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Article *in* American Journal of Infection Control · October 2017

DOI: 10.1016/j.ajic.2017.08.029

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ARTICLE IN PRESS

American Journal of Infection Control ■■ (2017) ■■-■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Commentary

Glove: Use for safety or overuse?

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BACKGROUND

Occupational exposure to blood and body fluids presents a major safety risk for bloodborne viruses to all health care workers (HCWs). In response to human immunodeficiency syndrome (HIV), various strategies were adopted to reduce this risk.[1] The most important and cost-effective strategy was the introduction of gloves as part of personal protective equipment (PPE) for all potential or expected exposures to blood and body fluid.[1] The term gloves in this report refer to nonsterile, medical, and examination gloves. Today, the aim of glove use is for the protection of both the care provider and the patient.[2] However, the indications for glove use are now broader than the original intention, with some contemporary authors raising concerns that gloves have inadvertently affected hand hygiene practice before[3-5] and after the introduction of My 5 Moments for Hand Hygiene.[2-6] In this article we present a historical overview of glove use to explain the changes in the pattern of use over time and call for a safe reduction of glove use to improve hand hygiene practice.

HISTORICAL PERSPECTIVE

In 1758, gloves were made from sheep caecum in an attempt to protect the surgeon's hands during surgery, vaginal examination, and autopsies.[7] By 1899, a surgeon, William Halsted, advocated gloves for the protection of patients from surgical infections during hernia operations.[7] However, in the early 1900s, the purpose of gloves was refocused on the protection of HCWs while caring for patients with contagious diseases such as small pox, diphtheria, or meningitis when protective equipment included gauze masks, hair covering, gloves, and gowns.[8,9] However, HCWs were not overtly instructed to protect patients from these potentially contaminated equipment that were used for multiple sequential patients.[8,9]

During the mid-1950s, the consensus for adequate handwashing in the absence of gloves was "more than a dozen times in a working day,"[10] and in 1957, glove use moved out of the operating theater onto the ward.[11] Then gloves on the ward were used in conjunction with handwashing after every patient but only for "grossly contaminated hands with pathogens."[11] The aim of these instructions were to reduce bacterial contamination on hands but also to protect nurses from frequent washing with harsh handwashing chemicals such as chlorinated lime, chlorhexidine, and tricresol.[10] The editor of the September 1958 edition of *The Lancet* supported the use of thin, sterile, rubber gloves for possible exposures to body fluids during washing and shaving patients, preparing a cadaver, changing diapers, wound care, and changing stained bed linen.[10] The aim of glove use was to reduce frequent handwashing, and *The Lancet* was the first reference of this promotion.[10]

EVOLUTION OF THE AIM OF GLOVE USE

Gloves have evolved during the 20th century. In 1960, the disposable glove emerged, and the prepackaging gloves in 1966 transformed gloves into an essential accessible protective item.[12] A decade after *The Lancet* recommendation,[10] the American Hospital Association published the first hospital infection control manual[13] that detailed gloves, mask, and gown use as precaution equipment for the "containment of contagious infectious diseases." This recommendation suggested that the target of the equipment was the safety of HCWs. The term personal protective equipment was introduced during the 1970s by the Occupational Safety Health Administration[14] of the United States Act. Two years after the American Hospital Association manual was released, the U.S. National Communicable Disease Center, now known as the Centers for Disease Control and Prevention (CDC), released their own manual[8] and gave attention to the category of isolation and recommended the use of PPE and explicitly identified the aim of PPE was for the protection of both HCWs and patients from communicable diseases.[8]

UNIVERSAL PRECAUTIONS

The risk of HCWs being exposed to HIV infection through sharps injuries and mucus membrane or nonintact skin contamination was the impetus for the change in the existing category- or disease-specific isolation practices in U.S. hospitals.[15] These new precautions

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Conflicts of interest: None to report.

https://doi.org/10.1016/j.ajic.2017.08.029

were termed universal precautions[16] and recommended glove use when handling blood or body fluids to explicitly reduce the HCWs' risk of exposure to bloodborne viruses.[17] Further recommendations included masks and eye protection to eliminate mucus membrane exposure to blood or body fluids[18] and the wearing of gowns for all patient contact regardless of their presumed infection status.[16] The category-specific system of isolation was practiced for many years; however, the efficacy of category- and disease-specific isolation to reduce the frequency of health care–associated infections was never formally evaluated.[19]

In 1987, the CDC published a document entitled "Recommendations for prevention of HIV transmission in health-care settings."[20] In an attempt to clarify these recommendations and improve the practicality of the recommendations, the CDC introduced 10 years later another new system of isolation called body substance isolation.[16] This system primarily used gloves to isolate the HCWs from all moist and potentially infectious body substances (blood, feces, urine, sputum, saliva, wound drainage, and other body fluids) regardless of the patient's presumed infection status.[21]

REINFORCEMENT OF GLOVE USE OVER HANDWASHING

Body substance isolation and universal precautions shared many similar features designed to prevent the transmission of bloodborne pathogens to HCWs. However, there was an important difference in the recommendations for glove use and handwashing. Universal precautions recommended gloves for anticipated contact with blood and specified body fluids, and hands were to be washed immediately after glove removal.[21] Under body substance isolation, gloves were recommended for anticipated contact with any moist body substance, but handwashing after glove removal was not required unless the hands were visibly soiled.[16,19] The original emphasis of glove use for body substance isolation was an alternative rather than a supplement to handwashing.[15] Observations made by the late 1980s suggested that an overreliance on glove use produced an increased risk of the transmission of pathogens from the contaminated gloved hands to patients and to the environment,[21,22] and reports on compromised handwashing compliance followed.[23,24]

By 1990, the consequences of multiple changes to guidelines for glove use that did not also focus on diligent handwashing[1] raised concerns about poor compliance with hand hygiene associated with glove use.[25-27] The lack of consensus for the importance of handwashing associated with glove use,[28] infrequent change of gloves, and confusion over which blood and body fluid required precautions produced in 1996 a revision of the existing isolation guidelines,[29] called "Guidelines for isolation precautions in hospitals."[16] Universal precautions were now referred to as standard precautions, whereas transmission-based precautions referred to the specific prevention and control methods based on the transmission mode of each pathogen.[30] Based on the known modes of transmission, precautions were classified into contact precautions, airborne precautions, and droplet precautions.[29] Standard precautions applied to all patients, whereas transmission-based precautions were applied according to the pathogen.[29]

Applying these precautions has challenges, including the interpretation of the principles of the infection prevention strategies and the strict use of PPE where the transmission modes may be airborne and droplet transmission.[31] Contact precautions now require hand hygiene and the donning of PPE before entry to the patient zone to ensure the HCW's clothing and skin did not come into contact with the patient's environment; on exiting the room, the HCW is required to remove all PPE and immediately perform hand hygiene.[1,32] With the current primary emphasis on gloves as a protective barrier for HCWs against pathogens, it is unsurprising that hand hygiene remains low before and after removal of gloves.[3,5,33] The historical absence of a focus on changing contaminated gloves between care activities has been undervalued as a mode of transmitting bacterial contamination from gloved hands to susceptible patients.[34] Gloves are not impervious to microorganisms, and hands can become progressively contaminated with pathogens during routine patient care.[32] Regardless of the indications in contact precautions for glove use, there remains an overreliance on gloves in an absence of integrating hand hygiene into the My 5 Moments for Hand Hygiene.[35] This integration of changes of gloves with associated hand hygiene remains a challenge because of conflicting current policies[29] and practice guidelines.[36] HCW willingness to accept the scientific rationale behind the role of hand hygiene and glove use varies.[3,37,38] Despite the application of these new precautions,[29] the transmission of pathogens continues in teaching hospitals globally,[39-42] even after the introduction of My 5 Moments for Hand Hygiene[35,43] that is possibly hampered by glove use.[5,44,45]

DOES GLOVE USE INFER THAT MY 5 MOMENTS FOR HAND HYGIENE IS NOT SUFFICIENT PROTECTION AGAINST COLONIZATION OR INFECTION FROM PATHOGENS?

The role of HCWs' hands in the transmission of pathogens to patients is undisputed,[46-48] and high compliance is accepted as the most cost-effective infection prevention activity.[32,49,50] However, there are several challenges to improving hand hygiene compliance around glove use. First, HCWs find integrating changes of gloves into the principles of My 5 Moments for Hand Hygiene notoriously difficult.[3,35,45] Second, by advocating glove use for contact with patients under isolation when no exposure to body fluid is expected, it is only natural that HCWs conclude hand hygiene alone is not reliable.[37] Finally, efforts to provide candid feedback about compliance with and without gloves is complicated by falsely enhanced compliance rates produced by the Hawthorne effect.[51-54]

Practice-based reports suggest that the purpose of glove use is to protect both patients and HCWs from exposure to infectious agents carried on hands.[55] However, the evidence contradicts this strategy because an ambulatory patient does not require protection from the pathogen that has placed them under contact precautions during noninvasive care. Rather, HCWs have become accustomed to feeling safe with gloves, and this feeling may have averted their need for hand hygiene.[45] When attempting to improve hand hygiene associated with gloves,[4,5,45,46] more attention needs to be given to changing contaminated gloves during an episode of care that had the HCW's hands been ungloved would have involved several indications for hand hygiene. An example of this risk for transmission associated with gloved hands includes the use of the same gloves between different sites on the same patient and care zones such as when a HCW takes a telephone call or writes up the medical records without removing contaminated gloves.[33,44]

Common breaches of infection control and suggested indications for removal of gloves for hand hygiene that would have occurred for ungloved hands in accordance with My 5 Moments for Hand Hygiene are outlined in Table 1. Nonsterile glove boxes have been reported to be contaminated with bacteria, and the source of the bacteria is likely to have included HCWs' contaminated hands as they access gloves.[56,57] A common error that is associated with glove use and isolation precaution occurs around moment 2 when HCWs fail to change nonsterile gloves donned outside the patient zone into sterile gloves for invasive or aseptic care opportunity.

RECOMMENDATION

The choice to use nonsterile gloves can be driven by emotion and a feeling of aversion associated with touching the patient rather than an indication of risk,[45] whereas failure to change or remove

Table 1
Glove use and change of gloves by type of patient care

Type of patient care	Hand hygiene	Gloves indicated	Indication for change of glove
Taking vital signs	Yes	No	
Administering oral medication	Yes	No	
Adjusting IV pump	Yes	No	
Administering IV medication	Yes	Yes, immediately before the procedure	Change gloves and perform hand hygiene for continued care
Changing peripheral catheters	Yes	No, unless visibly soiled	Change gloves and perform hand hygiene for continued care (eg between removing catheter and applying wound dressing)
Personal hygiene	Yes	No, unless patient is incontinent or HCW anticipates exposure to secretions or excretions	Change gloves and perform hand hygiene for continued care (eg, between wound assessment and IV medication, output measurement, and medication administration)
Wound care	Yes	Yes (sterile gloves)	Change between dirty to clean care

HCW, health care worker; *IV*, intravenous.

contaminated gloves is predictive of poor hand hygiene compliance.[44] My 5 Moments for Hand Hygiene should be refreshed to explicitly indicate the removal of gloves between the moments as this would reduce the risk of cross infection and improve compliance. The elimination of routine glove use from contact precautions would reduce wastage and improve cost savings while adding substantial value to the delivery of patient care without a concomitant increase in infections even if hand hygiene compliance remained stable.[58,59] Before reaching for gloves, HCWs are more than able to assess the need for gloves based on the likelihood of exposure to blood or body fluids.[36] A modified glove use approach with a cultural shift[60] would improve the safety of patient-centered care.

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