The Role of “NO-TOUCH” Decontamination Technologies:
Room Disinfection by Hydrogen Peroxide Vapor at Siriraj Hospital

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Contents

❖ Overview  HAIs’ rate and Mode of transmission
❖ NO-TOUCH decontamination
❖ Siriraj’s study
❖ Recommendations
Healthcare Associated Infections (HAIs)

- **Acinetobacter baumannii**
- **VRE**
- **MRSA**
- **Pseudomonas aeruginosa**
- **Klebsiella pneumoniae**
- **Mycobacterium tuberculosis**
- **Norovirus**

New resistant organisms are emerging and vary among hospitals
Percentage of Imipenem Resistant
*Acinetobacter calcoaceticus-baumannii* complex
by ICU, non-ICU and OPD (28 hospitals)

Source: National Antimicrobial Resistance Surveillance, Thailand, 2011
Survival of nosocomial pathogens on surfaces

# Persistence despite conventional cleaning

## Overall MRSA results

<table>
<thead>
<tr>
<th>Overall assessment</th>
<th>Percentage of MRSA swabs positive for MRSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before cleaning</td>
<td>74% (264 out of 359) swabs positive for MRSA</td>
</tr>
<tr>
<td>After cleaning</td>
<td>90% (111 out of 124) swabs positive for MRSA</td>
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- **Before Cleaning**: 74% (264 out of 359) swabs positive for MRSA
  - (18 rooms; 2 four-bed bays; 4 bathrooms previously occupied by MRSA patients)
- **After Cleaning**: 90% (111 out of 124) swabs positive for MRSA
  - (8 rooms; 2 four-bed bays previously occupied by MRSA patients)
- **Overall assessment**


## Effect of cleaning

**Cleaning ineffective:**

**Poor level of reduction**
Thoroughness of Environmental Cleaning

![Bar chart showing the thoroughness of daily and terminal cleaning across different sites and areas. The chart indicates that the mean percentage cleaned is 32%, with more than 110,000 objects cleaned.

Source: PC Carling et al, SHEA 2010]
High touch areas in patient rooms are not cleaned consistently – Carling study (2008)

Source: PC Carling et al, SHEA 2007 and ICHE 2008; 29:1
Manual Cleaning is not enough !!!
“NO-TOUCH”
Decontamination Technologies
“NO-TOUCH” Decontamination Technologies

- Hydrogen peroxide
- UV light (UV-C)
- Chlorine dioxide
- Formaldehyde
- Ozone
NO-TOUCH Method
Considerations

Decontamination Effectiveness

- **High efficacy** (bactericidal, tuberculocidal, virucidal, fungicidal, sporicidal)
- **Organic material resistance** (withstands organic material challenge without loss of efficacy)
- **Material compatibility** (e.g. non-corrosive with equipment, metals, ...)
- **Adaptability** (suitable for different environments)

Source: LARRY GARRONE, Selecting and Using NO-TOUCH Room Disinfection, ICT 2012
NO-TOUCH Method Considerations

❖ Safety

❖ Least toxic (no health risk to operators, no toxic by-products)

❖ Environmental Friendly (no hazard to environment, minimal of waste)

❖ Automated shut-off system

❖ Cost (reasonable cost for installation and operation)

Source: LARRY GARRONE, Selecting and Using NO-TOUCH Room Disinfection, ICT 2012
NO-TOUCH Method
Considerations

❖ **Speed and Convenience**
  - Rapid activity, Shortest possible cycle time
  - Monitoring capability (easy and accurate monitoring)
  - Potential for misapplication (easy to operate)

❖ **Operators** (Able to be operated by housekeepers)

❖ **Infection Rate Impact** (Reduction in infection rates)

Source: LARRY GARRONE, Selecting and Using NO-TOUCH Room Disinfection, ICT 2012
Study Design & Objective

- **Phase I**: Examine current status.
  
  *(Conventional Cleaning)*

- **Phase II**: Examine the efficiency of hydrogen peroxide \((H_2O_2)\).
5 x 6.5 x 3 ~ 100 m³

Operating Theatre Layout

- Plate #1 Floor
- Plate #2 Front Door
- Plate #3 Desk (Top)
- Plate #4 Floor under Desk
- Plate #5 Cabinet Door
- Plate #6 Mobile Cabinet (Top)
- Plate #7 Upper Wall
- Plate #8 Bottom Wall
- Plate #9 Floor
- Plate #10 Bottom Wall
- Plate #11 Bed End
- Plate #12 Back Door
- Plate #13 Bed End
- Plate #14 Upper Wall
- Plate #15 Bottom Wall
- Plate #16 Floor by the bed
- Plate #17 Floor by the bed
- BED
- CABINET
- MOBILE CABINET
Phase I: Examine baseline conventional cleaning evaluation

5 days  330 samplings

1. Sampling (Pre-cleaning)
2. Room cleaning
3. Sampling (Post-cleaning)

RODAC plates (Replicate Organism Detection and Counting)
Phase II: Examine the efficiency of $\text{H}_2\text{O}_2$

11 days  1,089 samplings

1. Sampling (Pre-cleaning)
2. Room Cleaning
3. Sampling (Post-cleaning)
4. $\text{H}_2\text{O}_2$ fumigation
5. Sampling (Post- $\text{H}_2\text{O}_2$ Fumigation)
Clean the surface tested with 70% alcohol
Room Cleaning
Room Cleaning
Room Cleaning
# Room Cleaning: Result

<table>
<thead>
<tr>
<th></th>
<th>Door1</th>
<th>Door2</th>
<th>Bench</th>
<th>Shelf door</th>
<th>Shelf</th>
<th>Wall1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
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<tr>
<td><strong>After</strong></td>
<td><img src="image7.png" alt="Image" /></td>
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<td><strong>Fume</strong></td>
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<td><img src="image18.png" alt="Image" /></td>
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Room Cleaning: Result

- Floor beside Bed1
- Floor beside Bed2
- Floor under bench
- Floor corner 1
- Floor corner 2
Conventional cleaning versus HPV

Overall MRSA results
- **74%** (264 out of 359) swabs positive for MRSA
  - (18 rooms; 2 four-bed bays; 4 bathrooms previously occupied by MRSA patients)

**Effect of cleaning**
- **90%** (111 out of 124) swabs positive for MRSA
  - (8 rooms; 2 four-bed bays previously occupied by MRSA patients)

- **66%** (82 out of 124) swabs positive for MRSA
  - (4 rooms; 2 bathrooms previously occupied by MRSA patients)

**Effect of Bio-Decontamination**
- **72%** (61 out of 85) swabs positive for MRSA
  - (4 rooms; 2 bathrooms previously occupied by MRSA patients)

Cleaning ineffective: Poor level of reduction

Area/Room Decontamination

- Operating room
- ICU, RCU, CCU, Burn unit
- BSL-3
- BMT
- EID
- Chemo clinic
HPV Fumigation; OR
HPV Fumigation; CCU
HPV Fumigation; Burn Unit
HPV Fumigation; BSL-3
HPV Fumigation; TB Lab
HPV Fumigation; Stem cell Lab
HPV Fumigation; Ambulance
Disinfection Validate

- Biological indicator – *G. Stearothermophilus* 
  $10^6$ reduction
- Chemical indicators
Operating room

Before fumigation

After fumigation
Consideration for Effective Cleaning

- **Cleaning protocol**
  - Guideline, WI, SOP

- **Cleaner service**
  - Training - - Practice & Awareness

- **Monitoring system**
  - Equipment & Method - - *Observation, RODAC, Swab, ATP, Fluorescent gel, Agar slide*
Risks

Benefits

Do not replace standard cleaning and disinfection
Recommendations

- Special high risk areas (lab, OR, vaccine lab, etc)
- Adjunct measure to control outbreak of MDROs
- Terminal care in private patient room preoccupied with MDRO patients particularly in high risk units (BMT)
Recommendations

- In special situations (e.g., room decontamination for bioterrorism such as anthrax) and EID quarantine room, flood

- Sensitive equipment that may be difficult to disinfect after cleaning
Acknowledgement

- Assist. Prof. Teera Kolladarungkri
- Assoc. Prof. Dr. Srisurang Tantimavanich
- Assoc. Prof. Churairatana Nilakul
- Department of Surgery, faculty of Medicine, Siriraj Hospital, Mahidol University
- Johnson & Johnson (Thailand) Ltd.
- Simm Company Ltd. Thailand
- My colleague at Occupational Health Division
SAWASDEE KRUB