



DOUBLE-GLOVING

A self-study monograph for continuing education for registered nurses with an interest in patient safety and infection prevention.

LEARNING OBJECTIVES

- At the conclusion of this activity, participants will:
1. Be familiar with the current evidence relating to double-gloving.
 2. Understand the recommendations and requirements for double-gloving according to professional practice and policy criteria.
 3. Describe double-gloving decision making challenges.
 4. Understand the ‘two-colour glove system’ and other points for practice.
 5. Know ‘What’s Hot in Gloves’ including emerging general glove and related research, event, social media or professional trends.

ISSUE 1

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BACKGROUND

Healthcare workers (HCWs) and ancillary staff performing activities that involve either direct clinical care or contact with contaminated surfaces, equipment or instruments should routinely wear gloves as a protection against inadvertent exposure to blood, body fluids, secretions and microscopic particles of potentially pathogenic organisms such as bacteria and viruses.

World Health Organization Medical Glove Use Recommendations:

- Perform hand hygiene immediately before donning gloves.
- Wear gloves when touching blood, body fluids, secretions, excretions, mucous membranes and non-intact skin.
- Change gloves between tasks and procedures on the same patient after contact with potentially infectious materials.
- Remove gloves after use, before touching non-contaminated items and surfaces, and before going to another patient.
- Perform hand hygiene immediately after removal of gloves.

Wearing of gloves in this context is part of the standard and transmission-based precautions model which is well described in Section B1.2.5 of the *Australian Guidelines for the Prevention and Control of Infection in Healthcare*¹. Wearing of two gloves is also a standard endorsed globally by various healthcare professional associations. The type of glove in terms of sterility and composition depends on both individual and situational factors which vary according to circumstance, intended task or procedure and the clinical setting. The glove wearer always makes their glove selection based on a risk assessment, and it is therefore important that they are well informed about glove range and the relevant risks associated with their intended task. Their decision must also comply with the various criteria set out in accreditation, professional, public policy, and regulatory requirements. Experts recognise that staff can also be confused in their glove choice. Many such experts have undertaken and published elegant research studies or systematic reviews of available glove evidence in an effort to better protect glove users and to inform policy, guidelines and other directives such as those mentioned above.



A frequently asked question about glove use is “should I wear one or more pair(s) of gloves?” The question is an excellent one and worthy of in-depth consideration especially given that the most recent Australian research around this issue was published more than a decade ago when double-gloving rates among OR nurses were just over 50%.² Accordingly, the specific purpose of this issue is to consider the current evidence, practice trends and directives about glove integrity and double-gloving so that clinicians and especially operating room (OR) staff can make well informed decisions about glove use. Whilst many of the issues addressed in this update relate specifically to the OR, their consideration may be warranted in other clinical settings, including dental practices, where the nature of the work performed and the routine passage and use of sharp instruments pose risks of glove perforation.

CURRENT EVIDENCE RELATING TO DOUBLE-GLOVING

Questions to consider when double-gloving

Typically the types of questions clinicians ask about double-gloving are along the lines of:

1. Is an extra pair needed?
2. Are double gloves protective?
3. Do they negatively impact dexterity?
4. Should I use double gloves only for certain procedures or surgical specialities?

These questions are vexed. Not all have been fully answered. Recently however, researchers have attempted to find answers which have the potential to better inform guidance and policy.

One of the most astounding aspects of infection prevention and control is the unresolved level of HCW non-compliance observed across several different occupational groups and settings. Non-compliance is observed across a range of recommendations from hand hygiene^{3,4}, use of personal protective equipment⁵ and inappropriate wearing of OR attire⁶. This non-compliance has also been observed around glove use among nurses where almost one-fifth of respondents in a 2007 study reported not wearing gloves despite having cuts and abrasions.⁵

Research has recently confirmed that when glove integrity is compromised through tearing, splitting or piercing with a sharp object, there is potential for pathogens to transfer bi-directionally between the HCW and anything or anybody their hands touch.⁷ Glove micro-perforation is not uncommon and in the OR rates from 15% to 24% have been reported depending on the duration of wear.⁸

Investigators in that study recommended that gloves be changed routinely every 90 minutes regardless of whether or not a perforation is recognised. Further, for more than a decade we have known that in water-permeability tests leakage is reduced between

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three-to-nine fold when two pairs of gloves are worn compared to wearing a single pair of gloves.⁹⁻¹² One of the earliest studies of the benefits of double-gloving among surgeons found that in 82% of cases where an outer glove is perforated the inner glove protects the surgeon's hand from contamination.¹³



CURRENT EVIDENCE RELATING TO DOUBLE-GLOVING



Early systematic reviews reported mixed results regarding the protective effect of double-gloving for OR staff.^{9,14} However, the most recent 2014 Cochrane Review,¹⁵ reported that '...in 12 studies, two pairs of gloves reduced the number of perforations in gloves by 71% compared to the use of one pair of gloves. In three studies, two pairs of gloves reduced blood stains on the skin by 65%.' The Cochrane Review also reported

further reductions in perforations when three pairs of gloves are worn compared to either wearing a double or single pair of gloves. The use of indicator gloves which enable a coloured spot to show when the user's outer glove is perforated reduced the number of glove perforation in two studies.¹⁵ Overall, the Cochrane Review authors concluded that surgeons and surgical staff wearing two pairs of gloves rather than one reduce their risk of being exposed to and contracting serious viral infection occupationally. They recognise that more work is needed to determine whether the additional protective benefits apply to HCWs outside of the OR.

Two pairs of gloves reduced blood stains on the skin by 65%.

Some HCWs and particularly surgeons and OR staff are disinclined to wear more than one pair of gloves. They claim that their dexterity and ability to safely handle and use instruments is compromised or in some way diminished with the addition of an outer pair of gloves.^{16,17} Multiple studies investigating tactility and sensation both objectively and subjectively have concluded that there is no negative impact on tactility associated with use of double gloves.^{18,19} A 2010 study by Fry disputes any negative impact of double-gloving on a surgeon's manual dexterity and tactile sensation. In interviews with 56 surgeons, Fry found no difference in dexterity or sensation when no gloves, one pair or two pairs were worn.²⁰



Mylan and colleagues have recently published important work in which they advocate better understanding of glove use so that design, composition and fit can be maximised. Mylan also recognised differences between perceived and actual glove performance.²¹ It is likely that reluctance to wearing an additional pair of gloves is based more on a perception that dexterity and tactile sensation are affected than any actual measurable difference. The extent to which habitual practice and general disregard for infection control measures affect non-compliance with current recommendations for OR staff to routinely double glove should also be considered.²²

RECOMMENDATIONS AND REQUIREMENTS FOR DOUBLE-GLOVING



HCW non-compliance with infection prevention and control recommendations can result from lack of understanding, conflict with internal values and beliefs, poor human factors design that make compliance difficult or even ambiguous or conflicting positions included in relevant directives.²³ It is common for guideline recommendations to conflict with evidence especially as research using innovative new or re-designed equipment or product is published. Further, new product may come to market but there may be a substantial lag before the impact of product can be tested in clinical rather than laboratory-based settings in numbers sufficient for scientifically rigorous research. The submission and publication of peer-reviewed scientific research is typically also protracted. As a result, clinicians who demand evidence before adopting new technologies, formulations, designs or compositions may inadvertently be delaying local adoption of best practice.

Understanding the ongoing inability of guidelines and standards to reflect best available research and appreciating how this often results in conflicting recommendations is important. It often explains ambiguity in recommendations and the resultant confusion amongst HCWs as to which practice is best, safest and most effective.

Variations and conflicts in current Australian recommendations regarding double-gloving illustrate this point well and are described in this section. Making sense of which recommendation to follow at an organisational level is often left up to those with governance responsibility. Good practice should include an appreciation for staying on top of and understanding evolving research, product innovation and always checking the publication date of any directive as well as the currency of research used to underpin its recommendations. Obviously, where conflict exists, the “strength” of the directive, that is its role in terms of a legislative, accreditation or professional requirement, should also be considered.

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RECOMMENDATIONS AND REQUIREMENTS FOR DOUBLE-GLOVING

There are several very prestigious organizations that are involved with healthcare professionals and concerned with the protection and safety of both the healthcare worker and the patient. The following recommendations have come forth from these organizations:

Association of PeriOperative Registered Nurses

The Association of PeriOperative Registered Nurses stated, "Health care practitioners should double glove during invasive procedures."²⁴

American College of Surgeons

The American College of Surgeons states, "Double gloving does help to cut down by a factor of 10 the number of potential exposures." The ACS also acknowledges that double gloving will offer increased protection to the patient as well.²⁵

American Academy of Orthopaedic Surgeons (AAOS)

In June 2008, the American Academy of Orthopaedic Surgeons (AAOS) revised its Information Statement on "Preventing the Transmission of Bloodborne Pathogens" and double gloving is recommended.²⁶

Centers for Disease Control and Prevention (CDC)

The 1999 CDC Guideline for Prevention of Surgical Site Infection specified, "Wearing two pairs of gloves (double gloving) has been shown to reduce hand contact with patients' blood and body fluids when compared to wearing only a single pair."²⁷

Australian College of Operating Room Nurses (ACORN)

In 2014 the Australian College of Operating Room Nurses (ACORN) released updated Standards which represent the accepted standard of professional practice for Australian OR nurses. Standard 8 section 8.4 deals with glove use and sub-section 8.4.2 directly stipulates that nurses "comply with the recommended practice of double-gloving when scrubbed for surgical invasive procedures".²⁸

Australian Commission on Safety and Quality in Healthcare National Safety and Quality Health Service Standards: Standard 3 Preventing and Controlling Healthcare Associated Infections

Compliance with the above 2012 Standards is mandatory in all Australian healthcare organisations, day procedure centres and the majority of public dental services. Managing the foreseeable risk of glove perforation, tearing or splitting by recommending routine double-gloving during surgery fits within the Commission's standard. Further, Section 3.10.3 of Standard 3 stipulates that "action is taken to increase compliance with aseptic technique protocols". Accordingly, given current scientific evidence that bacteria pass through perforated gloves²⁹ and very recent proof that in non-surgical everyday clinical settings double-gloving can reduce the risk of viral contamination of HCW's hands during removal of PPE, there is growing argument for routine double-gloving.³⁰

International College of Surgeons (ICS)

The International College of Surgeons (ICS) urges all members to support and introduce whenever possible, standard double gloving with the additional benefit of a perforation indication system for all surgical intervention.³¹

European Center for Disease and Control (ECDC)

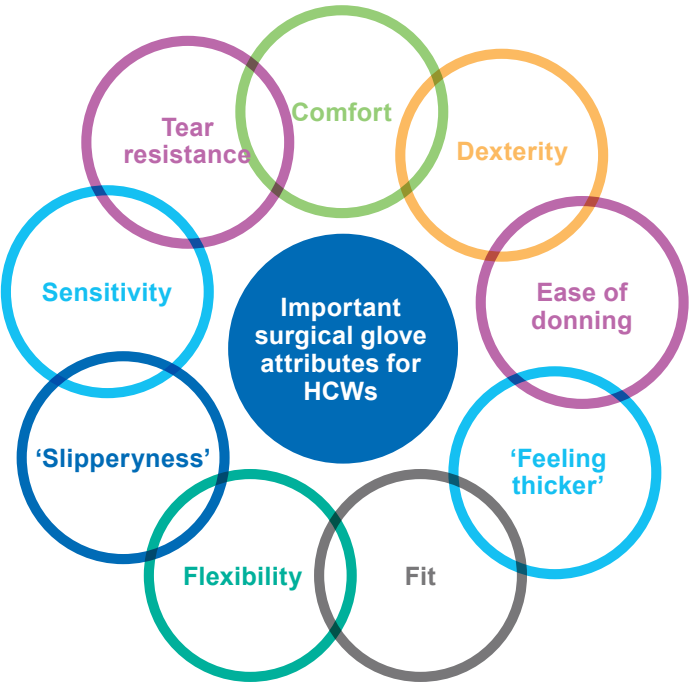
The European Center for Disease and Control (ECDC) encourages the practice of double gloving to reduce hand contact to bodily fluids.³²

World Health Organization (WHO)

The World Health Organization (WHO) recommends double gloving in countries with a high prevalence of HBV, HCV and HIV for long surgical procedures (>30 minutes), for procedures with contact with large amounts of blood or body fluids, for some high-risk orthopedic procedures, is considered an appropriate practice.³³

DOUBLE-GLOVING DECISION MAKING

It is well recognised that glove users value, appreciate and require specific glove features. These vary between individuals and across practice settings. The extent to which glove manufacturers and organisations can provide gloves that meet these requirements influences HCW glove use. Compliance with PPE use among surgical nurses has been studied with researchers concluding that items on the following list are what HCWs consider important in surgical gloves:⁵



If these requirements are met it could be assumed that users are more likely willing to don a second pair of gloves than if any of these criteria remain unmet. In addition to willingness to wear an additional pair of gloves users must also appreciate the risks posed by not wearing an additional pair. In the current clinical climate where directives, guidelines and requirements are unfortunately ambiguous and generally non-specific about double-gloving the clinician's decision is often based on their own decision. This is a particularly risky situation as multiple studies of HCW compliance with PPE recommendations confirm inadequate levels of protection.

Failure to double-glove is increased if the HCW makes the decision:

- with incomplete, incorrect or assumed information;
- on a case-by-case basis versus standard practice with inbuilt systems of reliability;
- based on observed incorrect behaviours of peers or superiors; and
- based on risk to self rather than also considering the risk to patient.

To overcome this risk, we encourage HCWs to engage in discussion with their respective infection prevention and control teams and senior management. These discussions should ensure that local policies, procedures and protocols reflect the needs and obligations of the organisation and the individual HCW. Discussion must also consider procedure and/or setting specific requirements. Consideration of new and evolving research should also inform practice.

Some organisations may manage the risk by stipulating that double-gloving is the minimum requirement. Others may make such a requirement mandatory only in certain circumstances. Less ideal is the option that the decision is left entirely up to the individual HCW's personal choice.³⁴

'Some organisations may manage the risk by stipulating that double-gloving is the minimum requirement.'

Ideally gloving practice should be standardised. Individuals required or choosing to routinely wear double gloves are encouraged to try several different combinations of glove type and size to determine which feels most comfortable.³⁴ The two-colour glove system is one possible approach double glove wearers may choose to adopt.

THE TWO-COLOUR GLOVE SYSTEM AND POINTS FOR PRACTICE

Indicator systems for detecting glove perforation have been used successfully for more than a decade.³⁵ Specifically, the 'two-colour' glove system involves use of a coloured indicator glove which is worn as the inside glove on each hand. It is typically darker than the standard outside glove so that any tear, split or other perforation in the outer glove is indicated by the inside glove becoming visible at the point of perforation.¹⁵ When the outer glove is perforated the moisture that seeps through allows the site of perforation to be more easily seen. The two-colour glove system therefore acts as an alert for the wearer making them realise that they must immediately change their outer glove.

The 'two-colour' glove system's importance stems from the consistently low rates of recognition of perforations in gloves (regardless of whether one of more pairs are worn) and the immediate breaks in asepsis and protection caused by those perforation. Reported rates of perforation recognition are low; ranging between 4.5% to 17%.^{13,36,37} They illustrate the importance of having a reliable and comfortable system for HCW's to recognise perforation. When an indicator system such as the two-colour glove system is used, glove perforation recognition rates are higher. Investigators have also reported that frequency of changing gloves among wearers of double gloves is significantly higher when an indicator system was used.³⁸

The following points to practice are based on recommendations from Childs³⁴ and other researchers.

They are offered here as further prompts and ideas to maximise the quality of infection prevention practice and guarantee patient and HCW safety:

- HCWs should routinely check their gloves for perforations even if they are not obvious.
- Double gloves should be common practice in all major cases, and specifically when contamination or extended duration are expected or encountered.
- If double gloves are worn and the outer glove is perforated, it is best to change both layers.
- Both viruses and bacteria have been demonstrated as being capable of passing through perforated outer gloves.
- Finding the most appropriate glove combination may require experimentation.
- Required glove resources include a colour indicator system and a range of glove sizes.
- Audits should be done regularly to monitor personnel compliance with PPE and glove-wearing recommendations.
- Ensure local policies, protocols and procedures are reviewed as evidence and technology evolves.

This edition of Ansell Cares InTouch raises controversial but important questions for infection prevention teams, OR staff and all HCWs to consider in terms of their own occupational health and safety as well as that of the patient. Part of guaranteeing that safety should involve routine use of double gloves in all situations in which the foreseeable risk warrants them.



WHAT'S HOT IN GLOVES

This section is separate from the above section and is intended to provide a brief overview of contemporary and emerging issues. One such issue is a peer-reviewed study which has provided further insight into HCW non-compliance with PPE recommendations. Given that non-compliance has confounded infection prevention teams for more than 40 years this section will briefly outline the authors' findings and recommendations especially those relating to glove use.

In the study Dhar³⁹ and colleagues investigated how HCWs in eleven US hospitals complied with PPE requirements and in particular how increases in the number of patients requiring contact isolation impacted compliance. The researchers studied HCW's hand hygiene practice, donning of gloves and gowns before room entry and also their practices on leaving the patient's room. Perhaps unsurprisingly the results indicated that as the volume of patients requiring isolation increased HCWs' compliance decreased. Overall observed compliance with gloving was 81%. Three professional groups; medical students, phlebotomists and radiology technicians wore gloves 100% whereas at 75.9% senior medical staff had the lowest rate of glove compliance. There was no significant difference between glove compliance in ICU and non-ICU settings. Investigators noted that the least HCWs were least compliant with the requirement to undertake hand hygiene before glove use. They recognise that even though there is an "8-fold reduction in bacteria" on HCW's hands as a result of glove use, hand hygiene remains crucial before and after glove use. This observation is therefore of concern.

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The overall compliance with all five requirements was only 28.9% and importantly, the study showed that when the proportion of patients requiring isolation exceeded 60%, there was a marked 6-fold reduction in compliance with all five elements. The authors suggest

that this may indicate isolation fatigue and they raise the important point that non-compliance even when the isolation frameworks are in place, may inadvertently contribute to disease transmission.

The study is a sobering reminder of why education, measurement and frontline healthcare worker involvement in infection prevention and control are crucial to our efforts to achieve sustained compliance improvements. Readers wanting to know more about this issue are encouraged to access the full article Dhar SMD, Marchaim DMD, Tansek RMD, et al. Contact Precautions: More Is Not Necessarily Better. *Infection Control and Hospital Epidemiology* 2014;35:213-21.



Compared to the science the social media platforms have been less forthcoming with information about gloves. A quick search on Twitter using the term 'gloves and infection' has however revealed an interesting link to a page Medline Plus which is a service of the U.S. National Library of Medicine and the National Institutes of Health (NIH). The page is titled 'Wearing gloves in the hospital' and in less than 600 words it succinctly describes when and how to wear gloves in hospitals. Check out the posting at this link. In the meantime we will continue to scour the conference circuit, as well as the research and social media platforms for more examples of glove-related information. We look forward to sharing our findings in upcoming editions of Ansell Cares InTouch.

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