

Use of gloves is widespread in clinical practice, but research suggests they are often used inappropriately, and that this increases infection risks to patients

# Does glove use increase the risk of infection?

## In this article...

- › Why gloves are misused in practice
- › Guidance on the correct use of gloves
- › Role of emotions and socialisation in influencing glove use

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**Abstract** Wilson J, Loveday H (2014) Does glove use increase the risk of infection? *Nursing Times*; 110: 39, 12-15.

There is clear evidence that gloves are often misused in clinical practice, which puts patients at increased risk of infection. New evidence suggests there are two main influences on health professionals' decision to wear gloves: socialisation, reflecting the expectations of peers, patients or the organisation; and emotion, reflecting the response to a sense of disgust and need for self-protection. This article explores the extent of glove misuse and why they are misused, and suggests strategies to address the problem.

Over the past two decades gloves have become a routine part of healthcare delivery, and are often used with little consideration for whether it is appropriate in a given situation or the potential hazards associated with their use. While hand hygiene is acknowledged and promoted as a fundamental aspect of infection prevention practice, how the use of gloves may affect compliance with hand hygiene is rarely discussed.

### Hands and infection transmission

Numerous studies have shown the role of hands as a vehicle for transmitting infection between patients in healthcare settings (World Health Organization, 2009). Micro-organisms are picked up on hands by touch and, as they are not adapted to survive in the arid micro-environment of

the skin, these transient organisms are readily transferred to the next object touched by the hands (Hoffman and Wilson, 1994). Touching any person or non-sterile object is likely to result in the transfer of micro-organisms to the hands, but some surfaces are more contaminated than others and the numbers of organisms transferred from these is likely to be much greater (Mackintosh and Hoffman, 1984). These transient micro-organisms are easily removed from the skin surface by washing or destroyed by contact with alcohol hand rubs (WHO, 2009).

### Indications for glove use

Before the mid-1980s, non-sterile examination or clinical gloves were primarily recommended for use with patients under isolation precautions (Garner and Simmons, 1983). However, after the identification of the HIV and evidence that transmission occurred as a result of exposure to infected blood, the Centers for Disease Control in the US recommended the use of "protective barriers to prevent exposure to blood, body fluids containing visible blood", together with other high-risk fluids such as cerebrospinal and amniotic fluids (CDC, 1988; 1987).

The advice acknowledged the difficulty in identifying those carrying blood-borne viruses and specified the need to apply the precautions in the care of all patients; as a result they were described as "universal precautions" (UPs) (Siegel et al, 2007). UPs also emphasised the importance of risk assessment, with the type of protective barrier(s) selected being appropriate for the procedure performed and the type of exposure anticipated. The principles of risk assessment are summarised in Box 1.

## 5 key points

**1** Contaminated gloves have been implicated in outbreaks of infection

**2** Evidence suggests that gloves are used inappropriately in clinical practice

**3** Gloves should be used where direct contact with body fluids, non-intact skin or mucous membranes is anticipated

**4** Gloves should be applied immediately before there is any contact with blood, body fluids, mucous membranes or non-intact skin

**5** Gloves should be removed immediately after a procedure to prevent cross contamination



Nurses should wear clean gloves when taking blood, but these need not be sterile



## “Be transparent with the people you’re working with”

Carol-Anne Murphy ▶ p25

### BOX 1. PRINCIPLES OF RISK ASSESSMENT

- Identify the hazard
- Decide whether there is a risk of being harmed
- Evaluate the risk and decide on precautions
- A hazard is something that may cause harm, for example micro-organisms in body fluids
- A risk is the chance of being harmed by a hazard together with the potential seriousness of the harm

Adapted from Health and Safety Executive (2011)

Subsequently, CDC guidance on UPs was extended to take account of the fact that potentially infectious micro-organisms are present in “moist body sites or substances”; the use of protective barriers for any direct contact with blood, body fluids (BBF), mucous membranes and non-intact skin became widely recommended (Wilson and Breedon, 1990; CDC, 1988; Lynch et al, 1987).

The primary purpose of this approach was to reduce the risks to patients of cross-transmission of micro-organisms via health professionals’ hands by minimising soiling in situations where gross contamination of the skin was likely (Jackson and Lynch, 1991). Patients are far more vulnerable to infection caused by pathogens acquired on the hands than the staff who care for them, because the organisms can enter their tissues via invasive devices and lesions. In addition, underlying illness, comorbidities and treatments diminish their ability to fight infection (Wilson, 2006). The use of gloves to protect health professionals from micro-organisms harboured by their patients is therefore a secondary benefit (Jackson and Lynch, 1991). Table 1 gives examples of procedures where the use of gloves is indicated.

Gloves should be applied immediately before contact with a patient’s BBF, mucous membranes or non-intact skin; this ensures that other micro-organisms are not acquired on the gloves and transferred to susceptible sites on the patient. Likewise, gloves should be removed immediately after the procedure to ensure that contamination is not transferred to other items or patients (Royal College of Nursing, 2012; Jackson and Lynch, 1991). The concept that protective equipment should be used where direct contact with BBF, non-intact skin or mucous membranes is anticipated has now been incorporated into guidance on “standard precautions” (Loveday et al, 2014a). These are a set of principles designed to be used in the care of all patients to minimise the risk of transmission of pathogens (and therefore infection) to patients and staff (Siegel et al, 2007; Wilson, 2006).

### Glove use and hand hygiene practice

Hand decontamination is considered the mainstay of practice to prevent transmission of infection between patients and from patients to staff. As such, it is the focus of considerable audit activity to measure and monitor staff compliance (WHO, 2009). Audits of hand hygiene are frequently based on the framework of “My Five Moments For Hand Hygiene” (5MHH) (Sax et al, 2007), which promotes five key indications for hand hygiene:

- » Moment 1: Before patient contact;
- » Moment 2: Before an aseptic task;
- » Moment 3: After BBF exposure;
- » Moment 4: After patient contact;
- » Moment 5: After contact with patients’ surroundings.

In the original concept of 5MHH, glove use was acknowledged but it was anticipated that gloves would be used as a “second skin” in some situations, for example to protect wearers from exposure to BBF or to protect a susceptible site such as a wound. Glove use was not expected to affect the points at which hand hygiene should be performed (Sax et al, 2007).

Evidence from practice suggests the use of gloves has extended far beyond the type of indications listed in Table 1, and that they are commonly used inappropriately (Loveday et al, 2014b; Fuller et al, 2011; Pittet et al, 1999). In observations of over 7,000 moments for hand hygiene, Fuller et al (2011) found gloves were used in 26% ( $n = 1,983$ ) of occasions. Gloves were worn for 17% of the observations where the risk of contact with moist body substances was minimal and so the use of gloves was inappropriate, but in 21% of occasions where the risk of contact with BBF was high gloves were not used.

There is also evidence that the way gloves are used can breach 5MHH. A recent study in a large acute teaching NHS trust focused on how gloves were used in a clinical setting and the extent to which their use may contribute to cross transmission of micro-organisms between patients. The risk of contamination was defined by non-compliance with one or more of the 5MHH;

out of a total of 163 episodes of care involving glove use, a risk of cross contamination was observed in 60 (37%) (Loveday et al, 2014b). The most common point of risk was Moment 4, (after contact with the patient) followed by Moment 3 (after contact with BBF). However, an additional point of cross contamination was before contact with the patient (Moment 1), as gloves were commonly put on outside patients’ rooms or at glove dispensers in bays rather than at the bedside. As a result, curtains and other equipment were touched with gloved hands before patient contact.

In addition, even inside the “patient zone” (the intact skin of a patient, together with the immediate surroundings where his or her microbial flora will be colonised) health professionals often touched a large number of items with gloved hands before patient contact – in 7% of episodes more than 10 items were touched. The study also found widespread inappropriate use of gloves – in 58% of episodes where gloves were used, their use was unnecessary. This practice was observed across all groups of health professionals (Loveday et al, 2014b).

There is clear evidence that gloves become contaminated with micro-organisms during use and transfer these to other surfaces touched (Moore et al, 2013). Contaminated gloves have been implicated in outbreaks of infection and micro-organisms have been recovered from gloves after use, even after the wearer has tried to remove contamination by using alcohol hand rub (Girou et al, 2004; Patterson et al, 1991). Rather than aiding infection prevention, when put on too soon or taken off too late, gloves may facilitate the transmission of micro-organisms from the environment to the patient and between patients (Girou et al, 2004; Pittet et al, 1999).

### Audit of glove use behaviour

5MHH has become the standard approach to both education and audit of hand hygiene behaviour but, as the use of gloves is not integrated into this framework, the significance of glove use may go unrecognised. While 5MHH suggests gloves should not replace or alter the performance of hand hygiene, the extension of their use into a broad set of activities that do not involve exposure to BBF means triggers for their removal are not obvious.

As the inappropriate use of gloves is widespread, it is possible that when hand hygiene practice is audited by peers, they do not recognise lack of compliance with 5MHH when it is linked to glove use, for example, the contravention of Moment 1 when gloves are put on before entering the

**TABLE 1. GLOVE USE IN CLINICAL PRACTICE**

Gloves not indicated	Gloves indicated	
	Clean	Sterile
Taking patient observations	Touching/handling blood or body fluids (BBF)	Insertion of invasive devices (eg central venous catheters, urine catheters, endotracheal tubes, bronchoscope)
Subcutaneous/intramuscular injections <sup>1</sup>	Contact with mucous membranes	Surgical procedures
Administration/preparation of IV drugs <sup>2</sup>	Insertion/removal of peripheral cannula	Preparation of total parenteral nutrition
Bathing/dressing patient (unless visible BBF)	Contact with non-intact skin	Dressing wounds
Handling used linen (unless soiled with BBF)	Removal of invasive devices (eg urine catheters, endotracheal tubes)	
Manipulation of vascular lines (using aseptic technique)	Taking a blood sample	
Physiotherapy (unless procedure involves direct exposure to BBF)	Vaginal/pelvic examination	
Giving oral medications	Oral/tracheal suctioning	
Feeding a patient	Handling hazardous chemicals, eg disinfectants, chemotherapy agents	
Transporting a patient	Handling instruments, equipment or items contaminated with BBF	
Writing on charts	Handling waste contaminated with BBF	
	Handling sharp instruments contaminated with BBF	
	Cleaning BBF spills	

Adapted from Loveday et al (2014a), McLaws et al (2009), Seigel et al (2007), Wilson (2006).  
<sup>1</sup> May be preferred for handling contaminated sharps. <sup>2</sup> Only indicated for preparation of hazardous drugs such as chemotherapy agents. BBF = blood, body fluids. IV = intravenous.

patient zone. A recent study described an audit tool based on 5MHH that was specifically designed to capture audit data on glove use behaviour and identify key points in the delivery of care associated with a risk of transmission (Wilson et al, in press). Such data may be useful in providing systematic evidence about the risks of inappropriate glove use that can be used to help change staff behaviour.

### Drivers of glove use behaviour

Educational strategies are unlikely to be effective unless the drivers of glove use are more clearly understood. Loveday et al (2014b) undertook qualitative interviews with staff to elicit the factors that influence health professionals' decisions to wear

gloves. Thematic analysis identified two main drivers of glove-use behaviour:

- » Emotion; and
- » Socialisation.

In terms of emotion, the rationale for glove use was participants' desire for a barrier to protect themselves and their families from a perceived threat of infection and a response to a sense of "disgust" about contact with people/patients who are not considered to be clean (Box 2). The influence of socialisation reflected expectations of their organisation, peers and patients, and indicated that participants commonly learn their glove use behaviour from watching colleagues or were driven to use gloves because they were challenged to do so by others.

Participants also saw gloves as a way to save time and avoid the need for hand hygiene, and considered that hospital policy on gloves contradicted their perception of infection control practice. Gloves were also justified as something that patients expected as a demonstration of high standards of hygiene or as a physical barrier, although participants acknowledged that it might negatively impact on their relationship with patients. There is currently no evidence on patients' views on glove use; this is an important area for further research (Loveday et al, 2014b).

The role of disgust in hygienic behaviour in different countries has been described as an innate mechanism for defence against infection (Curtis, 2007). The work of Whitby et al (2007; 2006) suggested that feelings of disgust towards "dirt and germs" are important drivers for hand hygiene behaviour in healthcare settings and that these attitudes are established early in life and become a form of ritualised behaviour to protect the self from infection (Whitby et al, 2007). However, there is evidence that an assessment of the risk of exposure to "dirt" rather than infection is the key driver, and that perception of dirt is highly contextual, encompassing much more than BBF – examples include washing water contaminated by "body debris" and fingers that may have had contact with faeces; health professionals are also strongly influenced by value judgements made about patients and their standard of cleanliness (Jackson and Griffiths, 2014).

Perceptions of dirt also seem to be moderated by familiarity and are applied differently to adults and children, even though both may be incontinent (Jackson and Griffiths, 2014), and precautions may be relaxed if the patient is "known" or is perceived to be clean. Health professionals' focus on the protection of self from dirt, rather than on the risk of infection may therefore lead to behaviour that increases the risk of transmitting micro-organisms between patients, such as the observed conduct in relation to the use of gloves.

These studies show the importance of addressing underlying motivators of glove use if behaviour is to be modified. It is possible the strong messages in recent years about the risks of infection in healthcare settings may have increased health professionals' perceived need to protect themselves and contributed to gloves being seen as an essential part of this protection.

Approaches that provoke emotions of disgust have been proposed as a means of improving hand hygiene behaviour (Porzig-Drummond et al, 2009). However,



## BOX 2. HEALTH PROFESSIONALS' PERCEPTIONS OF GLOVE USE

"When I'm at work I don't mind [wearing gloves] because I hope they are protecting me. If I'm protecting myself then I don't mind doing it."

"I actually wear gloves even if they [the sheets] are not soiled so, even if a patient's bed is being changed, I wear gloves for changing sheet."

"Yes it makes you feel very clinical. And if I was a patient and I saw... I would be 'Oh my God, have I got the worst lurgie in the world that no one wants to touch me?' So it is not nice for the doctor-patient relationship."

Source: Loveday et al (2014b)

the emerging evidence about glove use suggests this could be a high-risk strategy as it is likely to increase the triggers for using gloves and decrease the focus on the critical points for glove removal and hand hygiene. Education and training of the multidisciplinary team to address the lack of knowledge, the irrational beliefs and the inaccurate perceptions of risk is needed but may not be enough to counteract these emotions (Prieto and McLeod Clark, 2005).

### Conclusion

Recent achievements in the UK relating to reducing infections caused by MRSA and *C difficile* are impressive but represent a very small part of the problem of healthcare-associated infection (Johnson et al, 2012; Health Protection Agency, 2011). As well as the endemic problems of healthcare-associated pneumonia, surgical site and urinary tract infections, there are now new threats in the form of increasing cases of severe infections caused by Gram-negative pathogens such as *E coli* and *Klebsiella pneumoniae*, and a rapid rise in strains that are highly resistant to antimicrobial agents (Chief Medical Officer, 2011; Wilson et al, 2011). The highest standards of practice in relation to the prevention of HCAs therefore continue to be paramount in assuring patient safety.

The emerging evidence of excessive and inappropriate glove use in healthcare settings and associated risks of cross-contamination indicates the need to challenge health professionals' perceptions of risk, the role of gloves in preventing HCAs and hazards associated with their misuse.

It is likely that many of the factors that have been successful in improving compliance with hand hygiene, such as using cues to action and influencing system change at an institutional level, will be relevant to improving glove use behaviour. However, educational approaches that address the motivators of this behaviour

are essential if change in practice is to be effective and sustained. **NT**

### References

- Centers for Disease Control** (1988) Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus and other bloodborne pathogens in healthcare settings. *Morbidity and Mortality Weekly Report*; 37: 377-388.
- Centers for Disease Control** (1987) Recommendations for prevention of HIV transmission in healthcare settings. *Morbidity and Mortality Weekly Report*; 36: Suppl 2, S3-S18.
- Chief Medical Officer** (2011) *Annual Report of the Chief Medical Officer. Volume Two, 2011: Infections and the Rise of Antimicrobial Resistance*. [tinyurl.com/DH-CMORpt2011](http://tinyurl.com/DH-CMORpt2011)
- Curtis V** (2007) A natural history of hygiene. *Canadian Journal of Infectious Diseases and Medical Microbiology*; 18: 11-14.
- Fuller C et al** (2011) "The dirty hand in the latex glove": a study of hand hygiene compliance when gloves are worn. *Infection Control and Hospital Epidemiology*; 32: 1194-1199.
- Garner JS, Simmons BP** (1983) Centers for Disease Control guideline for isolation precautions in hospitals. *Infection Control*; 4: 245-325.
- Girou E et al** (2004) Misuse of gloves: the foundation for poor compliance with hand hygiene and potential for microbial transmission? *Journal of Hospital Infection*; 57: 162-169.
- Health and Safety Executive** (2011) *Five Steps to Risk Assessment*. [tinyurl.com/5StepsHSE](http://tinyurl.com/5StepsHSE)
- Health Protection Agency** (2011) *English National Point Prevalence Survey on Healthcare-associated Infections and Antimicrobial Use, 2011*. [tinyurl.com/HPA-HCAIPrevalence2011](http://tinyurl.com/HPA-HCAIPrevalence2011)
- Hoffman PN, Wilson J** (1994) Hands, hygiene and hospitals. *PHLS Microbiology Digest*; 11: 4, 211-216.
- Jackson C, Griffiths P** (2014) Dirt and disgust as key drivers in nurses' infection control behaviours: an interpretative, qualitative study. *Journal of Hospital Infection*; 87: 71-76.
- Jackson MM, Lynch P** (1991) An attempt to make an issue less murky: a comparison of four systems for infection precautions. *Infection Control and Hospital Epidemiology*; 12: 7, 448-449.
- Johnson AP et al** (2012) Mandatory surveillance of methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia in England: the first 10 years. *Journal of Antimicrobial Chemotherapy*; 67: 4, 802-809.
- Loveday HP et al** (2014a) epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *Journal of Hospital Infection*; 86: S1, S1-S70.
- Loveday HP et al** (2014b) Clinical glove use: healthcare workers actions and perceptions. *Journal of Hospital Infection*; 86: 110-116.
- Lynch P et al** (1987) Rethinking the role of isolation

practices in the prevention of nosocomial infections. *Annals of Internal Medicine*; 107: 243-246.

**Mackintosh CA, Hoffman PN** (1984) An extended model for transfer of microorganisms via the hands: differences between organisms and the effect of alcohol disinfection. *The Journal of Hygiene (Cambridge)*; 92: 345-355.

**McLaws M-L et al** (2009) Improvements in hand hygiene across New South Wales public hospitals: Clean hands save lives, Part III. *Medical Journal of Australia*; 191: S18-25.

**Moore G et al** (2013) The effect of glove material upon the transfer of methicillin-resistant *Staphylococcus aureus* to and from a gloved hand. *American Journal of Infection Control*; 41: 19-23.

**Patterson JE et al** (1991) Association of contaminated gloves with transmission of *Acinetobacter calcoaceticus* var. *anitratus* in an intensive care unit. *American Journal of Medicine*; 91: 479-483.

**Pittet D et al** (1999) Bacterial contamination of the hands of hospital staff during routine patient care. *Archives of Internal Medicine*; 159: 821-826.

**Porzig-Drummond R et al** (2009) Can emotion be harnessed to promote hand hygiene? Experimental and field-based tests. *Social Science and Medicine*; 68: 1006-1012.

**Prieto J, Macleod Clark J** (2005) Contact precautions for *Clostridium difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA): Assessing the impact of a supportive intervention to improve practice. *Journal of Research in Nursing*; 10: 5, 511-526.

**Royal College of Nursing** (2012) *Tools of the Trade: RCN Guidance for Health Care Staff on Glove Use and the Prevention of Contact Dermatitis*. [tinyurl.com/RCN-glove-use](http://tinyurl.com/RCN-glove-use)

**Sax H et al** (2007) "My five moments for hand hygiene": a user-centred design approach to understand, train, monitor and report hand hygiene. *Journal of Hospital Infection*; 67: 9-21.

**Siegel JD et al** (2007) Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. *American Journal of Infection Control*; 35: Suppl2, S65-164.

**Whitby M et al** (2007) Behavioural considerations for hand hygiene practices: the basic building blocks. *Journal of Hospital Infection*; 65: 1-8.

**Whitby M et al** (2006) Why healthcare workers don't wash their hands: a behavioural explanation. *Infection Control and Hospital Epidemiology*; 27: 484-492.

**Wilson J** (2006) *Infection Control in Clinical Practice*. London: Elsevier.

**Wilson J et al** (in press) The misuse and overuse of clinical gloves: a validated audit tool to define the problem. *Journal of Infection Prevention*.

**Wilson J et al** (2011) Trends among pathogens reported as causing bacteraemia in England: 2004-08. *Clinical Microbiology and Infection*; 17: 3, 451-458.

**Wilson J, Breedon P** (1990) Universal precautions. *Nursing Times*; 86: 37, 67-70.

**World Health Organization** (2009) *WHO Guidelines on Hand Hygiene in Health Care*. [tinyurl.com/WHO-hand-hygiene](http://tinyurl.com/WHO-hand-hygiene)

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