Ministry of Health
Sultanate of Oman

Guidelines for Enhanced Environmental Decontamination Program in Healthcare Facilities

MOH/DGDSC-DIPC/ Environmental

Decontamination /Vers 01/25th June-2020

The Department of Infection Prevention and Control
Directorate General for Disease Surveillance and Control

Abbreviations:	
A & E	Accident & Emergency
US-EPA-	United States Environmental Protection Agency
EU	European Union
ICU	Intensive care unit
ICD	Infection Control Department
IFU	Information of use
MoH	Ministry of Health
PPE	Personal protective equipment
SDS	Safety data sheets
IPCD	Infection Prevention and Control Department
OMASS	Oman antimicrobial resistance surveillance system
MDRO	Multi-drug resistant organisms
WHO	World health organization
HCAIs	healthcare associated infections
DGDSC	Directorate general of disease surveillance and control

Definitions:

Terminal /discharge cleaning	Cleaning and disinfection after patient is discharged or transferred to ensure that there is no transfer of microorganisms to the next patient
Contact time	Contact time refers to the amount of time necessary for the disinfectant to be in contact with the surface to inactivate microorganisms
Detergent	Detergent is a surfactant or a mixture of surfactants having a cleansing property when dissolved in water and facilitate the removal of dirt and organic matter
Disinfectants	Disinfectant is a chemical agent, which under defined conditions, rapidly kills or inactivates most microorganisms but not used as general cleaning agent, unless combined with a detergent as a combination- cleaning agent (detergent-disinfectant).
Disinfection	A thermal or chemical process for inactivating microorganisms on inanimate objects. The process may or may not inactivate bacterial spores, prions, and some viruses
Decontamination	Decontamination is a process of removal of contaminants (e.g. microorganisms) which are hazardous to human health and environment, from objects or surfaces, and to prevent there spread.

1. Introduction:

The rising trend in healthcare associated infections (HCAIs) and antimicrobial resistance (AMR), have a significant impact on morbidity, mortality and treatment outcome of patients globally. According to Oman antimicrobial surveillance system (OMASS) report 2018, 9.8% of cultures from bacteremia patients grew Multi-drug resistant organisms (MDROs).

Scientific evidences show that patients are at increased risk of acquiring MDROs, if the room is vacated by previously colonized or infected person with such pathogens, suggesting transmission via contaminated environment which conventional (manual) cleaning does not reduce sufficiently. Thus, surface decontamination of non-critical environment is considered as one of the comprehensive infection prevention strategies for preventing transmission of infection. The other elements include hand hygiene, prudent prescription of antibiotics, isolating infected patients and usage of appropriate personal protective equipment's (PPE).

Evidences show that conventional cleaning and decontamination without a "structured program" targeting improvement rarely eradicate pathogens.[1] Therefore, the Central department of infection prevention and control issues this guidance to facilitate the development of "**environment decontamination program**" in healthcare facilities, as part of a multimodal strategy to prevent HCAIs and decrease AMR.

Purpose:

1.1. Guide to formulate and implement decontamination program in HCFs to:

- 1.1.1. Reduce the risk of cross- transmission between patient environment, equipment and patient.
- 1.1.2. Reduce HCAI rates and related morbidity and mortality

1.2. To establish a system for supervision, monitoring, follow up of process and training as part of the "**environment decontamination**" program.

2. Environment decontamination Program(ED):

This is a comprehensive program, structured for implementation, follow up, monitoring of environmental decontamination processes for removal of contaminants (e.g. microorganisms), and prevent transmission of harmful pathogens via environment, within healthcare facilities. This guidance elaborates the indication and procedure for use of hydrogen peroxide (mist) technology for enhanced decontamination as this is available in our healthcare facilities. Regardless of the type of facility, an effective decontamination program should include the following key components:

Organizational structure	Staff Training	Equipment's and supplies	Policies and Procedures	Monitoring & audits

2.1. Structure of ED Program

Though most of the decontamination processes are done by contracted services, administrative support is essential for effective implementation of ED program.

2.1.1. The healthcare facilities shall write policy and procedures on appropriate use of HPV technology considering cost effectiveness and turnaround time.

2.1.2. Designate decontamination team- healthcare facilities shall have a multidisciplinary team with representatives from

- General services
- Housekeeping supervisor
- Maintenance
- Nursing
- Infection control
- HSE
- Bed management
- Quality management

2.1.3. Roles of the decontamination team

- Facility shall appoint a chairman/ leader of the team
- Facility IC team shall conduct risk assessment for appropriate use of HPV e.g probability of degree of contamination in a given area
- Plan decontamination of rooms / or areas in collaboration with service provider, facility manger and concerned units
- Designate dedicated staff to operate the HPV machine
- Decide the Frequency of HPV decontamination in high risk areas
- Ensure that decontamination process is monitored, documents are maintained and feedbacks in the form of audits are in place
- Ensure that annual consumption of disinfectant (e.g.HPV) is calculated to determine regular supply for the program
- Ensure collaboration with the engineering department to conduct survey to calculate the number of (isolation room, ICUs, OTs etc) and calculate the volume of each room.

2.2. Staff training

2.2.1. Facility should have a structured training program for staff involved in environmental decontamination process especially those involved in decontamination of critical areas e.g. ICUs, isolation room, A&E etc

2.2.2. Conduct education and training of new staff as well as refresher courses for the existing staff involved in decontamination

2.2.3. Training should include key elements of infection control e.g. hand hygiene,

Donning and doffing of PPE, measurement of disinfectant (Hydrogen peroxide) and the contact time, etc.

2.2.4. Ensure that training records with dates, training content, and names of the trainer and trainees are maintained

2.3. Equipment's and supplies

2.3.1. Ensure the availability of necessary equipment's (janitorial trolley with cleaning cloth, deep scrubbers, high duster, colour coded floor mops with mop handles and cleaning double bucket).

2.3.2. Regular supply and sufficient stock of detergent and disinfectant (e.g/HPV)

2.3.3. Fogging machine is functional and maintained

2.4. Policy and procedures

The ED is usually done as preventive and / or reactive purpose. It is recommended that healthcare facility should have both preventive and reactive decontamination process to in place to help reduce HCAI rates, prevent recurrence of infection thus minimizing the risk of outbreaks from contaminated environment.

2.4.1. **Preventive decontamination program**

Preventive decontamination reduces the levels of contamination and minimizes the risk of outbreaks.

2.4.1.1. This includes inpatient areas with high level contamination such as:

- Inpatient care facilities, therapy units and operating theaters etc.
- High- risk areas (e.g. ICUs, HDU), cubicles with curtains (A&E)

2.4.1.2. Ensure prior planning along with all concerned stakeholders to

- Agree on decontamination program and transfer of patients to other units
- Organize any refurbishment needs (e.g. repair of any plug points etc.) before undertaking decontamination process
- Thorough cleaning of the room followed by decontamination
- Arrange for patients to be transferred back to unit

2.4.2. **Reactive decontamination program**

Reactive decontamination prevents the recurrence of contamination and infections which can spread to subsequent patients, by decontaminating rooms (e.g isolation room) and / or other areas occupied by infected patients, at the earliest. This may include

- Isolation rooms after discharge of the patients
- Special clinical areas in the event of outbreaks (guided by IPC team)

2.5. Enhanced Decontamination using Hydrogen peroxide (HPV) technology

Enhanced decontamination in healthcare facilities can be done using "non-touch" automated technologies e.g. mobile ultraviolet light (UVC) 254nm, hydrogen peroxide in the form of mist or vapor etc. As HPV technologies are currently available in healthcare facilities, we elaborate the process of decontamination using the same.

2.5.1. Mechanism of action of Hydrogen peroxide

Hydrogen peroxide produces destructive hydroxyl free radicles, which attack the lipid membrane, DNA and other essential cell components and kill the microorganisms.

2.5.2. Indications for use of HPV decontamination

The concentration HPV and the frequency vary according to risk assessment area/ room identified and the purpose for decontamination. The recommended concentrations for preventive and reactive decontamination process are:

- **Preventive decontamination** process uses 6% HPV
- **Reactive decontamination** process 6% to 12% of HPV, depending on mode of transmission of infection and the setting (e.g. outbreak)
  - Isolation rooms
    - 6% HPV for infection transmitted by Contact and Droplet
    - 12% HPV for airborne transmitted infections
  - During an outbreak setting 12%, HPV decontamination should be used

* For details Please refer to Annex 1

2.5.3. Procedure for decontamination with HPV

2.5.3.1. Pre- fogging preparation

2.5.3.1.1. Terminal / discharge cleaning

2.5.3.1.1.1. Perform terminal /discharge cleaning prior to decontamination

2.5.3.1.1.2. Adhere to national colour coding for mops (shown below) to prevent cross transmission within healthcare facility

Table 1 : Use Color coded mops

Color	Areas
Yellow	Isolation room
Red	OB Gyne and Operating Theater
Blue	Offices, Corridors, Kitchen / Catering and Laundry clean area, CSSD
Green	All clinical wards/units

2.5.3.1.1.3. Don appropriate PPE according to transmission based precaution (see annex 2)

2.5.3.1.1.4. Work from clean to dirty, high to bottom and low touch to High- touch areas

2.5.3.1.1.5. Change cleaning cloth between each patient area a bathroom; after cleaning heavily soiled area

2.5.3.1.1.6. Avoid cleaning method that produce mist or aerosol or disperse dust in patient care area

2.5.3.1.1.7. For all cleaning and disinfecting agents follow manufacturer IFU and safety data sheet

* For detailed cleaning process see annex 3

2.5.3.1.2. Calculate the volume of the room=W x L x H =total in cm^3

2.5.3.1.3. Prepare the room as follows:

- Close the ventilation system
- Seal the supply and exhaust air, windows, doors /exits and gaps using plastic sheets (e.g folded plastic bags)
- Open all shelves and cabinets in the room
- Move the bed mattress in vertical position over the bed frame
- Open the bathroom door (if attached)

2.5.3.2. Fogging with hydrogen peroxide

2.5.3.2.1. Don PPE (gown,N95mask, goggles, disposable gloves)/ or as recommended in safety data sheet (SDS)

2.5.3.2.2. Place the fogging machine inside the room, near the door

2.5.3.2.3. Adjust the setting pad of the machine according to the size of the room

2.5.3.2.4. Operate the machine according to its manufacturers IFU using 6% or 12% H_2O_2 concentration for preventive or reactive decontamination process respectively. (see annex 4 for operating the fogging machine)

2.5.3.2.5. Seal the exit door with masking tape outside and place the "**stop**" sign on the door. (See Annex 5)

2.5.3.2.6. Doff all PPE (gloves, gown, goggles and N95mask)

2.5.3.2.7. Observe the contact time as per manufacturers IFU of disinfectant

2.5.3.2.8. Wait for additional 30 min after contact time

2.5.3.2.9. Don the PPE (same as above), and enter the room; open the doors and windows for ventilation for one hour.

2.6. Monitoring and audit:

To ensure that rooms/ areas in healthcare facilities are clean and acceptable to patient, visitors and staff, it is essential that there is a system in place for monitoring of these activities. Though various methods are available for monitoring the decontamination process, e.g. visual assessment, fluorescent markers and microbiological surveillance cultures etc. Using multiple methods is a more effective.

2.6.1. **Visual assessment**- It is the most frequently used method to audit cleaning and decontamination in healthcare facilities, and measures the appearance of an item or surface against a standard checklist

2.6.2. **Fluorescent markers**: Spots of fluorescent material can be applied to a surface in the form of gel, powder or lotion (if available); their removal after cleaning performance can be assessed using ultraviolet light. The percentage of spots removed is used for evaluating cleaning, and can indirectly correlate with decrease in the microbial burden.

2.6.3. **Microbial surface cultures** help to monitor the microbial load after cleaning and decontamination. However, being expensive and labour intensive, this method is only recommended, for outbreak setting

2.6.4. **Record keeping:**

2.6.4.1. Ensure that all decontamination activity is documented in log sheet

- Location
- Equipment used
- Size of the room
- Concentration and volume of H_2O_2 used
- Confirmation of pre-fogging procedures done
- Time started, time finished
- Countersigned by ward staff

2.6.4.2. Monthly reporting/ meeting

- Review previous months decontamination activities
- Agreed schedule for preventive decontamination
- Review the program against the HCAI rates

2.6.4.3. Annual supply of Hydrogen peroxide solution

Ensure that the annual requirement of H_2O_2 is calculated and maintained to continue the decontamination program. (Use excel sheet prepared for this calculations)

References:

1. Jimmy Walker. Decontamination in hospitals and healthcare second Ed.2019. https://www.elsevier.com/books/decontamination-in-hospitals-and-healthcare/walker/978-0-08-102565-9
2. Best practices for Environmental cleaning in healthcare facilities in Resource-limited settings. Version 1 Nov 2019. Center Disease Prevention and Control, National Center for Emerging and Zoonotic Infectious Diseases. https://www.cdc.gov/hai/prevent/resource-limited/environmentalcleaning.html
3. John M Boyce. Modern technologies for improving cleaning and disinfection of environmental surfaces in the hospital. *Antimicrobial resistance and Infection control* (2016) 5:10 https://aricjournal.biomedcentral.com/articles/10.1186/s13756-016-0111-x
4. Guideline for Environmental infection control in healthcare facilities (2003). https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html
5. APSIC Guidelines for environmental cleaning and decontamination https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4696151/

Annex1. Indications for Preventive and Reactive decontamination with HPV

Methods	Indication/ Areas	Frequency
Preventive decontamination Use 6% H_2O_2 solution	All patient care facilities including OTs , high-risk areas (ICUs, HDU,A&E), therapy units	2 times / year
	Construction and renovation projects in clinical areas	Before hand over or after commence
	Ambulance transporting suspected or positive case patients with highly communicable diseases	During epidemic/pandemic or any time as per the risk assessment
Reactive decontamination Use 6% H_2O_2 solution	• All isolation rooms occupied by patients with contact precautions (MDROs), and droplet precautions	**Only** if Patient has occupied the same room for 7 days enhanced decontamination should follow terminal cleaning.
Use 12% H_2O_2 solution	• Airborne isolation precautions, MDR-TB, XDR-TB etc.	After discharge/ transfer of each patient
	• During outbreaks /epidemic or pandemics, Any rooms, areas, wards and bays provided that it can be enclosed and sealed	If the facility has a dedicated ward for confirmed cases, HPV decontamination should be done on periodic basis (not after each patient discharge) -Frequency to be decided according to risk assessment

Annex 2: Selection of PPE for cleaning & decontamination process

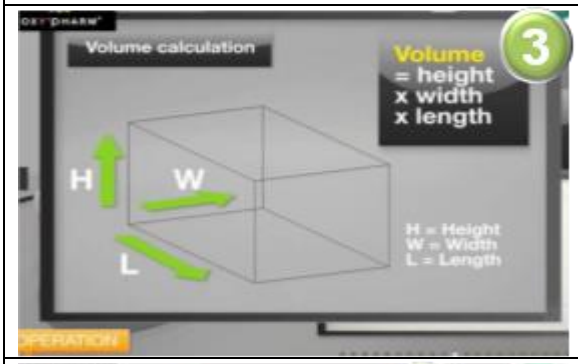
Cleaning activities	PPE requirements	Pictures
Droplet precautions (terminal cleaning & Decontamination)	• Gown and/or plastic apron • Disposable vinyl gloves • Face shield or googles and face mask	
Contact precautions (terminal cleaning & decontamination)	• Gown and/or plastic apron • Disposable vinyl gloves	
Airborne precautions (and terminal cleaning & decontamination)	• Respirator (N95 or FPP2), fit tested • Disposable vinyl gloves	

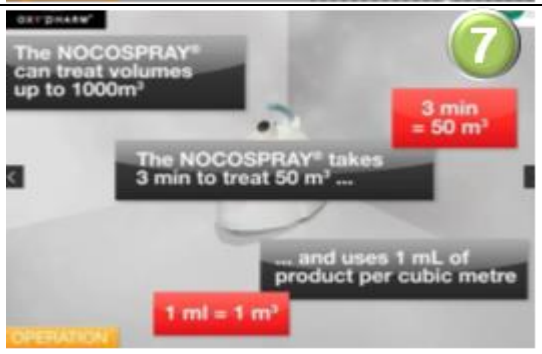
Annex 3: **Procedure of Discharge/Terminal cleaning**

No.	Activities
1.	Prepare the necessary materials
2.	Leave the janitorial carts outside the room
3.	Place the wet floor signage
4.	Perform hand washing
5.	Wear PPE according to transmission based precautions (See Annex 2)
6.	Remove the curtain if it is visibly dirty or if the previous patient was on contact precautions
7.	If the patient on contact isolation precautions-remove and dispose all unwanted disposables- in yellow waste bag.
8.	Clean and disinfect the walls and window sills from top to bottom
9.	Clean and disinfect the horizontal surfaces e.g. light fixtures, lockers, headlights, bed mattress, bed frame bedside table's, counters and furniture's
10.	Push the furniture's outside the room to clean the floor
11.	Perform hand washing & change gloves
12.	Flood the floors with water and detergent and scrub
13.	Clean the corners and edges, if dirt is resistant scrub with detergent
14.	Disinfect the floor. Use color coded mops for mopping (see table 1)
15.	Perform handwashing & change gloves
16.	Collect the general waste bins first and then the healthcare waste
17.	Clean and disinfect outside and inside of the bins with detergent
18.	Perform hand washing & change gloves
19.	Clean the bathroom. Start cleaning from top to bottom. Disinfect the frequently touch items e.g. hand spray, faucets, light switch, toilet bowls
20.	Remove gloves and perform hand washing
21.	Move back the furniture's inside the room
22.	Rinse all the surfaces with clean water and let it dry every after disinfection process
23.	Hang new clean curtains
24.	Perform fogging with H_2O_2 if indicated

Annex: 4 Operation of Fogging machine

Operating Procedure of Hydrogen Peroxide Vapour Technology (Fogging)





Annex 5: Print this and use as label for the patient room door during the fogging

HPV (FOGGING)

DECONTAMINATION IN PROGRESS

NO ENTRY UNTIL AT LEAST:_____