Experience of Using Hydrogen Peroxide Vapor for Preventing Environmental Transmission of Multi-drug Resistant Organism - Vancomycin-Resistant Enterococcus
Several outbreaks of VRE have occurred in HA hospitals since 2011

Clinical impact of VRE
- Reduces therapeutic options
- Resistance genes can transfer from enterococci to other Gram-positive organisms (e.g. MRSA)

Environmental contamination has been considered an important factor leading to patient-to-patient transmission
Important to achieve a satisfactory environmental decontamination ........
Major Concerns in Environmental Decontamination

* Limitations with standard environmental cleaning method

* Transmission via hands of health care workers

Passaretti et al. Clinical Infectious Disease 2013: 56 (1 January)
Hydrogen Peroxide Vapor Decontamination (HPV)
H$_2$O$_2$ - Microbiological efficacy

* Microbial components are killed by the hydroxyl radical of H$_2$O$_2$

* Sporicidal, bactericidal, mycobactericidal and virucidal

Passaretti et al. Clinical Infectious Disease 2013: 56 (1 January)
H₂O₂ - other properties

* H₂O₂ is broken down to water vapor and oxygen
* Compatible with most inanimate materials including electronics
* Can reach sites that are difficult to access

Falagas et al. Journal of Hospital Infection 2011; 78:17
Rutala WA, Weber DJ, ICHE(http://www.icas.org.sg/Ed_IC_Week/IC%20Week%202011.pdf)
The HPV System
(Bioquell System)

Generator

Aeration Unit

The control and monitoring unit outside the room
**Generator**

* Generates HPV from 30% aqueous hydrogen peroxide, vapourizes at 130°C.

* High velocity gas distribution nozzles

* Delivery of H₂O₂ continues until air inside the enclosure becomes saturated, and H₂O₂ starts to condense.

Fu T Y et al. Journal of Hospital Infection 80 (2012) 199-205
HPV Decontamination-Technology description (Cont’d)

* **Aeration unit**
  * Catalyse the breakdown of HPV after the exposure period
  * Converts the H$_2$O$_2$ vapor to water vapor and oxygen

Fu T Y et al. Journal of Hospital Infection 80 (2012) 199-205
**Instrumentation module**

- Controls cycle conditions
- Measures and monitors the concentration of hydrogen peroxide, relative humidity and temperature inside the room.

HPV Decontamination - Multi-disciplinary

* Ward staff

* Infection Control Team

* Facility Management

* EMSD

* Microbiology laboratory
HPV Decontamination

- making request.....
Initiation - Assessment - Approval

* Ward nurse raises request

* Infection control team assesses request and grants approval according to criteria
Joint Site Inspection

* Ward staff
* Infection Control Team
* Facility Management
* EMSD
HPV Decontamination

- Room Preparation
* Identify leakage of construction

* Fix the leak
Perform thorough environment cleaning using standard method

* sodium hypochlorite 1,000ppm
Ward staff (Cont’d)

* Send bed clothing for laundry

* Discard disposable items

* Leave reusable equipment and items inside the room

* Maximize exposure to HPV
  * Open drawers, locker and cupboard doors
  * Pull items away from walls
  * Prop up items (e.g. mattress)
  * Raise bed-side rails
  * Leave blood pressure cuff connection port open and hang the cuff free from environmental surfaces
  * Let down window blinds
Maximize exposure

Mattress propped up

Paper towel holder opened

Drawers, cupboard and locker doors opened
Leave electronic equipment inside room
Check cleanliness of room
- Soiling especially organic matter has been removed

Affix biological indicators in places that are difficult to bio-decontaminate
Some of the locations where biological indicators will be placed
* Seal off the room

* Stop the ventilation
* Seal off the supply and exhaust grills
* Close off supply and exhaust dampers
* Add water to floor drain/ sink
* Cover fire sensors to prevent false alarms during fumigation
* Arrange fans in strategic position to maximize exposure to H$_2$O$_2$
* Ensure that all windows are closed
* Confirm that all personnel have left the room
* Seal the room door
Room Preparation

- Seal off air grills
- Cover the fire sensor
- Add water to floor drain and sink
- Arrange fan in strategic position
Seal the room door
Decontamination Process

Different phases......
The Decontamination Process

* Starting the decontamination cycle

  * Specify the volume of the room

  * Set the type of loading
    * Light/ medium/ heavy

Decontamination

The Decontamination Process

Monitor for leakage of $\text{H}_2\text{O}_2$ during the procedure
The Decontamination Process

* Aeration phase and ending the cycle

* The aeration unit converts the H₂O₂ vapor to water vapor and oxygen

* Can end cycle once the concentration of gas inside the room has dropped to below 1ppm.
Evaluation of Performance

* Biological indicators
  * inoculated with *Geobacillus stearothermophilus* endospores
* From 2011 November through 2013 January

* 33 episodes of HPV bio-decontamination were performed in HAIDC.

* Using the biological indicator as a measure of success, only one episode failed, making a successful rate of 97%.
On the episode that failed

- the spores on one of the biological indicators were not completely killed

- was attributed to possible inadequate circulation of $H_2O_2$

- recommended that more attention be paid to ensure adequate distribution of $H_2O_2$ across the room
Environmental decontamination plays an important role in the prevention of transmission of VRE.

The experience in HAIDC has shown that HPV is a feasible and effective approach to thorough terminal environmental disinfection.
Acknowledgement

- Dr. Danny W K Tong
- Dr. T K Ng
- Mr. W T Hui
- Ms. S S Lam
- Mr. C H Tse
- Mr. W C Sin
Thank you