



## Review

# Disinfection of gloved hands for multiple activities with indicated glove use on the same patient

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## SUMMARY

Most hand hygiene guidelines recommend that gloves should be changed during patient care when an indication for hand disinfection occurs. Observational studies indicate that the majority of healthcare workers (HCWs) do not disinfect their hands at all during continued glove wear. The aim of this narrative review is to assess the potential benefits and risks for disinfecting gloved hands during patient care for multiple activities with indicated glove use on the same patient. Continued glove wear for multiple activities on the same patient often results in performing procedures, including aseptic procedures with contaminated gloves, especially in a setting where there are many indications in a short time, e.g. anaesthetics or accident and emergency departments. Of further note is that hand hygiene compliance is often lower when gloves are worn. To date, three independent studies have shown that decontamination is at least as effective on gloved hands as on bare hands and that puncture rates are usually not higher after up to 10 disinfections. One study on a neonatal intensive care unit showed that promotion of disinfecting gloved hands during care on the same patient resulted in a significant reduction in the incidence of late-onset infections and of necrotizing enterocolitis. We conclude that disinfection of gloved hands by HCWs may substantially reduce the risk of transmission when gloves are indicated for the entire episode of patient care and when performed during multiple activities on the same patient.

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## Introduction

Disinfection of gloved hands was first proposed in 1899 by Kocher who advocated the wearing of sterile gloves for every operation, whether hands were washed beforehand or not. He proposed that during long operations the gloved hands should be immersed from time to time in a strong antiseptic solution in

cases ‘when the surgeon wants to work particularly carefully’ [1]. Today, the topic is no longer relevant for procedures such as surgery where sterile gloves are worn. However, for medical examination gloves, disinfection of gloved hands might contribute to patient safety more than most healthcare workers (HCWs) would anticipate.

It is generally recommended that gloves should be used for activities that could involve exposure to blood or other body fluids; where patients are isolated with contact precautions; and in outbreak settings [2–6]. Gloves should then be removed when they are damaged or non-integrity is suspected [2,3]; after contact with blood or other body fluids, non-intact skin,

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or mucous membranes [2,3,5]; on leaving an isolation room, and as soon as an episode of patient contact or treatment has ended [2–5]. Individual guidelines also recommend removal of gloves where there is an indication for hand hygiene [2,3] or after use for washing a patient [3].

Inappropriate glove use refers to the wearing of gloves where there is no indication, and to the continued wearing of gloves that should have been removed [7]. For example, in rehabilitation units an indication for glove use was found in 17.1% of all contacts, but gloves were worn for 41.4% of all contacts [8]. In another study 213 anaesthetists were asked whether they routinely change gloves between patients. The total response rate was 68.1% with only 14.5% ‘always’ changing gloves between patients and 40% doing so ‘frequently’ [9]. Although levels of inappropriate glove use differ from country to country, the practice appears to be worldwide. For example, data from Malaysia show a high proportion of inappropriate glove use of 74.3% [10], whereas in the UK a rate of 57.5% was reported, resulting in a risk of cross-transmission in 36.8% of patient care episodes [7]. The main risks of inappropriate glove use are missing opportunities for hand hygiene and that gloves may be a vector for microbial transmission [2]. Indeed in long-term care facilities, unnecessary glove use was observed to have a clear negative effect on hand hygiene compliance [11]. Substituting glove use for hand hygiene may place HCWs and patients at risk of colonization or infection with pathogenic micro-organisms [12].

Despite the emphasis on removal of gloves after single use and avoidance of inappropriate glove use [7], there are many clinical situations when HCWs (perhaps appropriately) routinely wear gloves during multiple activities on the same patient. For example, anaesthetists and their assistants may wear the same gloves during an entire surgical procedure [13–15], despite limited hands-on patient time. The routine use of gloves is recommended in this setting [16,17]. However, while wearing gloves that may be contaminated with a patient’s micro-organisms, anaesthetists will repeatedly touch anaesthetic equipment and computer keyboards [18]. In accident and emergency departments and in ambulances staff continue to wear the same gloves when attending patients, despite the likelihood of their gloves becoming contaminated with patients’ micro-organisms and having contact with the environment [19,20]. Recently a survey among 417 paramedics in Australia revealed that all of them wear disposable gloves for every clinical case. The majority (57.8%) of them only changed gloves at the end of a case. The physical difficulty of changing gloves in some of the operational environments was a major barrier for hand hygiene compliance [21]. Another example is the insertion of central venous catheters (CVCs). Kocent *et al.* observed 20 CVC insertions and reported that immediately before CVC insertion the gloved fingertips of the operator were contaminated with micro-organisms in 55% of cases; contamination was assumed to originate from touching the previously disinfected skin. However, use of alcoholic chlorhexidine successfully decontaminated gloved hands. The authors therefore proposed that gloved hands should be disinfected immediately before CVC insertion [22], especially if a no-touch technique was not performed. In the recent Ebola virus disease (EVD) epidemic in West Africa, decontamination of gloved hands became standard practice, following transmission of the disease to a nurse in Spain [23] and to two nurses in the USA [24]. A new key component of the WHO guidelines was the disinfection of gloved

hands during patient care and during doffing of the personal protective equipment (PPE). Depending on the number of elements of PPE, the current guidelines recommend up to eight disinfections of gloved hands during doffing of PPE [25].

The EVD guidance has reopened the debate about the pros and cons of disinfection of gloved hands. In this narrative review, we explore the routine wearing of gloves during multiple activities on the same patient. We assess (i) the risk of glove contamination and cross-transmission for subsequent activities; (ii) the compliance with hand hygiene during continued glove use; (iii) the efficacy of hand disinfection on gloved hands; (iv) glove integrity after using hand rubs on gloved hands; and (v) the impact of disinfecting gloved hands on nosocomial infections.

## Methods

A systematic literature search was conducted via the National Library of Medicine (PubMed) on January 10<sup>th</sup>, 2017 and via the Cochrane Library on January 14<sup>th</sup>, 2017 using the following terms: medical glove (19 hits), examination glove (29 hits), compliance, adherence, glove use (371 hits) with compliance (74 hits) or adherence (41 hits), universal gloving (12 hits), gloving practice (89 hits), gloved hand (78 hits), contaminated glove (126 hits), disinfection of gloves (0 hits), disinfection of gloved hands (0 hits), glove integrity (19 hits) and glove puncture (44 hits). In addition, studies deemed suitable for this review were also included. Data were extracted from the publications by one author and reviewed by the other author. Studies were selected when they provided original data on glove use (medical or examination gloves) and hand hygiene compliance for multiple and/or single patients as well as for multiple and single patient care activities (15 studies), when they contained original data on glove integrity after washing or disinfecting gloved hands (nine studies), when they contained original data on the efficacy of hand disinfection on gloved hands (six studies), and when they contained original data on the nosocomial infections when gloved hands are allowed or even promoted to be disinfected during patient care (one study). Guidelines from the UK [epic3 and the National Institute for Health and Care Excellence (NICE)], Germany [Association of the Scientific Medical Societies (AWMF) and the Robert Koch Institute] and the World Health Organization (WHO) were also reviewed.

## Results

### *Risk of glove contamination and cross-transmission for subsequent activities*

The recommendations on glove use when HCWs perform multiple activities in a single patient are clearly defined by WHO: ‘when wearing gloves, change or remove gloves during patient care if moving from a contaminated body site to either another body site (including non-intact skin, mucous membrane or medical device) within the same patient or the environment’ [5]. The NICE guideline states that ‘gloves must be changed between different care or treatment activities for the same patient’ [4]. Furthermore, the epic3 guideline recommends that ‘gloves must be removed as soon as an episode is completed’ and ‘changed between caring for different patients’ [6].

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