Hand hygiene compliance in a universal gloving setting

Noriko Kuruno, Kei Kasahara, MD, PhD, Keiichi Mikasa, MD, PhD

Center for Infectious Diseases, Nara Medical University, Japan

Correspondence to:
Kei Kasahara, MD, PhD
Center for Infectious Diseases, Nara Medical University
634-8522, Shijo, Kashihara, Nara, Japan
Telephone: 81-744-22-3051
Email: kassan@naramed-u.ac.jp

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ABSTRACT

Background: The use of gloves for every patient contact (universal gloving) has been suggested as an infection prevention adjunct and alternative to contact precautions. However, gloves may carry organisms unless they are changed properly. In addition, hand hygiene is required before donning and after removing gloves, and there are scarce data regarding glove changing and hand hygiene in a universal gloving setting.

Methods: This non-randomized observational before-after study evaluated the effect of education and feedback regarding hand hygiene. Compliance with hand hygiene and glove use was directly observed in a universal gloving setting at a 10-bed intensive care unit in a Japanese tertiary care teaching university hospital.

Results: A total of 6,050 hand hygiene opportunities were identified. Overall hand hygiene compliance steadily increased from study period 1 (16.1%) to period 5 (56.8%), although there were indication-specific differences in the baseline compliance, the degree of improvement, and the reasons for non-compliance. There were decreases in the compliance for universal gloving and the incidence of methicillin-resistant Staphylococcus aureus.

Conclusion: It is difficult to properly perform glove use and hand hygiene in a universal gloving setting, given its complexity. Direct observation with specific feedback and education may be effective in improving compliance.

Key words: hand hygiene compliance; universal gloving; direct observation
Highlights (for review)

- Universal gloving may help prevent healthcare-associated infections.
- However, hand hygiene remains important, even in universal gloving settings.
- We evaluated whether hand hygiene and gloving were related.
- Hand hygiene exhibited indication-specific increases after education sessions.
- Direct observation with feedback and education may help improve compliance.
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Introduction

Healthcare-associated infections (HAIs) are a major threat to patient safety, and the estimated 1.7 million HAIs each year in the US are associated with significant healthcare costs and numbers of deaths. Although there are no clear data regarding the overall effects of HAIs in Japan, Uematsu et al. recently reported that patients who received anti-methicillin-resistant Staphylococcus aureus (MRSA) drugs had a longer median hospitalization (21 days vs. 14 days) and higher in-hospital mortality rate (22.6% vs. 12.2%), compared to patients who did not receive these drugs. The Centers for Disease Control and Prevention (CDC) guidelines recommend a well-known two-tier approach to infection control: standard precautions and transmission-based precautions. However, the success of these precautions is limited by several factors, such as contact protection measures only being implemented after a patient has been colonized and diagnosed with a multi-drug resistant organism (MDRO) infection. Thus, active surveillance cultures are used to help limit the transmission of MDROS, although its sensitivity is limited for specific MDROS and it may be prohibitively expensive for some healthcare facilities. Furthermore, even if contact precautions are used, reports have described low rates of adherence to glove use, gown use, and hand hygiene.

The use of gloves and gowns for all patient contacts (universal gloving and gowning) may help reduce the spread of microorganisms, including MDROS. For example, the Benefits of Universal Gloving and Gowning (BUGG) study, which was led by Harris et al., demonstrated that universal gloving and gowning reduced MRSA acquisition by 40% at 20 medical and surgical intensive care units (ICUs) in 20 American hospitals. Furthermore, Yin et al. reported that universal gloving during the respiratory syncytial virus season was associated with significantly lower rates of bacteremia and central line-associated bloodstream infections in pediatric ICUs and bone marrow transplant units. Although gloves are effective for protecting healthcare workers' (HCWs) hands from contamination with MDROS, Girou et al. reported that failure to change or remove contaminated gloves was associated with a high-risk of microbial transmission. Furthermore, in 2009, the World Health Organization (WHO) published guidelines regarding hand hygiene in the healthcare setting, which clearly state that "in no way does glove use
modify hand hygiene indications or replace hand hygiene”. Therefore, removing and changing gloves plus appropriate hand hygiene are needed to make universal gloving successful. The WHO hand hygiene guidelines also indicate that direct observation is the gold standard for evaluating compliance, although the BUGG study only evaluated compliance at room entry and exit. The present study is the first to evaluate hand hygiene compliance at all five moments in a universal gloving setting using direct observation. We also evaluated the relationship between hand hygiene and gloving, as well as the effect of education on hand hygiene and glove use improvements.

Materials and methods

Study design and outcome

This non-randomized observational before-after study evaluated hand hygiene compliance in an ICU using direct observation, as well as the effects of education and feedback. The primary outcome was hand hygiene compliance and the secondary outcomes were glove use compliance and MRSA incidences.

Study setting

This study was performed in the ICU of a tertiary care teaching university hospital with 992 beds in Nara, Japan. This ICU is a 10-bed unit that houses patients with acute-onset life-threatening diseases, such as cardiopulmonary arrest, stroke, severe burns, and multiple trauma. All rooms have a single bed, with one alcohol gel dispenser near the bed and one sink with antiseptic soap and paper towels. Alcohol-based hand rub was also available beside the personal computers that are located outside of each room, the desk for preparing infusions, and the portable x-ray machine. Gowns and each size of disposable latex gloves were available in racks outside of each private room. This ICU performed active screening for MRSA at the admission for all inpatients using nasal swabs and the conventional culture technique, and had a policy of universal gloving (staff wore gloves whenever they entered all patient rooms). This policy was implemented 3 years before this study because of an increase in the incidence of MRSA at that time.
Interventions

The study periods consisted of a baseline observational period (period 1: June 24, 2011 to November 28, 2011) and four interventional periods (period 2: April 9, 2012 to August 10, 2012; period 3: August 13, 2012 to November 2, 2012; period 4: November 5, 2012 to July 22, 2013; and period 5: July 26, 2013 to November 18, 2013). During each period, direct observation of nurses’ hand hygiene was performed by N.K. twice per week (at 9–10 AM and 1–2 PM) using the modified WHO direct observation method, which evaluates five moments of hand hygiene (before patient contact, before clean/aseptic procedures, after exposure to body fluids, after touching a patient, and after touching the patient’s surroundings). Although the WHO hand hygiene technical reference manual recommends recording glove use only when hand hygiene is not performed, glove use in the ICU was always recorded to facilitate the evaluation of universal gloving compliance.

N.K. is a registered nurse who completed a 6-month course to become certified as a Professional Nurse for Infection Prevention and Control by the Tokyo Healthcare University. N.K. learned about direct observation using the WHO guidelines regarding hand hygiene in healthcare, a hand hygiene technical reference manual, and training films. The nurses in the study’s ICU were informed that their clinical practices were to be observed, and N.K. was given strict instructions to maintain a distance that would not interfere with the observed nurses’ clinical care.

Several educational sessions were administered by N.K. or K.K. between each period to maximize the number of staff who could attend, although not all staff attended each session. The sessions involved a slide presentation of approximately 30 min regarding the WHO’s “My Five Moments” of hand hygiene, correct hand hygiene indications and techniques, and feedback based on the results of the direct observation. The educational sessions before period 4 and period 5 were specifically focused on appropriate hand hygiene before donning and after removing gloves.

Calculations

Hand hygiene compliance (%) was calculated as the number of hand hygiene performances divided by the number of hand hygiene opportunities, according to the WHO definition. Universal gloving compliance was
calculated as the number of glove uses divided by the number of hand hygiene opportunities. The relationship between glove use and hand hygiene was closely monitored and classified as: (1) hand hygiene non-compliance without wearing gloves (universal gloving non-compliance), (2) hand hygiene non-compliance because of unchanged gloves, (3) hand hygiene non-compliance when donning or removing gloves, (4) hand hygiene compliance without wearing gloves (universal gloving non-compliance), and (5) hand hygiene compliance with appropriate glove donning, removal, or changing. The overall incidence of MRSA infection or colonization was calculated by dividing the total number of MRSA-positive patients by the total number of patient-days at the ICU, and multiplying the resulting value by 1,000.

Ethical considerations

This study was performed as a part of an infection control program in the hospital, and the requirement for ethical approval was waived.

Results

During the study period, 6,050 hand hygiene opportunities were identified (period 1: 1,221, period 2: 1,611, period 3: 711, period 4: 1,696, period 5: 811). Overall hand hygiene compliance increased from period 1 (16.1%) to period 5 (56.8%; P < 0.05, chi-square test for trend), and this increase was mainly related to hand rubbing (from 7.0% to 45.7%), rather than hand washing (from 9.1% to 11.1%) (Figure 1).

The baseline compliance and the degree of improvement varied according to the specific indication (Figure 2). The baseline hand hygiene compliance was lowest before aseptic/clean procedures (3.3%) and highest after contact with a patient’s environment (38.2%). Although the compliance improved for each indication over time, the compliances before aseptic/clean procedures and after body fluid exposure were low during period 3 and period 4. Therefore, we further evaluated hand hygiene compliance according to glove use (Figure 3). The reasons for hand hygiene non-compliance also varied according to the specific indication. Before aseptic/clean procedures (moment 2), the major reasons for hand hygiene non-compliance were unchanged gloves (i.e., gloves that were already worn before the aseptic tasks because of the universal gloving policy) and hand
hygiene not being performed (Figure 3d, moment 2). After body fluid exposure (moment 3), the major reasons for hand hygiene non-compliance were unchanged gloves (i.e. gloves were not changed after body fluid exposure) or missed hand hygiene after removing gloves because of body fluid exposure (Figure 3c, moments 3 and 4).

Based on these findings, we focused on the importance of changing gloves during the education sessions after periods 3 and 4, especially in the context of the universal gloving setting and the need for hand hygiene before donning and after removing gloves. Hand hygiene compliance increased after the education sessions, although it was still lower than that for other indications.

Although hand hygiene compliance improved over time, universal gloving compliance decreased over time (Figure 3b, all moments). The incidence of MRSA also exhibited a declining trend during the study period (Figure 4).

Discussion

Hand hygiene is generally considered the most important activity for preventing HAI, although a WHO review of hand hygiene studies found that the average baseline hand hygiene compliance rate among healthcare workers was only 38.7% (range: 5–89%). To the best of our knowledge, our study is the first to evaluate hand hygiene compliance in a universal gloving setting based on direct observation according to the WHO’s “My Five Moments” of hand hygiene guideline. The baseline hand hygiene compliance rate in the present study was low (16.1%), although the hand hygiene compliance rates varied significantly according to the specific indication, with the highest rate being observed after patient contacts. Similarly, several studies have reported better hand hygiene compliance when gloves were used, which may have been related to a simultaneous increase in hand hygiene compliance after room exit and glove removal.

The present study also revealed poor hand hygiene compliance before patient contacts, before aseptic/clean procedures, and after body fluid exposure. Furthermore, there was limited improvement before aseptic/clean procedures and after body fluid exposure. However, the reasons for non-compliance varied according to the
specific indications. For example, most non-compliance before patient contact was related to the non-performance of hand hygiene before donning gloves. In contrast, most non-compliance before aseptic/clean procedures was related to the gloves not being changed. These findings are useful for understanding hand hygiene non-compliance, and may help develop plans to improve hand hygiene compliance in universal gloving settings.

Improvements in HCW behaviors are best achieved through staff education, including audits and providing feedback, and this approach has been shown in multiple studies to effectively prevent HAIs. Furthermore, hygiene evaluation and training based on audits, feedback, and education are key elements of the WHO multimodal hand hygiene improvement strategy. Moreover, reporting the results of hand hygiene observation based on the five moments is recommended, as the effect of feedback is improved when the different moments are individually discussed and addressed.

Hand hygiene indications in the universal gloving setting are extremely complicated and require specific instructions to increase compliance. For example, the present study revealed limited improvements in compliance before aseptic/clean procedures and after body fluid exposure, which were related to the wearing of unchanged gloves because of the universal gloving policy. Thus, the education sessions after periods 3 and 4 focused on the importance of changing gloves and performing hand hygiene before aseptic/clean procedures and after body fluid exposure. We believe that any improvements in hand hygiene would have been impossible without this specific education and feedback. Therefore, in special populations, such as nurses working in a universal gloving setting, feedback and education based on direct observation (with some modifications of the observation sheet) may be effective for improving hand hygiene compliance.

The ultimate aim of hand hygiene is to prevent HAIs, and several studies have demonstrated that hand hygiene may reduce the rates of healthcare-associated colonization or infections with MRSA, Clostridium difficile, and other MDROs. The incidence of MRSA decreased in the present study, which may have been related to the implementation of universal gloving at the start of the intervention. However, no other infection control strategies (other than hand hygiene) were changed during the intervention, which suggests that the decreased
MRSA incidence was related to improvements in hand hygiene compliance.

Another interesting finding is that the universal gloving compliance gradually decreased, while the hand hygiene compliance increased during the study period. Multiple studies have revealed that glove use is associated with poor hand hygiene compliance, which is related to a failure to change or remove contaminated gloves. However, our results indicate that poor glove use compliance was associated with improved hand hygiene compliance. We assume that the improved hand hygiene compliance may have compromised the use of gloves, or may have improved the HCWs' understanding that hand hygiene is more effective than universal gloving.

There are several limitations to this study. First, this study was performed in a single ICU, and the results may not be generalizable to other wards or medical facilities. Second, we only observed nurses, as hand hygiene compliance among physicians is generally poor, and further studies are needed to evaluate compliance among various types of HCWs. Third, the observations were only performed during the daytime and the results may not represent hand hygiene compliance throughout the entire day. Fourth, the findings were likely affected by the Hawthorn effect, which is inherent to direct observation studies, and the compliance rates might have been artificially elevated.

In conclusion, we performed direct observation of hand hygiene compliance in an ICU with a universal gloving policy, and provided stepwise feedback and education. The hand hygiene compliance rate gradually increased, with decreases in universal gloving compliance and MRSA colonization. These results indicate that the relationship between hand hygiene and glove use is complicated in the universal gloving setting, which highlights the importance of specific and thorough education to ensure the success of universal gloving.

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**Conflicts of interest**
None to report.

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Figure legends

Fig 1. Overall hand hygiene compliance during the study period
Fig 2. Indication-specific hand hygiene compliances during the study period
Fig 3. Hand hygiene compliance according to glove use
Fig 4. Glove use compliance (%)
Fig 5. Methicillin-resistant *Staphylococcus aureus* (MRSA) incidence per 1,000 patient-days
References


Fig 1. Overall hand hygiene compliance during the study period.
Fig 2. Indication specific hand hygiene compliance during the study period.