



## **Standard principles: personal protective equipment and the safe use and disposal of sharps**

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This article looks at personal protective equipment and the safe use and disposal of sharps. These precautions need to be applied by all healthcare practitioners to the care of all patients, regardless of whether they are adults, children or neonates.

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. These recommendations are not detailed procedural protocols and need to be incorporated into local guidelines.

### **Personal Protective Equipment**

This section discusses the evidence and associated recommendations for the use of personal protective equipment by healthcare workers in general care settings, including aprons, gowns, gloves, eye protection and face masks. Where appropriate, in addition to the grade of the evidence underpinning the recommendations, there is an indication of a Health and Safety requirement.

The primary role of personal protective equipment is to protect staff and reduce opportunities for transmission of microorganisms in hospitals (Pratt et al, 2001; Clark et al, 2002; Expert Advisory Group on AIDS and the Advisory Group on Hepatitis, 1998). Over the past 20 years there has been a trend to eliminate the inappropriate wearing of aprons, gowns and masks in general care settings because of a lack of evidence that they are effective in preventing healthcare acquired infection (HCAI) (Pratt et al, 2001; Clark et al, 2002).

The decision to use or wear personal protective equipment must be based upon an assessment of the level of risk associated with a specific patient care activity or intervention and take account of current health and safety legislation (Expert Advisory Group on AIDS and the Advisory Group on Hepatitis, 1998; Health and Safety Executive, 1999; Health and Safety Executive, 1992; Health and Safety Commission, 2002)). However, several studies have identified that both a lack of knowledge of guidelines and non-adherence to guideline recommendations are widespread and that on going in-service education and training is required (Sax et al, 2005; Kuzu et al, 2005; Trim et al, 2003; Ferguson et al, 2004). A national blended e-learning programme on preventing HCAI is available for all healthcare workers at <http://www.infectioncontrol.nhs.uk>.

- SP18 Selection of protective equipment must be based on an assessment of the risk of transmission of microorganisms to the patient or to the carer, and the risk of contamination of the healthcare practitioners' clothing and skin by patients' blood, body fluids, secretions or excretions.

*Class D/ H&S*

SP19	Everyone involved in providing care should be educated about standard principles and trained in the use of protective equipment.	<i>Class D/ H&amp;S</i>
SP20	Adequate supplies of disposable plastic aprons, single use gloves and face protection should be made available wherever care is delivered. Gowns should be made available when advised by the infection control team.	<i>Class D/ H&amp;S</i>

**Gloves: their uses and abuses**

Since the mid-1980s the use of gloves as an element of personal protective equipment has become an every-day part of clinical practice for healthcare workers (Pratt et al, 2001). Expert opinion agrees that the two main indications for the use of gloves in preventing HCAI (Pratt et al, 2001; Clark et al, 2002) are to protect hands from contamination with organic matter and microorganisms, and to reduce the risks of transmission of microorganisms to both patients and staff.

**To glove or not to glove?**

Gloves should not be worn unnecessarily because prolonged and indiscriminate use may cause adverse reactions and skin sensitivity (Pratt et al, 2001; Clark et al, 2002). As with all items of personal protective equipment the need for gloves and the selection of appropriate materials must be subject to careful assessment of the task to be carried out and its related risks to patients and healthcare workers (Pratt et al, 2001; Clark et al, 2002). Risk assessment should consider:

- who is at risk (whether it is the patient or the healthcare worker) and whether sterile or non-sterile gloves are required;
- the potential for exposure to blood, body fluids, secretions and excretions;
- contact with non-intact skin or mucous membranes during general care and invasive procedures.

Gloves must be discarded after each care activity for which they were worn in order to prevent the transmission of microorganisms to other sites in that individual or to other patients. Washing gloves rather than changing them is not safe (Pratt et al, 2001).

**Gloves leak**

Our previous systematic review showed that gloves used for clinical practice may leak when apparently undamaged (Pratt et al, 2001; Clark et al, 2002). In terms of leakage, gloves made from natural rubber latex (NRL) performed better than vinyl gloves in laboratory test conditions. Revised standards relating to the manufacture of medical gloves for single use have been devised and implemented (British Standards Institute, 2000a; British Standards Institute, 2000b; British Standards Institute, 2000c). These standards require gloves regardless of material to perform to the same standard.

The integrity of gloves cannot be taken for granted and hands may become contaminated during the removal of gloves (Pratt et al, 2001; Clark et al, 2002). An additional study provided evidence that vancomycin resistant enterococcus remained on the hands of healthcare workers after the removal of gloves (Tenorio et al, 2001). Therefore, the use of gloves as a method of barrier protection reduces the risk of contamination but does not eliminate it and hands are not necessarily clean because gloves have been worn.

SP21	Gloves must be worn for invasive procedures, contact with sterile sites, and non-intact skin or mucous membranes, and all activities that have been assessed as carrying a risk of exposure to blood, body fluids, secretions and excretions; and when handling sharp or contaminated instruments.	<i>Class D/ H&amp;S</i>
SP22	Gloves must be worn as single use items. They are put on immediately before an episode of patient contact or treatment and removed as soon as the activity is completed. Gloves are changed between caring for different patients, or between different care/treatment activities for the same	<i>Class D/ H&amp;S</i>

SP23      patient.  
Gloves must be disposed of as clinical waste and hands decontaminated,  
ideally by washing with liquid soap and water after the gloves have been  
removed.

*Class D/ H&S*

### **Making choices**

Expert opinion is quite clear about when gloves *must* be used by healthcare workers in general clinical practice (Pratt et al, 2001; Clark et al, 2002), but having decided that gloves should be used for a healthcare activity, the healthcare worker must make a choice between the use of:

- sterile or non-sterile gloves, based on contact with susceptible sites or clinical devices;
- surgical or examination gloves, based on the aspect of care or treatment to be undertaken.

NHS Trusts need to provide gloves that conform to European Standards, and which are acceptable to healthcare practitioners (Pratt et al, 2001; Clark et al, 2002). Gloves are available in a variety of materials, the most common being natural rubber latex (NRL) and synthetic materials. NRL remains the material of choice due to its efficacy in protecting against bloodborne viruses and properties that enable the wearer to maintain dexterity (Pratt et al, 2001; Clark et al, 2002). The problem of patient or healthcare practitioner sensitivity to NRL proteins must be considered when deciding on glove materials.

Synthetic materials are generally more expensive than NRL and due to certain properties may not be suitable for all purposes (Pratt et al, 2001). Nitrile gloves have the same chemical range as NRL and may also lead to sensitivity problems. Vinyl gloves made to European Standards provide the same level of protection as NRL (Pratt et al, 2001). Polythene gloves are not suitable for clinical use due to their permeability and tendency to damage easily (Pratt et al, 2001). A study comparing the performance of nitrile, latex, copolymer and vinyl gloves under stressed and unstressed conditions found that nitrile gloves had the lowest failure rate, adding further evidence that nitrile gloves are a suitable alternative to latex, providing there are no sensitivity issues. Importantly, the study noted variation in performance of the same type of glove produced by different manufacturers and propose a test and rating system to assist healthcare workers (Kornewicz et al, 2002).

SP24      Gloves that are acceptable to healthcare workers and CE marked must be  
available in all clinical areas.

*Class D/ H&S*

SP25      Sensitivity to natural rubber latex in patients, carers and healthcare workers  
must be documented and alternatives to natural rubber latex must be  
available.

*Class B/ H&S*

SP26      Neither powdered nor polythene gloves should be used in healthcare  
activities.

*Class C/ H&S*

### **Aprons or gowns?**

We identified four small scale observational studies that investigated the potential for uniforms to become contaminated during clinical care. However none of these studies established an association between contaminated uniforms and HCAI (Callaghan, 1998; Perry et al, 2001; Huntley and Campbell, 1998). One study demonstrated high levels of contamination of gowns, gloves and stethoscopes with vancomycin-resistant enterococci (VRE) following examination of patients known to be infected (Zachary et al, 2001).

A systematic review of eight studies assessing the effects on outcomes of 3,811 babies of attendants and visitors wearing gowns found no evidence to suggest that over gowns reduced mortality, clinical infection or bacterial colonisation in infants admitted to newborn nurseries (Webster and Pritchard, 2003). One quasi-experimental study investigated the use of gowns and gloves as opposed to gloves only in preventing the acquisition of VRE in a medical intensive care unit setting (Puzniak et al, 2002). A further prospective observational study investigated the use of a similar intervention in a medical intensive care unit (Srinivasan et al, 2002). These studies suggest that the use of gloves and gowns may minimise the transmission of VRE when colonisation pressure is high.

National and international guidelines recommend that protective clothing should be worn by all healthcare workers when close contact with the patient, materials or equipment may lead to contamination of uniforms or other clothing with microorganisms, or when there is a risk of contamination with blood, body fluids, secretions, or excretions (with the exception of perspiration) (Pratt et al, 2001; Garner, 1996; Clark et al, 2002). Disposable plastic aprons are recommended for general clinical use (Pratt et al, 2001; Garner, 1996; Clark et al, 2002). However, unused aprons need to be stored in an appropriate area away from potential contamination (Callaghan, 1998). Full body gowns need only be used where there is the possibility of extensive splashing of blood, body fluids, secretions or excretions and should be fluid repellent (Pratt et al, 2001; Garner, 1996; Clark et al, 2002).

SP27	Disposable plastic aprons must be worn when close contact with the patient, materials or equipment are anticipated and when there is a risk that clothing may become contaminated with pathogenic microorganisms or blood, body fluids, secretions or excretions, with the exception of perspiration.	<i>Class D/ H&amp;S</i>
SP28	Plastic aprons/gowns should be worn as single-use items, for one procedure or episode of patient care, and then discarded and disposed of as clinical waste. Non-disposable protective clothing should be sent for laundering.	<i>Class D/ H&amp;S</i>
SP29	Full-body fluid-repellent gowns must be worn where there is a risk of extensive splashing of blood, body fluids, secretions or excretions, with the exception of perspiration, onto the skin or clothing of healthcare workers (for example when assisting with childbirth).	<i>Class D/ H&amp;S</i>

### **Facemasks, respiratory and eye protection**

Healthcare workers (and sometimes patients) may use standard surgical facemasks to prevent respiratory droplets from the mouth and nose being expelled into the environment. Facemasks are also used, often in conjunction with eye protection, to protect the mucous membranes of the wearer from exposure to blood and/or body fluids when splashing may occur. Our previous systematic review failed to reveal any robust experimental studies that demonstrated that healthcare workers wearing surgical facemasks protected patients from HCAI during routine ward procedures, such as wound dressing or invasive medical procedures (Pratt et al, 2001).

Facemasks are also used to protect the wearer from inhaling minute airborne respiratory particles. As surgical facemasks are not effective in filtering out such small respiratory particles, specialised respiratory protective equipment (sometimes called 'respirators') is recommended for the care of patients with certain respiratory diseases, such as active multiple drug-resistant pulmonary tuberculosis (National Collaborating Centre for Chronic Conditions for the National Institute of Health and Clinical Excellence, 2006), Severe Acute Respiratory Syndrome (SARS) and pandemic influenza. In order to protect the wearer effectively from inhaling small respiratory particles, they masks must fit closely to the face to minimise leakage (Pratt et al, 2001; The Independent Working Group on Tuberculosis, 1998; Health and Safety Commission, 1999). Although the advice to use particulate filter masks is based on expert opinion, one study found that staff exposed to patients with SARS acquired the infection when they did not use particulate filter masks (Seto et al, 2003). Another study demonstrated a lack of knowledge about guidance on using particulate respirator masks among staff caring for patients with SARS and suggests that focused training on the use of personal protective equipment and the transmission risk of SARS is required (Chia et al, 2004).

Our previous systematic review indicated that different protective eyewear offered some protection against physical splashing of infected substances into the eyes but that compliance was poor (Pratt et al, 2001). Expert opinion is that face and eye protection reduce the risk of occupational exposure of healthcare workers to splashes of blood, body fluids, secretion or excretions (Pratt et al, 2001; Garner, 1996; Clark et al, 2002).

SP30 Face masks and eye protection must be worn where there is a risk of blood, body fluids, secretions or excretions splashing into the face and eyes.

Class D/ H&S

SP31 Respiratory protective equipment, i.e., a particulate filter mask, must be correctly fitted and used when recommended for the care of patients with respiratory infections transmitted by airborne particles.

Class D/ H&S

## The Safe Use and Disposal of Sharps

This section discusses the evidence and associated recommendations for the safe use and disposal of sharps in general care settings, including minimising the risks associated with sharps use and disposal and the use of needle protection devices. Where appropriate, in addition to the grade of evidence underpinning the recommendations, there is an indication of a Health and Safety legislation requirement.

### Sharps injuries – what's the problem?

The safe handling and disposal of needles and other sharp instruments forms part of an overall strategy of clinical waste disposal to protect staff, patients and visitors from exposure to bloodborne pathogens (Health Services Advisory Committee, 1999). In 2003 the National Audit Office found that needlestick injuries ranked alongside moving and handling, falls, trips and exposure to hazardous substances as the main types of accidents experienced by NHS staff (National Audit Office, 2003). In 2001 the Royal College of Nursing (RCN) launched its *Be Sharp Be Safe* campaign aimed at reducing sharps injuries. A component of the campaign is surveillance using the software EPINet™. Fifteen sites contributed to the RCN 2002 survey and reported a total of 1,445 injuries (Watterson, 2004). Although many injuries (52.6%) were superficial, 44.6% (n = 626) ranked moderate, including some bleeding, and 2.8% (n=39) were severe. Nurses were the group with the highest proportion of sharps injuries, accounting for 41.2% of all reported injuries.

A report in 2006 from the Health Protection Agency confirms that healthcare workers are still being exposed to bloodborne virus infections, even though such exposures are largely preventable. The number of reported occupational exposures increased by 49% in three years, from 206 in 2002 to 306 in 2005, with almost half of all exposures occurring in nurses (Health Protection Agency, 2006). The report draws attention to the need for NHS Trusts to provide local protocols and information on the risk of bloodborne viruses in the work place and to ensure that healthcare workers are adequately trained on how to prevent injuries.

The average risk of transmission of bloodborne viruses following a single percutaneous exposure from an infected person, in the absence of appropriate post-exposure prophylaxis has been estimated (Health Protection Agency, 2006; Center for Disease Control and Prevention, 2006):

- hepatitis B virus (HBV) 33.3% (1 in 3)
- hepatitis C virus (HCV) 1.8 -1.9% (1 in 50)
- human immunodeficiency virus (HIV) 0.3 % (1 in 300)

National and international guidelines are consistent in their recommendations for the safe use and disposal of sharp instruments and needles (Expert Advisory Group on AIDS and the Advisory Group on Hepatitis, 1998; Ward et al, 1997; Centers for Disease Control, 1988; Occupational Safety and Health Administration, 1999). As with many infection prevention and control policies, the assessment and management of the risks associated with the use of sharps is paramount and safe systems of work and engineering controls must be in place to minimise any identified risks, such as positioning the sharps bin as close as possible to the site of the intended clinical procedure (Health and Safety Commission,

1999). Any healthcare worker experiencing an occupational exposure to blood or body fluids needs to be assessed for the potential risk of infection by a specialist practitioner, such as a physician or occupational health nurse, and offered testing, immunisation and post-exposure prophylaxis if appropriate (Expert Advisory Group on AIDS, 2000).

## Avoiding sharps injuries is everybody's responsibility

All healthcare workers must be aware of their responsibility in avoiding needle stick injuries. This should be included as part of induction programmes for new staff and on-going in-service education. A national blended e-learning programme on preventing HCAI is available for all healthcare workers at <http://www.infectioncontrol.nhs>. In addition, the Centers for Disease Control and Prevention has developed an online programme focused on implementing and evaluation a sharps injury prevention programme at <http://www.cdc.gov/sharpsafety/workbook.html>.

SP32	Sharps must not be passed directly from hand to hand and handling should be kept to a minimum.	
SP33	Needles must not be recapped, bent broken or disassembled before use or disposal.	<i>Class D/ H&amp;S</i>
SP34	Used sharps must be discarded into a sharps container (conforming to UN3291 and BS 7320 standards) at the point of use by the user. These must not be filled above the mark that indicates the bin is full.	<i>Class D/ H&amp;S</i>
SP35	All sharps bins should be positioned out of the reach of children at a height that enables safe disposal by all members of staff. They should be secured to avoid spillage.	<i>Class D/ H&amp;S</i>
SP36	All staff both clinical and non-clinical must be educated about the safe use and disposal of sharps.	<i>Class D/ H&amp;S /GPP</i>

## Do needle protection devices reduce avoidable injuries?

Many agencies, including the Department of Health and NHS employers encourage healthcare providers and their employees to pursue safer methods of working through considering the benefits of new safety devices (Department of Health, 2000; NHS Employers, 2005). The incidence of sharps injuries has led to the development of needlestick-prevention devices in many different product groups (ECRI, 2003). These are designed to minimise the risk of operator injury during needle use as well as so-called 'downstream' injuries that occur after disposal, often involving the housekeeping or porters responsible for the collection of sharps disposal units.

Our previous systematic reviews (Pratt et al, 2001; Pellowe et al 2003) failed to identify any convincing evidence that needlestick-prevention devices were responsible for any significant impact on injury rates. This was primarily due to the lack of well-designed, controlled intervention studies. More recent studies have shown significant reductions in injuries associated with the use of safety devices in cannulation (Asai et al, 2002; Sohn et al, 2004), phlebotomy (Alvarado-Ramu et al, 2003; Rogues et al, 2003; Mendelson et al, 2003) and injections (Adams and Elliott, 2003).

It would seem logical that where needle-free or other protective devices are used there should be a reduction in sharps injuries. A review of needlestick injuries in Scotland suggested that 56% of injuries would 'probably' or 'definitely' have been prevented if a safety device had been used (Cullen et al, 2006). However, some studies identify a range of barriers to the expected reduction in injuries, including staff resistance to using new devices, complexity of device operation or improper use, and poor training (Pratt et al, 2001). A comprehensive report and product review conducted in the United States provides background information and guidance on the need for and use of needlestick-prevention devices but also gives advice on establishing and evaluating a sharps injury prevention program (ECRI, 2003). The report found that all devices have limitations in relation to cost, applicability and/or effectiveness. Some

of the devices available are more expensive than standard devices, may not be compatible with existing equipment, and may be associated with an increase in bloodstream infection rates (Centers for Disease Control, 1997).

In the US, the Occupational Safety Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) suggest that a thorough evaluation of any device is essential before purchasing decisions are made (OSHA, 1999; NIOSH, 1999). Similarly in the UK, the NHS Purchasing and Supply Agency recognises that meaningful evaluations are paramount in assessing user acceptability and clinical applicability of any needle safety devices (NHS Purchasing and Supply Agency, 2006). The evaluation should ensure that the safety feature works effectively and reliably, that the device is acceptable to healthcare practitioners and that it does not adversely affect patient care.

SP37	Consider the use of needlestick-prevention devices where there are clear indications that they will provide safe systems of working for healthcare practitioners.	Class B/ H&S
SP38	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.	Class D
SP39	The introduction of new needle-free devices should be monitored for an increase in the occurrence of device associated infection. If an increased in infection rates is suspected, this should be reported to the Medicines and Healthcare products Regulatory Agency [ <a href="http://www.mhra.gov.uk">http://www.mhra.gov.uk</a> ]	Class D

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