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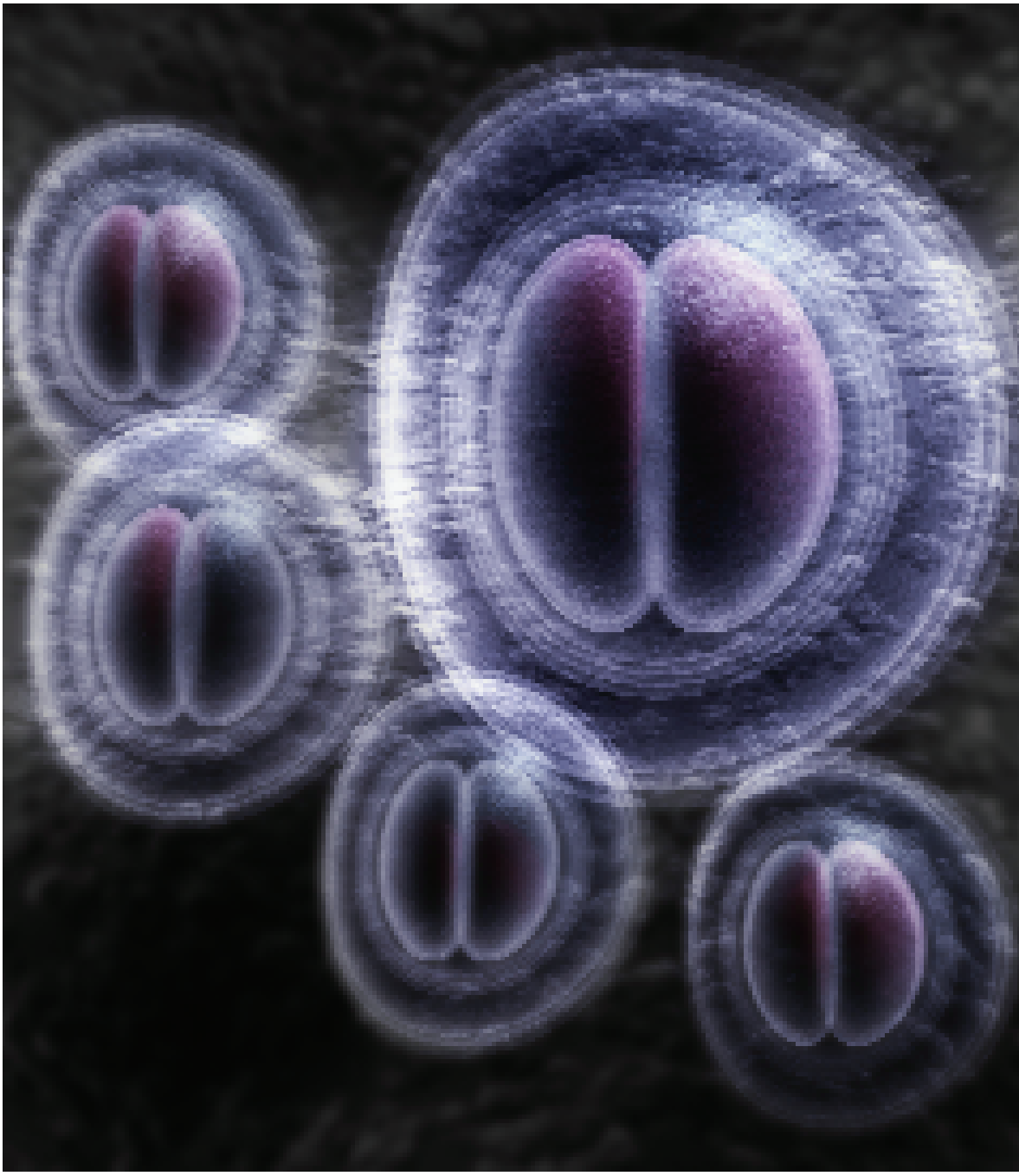
Healthcare associated infections

A guide for healthcare professionals

February 2006



BMA

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Declaration of interest

Of the people involved in the research and writing of this report, Dr R H George is related to Professor Sir Charles George. For further information about the editorial secretariat or board members please contact the Science and Education Department which hold a record of all declarations of interest: **info.science@bma.org.uk**

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- Dr Robert C Spencer, **Chair, Hospital Infection Society** and **Director, Health Protection Agency Southwest Regional Laboratory**

Contents

Foreword

The British Medical Association (BMA) resolved at its 2005 annual representative meeting (ARM) to further investigate the increasing problem of healthcare associated infections (HCAIs). In particular, the BMA is concerned by the lack of cleanliness in NHS hospitals, poor levels of compliance with standard hygiene protocols and the development of antimicrobial resistance. In addressing this resolution, the Board of Science decided to undertake a review of the guidance currently available to healthcare professionals in an attempt to raise awareness of the problem and highlight the available resources and information.

As a significant number of reports and guidance on aspects of HCAIs already exists, the aim of this resource is to provide healthcare professionals with summary information and to signpost access points for further information and resources. It provides guidance on good practice in infection prevention and control, and specifically the responsibilities healthcare professionals have in managing and reducing the incidence and spread of HCAIs in all clinical settings.

Professor Sir Charles George
Chair, Board of Science

The Board of Science, a standing committee of the BMA, provides an interface between the medical profession, the government and the public. The board produces numerous reports containing policies for national action by government and other organisations, with specific recommendations affecting the medical and allied professions.

Introduction

Healthcare associated infections (HCAIs) are infections acquired as a result of contact with the healthcare system in its widest sense – from care provided in the home, to primary care, nursing home care and acute care in hospitals.[1] Accordingly, HCAIs include both hospital acquired infections (HAIs)[a] which are infections that develop in a patient 48 hours or more after admission to a hospital; and community acquired infections (CAIs) that refer to any infection from which a patient is suffering when they come into a hospital or occurs within the first 48 hours of admission (ie acquired in the community). For some viral infections where it is known that the incubation period is longer (eg varicella-zoster virus), CAIs can be diagnosed after 48 hours. HCAIs are mainly acquired during a patient's stay in hospital, although it is important to acknowledge that infections occur in community and primary, as well as secondary, healthcare settings.

The occurrence of HCAIs is not a new phenomenon and to some degree it is inevitable in any healthcare setting. HCAIs now pose significant problems in all developed healthcare systems and necessitate monitoring, control and regulation. A report published by the Department of Health (DH) indicates that between 5 and 10 per cent of hospitalised patients in the United States of America (USA), Australia and most European countries contract an HCAI (see box 1).[1] The recent resurgence in HCAIs is to some extent a result of advances in medical technology and treatment, and the development of healthcare in the primary, secondary and community settings. The ageing population and the ability to treat more severe and chronic disease mean that, although more patients are being treated than ever before, they are often more vulnerable to infections because of the use of invasive procedures and/or as a result of suppression of the immune system. The spread of HCAIs is facilitated by high bed occupancy rates, the increasing movement and turnover of patients, and poor standards of hygiene in healthcare settings.

Box 1: Estimated prevalence of HCAIs.[1]

• Australia	6%	• France	6-10%
• Norway	7%	• Netherlands	7%
• England	9%	• Spain	8%
• USA	5-10%	• Denmark	8%

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

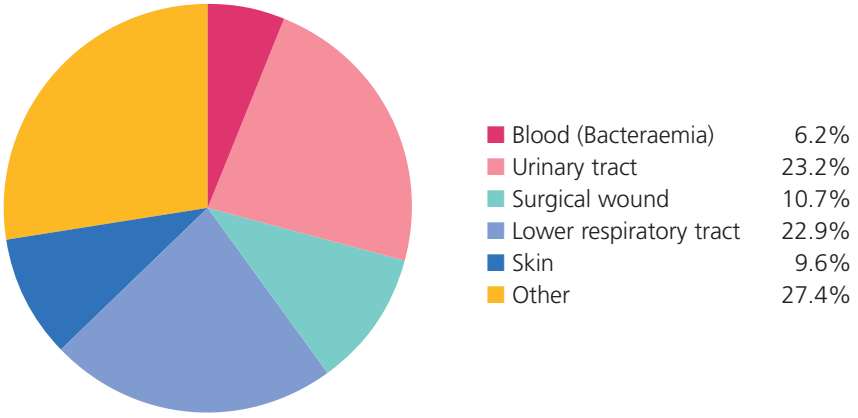
The need to control the level of HCAIs is compounded by the emergence of antimicrobial-resistant micro-organisms. The development of resistance is a natural response to the selective pressure generated by antimicrobial treatment of infections. Increasing use of antimicrobials within and outside the healthcare setting has resulted in the emergence of 'super-bugs' that are resistant to multiple antimicrobials. Infections have become increasingly difficult and expensive to treat. The antimicrobials that are needed to treat drug-resistant infections are potentially more toxic, which complicates efforts to control the spread of infection. This problem has been highlighted by the dramatic increase in the proportion of *Staphylococcus aureus* bacteraemias that are resistant to the antibiotic methicillin.[2]

[a] Hospital acquired infections (HAIs) are also known as nosocomial infections

Healthcare associated infections

A wide variety of micro-organisms can be transmitted in healthcare settings, including bacteria, viruses, fungi and mycoplasmas, producing in turn a wide range of different diseases. The majority of HCAIs are caused by bacteria, many of which are carried harmlessly by healthy people. They most commonly affect the urinary tract, lower respiratory tract, surgical wounds, skin and the bloodstream. These account for three-quarters of all HCAIs while less common causes include specific infectious diseases such as influenza and viral gastro-enteritis (see figure 1).[3] While some bacteria are more difficult to treat, the type of bacteria involved is often less important, in terms of the impact on the patient, than the site and kind of infection. Many HCAIs are caused by micro-organisms susceptible to antimicrobials and can therefore be treated effectively. Of the main categories of HCAIs, urinary tract infections occur most frequently, while bloodstream infections have the highest associated mortality.[3] HCAIs can be transmitted between persons, derived from the patient's natural flora or spread as a result of environmental contamination.

Figure 1: The main sites of healthcare associated infections[3]



Source: The management and control of hospital acquired infection in acute trusts in England (NAO, 2004)

HCAIs affect patients in a variety of ways, from increased discomfort and pain to severe chronic illness, permanent disability and in some cases may cause death. Infection can also lead to extended lengths of stay of affected patients, bed and ward closure, and increased diagnostic and treatment costs, especially when infection is caused by an antimicrobial resistant micro-organism. Although HCAIs are caused by a wide variety of micro-organisms, several pathogens and their associated antimicrobial resistance are of particular significance including *S. aureus*, Glycopeptide-resistant enterococci (GRE), *Clostridium difficile (C. difficile)*, *Streptococcus pneumoniae*, *Acinetobacter* species, Extended-spectrum Beta-Lactamases (ESBL) producing *Escherichia coli*, and *Candida* species.

Further information

- Summary information on the micro-organisms commonly causing HCAIs can be found in the appendix.
- More detailed information about the causative agents of HCAIs and their epidemiology can be found on the Health Protection Agency (HPA) website at **www.hpa.org.uk** and on the National Resource for Infection Control (NRIC) website at **www.nric.org.uk.**

The present position

HCAIs remain a high priority and a significant problem throughout the United Kingdom (UK), important both in terms of the safety and wellbeing of patients and of the resources consumed by potentially avoidable infections. The National Audit Office (NAO) estimates that HCAIs contribute to the death of up to 5,000 people each year and cost the NHS up to £1 billion per year in the UK.[3] In England, 300,000 patients acquire infections in hospitals every year and at any given time some 9 per cent of hospital patients are infected with an HCAI.[3,4] A report from NHS Quality Improvement Scotland (NHS QIS) in 2004 found that HCAIs were a major factor in 457 deaths each year and a contributory factor in 1,372 infections, at a cost to the health service in Scotland of over £186 million per year.[5]

With the significant increase in the proportion of *S. aureus* bacteraemias resistant to methicillin, much of the intense media interest in HCAIs has focused on methicillin-resistant *Staphylococcus aureus* (MRSA). According to the NAO, the proportion of *S. aureus* that is methicillin-resistant increased from 2 per cent in 1994 to 35 per cent in 2001.[2] The UK now has one of the highest levels of antimicrobial resistance in Europe with respect to MRSA (see box 2).[1] In 2004, there were 7,684 cases of MRSA bacteraemia in the UK,[6] and according to the Office of National Statistics (ONS), MRSA contributed to 955 deaths in 2003.[7] While MRSA is the most common multi-resistant bacteria, the majority of HCAIs result from infections by other pathogens. In 2004, the number of reported cases of *C. difficile* in England, Wales and Northern Ireland was 43,672, while in 2003 it was mentioned on 1,748 death certificates in England and Wales and in 934 of those cases it was identified as the underlying cause of death.[8] In 2005, an epidemic of *C. difficile* was responsible for at least 12 deaths at Stoke Mandeville Hospital. The causative strain was found to be closely related to that isolated during outbreaks in Canada and North America of *C. difficile*-associated disease with increased morbidity and mortality.[9]

Box 2: Proportion of *S. aureus* blood isolates resistant to methicillin.[1]

• Denmark	1%	• France	33%
• Netherlands	1%	• Portugal	38%
• Austria	11%	• Italy	38%
• Germany	19%	• Greece	44%
• Spain	23%	• United Kingdom	44%

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

In 2003 there were 7,992 reported cases of streptococcal bacteraemia, 6,036 reported cases of *Enterococcus spp* bacteraemia and 1,087 reported cases of *Acinetobacter spp* bacteraemia in England, Wales and Northern Ireland.[10,11,12] Of the two main enterococcal species, 16 per cent of *E. faecium* reports were resistant to vancomycin and 14 per cent were resistant to teicoplanin, while 2 per cent and 4 per cent of *E. faecalis* reports found resistance to vancomycin and teicoplanin respectively.[11] In 2003 there were 1,380 reports of the fungal *Candida* species in England, Wales and Northern Ireland, of which 54 per cent were identified as *Candida albicans*.[13] In England and Wales, there are on average between 130 and 250 outbreaks of norovirus gastroenteritis annually, of which 79 per cent occur in healthcare settings, either in hospitals or residential care homes.[14]

The prevalence of HCAIs in patients in primary and community care settings in the UK is not known. Many infections in these patients may have been acquired in hospital and only identified following early discharge into the community. In reducing the length of hospital stay, care which was previously delivered only in hospitals has progressively shifted to outpatient and home settings. Healthcare practitioners are increasingly working across the boundaries of acute and community care, and invasive procedures are performed in outpatient clinics, nursing home and home settings. These factors create the potential for patients to be at greater risk of acquiring HCAIs in a diverse range of environments and outside the hospital setting. As complex care is increasingly performed in primary and community care settings (eg minor surgery), the risk of infections associated with healthcare interventions increases. Community-acquired MRSA infection (C-MRSA) is when an MRSA infection occurs in a previously healthy individual who has no recognised risk factors associated with MRSA (eg no previous hospitalisation). In the UK, the term community-acquired MRSA may refer to infections in residential homes that are caused by hospital strains of MRSA. Some other countries (eg the USA) are describing strains of MRSA that have arisen in the community ('true' community MRSA) and are very different from hospital MRSA strains. There have been no systematic studies to establish how common C-MRSA infection is in the UK, but routine surveillance of MRSA isolates has identified approximately 100 cases over the last three years.[15]

In the UK, the HPA is responsible for developing strategies to prevent, control and monitor all HCAIs. The HPA has established a Steering Group on Healthcare Associated Infections that advises the DH on all matters relating to HCAIs and provides recommendations on developments required in the field. The DH recently undertook a consultation on proposed legislation to support the prevention and control of HCAIs, which included a draft Code of Practice incorporating clinical care protocols. The consultation, *Action on health care associated infection in England* (DH, 2005) closed in September 2005.[16] In Scotland, the HAI Task Force was established in 2003 to coordinate the development and implementation of the Ministerial HAI *Action Plan Preventing infections acquired while receiving health care* (Scottish Executive, 2002), to monitor progress in its implementation across NHSScotland, to monitor levels of HCAIs and to report on progress to the Scottish Executive Health Department (SEHD). The Scottish Executive has already developed and implemented the *NHSScotland code of practice for the local management of hygiene and healthcare associated infection* (Scottish Executive, 2004). The Welsh Healthcare Associated Infection Programme (WHAIP) established the Welsh Healthcare Associated Infection Sub Group (WHAISG) to develop an evidence base for control of HCAIs in Wales, to identify preventable aspects and audit compliance with agreed practices. The Communicable Disease Surveillance Centre Northern Ireland (CDSC (NI)), which forms part of the HPA, is responsible for monitoring changes in the incidence, prevalence and patterns of HCAIs in Northern Ireland.

Nature of the problem

There is no single cause for the increase in HCAIs in the UK; however, a number of factors contribute to the problem including:

1. Patient susceptibility

With the development of new treatments and improvement in traditional treatments, many more seriously ill patients are being treated. The degree of underlying illness in patients has been identified as one of the two strongest risk factors linked to HCAIs.[1] Patients with weaker immune systems are particularly at risk. This includes the very young and very old, patients in intensive care units and patients undergoing complex treatment or surgery – such as transplant or chemotherapy – that suppress their immune system.

2. Therapeutic interventions

The second of the two strongest risk factors linked to HCAIs has been identified as the use of medical devices such as catheters, tubes, drains and feeding lines. Their insertion breaches the body's natural defences and creates a pathway for micro-organisms to enter a patient's system. Risk of infection is increased the longer such devices dwell in a patient and where best practice in terms of hygiene and device management is not followed. Another major concern is the level of surgical site infections (SSIs) that are caused before, during or after surgical procedures. Complex surgery increases the vulnerability of patients as well as the length of time spent in hospital. SSIs are caused by organisms on the patient's own skin, organisms on the skin or clothing of operating theatre staff, organisms in the environment at the time of operation, operating on a contaminated site (eg bowel), incompletely sterilised surgical instruments, and unhygienic wound care in the post-operative period. Approximately 10 per cent of all HAIs are SSIs and these are estimated to result on average in an additional six and a half days hospital stay.[17] A report summarising the findings of a voluntary SSIs surveillance system in hospitals in England between 1997 and 2002 found that 49 per cent of SSIs were caused by Staphylococci, and that 81 per cent of these were *S. aureus*, of which 63 per cent were methicillin-resistant.[18] With short hospital stays, many SSIs do not become evident until discharge into the community.

3. Behaviour of healthcare professionals

Micro-organisms are commonly transmitted by staff, from one patient to another or from the environment to the patient. Failure of healthcare professionals to decontaminate their hands adequately between patients has been shown to contribute to the spread of infection.[1] Despite this, compliance with hand hygiene protocols among healthcare professionals is poor, thereby increasing the risk of cross-contamination.[19] Compliance levels vary significantly and it is difficult to determine the exact impact on the spread of HCAIs. Non-compliance results from a lack of understanding of the associated risks, a lack of knowledge of the guidelines, inadequate hand-washing facilities, time pressures, inadequate access to hand hygiene agents, and the irritation that may be caused by hand hygiene agents.[1]

4. Environmental factors

Micro-organisms that cause infection enter the healthcare system in many different, often unavoidable, ways. If the healthcare environment is not cleaned thoroughly and procedures to ensure the disinfection of instruments, beds and all other appliances are not followed, then the risk of infection is greatly increased. A poor level of cleanliness of instruments, floors and walls in clinical areas is one of the factors that may contribute to the spread of HCAIs.[2] In 2005, the Healthcare Commission carried out a brief audit of hospital cleanliness and infection control consisting of unannounced inspections of a sample of acute, community and mental health hospitals, in both the NHS and independent sectors in England. The results of the audit found that a third of hospitals visited (33 out of 98) achieved the highest standards of cleanliness, while 43 of the 98 hospitals failed to perform as well as they could.[20] There was clear evidence of systemic problems with cleanliness in 22 of the 98 hospitals, indicating that cleanliness was unsatisfactory for an environment in which clinical care is being provided.[20] Overall, the standards were found to be markedly poorer in mental health hospitals compared to acute hospitals. The Commission plans to use the collected information to carry out further inspections of the hospitals rated as performing poorly and will emphasise cleanliness as a priority in its inspections under the new annual health check for NHS organisations. A more detailed longer-term study of HCAIs is due to be undertaken in 2006. Further information can be found on the Healthcare Commission review website at **www.healthcarecommission.org.uk**.

5. Organisational factors

The risk of HCAIs is greatly increased by extensive movement of patients within the hospital and by very high bed occupancy. Improved medical knowledge and technology, and increasing patient throughput, places significant pressure on infection control teams that are often under-resourced and over-stretched. These factors create poor healthcare staff-to-patient ratios and mix patients with a wide range of serious illnesses from a large geographical area, thereby facilitating the spread of infection.

6. Estates and facilities

At present, many healthcare institutions are operating with insufficient isolation facilities including single-bed rooms and isolation wards, and inadequate numbers of hand-washing stations or access points providing disinfectant agents such as alcohol wipes.[2,3] An improved local infrastructure is required to control the spread of HCAIs and increase the likelihood of compliance with hygiene protocols.

7. Antimicrobial resistance

Antimicrobial resistance and multi-resistant micro-organisms make HCAIs more difficult to treat, inhibit recovery after surgical interventions, increase the length and severity of illness, prolong the period of infectiousness, and lengthen hospital admissions and costs. Antimicrobial treatment is an essential component of modern healthcare. The indiscriminate and inappropriate use of antimicrobials in medicine and agriculture promotes the emergence of antimicrobial resistance and multi-resistant micro-organisms.

Strategies for improvement: role of the healthcare professional

A reduction in the incidence and associated burden of HCAIs necessitates a long-term multidisciplinary approach involving many groups including healthcare professionals, healthcare employers, patients and regulatory bodies. There are several ways in which the spread and seriousness of HCAIs can be lessened or prevented. This section provides practical ways in which healthcare professionals can contribute to tackling the problem. In response to the resurgence of HCAIs, several sets of guidelines and initiatives have been developed to promote best practice with regard to preventing and controlling HCAIs. This document is aimed at healthcare professionals in both the primary and secondary care setting.

Although HCAIs cannot be eliminated, it is widely accepted that a significant proportion are avoidable as they result from cross-infection. The DH estimates that approximately 15 to 30 per cent of HCAIs are preventable.[21] It is worth noting that a reduction in the incidence of HCAIs by 15 per cent would free up £150 million a year for resources that could be used elsewhere.[3] The problem, however, is greater than just the incidence and spread of infection. The increasing difficulty in treating infection resulting from escalating antimicrobial resistance is of greater concern. In its 2003 publication *Winning ways: working together to reduce healthcare associated infection in England*,[1] the DH identified a number of actions aimed at reducing the relatively high levels of HCAIs and curbing the proliferation of antimicrobial resistant micro-organisms. These include responsibilities of healthcare professionals, while others relate to organisational and managerial concerns. One specific recommendation is the appointment of a director of infection prevention and control within each organisation providing NHS services.[1] This key individual will have responsibility for the prevention and control of HCAIs in the organisation(s). A series of national evidence-based guidelines has been developed that provide broad statements of good practice intended to inform the development of detailed operational protocols to prevent HCAIs. These include:

1. *The* epic *project: developing national evidence-based guidelines for preventing healthcare associated infections* – commissioned by the DH and focusing on developing the standard principles for preventing infections in hospitals, and those infections associated with the use of catheters.[21]
2. *Infection control: prevention of healthcare-associated infection in primary and community care* – commissioned by the National Institute for Health and Clinical Excellence (NICE) and focusing on preventing infections in primary and community care settings.[22]

Key action areas and recommendations from the infection control guidelines are outlined below along with the specific responsibilities of healthcare professionals. These guidelines and responsibilities apply to all healthcare professionals working in primary, secondary and community healthcare.

High standards of hygiene in clinical practice

Hand hygiene

Attention to simple preventive strategies can significantly reduce disease transmission rates. In order to prevent the spread of infection from one patient to another or from the environment or from healthcare staff to a patient, all healthcare professionals are duty bound to comply with hand-washing and other hygienic practice protocols. There is considerable evidence that patient contact results in contamination of healthcare professionals' hands by pathogens that cause HCAIs, including antimicrobial-resistant microbes.[21, 22] Staff not wearing gloves and dressing wounds infected with MRSA have an 80 per cent chance of carrying the organism on their hands for up to three hours.[23] Compliance with hand hygiene protocols, including the appropriate use of gloves (see the section on personal protective equipment), limits the spread of infection by removing these pathogens.[23] A systematic review of the evidence has not revealed any compelling evidence to favour the general use of antimicrobial hand-washing agents over soap, or one antimicrobial agent over another.[21]

It is vital that healthcare professionals consider the need to remove transient hand flora and use an appropriate preparation to decontaminate their hands. Effective hand-washing with a non-medicated liquid soap generally will remove transient micro-organisms and provide adequate hand decontamination for everyday clinical practice. Due to their residual effect, antimicrobial preparations should be used for invasive procedures and in outbreak situations because they provide hand antisepsis. Although alcohol does not remove dirt and organic material, alcohol-based handrubs are a highly acceptable alternative to hand-washing when the hands are not grossly soiled and are recommended for routine use. There is, however, no evidence that alcohol-based handrubs are effective in killing *C. difficile* spores on hands, although they can be removed with soap and water.[24] Healthcare professionals must wash their hands with non-medicated liquid soap and warm water in addition to using alcohol hand gels where *C. difficile* infection is confirmed or suspected.[24]

In maintaining high standards of hand hygiene, the use of elbow-operated or no-touch taps should be used to limit the spread of HCAIs by preventing recontamination of the hands after washing.[25] Effective hand hygiene is paramount and the single most important intervention in infection control. The DH recommends that each clinical team demonstrate consistently high levels of compliance with hand-washing and hand disinfection protocols (see box 3).[1] Low rates of compliance with hand hygiene protocols have been reported and identifying mechanisms to ensure compliance by health professionals remains a perplexing problem. Many factors are involved, including a lack of awareness of the risk of cross-transmission of pathogens, personal and organisational attitudes towards hand-washing, and various logistical barriers.[19,26,27] The issue is no longer whether hand hygiene is effective, but how to produce a sustained improvement in compliance. Feedback, behavioural and educational interventions may achieve this goal in conjunction with the influence of senior staff who should act as role models. The National Patient Safety Agency (NPSA) reports that increased compliance with hand-washing from healthcare professionals could result in reductions in infection rates ranging from 10 per cent to 50 per cent,[28] while a study using feedback data and encouraging the use of alcohol-based handrubs reported improved levels of compliance by 20 per cent.[29]

Box 3: Guidelines on the standard principles of hand hygiene

- Hands must be decontaminated immediately before each and every episode of direct patient contact/care and after any activity or contact that could potentially result in hands becoming contaminated.
- Hands that are visibly soiled or potentially grossly contaminated with dirt or organic material must be washed with liquid soap and water.
- Apply an alcohol-based handrub or wash hands with liquid soap if hands are visibly soiled, between caring for different patients and between different care activities for the same patient.
- Remove all wrist and hand jewellery before regular hand decontamination. Cuts and abrasions must be covered with waterproof dressings. Fingernails should be kept short, clean and free from nail polish.
- An effective hand-washing technique involves three stages: preparation, washing and rinsing, and drying. Preparation requires wetting hands under tepid running water before applying liquid soap or an antimicrobial preparation. The handwash solution must come into contact with all of the surfaces of the hand. The hands must be rubbed together vigorously for a minimum of 10 to 15 seconds, paying particular attention to the tips of the fingers, the thumbs and the areas between the fingers. Hands should be rinsed thoroughly before drying with good quality paper towels.
- When decontaminating hands using an alcohol handrub, hands should be free from 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.
- An emollient hand cream should be applied regularly to protect skin from the drying effects of regular hand decontamination. If a particular soap, antimicrobial handwash or alcohol product causes skin irritation an occupational health team should be consulted.

Source: *The* epic *project – developing national evidence-based guidelines for preventing healthcare associated infections* (DH, 2001)

The NPSA has introduced a hand-washing campaign aimed at improving compliance with hand hygiene in healthcare. The 'clean*your*hands'[28] campaign aims to improve patient safety by reducing the risk of infection through a toolkit of measures including:

- placing disinfectant handrubs near to where staff have patient contact, enabling staff to clean their hands at the right time and in a quick and effective manner
- displaying posters and promotional materials where they will influence staff and patients. Posters are changed monthly and some of the posters display photographs of staff champions who give their support to the campaign
- involving patients in improving hand hygiene by providing information leaflets, posters and stickers.

Safe use and disposal of sharps

Sharps such as needles, scalpels, stitch cutters and glass ampoules are a significant source of cross infection when handled inappropriately, with the main hazards of sharps injury including hepatitis B, hepatitis C and HIV. In the UK, 16 per cent of occupational injuries in hospitals are attributable to sharps,[21] while 7 per cent of the occupational exposure to bloodborne viruses between 1997-2001 occurred in healthcare personnel in primary and community care.[22] Safe disposal of sharps at the point of use is vital to reduce the risk of injury, exposure to bloodborne viruses and cross infection (see box 4). Some procedures carry a higher risk of injury including intra-vascular cannulation, venepuncture and injection.

Box 4: Guidelines on the safe 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 or broken prior to use or disposal.
- Needles and syringes must not be disassembled by hand prior to disposal.
- Used sharps must be discarded into a sharps container (conforming to UN3291 and BS 7320 standards) at the point of use. These must not be filled above the mark indicating that they are full.
- Containers in public areas must not be placed on the floor and should be located in a safe position.
- Consider the use of needlestick-prevention devices where proper risk assessment indicates that they are likely to reduce the risk of injury.
- 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.

Source: *The* epic *project – developing national evidence-based guidelines for preventing healthcare associated infections* (DH, 2001)

The Safer Needles Network has set up a new initiative '*Safer Needles Now!*'[30] to support the full implementation of the 2005 guidance issued by NHS Employers on the minimisation of needlestick injuries in the NHS.[31] The Safer Needles Network aims to reduce the number of needlestick injuries by promoting preventive measures and safer systems of working including the provision of safer needles, improved training and education, use of standard (universal) precautions, and better monitoring of the incidence of needlestick injuries and safer disposal of sharps. Further information on the Safer Needles Network can be found on its website at **www.needlestickforum.net.**

Personal protective equipment

Personal protective equipment is used to protect both healthcare staff and patients from the risks of cross-infection and includes items such as gloves, aprons, masks, goggles and/or visors. As with hand hygiene, patient contact results in contamination of protective equipment by pathogens that may lead to cross-infection if hygiene protocols are not adhered to (see box 5). Personal protective equipment of an approved standard should be used in every appropriate clinical care situation and properly disposed of after use. As there is a paucity of evidence that they are effective in preventing HCAIs, the unnecessary wearing of aprons, gowns and masks in everyday clinical settings is not recommended.[21, 22, 32]

Box 5: Guidelines on the use of personal protective equipment

- Select protective equipment on the basis of an assessment of the risk of transmission of micro-organisms to the patient, and the risk of contamination of healthcare practitioners' clothing and skin by patients' blood, body fluids, secretions and excretions.
- Gloves must be worn for invasive procedures, contact with sterile sites, and non-intact skin, 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 should be worn as single use items. Put gloves on immediately before an episode of patient contact or treatment and remove them as soon as the activity is completed. Change gloves 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 should be decontaminated following the removal of gloves.
- Gloves conforming to European Community (CE) standards and of an acceptable quality must be available in all clinical areas.
- Alternatives to natural rubber latex (NRL) gloves must be available for use by practitioners and patients with NRL sensitivity.
- Powdered and polythene gloves should not be used in healthcare activities.
- Disposable plastic aprons should be worn when there is a risk that clothing or uniform may become exposed to blood, body fluids, secretions and excretions, with the exception of sweat.
- Full body, fluid repellent gowns should be worn where there is a risk of extensive splashing of blood, body fluids, secretions and excretions, with the exception of sweat, on to the skin of healthcare practitioners.
- Plastic aprons should be worn as single use items for one procedure or episode of patient care and then discarded and disposed of as clinical waste.
- Face masks and eye protection should be worn where there is a risk of blood, body fluids, secretions and excretions splashing into the face and eyes.
- Respiratory protective equipment should be used when clinically indicated.

Source: *The* epic *project – developing national evidence-based guidelines for preventing healthcare associated infections* (DH, 2001)

Dress code in the clinical setting

Research has shown that pathogenic micro-organisms including *S. aureus*, *C. difficile* and GRE are frequently carried on clothes, representing a potential source of cross infection in the clinical setting.[33, 34, 35, 36] Maximum contamination occurs in areas of greatest hand contact (eg pockets and cuffs) thereby resulting in re-contamination following hand-washing.[37] Certain clothes such as ties are rarely laundered but worn daily, commonly outside the healthcare environment. Ties perform no beneficial function in patient care and have been shown to be colonised by pathogens.[36] They are regularly handled by the owner and come into contact with numerous objects. Ties have the potential, therefore, to act as a vector for the transmission of HCAIs. Studies have shown that closely woven cotton is suitable for wearing in clinical practice as it has a low bacterial transfer rate that minimises cross-infection and is durable enough to be washed at high temperatures.[38, 39]

Healthcare professionals have a responsibility to minimise the spread of HCAIs by wearing appropriate clothing in the clinical setting. As outlined above, aprons or gowns should only be worn when there is a risk that clothing or uniform may become exposed to blood, bodily fluids, secretions and excretions. Under all other circumstances, the Board of Science suggests that healthcare professionals should:

- wear clothes that minimise the spread of infection (eg those made from closely woven cotton) and that are laundered frequently
- refrain from wearing functionless clothing items such as ties
- where possible, change clothes when leaving the clinical setting and avoid unnecessary journeys outside the healthcare environment
- travel directly between locations when working in the primary or community healthcare setting
- ensure that clothes are thoroughly laundered and remain separate from other clothing items
- presume some degree of contamination, even on clothing which is not visibly soiled.

To reduce the spread of HCAIs, healthcare professionals must ensure that they demonstrate consistently high levels of compliance with the standards of hygiene and aseptic technique set out above. To improve patient outcomes and reduce healthcare costs, it is essential that this is achieved across the healthcare setting.

Further information

- Further information on the NPSA 'clean*your*hands' campaign can be found on the NPSA website at **www.npsa.nhs.uk/cleanyourhands**
- NHS Education for Scotland has launched a '*Cleanliness Champions*' initiative to promote the prevention and control of HCAIs in NHSScotland. This provides a major educational resource designed to equip staff with the skills and knowledge they need to ensure good practice in preventing HCAIs. Further information can be found on its website at **www.space4.me.uk/hai**
- More detailed information can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003), *Infection control: prevention of healthcare-associated infection in primary and community care* (NICE, 2003) and *The* epic *project – developing national evidence-based guidelines for preventing healthcare associated infections* (DH, 2001).

Reducing the risk of infection from the use of indwelling devices

With the body's natural defences transiently breached, it is very common for infection to be transmitted at the site where devices such as catheters, tubes and cannulae enter the body. The impact of medical devices is highlighted by the fact that 80 per cent of urinary infections, which make up 23 per cent of all HCAIs, can be traced back to indwelling urinary catheters, while 60 per cent of bacteraemia infections are introduced by intravenous feeding lines, catheters or similar devices.[1] In a study of the sources of bacteraemia in English hospitals between 1997 and 2002, almost two-thirds of bacteraemias were associated with an intravascular device or with device-related infections.[18] In order to prevent infection it is important that these devices are sterilised and are used and managed in an appropriate and hygienic manner.

There is a wide variety of indwelling devices used in the healthcare setting and specific guidelines have been developed to prevent infections associated with the use of urinary catheters, central venous lines, parenteral and enteral feeding lines, peripheral intravenous cannulae and respiratory support apparatus (see boxes 6-11). The risk of infection with indwelling devices is associated with the method and duration of insertion, the quality of device care and host susceptibility. The use of indwelling devices is commonplace in hospitals and is increasing in primary and community settings. Long-term urinary catheterisation and enteral feeding are routinely used in the community for the management of elderly patients. With enteral feeding, the contamination of feeds is a key concern because it has been found that more than 30 per cent of feeds in hospital and home are contaminated with a variety of micro-organisms, largely due to the preparation or administration of feeds, and this has been linked to serious clinical infection.[22] Patients in the community with chronic health conditions may require short or long-term central vascular access as a necessary component of their treatment. The management of indwelling devices is an area where healthcare professionals, carers and patients in all healthcare settings have an important responsibility for the control of HCAIs.

Box 6: Care of patients with long-term urinary catheters

- Urinary catheters should only be used when there is no suitable alternative, and even then kept in place for as short a time as possible.
- Where long-term indwelling use is unavoidable, a catheter of low allergenicity will be used.
- Urinary catheter insertion, manipulation, washing out, urine sampling and removal will be undertaken by trained and competent staff using strictly aseptic techniques.
- Patients and carers will be educated in catheter maintenance with an emphasis on the techniques for reducing risk of infection.
- The date of insertion and date of removal of the device will be documented in the clinical record as a matter of routine.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Box 7: Care of patients with central venous catheters

- Central venous line insertion, manipulation, and removal will be undertaken by trained and competent staff using strictly aseptic techniques.
- Central venous line catheters will not be replaced over a guide wire if infection is present.
- A dedicated occlusive transparent dressing will be used to allow continuous inspection of the exit site and will be changed at no later than seven days.
- The date of insertion and date of removal of the device will be documented in the clinical record as a matter of routine.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Box 8: Care of patients during enteral feeding

Preparation and storage of feeds

- Wherever possible pre-packaged, ready-to-use feeds should be used in preference to feeds requiring decanting, reconstitution or dilution.
- The system selected should require minimal handling to assemble, and be compatible with the patient's enteral feeding tube.
- Effective hand decontamination must be carried out before starting feed preparation.
- When decanting, reconstituting or diluting feeds, a clean working area should be prepared and equipment dedicated for enteral feed use only should be used.
- Feeds should be mixed using cooled boiled water or freshly opened sterile water and a no-touch technique.
- Feeds should be stored according to manufacturer's instructions and, where applicable, food hygiene legislation.
- Where ready-to-use feeds are not available, feeds may be prepared in advance, stored in a refrigerator, and used within 24 hours.

Administration of feeds

- Minimal handling and an aseptic no-touch technique should be used to connect the administration system to the enteral feeding tube.
- Ready-to-use feeds may be given for a whole administration session, up to a maximum of 24 hours. Reconstituted feeds should be administered over a maximum four-hour period.
- Administration sets and feed containers are for single use and must be discarded after each feeding session.

Care of insertion site and enteral feeding tube

- The stoma should be washed daily with water and dried thoroughly.
- To prevent blockage, the enteral feeding tube should be flushed with fresh tap water before and after feeding or administrating medications. Enteral feeding tubes for patients who are immunosuppressed should be flushed with either cooled freshly boiled water or sterile water from a freshly opened container.

Source: *Infection control – prevention of healthcare-associated infection in primary and community care* (NICE, 2003)

Box 9: Care of patients during parenteral feeding

- Intravenous feeding lines will only be used when there is no suitable alternative, and even then kept in place for as short a time as possible.
- Insertion, manipulation, and removal of intravenous feeding lines will be undertaken by trained and competent staff using strictly aseptic techniques.
- A dedicated line or lumen of a multi-channel line will be used. No other infusion or injection will go via this route. Three-way taps will not be used.
- Any additives to intravenous fluid containers will be introduced aseptically in a unit or safety cabinet designed for the purpose, by trained staff using strictly aseptic techniques.
- Intravenous feeding cannulae insertion sites will be regularly inspected for signs of infection and the cannula removed if infection is suspected.
- The date of insertion and date of removal of the device will be documented in the clinical record as a matter of routine.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Box 10: Care of patients with peripheral intravenous cannulae

- Intravenous cannula insertion should be carried out by trained and competent staff using strictly aseptic techniques.
- The number of lines, lumens and stopcocks will be kept to the absolute minimum consistent with clinical need.
- Peripheral intravenous cannulae insertion sites will be regularly inspected for signs of infection and the cannula removed if infection is suspected.
- Peripheral intravenous cannulae will be kept in place for the minimum time necessary and changed every 72 hours irrespective of the presence of infection.
- Administration sets will be changed immediately following a blood transfusion, intravenous feed or at 24 hours (whichever is sooner). For other clear fluids, change will occur at 72 hours.
- The date of insertion and date of removal of the device will be documented in the clinical record as a matter of routine.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Box 11: Care of patients on respiratory support systems

- Ventilator tubing will only be changed when visibly soiled or malfunctioning.
- Gloves will be worn for handling respiratory secretions or contaminated objects.
- Gloves and appropriate personal protection will be used when aspirating respiratory secretions.
- Hands will be decontaminated after glove removal.
- The date of insertion and date of removal of the device will be documented in the clinical record as a matter of routine.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Further information

- More detailed information can be found in *Urinary catheterisation and catheter care: best practice statement* (NHS QIS, 2004), *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003), *Infection control: prevention of healthcare-associated infection in primary and community care* (NICE, 2003) and *The* epic *project – developing national evidence-based guidelines for preventing healthcare associated infections* (DH, 2001).
- Specific guidance for the use of arterial catheters can be found in a publication from the Royal College of Nursing (RCN), *Standards for infusion therapy* (RCN, 2005).

Optimal use of antimicrobials

Antimicrobial resistance and multi-resistant micro-organisms complicate prevention and control of HCAIs and exacerbate the associated problems of infection. It is widely acknowledged that complacency, poor prescribing practice and misuse of antimicrobials are major factors in the emergence of drug resistant infections. The unsystematic and inappropriate prescribing of antimicrobials to treat infection within the healthcare setting promotes the emergence of antimicrobial resistance and multi-resistant micro-organisms.[40] In June 2000, the DH published the UK Antimicrobial Resistance Strategy and Action Plan that outlines key actions required by many organisations to tackle the growing problem of antimicrobial resistance.[41] One key area identified in this report that has responsibilities for healthcare professionals was prudent use of antimicrobials in humans, and in particular, promotion of optimal antimicrobial prescribing in clinical practice through professional education, tailored information, guidelines and prescribing support, and organisational support. In 2003, new funding was provided by the DH for the development of a hospital pharmacy initiative for promoting prudent use of antimicrobials in hospitals in England.[42] The funding was designed to facilitate the development of clinical pharmacy services and provide a focus on antimicrobials management in key areas such as antimicrobials use in surgical prophylaxis, antimicrobials use in children, and infection control. The initiative has led to the appointment of 'antibiotic pharmacists' by NHS trusts who play a key role in developing appropriate antimicrobials policies.

Healthcare professionals have a responsibility to reduce the development of antimicrobial resistance by ensuring optimal use of antimicrobials (see box 12). This includes preventing the unnecessary prescribing of antimicrobials, tailoring antimicrobial treatment to the specific infection and encouraging patients to complete the course of antimicrobials correctly. This should be complemented by strict adherence to infection control measures including hygiene protocols. The vast majority of antimicrobial prescribing occurs in primary care (80 per cent) and approximately half of these antimicrobials are prescribed for respiratory tract infections, a high proportion of which are caused by viral pathogens or self-limiting bacterial infections.[43] Prescribing antimicrobials as a result of diagnostic uncertainty can be counterproductive as they are a potentially inappropriate treatment for the infection, and can reinforce patient beliefs that antimicrobials are universally beneficial and encourage future consultations. Antimicrobial prescribing is heavily influenced by patient pressure. Healthcare professionals have a responsibility to assist in educating patients and the public about the limitations of antimicrobials and the harmful effects of over-prescribing, so that they are less demanding for antibiotic prescriptions.

Box 12: Action areas and guidelines for the prudent use of antimicrobials

- Antimicrobials will normally be used only after a treatable infection has been recognised or there is a high degree of suspicion of infection.
- Choice of antimicrobial will normally be governed by local information about trends in antimicrobial resistance or a known sensitivity of the organism.
- Antimicrobials will only be taken by patients over the prescribed period at the correct dose.
- Prescription of antimicrobials for children will be carefully considered; they are often unnecessarily prescribed for common viral infections and the child is subsequently more likely to develop a resistant infection.
- Support for prudent antimicrobial prescribing in hospitals will be provided by the clinical pharmacists, medical microbiologists and infectious diseases physicians on the staff.
- Antimicrobials will be used for prevention of infection only where benefit has been proven.
- Narrow spectrum antimicrobials will be preferred to the broad spectrum groups.

Source: *Winning ways – working together to reduce healthcare associated infection in England* (DH, 2003)

Further information

- The HPA is responsible, through the Antibiotic Resistance Monitoring and Reference Laboratory (ARMRL) and the Laboratory of Healthcare Associated Infection (LHCAIs), for the detection and investigation of antimicrobial resistance. The HPA has developed evidence-based guidance on the use of antimicrobials and the management of common infections in primary care, outlining treatment options including first and second-line antimicrobial choices, if appropriate. This guidance is available on the HPA website at **www.hpa.org.uk/infections/topics_az/antimicrobial_resistance/guidance.htm**
- Guidance on managing common infections is available from the computerised decision support system, PRODIGY that can be accessed at **www.prodigy.nhs.uk**
- Information from the DH on antimicrobial resistance can be found on its website at **www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/AntimicrobialResistance/fs/en**
- Further information on antimicrobial resistance can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003), *UK antimicrobial resistance strategy and action plan* (DH, 2000) and *The path of least resistance: summary and recommendations* (Standing Medical Advisory Committee Sub-group on Antimicrobial Resistance, 1998).

Active surveillance and investigation

High quality information on HCAIs and antimicrobial resistance is essential to tracking progress, investigating underlying causes and instituting prevention and control measures. The availability of complete and accurate information to clinical staff and patients has been recognised as the cornerstone of infection control.[1] The DH identified active surveillance and investigation as one of the key action areas in controlling HCAIs. In England, the HPA Centre for Infection (CFI) is responsible for the surveillance and monitoring of HCAIs through a national surveillance scheme co-ordinated by the Healthcare Associated Infection and Antimicrobial Resistance (HCAIs & AMR) Department of the Communicable Disease Surveillance Centre (CDSC). As part of the national HCAIs surveillance initiative, mandatory surveillance in England was introduced for MRSA in 2001, followed by GRE in 2003, *C. difficile* in 2004 and orthopaedic SSIs in 2004. In addition, a voluntary initiative known as the Surgical Site Infection Surveillance Service (SSISS) (formerly the Nosocomial Infection National Surveillance Scheme) was established in 1996 to encourage the surveillance of SSIs.

In Wales, the WHAISG is responsible for surveillance of HCAIs and mandatory surveillance of MRSA was introduced in 2001, followed by SSI for knee and hip operatives in 2003 and *C. difficile* in hospital inpatients aged over 65 in 2005. Health Protection Scotland (HPS) is responsible for surveillance of HCAIs in Scotland where mandatory surveillance of MRSA was introduced in 2001, followed by SSI in 2002. The Healthcare-associated Infection Surveillance Centre (HISC) is responsible for surveillance of HCAIs in Northern Ireland where mandatory surveillance of MRSA was introduced in 2002 followed by *C. difficile* in 2005. All hospitals in Northern Ireland performing adult orthopaedic procedures have participated in a SSI surveillance initiative organised by the HISC. There is, however, no national mandatory surveillance scheme for all HCAIs and the full extent of the problem remains difficult to gauge. Although mainly an organisational and managerial concern, healthcare professionals have an important role to ensure that accurate records are maintained and that all new infections are accurately reported if surveillance is to be effective.

Further information

- Action areas and guidelines on active surveillance and investigation can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003).
- Details of the activities and roles of the Healthcare Associated Infection and Antimicrobial Resistance (HCAIs & AMR) Department can be found on the HPA website at **http://www.hpa.org.uk/infections/about/dir/dir_hcai.htm**

Reducing reservoirs of infection

The risks of HCAI is greatly increased by extensive movement of patients within the hospital, by very high bed occupancy and by an absence of suitable facilities to isolate infected patients. For a person to become infected with an HCAI there has to be a source or reservoir of the micro-organism that can cause the infection and a vector or means of transmission. Reducing reservoirs of infection is particularly important and encompasses healthcare building design and procurement, high standards of cleanliness, engineering standards (eg ventilation), decontamination of surgical instruments and organisational management. For example, to facilitate adherence to hand hygiene protocols, it is vital that there is sufficient access to sinks close to each patient.

The spread of HCAIs is associated with high bed occupancy rates and movement of patients. The increased throughput of patients to meet performance targets has resulted in considerable pressure towards higher bed occupancy, which is not consistent with good infection control and bed management practices. In England, the average daily bed occupancy of general and acute beds has risen from 80.8 per cent in 1996-97 to 85.8 per cent in 2004-05.[44] In 2004, 71 per cent of NHS trusts were operating with bed occupancy rates above the 82 per cent target set by the DH.[2] Analysis of performance indicators by the NAO found that lower bed occupancy rates were associated with lower rates of MRSA infection in 2002-03.[2]

A large body of clinical evidence derived from case reports and outbreak investigations links poor environmental hygiene with the transmission of micro-organisms causing HCAIs.[21] A review of international literature highlights a growing recognition of the relationship between the effective cleaning of hospitals and the spread of infection.[2] Good hygiene standards in healthcare environments are an integral and important component of a strategy for preventing HCAIs. Hospital environmental hygiene encompasses a wide range of routine activities including cleaning, decontamination, laundry and housekeeping, safe collection and disposal of general and clinical waste, and good kitchen and food hygiene. Recently, attention has focused on falling standards in hospital cleanliness and concern over the introduction of compulsory comprehensive tendering of cleaning contracts, the reduction in the number of cleaners in the healthcare environment and the rapid turnover of cleaning personnel over time. According to the public service union UNISON, the number of cleaners in the NHS has fallen over the last 20 years from 100,000 to a low of 55,000 in 2003-04.[45] Cleaning staff endure low pay, poor conditions, inadequate cleaning equipment, an intensification of work and a decline in job satisfaction that in turn leads to a high turnover of cleaning staff.[45] Since 2000, recognition of concerns over cleaning standards has been translated into a number of initiatives including the publication of national standards of cleanliness, an NHS Healthcare Cleaning Manual, infection control guidelines on the planning and design of healthcare facilities, and annual inspections of hospitals by Patient Environment Action Teams (PEATs).

It is vital that healthcare managers, infection control teams, clinical teams and non-clinical staff work together to ensure that infection control considerations are an integral part of healthcare environmental cleanliness, surgical instrument decontamination and bed management policies. Healthcare professionals have responsibilities to ensure that:

- the hospital environment is visibly clean, free from dust and soilage, and acceptable to patients, their visitors and staff
- any equipment used for more than one patient (eg commode, bath hoist) is cleaned following each and every episode of use
- statutory requirements are met in relation to the safe disposal of clinical waste, laundry arrangements for used and infected linen, food hygiene and pest control.

Further information

- Action areas and guidelines on reducing reservoirs of infection can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003).
- NHS Estates has produced a number of guidance documents including *National standards of cleanliness for the NHS* (NHS Estates, 2001), *Housekeeping: a first guide to new, modern and dependable ward housekeeping services in the NHS* (NHS Estates, 2001), *A guide to decontamination of reusable surgical instruments* (NHS Estates, 2003), *Revised guidance on the contracting for cleaning* (NHS Estates, 2004) and *The NHS healthcare cleaning manual* (NHS Estates, 2004).
- Details of the action being taken to improve hospital cleanliness are outlined in the DH publications *Towards cleaner hospitals and lower rates of infection – a summary of action* (DH, 2004) and *A matron's charter: an action plan for cleaner hospitals* (DH, 2004).
- Recommendations from the NAO on the strategic management of HCAIs can be found in *The management and control of hospital acquired infection in acute NHS trusts in England* (NAO, 2000) and *Improving patient care by reducing the risk of hospital acquired infection: a progress report* (NAO, 2004).
- Guidance developed by the HAI Task Force of the Scottish Executive Health Department on the specifications for cleaning services can be found in *NHSScotland national cleaning services specification* (SEHD, 2004).
- Further information on the PEATs can be found at **http://patientexperience.nhsestates.gov.uk/clean_hospitals/ch_content/home/home.asp**

Management and organisation

In addition to the responsibilities of healthcare professionals, tackling HCAIs necessitates senior managerial commitment and the development of local infrastructure and systems. All healthcare providers should have suitable management and evaluation systems in place that define responsibility and accountability for infection prevention and control. Managerial interest at a strategic level and the commitment and support of senior management and heads of clinical directorates are essential.

Further information

- Action areas and guidelines on management and organisation of HCAIs can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003).
- The DH has launched a programme, '*Saving Lives: a delivery programme to reduce healthcare associated infections (HCAIs) including MRSA*' that is designed to support NHS trusts in reducing HCAIs through a series of tools and supporting information. It has developed five high impact interventions in the form of simple evidence-based tools including preventing the risk of microbial contamination, central venous catheter care, preventing surgical site infections, care of ventilated patients and urinary catheter care. These review tools provide checklists for the standard protocols that should be followed, and can be used to monitor the level of compliance and improve the reliability of the clinical process. Further information can be found on the DH website at **www.dh.gov.uk**
- Recommendations from the NAO on the strategic management of HCAIs can be found in *The management and control of hospital acquired infection in acute NHS trusts in England* (NAO, 2000) and *Improving patient care by reducing the risk of hospital acquired infection: a progress report* (NAO, 2004).

Screening and isolation

In reducing the risk and spread of HCAIs, screening and isolation of patients provides a preventive and proactive method of infection control practice. Patients are not currently routinely screened for any HCAI when they enter healthcare environments, although some may be screened pre-operatively where there is considered to be a high risk of infection. When an HCAI is suspected, swabs are taken and sent for diagnosis. If positive, isolation measures to limit the spread of an HCAI include:

- putting patients into isolation wards
- 'nurse cohorting': physically segregating infected patients in one part of a ward, with nursing by designated staff
- putting cohorts of patients on general wards (without designated nursing staff)
- use of single-bedded rooms
- healthcare workers using barrier precautions (gowns, gloves, masks) as physical barriers to transmission.[46]

A study of MRSA bacteraemia in patients on arrival in a hospital between 1997 and 2003 found that a quarter of hospital cases occur in patients who have previously been in hospital and were subsequently readmitted.[47] In its proposed code of practice for reducing HCAIs, the DH has indicated that there should be written protocols for the screening and isolation of potentially colonised or infected patients in specified risk categories.[16] The proposals outline a system of evidence-based clinical care protocols that encompass infection control of patients in isolation, and incorporate pre-admission screening for MRSA and screening of high risks groups for GRE. Screening of healthcare professionals is usually only done in the context of an outbreak because of the practical difficulties and limited usefulness of continuous or regular screening.

Further information

- The DH draft code of practice for the prevention and control of HCAIs, including isolation and screening criteria can be accessed on its website at **www.dh.gov.uk**
- The HAI Task Force working group of the SEHD is currently developing a draft document on the management of incidents and outbreaks of HCAI, including guidance on staff screening. Further information can be found on the SEHD website at **www.show.scot.nhs.uk/sehd**

Information for patients and visitors

Healthcare professionals have a responsibility to provide information to patients and visitors on all aspects of HCAIs without compromising confidentiality. The Board of Science suggests this should include information on:

- the basic facts about HCAIs including what they are, how they are spread, how they can be prevented and treated
- what precautions patients and visitors can take to prevent the development and spread of HCAIs. For example, explaining clearly hygiene protocol guidelines within the healthcare environment and following discharge into the community, particularly with respect to the care of wounds, hand decontamination and the management of indwelling devices
- patients need to be informed of the importance of completing antimicrobial courses and encouraged to have realistic expectations on the treatment of simple ailments (eg sore throats), and not to put undue pressure on healthcare professionals to prescribe antimicrobials
- how HCAIs might affect patient care and increase the complexities of treatment of other conditions or illnesses.

Patients have a role to play in monitoring and reporting on standards of cleanliness in the healthcare setting. Healthcare professionals should ensure they take regular, formal feedback from patients about cleanliness, and encourage patients and visitors to highlight any problems or concerns.

Further information

- General information on HCAIs provided by the HPA can be found on its website at **www.hpa.org.uk/infections/topics_az/hai/gen_inf.htm**
- Information on MRSA for patients and their carers can be found in a publication by the HPA *MRSA: information for patients* (HPA, 2003).
- The DH has produced two publications, *A simple guide to MRSA* (DH, 2005) and *A simple guide to Clostridium difficile* (DH, 2005), that provide basic information on the respective HCAIs.
- NICE has produced the publication *Prevention of healthcare-associated infections in primary and community care: understanding NICE guidance – information for patients, their carers and the public* (NICE, 2003). This accompanies the NICE infection control guidelines developed for healthcare professionals that focuses on preventing infections in primary and community care settings. It provides explanatory notes on the guidelines but focuses on what patients and carers can do themselves to prevent infection, particularly when they have had medical devices inserted.
- The NPSA 'clean*your*hands' campaign provides useful information to patients on the required standards of hygiene in clinical practice, and is designed to empower patients and their carers to challenge healthcare professionals to maintain these standards. Further information is available on the NPSA website at **www.npsa.nhs.uk/cleanyourhands**
- The DH has produced two publications that provide information for healthcare professionals on the role and responsibilities of patients including, *Towards cleaner hospitals and lower rates of infection: a summary of action* (DH, 2004) and *A matron's charter: an action plan for cleaner hospitals* (DH, 2004).
- The SEHD has produced five top tips for patients and visitors to combat HCAIs which can be found at **www.scotland.gov.uk/Publications/2004/08/hai**

Research and development

The prevention and control of HCAIs requires the continual development of proactive measures and intervention strategies aimed at reducing the spread of infection, inhibiting the development of antimicrobial resistance and combating existing infections. This in turn necessitates scientific and clinical research to increase our understanding of all aspects of HCAIs. Relatively little evidence-based research has been conducted into the best methods to reduce and combat HCAIs.[46] The DH has invested £3 million for new research programmes into HCAIs,[48] but it has been argued that this level of funding is inadequate.[46] The new research programmes include a national research strategy to address gaps in current scientific and clinical knowledge, a rapid review process to fast-track promising innovative procedures and the establishment of a research network for HCAIs.[1] Despite our increased understanding of the mechanisms of antibiotic resistance, the likelihood of the development of new antibiotics is limited. Development requires significant investment from the pharmaceutical industry, yet any new antibiotic is likely to be used sparingly to prevent the emergence of resistant micro-organisms. Pharmaceutical companies would therefore face difficulties in recovering developmental and production costs.

Further information

- Action areas and guidelines research and development for HCAIs can be found in *Winning ways: working together to reduce healthcare associated infection in England* (DH, 2003).

Recommendations

For the prevention and control of HCAIs to be effective, a multi-dimensional approach is required at both an institutional and individual level. Infection prevention and control activities have to be embedded into everyday practice and applied consistently by everyone. Healthcare professionals have a number of responsibilities in reducing the burden and level of HCAIs. There is no point in adhering to these intermittently or following some guidelines and not others. It is imperative that all healthcare professionals share this responsibility for infection prevention and control, rather than some doing it and not others.

- Healthcare professionals must be aware of the current evidence-based national guidelines for the control and prevention of HCAIs, and ensure these are effectively implemented in every clinical setting.

- Healthcare professionals should ensure they comply with the high standards of hygiene in clinical practice, and in particular with respect to:
  - hand hygiene protocols
  - the use of personal protective equipment
  - the safe disposal of sharps
  - dress code in the clinical setting.

- Healthcare professionals should ensure they adhere to guidelines on the management and use of indwelling devices including urinary catheters, central venous catheters, arterial catheters, enteral and parenteral feeding equipment, peripheral intravenous cannulae and respiratory support equipment.

- To reduce the development of antimicrobial resistance, healthcare professionals should ensure they achieve optimal antimicrobial prescribing.

- In addition to carrying out their own responsibilities appropriately, healthcare professionals are duty bound to ensure that their colleagues fulfil their responsibilities with regard to infection prevention and control.

- Senior healthcare professionals should lead by example by demonstrating good infection control and hygiene practices. This should include ensuring that junior staff members adhere to the same principles.

- Healthcare professionals and managers should ensure that they provide clear information to patients on HCAIs and advice on how they can help to prevent and control them.

Key publications, further reading and sources of information

This listing of organisations and publications is intended as a guide for those wishing to know more about HCAIs in the UK. The BMA is not responsible for the content of external websites, nor does it endorse or otherwise guarantee the veracity of statements made in non-BMA publications.

Useful reading

Chief Medical Officer (2005) *Protecting patients and staff – a strategy for prevention and control of healthcare associated infections in Northern Ireland 2005 – 2010*. Belfast: Department of Health, Social Services and Public Safety.

Royal College of Nursing (2005) *Good practice in infection prevention and control: guidance for nursing staff.* London: Royal College of Nursing.

Scottish Executive Health Department (2005) *Infection control in adult care homes: final standards*. Edinburgh: Scottish Executive.

Royal College of Nursing (2005) *Standards for infusion therapy*. London: Royal College of Nursing.

Department of Health (2004) *Towards cleaner hospitals and lower rates of infection. A summary of action.* London: Department of Health.

Department of Health (2004) *A matron's charter: an action plan for cleaner hospitals.* London: Department of Health.

Pellowe C, Pratt & R Loveday H et al (2004) The *epic* project: updating the evidence-base for national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England: a report with recommendations. *British Journal of Infection Control* **15**:10-16.

National Audit Office (2004) *Improving patient care by reducing the risk of hospital acquired infection: a progress report*. London: The Stationery Office.

Scottish Executive Health Department (2004) *The NHSScotland code of practice for the local management of hygiene and healthcare associated infection (HAI)*. Edinburgh: Scottish Executive.

NHS Quality Improvement Scotland (2004) *National progress report: healthcare associated infection (HAI); infection control in NHSScotland*. Edinburgh: NHS Quality Improvement Scotland.

NHS Quality Improvement Scotland (2004) *Urinary catheterisation and catheter care: best practice statement.* Edinburgh: NHS Quality Improvement Scotland.

NHS Estates (2004) *The NHS healthcare cleaning manual*. London: Department of Health.

Welsh Assembly Government (2004) *Healthcare associated infections: a strategy for hospitals in Wales*. Cardiff: Welsh Assembly Government.

Scottish Executive Health Department (2004) *The NHSScotland national cleaning services specification*. Edinburgh: Scottish Executive.

National Institute for Health and Clinical Excellence (2003) *Infection control: prevention of healthcare-associated infection in primary and community care*. London: NICE.

Department of Health (2003) *Getting ahead of the curve: a strategy for combating infectious diseases.* London: Department of Health.

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Useful websites

Department of Health
http://www.dh.gov.uk

Health Protection Agency
http://www.hpa.org.uk

National Institute for Health and Clinical Excellence
http://www.nice.org.uk

National Audit Office
http://www.nao.org.uk

National Patient Safety Agency
http://www.npsa.nhs.uk

Hospital Infection Society
http://www.his.org.uk

Healthcare Commission
http://www.healthcarecommission.org.uk

Healthcare Standards Unit
http://www.hcsu.org.uk

Healthcare Associated Infection and Infection Control
http://www.show.scot.nhs.uk/scieh/infectious/infhospital.html

Welsh Healthcare Associated Infection Programme (WHAIP)
http://www.wales.nhs.uk/sites/home.cfm?OrgID=379

Communicable Disease Surveillance Centre Northern Ireland
http://www.cdscni.org.uk

Other resources

Department of Health (DH) initiative *Saving Lives: a delivery programme to reduce healthcare associated infection (HCAIs) including MRSA*

National Patient Safety Agency (NPSA) 'clean*your*hands' campaign
http://www.npsa.nhs.uk/cleanyourhands

NHS Education for Scotland '*Cleanliness Champions*' initiative
http://www.space4.me.uk/hai

Royal College of Nursing '*Wipe it out*' campaign
http://www.rcn.org.uk/resources/mrsa

National Resource for Infection Control
http://www.nric.org.uk

Appendix

Summary information on the micro-organisms causing HCAIs that are of particular significance:

Staphylococcus aureus This Gram-positive bacterium frequently colonises human skin and mucosa and is found in up to 30 per cent of the population. *S. aureus* is a common cause of food poisoning as well as skin and wound infections, urinary tract infections, pneumonia and bacteraemia. *S. aureus* is a major cause of HCAIs but most strains are sensitive to many antibiotics, and infections can be effectively treated. Some *S. aureus* strains have developed resistance to conventional antibiotics, including methicillin, and are known as methicillin-resistant *Staphylococcus aureus* (MRSA). Effective treatment for MRSA infections is usually with the glycopeptide antibiotics vancomycin or teicoplanin. However, the emergence of vancomycin-resistant *Staphylococcus aureus* (VRSA) is causing concern.

Glycopeptide-resistant enterococci (GRE) Enterococci are bacteria found in the faeces of humans and many animals and they commonly cause urinary tract infections and wound infections as well as bacteraemia, and occasionally endocarditis and meningitis. Enterococci frequently colonise open wounds and skin ulcers. Minor infections can be treated by common antibiotics. However, only aminopenicillins, or teicoplanin and vancomycin are reliably effective against serious enterococcal infections. *Enterococcus faecalis* and *Enterococcus faecium* have emerged as leading nosocomial pathogens in recent years. Enterococci are among the most antibiotic resistant bacteria isolated from humans. GRE, and in particular Vancomycin Resistant Enterococci (VRE), have emerged as major nosocomial pathogens as they are typically resistant to multiple antimicrobials and treatment is extremely difficult, often limited to linezolid.

Clostridium difficile This is a Gram-positive, spore-forming bacterium that is present in the natural flora of the gut in up to 3 per cent of healthy individuals. *C. difficile* causes illness when the 'normal' bacteria in the gut are disturbed by certain antibiotics. Through the production of toxins, *C. difficile* can cause diarrhoea which may be mild and resolve once antibiotic treatment ceases, or it can cause more severe colitis and life-threatening colitis with or without pseudo-membrane formation. The elderly are most at risk with over 80 per cent of cases reported in the over 65 years age group. Immuno-compromised patients are also at risk. The micro-organism produces spores that can exist in the environment and may be transmitted from patient to patient or via healthcare workers.

Streptococcus pneumoniae This Gram-positive bacterium colonises the nasopharyngeal mucosal epithelium and is a major cause of community-acquired pneumonia (CAP), invasive pneumococcal disease (IPD) and bacterial meningitis. Individuals principally affected are those at the extremes of age (children and the elderly), individuals without a functioning spleen, and immuno-compromised patients. Many strains of *S. pneumoniae* have become resistant to some of the antibiotics used to treat pneumococcal infections, and resistance to penicillin is common in some parts of the world.

***Acinetobacter* species** *Acinetobacter* is a type of bacterium carried by 25 per cent of healthy people and readily isolated from many sources in the environment, including drinking and surface waters, soil, sewage and various food types. There are at least 25 different *Acinetobacter* species, though it is mainly *Acinetobacter baumannii* that causes infections in hospital patients. Such infections can include skin and wound infections, urinary tract infections, pneumonia and bacteraemia. These 'hospital-adapted' strains of *Acinetobacter* are often resistant to antibiotics and may be difficult to treat and to eradicate; for example from intensive care units. Strains resistant to carbapenems have been reported in UK hospitals, leaving polymixin as the only licensed antibiotic available for treatment.

Extended-Spectrum Beta-Lactamase (ESBL) producing *Escherichia coli* ESBL-producing *E. coli* are antibiotic resistant strains of *E. coli*. Although *E. coli* normally resides harmlessly in the gut, it is one of the most common bacteria causing infections in humans – particularly urinary tract infections (UTIs) – in the community as well as in hospitals. These infections can sometimes progress to cause more serious infections such as blood poisoning which can be life threatening. ESBL strains of *E. coli* produce an enzyme called extended-spectrum beta-lactamase (ESBL), which makes them more resistant to antibiotics and the infections harder to treat. Most ESBL-producing *E. coli* are resistant to cephalosporins, penicillins, fluoroquinolones, trimethoprim, tetracycline and some other antibiotics, leaving very limited options for oral treatment in the community. In many instances, only two oral antibiotics (nitrofurantoin and fosfomycin) and a very limited group of intravenous antibiotics remain effective. Most ESBL-producing *E. coli* infections occur in people with other underlying medical conditions and in elderly people. Patients who have been taking antibiotics or who have been previously hospitalised are mainly affected. Further research is needed to look at the risk factors associated with different strains of ESBL-producing *E. coli* and how they are transmitted between patients and in community settings.

***Candida* species** The yeast *Candida* is the most common cause of opportunistic mycoses worldwide. It is a member of the normal flora of the skin, mouth, vagina, and stool, and is commonly found in the environment, particularly on leaves, flowers, water and soil. The genus *Candida* includes around 154 species, of which six are most frequently isolated in human *Candida* infections including *Candida albicans*, *Candida tropicalis*, *Candida glabrata*, *Candida parapsilosis*, *Candida krusei*, and *Candida lusitaniae*. Infections caused by *Candida* spp are in general referred to as candidiasis. The clinical spectrum of candidiasis is extremely diverse and almost any organ or system in the body can be affected. It can cause either benign and frequent infections such as oral and vaginal candidiasis or more serious problems such as life-threatening invasive infections in immuno-compromised hosts. *C. albicans* is the most pathogenic and most commonly encountered species and accounts for 60 per cent of all *Candida* infections. It can grow as a biofilm on artificial surfaces including medical implant devices such as catheters, prostheses, artificial valves and joints, and dentures. Several anti-fungal drugs are effective against candidiasis, of which the most effective is fluconazole. The emergence of strains of *C. albicans* resistant to fluconazole increases the difficulty in treating the infection and necessitates the use of other anti-fungal drugs that are less effective or have damaging side effects (eg amphotericin).

Norovirus Noroviruses are a group of viruses that are the most common cause of gastroenteritis in England and Wales and estimated to affect between 600,000 and one million people in the UK each year. Although relatively mild, norovirus gastroenteritis can occur at any age as prior infections do not elicit long-lasting immunity. The incubation period is usually 24 to 48 hours and symptoms last between 12 and 60 hours. The symptoms can include the sudden onset of nausea followed by projectile vomiting, and watery diarrhoea. Some people may have a raised temperature, headaches and aching limbs. The majority of people make a full recovery, however, some (usually the very young or elderly) may become very dehydrated and require hospital treatment. Norovirus spreads very easily from one person to another and can be transmitted by contact with infected individuals, by consuming contaminated food or water, or by contact with contaminated surfaces or objects. As the virus is easily spread from one person to another and can survive in the environment for many days, outbreaks of norovirus gastroenteritis are common in semi-closed environments such as hospitals, nursing homes and schools. The most effective way to respond to an outbreak is to isolate those infected for up to 48 hours, disinfect contaminated areas, institute good hygiene measures including hand-washing and provide advice on food handling. There is no specific treatment for norovirus; however it is a self-limiting infection and recovery occurs within one to two days.

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