Health Protection Scotland

The Scottish Government

PANDEMIC FLU

Guidance for infection control in hospitals and primary care settings

For Guidance specific to Influenza A H1N1v please refer the HPS guidance on the Influenza A H1N1v page at http://www.hps.scot.nhs.uk/resp/swineinfluenza.aspx.

October 2009

Published by The Scottish Government & Health Protection Scotland, 2008

TABLE OF CONTENTS

EXECUTIVE SUMMARY **4**

1. OVERVIEW OF THE GUIDANCE DOCUMENT **5**

1.1 SCOPE AND PURPOSE 5
1.2 CHANGES AND AMENDMENTS IN THIS EDITION 6
1.3 TERMINOLOGY 6
1.4 ORGANISATION OF THE GUIDANCE DOCUMENT 7

2. OVERVIEW OF PANDEMIC INFLUENZA AND INFECTION CONTROL **8**

2.1 EMERGENCE OF A PANDEMIC 9
2.2 INFLUENZA: CLINICAL FEATURES AND TRANSMISSION 10
2.3 CORE PRINCIPLES OF CONTAINMENT AND INFECTION CONTROL 10

3. PREPAREDNESS PLANNING FOR PANDEMIC INFECTION CONTROL **13**

4. OCCUPATIONAL HEALTH AND STAFF DEPLOYMENT **15**

4.1 WHO SHOULD WORK? 15
4.2 STAFF DEPLOYMENT 16
4.3 BANK AND AGENCY STAFF 16
4.4 WORKERS AT RISK FOR COMPLICATIONS FROM PANDEMIC INFLUENZA 17

5. INFECTION CONTROL PRECAUTIONS **18**

5.1 STANDARD INFECTION CONTROL PRECAUTIONS 18
5.2 APPLYING DROPLET PRECAUTIONS FOR PANDEMIC INFLUENZA 19
5.3 MANAGEMENT OF A COUGHING AND SNEEZING PATIENT 20
5.4 PERSONAL PROTECTIVE EQUIPMENT (PPE) 21
5.5 AEROSOL-GENERATING PROCEDURES 27

6. ENVIRONMENTAL INFECTION CONTROL **29**

6.1 CLINICAL AND NON-CLINICAL WASTE 29
6.2 STAFF UNIFORMS 30
6.3 CROCKERY AND UTENSILS 30
6.4 ENVIRONMENTAL CLEANING AND DISINFECTION 31
6.5 PATIENT CARE EQUIPMENT 31
6.6 FURNISHINGS 32

7. SUPPLEMENTARY GUIDANCE FOR HOSPITALS **33**

7.1 PREPAREDNESS CHECKLIST FOR PANDEMIC INFECTION CONTROL 33
7.2 PATIENT PLACEMENT, SEGREGATION AND COHORTING 36
7.3 PATIENT TRANSFER/TRANSPORT AND HOSPITAL DAY CARE PROCEDURES 38
7.4 SPECIAL SETTINGS: ACCIDENT AND EMERGENCY 40
7.5 SPECIAL SETTINGS: CHILDREN'S UNITS 41
7.6 SPECIAL SETTINGS: CRITICAL CARE UNITS 42
7.7 THE DYING/DECEASED PATIENT 45
7.8 VISITORS 46

8. SUPPLEMENTARY GUIDANCE FOR PRIMARY CARE SETTINGS **47**

8.1 PREPAREDNESS CHECKLIST FOR PANDEMIC INFECTION CONTROL 47
8.2 PATIENT PLACEMENT, SEGREGATION AND COHORTING 51
8.3 PATIENT TRANSFER/TRANSPORT AND HOSPITAL DAY CARE PROCEDURES 52
8.4 SPECIAL SETTINGS: AMBULANCE SERVICE 52
8.5 SPECIAL SETTINGS: GENERAL PRACTICES 53
8.6 SPECIAL SETTINGS: SINGLE-HANDED GPS 56

8.7 SPECIAL SETTINGS: DISTRICT NURSING TEAMS 56
8.8 SPECIAL SETTINGS: HEALTH VISITORS 56
8.9 SPECIAL SETTINGS: ALLIED HEALTH PROFESSIONALS (AHPS) 57
8.10 SPECIAL SETTINGS: DENTAL PRACTICES 57
8.11 THE DYING/DECEASED PATIENT 58
8.12 VISITORS 58

9. APPENDICES 59

9.1 THE EPIDEMIOLOGY OF PANDEMIC INFLUENZA 59
9.2 INFECTION CONTROL PRECAUTIONS 67
9.3 REFERENCES 72
9.4 SELECTED ADDITIONAL BIBLIOGRAPHY AND WEB LINKS 78
9.5 ACKNOWLEDGEMENTS 80
9.6 ACRONYMS 81

EXECUTIVE SUMMARY

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

This guidance document has been developed to facilitate planning by NHS Boards and provides infection control guidance and tools for local public health and healthcare officials who are the front line for 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 on hospital and primary care specific-issues separately. Planning now is essential and will ease the decision making process at the time of the pandemic.

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 at: www.scotland.gov.uk/pandemicflu

For planning purposes it is assumed that a pandemic strain of influenza will have similar transmission, communicability, and inactivation properties as "routine" seasonal influenza. Influenza is well established to be 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 transmission. In view of this, **standard infection control precautions and droplet precautions** are the principal infection control strategies to be rigorously followed. Aerosol transmission may also occur. In certain circumstances the standard and droplet control measures may need to be augmented with 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 or cohorting of patients** with pandemic influenza from other patients; prompt identification and exclusion of ill staff and **restriction of ill visitors** from healthcare settings; **wearing appropriate personal protective equipment (PPE)** and **education of staff, visitors, and patients** about the transmission and prevention of influenza that is understandable and applicable to their particular situation.

During a pandemic, there may be limited supplies of antiviral drugs and an effective strain-specific vaccine is unlikely to 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 approach to infection control are necessary. Readers are strongly urged to refer to the most up-to-date version of this guidance on the Scottish Government website at: www.scotland.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 health planning for pandemic influenza. It is issued jointly by the Scottish Government and Health Protection Scotland (HPS) 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, England and Wales.

This document is intended for use in the event that the World Health Organisation (WHO) declares that an influenza pandemic has started [2] and the Department of Health has declared "UK Pandemic Alert Level 2"[3] (i.e. cases of pandemic influenza identified within the UK).[a]

This guidance should be read in conjunction with the *Scottish Framework for Responding to an Influenza Pandemic* and associated supplementary guidance [4]. There are a number of other relevant documents which should also be consulted: *Pandemic Flu*: *Clinical management of patients with an influenza-like Illness during an influenza pandemic* [5], and various pieces of Health and Safety Executive (HSE) legislation and guidance, including the *Control of Substances Hazardous to Health (COSHH) Regulations 2002* (as amended) [6], *Biological agents: Managing the risk in laboratories and healthcare premises* [7], and *Respiratory protective equipment at work* [8]

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 the causative virus remains unknown. It is based on the best evidence available from previous pandemic and interpandemic 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 on the Scottish Government website at: www.scotland.gov.uk/pandemicflu

a Prior to WHO's declaration that a pandemic has started, hospitals and practitioners should be alert for cases of influenza caused by a novel virus which has not yet fully adapted to humans to become a pandemic virus. The number of such cases is expected to be small and 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 these cases and practitioners should follow current guidance as issued by the HPS at: www.hps.scot.nhs.uk

1.2 Changes and amendments in this edition

This guidance should be used in replacement of the guidance issued in October 2005.

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 to avoid infecting patients, colleagues and others.

Aerosol-generating procedures and personal protective equipment (PPE) (Section 5.5)

- Procedures with the potential to generate aerosols are detailed.
- Guidance is given with respect to putting on and removing PPE.

Patient placement, segregation and cohorting (section 7.2)

- Practical issues identified during pandemic influenza simulations are included for consideration.

Critical care units (Section 7.6)

- Advice regarding 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: In the previous version of this document the terms 'large droplet' and 'fine droplet' were employed; for the purposes of this document 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 5 to >10μm 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 the environment. However because of their relatively large size, generally droplets travel only short distances (typically less than one metre) before falling to the ground.

Aerosol: In the previous version of this document, the terms 'fine droplet' and 'aerosol' were used 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 can remain

suspended in the air, due to their small size, 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, either 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 the allied health professionals (AHPs).

Influenza: Refers to cases of pandemic influenza either confirmed by laboratory test(s) or based on clinical signs and symptoms. A laboratory-confirmed diagnosis of influenza is most 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 patients 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 applicable 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 (section 7) and primary care (sections 8) settings including key infection control issues for specialised settings within these domains
- Appendices (section 9) providing the evidence-base underpinning this guidance and bibliography and tools to aid local-level preparedness.

Using this guidance NHS Boards and other health services can develop operational pandemic influenza response plans that utilise consistent infection control precautions and practices.

2. OVERVIEW OF PANDEMIC INFLUENZA AND INFECTION CONTROL[b]

KEY POINTS

Health impacts of a pandemic

- UK planning assumptions are based on attack rates of 25%, 35% and 50%. Planners are asked to plan across the range including the upper end of the scale
- Between 5,100 and 63,700 additional deaths are possible
- Substantial demand for healthcare services in both primary care and hospital settings is likely

Clinical features of influenza

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

How influenza is spread

- Transmitted from person-to-person through close contact. Balance of evidence points to droplet and direct and indirect contact transmission as the most important routes
- Aerosol transmission may occur in certain situations, for example during aerosol-generating procedures

Prevention of influenza transmission

- Strict adherence to infection control practices especially hand hygiene, containment of respiratory secretions and the use of personal protective equipment (PPE)
- Adherence to standard infection control precautions and droplet precautions
- Administrative controls such as separation or cohorting of patients with

[b] Consult Appendices 9.1and 9.2 for more detailed information.

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 between 25% and 50%) and almost all the population will potentially be at risk.

The ubiquitous nature of a pandemic virus means that staff are equally as likely to encounter pandemic influenza in settings associated with normal daily living, for example, 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 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.

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 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 which may saturate or overwhelm normal 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 possible chills, headache, sore throat and aching muscles and joints as other symptoms. 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 though they can continue to excrete viruses for up to five days although longer periods have been found.[9] The period of communicability is longer in children; typically seven days. It is sometimes stated that people are infectious shortly before symptoms develop, however the evidence for this is limited. Spread from person to person before they develop symptoms has rarely been recorded though experimental studies have shown 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.

Influenza is well established to be 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. [10] Aerosol transmission may also occur in certain situations. [11] There is no evidence which establishes a clear hierarchy for modes of transmission. However, the patterns of transmission observed during nosocomial outbreaks frequently point to droplet and contact transmission as the most important and the most likely routes.

Experimental studies of influenza virus survival suggest that the virus can survive for limited periods of time in the environment, depending on the surface contaminated. [12] It can be transferred from contaminated surfaces onto hands, and is easily inactivated by commercially available alcohol handrub. [13] When the transferability of influenza A virus from contaminated surfaces onto hands was evaluated, 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 in very low quantities after 15 minutes. Therefore careful and frequent hand hygiene and environmental cleaning are important to help control contact spread.

(*See appendix 9.1 for detailed review of transmission*)

2.3 Core principles of containment and infection control

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

2.3.1 Summary of pandemic infection control assumptions

The principles of infection control for pandemic influenza are based on the assumption that pandemic influenza has similar properties to seasonal influenza:

- 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.
- For some pathogens, aerosols generated under specific circumstances may be associated with an increased risk of pathogen transmission [14,15] 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 [9]) and children 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 or without showing their 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 for up to 24 hours on environmental surfaces, especially on hard non-porous materials such as stainless steel.[12]
- Influenza viruses are easily deactivated by washing with soap and water, alcohol based handrub, and cleaning with normal household detergents and cleaners.

2.3.2 Core principles of containment and infection control

During a pandemic, healthcare workers can be exposed to those with influenza both through their normal daily lives (outside of work) and in

healthcare settings. Limiting 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
- segregation of staff into those who are dealing with influenza patients and those who are not
- consistent and correct implementation of appropriate infection control precautions to limit transmission (standard infection control precautions and droplet precautions)
- the use of personal protective equipment (PPE) according to risk of exposure to the virus
- maintaining separation in space and/or time between influenza and non-influenza patients
- restricting ill visitors to the facility and posting of pertinent signage in clear and unambiguous language (including languages other than English)
- environmental cleaning and disinfection
- education of staff, patients, and visitors about the transmission and prevention of influenza
- treatment of patients and staff with antiviral drugs which can reduce infectiousness and the duration of illness
- vaccination of patients and staff.

Scotland has a stockpile of antiviral drugs sufficient for the treatment of all symptomatic patients up to clinical attack rates of 25% and intends to increase this stockpile to 60% population coverage. This will mean that, even at an attack rate of 50%, treatment will be available to everyone who requires it.

During the first wave of a pandemic, a strain-specific pandemic vaccine is unlikely to be available. Therefore, attention to non-pharmaceutical methods of control as outlined in this document will be particularly important in reducing exposure.

3. PREPAREDNESS PLANNING FOR PANDEMIC INFECTION CONTROL

KEY POINTS

- An influenza pandemic will not be 'business as usual' for health services
- The way in which health services function will have to be altered to accommodate exceptional infection control arrangements
- Staff will be required to work flexibly to meet high demand
- Planning in advance and stockpiling of personal protective equipment (PPE) will be necessary
- Local risk assessment will be required to determine available control measures.

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

Health services 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.

NHS Boards 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 others
- General practice surgeries are not usually designed or configured to permit patient segregation 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 interpandemic period is essential and will ease the decision making

process during a pandemic. The following are examples of issues that should be addressed immediately:

IMMEDIATE ACTION POINTS

- Provide general training for all staff on the infection control implications of pandemic influenza
- Plan for and perform training and fit-testing for staff likely to use FFP3 respirators
- Test local response capabilities; a tabletop exercise is strongly recommended
- Estimate and address anticipated increase in demand for supplies

Most NHS Boards 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 a pandemic will be a "rising tide" (gradual escalation) scenario in which pressure builds more slowly but 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,[6] all employers, including NHS Boards, are required to undertake local risk assessments to inform decisions on choice of control measures. This guidance can be viewed as a generic assessment designed to ensure that infection control measures across health services are implemented in a consistent manner. It reflects published evidence on influenza transmission and control, and the exceptional circumstances of a pandemic, where there may be:

- potential for a large number of patients
- greater number of healthcare workers potentially exposed to the pandemic virus; and where the
- availability of control measures may vary.

The local COSHH risk assessment should identify any local circumstances which should also be taken into account.

To assist in this effort, checklists for infection control related issues are included in the hospital and primary/community care sections of this document.

4. OCCUPATIONAL HEALTH AND STAFF DEPLOYMENT

KEY POINTS

- Prompt recognition of healthcare workers with influenza 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 pandemic influenza patient areas should not care for other patients; exceptions may be necessary
- Healthcare workers at high-risk for complications from influenza should not provide direct patient care
- Bank and agency staff should follow the same deployment advice as permanent staff
- Occupational health should lead on the implementation of systems to monitor for illness and absence
- It is proposed that occupational health will deliver the H5N1 vaccine to the healthcare workforce when required.
- As part of their employer's duty of care, occupational health have a role to play in ensuring that fit-testing programmes for those who may need to wear FFP3 respirators are in place.

4.1 Who should work?

Healthcare workers will be at risk of acquiring influenza through both community and healthcare-related exposures 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, if a member of staff develops such symptoms whilst on duty he/she 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 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/absence is recorded and this information is sent to the local occupational health department/provider if relevant.

4.2 Staff deployment

Healthcare workers assigned to care for patients with influenza or who work in areas of a facility 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, occupations with a limited number of staff; e.g. medical staff and allied health professionals (AHPs), although segregation of staff should be maintained as much as practically possible

- situations when the care and management of the patient would be compromised

- staff who have fully recovered from pandemic influenza.

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

In hospitals, a healthcare worker from a non-influenza area can be redeployed to an area segregated for the care of influenza patients. However, once deployed a worker cannot return to their original non-influenza area for the duration of the pandemic, subject to the exceptions listed in the first paragraph.

Healthcare workers who have recovered from influenza, or have received a full course of vaccination against the pandemic strain (the latter is unlikely to happen in the first phase of a pandemic) 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 can 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 (e.g., 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

Bank and agency staff are traditionally employed to complement staffing levels on a day-to-day basis. 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 for complications from pandemic influenza

Healthcare workers who are at high risk for complications of influenza (for example pregnant women, immunocompromised workers) should be considered for alternate work assignments, away from direct patient care for the duration of the pandemic or until vaccinated if it is clinically appropriate for them to receive vaccination. At the very least they should not provide care to patients known to have influenza nor enter parts of the facility segregated for the treatment of patients with influenza.

5. INFECTION CONTROL PRECAUTIONS

KEY POINTS

- Standard infection control precautions and droplet precautions must be used for patients with or suspected of having influenza (appendix 9.3).
- Good staff and patient hand hygiene is vital for the protection of both parties.
- Good respiratory hygiene is essential.
- The use of PPE should be proportional to the risk of contact with respiratory secretions and other body fluids, and should depend on the type of work/procedure being undertaken.

5.1 Standard infection control precautions

Standard infection control precautions and droplet precautions must be used for patients with, or suspected of having, influenza. Standard infection control precautions are a set of broad statements of good practice to minimise exposure to and transmission of a wide variety of micro-organisms which should be applied by **all** healthcare practitioners to the care of **all** patients **all** of the time. Standard infection control precautions including hospital environmental hygiene, hand hygiene, use of PPE and safe use and disposal of sharps are published [16] in full and the recommendations detailed in appendix 9.2. Hand hygiene and PPE are also discussed in sections 5.1.1 and 5.4 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 precautions. During outbreaks of pandemic influenza, strict adherence to hand hygiene recommendations should be enforced.

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

Hand hygiene includes hand-washing with soap and water and thorough drying, or the use of alcohol-based products containing an emollient that do not require the use of water. If hands are visibly soiled or contaminated (for example, contaminated with respiratory secretions), they should be washed with soap and water and dried. When decontaminating hands using an alcohol handrub, hands should be free of visible dirt and organic material. The handrub must come into contact with all surfaces of the hand.

Hands must be decontaminated immediately before each and every episode of direct patient contact/care 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 or between different care activities for the same patient, even if gloves have been worn. Following hand washing, hands should be dried thoroughly using paper towels that are then 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 (for example patient's beds/examination rooms and lockers), consideration should also be given to distributing personally carried alcohol handrub to certain groups of transient/migratory staff (for example, medical staff in hospitals and community staff performing 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 for pandemic influenza

In addition to standard infection control precautions, droplet precautions should be used for a patient known or suspected to be infected with influenza which is transmitted by droplets that can be generated by the patient during coughing, sneezing or talking and during some procedures.

5.2.1 Patient placement

- Ideally patients with influenza should be placed in single rooms; however 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 laboratory confirmed diagnosis, beds should be at least one metre apart; (this is well within the minimum bed space specifications stipulated in Scottish guidance [17]).

- Special ventilation is not necessary, and the doors with segregated areas can remain open (unless a patient is being isolated for another reason in addition to influenza which 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 as outlined under standard infection control precautions, (see appendix 9.2), surgical masks must be worn when working in close contact (within one metre) with a symptomatic patient. In a cohorted area, for practical reasons, this is likely to mean wearing a surgical mask at all times within that cohorted area.

5.2.3 Patient transport

- 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 patient dispersal of droplets by masking the patient, 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 then good respiratory hygiene should be encouraged.

*These guidelines are adapted from:

Garner, J.S. and The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. Am J Infect Control 1996;24:24-52. See Appendix 9.2

5.2.4 Duration of isolation precautions

Infection control precautions should be implemented on admission and be continued for the duration of the illness. [14]

5.3 Management of a coughing and sneezing patient

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

- Cover nose and mouth with disposable single-use tissues when sneezing, coughing, wiping and blowing noses.

- Dispose of used tissues promptly in 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 (for example, 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 (for example, from the community to an acute hospital or from one area of the hospital to another), coughing/sneezing patients should wear surgical masks to assist in the containment of respiratory secretions and to reduce environmental contamination.

5.4 Personal protective equipment (PPE)

5.4.1 Overview

PPE is worn to protect staff from contamination with body fluids so as to reduce the risk of transmission of influenza between patients and staff and from one patient to another. Appropriate PPE is summarised in Table 1. Standard infection control precautions apply at all times.

Care must be taken to ensure that PPE is worn and removed correctly, to avoid inadvertent contamination - see 5.4.8 for guidance on putting on and removing PPE. All contaminated clothing must be removed, surgical masks or respirators being removed last, and disposed of appropriately before leaving a patient care area i.e. treated as clinical waste (*special waste* [18])

Surgical masks should be fluid repellent and PPE should comply with relevant BS EN standards (European technical standards as adopted in the UK) where these apply. In November 2007, the Scottish Government announced its intention to stockpile surgical masks and respirators for health and community care workers.

Table 1. Personal protective equipment for care of patients with pandemic influenza

	ENTRY TO COHORTED AREA BUT NO PATIENT CONTACT	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]	✓	×
FFP 3 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 5.5).

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 precautions. If glove supplies become limited or pressurised, 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 in place of apron if extensive soiling of clothing or contact of skin with blood and other body fluids is anticipated (for example, during intubation or 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 pressurised, then in cohorted areas use should be limited to close contact with a symptomatic patient (within one metre).

5.4.2 Gloves

Gloves are not required for the routine care of patients with pandemic influenza *per se.* Standard infection control precautions require that gloves be worn for invasive procedures, contact with sterile sites, non-intact skin, and mucous membranes, during all activities that carry a risk of exposure to blood, body fluids, secretions (including respiratory secretions) and excretions, and when handling sharp or contaminated instruments.

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

Gloves must be changed between patients and between different tasks with 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.**

5.4.3 Aprons

Disposable plastic aprons should be worn whenever there is a risk of personal clothes or uniform coming into contact with a patient's blood, body fluids, secretions (including respiratory secretions) and excretions or during activities that involve close contact with the patient (for example, 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 as clinical waste. In cohorted areas, aprons must be changed between patients.

5.4.4 Gowns

Gowns are not required for the routine care of patients with influenza. However gowns should be worn if extensive soiling of personal clothing or uniform with respiratory secretions is anticipated, or there is risk of extensive splashing of blood, body fluids, secretions, and excretions onto the skin of the healthcare worker. 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, and hand hygiene performed immediately after removal.

5.4.5 Eye protection

Eye protection should be considered when there is a risk of contamination of the eyes by splashes and droplets for example by blood, body fluids, secretions and excretions. There should be an individual risk assessment carried out at the time of providing care to identify those at risk and decide on reasonable precautions to reduce the risk. For influenza, the hazard is potential inoculation of the conjunctiva of the healthcare worker by splashes from procedures or the coughs and sneezes of an influenza patient. Reasonable precautions might include keeping personnel to a minimum i.e. those essential to carry out the care, and a requirement for eye protection for those in close contact with the patient. **Eye protection should always be worn during aerosol-generating procedures.** This requirement would extend to all those present in the room during a procedure with the potential to produce an aerosol (see section 5.5).

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

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

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

5.4.6 Fluid-repellent surgical masks

Surgical masks should be fluid-repellent and should be worn by healthcare workers for close patient contact (i.e. within one metre). This 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 usage
- not be touched once put on
- be changed when they become moist
- be worn once only and 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 multiple patients must be visited over a short time or in rapid sequence (for example, cohorted areas of a hospital or nursing home, an “influenza clinic” or GP surgery session for influenza patients), it may be more practical 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 risk area. **However, other PPE (for example gloves and apron) must be changed between patients and hand hygiene performed.**

Depending on the geography of the ward, it is likely that some locations within parts of the facility segregated for influenza patients will not be designated part of a cohorted area, as there is no close patient contact in these areas. Therefore surgical masks will not be required in these areas. Examples of such areas 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 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, followed by thorough hand hygiene.

5.4.7 Respirators

A disposable respirator providing the highest possible protection factor available (i.e. an EN149:2001 FFP3 disposable respirator; referred to as FFP3 respirator in the rest of this document) should be worn by healthcare workers when performing procedures that have the potential to generate aerosols (see next section). If an FFP3 disposable respirator is not immediately available, the next highest category of respirator available should be worn (for example 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 only be achieved 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 have a role to play in ensuring that fit-testing programmes for those who may need to wear FFP3 respirators are in place. These should be organised well in advance as part of the initial pandemic influenza planning. Fit-testing or training others to fit-test may sometimes be offered by the suppliers of respirators. The task of fit-testing should not be underestimated as not all makes of respirators 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 not weeks for an average sized hospital.

Other types of respiratory protective equipment (for example, powered hoods/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 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 necessary, for example with regard to batteries and filters. Re-usable respirators must be decontaminated in accordance with manufacturer's recommendations between uses and stored correctly.

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

5.4.8 Putting on and removing personal protective equipment

The level of PPE used will vary based on the procedures being carried out and not all items of PPE will always be required. Standard infection control precautions apply at all times. PPE should be put on before entering the 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:

a) Gown (or apron *[illustrated]* if not aerosol-generating procedure)

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

b) FFP3 respirator (or surgical mask if not aerosol generating procedure)

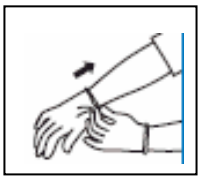
- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

c) Goggles or face shield (aerosol-generating procedure and as appropriate after risk assessment)

- Place over face and eyes and adjust to fit

d) Disposable gloves

- Extend to cover wrist of gown if worn.

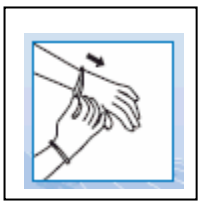


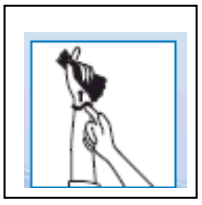
PPE should be removed in an order that minimises the potential for cross contamination and should be done upon leaving the room or cohorted area (see section 7.2.3). If a single room has been used for an aerosol-generating procedure, before leaving the room, gloves, gown and eye goggles should be removed (in that order) and disposed of as clinical waste. After leaving the room the respirator (or surgical mask) can be removed and disposed of as clinical waste. Hand hygiene should be performed after removing all PPE. The order for removing PPE is important to reduce cross contamination so the order outlined below always applies even if not all items of PPE have been used:

a) Gloves

Assume 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 fingers of the ungloved hand under the remaining glove at wrist
- Peel second glove off over first glove
- Discard appropriately





b) Gown or apron

Assume the gown/apron front and sleeves are contaminated:

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

c) Goggles or face shield

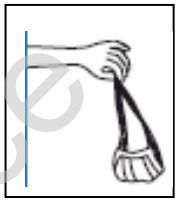
Assume the outside of goggles or face shield is contaminated:

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

d) Respirator or surgical mask

Assume the front of respirator/surgical mask is contaminated:

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



Perform hand hygiene immediately after removing all PPE.

5.5 Aerosol-generating procedures

5.5.1 Background

Several medical and dental procedures have been reported to generate aerosols and some have been suggested to be associated with increased risk of pathogen transmission [14,15]. However the risk associated with many of the aerosol- generating procedures is not yet well defined, and the understanding of AGP aerobiology may change with further studies in this area. 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 are considered to be aerosol-generating procedures associated with a documented increase in risk of pathogen transmission in acute respiratory disease patients: [15]

- intubation and related procedures, for example manual ventilation and suctioning
- cardiopulmonary resuscitation
- bronchoscopy
- surgery and post-mortem (where high-speed devices are used)

The authors of the WHO document comment that there are other procedures which *may* be associated with an increased risk of pathogen transmission, but that some of the studies have methodological flaws that preclude the use of their conclusions to draw 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.

5.5.2 Infection control and PPE recommendations for aerosol-generating procedures

The performance of all aerosol-generating procedures should be minimised as far as is feasible without compromising patient care. Aerosol-generating procedures should be carried out in single well-ventilated rooms with the doors shut, and to avoid unnecessary exposures, only those healthcare workers 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, for example manual ventilation and suctioning
- cardiopulmonary resuscitation
- bronchoscopy

WHO's inclusion of surgery with high speed devices as an AGP is extrapolated from a report of TB transmission after use of a high speed saw during post mortem of a patient with lung and bone marrow TB [18]. Individual risk assessments should be used for selecting appropriate respiratory protection for surgery (where high speed devices are used).

HSE advice should be followed for post-mortems, which stipulates the use of a powered respirator where high speed devices are used (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 to better assess the risk associated with different procedures are available.

6. ENVIRONMENTAL INFECTION CONTROL

6.1 Clinical and non-clinical waste

Health Facilities Scotland has produced interim guidance on the reclassification of healthcare waste in Scotland "*NHSScotland - EWC coding guide for healthcare wastes - Interim SHTN 3 guidance*". [18]

No special handling procedures beyond those required to conform with standard infection control precautions are recommended for clinical waste (also known as *special 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/sputum (for example 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 into the sewerage system.

All waste collection bags should be tied and sealed before removal from the patient area. Gloves should be worn when handling ALL waste and hand hygiene performed after removal of gloves.

6.1.1 Linen and laundry

Linen used during the patient's care 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 HPS model infection control policy on the safe management of linen [21]. Both "used" and "infected" linen must be handled, transported and processed in a manner that prevents skin and mucous membrane exposures to 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, this should be treated as potentially infected and managed as per local policies.

- Linen bags must be closed before removal from the influenza patient care area.

- Gloves and aprons should be worn for handling all contaminated linen.

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

Primary care: Paper sheeting is a good alternative to linen for use on patient examination couches and should be changed after each patient.

Laundry workers: Guidance on laundry worker protection is described in *Safe Management of Linen Policy and Procedures*. [21] Laundry staff should be fully trained in appropriate infection control measures, including hand hygiene and the correct use of protective clothing.

6.2 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/areas where staff can change into uniforms upon arrival at work.
- Ideally, hospital/facility laundry services should be used to launder uniforms if they are available.
- If there are no laundry facilities available then uniforms should be laundered in a domestic washing machine washed 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, washed separately from other linen in a load not more than half the machine capacity, in order to ensure adequate rinsing and dilution.
- Health Boards 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, for example medical staff.

The Department of Health has issued an evidence base for uniforms and workwear which can be found at:

www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_078433

6.3 Crockery and utensils

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

6.4 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, patient cohorted areas should be cleaned daily.

- Clinical rooms should be cleaned at least daily and between clinical sessions for patients with influenza and clinical sessions 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 correct methods of wearing PPE and precautions to take when cleaning cohorted areas; domestic staff should wear gloves and aprons; in addition a surgical mask should be worn when cleaning in the immediate patient environment in cohorted areas.

- 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.

6.5 Patient care equipment

Effective cleaning of patient care equipment is an essential prerequisite to both disinfection and sterilisation. Standard practices for handling and reprocessing used and soiled patient-care equipment, including re-usable medical devices, should be followed for 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 removing from the patient's room or consulting room

- Reusable equipment (for example, 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 x-rays and other procedures in the patient's room should be cleaned with neutral detergent and warm water upon removal from the patient's room or consulting room.

- Whenever possible, non-critical patient equipment should be dedicated for use by influenza patients only.

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

6.6 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/lounges and A&E. 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 chapter 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

NHS Boards need to consider a number of key issues related to hospital infection control during a pandemic and find the best way of integrating/embedding these into their organisational processes:

7.1.1 Overall coordination

1. Identify a lead member of hospital staff (for example, Infection Control Manager [ICM]) who will take responsibility for coordinating infection control during a pandemic

2. Ensure that board members and senior managers are fully informed of the critical infection control issues in relation to pandemic influenza

3. Identify if there are existing forums within the NHS Boards that can address the issues and actions required towards preparation for a pandemic (including performing local risk assessments). If not, form a local hospital pandemic action group/sub-groups consisting of membership from the following:

   - Executive board member/ICM
   - Community Health Partnership Manager
   - Nursing executive
   - Medical staff
   - Senior representative from each clinical division
   - Occupational health dept
   - Infection control team
   - Health and safety team
   - Bed manager
   - Public relations/communications manager
   - Estates/facilities dept
   - Housekeeping/Supplies
   - Consultant in Public Health Medicine (CPHM) or other member of local Health Protection Unit
   - Pharmacy
   - Human resources
   - Others as appropriate

7.1.2 Infection control

1. Identify suitable staff (for example, infection control link nurses/professionals) who can supplement the existing team if needed

2. Prepare a strategy to communicate infection control information to staff

7.1.3 Triage and patient placement

1. Establish procedures and test a plan for pandemic triage and rapid separation of patients with influenza from other patients

2. Identify areas for segregating/cohorting large numbers of patients with pandemic influenza

3. 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 absence
- Provide psychological and social support to staff
- Deliver the H5N1 vaccine to the healthcare workforce when required

7.1.5 Staffing

Ensure that plans are in place to address:

- Staff allocations to influenza/non-influenza areas, considering skill-mix and the likelihood of sickness and absence
- Tracking and coordination of staff movements (including agency staff)
- When an emergency staffing crisis would be declared
- Possible use of family members and lay volunteers in an ancillary capacity
- Staff working outside their usual area of practice (for example, medical and nursing students working as healthcare assistants)

7.1.6 Bed management

Ensure that the following is addressed in the existing *Escalation policy*:

- Procedures for reviewing and revising admission criteria
- Policies for expediting discharge of patients in conjunction with primary care 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

1. Evaluate current stock of essential equipment

2. Assess anticipated demand for consumables and determine trigger point for ordering extra supplies

3. Determine feasibility of ordering and storing extra PPE

4. Direct supplies managers to establish contingency plans in the event that primary sources of supplies become limited or exhausted

7.1.8 Mortuary issues

1. Plan for mass fatalities

2. Assess capacity for refrigeration

3. Define overflow arrangements

7.1.9 Education and training

1. Brief senior medical and nursing staff on pandemic infection control procedures (from board to consultant/ward manager level)

2. Brief managers of other departments (including estates, porters, radiology, physiotherapy, occupational health) and Community Health Partnerships

3. Test local response capabilities; a tabletop exercise is strongly recommended

4. Plan for additional training and fit-testing for staff likely to use FFP3 respirators

5. Provide general training for all staff on the infection control implications of pandemic influenza

6. Consider how the hospital intranet could be utilised for training, education and communication on infection control issues during a pandemic 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 discharged

7.2.1 Selection of segregated areas for cohorting patients

Cohorting (grouping patients together who have the same infection and no other infection) of patients 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/wing of the hospital should be used for the treatment and care of patients with influenza whenever possible. Ideally, this area should:

- include a reception area separate from the rest of the hospital and if feasible, have a separate entrance/exit from the rest of the hospital
- not be used as a thoroughfare by other patients, visitors or staff, including patient transfers, staff going for meal breaks, and staff and visitors entering and exiting the building
- be separated from other 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 influenza segregated areas should be reserved for performing aerosol-generating procedures whenever possible.

Consideration should be given to cohorting separately patients infected with influenza and another pathogen (for example, MRSA) to minimise hospital transmission of other infectious pathogens. This will be dependent 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 not allowed to be transferred to other areas purely for bed management purposes. However, if there is extreme pressure for beds in the segregated area of the hospital, convalescing patients with residual, non-respiratory problems (i.e. who are unlikely to be secreting virus in large quantities) but who require hospitalisation for other reasons (for example, poor mobility or non-respiratory complications) may need to be moved to another area of the hospital, an intermediate care facility, or a nursing/residential home. Such convalescing patients should, where possible, be accommodated together and away from other patients (see supplementary guidance for primary care settings, 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 pandemic influenza. These 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 the safe putting on and removal of 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/unit is segregated for influenza patients as this allows PPE prior to entry to a cohorted area to be put on away from where PPE is removed as the cohorted area is exited.

- Consider the practical implications when identifying the borders of a cohorted area for example, if the segregated area does not include the store room 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

- Stock replenishment

- Increase in waste generation due to increase in PPE usage

- Storage space for extra supplies

- Decreased efficiency in many tasks due to 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 those entering, including visitors, should sign in so that if follow up/contact tracing is required, details are readily available. Personnel

should be limited to those necessary for patient care and support. A sign should be placed at the entrance alerting all to the precautions to be adopted.

Infection control precautions: Standard infection control precautions must be strictly applied in conjunction with droplet precautions (see appendix 9.2). These precautions should be maintained for all patients in the segregated area.

Ward furnishings: For four to six bedded bays, 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. Patient personal belongings should be kept to a minimum. A water jug, glass, tissues, wipes and suitable disposable containers (for example plastic bags), and all other items necessary for personal hygiene should be provided and placed within the patients reach.

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

Day rooms/lounges: Consideration should be given to closing day rooms/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 following patient discharge should be carried out as normal. Close liaison with housekeeping/domestic services will be required.

7.3 Patient transfer/transport and hospital day care procedures

7.3.1 Inter-hospital transfers

Patients must not be automatically admitted to hospital if they have pandemic influenza. 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 (for example, 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 (for example transplant units) where if influenza is introduced, mortality is likely to be very high.

7.3.2 Intra-hospital transfers

Where possible, dedicated equipment such as x-ray equipment and 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 only leave the segregated care area for urgent and essential procedures. If a 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 (for example 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 in to the environment. If a surgical mask cannot be tolerated (for example, due to the patient's age or deteriorating respiratory status) use the most practical measures (such as tissues) to contain respiratory secretions. Where possible patients should also perform hand hygiene before leaving their room or cohorted area
- If advice is required on patient transfer to other areas of the hospital this can be provided by the ICT.

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 Special settings: Accident and emergency

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

- Rapidly screen and identify those who have symptoms of influenza upon their arrival
- Separate symptomatic patients from others to reduce the risk of transmission
- Determine as early as possible the type of care patients will require (i.e. “see and discharge” or admit for treatment).

7.4.1 Screening and triage

Signage should be displayed prior to and on entry to 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 in those entering the hospital may escalate from passive (for example signs at the entrance) to active (such as direct questioning) on the advice of the Scottish Government and HPS.

7.4.2 A & E 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, 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 (for example, outpatients presenting for dialysis, patients with a history of organ transplantation, chemotherapy, or who are immunocompromised for other reasons).

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

Attention to respiratory hygiene should be reinforced by posters. 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 for A & E waiting rooms

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

- Cover nose and mouth with disposable one-use tissues when sneezing, coughing, wiping and 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 (for example, 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 persons wear surgical masks. This will help contain of respiratory secretions and minimise environmental contamination.

7.4.4 Infection control procedures in A & E rooms/cubicles

All non-essential equipment from the examination room/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 minimize environmental contamination of the cubicle. Patients should be confined to their rooms/cubicles and only moved outside for essential procedures.

Frequently touched surfaces must be cleaned between patients.

7.5 Special settings: Children's units

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

7.5.1 Patient placement

The following points need to be taken into consideration when cohorting children:

- Different age groups (for example infants, toddlers, adolescents)

- Routine childhood vaccination status of children
- Presence of immunocompromising conditions
- Co-infection with another pathogen (for example RSV); such children may be cohorted separately. However, this will depend upon the availability of rooms, staff and the number of patients who are infected with both influenza and another pathogen requiring 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

Gowns may be required when caring for babies and neonates due to the close contact required. An overview of the type of PPE to be worn in different circumstances can be found at Table 1 (page 20). Guidance on putting on and removing PPE is at section 5.4.8.

7.5.4 Environmental cleaning

The environment should be cleaned at least twice daily and when known to be contaminated with secretions and body fluids. Communal areas such as play rooms 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 Special settings: Critical care units

7.6.1 Unit layout and patient placement

A separate document of specific guidance for pandemic influenza in critical care units is currently being produced [22]. This section summarises the main points specific to critical care units in the above document which should be read in full by those working in that setting.

The ubiquitous nature of a pandemic virus means that critical care staff, as with other healthcare staff, are equally as likely to encounter pandemic influenza in settings associated with normal daily living, e.g. 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 observed 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.

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

Although there is a need within critical care units to address these key points like anywhere else in the healthcare setting, there are a number of additional issues due to the nature of the work undertaken within such units:

7.6.2 Aerosol-generating procedures

The performance of aerosol-generating procedures should be minimised as far as is feasible without compromising patient care. To avoid unnecessary exposures, only those healthcare workers 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 5.5 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 anticipation of those likely to require respiratory support including 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 the time required, or the need for multiple attempts as much as possible [24].

7.6.4 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, p20).

7.6.5 Respiratory equipment

- Disposable patient respiratory equipment must be used wherever possible. Reusable equipment must be decontaminated in accordance with local policy and manufacturer's guidelines

- Closed systems should be used wherever possible (for example 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 manufacturers 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 fitting 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.

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

- Training in infection control for staff

- 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 to better assess the risk associated with different procedures are available (see section 5.5)

- Patients should ideally 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 NIV should be used

- Non-vented respirators or hoods 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 turning on the ventilator

- Ventilators which function with double hose tubing (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 for example, for mouthcare or sips of fluid

- Water humidification should be avoided.

* Adapted from Non-invasive respiratory support: a practical handbook. Editor AK Simonds 3rd edition 2007. Publisher Arnold.

7.7 The dying/deceased patient

7.7.1 Ministers of religion

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

7.7.2 Last offices

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

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 which may be of vital importance in refining recommendations related to prevention and treatment of infection. The post-mortem should be conducted in a high risk post-mortem room and 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 precautions 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 a restriction on 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 where there are immunocompromised patients such as haematology and transplant units.

On arrival to influenza segregated 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 prior to entering the ward. Visitors entering a cohorted area must be instructed on standard infection control precautions including hand hygiene practice and the wearing of protective equipment as appropriate. The use of PPE by visitors 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 patient environment.

The use of 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 influenza segregated areas unless 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 TV and telephones should be organised such that staff who work in influenza segregated areas do not also work in non-influenza segregated 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 precautions including hand hygiene and PPE.

Unless their help is essential, 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 precautions 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 influenza segregated areas, including patient waiting or reception areas designated for patients with symptoms of influenza.

8. SUPPLEMENTARY GUIDANCE FOR PRIMARY CARE SETTINGS

The infection control precautions discussed so far in this document are transferable to other settings. Each primary care 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 setting, after a local risk assessment has been performed. This chapter covers the following care settings:

- General practice premises
- Primary care teams making home visits
- Primary care clinics
- Community hospitals
- Prison medical units
- Allied health professionals
- Dental practices

Readers should be aware that separate guidance is available for community care staff [25].

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

- Prisons
- Fire and rescue service
- 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

1. Identify a lead member of staff (for example the ICM) who will take responsibility for coordinating infection control during a pandemic.

2. Ensure that board members and senior managers are fully informed of the critical infection control issues in relation to pandemic influenza.

3. Identify if there are existing forums within the NHS Board that can address the issues and actions required towards preparation for a pandemic (including performing local risk assessments). If not, form a local pandemic action group/sub-groups. This group may comprise a number of Community Health Partnerships (CHPs) covered by the same local Health Protection Unit (HPU) consisting of membership from the following:

   - Executive board/ICM
   - Nursing executive
   - Medical staff
   - Senior representative from each clinical team (for example, 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 dept
   - Domestic services/housekeeping
   - Supplies
   - CPHM or other member of local HPU
   - Community pharmacist
   - Human resources
   - Others as appropriate

8.1.2 Infection control

1. Identify suitable staff (for example, infection control link nurses/professionals) who can supplement the existing team if needed

2. Prepare strategy to communicate infection control information to staff

8.1.3 Triage and patient placement

1. Establish procedures and test a plan for a pandemic configuration of healthcare settings and premises, including where possible the rapid separation of patients with influenza from other patients

2. Identify areas for segregating/cohorting large numbers of waiting patients with influenza

8.1.4 Occupational health

Develop plans and procedures to:

- Ensure managers know how to assess staff with respiratory symptoms
- Supervise and monitor staff deployment, including bank and agency staff
- Track and document staff sickness/absence
- Provide psychological and social support to staff
- Deliver the H5N1 vaccine to the healthcare workforce when required
- Provide PPE, including masks, according to national policy

8.1.5 Staffing

Ensure that plans are in place to address:

- Staff allocation considering skill-mix and the likelihood of sickness/ absence
- Tracking and coordination of staff movements (including agency staff)
- When an emergency staffing crisis would be declared
- Possible use of family members and lay volunteers in an ancillary capacity
- Staff working outside their usual area of practice (for example, medical and nursing students working as healthcare assistants)

8.1.6 Bed management

Ensure that the following points are addressed in the existing *Escalation policy*:

- Procedures for reviewing and revising admission criteria to acute hospital care as admission thresholds are likely to be higher
- Policies for expediting discharge of patients in conjunction with acute and community hospitals 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 and community hospitals.

8.1.7 Supplies of consumables

1. Evaluate current stock of essential equipment

2. Assess anticipated demand for consumables and determine trigger point for ordering extra supplies

3. Determine feasibility of ordering and storing extra PPE

4. 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 Strategic Coordination Groups:

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

8.1.9 Education and training

1. Brief senior CHP and primary care staff (including practice managers, district nurse managers, GPs, ambulance managers) on pandemic infection control procedures

2. Brief managers of other departments (including estates, practice nurses, physiotherapy, occupational health)

3. Test local response capabilities; a tabletop exercise is strongly recommended

4. Plan for additional training and fit-testing for the small number of staff likely to use FFP3 respirators

5. Provide general training for all staff on the infection control implications of pandemic influenza

6. Liaise with others who may require training on infection control precautions as appropriate to their respective roles (for example, ministers of religion and funeral directors)

7. Consider how the NHS intranet could be utilised for training, education and communication on infection control issues during a pandemic to minimise face-to-face meetings during a pandemic.

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 each premise should be used for the treatment and care of patients with influenza whenever possible. Ideally this area should:

- Be fully self-contained
- Include reception and waiting areas 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 pandemic area.

While such arrangements may not be possible in some premises within a NHS Board, solutions should be sought which incorporate the above principles, for example, mixed influenza and non-influenza patients surgeries should be avoided.

8.2.1 Configuration of community healthcare premises

Once a pandemic is established, segregation principles should be applied to address handling a large number of patients with influenza whilst minimising transmission to others.

In GP surgeries/community outpatient settings, where possible, part of the surgery (at a minimum a consulting room) should 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 primary care level should plan for high numbers of patients being discharged from hospital into the community. Plans should be in place to provide accommodation for segregated transitional/interphase care (for example, 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 which are not designed or optimised for the delivery of clinical care (for example sports halls, schools, town halls).

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 community infection control team for the NHS Board and 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 (may require liaison with local authority). 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 entrance and exit points of the building. 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 the beds should be capable of being separated by a physical barrier (for example screens).

8.3 Patient transfer/transport and hospital day care procedures

See section 7.3

8.4 Special settings: Ambulance service

KEY POINTS

- Where practical designate an ambulance(s) for influenza patients
- Standard infection control precautions and droplet precautions are applicable in most circumstances
- Crew members should wear FFP3 respirators if critically ill patients require aerosol-generating procedures (for example, intubation, nasopharyngeal aspiration)
- Equipment carried should be kept to a minimum

Where practical and possible, designate an ambulance(s) for transfer of patients with influenza for the duration of each shift.

The immediate environment i.e., trolley, patient equipment and hand contact points must be decontaminated between patients. Upon completion of transfer of patients with influenza (for example, at the end of a shift) the vehicle must be thoroughly cleaned and decontaminated using 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).

8.5 Special settings: 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 segregated for influenza patients
- Hand hygiene facilities and paper tissues should be made available
- The environment should be cleaned frequently using neutral detergent.

8.5.1 Organisation of work flow and appointments

The principal GP, together with the practice manager, are responsible for clinical and administrative infection control issues 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 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, one GP would be designated for the morning surgery to see all patients with influenza in a designated area; 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 prior to using the same facilities for non-influenza patients.

8.5.2 Telephone triage

Patients with symptoms of influenza should be directed to contact the national telephone assessment service in the first instance.

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 especially for patients with complications of influenza.

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 records should be kept of staff working 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 precautions and droplet precautions (appendix 9.2), with particular attention to hand hygiene and the additional cleaning of consulting and treatment rooms required after being used for seeing patients with influenza (see section 6.5). Standard infection control precautions 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) should be made available. Coughing/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 (for example, 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

<u>Layout/configuration of the practice</u>

1. Create separate waiting areas for influenza and non-influenza patients

2. Designate clinical rooms/doctors' offices for influenza and non-influenza patients

3. Display clear signage at surgery entrances and clinical rooms/doctors' rooms indicating influenza/non-influenza areas

4. Remove extraneous items (toys, soft furnishings, magazines) from waiting areas

Staffing

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

Infection control

1. Ensure that hand hygiene facilities (sinks, soap, alcohol handrub, paper towels) are available for staff and patient use

2. Consider use of hand carried alcohol handrub for GPs and practice staff when making community/home visits

3. Ensure that tissues and waste bins (preferably lined and foot-operated) are available for patients and staff

Personal protective equipment

1. Ensure that supplies of gloves, surgical masks, aprons and any other items that may be needed are available

2. Ensure that eye protection is available if needed

3. Perform local risk assessment to review potential for performing aerosol-generating procedures; ensure that FFP3 disposable respirators and fluid repellent gowns are available if this is likely

Environmental cleaning

1. Ensure that a cleaning rota is in place and domestic staff have been trained in cleaning and decontamination procedures

2. Ensure that adequate supplies of cleaning materials are available

Education and training

1. Provide all staff with training in pandemic influenza infection control procedures

2. Ensure that any potential users of FFP3 disposable respirators have been fit-tested and trained in their proper use and care

Record keeping

1. Track and document staff sickness and absence

2. Track and document staff assignments

Patient information

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

8.6 Special settings: Single-handed GPs

Single-handed GPs may encounter a number of difficulties 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 due to small team size
- Limited resilience due to staff sickness and absence.

Single-handed GPs should seek help and advice from the local NHS Board/CHP to help ensure that they can function effectively during a pandemic without increasing the potential for spread of influenza in their practice. Boards/CHPs 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.

8.7 Special settings: District nursing teams

Team leaders may need to consider flexible and new approaches such as 'cross working'. For example, district-nursing teams might consider sharing staff or a designated district nurse could visit multiple 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/appointments should be continued as long as possible. However, it may be necessary to cancel routine appointments and clinics.

8.8 Special settings: Health visitors

Close liaison with other members of the extended primary care teams and community teams is essential. Health visitors may be requested to work outside their normal duties and managers should ensure that training is provided to facilitate this need.

Home visits should continue as long as possible to patients without influenza. 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 alternative arrangements (for example, telephone liaison) are in place to maintain contact. Health visitors performing non-deferrable essential visits (for example, child protection) to households with influenza should follow the infection control precautions detailed in this document.

8.9 Special settings: Allied health professionals (AHPs)

Close liaison with other primary care and community services 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/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.

8.10 Special settings: Dental practices

Patient visits: It may be prudent to cancel routine dental visits during the pandemic period. At a minimum, dental practices should put in place active screening of all patients for symptoms of influenza prior to entering 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: Health professionals should avoid aerosol-generating procedures for symptomatic patients as far as possible and must wear appropriate PPE where that is not possible (see table 1). Many dental procedures have the potential to generate aerosols and risk assessments will therefore be necessary. Emergency patients with symptoms of pandemic flu 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 all should wear PPE in accordance with an aerosol-generating procedure (Table 1, p20).

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 those with respiratory symptoms, and patients themselves deferring treatment or facing 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.

8.11 The dying/deceased patient

See section 7.7

In addition, specific guidance for pandemic influenza has been written for funeral directors and is available on the Scottish Government web site at: www.scotland.gov.uk/pandemicflu

8.12 Visitors

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

9. APPENDICES

9.1 The epidemiology of pandemic influenza

9.1.1 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. Treatment in primary care and hospital may be required due to 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 which 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 associated with pandemic influenza are likely to be of a substantially higher order than even the most severe winter influenza 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 this may not necessarily be the case. 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. The unpredictability of the timing of the next pandemic is underlined by the occurrence of several large outbreaks of highly pathogenic avian influenza (A/H5N1) associated with epizootic transmission to humans [26]. 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 (proportion of population with symptomatic illness) in the UK have occurred in the range of approximately 25-35%, compared with the usual seasonal range of five to 15%. The actual extent of the clinical attack rate will only become evident as person-to-person transmission develops, but current planning assumptions are based on 3 attack rates: 25%, 35% and 50%. It is important to emphasise that planning should take place across the range of possible attack rates, including the upper end of the scale.

Case fatality rate

In the previous pandemics of the 20th Century, case fatality rates (proportion of persons with symptomatic illness who died) have varied widely between 2-2.5% in 1918 to less than 0.5% in 1957 and 1968.

Age-specific impact

Age specific impact 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 impacted across the age range of the population in a fashion much more akin to seasonal influenza (i.e. greatest impact 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. Of the influenza pandemics of the 20th Century, that of 1918/19 produced three separate epidemic waves each separated by three to six months; one wave in the pandemic of 1957; and two in the pandemic of 1968/69. Each wave may last around 15 weeks, and if they occur, a second or subsequent wave 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 (increased winter mortality) due to 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 3,000 deaths per annum in Scotland [27], although there is considerable yearly variation and some years are notably much higher than the average (estimated 5,500 in 1989/90 epidemic). Excess mortality in Scotland associated with the three pandemics of the 20th century has also varied widely; this was estimated at 22,000 in 1918/19, and 9,200 in 1958/59. In 1968/69 and 1969/70 (both seasons considered to be associated with the influenza A/H3N2 pandemic) there were an estimated 4,800 and 7,000 excess deaths respectively [28]. 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.

9.1.2 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 the initial cases were limited to a small geographic area and rapidly detected [30, 31]. 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 [32].

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. International travel restrictions are unlikely to delay an epidemic significantly [33]. 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 [34].

School closure might reduce clinical attack rates in children and slow epidemic spread to some extent [32].

9.1.3 Transmission of influenza virus

Influenza is well established to be transmitted person-to-person through close contact. Transmission almost certainly occurs through multiple routes including droplets and direct and indirect contact [10]. Aerosol transmission may also occur [11].

Although the respiratory tract is the main focus for infection, the human eye is also a possible route for infection. 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 [35]. A mechanism therefore exists for avian influenza to replicate and ultimately cause avian influenza respiratory symptoms.

Transmission of influenza has been well-described in hospital, nursing home, 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 (for example, patient bed locations, health-care worker-patient contacts, laboratory evaluation of health-care workers for influenza, and time-space clustering of illnesses in patients and health-care workers) to delineate precisely between droplet, contact and aerosol spread. Further, outbreaks in health-care settings are almost always confounded by concurrent community-based epidemics, which make it difficult to pinpoint the exact source of exposure for health-care 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 [36]. In none of these outbreaks were airborne [sic] isolation precautions instituted or required to halt transmission; instead droplet and/or contact precautions were usually implemented along with various other approaches (for example, use of antiviral drugs and vaccines and limiting visitors). The author 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 [37]. Infection in patients located in separate rooms off the same corridor was rarely observed despite opportunities for airborne [sic] transmission to occur (for example, open doors and housing in positive pressure rooms). Blumenfeld *et al.* described a nosocomial outbreak of influenza A/H2N2 that occurred at the beginning of the 1958-59 pandemic before evidence of widespread cases in the community [38]. The outbreak was traced to admission of a symptomatic patient subsequently documented to have influenza. Within 48 hours, the patient in the adjacent bed developed symptoms and 12 other cases in health-care 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 [12].

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 [39]. 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, ¾″ apart [40, 41]. 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 particle infectious particles (<10 microns in size) were recovered from the air surrounding infected mice [41]. Similarly, studies in ferrets demonstrated transmission despite separating ill from susceptible ferrets by a nine-foot duct with two 90 degree bends, making droplet transmission unlikely [42]. 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 10-100 fold lower doses [43]. 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 pandemic influenza A/H2N2 was significantly less among tuberculosis patients housed in a Veteran's Hospital ward equipped with ultraviolet lighting (four of 209 [2%] compared with patients in a non-radiated ward (75/396 [19%]) suggesting that the ultraviolet radiation had inactivated viral-laden aerosols [44]. However interpretation of this observational report is severely limited because critical elements were either not recorded or reported which could have confounded the observations. Importantly, the study lacked suitable controls, which limits firm conclusions [45].

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 [46]. 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 [39], 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 which 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.

9.1.4 Infection control measures to interrupt the 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 [16], the use of face masks to protect healthcare workers has a long history [47, 48] and has been incorporated into international [15] and national infection control guidance [14]. Two recent retrospective studies of the SARS (severe acute respiratory syndrome) epidemic suggested that surgical masks afforded health care professionals some measure of protection when in close contact with patients [49, 50]. 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 [14].

Epidemiological evidence has defined the area of risk around the patient as being a distance of less than one metre [51]. Recent CDC Isolation guidance suggests that this should be used as an approximation rather than an absolute distance [14]. Nonetheless using one metre for using surgical masks has been effective in preventing transmission of infectious agents via the droplet route.

Common sense suggests that well adhered to respiratory hygiene such as covering coughs and sneezes will interrupt droplet transmission. A recent "cover your cough" campaign was found to prevent exposures of employees to pertussis, which is spread by droplet transmission [52].

Multiple studies have documented both the major contribution played by contaminated hands in the transfer of infection and the effectiveness of hand hygiene in healthcare [16, 53] and community settings [54, 55, 56]. 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 [57]. 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 [16]. Alcohol handrubs are recognized 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 [13].

There is little 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 [58], is important.

Micro-organisms are removed and killed during all stages of the laundering process. Health Service 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 cross infection risk of hospital pathogens to other items in the washload [59]. 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 microorganisms are killed [60]. Although evidence shows that the washing process itself adequately removes microbes, components such as ironing or tumble drying are also beneficial in reducing microbial counts. The authors of one study specific to the 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 [61].

9.1.5 Influenza virus survival and inactivation

Studies of mice exposed to aerosols of fine, uniform-sized droplets of influenza virus found that under conditions of low humidity (i.e. 17%-24%) mice could become infected for up to 24 hours after the virus was first aerosolised in a room that was continuously agitated via a slowly rotating fan [62]. Loosli 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 [62].

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 [12]. Virus survived on hard non-porous surfaces (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.

Bean and colleagues also evaluated the transferability of influenza A virus from contaminated surfaces onto hands [12]. 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). Using 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 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 [13].

9.1.6 Incubation and communicability

Estimates of the incubation period of influenza vary from one to four days, with most ranging from two to three days [63].

The period of communicability of influenza virus (i.e. 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, 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 illness onset. The level of virus shedding pre-symptomatically is lower when compared with the symptomatic period and usually subsides to low levels by day five [63, 64]. A more recent study found that adult patients could shed virus (detected by pcr or culture) beyond this traditional period. However it was unclear if influenza A virus detected by pcr was infectious [9].

Viral shedding is proportional to severity of illness and temperature elevation [65]. It is estimated that approximately 50% of all influenza infections are asymptomatic [37]. Infected persons (typically adults) can shed influenza virus yet have no evidence of respiratory symptoms [66], 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 fertilizer 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 [67].

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 [65]. In general, young children cease shedding influenza viruses seven to eight days after onset of symptoms, however, they can shed infectious virus several days before onset of illness [68].

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 [69, 70]. Case reports of severely immunocompromised adults and children indicate that viral shedding can occur for even longer periods of time [71, 71].

9.2 Infection control precautions

9.2.1 Standard infection control precautions

Standard infection control precautions are a set of broad statements of good practice to minimise exposure to and transmission of a wide variety of microorganisms. Standard precautions 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 from dust and soilage, 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/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 i.e. following the removal of gloves must be washed with liquid soap and water.

Hands should be decontaminated between caring for different patients or between different care activities for the same patient. For convenience and efficacy an alcohol based handrub is preferable unless hands are visibly soiled. Local infections 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 from nail polish. False nails and nail extensions must not be worn by clinical staff.

An effective handwashing 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 handwash 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 paying particular attention 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 decontaminating hands using an alcohol-based handrub, 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, paying particular attention 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 affects of hand decontamination products. They should be encourages to use an emollient hand cream regularly, for example, after washing hands before a break, or going off duty and when off duty, to maintain the integrity of the skin.

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

Near patient alcohol-based handrub should be made available 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 protective equipment must be based on an assessment of the risk of transmission of microorganisms to the patient or to the carer, and the risk of contamination of the healthcare practitioners' clothing and skin by patients' blood, body fluids, secretions, or excretions.

Everyone involved in providing care should be educated about standard precautions and trained in the use of protective equipment.

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 advised by the infection control team.

Gloves must be worn for invasive procedures, contact with sterile sites, and non-intact skin or mucous membranes, and all activities that have been assessed as carrying a risk of exposure to blood, body fluids, secretions and excretions; and 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, or between different care/treatment activities for the same patient.

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

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

Sensitivity to natural rubber latex in 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 are anticipated and when there is a risk that clothing may become contaminated with pathogenic organisms or blood, body fluids, secretions and 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 (for example when assisting with childbirth).

Plastic aprons/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, i.e. 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.

Taken 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

9.2.2 Droplet precautions

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

Patient placement

Place the patient in a single room (i.e. isolation room or side room/cubicle). When a single room is not available, place the patient in a room with a patient(s) who has active infection with the same microorganism 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 standard precautions (i.e. standard infection control precautions), 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 patient dispersal of droplets by masking the patient, if tolerated and encourage good respiratory hygiene.

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

9.3 References

1. *Guidance for pandemic influenza: Infection control in hospital and primary care settings* (2005) at www.scotland.gov.uk/pandemicflu

2. World Health Organisation. WHO global influenza preparedness plan. The role of WHO and recommendations for national measures before and during pandemics. Geneva: World Health Organisation; 2005. www.who.int/csr/resources/publications/influenza/WHO_CDS_CSR_GIP_2005_5.pdf.

3. More guidance on this can be found in *A Scottish Framework for Responding to an Influenza Pandemic* was issued by the Scottish Government in November 2007. It is available at: www.scotland.gov.uk/pandemicflu

4. Available at www.scotland.gov.uk/pandemicflu

5. British Infection Society; British Thoracic Society; Health Protection Agency. Pandemic Flu: Clinical management of patients with an influenza-like illness during an influenza pandemic. *Thorax* 2007 Jan; 62 Suppl 1:1-46.

6. Health and Safety Executive. Control of Substances Hazardous to Health (5th edition). *The Control of Substances Hazardous to Health Regulations* 2002 (as amended). Approved Code of Practice and guidance. L5. ISBN 0717629813. Available from HSE Books at: www.hsebooks.com/Books/default.asp

7. Health and Safety Executive. Advisory Committee on Dangerous Pathogens. *Biological Agents: Managing the risks in laboratories and healthcare premises*. 2005. Available at: www.hse.gov.uk/biosafety/biologagents.pdf

8. Health and Safety Executive. *Respiratory protective equipment at work: A practical guide.* 2005. HSG53. ISBN 071762904X. www.hsebooks.com/Books/default.asp.

9. Leekha S, Zitterkopf L, Espy M et al. Duration of influenza A shedding in hospitalized patients and implications for infection control. *Infect Control Hosp Epidemiol* 2007; 28:1071-1076

10. Brankston G, Giterman L, Hirji Z, Lemieux C, Gardam M. Transmission of influenza A in human beings. *Lancet Infect Dis* 2007; 7:257-65.

11. Tellier R. Review of aerosol transmission of influenza A virus. *Emerg Infect Dis* 2006; 12:1657-62.

12. Bean B, Moore BM, Sterner B, Petersen LR, Gerding DN, Balfour HH Jr. Survival of influenza viruses on environmental surfaces. *J Infect Dis* 1982;146:47-51.

13. Schurmann W, Eggers HJ. Antiviral activity of an alcoholic hand disinfectant: comparison of the in vitro suspension test with in vivo experiments on hands, and on individual fingertips. *Antiviral Res* 1983;3:25-41.

14. Centers for Disease Control and Prevention. *Guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings 2007*. Available at www.cdc/goc/ncidod/dhqp/gl_isolation.html

15. World Health Organisation. *Infection prevention and control of epidemic- and pandemic-prone acute respiratory diseases in healthcare 2007*. www.who.int/crs/resourses/publications/WHO_CD_EPR_2007_6/en/index/html.

16. Pratt RJ, Pellowe C, Wilson JA, Loveday HP et al. epic2: National evidence-based guidelines for preventing healthcare associated infections in NHS hospitals in England. *J Hosp Infect* 2007; 65 (supplement): S1-64.

17. *Interim Guidance on Single Room Provision* is available on the Scottish Government website at: www.pcpd.scot.nhs.uk/developing.htm

18. Health Facilities Scotland (2007) *NHS Scotland - EWC coding guide for healthcare wastes - Interim Final SHTN 3 guidance* http://www.hps.scot.nhs.uk/ewr/article.aspx [the final version of this document is due to be published in 2008 and will be available from the HPS website]

19. Kantor HS, Poblete R,Pusateri SL. Nosocomial transmission of tuberculosis from unsuspected disease. *Am J Med* 1988;84:833-8.

20. Health and Safety Executive. Health Services Advisory Committtee. *Safe working and the prevention of infection in the mortuary and post-mortem room.* 2003 Available from HSE Books at www.hsebooks.com/Books/default.asp

21. Health Protection Scotland; *Safe Management of Linen Policy and Procedure*; www.hps.scot.nhs.uk/haiic/ic/guidelinedetail.aspx?id=31230

22. *Pandemic Influenza: Guidance for infection control in hospitals and primary care settings – Specific guidance for critical care units* (at the time of publication this document is still in press but will shortly be available from the Scottish Government web site at: www.scotland.gov.uk/pandemicflu)

23. Gamage B, Moore D, Copes R, Yassi A, Bryce E. Protecting health care workers from SARS and other respiratory pathogens: a review of the infection control literature. *Am J Infect Control* 2005; 33:114-21.

24. Cooper A, Joglekar A, Adhikari N. A practical approach to airway management in patients with SARS. *CMAJ* 2003;169:785-7

25. *Planning for pandemic influenza in adult community care - Guidelines for community care staff* was issued in November 2007. It is available at www.scotland.gov.uk/pandemicflu, which should be consulted for the latest version.

26. www.who.int/csr/disease/influenza/H5N1-9reduit.pdf

27. Statistics for deaths in Scotland can be found at the website of the General Register Office for Scotland at: http://www.gro-scotland.gov.uk/index.html

28. Increased Winter Mortality, Scotland, 1951/52 – 2006/07; General Register Office for Scotland http://www.gro-scotland.gov.uk/files1/stats/iwm07-tab2.pdf

29. Longini IM Jr, Nizam A, Xu S, Ungchusak K, Hanshaoworakul W, Cummings D, et al. Containing pandemic influenza at the source. *Science* 2005;309:1083-7.

30. Ferguson NM, Cummings DAT, Cauchemez S, Fraser C, Riley S, Meeyai A, et al. Strategies for containing an emerging influenza pandemic in southeast Asia. *Nature* 2005;437:209-14.

31. Ferguson NM, Cummings DA, Fraser C, Cajka JC, Cooley PC, Burke DS. Strategies for mitigating an influenza pandemic. *Nature* 2006; 442:448-52.

32. Cooper BS, Trotter CL, Pitman RJ. Modelling the international spread of pandemic influenza: how much time can interventions buy? [Abstract] *Influenza Vaccines for the World*, 24th-26th May 2004, Lisbon.

33. Pitman RJ, Cooper BS, Trotter CL, Gay NJ, Edmunds WJ. Entry screening for severe acute respiratory syndrome (SARS) or influenza: policy evaluation. *BMJ* 2005; 331: 1242-3.

34. Koopmans M, Wilbrink B, Conyn M. Transmission of H7N7 avian influenza A virus to human beings during a large outbreak in commercial poultry farms in the Netherlands. *Lancet* 2004; 363: 587-93.

35. Salgado CD, Farr BM, Hall KK, Hayden FG. Influenza in the acute hospital setting. *Lancet Infect Dis* 2002;2:45-55.

36. Bridges CB, Kuehnert KJ, Hall CB. Transmission of influenza: implications for control in hospital settings. *Clin Infect Dis* 2003;37:1094-1101.

37. Blumenfeld HI, Kilbourne ED, Louria DB, Rogers DE. Studies on influenza in the pandemic of 1957-1956. I. An epidemiologic, clinical and serologic investigation of an intrahospital epidemic, with a note on vaccination efficacy. *J Clin Invest* 1959;38:199-212.

38. Schulman JL, Kilbourne ED. Transmission of influenza virus infection in mice. *Nature* 1962;195:1129-1130.

39. Schulman JL. The use of an animal model to study transmission of influenza virus infection. *Am J Public Health* 1968;59:2092-96.

40. Schulman JL. Experimental transmission of influenza virus infection in mice. IV. Relationship between transmissibility of different strains of virus and recovery of airborne virus in the environment of infector mice. *J Exp Med* 1967;125:478-88.

41. Andrews CH,Glover RE. Spread of infection from the respiratory tract of the ferret. 1. Transmission of influenza A virus. *Br J Exp Pathol* 1941; 22:91-97.

42. Henle W, Henle G, Stokes J Jr, Maris EP. Experimental exposure of human subjects to viruses of influenza. *J Immunology* 1945; 52:145-65

43. Jordan WS. The mechanism of spread of asian influenza. *Am Rev Respir Dis* 1961;83:29-40.

44. Lemieux C, Brankston G, Glitterman L, Hirji Z, Gardam M, Questioning aerosol transmission of influenza (letter) Emerg Infect Dis 2007;13:173-4

45. Moser MR, Bender TR, Margolis HS, Noble GR, Kemdal AP, Ritter DG. An outbreak of influenza aboard a commercial airliner. *Am J Epidemiol* 1979;110:1-6.

46. Weaver GH. Droplet infection and its prevention by the face mask. *J Infect Dis* 1919; 24:18-30

47. Weaver GH Value of the face mask and other measures. *JAMA* 1918; 70:76.

48. Seto WH, Tsang D, Yung RW et al. Effectiveness of precautions against droplets and contact prevention of nosocomial transmission of severe acute respiratory syndrome (SARS). *Lancet* 2003; 361:1519-20.

49. Loeb M, MCGeer A, Henry B, et al. SARS among critical care nurses, Toronto. *Emerg Infect Dis* 2004; 10:251-5

50. Feigin RD, Baker CJ, Herwaldt LA et al. Epidemic meningococcal disease in an elementary school classroom. *N Engl J Med* 1982; 304: 1255-7.

51. Chatterjee A, Plummer S, Heybrock B, et al. A modified 'cover your cough' campaign prevents exposures of employees to pertussis at a children's hospital. *AJIC* 2007;35:489-91

52. World Health Organisation. WHO guidelines on hand hygiene in health care (Advanced draft) Geneva: World Health Organisation; 2006. www.who.int/patientsafety/information_centre/ghhad_download_link/en/

53. Luby SP, Agboatwalla M, Feikin DR et al. Effect of handwashing on child health: a randomized controlled trial. *Lancet* 2005; 366:225-33.

54. Carabin H, Gyorkos TW, Soto JC et al. Effectiveness of a training program in reducing infections in toddlers attending day care centers. *Epidemiology* 1999; 10:219-27.

55. Boyce J, Pittet D. Guideline for hand hygiene in health-care settings. *Morb Mortal Wkly Rep* 2002; 51:1-44.

56. Sattar SA. Microbiocides and the environmental control of nosocomial viral infections. *J Hosp Infect* 2004; 56:S64-S69.

57. National Patient Safety Agency. The national specifications for cleanliness in the NHS: a framework for setting and measuring performance outcomes.2007.London: NHS/NPSA. Available at www.npsa.nhs.uk/health/currentprojects/nutrition/cleaning.

58. Wilson JA, Loveday HP, Hoffman PN, Pratt RJ. Uniform: an evidence review of the microbiological significance of uniforms and uniform policy in the prevention and control of healthcare-associated infections. Report to the Department of Health (England). *J Hosp Infect* 2007; 66:301-307.

59. Department of Health. *Uniforms and workwear: an evidence base for developing local policy*. Available at www.dh.gov.uk/publications

60. Patel SN, Murray-Leonard J, Wilson APR. Laundering of hospital staff uniforms at home. J Hosp Infect 2006; 62:89-93.

61. Loosli CG, Lemon HM, Robertson OH, Appel E. Experimental airborne influenza infection. I. Influence of humidity on survival of virus in air. *Proc Soc Exp Biol* 1943;53:205-6.

62. Morris JA, Kasel JA, Saglam M, Knight V, Loda FA. Immunity to influenza as related to antibody levels. *N Engl J Med* 1966;27:527-35.

63. Murphy BR, Chahlub EG, Nusinoff SR, Kasel J, Chanock RM. Temperature-sensitive mutants of influenza virus. 3. Further characterization of the ts-1(E) influenza A recombinant (H3N2) virus in man. *J Infect Dis* 1973;128:479-87.

64. Hall CB, Douglas RG, Geiman JM, Meagher MP. Viral shedding patterns of children with influenza B infection. *J Infect Dis* 1979;140:610-3.

65. Foy HM, Cooney MK, Allan ID, Albrecht JK. Influenza B in households: virus shedding without symptoms or antibody response. *Am J Epidemiol* 1987;126:506-15.

66. Sheat K. An investigation into an explosive outbreak of influenza—New Plymouth. *Communicable Disease New Zealand*. 1992;92:18–9.

67. Frank AL, Taber LH, Wells CR, Wells JM, Glezen WP, Paredes A. Patterns of shedding of myxoviruses and paramyxoviruses in children. *J Infect Dis* 1981;144:433-41.

68. Hall CB, Douglas RG. Nosocomial influenza infection as a cause of intercurrent fevers in infants. *Pediatrics* 1975;55:673-7.

69. Munoz FM, Campbell JR, Atmar RL, et al. Influenza virus A outbreak in a neonatal intensive care unit. *Pediatr Infect Dis J* 1999;18:811-5.

70. Englund JA, Champlin RE, Wyde PR, et al. Common emergence of amantadine- and rimantidine-resistant influenza A viruses in symptomatic immunocompromised adults. *Clin Infect Dis* 1998;26:1418-24.

71. Evans KD, Kline MW. Prolonged influenza A infection responsive to rimantadine therapy in a human immunodeficiency virus-infected child. *Pediatr Infect Dis J* 1995;14:332-4.

9.4 Selected additional bibliography and web links

Pandemic influenza planning

The Scottish Government (2008) www.scotland.gov.uk/pandemicflu

Public Health Agency of Canada (2006) The Canadian Pandemic Influenza Plan for the Health Sector. Available at: www.phac-aspc.gc.ca/cpip-pclcpi

United States Department of Health and Human Services (2005) Pandemic Influenza Plan. Available at: www.hhs.gov/pandemicflu/plan

Hand hygiene

Infection Control Nurses Association (2002) hand decontamination guidelines. Bathgate; Fitwise

National Patient Safety Agency (2004) Achieving our aims; Evaluating the results of the pilot cleanyourhands campaign. www.npsa.nhs.uk

Standard precautions/ standard and droplet precautions

Health Protection Scotland has produced a number of model infection control policies. These can be found at: www.hps.scot.nhs.uk/haiic/ic/guidelines.aspx

Garner, J.S. and The Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Am J Infect Control* 1996;24:24-52.

NICE (2003) Infection control: Prevention of healthcare associated infection in primary and community care.

Personal protective equipment

Health and Safety Executive: (2005) Biological agents: Managing the risks in laboratories and healthcare settings. Advisory Committee on Dangerous Pathogens. www.hse.gov.uk

Health and Safety Executive: (2005) Respiratory Equipment at work: A practical guide. ISBN 07176 2904 X (Available from HSE Books at: www.hsebooks.com/Books/default.asp)

Health Protection Scotland – general advice and guidance on fit testing of facemasks and other influenza related issues: www.hps.scot.nhs.uk/resp/influenza.aspx?subjectid=95

Infection Control Nurses Association (2002) *A comprehensive glove choice*. Bathgate, UK: Infection Control Nurses Association.

Infection Control Nurses Association (2002) *Protective clothing: Principles and guidance*. Bathgate, UK: Infection Control Nurses Association.

National Institute for Clinical Excellence (2003) *Infection control: Prevention of healthcare-associated infection in primary and community care.* Clinical Guideline [on-line]. London: NICE. www.nice.org.uk/guidance/CG2

Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance. L21. (2nd edition). ISBN 0717624889.

www.hsebooks.com/Books/default.asp

Environment and decontamination

Ayliffe GAJ, Fraise AP, Geddes AM, Mitchell K. (2000) *Control of Hospital Infection* 4th edition London. Arnold

Sterilization, Disinfection and Cleaning of Medical Equipment: Guidance

on Decontamination from the Microbiology Advisory Committee to Department of Health.

www.mhra.gov.uk/home/idcplg?IdcService=SS_GET_PAGE&ssDocName=CON007438&ssSourceNodeId=311&ssTargetNodeId=575

NHS decontamination programme. www.DH.gov.uk/decontamination

NHS Estates (2004) *Healthcare facilities cleaning manual* . London: Department of Health. www.patientexperience.nhsestates.gov.uk

9.5 Acknowledgements

Mrs Vivien Duncanson (North Lincolnshire and Goole Hospitals NHS Trust)

Dr Mary Chamberland (Health Protection Agency and Centers for Disease Control)

Ms Helen Jenkinson (South Staffordshire Healthcare NHS Trust)

Dr Jonathan S. Nguyen-Van-Tam MBE (Health Protection Agency)

Ms Carole Fry (Department of Health)

9.6 Acronyms

A&E	Accident and emergency
AHP	Allied health professionals
BS EN	British standard
COSHH	Control of substances hazardous to health
CPHM	Consultant in Public Health Medicine
ECG	Electro cardiograph
FFP	Filtering face piece
GP	General practitioner
HPS	Health Protection Scotland
HPU	Health Protection Unit
HSE	Health and Safety Executive
HSG	Health service guidelines
ICM	Infection Control Manager
MRSA	Methicillin resistant *staphylococcus aureus*
NHS	National Health Service
PPE	Personal protective equipment
RSV	Respiratory syncytial virus
SARS	Severe acute respiratory syndrome
WHO	World Health Organisation