

WHO guideline on hand hygiene in health care in the Context of Filovirus Disease Outbreak Response

Rapid advice guideline

Summary of the recommendations

November 2014

1. Introduction

This document provides a summary of recommendations for hand hygiene best practices to be performed by health workers providing care to patients with filovirus infection (Ebola and Marburg viruses). The recommendations have been developed in accordance with the WHO Rapid Advice Guideline procedures.

Filovirus (Ebola and Marburg viruses) infections in humans are some of the most severe and feared of all viral hemorrhagic fevers, with very high case fatality. Most outbreaks occur after a single or very small number of zoonotic infections, followed by person-to-person transmission with nosocomial amplification in a setting of inadequate infection prevention and control (IPC), usually in rural areas of countries with poor health-care infrastructure.

In most cases, filovirus transmission occurs when infected blood or other body fluids come into contact with the mucous membranes of the mouth, nose and eyes. Transmission can occur through direct contact with infected body fluids or through fomites (touching inanimate objects), such as the floor, utensils and bed linens that have recently been contaminated with infected body fluids. Transmission through intact skin has not been documented, but the infection can be transmitted through non intact skin and by penetrating injuries of the skin, such as needle-stick injuries.

It must be emphasized that the protection of health-care workers, patients (whether infected with filovirus or not), and visitors requires the application of procedures and protocols for IPC of which procedures hand hygiene best practices are an essential part. Strengthening and carefully applying standard precautions when providing care to all patients, regardless of the signs and symptoms they present with, is essential because the initial manifestations of filovirus infection may be non-specific.

2. Principles of hand hygiene

Hands are the most frequent vectors of pathogens to other parts of the body, to other individuals, and to the environment. Hands contaminated with blood or bodily fluids (including when not visible) play a crucial role in the transmission of filovirus through direct contact with mucous membranes or broken skin. As a consequence, hand hygiene best practices and appropriate use of gloves are essential, both to protect the health-care workers and to prevent transmission to others. However, no single infection control measure can be effective in isolation, and must be carried out as part of a comprehensive package of IPC measures, including effective administrative, environmental and engineering controls.

The *WHO guidelines on hand hygiene in health care* issued in 2009 recommend the use of an alcohol-based hand rub solution as the preferred means for routine hand antisepsis in all clinical situations unless hands are visibly soiled, in which case hand rubbing should be replaced by hand

washing with soap and water.¹ If alcohol-based hand rubs are unavailable, hands should be cleaned by washing with clean running water and soap, and drying using disposable towels. These guidelines are based on previous US Centers for Disease Control and Prevention (CDC) recommendations² and on systematic evidence reviews, experts' consensus and pilot testing of the recommendations in the six WHO regions.³ The approach proposed by the WHO guidelines is currently considered the gold standard used in all other existing national and international recommendations on hand hygiene.⁴

Hand hygiene and bleach/chlorine solutions

Current WHO and CDC recommendations for the care of patients with suspected or confirmed filovirus infection are in accordance with the 2009 WHO guidelines in terms of hand hygiene best practices. However, chlorine solutions are currently widely used for hand hygiene in the African countries affected by the Ebola virus disease (EVD) outbreak because of limited availability of alcohol-based hand rubs and soap, the ease of use of chlorine solutions, and “fear” factors that lead users to prefer an easily available environmental disinfectant.

The *Médecins sans Frontières (MSF) Filovirus hemorrhagic fever guideline*⁵ published in 2008 recommends the use of 0.05% chlorine solution for hand washing (0.5% if in a high-risk zone) and 0.5% chlorine solution for disinfection of gloved hands. The document does not mention the use of any other products, including soap and water. The MSF document also reports that chlorine solutions can damage both medical and rubber household gloves, and therefore advises that gloves should be regularly checked for damage, and the person wearing them should leave the high-risk area if they are broken. This issue is also raised in a more recent document developed by the Belgian Superior Health Council, which recommends against hand washing practices on gloved hands as it might increase the permeability of the glove. The document also states that only gloves certified as chemical resistant and that comply with the PPE directive 89/391/CEE and the Belgian Royal Decree of 16/01/2006 should be used to handle chlorine solutions.⁶

This inconsistency between guidelines with regards to hand hygiene best practice is unfortunately reflected by the variations among local standard operating procedures (SOPs) and rapid guidance documents created by local organizations or ministry of health (MoH) in countries affected by the EVD outbreak. This is creating confusion not only among staff involved in the EVD outbreak response, but also among patients, visitors, and members of the wider community who need to perform effective hand hygiene practices to help reverse the spread of EVD.

The 2009 WHO hand hygiene guidelines discuss the efficacy and side-effects of a broad range of hand hygiene agents. However, the guidelines provide limited guidance on the use of chlorine solutions for hand washing because in general these are considered not common and suitable

¹ WHO guidelines on hand hygiene in health care. World Health Organization, Geneva, 2009; available at <http://www.who.int/gpsc/5may/tools/9789241597906/en/>

² Guideline for Hand Hygiene in Health-Care Settings, Centers for Disease Control and Prevention, *Morbidity and Mortality Weekly Report* 2002; Vol. 51, No. RR-16, available at: <http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf>

³ Allegranzi B, et al. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: a quasi-experimental study. *Lancet Infect Dis.* 2013 Oct;13(10):843-51.

⁴ E. Mathai, et al. Promoting hand hygiene in healthcare through national/subnational campaigns. *J Hosp Infect* 2011;77:294-8.

⁵ Filovirus Haemorrhagic Fever Guideline, Médecins sans Frontières, 2008, available at: <http://www.slamviweb.org/es/ebola/FHFfinal.pdf>

⁶ Publication of the Superior Health Council no. 9188, available at <http://www.shea-online.org/Portals/0/PDFs/Belgian-guidelines-ebola.pdf>

practices. Indeed, chlorine is widely used in environmental disinfection, and sodium hypochlorite (household bleach) is the most readily available effective inactivation product for filoviruses, especially in Africa.

Many documents, including WHO guidelines, provide guidance for the use of chlorine solutions for environmental cleaning, decontamination of personal protective equipment (PPE), management of linen, and they also provide guidance on the local production of these solutions, although there is inconsistency regarding the concentration of chlorine to be used. Because chlorine is potentially highly toxic, solutions should be prepared daily, kept away from sunlight, and should be handled with care.

International stakeholders (e.g. the Infection Control African Network), field partners (e.g. CDC), clinicians and other technical staff working in countries currently affected by the EVD outbreak have requested guidance on best hand hygiene practices in order to ensure the protection of health-care workers and to prevent disease transmission in health-care settings in the context of the current epidemic.

Because chlorine solutions are currently recommended by some partners and in ministerial SOPs and are widely used in the context of the EVD outbreak, WHO has undertaken a systematic examination of the evidence relating to the microbiological efficacy of chlorine solutions, the concentrations at which they are most effective, tolerability and potential side-effects when used for hand hygiene and/or for glove disinfection.

3. Implementation

Implementing these recommendations will require a multimodal strategy including education and training that is suitable for different categories of health workers (including supervisors), and that takes into account local customs and cultural acceptability. Adequate resources (human, material and financial) must be allocated in order to make alcohol-based hand rubs available at the point of care and to improve access to clean and running water and soap.

4. Resource management

To achieve hand hygiene best practices in health care, resource management includes stock management, ensuring the availability of alcohol-based hand rub or clean running water and soap, placement of items for easy access, ensuring the quality of items purchased, and line management for reporting shortages. Local production of alcohol-based hand rub should be strongly encouraged and facilities should be dedicated to it.

5. Methods of guideline development

Development of these recommendations included: the development of a scoping document for approval by the WHO Guideline Review Committee; development of key questions; systematic reviews of the literature; an expert consultation; and an evidence-to-recommendations exercise using the GRADE framework.

The research questions for the systematic review were:

1. What is the comparative efficacy of chlorine solutions for hand hygiene practices or disinfecting gloves for health workers compared with alcohol-based hand rub or other antiseptics products, including water and soap?
2. Does the use of chlorine solutions for hand hygiene cause health workers skin irritation or lesions, respiratory side-effects, or any other adverse reactions?

3. Do chlorine solutions used for disinfecting gloves increase glove permeability or the occurrence of perforations?

In summary, the systematic reviews yielded no comparative studies using bleach/chlorine solutions versus alcohol-based hand rubs or soap and water for hand hygiene or glove disinfection. Very limited evidence was available on adverse reactions following the use of bleach/chlorine solutions for hand hygiene but more information could be derived from reports about use of this disinfectant for other purposes. Only one study was identified on the effect of chlorine solutions on glove permeability showing no permeation. No data were available from the literature on the values and preferences of health workers regarding the use of bleach/chlorine solutions for hand hygiene. We gathered advice on the values and preferences of Guideline Development Group (GDG) members, including some professionals with extensive clinical field experience in the current and previous outbreaks of EBV.

Guideline Development Group Meeting

A GDG meeting was convened on 12 and 13 November 2014. The group was comprised of 13 experts who were invited based on their knowledge, field experience and technical expertise. According to WHO requirements for guideline development, members participated as independent experts and did not represent any agency, institute or country. All GDG members completed WHO Declaration of Interest forms, which were reviewed by the Steering Group prior to the meeting. None of the GDG members declared any relevant conflict of interests.

The results of three systematic reviews addressing the three research questions were submitted to the GDG ahead of the meeting and then presented to the experts during the meeting. One additional presentation by an expert on susceptibility of filovirus to disinfectants helped the discussion and final conclusions. Full consensus was achieved within the GDG about the final recommendations.

6. Recommendations:

Recommendation 1. We recommend performing hand hygiene, by using either an alcohol-based hand rub or soap and running water applying the correct technique recommended by WHO. Alcohol-based hand rubs should be made available at every point of care (at the entrance and within the isolation rooms/areas) and are the standard of care. If alcohol-based hand rubs are unavailable, hand hygiene should be performed with soap and running water whenever necessary. When hands are visibly soiled, hand hygiene should always be performed with soap and running water.

Strong recommendation, high-quality evidence for the effectiveness of alcohol-based handrub or soap and water.

Rationale and remarks:

This first recommendation is based upon the WHO *Guidelines on hand hygiene in health care*¹ and is included in the WHO 2014 *Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Focus on Ebola*⁷. In particular, the above recommendation refers to recommendations 1A and 1C of the WHO guidelines that are currently implemented worldwide. The preferred use of alcohol-based hand rubs

⁷ Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Focus on Ebola. World Health Organization, Geneva, 2014; available at http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/.

for hand hygiene in health care is based upon the following criteria for which evidence is provided in the WHO Guidelines and the related Summary⁸:

- elimination of the majority of germs (including viruses);
- the short time required for action (20 to 30 seconds);
- availability of the product at the point of care;
- better skin tolerability;
- no need for any particular infrastructure (clean water supply network, washbasin, soap, hand towel).

Hand washing with soap and water is also considered highly effective against enveloped virus¹, although no specific data are available for filovirus.

However, the correct application technique and duration of the procedure are considered crucial to achieve the desired effect for both hand rubbing with an alcohol-based hand rub and hand washing with soap and water. For hand rubbing, WHO recommends to apply a palmful of alcohol-based handrub and cover all surfaces of the hands. Hands should be rubbed by following eight specific steps for 20 to 30 seconds until dry (recommendation 2A).¹ When washing hands with soap and water, hands should be wet with clean, running water and the amount of product necessary to cover all surfaces should be applied. Hands should be rinsed with water and dried thoroughly with a single-use towel (recommendation 2A). As recommended by WHO, the procedure should include 11 specific steps and should last 40-60 seconds to achieve the desired effect.^{1,2}

The GDG strongly agreed that these recommendations should be applied in the context of the current outbreak of EVD.

Recommendation 2. In settings where bleach/chlorine solutions are currently used for hand hygiene, we recommend implementing a strategy to change to alcohol-based hand rub or soap and water.

Strong recommendation, very strong evidence for the in-vivo effectiveness of alcohol-based hand rub or soap and water.

Rationale and remarks:

Similar to the previous one, this recommendation is based on the WHO Guidelines on hand hygiene in health care¹. In particular, the above recommendation refers to recommendations 9.1.B and C of the WHO Guidelines which urge health-care administrators to provide health-care workers with access to a safe, continuous water supply and to the necessary facilities to perform hand washing, and with a readily accessible alcohol-based hand rub at the point of patient care. No comparative evidence is available about the efficacy of bleach/chlorine solutions against filovirus when used for hand hygiene (also see below in the rationale and remarks for recommendation 3). Furthermore, quality control of chlorine solutions is a major concern. Without standardized checks of

⁸ Guidelines on Hand Hygiene in Health Care: a Summary. World Health Organization, Geneva, 2009; available at <http://www.who.int/gpsc/5may/tools/9789241597906/en/>

concentration that are consistently applied, the efficacy of bleach/chlorine solutions for hand hygiene cannot be guaranteed.

In addition, recommendation 9.2A of the WHO hand hygiene guidelines urges national governments to make improved hand hygiene adherence a national priority and consider provision of a funded, coordinated implementation programme, while ensuring monitoring and long-term sustainability. Based on evidence related to implementation science, behavioural change, spread methodology, diffusion of innovation and impact evaluation, WHO developed a multimodal implementation strategy and tool package to enable translation into practice of the WHO recommendations on hand hygiene.¹ These have been tested and were shown to be effective to determine improved hand hygiene practices among health-care workers in a range of countries, including in settings with limited resources³. One of the key pillars of this strategy is the change of the system in order to make alcohol-based hand rubs available and ensure access to a safe, continuous water supply and to the necessary facilities to perform hand washing. However, the availability of alcohol-based hand rubs might be limited in developing countries and in settings with limited resources; for this reason, WHO identified, tested and validated alcohol-based formulations that can be produced locally at low cost in health-care settings by following simple instructions.⁹ A recent survey in facilities from 29 countries¹⁰ demonstrated that the WHO-recommended formulations can be easily produced locally at low cost and are very well tolerated and accepted by health-care workers, although some challenges can be encountered in procuring the ingredients and the dispensers.

Changing the system and practices in the current emergency situation and even beyond will be challenging. Evidence-based approaches and proven behavioural change strategies need to be put in place and require high-level commitment with implications at the political level and for WHO and partners. In the context of the current EVD outbreak, the United Nations Mission for Ebola Emergency Response represents the opportunity to join forces in order to tackle the entire value chain to achieve successful implementation of hand hygiene improvement strategies in the affected countries.

Recommendation 3. Bleach/chlorine solutions currently in use for hand hygiene and glove disinfection for emergency situations can be used in the interim period until alcohol-based hand rub or soap and water become available.

Conditional recommendation, very low-quality evidence for the comparative efficacy of bleach /chlorine solutions compared with alcohol-based handrub or soap and water, and very low-quality evidence about tolerance to bleach or chlorine solutions for hand hygiene and glove disinfection.

Rationale and remarks:

Based on the systematic review we conclude that there is very limited evidence to evaluate the efficacy of sodium hypochlorite (bleach/chlorine solutions) compared with other agents when used for hand hygiene or glove disinfection. No comparative study was found to show the efficacy of bleach/chlorine solutions to prevent transmission of filovirus or other enveloped viruses to patients

⁹ Guide to Local Production: WHO-recommended Handrub Formulations. World Health Organization, Geneva, 2010; Available from: http://www.who.int/gpsc/5may/tools/system_change/en/.

¹⁰ Bauer-Savage J, et al. Local production of WHO-recommended alcohol-based handrubs: feasibility, advantages, barriers and costs. Bull World Health Organ. 2013 Dec 1;91(12):963-9.

and health-care workers or to reduce the viral load on hands. Efficacy of bleach/chlorine solutions when used for hand hygiene in healthy volunteers was shown against some bacteria (i.e. *Staphylococcus aureus*, *Escherichia coli*, *Clostridium difficile*, and *Bacillus atrophaeus*), although some studies did not demonstrate higher efficacy of sodium hypochlorite than distilled water or water and antimicrobial soap or other compounds. The number of manuscripts and the quality of the performed comparative studies were both very limited. Furthermore, differences in sodium hypochlorite concentrations, contact time and microorganisms studied were observed. However, among the GDG there was a high degree of consensus that bleach/chlorine solutions with a concentration of 500 ppm sodium hypochlorite (a 0.05% chlorine solution) can be considered efficacious against filovirus, including use for hand hygiene.

Furthermore, available data indicates that for hand hygiene efficacy there is a relation between bleach/chlorine concentration and contact time. A concentration of 0.05% chlorine solution applied for a minimum time of 40 to 60 seconds until hands are dried is considered appropriate for hand hygiene practices. To perform the correct technique, the same steps as for hand rubbing should be followed.^{1,7,8}

There is extremely limited evidence (only one case report) showing that sodium hypochlorite used for hand hygiene purposes can cause skin irritation or lesions; however, the concentration in this case was much higher than is currently used for hand hygiene. Other studies reported skin irritation following exposure to sodium hypochlorite as a disinfectant for other uses, and therefore at higher concentrations.

There is no evidence that low concentrations of sodium hypochlorite used for hand hygiene cause respiratory irritation, other respiratory symptoms or asthma. However, respiratory symptoms are clearly reported and described in patients, health workers and other users as a consequence of exposure to chlorine solutions used for environmental decontamination.

Finally, based on available reports the risk for irritative conjunctivitis was also noted.

Therefore, the experts concluded that the use of bleach/chlorine solutions at the concentrations currently used for hand hygiene (500 ppm sodium hypochlorite or a 0.05% chlorine solution) can be acceptable from the tolerability point of view, if other products are unavailable. However, dermatologically, alcohol-based handrubs are considered the best option for hand hygiene. In addition, using chlorine is not advised for people with previous skin problems (e.g. contact dermatitis). Experts highlighted the importance of establishing safety measures and assessments in settings where bleach/chlorine solutions are used for hand hygiene.

Overall, in the systematic reviews great variability was found in the type of setting, concentrations used (high in most studies), study designs and exposure methods. The quality of the studies was low or very low.

In terms of balancing benefits and harms, the overall conclusion is that for the proposed recommendation the benefits outweigh harms.

Accepting bleach/chlorine solutions in the current EVD outbreak until alcohol-based hand rubs or soap and water are available will be less disruptive to the outbreak response in the emergency situation than to actively advocate against it in the context of the limited available data. However, the potential harm is that accepting the use of bleach/chlorine solutions for hand hygiene may discourage administrators, policy makers and logisticians from making efforts to enable the change to make alcohol-based hand rub solutions and water and soap available. Harm could also come from the uncertainty about the quality of chlorine solutions. It has been reported by several professionals in the field that the concentration of original bleach is often unavailable and therefore dilutions made are probably unreliable. In the emergency situation of an outbreak, quality checks on concentrations are unlikely to be made or will be rarely and inconsistently applied. The use of these

solutions at lower concentrations than they are meant to be can give a false sense of safety and lead to increased risk taking. Therefore, quality control tests to check the concentration of chlorine solutions are highly recommended and can be easily performed by using specific strips, if made available.

With regards to values and preferences of health workers regarding the use of chlorine solutions for hand hygiene, the GDG considered that no major variability is expected. However, it was highlighted that alcohol-based hand rubs are generally preferred because better tolerated. On the other hand, in the current situation chlorine solutions are valued by users because bleach is readily available everywhere and it has been commonly used during EVD outbreaks.

With regards to glove disinfection, no study on efficacy of chlorine solutions compared with alcohol-based hand rub or other antiseptics products, including water and soap was retrieved. Only one study assessed the permeability of surgical gloves to sodium hypochlorite 13% and showed no permeation or glove damage.

The WHO hand hygiene guidelines examined the issue of glove reprocessing mainly for the purpose of glove reuse in settings with limited resources and limited glove availability. In this context, the guidelines state that any practice of glove washing, decontamination or reprocessing is not recommended as it may damage the material integrity and jeopardize the glove's protective function.¹ On this topic, the guidelines concluded that the opinion of international experts consulted by WHO is that glove reprocessing must be strongly discouraged and avoided, mainly because at present no standardized, validated, and affordable procedure for safe glove reprocessing exists. However, the guidelines also report that some evidence exists that cleansing latex-gloved hands using an alcohol-based hand rub solution is effective in removing micro-organisms. In the context of EVD outbreaks, decontamination of gloves has been considered for the purpose of avoiding changing gloves between patients within the isolation area considering the risk of health-care workers' hand contamination with patient's blood or bodily fluids. Experts convened by WHO to develop recommendations on PPE to be used for care of EVD patients¹¹ agreed that glove disinfection could help facilitate changing gloves safely while providing clinical care for patients with filovirus disease and/or when gloves become compromised. A two-step procedure should be followed: 1) disinfect the outer gloves before removing them safely and 2) keep the inner gloves on and disinfect them before putting on a fresh outer pair. Alcohol-based hand rubs are preferred when disinfecting gloved hands; however, when unavailable, bleach/chlorine solutions can also be acceptable in the interim.

¹¹ *Personal protective equipment in the context of Filovirus disease outbreak response: rapid advice guidelines and technical specifications.* World Health Organization, Geneva, 2014; available at <http://www.who.int/csr/resources/publications/ebola/ppe-guideline/en/>