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Modified glove use for contact precautions: Health care workers' perceptions and acceptance

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Hand hygiene
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Background: Patients colonized or infected with methicillin-resistant *Staphylococcus aureus* and or vancomycin-resistant *Enterococcus* are placed under contact precautions. Contact precautions require patients to be placed in single rooms and their health care workers (HCWs) to wear gowns, aprons and gloves on entry and doffing on exit. Glove use is widely accepted to be associated with poor hand hygiene compliance. We trailed the removal of gloves for contact precautions for contacts not expected to involve body fluids to improve hand hygiene between multiple contacts of the patient and patient zone.

Methods: We have conducted a 5 phase study of the removal of gloves for contacts without body fluids in 250 HCWs using pretrial focus groups (N = 12), hand microbiology (N = 40) (reported elsewhere), development of a modified contact precautions poster, trial of modified poster (n = 100), posttrial focus group discussion (n = 22), and a survey of HCWs postrollout in additional locations (n = 76).

Results: Pretrial focus groups identified 4 themes, and the leading theme identified as the facilitator for glove use as self-protection. HCWs viewed current contact precaution guidelines as preventing them from making their own judgement regarding the need for gloving for patient contacts, leading continuous glove use without changing gloves between multiple contacts.

Participants believed that the trial empowered them to make their own clinical judgment for gloves and to consciously use hand hygiene between dry (no body fluid) contacts.

Four themes were discussed during the posttrial focus groups and although self-protection remained the central theme, hand hygiene replaced glove use. Participants spoke of an appreciation of and increased trust in hand hygiene during nonglove use for dry contacts.

The survey responses from additional sites were mostly positive for the safety of nonglove use for dry contacts, it improved hand hygiene and that the adoption of the modified guidelines was empowering.

Conclusions: The trial of nonglove use for expected dry contact, while caring for patients under contact precautions for methicillin-resistant *S aureus* and or vancomycin-resistant *Enterococcus*, was successful in refocusing HCWs reliance on hand hygiene for self-protection. Mandatory glove use for contact precautions was believed to contribute to their failure to change gloves between procedures on the same patient and patient zone, with HCWs now recognizing multiple contacts with the same gloves as a risk for contamination.

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The basic practice of placing patients colonized or infected with multidrug-resistant organisms (MDROs) under contact precautions¹ in conjunction with hand hygiene is aimed at reducing the spread of MDROs among patients.^{2–4} Patients under contact precautions are

placed in single rooms and cared for by their health care workers (HCWs) wearing gowns, aprons, and gloves at entry, and doffing on exit for every interaction that may involve contact with the patient or potentially contaminated areas within the patient's zone.⁵ The intended benefits of contact precautions are not for the isolated patient but for the protection of other susceptible patients, their environment outside the zone, and protection of HCWs from potential pathogenic microorganisms.^{6,7}

Since 2005, the World Health Organization has promoted the 'My Five Moments for Hand Hygiene' framework, and the use of alcohol-

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based handrub (ABHR) as the standard approach in the prevention of health care–associated infections (HAIs).⁸ Strong evidence suggests that contaminated hands and gloves continue to be among the most important contributors to the transfer of pathogens that contribute to HAIs.⁹ Glove use has been shown to reduce hand hygiene compliance, there may be increased risk of environmental transmission, and gloves may not be changed between procedures in the same patient as the risk of contamination is unrecognized.^{9–15} Glove material has also been demonstrated to increase transmission of *Staphylococcus aureus*.¹⁶ Despite the series of guidelines, published reports, and multimodal programs to support and influence key stakeholders, HCWs globally continue to struggle to comply with appropriate glove use and hand hygiene.^{17–19}

Ethical principles must be upheld when an intervention is imposed for the benefit of one group, whereas not posing potential harm to another group.²⁰ If less subversive alternatives are available, clinicians are required to adopt practices that have justifiable goals and evidence of effectiveness to balance the potential benefits against potential harms.⁶ The growing body of evidence of the historical intervention of gloves suggests that glove use has inadvertently brought harm to patients by acting as a barrier to HCWs for high hand hygiene compliance.^{15,21–23} Currently, *My Five Moments for Hand Hygiene* have not yet overly incorporated mandatory glove use,¹⁴ and reliance on gloves may have unwittingly been responsible for a significant proportion of cross-contamination via gloved hands.^{10,23,24} Mandated glove use was introduced explicitly to reduce HCWs' risk of exposure to bloodborne viruses and this practice is largely seen as primarily for the protection of the HCW.¹⁹ This evidence often drives us to ask why HCWs are dependent on gloves that are often contaminated even before use.^{25,26} We conducted an intervention to remove mandatory gloving from contact precautions for expected dry contacts only, and report here the pretrial and posttrial focus group discussions (FGDs) and questionnaire.

METHODS

Setting

Five health care facilities representing central- and provincial-level health care were selected based on their willingness to participate in the different stages of this study. These facilities represent large referral public university teaching hospitals (>400 patient capacity) and medium central or regional (50–100 patient capacity) hospitals located in Australia during 2016–2018. Institutional guidelines for contact precautions are based on national and local health district policies, derived from the Centers for Disease Control and Prevention for 'Management of Multidrug-Resistant Organisms in Healthcare Settings'.² These include soap and water hand hygiene after contact with body fluids and hand hygiene with ABHR for all other indications.² Patients known to be colonized or infected with any MDROs are placed under contact precautions according to their risk of cross-contamination. The compliance to the *My Five Moments for Hand Hygiene*, implemented by Hand Hygiene Australia,¹⁹ identified from human audits with quarterly rates publicly displayed at the entrance to every department.

Ethics approval was obtained from the relevant research ethics committee and accepted by each of the 5 hospitals. A signed informed consent was obtained from all participants.

We conducted a 5-phase study involving a pretrial FGD (phase 1), hand microbiology (phase 2), a trial of a modified contact precautions guidelines (phase 3), a posttrial FGD (phase 4), and a feedback survey of additional independent sites introduced in phase 3 (phase 5).

Participants and sample size

The 5 phases trial had a total of 250 participants; pretrial focus group (phase 1, n = 12); hand microbiology (phase 2, n = 40) reported elsewhere;²⁷ trial of modified contact precautions poster (phase 3, n = 100); and posttrial FGDs (phase 4, n = 22) in 3 wards (infectious diseases and respiratory medicine, spinal acute and rehabilitation, and general rehabilitation) at 1 tertiary hospital.

Phase 5 (n = 76) was a rollout of the intervention into additional locations: medical oncology, general surgical, and neurosurgery in the original large public hospital; 1 neonatal intensive care unit at the specialist hospitals for women and babies; a rehabilitation center at the specialized aged care rehabilitation and assessment hospital; and 2 provincial district hospitals. We report a posttrial questionnaire from these 7 extended trial sites.

Procedure

Phase 1: Pretrial and phase 4 posttrial focus groups

Pretrial FGDs were held at the original intervention hospital with participants who tested the modified contact precautions with hand microbiology.²⁷ At the intervention hospital, 6 pretrial focus groups were attended by 12 participants and 6 posttrial FGDs were attended by 22 participants. Posttrial FGDs were held at 1 hospital and a post-trial questionnaire was used at 4 hospitals. All FGDs were conducted by an experienced independent research facilitator. The duration of each FGD was no longer than 30 minutes. The facilitator used prompting items based on our observations during audits of HCWs performing clinical procedures on patients under standard and contact precautions. Prompting items that focused on nonglove use for episodes of care for patients under contact precautions and uptake of the new modified guidelines. The FGDs were digitally recorded by the facilitator and transcribed verbatim by an independent research assistant.

Phase 2: Hand microbiology as reported elsewhere

In brief, the microbiological culture of HCWs' dominant hand before and after hand hygiene showed that appropriate hand hygiene was effective in removing methicillin-resistant *S aureus* (MRSA) and or vancomycin-resistant *Enterococcus* (VRE) for dry contact, even when gloves were not used, despite contact with patients known to be colonized with MRSA or VRE.²⁷

Phase 3: Trial

Five hospitals followed the modified guidelines for 6 weeks (Fig 1) when they performed their own risk assessment "to glove or not to glove" before entering the patient's zone for each episode of care. Participants were educated on the rationale behind the "to glove or not to glove" approach by the clinical educator or local infection prevention and control delegate. Figure 1 indicated to participants to wear an apron and 'bare to the elbow'. In Australia, a nonpermeable apron is the preferred choice on the ward. *Bare to the elbow* is a local policy to encourage correct hand hygiene techniques.²⁸ The choice of apron or gown is in accordance with the National Health and Medical Research Council Guidelines²⁹ and this choice "depends on the degree of risk, including the anticipated degree of contact with infectious material and the potential for blood and body substances to penetrate through to clothes or skin."

Qualitative data analysis

Digital recordings of the FGDs were transcribed verbatim and the transcripts were read independently by 2 authors (SJ and MLM) for themes and subthemes. If there was any uncertainty over the meaning of transcribed discussions, the original audio recordings were

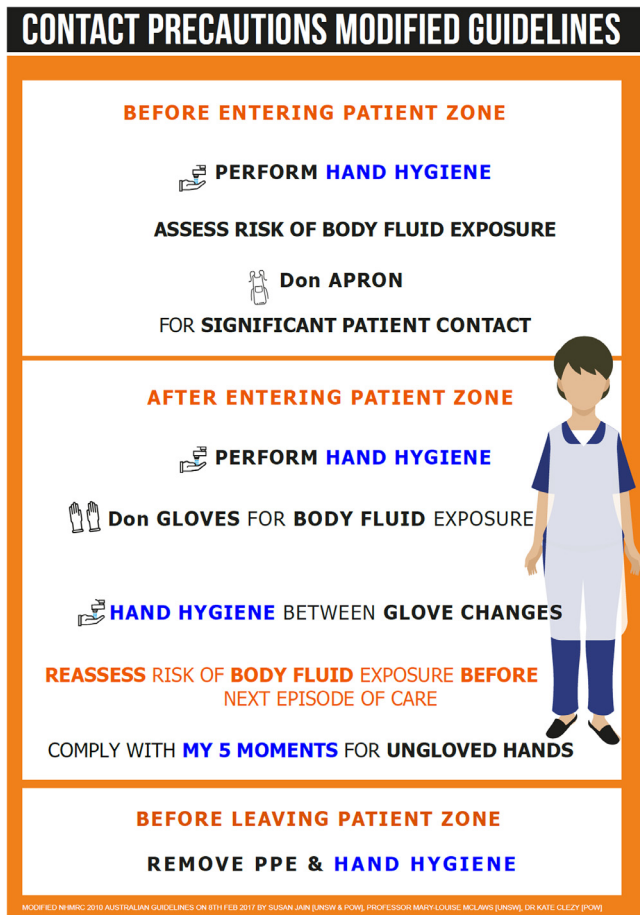


Fig 1. Modified contact precautions guidelines poster. PPE, personal protective equipment.

used for clarification. The data were manually coded using an inductive, bottom-up, data-driven approach to avoid fitting data to a framework of preconceived categories. The transcripts were then analyzed using a 6-step thematic analysis process and NVivo version 11 software (NVivo qualitative data analysis Software; QSR International, Warrington, UK) to confirm the themes and subthemes.

RESULTS AND INTERPRETATION

Phase 1: Pretrial focus group summary

A central theme “self-protection” dominated subthemes and was conveyed perfectly through the HCW’s mantra of “gloves for me-hand hygiene for my patients.” Around this central theme of (1) Self-protection was (2) Knowledge that was often overridden by Self-protection, (3) Trust in gloves over hand hygiene, and (4) being Task driven. The (3) Trust and (4) Task themes each had 1 subtheme (Fig 2). The discussions from all 6 groups reflected these major themes and are described in detail later.

Pretrial theme (1) self-protection: Gloves for HCWs and hand hygiene for the patients

Self-protection was a consistent persuader for glove use over hand hygiene. Participants revealed that they believed that they were safer wearing gloves irrespective of their hand hygiene practice, while acknowledging that as a result hand hygiene was overlooked.

[I] wear gloves because it's a protection to myself. So like that little bit of a security of walking into an infectious room and knowing I'm safe because of the stupid little latex gloves, I know it's silly but it's just that reassurance that you have. (HCW9)

[Wearing gloves] is more important to me than it is to the patient. For me, it's a little bit of an armour that you put on when you walk into the room. I can do whatever because I'm wearing gloves now. (HCW2)

Pretrial theme (2) knowledge: Does not override self-protection

Although participants recognized that hand hygiene prevents cross-contamination, knowledge could be readily overridden by self-protection. This would result in routine glove use for all patients under contact precautions. Only on reflection did HCWs acknowledge that hand hygiene had been neglected. Additionally, gloves offered participants a sense of security with HCWs wearing the same pair of gloves for extended periods and for multiple activities.

I would come in with the same pair of gloves, come out with the same pair of gloves, then not think about the five moments of hand hygiene in between. (HCW 4)

Participants understood gloves were not impermeable, not sterile, and eventually, participants had time to consider the implications of their habitual glove use and the role of self-protection behavior overriding their knowledge.

Again, you do the first bit [wearing gloves] outside the room, so you're touching the handle and everything else in the way before you get to them [patient], that probably in itself is what we need to change but people probably wouldn't. I think that you see gloves come out of the box, fall on the floor, and people put them back in the box. I never look at it and think that's a clean thing to be using right now. (HCW9)

There was a disparity between HCWs glove use practice and their acknowledgement of the importance of hand hygiene before and after glove use. Participants reflected that they could have been conducting a knowledge-based risk assessment to differentiate tasks as safe without gloves and the benefits of hand hygiene over glove use.

If you're helping them to eat a meal or something else why would you need to wear a glove? (HCW12)

I think wearing gloves can distract you from the main aims of hand hygiene. (HCW4)

I think people don't realize the gloves are permeable so if they don't clean their hands there's still, you know, the chance of cross-contamination. I think people aren't aware of that. (HCW1)

Pretrial theme (3) trust: They don't really trust hand hygiene

The trustworthiness of hand hygiene was a barrier to accepting replacing gloves with hand hygiene for dry contact (ie, without body fluids). Fear of their own deficient hand hygiene technique and the inability to feel adequately self-protected by hand hygiene was evident during the discussions.

I reckon it would [require] hard evidence and thorough grounded literature. I reckon it would need to [show] how much it protects the nursing staff by just doing hand hygiene. So, if you could show that it actually is better for us, yeah, I think that would be something that would get more people on board. (HCW 4)



Fig 2. Pretrial focus group themes. HCWs, health care workers.

Participants did not consider the success of hand hygiene on wards, in which a multitude of contacts were made with patients who may not be identified to carry MRSA/VRE or during the incubation period for other MDROs or HAIs.

It would take time getting used [not wearing gloves]. I suppose we won't know until someone gets sick, you know, if someone is not wearing gloves and they get MRSA or if they get diarrhoea or they come down with something, you know there's a lot of questions to be asked. (HCW6)

A layer of gloves gives better protection than hand hygiene

When pressed, participants agreed they would perform hand hygiene if they were not wearing gloves. Without gloves, HCWs believed an effective barrier between the patient and themselves would be removed. Gloves made HCW feel as if they had not made contacts and therefore did not required hand hygiene.

Well, I just see the gloves as an outer layer of skin, therefore, you put [on gloves] without washing hands I'd still see that as an acceptable step in between [episodes of care]. (HCW8)

Yeah, you're not thinking I've just touched that [so] I need to clean my hands because you can't actually feel that thing because you're wearing the gloves. (HCW3)

Pretrial theme (4) task oriented: Because I am task orientated, this governs my glove use

Hand hygiene was said to be often missed before donning gloves because HCWs were too busy performing their tasks and waiting for ABHR to dry was time-consuming and in addition, ABHR can, at times be sticky on their hands.

The 15-second strides a long time when you're waiting for your hands to dry to put the gloves on, and they [ABHR] stick. (HCW 10)

When participants were in a room with an infectious patient, they would wear a pair of gloves and attempt to perform all tasks consecutively to save time.

And, in terms of time-saving, we'll try and do a lot of tasks all at once with them [gloves] so it's kind of feels like you're 'Rushing- bang, bang, here's the medicine, let's do your observations, would you like a shower?' Because I'm just trying to not [change gloves] and I won't see you for another hour. I feel bad for them [patient] for that moment. I think that's the way it is. (HCW11)

Contact precautions, posters, and glove boxes remind me: Gloves are my habit, I blindly follow the poster

The use of cues, such as contact precautions posters at the entrance of a room and the availability of gloves inside and outside the room, was believed to increase uptake of glove use.

You walk in - there's a little picture on the door and the first little picture on the door says, "You put your gloves on and you put your gown on." And [you are permitted] to enter this space as long as [you have] the little barrier. And you even stand at the door and you tilt your head in like that's the invisible line is at that door. Yeah, it's very much like once you've crossed this spot you must wear your PPE when you walk in past this. (HCW9)

However, these cues to don gloves have negatively impacted hand hygiene because the same gloves were worn for all interactions and regardless of the risk of exposure to body fluids. Participants expressed a belief that their hands were still clean after glove removal, therefore, the urge to clean hands were missed.

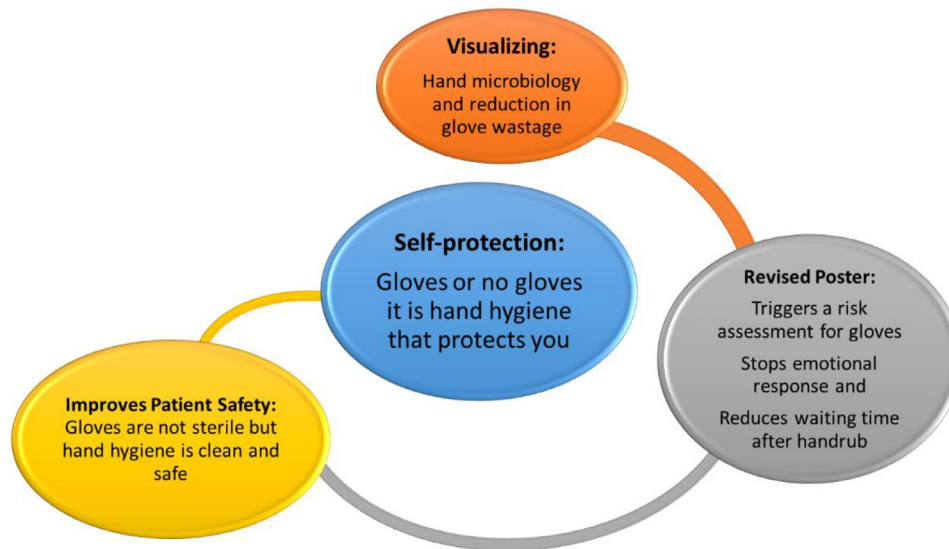


Fig 3. Posttrial focus group themes.

[Because of the poster] people just think that they're just protecting themselves by wearing gloves, they don't think by washing their hands they're actually probably protecting the patient more, maybe. (HCW12)

Four themes were mapped with self-protection as the pivotal facilitator that motivated HCWs to use gloves for patients and the patient zone (Fig 2). Gloves offered HCWs a sense of security and their discussions could be interpreted as a mantra, *gloves are for me and hand hygiene for my patients*, that overrode knowledge that hand hygiene is the key infection prevention and control strategy in these scenarios. Mandatory gloving for contact precautions may have encouraged the mistrust of the efficacy of hand hygiene as a protective practice and resulted in an absence of a reliance on hand hygiene. The contact precautions poster does not all allow HCWs to judge the need for gloving for the type of contact they will make with a patient under contact precautions, and this has led to habitizing glove use.

Phase 4: Posttrial focus group themes

The posttrial FGDs followed 4 themes: (1) self-protection, (2) visualization, (3) revised poster, and (4) patient safety. Participants spoke of their acceptance of the modification to contact precautions, rationalization, and explanations about their decision to support the modification (Fig 3). After the trial of the new modified guideline, poster and visualization of the hand microbiology results performed pre- and posthand hygiene of HCWs' dominant hand, HCWs expressed renewed confidence in the efficacy of hand hygiene.

Posttrial theme (1) self-protection: Gloves or no gloves, it is hand hygiene that protects you

Self-protection was still the pivotal theme for the participants for embracing hand hygiene over glove use. Participants unanimously agreed that appropriate hand hygiene, not gloves, were the key to self-protection and prevention of cross-contamination between patients.

For me, personally, and for the ward, I think that [the trial] showed that glove or no glove, you were protecting yourself by doing good hand hygiene; that's the most important thing. (HCW 4)

Participants now understood that the MRDO status did not automatically require glove use for dry contact (ie, contact without body fluids), and habitual glove use produced an irrational fear of patient contact. Participants' acceptance of the modification for rational glove use now elevates the practiced hand hygiene to a primary protection rather than secondary self-protective practice.

It's just kind of proving that you don't need to be wearing those gloves, it just becomes a habit because people are putting them on without washing their hands anyway, so I think it [no glove for dry contact] makes you wash your hands more. (HCW 2)

Posttrial theme (2) visualizing: Hand microbiology results and reduction in glove waste

Participants described how their habitual glove use was reshaped by the visualization of their microbiological culture results of their dominant hand pre- and posthand hygiene. This visual display supported the rhetoric that hand hygiene alone was effective in the removal of pathogens, such as MRSA and VRE, from their hands when performed correctly.

I think the hand agar experiment was pretty helpful. I think from that we learned that we needed three squirts of the handrub for it to have an effect, two or three. Having that evidence that if you're not using the handrub properly then you are carrying organisms on your hands. (HCW 15)

The microbiological evidence supported the safety of choosing when not to use gloves for dry contact. The advice to adhere to a risk assessment for donning gloves when expecting a wet contact (body fluids) made the transition easier to no glove for dry contacts.

Yeah, it [microbiology culture results] gave us trust in the product and knowing that we're covered for the patient and ourselves [from] cross-contamination. (HCW 20)

The reduced number of glove boxes during the trial was intellectualized by participants as a positive step toward waste reduction.

Everyone embraced it [the modification] from what I can understand and see we use [just] a box of gloves a week. If you think

about it, you go in and see a patient, you also have a clinical round assessment, also any other thing going on with a patient, say eight hours, eight to 12 hours, probably triple that, as well you might be seeing maybe 50, 60 times, sometimes a box a day, actually, probably even a bit more than that. It's quite a conservative guess if it's per week. (HCW 14)

I'd say time is a huge factor. If you've factored a 12-hour shift of donning and removing unnecessary PPE, because you know before [when glove use was mandatory] you'd enter before when they [patients] were buzzing, you could walk in and they'd say, oh sorry, big mistake. (HCW 18)

Posttrial theme (3) revised poster: Triggers a risk assessment for gloves, stops emotional response, and reduces waiting time after handrub

Rather than feeling forced to use gloves, the modified contact precautions empowered participants to make their own clinical judgment and consciously engaged them toward coherent glove use. The participants appreciated being able to rationalize the need for gloves by performing their own risk assessment of each care activity.

You can still use your judgment, they're [gloves] still there if you need them and you can make that decision yourself before you put gloves on and that ability to make the decision of your own judgment, I like it. (HCW 18)

I think what surprised more was that I found this [new poster] to be quite empowering for the nurses, increased our clinical judgment, our autonomy, and I think that was a major plus from my point of view. That's the main things that I got out of it. . . . It wasn't like a dictatorship as it was before with the contact precautions sign saying you have to do this, there and then. It just gave us a lot of decision making and I think that kind of made our jobs as nurses more satisfying. (HCW 4)

Posttrial theme (4) improves patient safety: Gloves are not sterile, but hand hygiene is clean and safe

Participants understood that gloves were not sterile, and therefore, a potential for further contamination during care. In addition, providing care with dirty gloves was acknowledged as increasing the risk of further contamination of the patient zone and themselves. Participants described how the new modified guidelines changed the emphasis on *hand hygiene for patient safety* and thinking about hand hygiene between touches requiring 1 of the 5 moments.

Even if I am wearing gloves and doing two different things in a room, I've noticed I'm changing the gloves more often or using the alcohol rub between them more than what I probably used to. (HCW 22)

I mean, the likelihood of us using the same pair of gloves throughout the whole patient encounter is [now] greatly reduced. (HCW 1)

The 4 themes in [Figure 3](#) illustrate the interconnection of the discussions about each, and that self-protection remained central to the discourse. Participants had moved from being habitual glove users to now have a greater appreciation for hand hygiene and renewed awareness that gloves were not sterile or remained clean between patient contacts. There was an appreciation of the reduction in the cost of consumables. The increased trust in hand hygiene allowed participants to embrace hand hygiene and a rational approach to glove use for dry contact.

Posttrial results of survey questionnaire from additional test sites

Four hospitals participated in the trial without microbiology testing on participants' dominant hand. Feedback from the 76 participants was mostly positive about glove use, the perception of the safety of 'no gloves' for contact precautions, the effect on hand hygiene practice, and the acceptance of the new modified contact precautions guidelines. A questionnaire identified that 95% (72/76) of participants were in favor of the new modified approach, whereas 5% (4/76) disliked or were unsure of this approach. The majority, 88% (67/76), of participants were confident that they would continue to replace gloves for dry contact with hand hygiene, whereas 12% (9/76) were undecided or not confident, and 35% believed that they were unsafe not wearing gloves during all patient care. Nearly all, 95% (72/76), participants believed their hand hygiene compliance had improved.

DISCUSSION

We were successful in promoting appropriate nonglove use for HCWs expecting dry contact while caring for patients under contact precautions for MRSA and VRE, and were successful in refocusing the importance of hand hygiene compliance. During phase 3 of the trial in the original trial site, compliance related to dry contacts associated with Moments 1 (before patient contact), 4 (after patient contact), and 5 (after contact with the patient zone) was 100%. This modification did not place patients at risk with the MRSA and VRE bloodstream infection rates remaining at zero from the pre- and posttrial in the original trial site wards. Glove use was initially motivated by self-protection, and self-protection remained as the impetus, but gloves were replaced with hand hygiene as the primary protective practice. The contact precautions policy was viewed retrospectively by participants as limiting their autonomy to make a clinical judgment for the appropriate nonglove use. In the pretrial phase, participants were not convinced that hand hygiene was as self-protective as gloves for dry contact with patients under contact precautions. Participants admitted that rather than placing patient safety at the center of all their patient interactions, their focus had been on glove use as self-protection for patients with an MDRO. These results were not unexpected and are consistent with findings elsewhere.^{23,30-32} Another self-protection practice that has always been globally high has been hand hygiene compliance with after patient contact (Moment 3 after exposure to body fluids and Moment 4 after patient contact).³³⁻³⁵

The influence of previous contact precautions guidelines and the related poster had omitted hand hygiene. Participants described the importance of visualization²⁷ as an evidence-driven strategy that improved appreciation of when to wear gloves, when to change gloves, and prioritizing their hand hygiene practice. Our participants admitted feeling safe behind gloves for prolonged periods, while at the same time realizing that the sense of security was false because gloves are permeable.

Our results reinforce the need for a selective approach for glove use for dry contact with a patient under contact precautions for MRSA and VRE. Participants appreciated being able to perform a risk assessment prior to the health care interaction expected with their patient. These findings suggest that modified contact precautions guidelines were practical, encouraged clinical judgment, and importantly promoted hand hygiene. Standard precautions requires glove use only when wet contact is anticipated. Therefore, nonglove use should be promoted for all dry contacts with patients and their environment.

The limitations of the study, as with other focus groups, include omission of participants who may have been less candid during sessions, especially when senior staff were present. The hand microbiological study was conducted at 1 hospital only, and

positively influenced their perception toward the *no gloves* for dry contact. However, the other 4 trial hospitals that did not participate in the hand microbiology study did not appear to have adversely influenced their acceptance to modified glove use. We have not included patients with symptomatic *Clostridium difficile* infection (CDI) based on evidence^{36,37} that all contacts with fecal soiling must use gloves, and, in the presence of a CDI outbreak, we agree gloves reduce both vegetative and spore contamination of hands. However, no glove use for care with CDI patients outside outbreaks, or high endemic levels that do not involve fecal soiling, followed by ABHR cleaning could be trialed. Despite these limitations, the use of an independent facilitator for the FGDs, and the inclusion of HCWs from a wide range of specialties and levels of training, increases the generalizability of our findings.

CONCLUSIONS

Gloves do not replace hand hygiene, and appropriate nonglove use can be achieved with a modified approach to all dry contact with patients under standard or contact precautions.

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