

Standard principles: hospital environmental hygiene and hand hygiene

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This article describes standard principles for infection prevention and control focusing on hospital environmental hygiene and hand hygiene, both of which are crucial to the prevention of healthcare associated infection (HCAI). The guidelines do not address the additional infection control requirements of specialist settings, such as the operating department or for outbreak situations.

This guidance is based on the best critically appraised evidence currently available. The type and class of supporting evidence explicitly linked to each recommendation is described. All recommendations are endorsed equally and none is regarded as optional. The recommendations are not detailed procedural protocols and should be incorporated into local guidelines.

Hospital environmental hygiene

Good hospital hygiene is vital to any strategy for preventing HCAs in hospitals. This section discusses the evidence upon which recommendations for hospital environmental hygiene are based, with the relevant standards.

Guidelines are provided here for:

- Cleaning the general hospital environment;
- Cleaning items of shared equipment; and
- Education and training of staff.

Maintain a clean hospital environment

Our initial systematic review concluded that there was little research evidence of an acceptable quality upon which to base guidance on maintaining hospital environmental hygiene (Pratt et al, 2001).

However, a body of clinical evidence derived from case reports and outbreak investigations suggested an association between poor environmental hygiene and the transmission of microorganisms causing HCAs in hospital (Dancer, 1999; Garner and Favero, 1986).

Attention had been drawn to perceived falling standards in the cleanliness of hospitals since the introduction of compulsory comprehensive tendering and the internal market.

This concern was addressed in quality standards for hospital cleanliness developed by the Infection Control Nurses Association and the Association of Domestic Managers (NHS Estates, 2000; DH, 1999) and more recently the NHS Healthcare Cleaning Manual (NHS Estates, 2004).

In addition, existing regulations (HSE, 1999; NHSE, 1995; 1989), specialist advice (Expert Advisory Groups 1998; Microbiology Advisory, 1991) and clinical governance guidance (NHSE, 1998) all provide a framework within which hospital environmental hygiene can be improved and monitored.

The NHS Code of Practice on the Prevention and Control of Healthcare Associated infection, which came into effect in October 2006 (DH, 2006), was developed to help organisations to plan and implement strategies for the prevention and control of HCAs. It sets out criteria by which managers of NHS organisations and other healthcare providers should ensure patients are cared for in a clean environment, where the risk of HCAs is kept as low as possible.

Failure to comply with the code may result in an Improvement Notice being issued or other measures.

There is new evidence confirming that the hospital environment can become contaminated with microorganisms responsible for HCAs (Barker et al, 2004; Denton et al, 2004; French et al, 2004; Wilcox et al, 2003; Griffiths et al, 2002; Boyce et al, 1997).

Transmission of microorganisms from the environment to patients may occur through direct contact with contaminated equipment, or indirectly as a result of touching by hands.

Methicillin-resistant *Staphylococcus aureus* (MRSA) and other pathogens have been recovered from a range of surfaces commonly touched, such as door handles (Barker et al, 2004; Oie et al, 2002), computer keyboards (Schultz et al, 2003), soap dispensers (Griffith et al, 2000; Brooks et al, 2002), and sink taps (French et al, 2004; Griffiths et al, 2002; Griffith et al, 2000) and sites where dust is allowed to accumulate (Denton et al, 2004; Rampling et al, 2001).

However, while the presence of the same strain of microorganism in the environment as those infecting/colonising patients demonstrates that the environment becomes contaminated with microorganisms from patients, it does not confirm that the environment is responsible for contaminating patients.

Evidence suggesting that environmental contamination is to blame for the transmission of HCAs is therefore not conclusive. Nevertheless, the evidence that pathogens responsible for HCAs can be widely found in the hospital environment and hence readily acquired on hands by touching surfaces does demonstrate the importance of decontaminating hands before every patient contact.

Many microorganisms recovered from the hospital environment do not cause HCAI. Cleaning will not completely eliminate microorganisms from environmental surfaces and reductions in their numbers will be transient (Denton et al, 2004).

There is some evidence that improved cleaning regimens are associated with the control of outbreaks of HCAs. In one study (Rampling et al, 2001) the control of an outbreak of an epidemic strain of MRSA was linked with increased cleaning hours and an emphasis on the removal of dust.

However, often a range of interventions are introduced in order to control an outbreak and it is difficult to clearly distinguish the effect of a single component such as cleaning.

Some evidence suggests that routine cleaning methods may not be sufficient to eliminate surface contamination with MRSA (French et al, 2004; Rampling et al, 2001). Disinfectants have been recommended for cleaning hospital environment, but a systematic review failed to confirm a link between disinfection and the prevention of HCAs, though contamination of detergent and inadequate disinfection strength could have been an important confounder (Dettenkofer et al, 2004).

The use of hypochlorite for cleaning has been associated with a reduction in incidence of *Clostridium difficile* infection in one study but this was in the absence of a detectable change in environmental contamination when either detergent or hypochlorite was used (Wilcox et al 2003).

In laboratory tests a combination of cleaning with detergent followed by hypochlorite was required to consistently eliminate norovirus from surfaces and prevent cross contamination (DH, 2003). Dusting and cleaning using detergent was reported to have no effect on the number of MRSA isolated from the hospital environment, but the organism was virtually eliminated by exposure to hydrogen peroxide vapour (French et al, 2004).

Indicators of cleanliness based on levels of microbial or adenosine triphosphate (ATP) contamination have been proposed but are based on arbitrary standards of acceptable contamination and do not distinguish between normal environmental flora and pathogens responsible for HCAI (Malik et al, 2003; Griffiths et al, 2002).

The relationship between these proposed standards and the risk of acquiring infection through contact with the environment have not been established. Since cleaning will only have a transient effect on the numbers of microorganisms, regular cleaning of hospital surfaces will not guarantee complete elimination. Hand decontamination before every patient contact is therefore required to ensure that pathogens acquired by touch are not transferred to patients.

SP1	The hospital environment must be visibly clean, free from dust and soilage and acceptable to patients, their visitors and staff.	Class C
SP2	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.	Class D
SP3	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.	Class D

Shared equipment must be decontaminated after use

There is some evidence demonstrating that shared clinical equipment becomes contaminated with pathogens. One study found that more than 50% of commodes tested were contaminated with *C. difficile* (Wilcox et al, 2003).

A systematic review identified a number of studies demonstrating that pathogens can be recovered from a range of non-invasive clinical equipment, including stethoscopes, lifting equipment, and ultrasound probes. None of these studies demonstrated a link between the contamination and infection in a patient (Griffiths et al, 2002).

Shared clinical equipment used to deliver care in the clinical environment comes into contact with intact skin and is therefore unlikely to introduce infection. However it can act as a vehicle by which microorganisms are transferred between patients, which may result in infection (Microbiology Advisory Committee, 1991).

This equipment should therefore be appropriately decontaminated after each use with detergent and water. In some outbreak situations hypochlorite and detergent should be considered.

SP4	Shared equipment used in the clinical environment must be decontaminated appropriately after each use.	Class D
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Hospital hygiene is everybody's business

Three studies in a systematic review of healthcare workers' knowledge of MRSA and/or frequency of cleaning practices indicated that staff were not utilising appropriate cleaning practices with sufficient frequency to ensure minimisation of MRSA contamination of personal equipment (Griffiths et al, 2002).

Staff education was lacking on optimal cleaning practices in the clinical areas. Knowledge deficits may hinder the application of cleaning practices and monitoring and evaluation was indicated. This is further reinforced by an observational study, which noted that lapses in adhering to the cleaning protocol were linked with an increase in environmental contamination with isolates of *Acinetobacter baumannii* (Denton, 2004).

A second systematic review of four cohort studies comparing the use of detergents and disinfectants on microbial contaminated hospital environmental surfaces suggested that a lack of effectiveness was, in many instances due inadequate strengths of disinfectants, probably resulting from a lack of knowledge (Dettenkofer et al, 2004).

A national blended e-learning programme on preventing HCAs is available free of charge for all healthcare workers at www.infectioncontrol.nhs.uk.

SP5	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.	Class D
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Hand hygiene

The following section provides the evidence for recommendations on hand hygiene practice. Due to the difficulty in designing and conducting robust, ethical, randomised controlled trials in the field of hand hygiene recommendations in these areas are based on evidence from non-randomised controlled trials (NRCTs), quasi-experimental studies and expert opinion derived from systematically retrieved and appraised professional, national and international guidelines. The areas discussed include:

- Assessment of the need to decontaminate hands;
- The efficacy of hand decontamination agents and preparations;
- The rationale for choice of hand decontamination practice;
- Technique for hand decontamination;
- Care required to protect hands from the adverse effects of hand decontamination practice;
- Promoting adherence to hand hygiene guidelines.

Why is hand decontamination crucial to the prevention of HCAs?

Overviews of epidemiological evidence conclude that hand-mediated transmission is a major contributing factor in the current infection threats to hospital in-patients (Pratt et al, 2001). These include both methicillin-sensitive *Staphylococcus aureus* (MSSA) and MRSA, multi-resistant Gram-negative organisms, such as *Acinetobacter spp* and vancomycin-resistant enterococci (VRE).

The transmission of microorganisms from one patient to another via the hands, or from hands that have become contaminated from the environment, may result in adverse clinical outcomes.

Primary exogenous infection is a direct clinical threat to patients where microorganisms are introduced into susceptible sites, such as surgical wounds, the lungs during pulmonary ventilation, intravascular cannulation sites, enteral feeding systems or urinary catheter drainage systems.

Secondary endogenous infection creates an indirect clinical threat to patients where potential pathogens transmitted by the hands establish themselves as temporary or permanent colonisers of the patient and subsequently cause infection at susceptible sites on the patient or are available for transfer to others.

Current evidence-based guidelines conclude that in outbreak situations contaminated hands are responsible for transmitting infections and that effective hand decontamination can significantly reduce infection rates in gastrointestinal infections and in high-risk areas, such as intensive care units (Pratt et al, 2001).

A recent case control study, conducted during an outbreak of *Klebsiella pneumoniae* in a neonatal ICU demonstrated an association between being cared for by a nurse with positive hand cultures for the outbreak strain and infants developing infection or colonisation (Gupta et al, 2004).

Recent descriptive studies of the dynamics of bacterial hand contamination demonstrate an association between patient care activities that involve direct patient contact and hand contamination (Pessoa-Silva et al, 2004; Pittet et al, 1999).

In an observational study of hand contamination during routine patient care in a large teaching hospital, high levels of hand contamination were associated with direct patient contact, respiratory care and handling body fluids (Pittet et al, 1999). A further descriptive study of healthcare workers' hand contamination during routine neonatal care demonstrated that hands become increasingly contaminated and that gloves do not fully protect workers' hands from contamination (Pessoa-Silva, 2004).

The association between hand decontamination and reductions in infection have been confirmed by two recent clinically-based trials (Fendler et al, 2002; Ryan et al, 2001) and two descriptive studies (Gordin et al, 2005; Pittet et al, 2000). A NRCT introducing the use of alcohol-based hand gel to a long-term elderly care facility demonstrated a reduction of 30% in HCAs over 34 months when compared with the control unit (Fendler et al, 2002), while another demonstrated a 45% reduction in respiratory illness in the post-intervention period following the introduction of a handwashing programme (Ryan et al, 2001).

One descriptive study conducted over a four-year period during which alcohol-based handrub was introduced for routine hand hygiene demonstrated a reduction in HCAs from 16.9% to 9.9% (Pittet et al, 2000). A second study that compared rates of HCAs caused by MRSA, VRE and *C. difficile* in the three years prior to the introduction of alcohol-based handrub showed reductions of 21% in MRSA and 41% decrease in VRE.

Rates of *C. difficile* remained unchanged throughout the intervention period (Gordin et al, 2005).

Current national and international guidance consistently identify that effective hand decontamination results in significant reductions in the carriage of potential pathogens on the hands and logically decreases the incidence of preventable HCAI leading to a reduction in patient morbidity and mortality (Pratt et al, 2001; Boyce and Pittet, 2002).

When *must* you decontaminate your hands?

Decontamination refers to a process for the physical removal of blood, body fluids, and the removal or destruction of microorganisms from the hands (Boyce and Pittet, 2002). Current national and international guidance suggests that in deciding when it is necessary to decontaminate hands prior to patient contact, four key factors need to be considered (Boyce and Pittet, 2002; Pratt et al, 2001):

- The level of the anticipated contact with patients or objects;
- The extent of the contamination that may occur with that contact;
- The patient care activities being performed;
- The susceptibility of the patient.

Patients are put at risk of developing HCAs when informal carers or healthcare workers caring for them have contaminated hands. Hands must be decontaminated before every episode of care that involves direct contact with patients' skin or food, invasive devices or dressings. Current expert opinion recommends that hands need to be decontaminated after completing an episode of patient care and following the removal of gloves to minimise cross contamination of the environment (Boyce and Pittet, 2002; Pratt et al, 2001).

SP6	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.	Class C
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Is any one hand cleaning preparation better than another?

Current national and international guidelines consider the effectiveness of various preparations for the decontamination of hands using liquid soap and water, antiseptic handwash agents, and alcohol-based handrubs. Overall there is no compelling evidence to favour the *general* use of antiseptic handwashing agents over soap, or one antiseptic agent over another (Boyce and Pittet, 2002; Pratt et al, 2001).

Systematic reviews conducted to underpin guidelines for community and primary care and update the 2001 epic guidance (Pellowe et al, 2004; Pellowe et al, 2003) identified 19 studies comparing hand hygiene preparations including alcohol-based handrubs and gels, antiseptic handwashes and liquid soap. Five randomised controlled trials (RCTs) were conducted in clinical settings and compared the use of alcohol-based preparations with other agents (Girou et al, 2002; Lucet et al, 2002; Larson et al, 2001; Winnefeld et al, 2000; Zaragoza et al, 1999).

All demonstrated alcohol-based preparations were more effective than non-medicated soap and antiseptic handwashing agents, except Zarazoga et al (1999), who found no statistical difference between the use of alcohol-based preparations and antiseptic soap.

A clinical crossover trial conducted over 11 months within a neonatal intensive care unit demonstrated no statistical difference between infection rates during the hand washing and handrub phases of the trial (Larson et al, 2005).

Three clinically based, quasi-experimental studies (Herruzo-Cabrera et al, 2001a; 2001b; Larson et al, 2000) and nine controlled laboratory experiments (Sickbert-Bennet et al, 2005; Dharan et al, 2003; Kramer et al, 2002; Moadab et al, 2001; Guilhermetti et al, 2001; Paulson et al, 1999; Cardoso et al, 1999; Kampf et al, 1998; Dyer et al, 1998) also demonstrated an association between reductions in microbiological flora and the use of alcohol-based preparations.

These studies underpin a growing trend to adopt the use of alcohol-based handrubs and gels in clinical practice. However, two of the above laboratory studies highlight the need for continued evaluation of the use of alcohol-based handrubs within the clinical environment to ensure staff adherence to guidelines and effective hand decontamination (Sickbert-Bennett et al, 2005; Dharan et al, 2003).

Dharan et al, using EU reference standards, raised the possibility that alcohol-based gels may not be as effective as handrubs for short durations of use, while Sickbert-Bennet (2005), comparing 14 different hand-hygiene agents used for a 'clinically realistic' 10-second hand hygiene episode, suggested that some alcohol-based handrubs may lose efficacy after 10 consecutive uses.

One clinically based quasi-experimental study compared the use of 4% chlorhexidine gluconate and 1% triclosan antiseptic handwash preparations in reducing MRSA hand carriage in a specialist surgical ward (Faoagali et al, 1999). Both preparations effectively reduced total hand bacterial counts but 1% triclosan was more effective at eliminating MRSA.

Is it always necessary to wash hands to achieve decontamination?

Choosing the method of decontaminating hands will depend upon the assessment of what is appropriate for the episode of care, the available resources, what is practically possible and, to some degree, personal preferences based on the acceptability of preparations or materials.

In general, effective handwashing with a liquid soap will remove transient microorganisms and render the hands socially clean. This level of decontamination is sufficient for general social contact and most clinical care activities (Pellowe et al, 2004; Boyce and Pittet, 2002; Pratt et al, 2001). The use of a liquid soap preparation that contains an antiseptic will reduce both transient microorganisms and resident flora (Pratt et al, 2001; Boyce and Pittet, 2002).

The effective use of alcohol-based handrubs will also successfully remove transient microorganisms and substantially reduce resident microorganisms. However, alcohol is not effective against some microorganisms such as *C. difficile*, will not remove dirt and organic material and may not be effective in some outbreak situations (Faoagali et al, 1999; Gordin et al, 2005). When deciding which hand decontamination preparation to use, practitioners must consider the need to remove transient and/or resident hand flora.

Preparations containing certain antiseptics that exert a residual effect on skin flora can be useful in situations where prolonged reduction in microbial flora on the skin is required, for example, surgery and some invasive procedures. They are not normally necessary for everyday clinical practice but may be used in outbreak situations.

National and international guidelines suggest that the acceptability of agents and techniques is an essential criterion for the selection of preparations for hand hygiene (Boyce and Pittet, 2002; Pratt et al, 2001). Acceptability of preparations is dependent upon the ease with which the preparation can be used in terms of time and access together with their dermatological effects. Due to their efficacy and ease of use, alcohol-based handrubs are recommended for *routine* use and offer a practical and acceptable alternative to handwashing when hands are not grossly soiled (Boyce and Pittet, 2002).

There are no robust economic evaluations of the comparative costs associated with different hand hygiene agents and rates of HCAs. In an unpublished study of the potential cost savings associated with a national hand hygiene campaign the cost of a single HCAI is estimated at over £3,000. The authors hypothesise that even a small reduction in infections through the use of alcohol-based handrubs, would result in a cost saving (Storr and Bowler, 2002).

SP7	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.	Class A
SP8	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.	Class A
SP9	Hands should be washed with soap and water after several consecutive applications of alcohol handrub. Local infection control guidelines may advise an alternative product in some outbreak situations.	Class D/GPP

Is hand decontamination technique important?

Investigations into the technique of hand decontamination are limited and observational in design. Two studies that focused on different aspects of hand hygiene technique were identified (Trick et al, 2003; Gupta et al, 2004). The first study proposes that there is an association between effective hand contamination and the wearing of rings by healthcare staff for clinical care (Trick et al, 2003).

It suggests that the removal of rings should result in decreased frequency of hand carriage of pathogens before and after the performance of hand hygiene. The other is a case control study conducted during an outbreak of *Klebsiella pneumoniae* in a neonatal intensive care unit, in which the investigators suggest an association between being cared for by a nurse who wore false nails and had positive hand cultures for the outbreak strain, and infants developing infection or colonisation (Gupta et al, 2004).

Systematic reviews conducted to underpin guidelines for community and primary care and update the 2001 epic guidance (Pellowe et al, 2003; Pellowe et al, 2004) identified one randomised controlled trial comparing different durations of handwashing and handrubbing on bacterial reduction that found no significant differences between the two study groups (Lucet et al, 2002).

In addition a laboratory study conducted following a period of clinical observation of hand hygiene technique identified that practitioners on average applied a product for 11.6 seconds and concluded that some alcohol-based handrubs become less effective following 10 consecutive hand hygiene episodes. The authors suggest that periodic decontamination of hands, using liquid soap and water, is advisable throughout a shift (Sickbert-Bennett et al, 2005).

Two small-scale laboratory studies investigating methods of hand drying were identified. One found no statistically significant differences between the four methods studied (Gustafson et al, 2000) and the other suggests that warm air drying, when the hands are not rubbed simultaneously, may be more effective at reducing the numbers of bacteria on the hands following hand washing than the use of paper towels (Yamaoto et al, 2005).

Due to the methodological limitations of the above studies, recommendations for hand decontamination technique continue to be based on existing expert opinion.

Duration hand decontamination, exposure of all aspects of the hands and wrists to the preparation used, vigorous rubbing to create friction, thorough rinsing in the case of handwashing, and ensuring that hands are completely dry are all key factors in effective hand hygiene and the maintenance of skin integrity (Pratt et al, 2001; Boyce and Pittet, 2002).

- SP10 **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.** *Class D*
- SP11 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 of 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. *Class D*
- SP12 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, and until the solution has evaporated and the hands are dry. *Class D*

Does hand decontamination damage skin?

Expert opinion is that skin damage is generally associated with the detergent base of the preparation and/or poor handwashing technique (Pratt et al, 2001). However, the frequent use of hand hygiene agents may cause damage to the skin and alter normal hand flora. Excoriated hands are associated with increased colonisation of potentially pathogenic microorganisms and increase the risk of infection (Pratt et al, 2001; Boyce and Pittet, 2002).

In addition, the irritant and drying effects of hand preparations have been identified as one of the reasons why healthcare practitioners fail to adhere to hand hygiene guidelines (Pratt et al, 2001; Boyce and Pittet, 2002).

Systematic reviews conducted to underpin guidelines for community and primary care and to update the 2001 epic guidance (Pellowe et al, 2003; Pellowe et al, 2004) identified 10 studies of which four were randomised controlled trials conducted in clinical settings (Winnefeld et al, 2000; Boyce et al, 2000; Larson et al, 2001; Larson et al, 2005).

They compared the use of alcohol-based preparations with liquid soap and water using self-assessment of skin condition by nurses. In these studies a greater level of irritation was associated with the use of soap. Three further studies, one clinically-based quasi-experimental study, one descriptive clinical study and one non-clinical experimental study concluded that alcohol-based handrubs caused less skin irritation (Forrester and Roth, 1998; Larson et al, 2000; Kampf and Muscatiello, 2003).

In addition, one longitudinal study of the introduction and subsequent use of alcohol-based handrub over a seven-year period observed no reports of irritant and contact dermatitis associated with the use of alcohol-based handrubs (Pittet et al 2000). A laboratory study demonstrated a strong relationship between the frequency of handwashing with a chlorhexidine preparation and dermatitis Pietsch, 2001)

Current national and international guidance suggests that skin care, through the appropriate use of hand lotion or moisturizers added to hand hygiene preparations, is an important factor in maintaining skin integrity, encouraging adherence to hand decontamination practices and assuring the health and safety of healthcare practitioners (Pratt et al, 2001; Boyce and Pittet, 2002).

SP13 Clinical staff should be aware of the potentially damaging effects of hand decontamination products. They should be encouraged to use an emollient hand cream regularly, for example, after washing hands before a break or going off duty and when off duty, to maintain the integrity of the skin. *Class D*

SP14 If a particular soap, antiseptic hand wash or alcohol-based product causes skin irritation, review methods as described in Recommendation SP11 and 12 before consulting the occupational health team. *Class D*

How can adherence to hand hygiene guidance be promoted?

National and international guidelines emphasise the importance of adherence to hand hygiene guidance and provide an overview of the barriers and factors that impact on hand hygiene compliance (Pratt et al, 2001; Boyce and Pittet, 2002).

In a systematic review of 21 studies of interventions to improve hand hygiene compliance reviewers concluded that:

- Single interventions have a short-term influence on hand hygiene;
- Reminders have a modest but sustained effect;
- Feedback increases rates of hand hygiene but must be regular;
- Near patient alcohol-based preparations improve the frequency with which healthcare workers clean their hands;
- Multi-faceted approaches have a more marked effect on hand hygiene and rates of HCAI (Naikoba and Hayward, 2001).

Recent observational studies of multimodal interventions involving the introduction of alcohol-based handrubs support findings that the use of near patient alcohol-based handrub is consistently associated with greater compliance by healthcare staff (Pittet et al, 2000; Hilburn et al, 2003; Rosenthal et al, 2005; Rosenthal et al, 2003; Won et al, 2004; Macdonald et al, 2004).

However, observational studies show that staff fail to assess risk appropriately and therefore make inappropriate choices in relation to hand hygiene and glove use (Wendt et al 2004; Cohen et al, 2004; Brown et al, 2003; Kuzu et al, 2005; Kim et al, 2003).

One study suggests that the use of motivational strategies, such as feedback, may be beneficial (Kuzu et al, 2005). There is some evidence from small-scale observational studies that providing patient information and actively involving patients in hand hygiene improvement programmes has a positive effect on hand hygiene compliance (Hilburn et al, 2003; McGuckin et al, 2004; McGuckin et al, 2001).

In addition a national blended e-learning programme on preventing HCAI is available for all healthcare workers through the NHS <http://www.infectioncontrol.nhs.uk>.

SP15 Near patient alcohol-based hand rub should be made available in all healthcare facilities. *Class D*

SP16 Hand hygiene resources and individual practice should be audited at regular intervals and the results fed back to healthcare workers.

Class D

SP17 Education and training in risk assessment, effective hand hygiene and glove use should form part of all healthcare workers' annual updating.

Class D

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