WHO Guideline and systematic review on hand hygiene and the use of chlorine in the context of Ebola

J.Hopman, Z.Kubilay, H.Edrees, T. Allen, B.Allegranzi
Service Delivery Safety, WHO, Geneva, HQ

Presentation Outline

- Introduction
- PPE and Hand hygiene in the context of Ebola
- Current WHO recommendations for hand hygiene best practices in health care
- Systematic reviews on use of chlorine solutions; efficacy for hand hygiene and adverse events
  - Search Strategy
  - Outline of the Studies
  - Summary of the Studies
- Conclusions
WHO Guideline and review on hand hygiene and the use of chlorine in the context of Ebola

Dr. Joost Hopman, Radboud University Medical Center, The Netherlands

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The NEW ENGLAND JOURNAL of MEDICINE

Perspective

Ebola Virus Disease in West Africa —
No Early End to the Outbreak
Margaret Ony, M.D.

Ebola virus disease in West Africa is an acute, life-threatening illness that spread rapidly in Liberia, Guinea, and Sierra Leone in 2014. The country affected is difficult to control. These questions can be answered with a single word: poverty.

Liberia, Ebola treating center (Foto von Francis N. Kedah, MD, MPH, MSc/PhD, LFDP, Medical Director/CEO, Margibi County Ebola response)

Pandemic and Epidemic Diseases department

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Film: Dec 2014
Subtitles available in 1 language

View interactive transcript

Bruce Aylward:
Humanity vs. Ebola. The winning strategies in a terrifying war

“Ebola threatens everything that makes us human,” says Bruce Aylward of the World Health Organization. With calm measure, he walks us through how the Ebola epidemic exploded — and how international alarm only fed the exponential growth of the problem. He shares four strategies critical to beating Ebola — and how they are succeeding, starting in Lofa County.

“Mathematics can offer a new way of looking at almost anything—even something as mysterious as love.”

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Enveloped RNA virus

Geographical distribution of Ebola and Marburg (1967-2014)

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Situation February 2015

Ebola Situation Report - 4 February 2015
(Data up to 1 February 2015)

Cases | Deaths
--- | ---
Guinea | 2975 | 1944
Liberia | 8745 | 
Sierra Leone | 3746 | 
Mali | 8740 | 
Nigeria | 3276 | 
Senegal | 8881 | 
Spain | 32 | 
United Kingdom | 12 | 
United States of America | 26 | 
Total | 32,495 | 

Situation February 2015

Ebola in West Africa: 12-months on
15 January 2015 – One year after the first Ebola cases started to surface in Guinea, WHO is publishing this series of 14 papers that take an in-depth look at West Africa’s first epidemic of Ebola virus disease. The papers explore reasons why the disease sustained infection for several months and the factors, many specific to West Africa, that fueled its subsequent spread.

One year into the Ebola epidemic: a deadly, tortuous and frequently virus
Read the note for media

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Document with essential IPC components

- Interim manual - Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation
- This document describes preparedness, prevention, and control measures that have been implemented successfully during previous epidemics


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
December 2014

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Principles of infection control

1. Procedures and protocols referred to as “controls”.
2. Standard precautions
3. Health and wellbeing of workforce
4. Implementation.
5. Resource management.

Procedures and protocols referred to as “controls”

In order of Infection Prevention and Control (IPC) effectiveness:

1. administrative controls
2. environmental and engineering controls
3. personal protective equipment (PPE)
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Standard Precautions

1. Hand hygiene
2. Point-of-care risk assessment for appropriate selection and use of PPE to avoid direct contact with patients’ body fluids
3. Respiratory hygiene (cough etiquette)
4. Prevention of needle-stick or sharps injuries
5. Safe waste management
6. Cleaning, disinfection (and sterilization, where applicable) of patient-care equipment and linen cleaning and disinfection of the environment.

Standard Precautions

- Routine precautions to be applied in **ALL** situations for **ALL** patients
  - whether or not they appear infectious or symptomatic
  - especially important for EVD because the initial manifestations are non-specific

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Ebola & Transmission

Ebola virus spreads through:
- direct contact with body fluids (stool, vomit, blood, urine, saliva, semen, breast milk) of a sick person with EVD
- by contact with surfaces or equipment contaminated by body fluids of an infected person
- Through mucous membranes or non-intact skin (e.g. cuts or abrasions)

• Transmission through intact skin has not been documented
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New WHO Guidelines on Personal Protective Equipment (PPE)

Guideline development process
+ Development of key research questions
+ Systematic literature reviews
+ Literature review and an online survey on values and preferences of health workers
+ Evidence-to-recommendations exercise using the GRADE framework
+ Expert consultation
+ WHO Guideline Review Committee

What are the benefits and harms of double gloves, full face protection, head cover, impermeable coveralls, particulate respirators, and rubber boots as PPE when compared with alternative less robust PPE for HCWs caring for patients with filovirus disease?

Issued on
31 October 2014

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Personal Protective Equipment (PPE)

A: *Helmet*

B: *Gown*

C: *N95 mask*

D: *Gloves*

E: *Boots*

F: *Gloves*

G: *Scissors*


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Need training and correct PPE!

Approximately 3-4% of infected patients are HCW

IPC training and reinforcement after training

- Importance of standard precautions in all outpatient and inpatient care
  - Many HCW infections from failure to apply standard precautions, rather than PPE in treatment centre

- PPE - putting on and taking off is a skill
  - not just knowledge that can be conveyed by demonstration
  - needs practice
  - needs ongoing supervision by dedicated supervisor

- Importance of safe work set-up and consistent practices
Hand hygiene

Role of hands and hand hygiene

- **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 non-intact skin.

- As a consequence, **hand hygiene** best practices and appropriate use of gloves are **essential**, both **to protect the health worker** providing care and **to prevent transmission to others**.
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Hand hygiene

The 5 Moments apply to any setting where health care involving direct contact with patients takes place

1. BEFORE TOUCHING A PATIENT
2. AFTER TOUCHING A PATIENT
3. AFTER BODY FLUID EXPOSURE RISKS
4. AFTER TOUCHING A PATIENT
5. AFTER TOUCHING A PATIENT

How to Handrub?

Duration of the entire procedure: 20-30 seconds
1. Apply a sufficient amount of product in a cupped hand, covering all surfaces.
2. Rub hands palm to palm.
3. Right palm over left clenched with interlaced fingers and vice versa.
4. Plen to palm with fingers interlaced.
5. Backs of fingers to cupping palm with fingers interlaced.
6. Rotational rubbing of all fingers except index fingers palm to palm and vice versa.
7. Rotational rubbing, heel and knuckles and then back to cupping fingers of each hand to left palm and vice versa.
8. Grasp your thumb with the fingers.
9. City hands thoroughly with a single use towel.

How to Handwash?

Duration of the entire procedure: 40-60 seconds
1. Wet hands with water.
2. Apply enough soap to cover all hand surfaces.
3. Rub hands palm to palm.
4. Right palm over left clenched with interlaced fingers and vice versa.
5. Plen to palm with fingers interlaced.
6. Backs of fingers to cupping palm with fingers interlaced.
7. Rotational rubbing of all fingers except index fingers palm to palm and vice versa.
8. Rotational rubbing, heel and knuckles and then back to cupping fingers of each hand to left palm and vice versa.
9. Grasp your thumb with the fingers.
10. City hands thoroughly with a single use towel.

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Hand hygiene and glove use

GLOVES PLUS
HAND HYGIENE
= CLEAN HANDS

GLOVES WITHOUT
HAND HYGIENE
= GERM TRANSMISSION

The use of gloves does not replace the need for cleaning your hands!

Guide for the local production of the WHO alcohol-based handrub formulations

From sugar can, at low cost (0.30 $US) = 0.006% of the total annual hospital budget
Mali, Africa, 2007

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System change made possible
WHO alcohol-based formulation local production
*Global Survey 2012*

39 sites in 28 countries


The use of Chlorine solutions for Hand hygiene

*Liberians are Creative and Innovative*

(Photos from Francis N. Kateh, MD, MHA, MPS/ISL, FLCP, Medical Director/CEO, Technical Assistant Margibi County Ebola response)

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Systematic review
Chlorine and hand hygiene

1. Are chlorine solutions effective for hand hygiene in health care?

3. Are chlorine solutions effective for disinfection of gloves?

5. Does the use of chlorine solutions for hand hygiene cause health workers’ skin irritation or lesions, respiratory side effects or any other adverse reactions?

PICO question 1

Are chlorine solutions effective for hand hygiene in health care?

• P: Health Workers (individuals who provide direct or indirect to patients, in particular affected by filovirus infection or pathogens with a similar route of transmission and infectivity)
• I: Hand hygiene with chlorine solutions,
• C: Hand hygiene with alcohol-based handrub or other agents including water and soap
• O: Primary outcome: Reduction of pathogen including Ebola virus, transmission to health workers or patients
  Secondary outcome: reduction of bacterial or viral load on hands
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PICO question 2

Are chlorine solutions effective for disinfection of gloves?

- **P**: Health Workers  
- **I**: Disinfection of gloves with chlorine solutions  
- **C**: Disinfection with alcohol-based handrub or other agents including water and soap  
- **O**: Primary outcome: Reduction of pathogen, including Ebola virus, transmission to patients  
  Secondary outcome: reduction of bacterial or viral load on hands

Search methods

- Limited to PubMed (including MEDLINE) and Ovid EMBASE databases  
- Performed on 26 September 2014  
- No time, age, human, language limit or geographical restrictions.  
- Refs of Retrieved papers

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Pubmed search strategy

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2. Chlorine/EXP OR Chlorine/ON OR hypochlorite sodium/EXP OR hypochlorite sodium/ON

3. Microorganism/EXP OR Microorganism/ON OR bacterium/EXP OR bacterium/ON OR microorganism/EXP OR microorganism/ON

4. Disease/EXP OR Disease/ON OR fever/EXP OR fever/ON OR infected/EXP OR infected/ON OR infection/EXP OR infection/ON OR virus/EXP OR virus/ON OR microorganism/EXP OR microorganism/ON OR infectious disease/EXP OR infectious disease/ON

5. Criminal organization/AB OR Criminal organization/ON OR microperforation/AB OR microperforation/ON OR hand wash/AB OR hand wash/ON OR disinfectant agent/EXP OR disinfectant agent/ON OR soap/AB OR soap/ON

EMBASE search strategy

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### Inclusion criteria

- All chlorine compounds
- Stated population
- In-vivo experiments on hands
- In-vivo experiments on gloves

Based on consultation with the WHO Steering Group, we modified the inclusion criteria for the rapid review so that only manuscripts that addressed sodium or calcium hypochlorite solutions were included.

### Exclusion criteria

- Animal studies
- In-vitro studies
- Environmental studies
- Studies addressing therapy
Table 1: FOUR SELECTED STUDIES For Q1&Q2

<table>
<thead>
<tr>
<th>First Author</th>
<th>Year</th>
<th>Compounds</th>
<th>Contact time</th>
<th>Comparator</th>
<th>Sample Size (N)</th>
<th>Microbiological Test Used</th>
<th>Microorganism</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowbury, E</td>
<td>1964</td>
<td>Sodium hypochlorite (Milton 1:80)</td>
<td>30 seconds</td>
<td>Chlorhexidine solutions</td>
<td>4 volunteers</td>
<td>Hands or gloves</td>
<td>Bacterial cell count</td>
<td>Staphylococcus aureus</td>
</tr>
<tr>
<td>Rotter, M</td>
<td>1998</td>
<td>Sodium hypochlorite (4%=40000ppm)</td>
<td>5 minutes</td>
<td>Isopropanol 60% and water/soap</td>
<td>15 volunteers</td>
<td>Hands</td>
<td>Bacterial cell count</td>
<td>Escherichia coli K12</td>
</tr>
<tr>
<td>Edmonds, S</td>
<td>2013</td>
<td>Bleach (0.5%) and surfactant (Triton-X) prototype</td>
<td>Not specifically mentioned</td>
<td>Tap water, 4% chlorhexidine gluconate, Nonantimicrobial hand wash, 0.3% triclosan hand wash, 8% hydrogen peroxide and surfactant (Triton-X) prototype, Peracetic acid wipe, Sodium tetraborate decahydrate, Ink and stain remover, Ink and stain remover with brush, 2000 ppm peracetic acid and surfactant (Triton-X) prototype</td>
<td>6 volunteers</td>
<td>Hands</td>
<td>Bacterial cell count</td>
<td>Clostridium difficile spores, Bacillus atrophaeus, Clostridium sporogenes</td>
</tr>
<tr>
<td>Weber, D</td>
<td>2003</td>
<td>Antibacterial microfiber towel (400ppm sodium hypochlorite)</td>
<td>10-30-60 seconds</td>
<td>61% ethyl alcohol, a 2% chlorhexidine gluconate preparation, and a non antimicrobial soap (control).</td>
<td>6 volunteers</td>
<td>Hands</td>
<td>Bacterial cell count</td>
<td>Bacillus atrophaeus</td>
</tr>
</tbody>
</table>
Summary

- Chlorhexidine significantly higher bacterial reduction than hypochlorite (p<0.001) (Lowbury)
- Bleach 0.5% non-significant difference compared with tap water and other agents (Edmonds)
- Peracid and surfactant formulation significantly superior compared to bleach 0.5% (p<0.05) (Edmonds)
- At 60 seconds, chlorine-towels NS higher effect compared to non antimicrobial soap and water (Weber)

- Sodium hypochlorite significantly higher bacterial reduction than isopropanol 60% or water and soap (p<0.001) (Rotter)
- At 60 seconds, chlorine-towels significantly superior effect compared to chlorhexidine (p=0.008) (Weber)

Summary

- **Different concentrations of chlorine** solution were used
  - aqueous sodium hypochlorite solution (Milton 1:80, 125ppm)
  - sodium hypochlorite solution 4% (40000ppm)
  - bleach 0.5% (5000ppm)
  - microfiber releasing 400 ppm bleach.

- **Variability in the applied contact time** for both the chlorine compound and the comparators.
  - Contact time ranged from 10 seconds up to 5 minutes.
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Sodium hypochlorite concentration dependent

Sodium hypochlorite efficacy contact time dependent

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Conclusion

- No evidence about efficacy of sodium hypochlorite used for hand hygiene to prevent filovirus transmission in health care
- No evidence about efficacy to reduce or eliminate filovirus or other (enveloped) viruses on hands in laboratory studies
- Limited evidence about the efficacy of sodium hypochlorite in comparison to other agents to reduce or eliminate other microorganisms in laboratory studies
- Very limited number of manuscripts and the quality of the performed comparative studies
- Differences in sodium hypochlorite concentrations, contact time and microorganisms were observed.
- No evidence that the advocated concentration of 500ppm sodium hypochlorite has a sufficient efficacy for hand hygiene with the current advocated contact time of 30 sec.

Adverse events related to use of chlorine solutions for hand hygiene

Z. Kubilay, J. Hopman, H. Edrees, T. Allen, B. Allegranzi
Service Delivery Safety
Geneva, WHO HQ
PICO question 3

Does the use of chlorine solutions for hand hygiene cause health workers’ skin irritation or lesions, respiratory side effects or any other adverse reactions?

- **P**: Any person who performs the hand hygiene with chlorine solutions
- **I**: Hand hygiene or glove disinfection with chlorine solutions
- **C**: Hand hygiene or glove disinfection with alcohol-based handrub or other agents including water and soap
- **O**: Skin irritation or other skin lesions, respiratory adverse events or any other adverse reactions

Search methods

- PubMed (including MEDLINE) and Ovid EMBASE databases
- Performed on 26 September 2014
- No time, age, human, language limit or geographical restrictions.
- References of retrieved papers
- *Contact Dermatitis Journal* using the terms "sodium hypochlorite" and "chlorine".
Pubmed search strategy

<table>
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<tr>
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<th>Searches</th>
<th>Results</th>
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<td>1</td>
<td>(&quot;chlorine&quot;[Mesh] OR &quot;chlorine&quot; OR &quot;sodium hypochlorite&quot; OR &quot;calcium hypochlorite&quot; OR &quot;organic chloramines&quot; OR &quot;Chlorine Compounds&quot;[Mesh] OR &quot;chlorine dioxide&quot; [Supplementary Concept]) OR &quot;chlorin&quot; OR &quot;Solvents&quot;[Mesh] OR &quot;bleach&quot; OR &quot;Dettol&quot; OR &quot;Chloramine&quot; OR &quot;Clorox&quot;</td>
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</table>

Inclusion criteria

Initial inclusion criteria
Comparative studies on adverse events due to use of chlorine solutions for hand hygiene or glove disinfection compared to use of alcohol-based handrubs or other agents incl. water and soap

Revised inclusion criteria
• Any kind of population
  • exposed to sodium hypochlorite
  • developed any kind of reaction, mostly skin or respiratory side effects

regardless of the concentration of the product, type of the setting or the method of exposure.
WHO Guideline and review on hand hygiene and the use of chlorine in the context of Ebola
Dr. Joost Hopman, Radboud University Medical Center, The Netherlands
Sponsored by the World Health Organization, Patient Safety Challenge

Exclusion criteria

- Studies about swimmers or chlorination of swimming pools,
- Chlorine use for therapeutic purposes,
- Chlorine gas/vapor exposures,
- Products used other than sodium and/or calcium hypochlorite i.e. chloramine, benzalkonium chloride,
- Animal studies
WHO Guideline and review on hand hygiene and the use of chlorine in the context of Ebola
Dr. Joost Hopman, Radboud University Medical Center, The Netherlands
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**1 CASE REPORT – Veterinary surgeon handwashing w/ 4-6% sodium hypochlorite**

<table>
<thead>
<tr>
<th>Article Title, Author, Year</th>
<th>Type of Participants</th>
<th>Sodium Hypochlorite (NaOCl) - INTERVENTION</th>
<th>COMPARATOR</th>
<th>Description of Skin reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hypochlorite dermatitis, Fun et al, 1984</td>
<td>Veterinary Surgeon</td>
<td>Hand washing 4-5% sodium hypochlorite (Hilod®8 used for handwashing)</td>
<td>Iodine and antibiotics</td>
<td>Allergic contact dermatitis - itchy skin lesions of 3-4 years duration on both hands and forearms + patch test to all concentrations of NaOCl, - to comparator</td>
</tr>
<tr>
<td>3 healthy volunteers</td>
<td>Patch test as described</td>
<td>1 in 100, Sodium hypochlorite (2% NaOCl, 1% NaOCl, 0.5% NaOCl, 0.25% NaOCl)</td>
<td>N/A</td>
<td>All negative patch test results except to undiluted 4-6% NaOCl</td>
</tr>
</tbody>
</table>
### Other CASE REPORTS COMBINED WITH EXPERIMENTAL CONTROLS n=5 (1)

<table>
<thead>
<tr>
<th>Sensitization to sodium hypochlorite causing hand dermatitis</th>
<th>2 housewives</th>
<th>Domestic cleaning w/t/gloves</th>
<th>Kretal product; 10% sodium hypochlorite (bleach)</th>
<th>NA</th>
<th>Chronic lathy dermatitis on the dorsum of the fingers for 9 months (case 1); chronic hand eczema for more than 15 years; dermatitis of the palms, periungual areas and dorsa of the fingers (case 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>69 control patients, randomly selected with suspect allergic contact dermatitis</td>
<td>Patch Test</td>
<td>Sodium hypochlorite 2% in aq; (for 69 patients); sodium hypochlorite 1% and 0.5% in aq (for 20/60 patients)</td>
<td>NA</td>
<td>15/69 a weak or moderate irritant reaction; 20/20 no reaction</td>
<td></td>
</tr>
<tr>
<td>Contact dermatitis due to sodium hypochlorite</td>
<td>Chloramine use for disinfection purposes</td>
<td>Patch test positive to sodium hypochlorite 0.5% aq and chloramine 0.5% aq (Extreme reaction to NaOCl)</td>
<td>NA</td>
<td>Extreme reaction to NaOCl patch test characterized by palm sized, red, grossly edematous and infiltrated reaction</td>
<td></td>
</tr>
<tr>
<td>225 patients with dermatitis</td>
<td>Patch test as described</td>
<td>NA</td>
<td>3/225 positive reaction - 1 patient with history of eczema, 2 with contact dermatitis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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</tr>
</thead>
<tbody>
<tr>
<td>15/69 weak or moderate irritant reaction- 2% Sodium hypochlorite</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20/20 no reaction 0.5-1 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/225 positive reaction 0.5%</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/40 positive reaction 1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20/20 negative reaction to 0.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/10 + low intensity reaction 6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contact dermatitis due to sodium hypochlorite | Chloramine use for disinfection purposes | Patch test positive to sodium hypochlorite 0.5% aq and chloramine 0.5% aq (Extreme reaction to NaOCl) | NA | Extreme reaction to NaOCl patch test characterized by palm sized, red, grossly edematous and infiltrated reaction |
| 225 patients with dermatitis | Patch test as described | NA | 3/225 positive reaction - 1 patient with history of eczema, 2 with contact dermatitis |
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4 additional case reports with severe reaction

- Two case reports from the ‘30s severe dermatitis following use of bleach (reported concentration 1:10) for environmental cleaning; the patch test was positive in both cases.

- Accidental contact exposure to unknown concentrations of bleach- linear IgA bullous dermatosis with systemic reaction

- The use of diluted Clorox® (one part of 6% NaOCl to five parts of water) for bathing the foot to treat an infected big toe for several weeks- severe allergic contact dermatitis characterized by diffuse swelling, scalling, vesiculation of the foot and hands.

Comprehensive study (Tupker, 1997)

<table>
<thead>
<tr>
<th>Article Title, Author, Year</th>
<th>Type of Participants</th>
<th>Sodium Hypochlorite (NaOCl) Interventions</th>
<th>Comparator</th>
<th>Outcome</th>
<th>Description of Skin Reaction</th>
</tr>
</thead>
</table>
| Comparative Study n=1       | 20 subjects without any skin disease, 40% exposure on the human skin, evaluated by non-invasive methods Tupker et al. 1997 | Open exposure model of 30 min duration for 4 consecutive days. With a plastic amp 0.8 ml of solution applied trice 30 mins diameter. | Sodium Hypochlorite (SH), L, 3% mg | Visual scoring for erythema, swelling, and fissures | **5.20 erythematic reaction - after 3 exposure to SH.**
|                             |                      |                                          | Chlorhexidine gluconate 0.5% in 75% ethanol (CE) | Subjective score of itching, tingling, burning, stinging, and pruritus | For all the outcomes SH was significantly the worst, followed by CE. |
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One survey on occupational skin diseases in nurses

<table>
<thead>
<tr>
<th>Article Title, Author, Year</th>
<th>Type of Participants</th>
<th>Sodium Hypochlorite (NaOCl) -INTERVENTION</th>
<th>COMPARATOR</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational skin diseases in nurses Telkaniene et al, 2003</td>
<td>706 nurses from Lithuania</td>
<td>exposure to chemical disinfecting materials in occupational environment</td>
<td>Chlorine compounds *presumably 0.02 or 0.1% chlorine in Haz-Tab® or 3% chloramine</td>
<td>Alcohols, aldehydes, hydrogen peroxide</td>
</tr>
</tbody>
</table>

- 62.5% of nurses who worked with chemical disinfecting materials for more than 9 hours were suffering from skin damage and 33.5% of cases induced by chlorine.

- The risk of developing occupational skin disease is higher for chlorine than alcohol. (OR – 3.6; CI = 2.1–6.2; 1.85 CI=0.9-3.9 respectively) Highest with aldehydes and H2O2

2 surveys among cleaners

- 818 professional cleaners in Spain (Mirabelli, 2012)
  – did not show significantly higher prevalence rate of hand dermatitis in health care settings,
  – Significantly higher prevalence rate of hand dermatitis among all cleaning workers who reported frequent use of bleach (≥4 days per week)

- 25 day care workers – (Sheretz, 1992)
  – used 1:1000 dilution of sodium hypochlorite-50 ppm chlorine for disinfection purposes
  – 13/25 workers who had hand dermatitis were exposed to wet work and latex gloves along with sodium hypochlorite.
CONCLUSION - Skin Side Effects

- Extremely limited evidence related to contact dermatitis following sodium hypochlorite use for hand hygiene purposes (only one case report but using high concentrations)
- Other studies - exposure to sodium hypochlorite as a disinfectant for other uses
- The quality of the studies was low or very low
- Great variability was found in the type of setting, concentrations used (high in most of these studies), study designs and exposure methods
- Overall, low or very low quality evidence shows that sodium hypochlorite can cause skin irritations even at low concentrations with bare skin exposure
HCW Survey study (Glumbakaite, 2003)

- 314 medical personnel surveyed in 9 different hospitals in Lithuania
- 0.02 or 0.1% chlorine solutions and a 3% chloramine solution, glutaraldehyde, hydrogen peroxide, isopropyl and ethyl alcohol
- Significantly more frequent skin reddening, itching symptoms and chronic bronchitis when using chlorine compounds,

| Table 6. Prevalence of symptoms and diseases of the medical personnel disinfecting with chlorine compounds |
|--------------------------------------------------|------------------|------------------|
| Symptoms                                         | Prevalence n (%) | 95% CI           |
| Reddening and itching of skin                    | 80/384 (20.9)    | 49.67-66.74      |
| Allergic conjunctivitis                          | 57/384 (14.9)    | 33.25-50.33      |
| Allergic rhinitis                                | 51/372 (13.7)    | 29.12-45.89      |
| Weakness                                         | 39/285 (13.7)    | 21.09-36.80      |
| Headache                                         | 38/272 (13.9)    | 20.43-36.03      |
| Dizziness                                        | 31/228 (13.6)    | 15.92-30.55      |
| Cough                                            | 20/204 (9.85)    | 14.02-28.16      |
| Hoarseness                                       | 21/153 (13.7)    | 9.74-22.47       |
| Chest tightness                                  | 15/107 (14.0)    | 6.26-27.41       |
| Dyspnea                                          | 13/97 (13.4)     | 5.15-25.68       |
| Difficulty in breathing                          | 96/853 (11.3)    | 2.35-21.18       |
| Wheeze                                           | 53/613 (8.7)     | 1.19-9.31        |
| Diseases                                         |                  |                  |
| Chronic bronchitis                               | 17/124 (13.7)    | 7.39-19.12       |
| Allergic contact dermatitis                      | 107/713 (15.0)   | 3.55-13.01       |
| Allergic rhinitis                                | 107/713 (15.0)   | 3.55-13.01       |
| Allergic conjunctivitis                          | 107/713 (15.0)   | 3.55-13.01       |
| Contact dermatitis                               | 75/131 (57.6)    | 2.08-10.24       |
| Chronic laryngitis                               | 64/124 (51.6)    | 1.62-9.29        |
| Chronic rhinitis                                 | 53/103 (51.5)    | 1.19-8.31        |
| Contact urticaria                                | 42/90 (46.7)     | 0.80-7.30        |
| Asthma                                           | 42/90 (46.7)     | 0.80-7.30        |

1 No. of people tested = 137; *p < 0.001; **p < 0.05.

One patient survey study (Aronhalt 2012)

- USA hospital during the "Wipe Out C.Difficile" intervention
- 94 patients and 6 environmental cleaning staff
- Bleach wipes containing 0.55% sodium hypochlorite (5,200 ppm) while their rooms were cleaned.
- Only 7% of patients from the medical units (n = 2) but half of the patients from the hematology–oncology units (n = 50) noticed the odor of the bleach used for cleaning; 44% of them found it bothersome and either used a mask or left their room during cleaning.
- All participating cleaners (n=6) reported respiratory irritation and less satisfaction from using the bleach wipes; however, later their satisfaction improved.
CONCLUSION - Respiratory side effects

• No evidence in the literature that shows that low level of sodium hypochlorite used for hand hygiene may cause respiratory irritation, other respiratory symptoms or asthma.
• However, respiratory symptoms are clearly reported in patients, health workers and other users as a consequence of exposure to chlorine solutions used for environmental decontamination also with low concentrations (0.02 or 0.1% chlorine solutions)

Other Side Effects

• No studies were identified addressing other possible side effects except the Glumbakaite, 2003 Lithuanian study.

Table 6. Prevalence of symptoms and diseases of the medical personnel disinfecting with chlorine compounds

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Prevalence n (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reddening and itching of skin</td>
<td>49 (58.4)*</td>
<td>49.67-66.74</td>
</tr>
<tr>
<td>Allergic conjunctivitis</td>
<td>57 (61.6)</td>
<td>33.25-80.33</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>51 (57.2)</td>
<td>29.17-95.89</td>
</tr>
<tr>
<td>Weakness</td>
<td>39 (28.5)</td>
<td>29.09-40.80</td>
</tr>
<tr>
<td>Headache</td>
<td>38 (27.7)</td>
<td>20.43-36.03</td>
</tr>
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<td>13.92-30.55</td>
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<tr>
<td>Cough</td>
<td>29 (20.7)</td>
<td>14.02-29.10</td>
</tr>
<tr>
<td>Hoarseness</td>
<td>23 (15.3)</td>
<td>9.3-32.47</td>
</tr>
<tr>
<td>Chest tightness</td>
<td>15 (10.9)</td>
<td>6.2-17.41</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>13 (9.5)</td>
<td>5.1-15.68</td>
</tr>
<tr>
<td>Difficulty in breathing</td>
<td>8 (6.0)</td>
<td>2.5-14.18</td>
</tr>
<tr>
<td>Wheezing</td>
<td>3 (2.3)</td>
<td>1.1-8.31</td>
</tr>
</tbody>
</table>

Diseases

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Prevalence n (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic bronchitis</td>
<td>17 (12.4)</td>
<td>9.3-19.12</td>
</tr>
<tr>
<td>Allergic contact dermatitis</td>
<td>10 (7.3)</td>
<td>3.5-13.01</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>10 (7.3)</td>
<td>3.5-13.01</td>
</tr>
<tr>
<td>Allergic conjunctivitis</td>
<td>10 (7.3)</td>
<td>3.5-13.01</td>
</tr>
<tr>
<td>Contact dermatitis</td>
<td>7 (5.1)</td>
<td>2.08-10.24</td>
</tr>
<tr>
<td>Chronic laryngitis</td>
<td>6 (4.0)</td>
<td>1.62-9.29</td>
</tr>
<tr>
<td>Chronic rhinitis</td>
<td>5 (3.6)</td>
<td>1.1-8.31</td>
</tr>
<tr>
<td>Contact urticaria</td>
<td>4 (2.9)</td>
<td>0.8-7.30</td>
</tr>
<tr>
<td>Asthma</td>
<td>4 (2.9)</td>
<td>0.8-7.30</td>
</tr>
</tbody>
</table>

1 No. of people tested = 137; *p < 0.001; **p < 0.05.
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Caveats regarding washing, decontaminating and reprocessing gloves – *WHO Guidelines on Hand Hygiene* (2009), section 23.1.6

- 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.
- Although these practices are common in many health-care settings, essentially in developing countries, where glove supply is limited, *no recommendation exists concerning the washing and reuse of gloves, nor the washing or decontamination of gloved hands* followed by reuse on another patient.
- Although the antibacterial efficacy of glove washing and decontamination is demonstrated (1 study using 4% chlorhexidine + 7.5% povidone-iodine liquid soap, and 1 study using ABHR+ chlorhexidine), *the consequences of such processes on material integrity still remain unknown.*

Caveats regarding washing, decontaminating and reprocessing gloves – *WHO Guidelines on Hand Hygiene*, section 23.1.6

- *Some evidence exists that cleansing latex-gloved hands using an alcohol-based handrub solution is effective* in removing micro-organisms and shows increasing contamination rates of hands only after 9–10 cycles of cleansing.
- However, cleansing plastic-gloved hands with an ABHR *leads to early dissolving of the plastic material.*
- It should be noted that this process may be applied *only in the framework of contact precautions implementation and as long as gloves are not soiled with blood and other body fluids.*
Conclusions on glove reprocessing

- 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.

- Every possible effort should be made to prevent glove reuse in health-care settings, and financial constraints in developing countries leading to such practices should be assessed and tackled. Institutions and health-care settings should firmly **avoid the reuse of gloves**.

- In circumstances where the reprocessing of gloves has been carefully evaluated but cannot be avoided, a clear policy should be in place to limit reprocessing and reuse of gloves until a budget is allocated to ensure a secure supply of single-use gloves.

- Policies for exceptional reprocessing should ensure a **process that follows strict procedures for collection, selection and reprocessing**, including instructions for quality/integrity control and discarding of unusable gloves.


Does glove disinfection with chlorine solutions cause damage to permeability or increased perforations?

Rapid review upon request by the WHO Guidelines Review Committee
WHO Guideline and review on hand hygiene and the use of chlorine in the context of Ebola
Dr. Joost Hopman, Radboud University Medical Center, The Netherlands
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Search Methods

- PubMed (including MEDLINE) and Ovid EMBASE databases
- Performed on 11 November 2014
- No time, age, human, language limit or geographical restrictions.

Pubmed search strategy

<table>
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<tr>
<th>#</th>
<th>Searches</th>
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</thead>
<tbody>
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</tr>
<tr>
<td>2</td>
<td>(((“Gloves, Protective”[Mesh] OR gloves [TW] OR glove [TW] OR gloving [TW])))</td>
</tr>
<tr>
<td>3</td>
<td>#1 AND #2</td>
</tr>
</tbody>
</table>

Hosted by Claire Kilpatrick, WHO
A Webber Training Teleclass
www.webbertraining.com
Seven brands of surgical gloves tested for permeation against seven chemicals according to the European and the American standards.

The gloves did not exhibit permeation of potassium hydroxide (45%), sodium hypochlorite (13%) or hydrogen peroxide (30%).

Neither glutaraldehyde (2%) nor chlorhexidine digluconate (4%) in the commercial disinfectant solutions studied exhibited permeation.

The surgical gloves studied are able to protect against sodium hypochlorite 13% (available chlorine > 12%) in conventional hospital work where there is usually contact with less concentrated chemicals and where contact is for short periods of chemical usage. However, should this chemical be used in mixtures with highly glove-permeable or glove-degrading chemicals or the mechanical stress is greater than the gloves can stand, then the results will be not applicable.
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Conclusions (1)

1. 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.
2. Available data indicates that for hand hygiene efficacy there is a relation between bleach/chlorine concentration and contact time.
3. With regards to glove disinfection, no study on efficacy of chlorine solutions compared with alcohol-based hand rub or other antisepsis 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.

Conclusions (2)

4. 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.
5. No evidence that low concentrations of sodium hypochlorite used for hand hygiene cause respiratory irritation, other respiratory symptoms or asthma.
6. Risk for irritative conjunctivitis is noted.
7. 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.
**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.*

http://apps.who.int/iris/bitstream/10665/144578/1/WHO_HIS_SDS_2014.15-eng.pdf?ua=1
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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 rubs or soap and water.

http://apps.who.int/iris/bitstream/10665/144578/1/WHO_HIS_SDS_2014.15_eng.pdf?ua=1

Recommendation 3

- Bleach/chlorine solutions currently in use for hand hygiene and glove disinfection can be used in the interim period in emergency situations until alcohol-based hand rubs 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.

http://apps.who.int/iris/bitstream/10665/144578/1/WHO_HIS_SDS_2014.15_eng.pdf?ua=1
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Final conclusions

• Handwashing with soap and running water is effective
• Ideally, for hand hygiene an alcohol-based handrub should be used as it is highly effective
• On the medium-/longterm, procurement of alcohol based handrub in developing countries including Africa, should be increased (with associated price reduction) and local production should be strongly encouraged and supported

Acknowledgements

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Acknowledgements
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Prof Folasade Ogunsola, Nigeria
Dr Benjamin Park USA
Prof Didier Pittet, Switzerland
Dr Diamantis Plachouras, Sweden
Prof Manfred Rotter, Austria
Dr Syed Sattar, Canada
Dr Wing Hong Seto, Hong Kong SAR

The next WHO teleclass ....
March 11, 2015

USING THE CORE COMPONENTS OF INFECTION CONTROL DURING THE EBOLA OUTBREAK

Dr. Sergey Eremin
Medical Officer, World Health Organization

Objectives ....
- To introduce the WHO concept of the core components of infection prevention and control programmes in health care.
- To understand the challenges and share the experience in implementing core components of IPC in the countries affected by the current EVD outbreak.
- To discuss minimum standards needed for health facilities in the EVD outbreak setting to operate and provide care in an environment that is safe for both patients and staff.
- To define strategy for building sustainable IPC capacity in the Ebola affected countries.

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WHO Guideline and review on hand hygiene and the use of chlorine in the context of Ebola
Dr. Joost Hopman, Radboud University Medical Center, The Netherlands
Sponsored by the World Health Organization, Patient Safety Challenge

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