers who flew on the same replacement plane as the ill passenger had the same rate of illness as those who flew on a second plane, suggesting that

additional time spent with the ill passenger, albeit under routine air flow conditions, did not increase the risk of transmission. The findings of this outbreak mimic those of Schulman's studies of air flow effect on transmission in mice,[38] and suggest that standard air exchange rates used in hospital rooms would assist in limiting transmission of influenza. In both these studies, however, it was not possible to delineate carefully other routes of exposure and to assess individuals' susceptibility to infection. For example, in the airline study, transmission may also have resulted from droplet or contact spread, as passengers moved freely about the cabin while it was grounded, including in and around the area where the index case was seated.

In summary, although there is no evidence that establishes a clear hierarchy for modes of transmission, the patterns of transmission observed during nosocomial outbreaks frequently point to short-range transmission. This suggests that droplet and contact transmission are the most important and the most likely routes.

Infection control measures to interrupt transmission of influenza virus

Surgical masks are worn by healthcare workers to provide a physical barrier and minimise contamination of the nose and mouth by droplets. Although there are few well-designed experimental or observational studies to conclusively demonstrate that surgical masks protect healthcare workers from respiratory infections during routine ward work,[17] the use of face masks to protect healthcare workers has a long history[46,47] and has been incorporated into international[16] and national infection control guidance.[15] Two recent retrospective studies of the SARS epidemic suggested that surgical masks afforded health-care professionals some measure of protection when in close contact with patients.[48,49] The impact of PPE use by visitors has not been addressed specifically in the literature, but its use should be determined by the level of interaction.[15]

Epidemiological evidence has defined the area of risk around the patient as being a distance of less than one metre.[50] Recent isolation guidance from the US Centers for Disease Control and Prevention suggests that this should be used as an approximation rather than an absolute distance.[15] Nevertheless, applying a one metre threshold for using surgical masks has been effective in preventing transmission of infectious agents via the droplet route.

Common sense suggests that good adherence to respiratory hygiene such as covering the nose and mouth when coughing and sneezing will interrupt droplet transmission. A recent 'cover your cough' campaign was found to prevent exposure of hospital employees to pertussis, which is spread by droplet transmission.[51]

Several studies have documented both the major contribution played by contaminated hands in the transfer of infection and the effectiveness of hand hygiene in healthcare[17,52] and community settings.[53,54,55] Hands have been shown to donate and receive viruses during contact with animate and inanimate surfaces, so thorough and regular decontamination by caregivers is crucial in preventing spread.56 UK guidelines for preventing healthcare-

associated infections indicate that effective hand decontamination results in significant reductions in the carriage of potential pathogens on the hands and logically decreases the incidence of preventable healthcare-associated infection.[17] Alcohol handrubs are recognised to have broad antimicrobial efficacy, including efficacy against enveloped viruses. At least one study has demonstrated that influenza virus is readily inactivated within 30 seconds by a commercially marketed alcohol hand disinfectant following experimental contamination of hands.[14]

There are few data specifically demonstrating the effectiveness of environmental cleaning in reducing transmission of influenza. However, alcohol is effective against influenza virus, and influenza viruses are deactivated by washing with soap and water, household detergents and cleaners. Therefore sensible (manageable) environmental cleaning appropriate to the specific environment and, in healthcare settings, in line with national specifications[57] is important.

Micro-organisms are removed and killed during all stages of the laundering process. NHS laundry guidelines[21] provide specifications for cleaning hospital linen on an industrial scale. Although some hospitals launder staff uniforms according to these guidelines, increasingly these are laundered at home. There is no strong scientific evidence to suggest that home laundering of uniforms is inferior to industrial processing as a means of decontaminating uniforms, nor that domestic machines pose a risk of transmitting hospital pathogens to other items in the washload.[58] However, dilution is an important element in the process, so to avoid overloading, uniforms should be washed separately and at the highest temperature they can tolerate to ensure that micro-organisms are killed.[59] Although evidence shows that the washing process itself adequately removes microbes, components such as ironing and tumble drying are also beneficial in reducing microbial counts. The authors of one study that looked specifically at laundering hospital uniforms at home concluded that domestic laundering of uniforms was an acceptable alternative to hospital laundering if combined with tumble drying or ironing.[60]

Influenza virus survival and inactivation

Studies of mice exposed to aerosols of fine, uniformly sized droplets of influenza virus found that under conditions of low humidity (17–24%) mice could become infected for up to 24 hours after the virus was first aerosolised in a room in which a slowly rotating fan was used to continuously agitate the air.[61] Loosli *et al* postulated that the low humidity allowed for rapid drying of infectious particles. That desiccation does not eliminate infectivity was supported by an increased rate of infection in mice following 'vigorous sweeping of the floor' 22 hours after the virus had first been sprayed into the experimental room.[61]

Indirect support for the feasibility of contact transmission of influenza virus can be derived from experimental data regarding the survival of influenza A viruses (as judged by the ability to recover and culture virus) on various environmental surfaces at 35–40% humidity.[13] Virus survived on hard non-porous surfaces (a stainless steel counter and plastic washing-up bowl)

for up to 72 hours, but only small quantities were detectable beyond 48 hours. In contrast, virus was recovered from soft porous items (pyjamas, handkerchiefs, tissues and magazines) for up to 24 hours, but only small quantities were detectable after 12 hours.

The authors of this study also evaluated the transferability of influenza A virus from contaminated surfaces onto hands.[13] Measurable virus could be transferred to hands from hard stainless steel surfaces for up to 24 hours after the surface had been contaminated and from soft porous items (pyjamas, handkerchiefs, paper tissues and magazines) for up to two hours after (albeit in very low quantities after 15 minutes). On the basis of their results the authors suggested that people shedding large amounts of virus could transmit via stainless steel surfaces for two to eight hours and via paper tissues for a few minutes. Of note, once virus was transferred to hands it survived for only five minutes – albeit long enough for self-inoculation of conjunctiva or mucous membranes to theoretically occur or to be transferred to other surfaces by touch.

At least one study has demonstrated that influenza virus is readily inactivated within 30 seconds by a commercially marketed alcohol hand disinfectant following experimental contamination of hands.[14]

Incubation and communicability

Estimates of the incubation period of influenza vary from one to four days, with most ranging from two to three days.[62]

The period of communicability of influenza virus (ie the period of viral shedding) can be inferred from the length of time that virus can be recovered from respiratory secretions and is influenced by age of the person infected, level of immunocompetency and treatment with antiviral agents. Older live-virus challenge studies indicated that adults shed virus from the day before symptoms through the three to five days after onset of illness. The level of virus shedding before symptoms appear is lower than in the symptomatic period and usually subsides to low levels by day five.[62,63] A more recent study found that adult patients could shed virus (detected by polymerase chain reaction (PCR) or culture) beyond this traditional period. However, it was unclear whether influenza A virus detected by PCR was infectious.[10]

Viral shedding is proportional to severity of illness and temperature elevation.[64] It is estimated that approximately 50% of all influenza infections are asymptomatic.[36] Infected people (typically adults) can shed influenza virus yet have no evidence of respiratory symptoms.[65] However, the importance of transmission from infected people during the incubation period or from those with asymptomatic infection is uncertain but appears to be substantially less than from symptomatic people.

There has been only one published report implicating transmission of influenza between adults during the incubation period. This involved a group of adults who worked bagging fertiliser in New Zealand. One worker, considered to be the probable index patient, had felt unwell during work, although he did not have respiratory symptoms; six hours after he finished work he developed an influenza-like illness. Subsequently 16 of 26 men became ill with influenza-like symptoms 24 to 48 hours later.[66]

Studies of naturally occurring influenza B infection in children have shown that 93% shed detectable virus during the first three days of symptomatic illness, 74% on day four and roughly 25% on day six.[64] In general, children cease shedding influenza virus seven to eight days after onset of symptoms, but they can shed infectious virus several days before onset of illness.[67]

Studies involving hospitalised children with underlying medical conditions who acquired influenza A virus in the hospital have demonstrated isolation of virus 7–21 days after the onset of symptoms.[68,69] Case reports of severely immunocompromised adults and children indicate that viral shedding can occur for even longer periods of time.[70,71]

Appendix B: Infection control precautions

Standard infection control principles*

Standard infection control principles are a set of broad statements of good practice to minimise exposure to and transmission of a wide variety of micro-organisms. Standard principles should be applied by **all** healthcare practitioners to the care of **all** patients **all** of the time.

Hospital environmental hygiene

The hospital environment must be visibly clean, free dust and soiling and acceptable to patients, their visitors and staff.

Increased levels of cleaning should be considered in outbreaks of infection where the pathogen concerned survives in the environment and environmental contamination may be contributing to spread.

The use of hypochlorite and detergent should be considered in outbreaks of infection where the pathogen concerned survives in the environment and environmental contamination may be contributing to spread.

Shared equipment used in the clinical environment must be decontaminated appropriately after each use.

All healthcare workers need to be aware of their individual responsibility for maintaining a safe care environment for patients and staff.

Every healthcare worker needs to be clear about their specific responsibilities for cleaning equipment and clinical areas (especially those areas in close proximity to patients). They must be educated about the importance of ensuring that the hospital environment is clean and that opportunities for microbial contamination are minimised.

Hand hygiene

Hands must be decontaminated immediately before each and every episode of direct patient contact or care and after any activity or contact that potentially results in hands becoming contaminated.

Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material, eg after removal of gloves, must be washed with liquid soap and water.

Hands should be decontaminated between caring for different patients and between different care activities for the same patient. For convenience and efficacy, an alcohol handrub is preferable unless hands are visibly soiled. Local infection guidelines may advise an alternative product in some outbreak situations.

Hands should be washed with soap and water after several consecutive applications of alcohol handrub.

Before a shift of clinical work begins, all wrist and, ideally, hand jewellery should be removed. Cuts and abrasions must be covered with waterproof dressings. Fingernails should be kept short, clean and free of nail polish. False nails and nail extensions must not be worn by clinical staff.

An effective hand washing technique involves three stages: preparation, washing and rinsing, and drying. Preparation requires wetting hands under tepid running water **before** applying the recommended amount of liquid soap or an antimicrobial preparation. The hand wash solution must come into contact with all the surfaces of the hand. The hands must be rubbed together vigorously for a minimum of 10–15 seconds, and particular attention should be paid to the tips of the fingers, the thumbs and the areas between the fingers. Hands should be rinsed thoroughly prior to drying with good-quality paper towels.

When an alcohol handrub is used to decontaminate hands, hands should be free of dirt and organic material. The handrub solution must come into contact with all surfaces of the hand. The hands must be rubbed together vigorously, with particular attention paid to the tips of the fingers, the thumbs and the areas between the fingers, until the solution has evaporated and the hands are dry.

Clinical staff should be aware of the potentially damaging effects of hand decontamination products. They should be encouraged to use an emollient hand cream regularly, eg after washing hands before a break, or when going off duty and when off duty, to maintain the integrity of the skin.

If a particular soap, antimicrobial hand wash or alcohol-based product causes skin irritation, review the methods described above before consulting the occupational health team.

Alcohol handrub should be made available at the point of care in all healthcare facilities.

Hand hygiene resources and individual practice should be audited at regular intervals and the results fed back to healthcare workers.

Education and training in risk assessment, effective hand hygiene and glove use should form part of all healthcare workers' annual updating.

The use of personal protective equipment

The selection of PPE must be based on an assessment of the risk of transmission of micro-organisms to the patient or to the carer, and the risk of contamination of the healthcare practitioner's clothing and skin by patients' blood, body fluids, secretions or excretions.

Everyone involved in providing care should be educated about standard principles and trained in the use of PPE.

Adequate supplies of disposable plastic aprons, single-use gloves and face protection should be made available wherever care is delivered. Gowns should be made available when this is advised by the infection control team.

Gloves must be worn:

- for invasive procedures
- when there is any contact with sterile sites, non-intact skin or mucous membranes
- for all activities that have been assessed as carrying a risk of exposure to blood, body fluids, secretions and excretions
- when handling sharp or contaminated instruments.

Gloves must be worn as single-use items. They are put on immediately before an episode of patient contact or treatment and removed as soon as the activity is completed. Gloves are changed between caring for different patients and between different care or treatment activities for the same patient.

Gloves must be disposed of as clinical waste and hands decontaminated, by washing after the gloves have been removed with, ideally, liquid soap and water.

Gloves that are acceptable to healthcare personnel and CE marked must be available in all clinical areas.

Sensitivity to natural rubber latex among patients, carers and healthcare personnel must be documented, and alternatives to natural rubber latex must be available.

Neither powdered nor polythene gloves should be used in healthcare activities.

Disposable plastic aprons should be worn when close contact with the patient, materials or equipment is anticipated and when there is a risk that clothing may become contaminated with pathogenic organisms or blood, body fluids, secretions or excretions, with the exception of perspiration.

Full-body fluid-repellent gowns must be worn where there is a risk of extensive splashing of blood, body fluids, secretions or excretions, with the exception of perspiration, onto the skin or clothing of healthcare personnel (eg when assisting with childbirth).

Plastic aprons and gowns should be worn as single-use items, for one procedure or episode of patient care, and then discarded and disposed of as clinical waste. Non-disposable protective clothing should be sent for laundering.

Face masks and eye protection must be worn where there is a risk of blood, body fluids, secretions or excretions splashing into the face and eyes.

Respiratory protective equipment, ie a particulate filter mask, must be correctly fitted and used when recommended for the care of patients with respiratory infections transmitted by airborne [sic] particles.

The safe use and disposal of sharps

Sharps must not be passed directly from hand to hand, and handling should be kept to a minimum.

Needles must not be recapped, bent, broken or disassembled after use.

Used sharps must be discarded into a sharps container (conforming to UN3291 and BS 7320 standards) at the point of use by the user. These must not be filled above the mark that indicates the bin is full.

All sharps bins should be positioned out of the reach of children at a height that enables safe disposal by all members of staff. They should be secured to avoid spillage.

All staff, both clinical and non-clinical, must be educated about the safe use and disposal of sharps.

Consider the use of needlestick-prevention devices where there are clear indications that they will provide safe systems of working for healthcare practitioners.

Conduct a rigorous evaluation of needlestick-prevention devices to determine their effectiveness, acceptability to practitioners, impact on patient care and cost benefit prior to widespread introduction.

* Adapted from Pratt RJ, Pellowe C, Wilson JA *et al.* Epic2: National evidence-based guidelines for preventing healthcare associated infections in NHS hospitals in England. *J Hosp Infect* 2007;65(1):S1–64.

Droplet precautions

In addition to the standard precautions, use droplet precautions if a patient is known or suspected to be infected with micro-organisms that can be transmitted by droplets generated by the patient during coughing, sneezing, talking or in the performance of some procedures.

Patient placement

Place the patient in a single room (an isolation room or side room or cubicle). When a single room is not available, place the patient in a room with patients who have active infection with the same micro-organism but with no other infection (cohorting). When a single room is not available and cohorting is not achievable, maintain spatial separation of at least one metre between the infected patient and other patients and visitors. Special air handling and ventilation are not necessary, and the door may remain open.

Surgical masks

In addition to wearing a surgical mask as outlined under the standard precautions (ie standard infection control principles), a surgical mask should be worn for close contact (within one metre) of a symptomatic patient. (Logistically, some hospitals may want to implement the wearing of a surgical mask to enter the room.)

Patient transport

Limit the movement and transport of the patient from the room or cohorted area to essential purposes only. If transport or movement is necessary, minimise the patient's dispersal of droplets by masking the patient, if the patient tolerates this, and encourage good respiratory hygiene.

Adapted from: Garner JS and The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Am J Infect Control* 1996;24:24–52.

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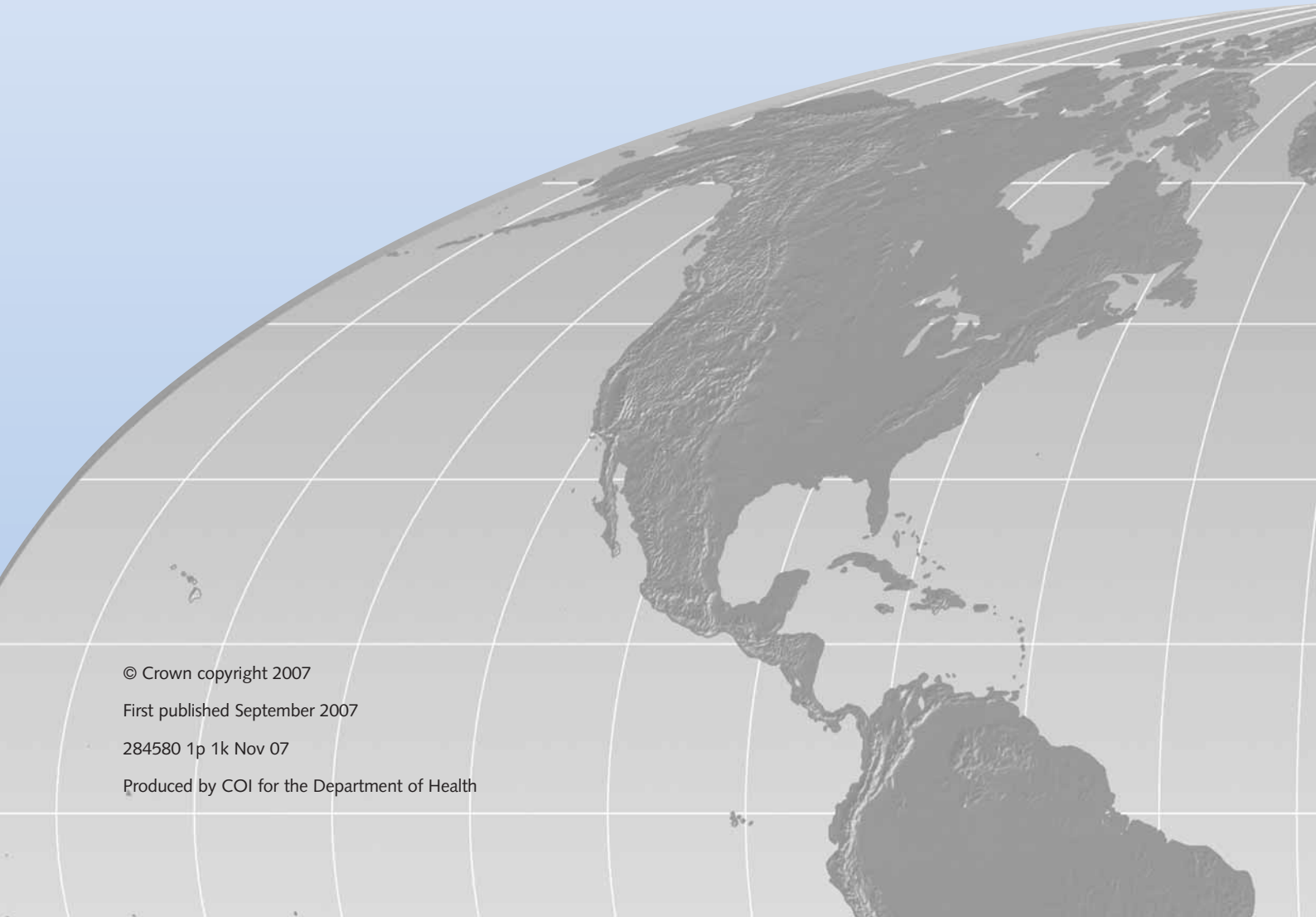
List of abbreviations

A&E	accident and emergency
AGP	aerosol generating procedure
AHP	allied health professionals
BS	British Standard
CCDC	consultant in communicable disease control
COSHH	control of substances hazardous to health
DIPC	director of infection prevention and control
ECG	electrocardiograph
FFP	filtering face piece
GP	general practitioner
HPA	Health Protection Agency
HPU	health protection unit
HSE	Health and Safety Executive
HSG	Health service guidelines
MRSA	meticillin resistant *Staphylococcus aureus*
NIV	non-invasive ventilation
PCT	primary care trust
PPE	personal protective equipment
SARS	severe acute respiratory syndrome
TB	tuberculosis
WHO	World Health Organization

NHS



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