DISSERTATION

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"Establish and test the process of decontamination of used PPE during COVID19 at Sitaram Bhartia Institute of Science and Research, New Delhi"

by

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PG/18/19

Under the guidance of

Dr. Pradeep Panda, Dean Academics IIHMR, Delhi

Post Graduate Diploma in Hospital and Health Management

2018-20

International Institute of Health Management Research
New Delhi

The certificate is awarded to

Ms. Debashreeta Das

In recognition of having successfully completed her
Internship in the department of

Quality and Training

And has successfully completed her Project on

Establish and test the process of decontamination of used PPE during COVID19 at Sitaram Bhartia Institute of Science and Research, New Delhi

03/02/2020 to 15/05/2020

Sitaram Bhartia Institute of Science and Research, New Delhi

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning.

We wish her all the best for future endeavors.

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Head-Human Resources

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The Candidate has successfully carried out the study designated to him during internship training and his/her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his/her future endeavors.

Dr Pradeep K Panda
Dean, Academics and Student Affairs
IIHMR, New Delhi

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The following dissertation titled **"Establish and test the process of decontamination of used PPE during COVID 19"** at Sitaram Bhartia Institute of Science and Research, New Delhi at Sitaram Bhartia Institute of Science and Research is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **Post Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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This is to certify that **Ms. Debashreeta Das,** a graduate student of the **Post- Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled "Establish and test the process for decontamination of used PPE during COVID 19" at Sitaram Bhartia Institute of Science and Research, New Delhi in partial fulfillment of the requirements for the award of the **Post-Graduate Diploma in Health and Hospital Management.**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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This is to certify that the dissertation titled **Establish and test the process of decontamination of used PPE during COVID 19 at Sitaram Bhartia Institute of Science and Research, New Delhi** and submitted by **Debashreeta Das** Enrollment No **PG/18/19** Under the supervision of **Dr. Pradeep Panda, Dean Academics and Student affairs, IIHMR Delhi** for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from **03 Feb 2020 to 15 May 2020** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

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Abstract

In the past few weeks, the worldwide pandemic attributed to COVID-19 has flourished and affected millions of people all over the world. The health care professionals are putting their efforts day and night to not only take care of the patients but also building a safe health care system within hospital premises. Healthcare workers should be provided with adequate PPE so that they can do their job with confidence. Due to sudden increase in the number of COVID suspected and positive patients, the hospitals are facing shortage of PPE supplies. Following the AIIMS guidelines, **Sitaram Bhartia Institute of Science and Research (SBISR)** have decided to establish the process of decontamination of used PPE during this pandemic and set up a decontamination and processing room for disinfection. **This is done for preparedness against the pandemic in case the number of patients gets increased in the hospital and there is shortage of PPE**. The main objective is to establish and test the process of decontamination of used PPE during COVID 19 at Sitaram Bhartia Institute of Science and Research (SBISR), Delhi. The study is designed to establish the area, utilizing limited resources and providing training to designated staff responsible for carrying out the disinfection & processing procedure. It is prospective and qualitative study in which major stakeholders like Anesthesiologist, Consultant Physician, Maintenance Head, Quality representative and Housekeeping & OT staff are involved. A checklist of all the requirements for decontamination of coveralls, N95 respirators, goggles and face shields was prepared and then after discussion with stakeholders, it was decided that the PAC room and Pre-op will be the decontamination and processing room respectively. After understanding of entire process, a defined process flow was created and designated housekeeping and OT technicians (7-Housekeeping and 4- OT technicians) were given training regarding PPE

donning & doffing, equipment handling, dilutions, treatment cycles etc. The knowledge of the designated staff regarding the entire process was assessed through questionnaire **"Disinfecting PPE for Re-use".** It was observed that all the OT technicians had good knowledge about the entire process but there were some lacunae in the training of Housekeeping staff which was resolved by second round of training by stakeholders. A first trial run of the entire process was conducted and the results showed that the coveralls and N95 masks were not decontaminated properly as all the 3 biological indicators came positive and color of the vial also got changed. So, it was decided to re-run more cycles to improve process as per the areas of improvement identified. Therefore, before next cycle, many points like fogger flow rate, location of decontamination room, quantity of chemical used, whether the hydrogen peroxide solution is aerosolized or not, placement of machine and biological indicator and aeration and post-aeration process needs to be considered properly. The major learning from this cycle is involvement of all the stakeholders during the test run is very necessary to make process smoother and easier for all the staff. It also helps to find gaps and improve the system with every trial run.

Introduction

As we all know that in the past few months, the global pandemic attributed to COVID 19 has affected millions of people all over the world causing many deaths. It is not only creating a huge impact on people's lives and communities but also posing a serious threat to global economy and finance. The health care professionals are putting their efforts day and night to not only take care of the patients but also building a safe health care system within hospital premises.

PPE is very important resource and it is necessary that everyone working the health care system has access to right personal protective equipment. The personal protective equipment (PPE) which comprises of mask, glove, goggle, isolation gown, face shield etc. are very important to minimize the risk of exposure from the virus, for all those who are treating COVID positive or suspected patients in various health care settings. Due to sudden increase in the number of COVID suspected and positive patients, the hospitals are facing shortage of PPE supplies. The increasing demand combined with panic purchasing, hoarding and misuse of personal protective equipment (PPE) in the midst of COVID 19 pandemic is disrupting global supplies and putting lives at risk.

Consequences of shortages of PPE-

(a) **Increased Healthcare worker infections-** If there is shortage of PPE for appropriate trained doctors and nurses who are working day and night, then hospitals or health care systems will look for help from retired health care professionals, raising questions on the quality of care.

(b) **Increased patient to patient transmission-** Shortage of PPE can put physicians and nurses, who would normally discard their PPE between each patient visits at increased likelihood of transmitting diseases from one patient to another. For e.g., there have been report that doctors are using N95 mask for many times even though it is intended for one-time use and disposal. The most significant challenge is to ensure that vital PPE supplies are obtained and distribu ted inaffected countries to frontline health workers and other responders, especially those most vulnerable to coronavirus. Many countries have already exhausted or will soon exhaust their PPE stockpile.

Healthcare workers must be equipped with the appropriate personal protective equipment (PPE) that they need to do their jobs with confidence. In times of global shortages, we

have to improvise and adapt existing technologies for new uses. Existing CDC guidelines suggest a combination of methods to conserve PPE in these unprecedented times. These methods include decontamination of PPE for subsequent reuse. Practices are being implemented whereby extended use and/or limited reuse of N95 respirators etc. is allowed. (1)**All India Institute of Medical Sciences (**AIIMS) also has created a protocol for decontaminating PPE for subsequently for extending the use of limited supplies. These guidelines have been adapted according to the local scenario and materials available.

Following the AIIMS guidelines, **Sitaram Bhartia Institute of Science and Research (SBISR)** have decided to establish the process of decontamination of used PPE during this pandemic and set up a decontamination and processing room for disinfection. **This is done for preparedness against the pandemic in case the number of patients gets increased in the hospital and there is shortage of PPE**. The study is designed to establish the area, utilizing limited resources and providing training to designated staff responsible for carrying out the disinfection & processing procedure. Several trial run of the entire process right from collecting the infected PPE, clipping the coveralls or N95 masks to cloth line, placing the biological indicator at different locations in the designated room to validate the decontamination process and packing of decontaminated PPE will be conducted to test whether to implement the process for Reuse of PPE or not by testing the biological indicator that will be used in every decontamination process.

Guidelines for Re-Use of Personal Protective Equipment

All India Institute of Medical Sciences, New Delhi

Protocol For Decontamination of Coveralls and N95 Respirators[6-8]

Segregation: Used coveralls [manufactured by Dupont (Tyvek- white/ Tychem- Grey color) **OR** by Kimberly Clark (A30- white color)] and N95 respirators (all types) should be deposited into separate clearly labelled **RED** bins with **RED double bags**.

Note: Used coveralls should be kept in closed bins/sealed bags in separate locked room until they are collected for reprocessing and decontamination.

Requirements:

- Minimum two designated adjoining rooms (one decontamination room for actual decontamination process & one processing room with clean areas for packing and dispatching decontaminated coverall).
- Hydrogen Peroxide Vapour (HPV) generator + clothes-clips (plastic/wooden)+ clothes-lines/ curtain lines with hooks (for N95)
- 11% commercially available stabilized Hydrogen Peroxide (e.g. Baccishield or Ecoshield in hospital supply)
- Measurement cylinders
- Closed bins/large plastic bags
- Stool/chair for standing while clipping the coveralls
- Permanent markers.
- Sealing machine with plastic pack rolls.
- PPE requirement for the processing staff [gown, N95 masks, nitrile gloves, heavy duty gloves, goggles, face shield, long boots, sterilium). The staff involved in this should be on hydroxychloroquine prophylaxis.
- Logbooks

Working solution: Make doubling dilution of 11% Hydrogen Peroxide according to volume of the room (see table).

Choose cycle/running time depending on the volume of the room as indicated below:.

Room Volume	Hydrogen Peroxide (11%) in ml	RO water in ml	Final volume	Cycle/Running time at 32 ml /min in SATEJ PLUS machine
1000 cu ft	100 ml	100 ml	200 ml	6 min
2000 cu ft	200 ml	200 ml	400 ml	12 min
3000 cu ft	300 ml	300 ml	600 ml	19min
4000 cu ft	400 ml	400 ml	800 ml	25min
5000 cu ft	500 ml	500 ml	1000 ml	31min
6000 cu ft	600 ml	600 ml	1200 ml	37min

Procedure:

Have the clothes line placed at a height of around 7 ft. Keep a gap of 3ft between each line.

- Seal entire room (including AC vents), except the door, using brown tape.
- Clip coveralls to clothes-lines suspended at each shoulder or hand using hangers. Ensure that the zip is open to expose the inner part. Keep a gap of at least 1 foot between each coverall.
- N95 masks can be clipped by the elastic band/ or hung on hooks on the clothes line with a gap of half foot between each mask.
- Ensure that HPV generator is plugged in and in position (45 degree angle), and there are no obstructions between HPV generator and suspended coveralls.
- Exit decontamination room and doff the gloves and gown at threshold. Discard in red bin. Perform hand hygiene.
- Start the HPV generator cycle.
- Let the room be sealed for at least 2 hrs after the cycle finishes.
- This completes the decontamination cycle.
- Open door- you will see fog; check the machine container to confirm that the solution was used. Aerate by switching on ceiling fans for 4 hours.

- After completion of decontamination cycle, collect decontaminated PPE in a clean container. The staff should don fresh PPE again.
- The collected PPE should then be moved to the adjacent room.
- The coveralls should be folded properly and packed in plastic bags
- The N95 masks should be placed in a separate box and sealed—NEED to work this out as there are different types.
-

Note: Biological indicator containing *Geobacillus stearothermophilus* spores may be used weekly, in separate locations inside the room, for quality control purpose.

Protocol for Re-use of Face shields and Goggles:

Segregation: Used face shields/goggles should each be deposited into separate clearly labelled **RED** bins/bags.

Equipment and materials required: 0.5% sodium hypochlorite- freshly prepared (see annexure); 70% alcohol (Bacillol solution), red buckets , flat surface for drying, clean pads/wipes.

Procedure[12]:

- Immerse face shields and goggles in buckets of freshly prepared (not more than 4 hrs old) 0.5 % sodium hypochlorite solution for 10 minutes.
- Take out the face shields/goggles from the bin.
- Dry on a flat surface.
- Only after the surface is completely dry, wipe all surfaces with 70% alcohol using a clean pad/wipes.
- Face shields/goggles can be used once dry.
- Place these in a new clean container.

- **PPE for re-processing staff** (gown, N95 masks, nitrile gloves, heavy duty long gloves, goggles, face shield, long boots, alcohol based hand rub). The staff involved in this should be on hydroxychloroquine prophylaxis.
- Log book

Annexure:

SOP to make 0.5% hypochlorite

I. **Procedure when 10% Sod. Hypochlorite solution is in hospital supply:**
   a. One part (1) of sodium hypochlorite solution in nineteen (19) parts of water.

II. **Procedure when 4% Sod. Hypochlorite solution is in hospital supply:**
   a. One part (1) of sodium hypochlorite solution in seven (7) parts of water.

Change solution after every four hours. Emptying of bin containing sodium hypochlorite to be done in the sluice room. ICNs in each area should help to standardise the protocol.

Research questions-

1) The time length in which the hydrogen peroxide solution used in the fogging machine will be used during one cycle period?
2) What will be the duration of treatment cycle and how many cycles can be done in 24 hours?
3) Are the coveralls and N95 masks are decontaminated properly?
4) Does the staff are properly trained regarding the disinfection and processing of PPE?

Objectives

General objective- Establish and test the process of decontamination of used PPE during COVID 19 at Sitaram Bhartia Institute of Science and Research (SBISR), Delhi.

Specific objectives

a) To plan and decide the designated room for decontamination and processing for Re use of PPE (coveralls, N95, face shields and goggles).

b) To train the designated staff (Housekeeping or OT) regarding PPE donning & doffing, equipment handling, dilutions, treatment cycles etc. because they will be responsible for disinfecting and processing PPE according to the guidelines.

c) To prepare a process flow of the entire process right from collecting the infected PPE from isolation room to processing the clean PPE and dispatching the decontaminated coverall.

d) To conduct a trial run of the fogging machine to check vaporisation time and also test run of the entire procedure of decontamination and processing of PPE by designated staff.

e) To assess the knowledge of the designated staff regarding the Re- use of PPE after the training through questionnaire.

f) To provide recommendations for PPE conservation during COVID 19.

Literature review

Can N95 Respirators Be Reused after Disinfection? How Many Times?

Lei Liao concludes that the coronavirus disease (COVID-19) pandemic has led to a major shortage of N95 respirators, which are very crucial for the protection of healthcare professionals and the general public. In these urgent times, it is important to determine how the respirators or other personal protective equipment (PPE) can be reused. Therefore, multiple commonly used disinfection schemes on media with particle efficiency of 95% were investigated. According to this study, heating was found to inactivate the virus in solution within 5 minutes at 70° C. The study also found that heat (≤85 °C) under various humidity's (≤100% relative humidity, RH) was the most promising, nondestructive method for the preservation of filtration properties in melt blown fabrics as well as N95-grade respirators. During the test run/experiment, 50 cycles of heat treatment without any significant changes in the filtration efficiency was performed at 85° C, 30% RH. Other results that are discussed in the paper are that under low humidity or dry conditions, temperatures up to 100 °C were not found to alter the filtration efficiency significantly within 20 cycles of treatment. The paper also states Ultraviolet (UV) irradiation as a secondary choice, but UV can potentially impact the material strength and subsequent sealing of

respirators. Finally, treatments that involve liquids and vapors require caution as they may lead to degradation of filtration efficiency.(2)

COVID-19 pandemic: the 3R's (reduce, refine, and replace) of personal protective equipment (PPE) sustainability

This research states that during this global shortage of personal protective equipment (PPE) drastic measures need to be taken to preserve it. In this paper the researcher proved that 3R-mantra is not only applicable in "green anesthesia" practice, but also is well suited for PPE preservation.

Reduce. The paper states that the first step is to eliminate all unnecessary use of PPE. Then comes refine,

Refine. Decontamination and reclamation of used PPE have been widely disseminated. This presents a unique opportunity to preserve the limited supplies of PPE while reducing the environmental burden from their eventual disposal.

Replace. For the replacement of PPE, the paper states that, during this time of uncertainty. HCPs need to be extra cautious in protecting themselves. Despite PPE being a scarce resource, we should not compromise the safety for HCP by limiting use.

To conclude, there is a need to develop and implement ways to embrace sustainable solutions both for the current pandemic and for the future. Innovative ideas such as a 3R approach may be one such resource-conscious solution. (3)

Use of personal protective equipment among health care personnel: Results of clinical observations and simulations

This paper concludes that substantial contamination rates measured after the doffing process regardless of differences in PPE sets and styles. According to the researchers, this study is the first to examine HCP PPE donning and doffing practices through a comprehensive approach using videotaped observations, fluorescent powder on full body simulation mannequins, both simple and full-body PPE sets, combinations of different PPE styles, and a realistic simulation center environment.

This study emphasizes the need for refining PPE protocols based on further scientific evidence, reinforcing PPE training using innovative methods, improving and standardizing PPE equipment for targeting HCP optimal use. Further research with multidisciplinary collaborations is crucial to resolve each piece of the complex PPE problem to reduce the potential for contamination and exposure to infectious diseases and hence ensure HCP safety.(4)

Disinfection of personal protective equipment for management of Ebola patients

Potential advantage of reusing the elastomeric face covers the sidestep danger of N95 respirator scarcity during a respiratory sickness pandemic and also points out the importance of proper disinfection in order to reuse the facial defensive gears. It is important to note that mindfulness on PPE stock must be remembered for any pandemic readiness plan.

Certain set of SOP's must be developed and followed in order to disinfect the reused protective gears which are routinely used by the health care workers followed documented

protocols for the management of patients with EBV cases at National institute of infectious disease situated in Rome, Italy. A voluntary team of medical attendants were made to go through the training in order to become polished with the documented procedures and donning docking off the protective gears. There were three options for the protective gears which were chosen at the time of EBV outbreak which included:

- Goggle based option: This further included goggles, splash-proof FFP3-N95 respirator, disposable hood [covering exposed skin areas] combined with surgical type IIR face mask, double or triple layer of gloves, rubber boots, full body head-to-foot leak proof biohazard suit and plastic apron
- Face mask-based option: This option covered an elastomeric face mask with non-reusable filters instead of N-95 respirator
- Powered air purifying respirator (PAPR) based option: composed of hood, motor unit, waist belt, and breathing tube to be put on the suit instead of goggle disposable hood.

The use of PAPR was prescribed for any aerosol generating procedures and especially for the medical attendants providing the services in ICU. All the other components of protective gears were non-reusable except the goggles, PAPR components and the face gears. According to the WHO guidelines, 0.5% chlorine suspension was routinely used for the disinfection. In a specified removal area, the HCWs were sprayed with 0.5% chlorine disinfectant before leaving the isolation area. The other reusable protective gears were also routinely wiped with 0.5% chlorine disinfectant. These protective gears such as goggles, face masks and PAPR hoods along with the waist belt were routinely decontaminated by immersing these gears in a solution of 0.5% chlorine for as long as 30 minutes and were

carefully washed with water to remove any chemical residue so that they could be used again. No case of contamination among the health care workers was notified while following up the documented protocols of disinfection SCOPs. However, certain points must be taken into consideration such as requirement of a removal area which must be specified only for the drying of the protective gear components; the removal of each components of PPE is very time consuming and the health care workers must be given adequate knowledge and training of the specified protocols. Care must be taken while spraying the chlorine disinfectant in order to prevent solution from entering the air outlets. (5)

Novel Process for N95 Respirator Disinfection with Vaporized Hydrogen Peroxide in the setting of the COVID-19 Pandemic at a Large Academic Medical Center

Personal protective equipment has been an important yet restricted asset when it comes to ensure the health of medical attendants against the spread and contamination during the COVID-19 pandemic. With the growing numbers of COVID-19 cases in the US, N95 respirator flexibly chains are seriously stressed and protection techniques are required. Therefore, CDC has urged prevention methodologies to help drag out the current supplies of N-95 masks. Also, FDA is conceding Emergency Use Authorizations to widen the utilization of sanitization innovations to decontaminate N95 respirators and moderate the effect of these shortages.

The two disinfection procedures that have shown promising results in decontamination of high viral load with negligible or no effect on the N95 filters are

Ultraviolet germicidal irradiation (UVGI) and vaporized hydrogen peroxide (VHP). However, the only method approved by FDA is VHP. A multidisciplinary group at the Washington University School of Medicine, Barnes Jewish Emergency clinic, and BJC Healthcare was shaped to actualize a program to sterilize N95 respirators via VHP technique. A roadmap of the process involves collection of the N-95 respirators from selected hospitals, disinfection of respirators followed by handling and dropping of the respirators at the designated hospitals to the health care worker.

A soiled utility area must be maintained in every designated unit of the hospital where the health care worker can dispose the N-95 respirators while following the appropriate health sanitation of hands before and after the doffing. Respirator is packed in a Tyvek pouch and sealed using adhesive strips. The pouch is labeled with all the information related to the health care worker such as name, department and hospital name and location. The pouch is then disposed in a soiled collection bin which is maintained in each and every soiled utility area. The soiled utility bins are then collected from every soiled utility area within every 12 hours by a VHP associate who also ensures the correct labelling and sealing of the pouch. The soiled utility bins are regularly disinfected to avoid any contamination of the virus.

VHP SETUP: The setup area which have been designated for the disinfection has 4 section areas: the VHP room, common workspace, aeration room and soiled utility area. Some key points which must be kept in mind while selecting the setup facility are large area to accommodate all the four section, facility for hands and eye washing, non-porous sealed

ceiling, sealed ventilation system to avoid leakage of VHP. Evenly spaced wire racks are maintained in VHP room along with facility of a bioquell Z-2 (Bioquell, Horsham, Pennsylvania), two Bioquell aeration units, and a fan in the center. The soiled utility bins must be placed in the soiled utility room, from where they are retrieved to be placed on the staggered wire racks in VHP room.

Disinfection procedure takes place in VHP room where the gassing of H2O2 is done in which the disinfection cycle lasts for about 4.5 hours by a trained VHP worker. A biological indicator, *GeoBacillus stearothermophilus* is also incorporated in the sealed pouches and VHP room in order to validate the complete disinfection process. The disinfection process is followed by the aeration which takes place in off gassing or the aeration room. The sealed pouches are checked for the levels of H202 via a small cut using an another H202 indicator sensor. Once the concentration of H2O2 reaches 0 ppm, the pouches are sealed back and get ready for the drop off.

The pouches are dropped off at the facility in the same soiled utility bin which is routinely disinfected and aerated to avoid any decontamination. The pouches containing the disinfected N95 respirators are packed in newly labeled soiled utility bins in an alphabetical order for easy pick up facility at the designated hospital unit.

Undoubtedly, a reproducible and adaptable procedure for executing N95 respirator decontamination inside a huge medical unit is attainable only through multidisciplinary coordinated and fast adjustments in such situation of COVID-19 pandemic.(6)

Methodology

A prospective cohort and qualitative study were undertaken to establish and test the process of decontamination of used PPE in Sitaram Bhartia Institute of Science and Research, Delhi. The hospital provides care in a wide range of medical specialties and offers superior diagnostic and inpatient facilities. The facility offers 70 beds, Operation theatres, ICU, NICU and other essential services. It provides care in wide range of medical specialties and offers superior diagnostic and inpatient facilities. The study was conducted for 2 months from 1st March to 30 April 2020. Major stakeholders like Anesthesiologist, Consultant Physician, Maintenance Head, Quality representative and Housekeeping & OT staff were involved in the study.

As we all know that COVID19 pandemic has exhaust our resources tremendously in healthcare setting. One of the important issues is the depletion of personal protective equipment for the healthcare workers. So, the AIIMS has released guidelines on decontamination of personal protective equipment while emphasizing that disinfection methods should only be regarded as last resort methods in the event of these PPE kits being in extreme shortage.

As the situation demand, Sitaram Bhartia Institute of Science and Research decide to test this process of decontamination of used PPE using the AIIMS guidelines because it is hard to forecast the demand and supply of PPE in the event that there is surge of patients coming to the hospital.

Techniques and tools-

The study was carried out in the following way in order to establish the process for decontamination of used PPE according to the AIIMS guidelines:

1. After a meeting with all the stakeholders regarding the guidelines, a checklist of all the requirements for decontamination of coveralls, N95 respirators, goggles and face shields was prepared. On the basis of checklist, following data was collected-

- Instead of 11% hydrogen peroxide, they suggested that we can use 10% and dilute in less quantity of RO water (90 ml water instead of 100 ml)

- 4 areas were proposed for making the decontamination and processing room-

a) OT pharmacy can be utilized by creating temporary
b) PAC room and Pre-op room can be used as minimum structure changes are required
c) 1st Floor Washroom (Female & Male) by sealing the drainage and other structural changes
d) Any two ward rooms can be converted

TABLE NO-1: Checklist of all the requirements for decontamination of coveralls, N95 respirators, goggles and face shields

Guidelines for Decontamination of Personal Protective Equipment for COVID 19				
Name of the hospital: Sitaram Bhartia Institute of Science and Research				
Reference: All India Institute of Medical Sciences, New Delhi				
S. No	**Protocols/ Requirements**	**Status**	**Responsibility**	**Remarks**
Requirements for Decontamination of Coveralls and N95 Respirators				
1	Minimum two designated adjoining rooms (one decontamination room for actual decontamination process & one processing room with clean areas for packing and dispatching decontaminated coverall).	After discussion with Dr. Ashok Vats, Mr. Sharma has suggested room for decontamination, packing & dispatching process. The following choices has been given: 1. OT pharmacy can be utilized by creating temporary 2. PAC room and Pre-OP room can be used as minimum structure changes are required 3. 1st Floor Washroom (Female & Male) by sealing the drainage and other structural changes 4. Any two ward rooms can be converted	Mr. Ashok Sharma	
2	Hydrogen Peroxide Vapor (HPV) generator + clothes-clips (plastic/wooden) + clothes-lines/ curtain lines with hooks **(for N95)**	1. Hydrogen Peroxide Vapor (HPV) generator- Vapor generator already available and currently we are using for room sanitation with Hydrochloride 2. Clothes-Clips, Clothes-lines/curtain line with hook - Can be procured	Mr. Ashok Sharma	
3	11% commercially available stabilized Hydrogen Peroxide (e.g. Baccishield or Eco shield in hospital supply)	We are using silivicide (10% Hydrogen peroxide)	Mr. Praveen	Mr. Sharma discussed with Dr. Nagpal & Dr. Mayank regarding the use of 10% hydrogen peroxide instead of 11%, they suggested that we can use 10% and dilute in less quantity of RO water (90 ml water instead of 100 ml)
4	Measurement cylinders	Already with Housekeeping department	Mr. Praveen	
5	Closed bins/large plastic bags	Already with Housekeeping department	Mr. Praveen	

6	Stool/chair for standing while clipping the coveralls	Already with Housekeeping department	Mr. Praveen	
7	Permanent markers.	Already with Material department	Ms. Lata	
8	Sealing machine with plastic pack rolls.	Already with CSSD Department	Dr. Reeta Chawla	
9	PPE requirement for the processing staff [gown, N95 masks, nitrile gloves, heavy duty gloves, goggles, face shield, long boots, sterilium). The staff involved in this should be on hydroxychloroquine prophylaxis.	Explained to Mr. Praveen and he will provide the same.	Mr. Praveen	
10	Logbooks	Already in place	Dr. Reeta Chawla/OT staff	
Procedure for Decontamination of Coveralls and N95 Respirators				
1	Used coveralls and N95 respirators (all types) should be deposited into separate clearly labelled RED bins with RED double bags.	Need to discuss with Dr Kartikeya Kohli and Dr. Reeta Chawla as we are using yellow bags/bins for disposing PPE	User (Doctors, Nursing and other staff)	As per BMW guidelines, we are using yellow bag for disposing PPE.
2	Used coveralls should be kept in closed bins/sealed bags in separate locked room until they are collected for reprocessing and decontamination.	Once the rooms are identified training will be given accordingly	Mr. Praveen	
3	The clothes line should be placed at a height of around 7 ft. Keep a gap of 3ft between each line.	One-time task	Mr. Ashok Sharma	
4	Seal entire room (including AC vents), except the door, using brown tape.	One-time task	Mr. Ashok Sharma	

5	Clip coveralls to clothes-lines suspended at each shoulder or hand using hangers. (Ensure that the zip is open to expose the inner part. Keep a gap of at least 1 foot between each coverall.)	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
6	N95 masks can be clipped by the elastic band/ or hung on hooks on the clothes line with a gap of half foot between each mask.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
7	Ensure that HPV generator is plugged in and in position (45-degree angle), and there are no obstructions between HPV generator and suspended coveralls.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
8	Exit decontamination room and doff the gloves and gown at threshold. Discard in red bin.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	As per BMW guideline, we are using yellow bag for disposing PPE.
9	Let the room be sealed for at least 2 hrs.' after the cycle finishes.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
10	Decontaminated PPE should be collected in a clean container. The staff should don fresh PPE again and transport the PPE to the processing room.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
11	The Decontaminated coveralls should be packed in plastic bags and cleaned N95 masks should be placed in a separate box and sealed.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	

12	Biological indicator containing ***Geobacillus stearothermophilus*** spores may be used weekly, in separate locations inside the room, for quality control purpose.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
13	Logbooks	Will be prepared	CSSD staff	
Protocol for Re-use of Face shields and Goggles				
1	0.5% sodium hypochlorite- freshly prepared	Already in place	Mr. Praveen	
2	70% alcohol (Bacillol solution)	Already in place	Mr. Praveen	
3	Red buckets	Already in place	Mr. Praveen	
4	Flat surface for drying Clean pads/wipes.		Mr. Praveen	
Procedure for Re-use of Face shields and Goggles				
1	Used face shields/goggles should each be deposited into separate clearly labelled RED bins/bags.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
2	PPE requirement for processing staff (gown, N95 masks, heavy duty gloves, goggles, face shield)	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
3	Face shields and goggles should be immersed in buckets of freshly prepared (not more than 4 hrs. old) 0.5 % sodium hypochlorite solution for 10 minutes.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	
4	After washing dry on a flat surface. Only after the surface is completely dry, wipe all surfaces with 70% alcohol using a clean pad/wipes.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	

5	Change hypochlorite solution after every four hours. Emptying of bin containing sodium hypochlorite to be done in the sluice room.	Training will be given to CSSD technicians and HK staff	Mr. Praveen/ Dr. Reeta Chawla	

2) Plan and decide the designated room for decontamination and processing for Re use of PPE (coveralls, N95, face shields and goggles).

TABLE NO 2: Proposal for decontamination process and packing /dispatching process room for re-use of PPE

Proposal for decontamination process and packing /dispatching process room for re-use of PPE			
Proposed Room	**Structural Changes**	**Requirements for structural changes**	**Limitations/ Remarks**
OT Pharmacy	1. **Room size: -**12'9"x8'x11' = approx.1122 cubic foot 2. Only wooden partition is required	1. 8 Ply boards are required - 3/4"- 8' x 4' 2. Plastic for Paris (POP) - 2 bags and batta - 300 rft	1. Need to find out other location for OT pharmacy 2. Maximum partition is with glass and Alkarma- sealing joints may leak
PAC & Pre-op	1. **PAC room Size: -** 13.5'x8'2"x11'= Approx. 1225 cubic foot + attached washroom size 8'x 4'9"x11'= Approx. 430 cubic foot - **Can be used for decontamination process, No Structural changes are required.** 2. **Pre-Op room Size: - 12'x10'x11'=** Approx. 1320 cubic foot+ attached washroom size 7'x5'11= Approx. 385 cubic foot, **no structural changes are required.**	Sealing tape is required for sealing door in PAC room	1.Pre- op room will be managed by as per Dr. Reeta 2. Anesthetist can be provided another room (rest room) preferably OT surgeon lounge. 3. If required then **PAC washroom** can be combined with the room with minimal changes.

1st Floor Washroom	1. **Male washroom size**- 11'x11'x10'= 1210 cubic foot 2. **Female washroom size**- 11'x7'x10'= 770 cubic foot 3. Wood partition is required between two toilets. 4. Need to remove the washroom fitting, WC doors and block the drains.	80 mm plywood, batta 100 rft , Plastic of Paris for sealing joints and other material for fixing	Zig-zag shape of toilets may not allow vapors to distribute equally in the whole process
Male Doctors Duty room	1.**Room size-** 1500 cubic foot approx. 2. No major structural changes are required but room can be used for only one purpose. Also need to block Audi AHU.	No major structural changes are required	1.Zig-zag shape of room may not allow vapors to distribute equally in the whole process. 2. Single entry of this room 3. Required another adjacent room

- After studying the layout & feasibility of the above decided areas and discussing with all the stakeholders, it was decided that PAC room will be decontamination room and Pre-op will be processing room as both the rooms require no structural changes. For now, Anesthetist will be provided with another room preferably OT surgeon lounge.

3) After designating the room for decontamination and processing procedure, a defined process flow for the entire process right from collecting the infected PPE from isolation room to clipping the coveralls and N95 masks to processing the clean PPE and dispatching the decontaminated coverall was prepared. The process flow was created according to the AIIMS guidelines.

Process for Re-use and decontamination of PPE during COVID 19(Coveralls,N95 masks, goggles and face-shields)

NOTE-
1)Seal entire room (including AC vents), except the door, using brown tape.
2) The clothes line should be placed at a height of around 7 ft. Keep a gap of 3ft between each line.
3) Keep a gap of at least 1 foot between each coverall and a gap of half foot between each mask.
4) Biological indicator containing *Geobacillus stearothermophilus* spores should be used once in a week in separate locations inside the room(PAC) for quality purpose.
5) Working solution for fogging machine(1225 cubic foot)- 130ml Hydrogen peroxide and 120ml water.
6) The staff will have to don fresh PPE for next cycle of decontamination.

The housekeeping staff will collect the infected PPE in double yellow bags from isolation / ICU and keep it in PAC(decontamination room) at designated area.

HK/OT staff — The designated staff don the fresh PPE level 3 in pre-op(processing room) and come to PAC room for decontamination procedure. — PPE level 3

HK/OT staff — The staff will open yellow bags and clip coveralls to clothes- line suspended at each shoulder or hand using hangers. N95 masks should be hung on hooks on clothes lines. — Hangers, plastic clamps, clothes-line

HK/OT staff — The staff will ensure that fogging machine is in right position (45 degree angle) and there are no obstructions between the machine and coveralls)

HK/OT staff — The staff will doff their infected PPE(except masks and inner gloves) and pack in double yellow bags in designated corner in PAC room. Perform hand hygiene. — Double Yellow bags, Hand sanitizer

HK/OT staff — The staff will exit the decontamination room and doff the mask, gloves and goggles in yellow bin and switch on the fogging machine. Perform hand hygiene. — Yellow bin, Hand sanitizer

HK/OT staff — After the cycle finishes(i.e., after 2 hours), the staff will open the door and check the machine to confirm that the solution was used.

HK/OT staff — The staff will switch on the ceiling fan for 4 hours for aerating the room.

HK/OT staff — After completion of decontamination cycle, the staff will don the clean PPE in pre-op and collect decontaminated PPE in clean container from PAC room. — PPE level 3

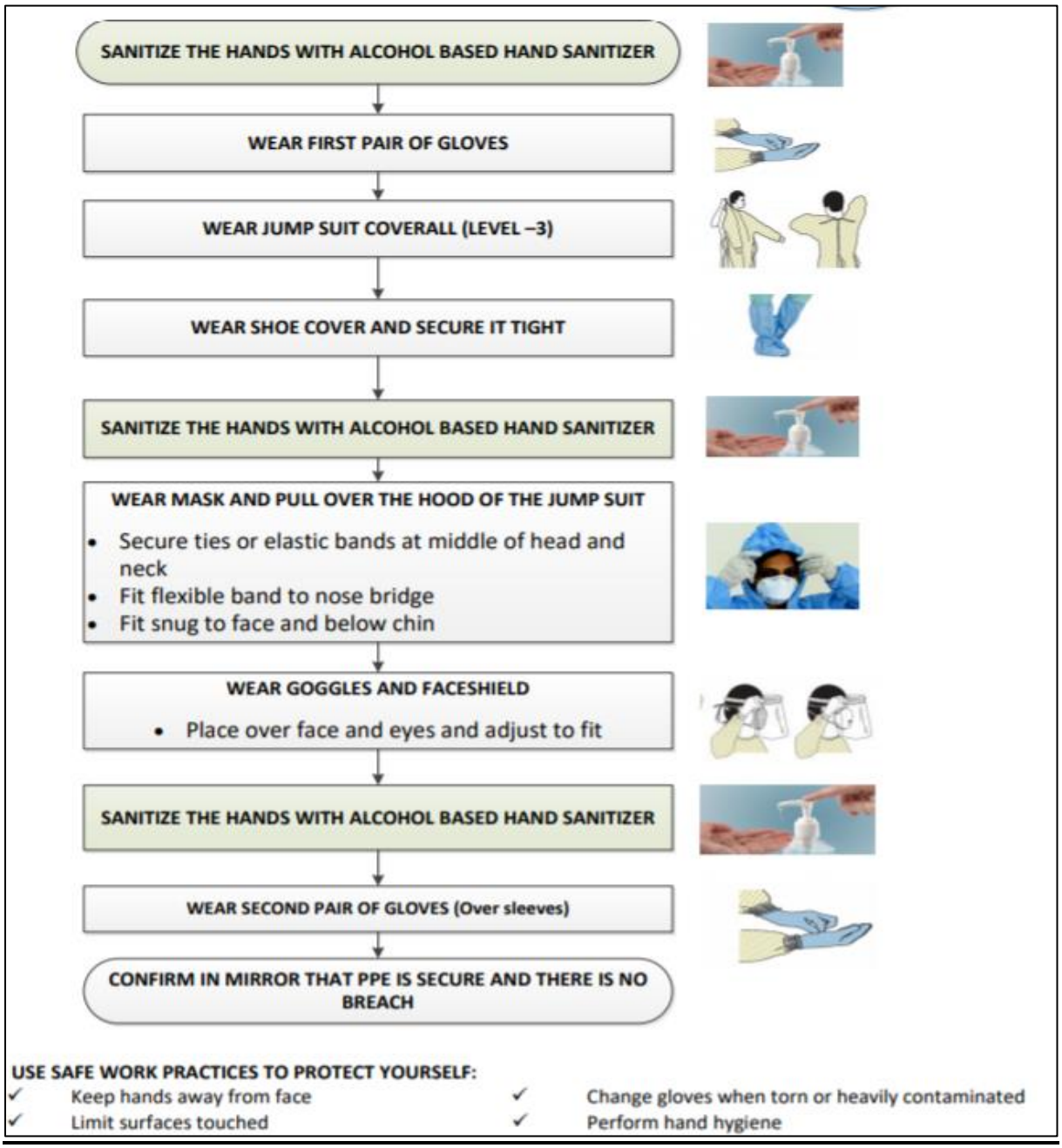
HK/OT staff — The staff will fold the coveralls and pack in plastic rolls using the sealing machine in Pre-op (processing room) . — Sealing machine with plastic rolls

HK/OT staff — The staff will place the N95 masks in separate box and sealed it properly.

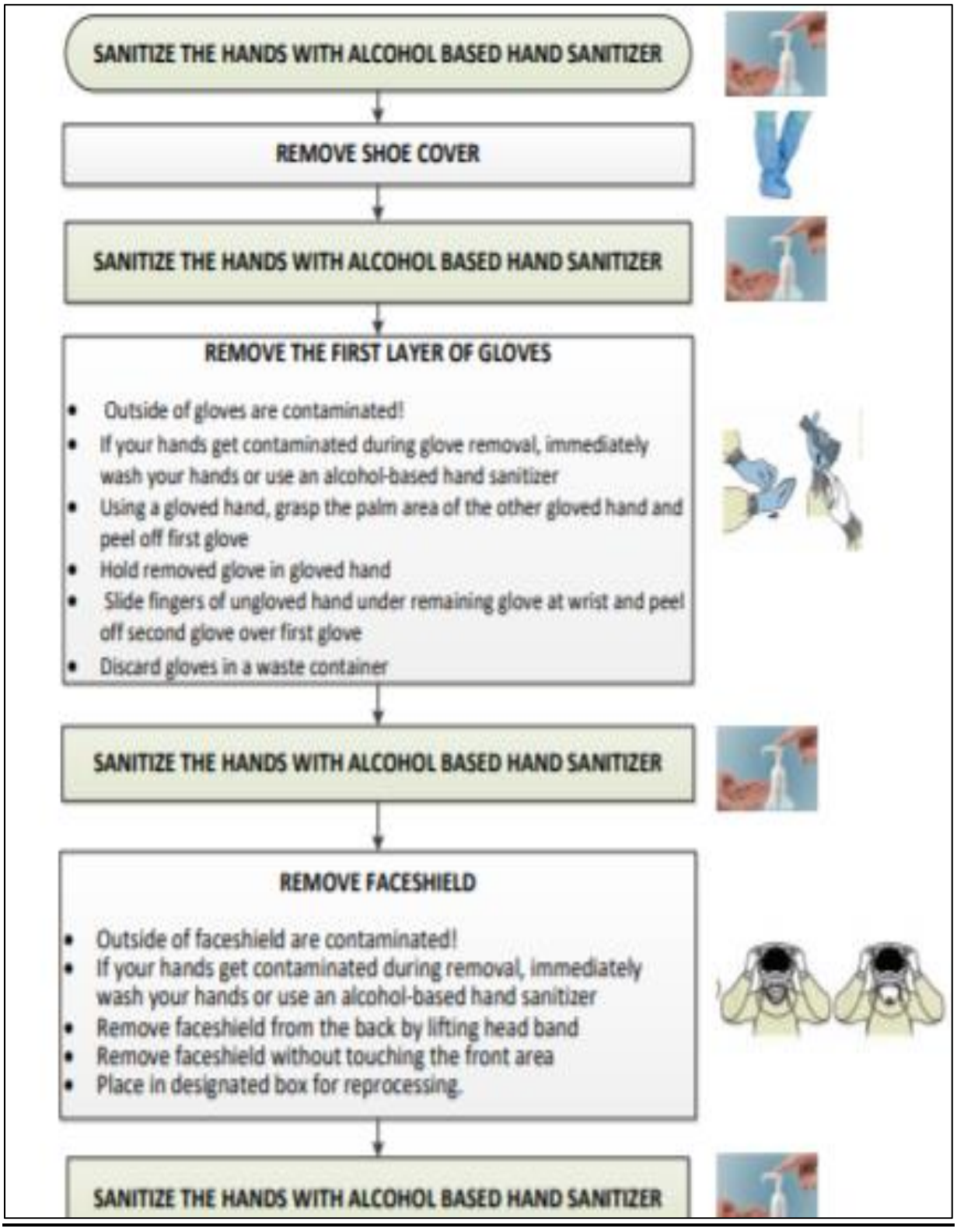
After packing, the staff will perform hand hygiene and housekeeping staff will dispatch the clean PPE to respective department. — Hand sanitizer

4) After setting the process flow, the designated housekeeping and OT technicians (7-Housekeeping and 4- OT technicians) were given training regarding PPE donning & doffing, equipment handling, dilutions, treatment cycles etc. because they will be responsible for disinfecting and processing PPE according to the guidelines.

Steps of PPE level 3 Donning-



Steps of PPE level 3 Doffing-



REMOVE JUMP SUIT (LEVEL 3)

SANITIZE THE HANDS WITH ALCOHOL BASED HAND SANITIZER

REMOVE GOGGLES

- Outside of goggles are contaminated!
- If your hands get contaminated during removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles without touching the front area
- Place in designated box for reprocessing.

SANITIZE THE HANDS WITH ALCOHOL BASED HAND SANITIZER

REMOVE THE 2ND PAIR OF GLOVES

SANITIZE THE HANDS WITH ALCOHOL BASED HAND SANITIZER

REMOVE THE MASK

- Front of mask is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask removal, immediately wash your hands/ use alcohol-based hand sanitizer.
- Grasp bottom ties or elastics of the mask, then the ones a the top, and remove without touching the front
- Discard in a waste container

Before providing the training to the staff, a small dry run of hydrogen peroxide machine in the open was conducted to test the efficacy of formation of H2O2 vapor and time taken to for the formation of the same. It was also observed that in how much time, the hydrogen peroxide solution is getting consumed completely.

Fig 1- **Staff putting the hydrogen peroxide solution in the fogging machine before the test run.**

Fig 2- **Testing of fogging machine**

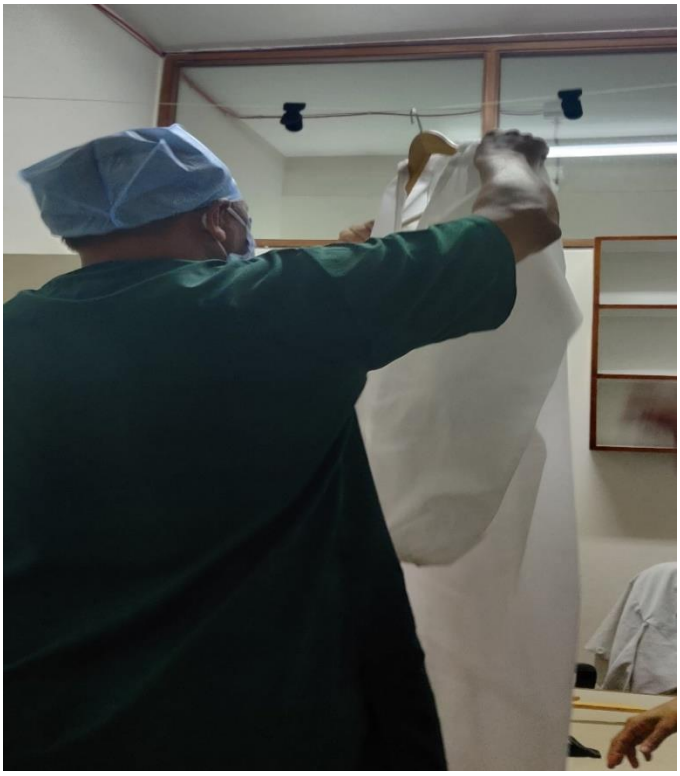
It was observed that the fogging machine (250 ml solution) took 20 minutes completely to create vapors and get consumed completely.

A small training of 2 staff was conducted and explain them about the steps of decontamination process, how to clip coveralls and N95 masks, where to Don and Doff the PPE, how to make dilutions and treatment cycles. They were told about the importance of disinfection procedure and what precautionary measures need to be taken during the process. The training was given by Anaesthesiologists, Consultant physician and Maintenance head.

Fig 3. **The PAC room where the decontamination process will be done (Hanging PPE on cloth line)**

Fig 4- **The stakeholders giving training to the staff regarding the process of decontamination**

Fig 5- **The staff clipping the coverall to cloth line during the training**



6) After the training of all the staff is done, questionnaire was prepared on **"Disinfecting PPE for Re-use"** to assess their knowledge regarding the decontamination and processing procedure. Questionnaire was prepared according to the AIIMS guidelines.

(Annexure attached)

Observations-

a) All the OT technicians had good knowledge regarding the entire process including the concentration of fogging solution, treatment cycles, placement of Biological indicator and the method of clipping the coveralls and N95 respirators. They were properly trained.

b) There were some lacunae in training of some of the housekeeping staff (OT & ICU). They didn't remember the steps of Donning and Doffing of PPE level 3 and in what ratio the hydrogen peroxide and RO water should be mixed to prepare fogging solution.

c) After discussing with the stakeholders, they conducted a second round of training for all the housekeeping staff to clear all their doubts and queries regarding the decontamination process.

d) Second round of training helped the staff to understand completely the process and they were not hesitant when asked questions about the **Disinfecting PPE for reuse.**

7) After training of all the staff, stakeholders decided to conduct **a PDSA** of test run of entire process and also to test the biological indicator which will be placed at different locations in the PAC room to validate the decontamination procedure.

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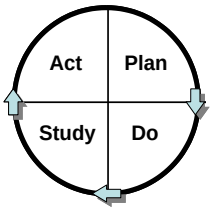
Learning and Improvement Cycle – PDSA Form

Team: Dr Reeta Chawla
Dr. Ashok Vats
Dr. Kartikeya Kohli
Dr. Vrushali
Mr. Ashok Sharma (Maintenance Head)
Mr. Bhupinder (HK supervisor)
Mr. Digamber (OT technician)
Ms. Sandhya Sachdev
Ms. Debashreeta das

Date- 13th May'20



Name of test: To test the new process for decontamination of used PPE according to the AIIMS guidelines.

Cycle #: Cycle 1

The objective of this cycle is to: ❑ Collect Data ❑ Develop a change
√ Test a change ❑ Implement a change

PLAN

What is the objective for this cycle?

To test the new process for decontamination of used PPE according to the AIIMS guidelines.
(Note: Housekeeping staff will be provided with green linen during the trial run instead of PPE level 3 to avoid the wastage of PPE)

What questions do you want to answer with this PDSA cycle?

1. Will the coveralls and N95 masks be decontaminated properly? If no, what will be the reasons?
2. Will the housekeeping staff face any issues while clipping the coveralls or N95 masks to cloth line?
3. Was the fogging machine kept at suitable height and was fully effective in creating the hydrogen peroxide vapors to decontaminate PPE during the process?
4. Will the biological indicator used in the process be able to validate the decontamination process?
5. Will there be any mechanical problem while running machine during the test run?

Predictions (for questions above based on plan):

1. It might happen that coveralls and N95 mask are not decontaminated properly.
2. The housekeeping staff can face issues clipping the coveralls or N95 masks to cloth line.

3. It might happen that the hydrogen peroxide vapors are not able to reach to height of coveralls and N95 mask and disinfect them properly.
4. It might happen that biological indicators were placed at wrong positions in the decontamination room and due to which the vapors were not able to enter into the vial.
5. Yes, we may face mechanical problems while running machine during the test run

List of tasks required to set-up this test: Who, What, When, Where?

What – tasks	Who	When	Where
1. Meeting with all the stakeholders to discuss the guidelines and prepare a checklist of all the requirements for decontamination of PPE.	Dr. Reeta Chawla, Dr. Ashok Vats, Mr. Ashok Sharma, Dr. Kartikeya Kohli , Mr. Digamber, Ms. Sandhya,, Ms. Debashreeta das	13th April 2020	OT lounge
2. Proposal for deciding the room for decontamination and processing procedure.	Dr Reeta Chawla, Dr Ashok Vats Mr Ashok Sharma, Dr Kartikeya Kohli, Mr Digamber, Ms Sandhya, Ms. Debashreeta das	15th April 2020	OT lounge
3. Deciding on the procurement of the supplies required for disinfection process.	Dr Reeta Chawla, Dr Ashok Vats Mr Ashok Sharma, Dr Kartikeya Kohli, Ms. Lata, Mr Digamber, Ms Sandhya, Ms. Debashreeta das	15th April 2020	OT lounge
4. Training of Housekeeping staff and OT technicians.	Dr Reeta Chawla, Dr Ashok Vats Mr. Ashok Sharma, Mr. Praveen	22nd April- 10th May 2020	OT lounge
5. Dry run of the fogging machine to observe in how much time the hydrogen peroxide solution is getting consumed.	Dr. Reeta Chawla, Dr. Ashok Vats Mr. Ashok Sharma, Mr. Praveen Ms Sandhya, Ms. Debashreeta das	18th April 2020 & 11th May'20	Terrace
6. Demo training of few staff explain them about the steps of decontamination process including Donning and Doffing of PPE	Dr Reeta Chawla, Dr Ashok Vats Mr Ashok Sharma, Dr Kartikeya Kohli, Mr. Digamber, Ms Sandhya, Ms. Debashreeta das	22nd April 2020	PAC room
7. Explaining the housekeeping supervisor and staff to clear the PAC room a day before the test run.	Dr Reeta Chawla, Dr Ashok Vats Mr Ashok Sharma, Dr Kartikeya Kohli, Mr Digamber, Ms Sandhya Ms. Debashreeta das	12th May 2020	OT lounge

Plan to collect data to answer your questions: Who, What, When, Where?

What Data?	Who Collect?	When collect?	Where collect?	How collect?
1. Observations of the test period.	Ms Sandhya Ms. Debashreeta	13.05.20	PAC room	NA
2. Feedback from Stakeholders and Housekeeping staff.	Ms Sandhya Ms. Debashreeta	13.05.20	PAC room	NA

DO

What did you observe when the test was carried out?

1. The test run was carried on 13.05.20. At 10 AM, the housekeeping staff started clearing the PAC room moving all the furniture outside the room and cleaned it for the decontamination procedure.
2. The maintenance staff sealed the fire detector, switches, camera and AC vents so that they don't get destroyed during the process.
3. The housekeeping staff wore the PPE (green linen, goggles, double layer of gloves, head cover and masks). To avoid the wastage of PPE, the staff was not given PPE level 3.
4. The staff prepared the hydrogen peroxide solution (150 ml hydrogen peroxide and 120 ml RO water) and put it in the fogging machine.
5. The staff clipped the Demo PPE and N95 masks to the cloth line using wooden hangers and hooks. (According to the AIIMS guidelines, keep a gap of at least 1 foot between each coverall and ½ between each N95 mask).
6. 3 Biological indicators (*Geobacillus stearothermophilus)* with their cap open was kept in the PAC room at 3 different locations on stool. First was kept at the entrance besides the fogging machine, second one at the middle just below the hanging PPE and third one at the end of the room on cupboard shelf.
7. The staffs discard their PPE in the yellow bin placed in the PAC room and switched on the fogging machine at 11:30 AM for 20 minutes. Staff exit the decontamination room and discard the mask, goggles and inner gloves in the yellow bin kept outside the room. (Note- The switch of machine will be made outside the PAC room afterwards when necessary so that staff don't have to get inside again to switch off the machine)

8. After 20 minutes, the machine was closed and the door was sealed using the tape. Room was kept closed for 2 hours.
9. After the cycle finishes(i.e., after 2 hours), the staff opened the door and switch on the ceiling fan for 4 hours for aerating the room.
10. After 4 hours around 7 PM, the staff don the PPE and collect the PPE in the separate container.
11. Staff closed the Biological indicator vial and seal the 3 vials in separate container with proper label and was sent to Lab for testing.
12. The staff fold the coveralls and pack in plastic rolls using the sealing machine in Pre-op (processing room) .

Were there any unexpected observations?

The test results of Biological indicator came positive and color of the vial also got changed. It might happen that the fogging machine did not vaporize the room properly and hydrogen peroxide solution didn't evenly spread in the room.

STUDY

Analyze your data and describe the results. How do the results compare with your predictions?

1. The coveralls and N 95 masks were not decontaminated properly as the biological indicator came positive. The hydrogen peroxide vapors were not able to evenly spread in the room.
2. The housekeeping staff didn't face any issues while clipping coveralls or N95 mask to cloth line. They already knew that how much distance should be there between each coveralls and mask.
3. The fogging machine was kept at the ground and not at certain height so it might happen that the vapors were not able to reach to the top of coveralls and N95 masks and disinfect them properly.
4. The biological indicators came positive and color of the vial also got changed. The vapors didn't evenly spread and were not able to enter into the vial.
5. The nozzle of the fogging machine was working properly and we didn't face any mechanical problems during the test run.
6. **Feedback was collected from Dr. Reeta and Dr. Vrushali** –a) It was observed that during the test run, the staff forget to check that how much hydrogen peroxide solution was consumed when the fogging machine was stopped after 20 minutes. b) The staff went inside to collect the PPE after the completion of whole cycle, they forget to check whether the PPE was decontaminated properly or not (by touching the surface of PPE to observe whether it was wet or not).

What did you learn from this cycle?

Involvement of all the stakeholders during the test run is very necessary to make process smoother and easier for all the staff. It also helps to find gaps and improve the system with every trial run.

ACT

Are you ready to implement? (Feel confident in change, have tested under different conditions and have no more questions)

Yes √ No

Plan for the next cycle (Have more questions, need to make adjustments).

There is need to re-run more test runs to improve process as per the areas of improvement identified. The next cycle will be conducted with only one biological indicator which will be placed at a very suitable position where the hydrogen peroxide vapors can reach the vial properly and also change the position of fogging machine (place at height).

Describe the objective for your next cycle(s):

To test the new process for decontamination of used PPE according to the AIIMS guidelines after tweaking changes identified in PDSA R1C1.

Fig 6- Before the trial run, the housekeeping staff cleared and clean the PAC room.

Fig 7- Staff sealing the cupboards and shelves with the brown tape before trial run.

Fig 8- The housekeeping staff wore the PPE (green linen, goggles, double layer of gloves, head cover and masks). To avoid the wastage of PPE, the staff was not given PPE level 3.

Fig 9- Staff preparing the Hydrogen peroxide solution and putting it in the fogger machine-

Fig 10- Staff clipping the coveralls and N95 masks to cloth line by wooden hangers and plastic clamps.

Fig 11- Ensure that the fogging machine is placed at 45-degree angle during the decontamination process.

Fig 12- 3 Biological indicators (*Geobacillus stearothermophilus)* with their cap open was kept in the PAC room at 3 different locations on stool. First was kept at the entrance besides the fogging machine, second one at the middle just below the hanging PPE and third one at the end of the room on cupboard shelf.

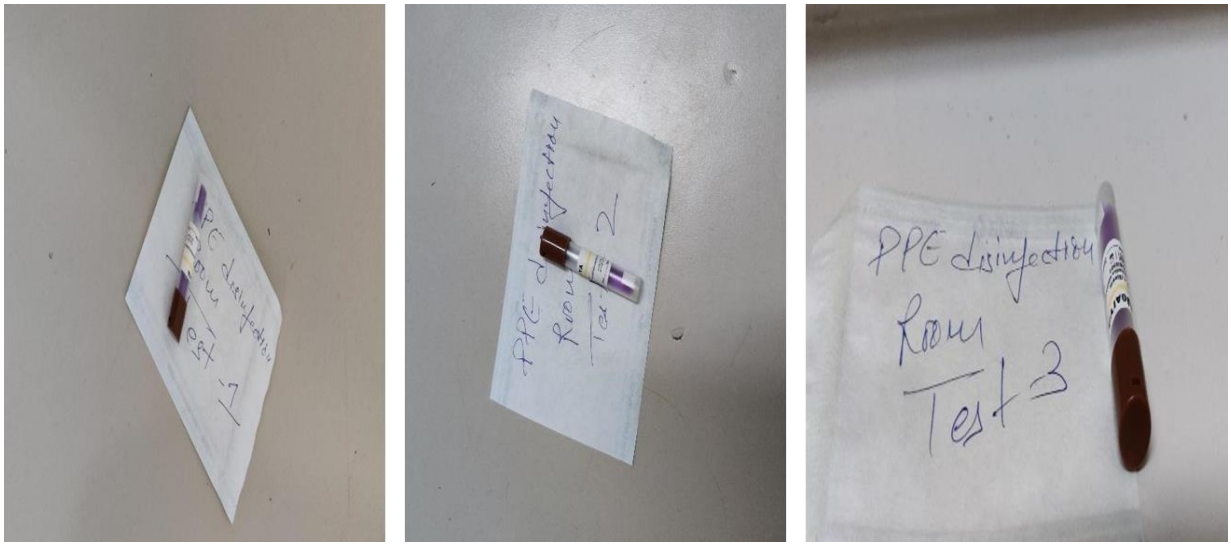


Fig 14- After hanging the PPE, staff discarding their PPE in the PAC room in yellow bin.

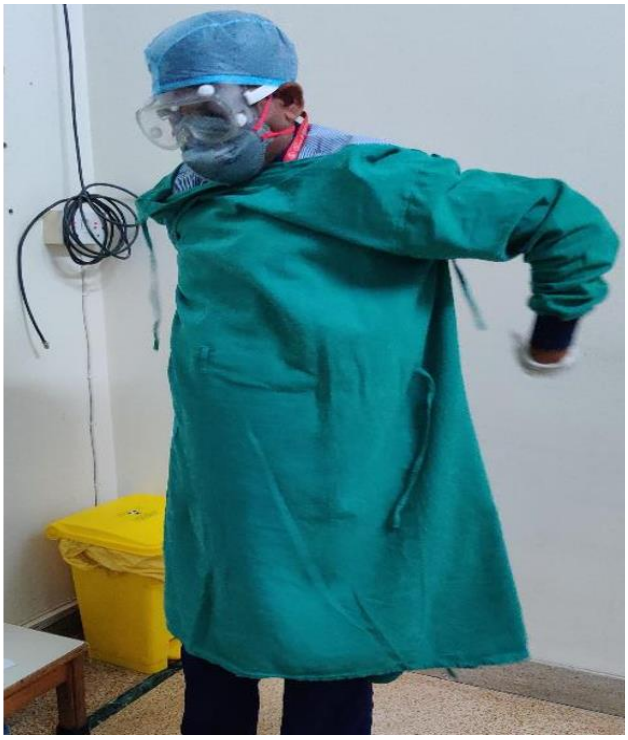



Fig 15- Staff after switching on the machine come out of room and discard goggles, head cover and inner pair of gloves in yellow bin kept outside the room.


Fig 16 – After 20 minutes, the staff switched off the machine and seal the door with tape and room is closed for 2 hours. (Note- brown tape is used)

Fig 17- After 2 hours, room is opened for 4 hours and ceiling fan is switched on for aeration.

Fig 18- After 6 hours of cycle, staff collecting the decontaminated PPE in separate clean container.

Fig 19- Staff sealing the decontaminated coveralls and N95 masks using sealing machine in Pre-op room (processing area)

Fig 20 – Packed decontaminated coveralls and N95 masks.

<u>Analyze the data and describe the results –</u>

- The coveralls and N 95 masks were not decontaminated properly as the biological indicator came positive. The hydrogen peroxide vapors were not able to evenly spread in the room.

- The housekeeping staff didn't face any issues while clipping coveralls or N95 mask to cloth line. They already knew that how much distance should be there between each coveralls and mask.

- The fogging machine was kept at the ground and not at certain height so it might happen that the vapors were not able to reach to the top of coveralls and N95 masks and disinfect them properly.

- **The biological indicators came positive and color of the vial also got changed. The vapors didn't evenly spread and were not able to enter into the vial.**

- The nozzle of the fogging machine was working properly and we didn't face any mechanical problems during the test run.

- **Feedback was collected from stakeholders** –a) It was observed that during the test run, the staff forget to check that how much hydrogen peroxide solution was consumed when the fogging machine was stopped after 20 minutes. b) The staff went inside to collect the PPE after the completion of whole cycle, they forget to check whether the PPE was decontaminated properly or not (by touching the surface of PPE to observe whether it was wet or not).

Discussion-

A prospective cohort and qualitative study were undertaken to establish and test the process of decontamination of used PPE in Sitaram Bhartia Institute of Science and Research, Delhi. As we all know that doctors, surgeons, nurses and other health care workers are very important part of our lives but this COVID 19 pandemic has completely exhaust our health care resources putting their lives in danger. PPE is very important resource and it is necessary that everyone working in the health care system has access to right personal protective equipment.

All India Institute of Medical Sciences (AIIMS) has released guidelines for decontaminating PPE for subsequently for extending the use of limited supplies. Following the AIIMS guidelines, **Sitaram Bhartia Institute of Science and Research (SBISR)** have

decided to establish the process of decontamination of used PPE during this pandemic and set up a decontamination and processing room for disinfection. Housekeeping staff and OT technicians were trained properly regarding each step of decontamination process including the steps of Donning and Doffing. After the training, their knowledge was assessed using the questionnaire **Disinfecting PPE for Re-use".** It was observed that all the OT technicians had good knowledge regarding the entire process and were properly trained but there were some lacunae in training of some of the housekeeping staff (OT and ICU). Stakeholders decided to conduct a second round of training and it helped the staff to understand completely the process and they were not hesitant when asked questions about the

Disinfecting PPE for reuse.

After training of all the staff, stakeholders decided to conduct a trial run of entire process and also to test the biological indicator which will be placed at different locations in the PAC room to validate the decontamination procedure. These were the following observations-

1) All the 3 biologicals indicator came positive and color of the vial also got changed.
2) The fogging machine was kept at the ground and not at certain height so it might happen that the vapors were not able to reach to the top of coveralls and N95 masks and disinfect them properly.
3) It was observed that during the test run, the staff forget to check that how much hydrogen peroxide solution was consumed when the fogging machine was stopped after 20 minutes.
4) The staff went inside to collect the PPE after the completion of whole cycle, they forget to check whether the PPE was decontaminated properly or not (by touching the surface of PPE to observe whether it was wet or not).

So, after first trial run it was decided to re-run more cycles to improve process as per the areas of improvement identified. The next cycle will be conducted with only one biological indicator which will be placed at a very suitable position where the hydrogen peroxide vapors can reach the vial properly and also change the position of fogging machine (place at height).

Before the next cycle, following points will be taken into consideration in order to find better results-

TABLE NO 3: Points to be consider before the next cycle of Decontamination process

Important points to consider before the Test run of Decontamination process of Used PPE	
Name of the hospital: Sitaram Bhartia Institute of Science and Research	
S.NO	**Points**
1	PPE worn by the staff
2	Name of Operator
3	Concentration and Volume of Hydrogen Peroxide
4	Volume of RO water
5	Number of Coveralls and respirators
6	Fogger Start time/off time (decontamination process)
7	Whether hydrogen peroxide solution is aerosolized or not
8	Presence of visible fog at end of 2 hours before starting aeration process
9	Aeration process (4 hours)- Start and end time
10	After 4 hours of Aeration process, the hydrogen peroxide should not stick on PPE because that can cause irritation to the person who will be wearing it. That's why Post Aeration process needs to be checked properly.

11	Qualitative assessment of H2O2 by doing a smell test to determine if there were any noticeable odors.
Important points to consider pertaining to fogger before the Test run	
12	**Fogger flow rate-** Lower flow rate is recommended for OT or to sterilize in smaller harbor ages. This will result in finer droplets. Done by the flow regulating valve.
13	**Volume of space to be fogged-** This is calculated as 1225 cuft for the decontamination room.
14	**Quantity of chemical-** It is recommended 300-400 ml per 1000 cuft. In the last trial run, 270 ml was used. So according to the volume of our room, we need approx. 428 ml.
15	**Output flow rate of fogger-** Checked by running fogger with the quantity of chemical for one minute at the set liquid flow rate.
16	**Placement of fogger in the decontamination room-** Whether on the ground or on a raised platform
Points of note for Biological Indicator (*Geobacillus stearothermophilus)*	
17	**Location**- Where to place all the Biological Indicator
18	Whether to remove the test strip from vial and keep in front of fogger during the process
19	Procedure to seal the Biological indicator prior to sending to Lab for testing.

Limitations of the study-

1) There will be more test run later to improve the process as per the areas of improvement identified.
2) The assessment of staff through questionnaire was only for designated Housekeeping (7) and OT staff (4).
3) The staff was given clean green linen instead of PPE level 3 to avoid the wastage of PPE.

Conclusion-

In the past few weeks, the worldwide pandemic attributed to COVID-19 has flourished and affected millions of people all over the world. Given that our health care systems, researchers and society are mounting preparedness and response effort, one issue appears of vital significance — how to keep patients, and those within health care settings who care for them, safe.

Personal protective equipment (PPEs), such as masks, gloves, and isolation gowns, are essential to limit the risk of exposure to the infection for all who are taking care of the wellbeing and prosperity of COVID positive or suspected patients in different health care settings. Healthcare workers should be provided with adequate PPE so that they can do their job with confidence.

Many health care organizations have not faced a shortage of PPE of this magnitude before. Many of them have collaborated with policy makers and other businesses so that our health care professionals are provided with PPE and keep themselves protected from the deadly virus. But the way these health care resources are getting exhausted, hospitals are forced to make difficult decisions to preserve existing supplies. We have to improvise and adapt existing technologies for new uses in times of global shortage.

The AIIMS has issued guidelines for the re-use of PPE, regarding the rapid depletion of stocks in the wake of coronavirus outbreak, while emphasizing that disinfection methods should only be considered when there are extreme shortages of personal protective equipment.

Following the AIIMS guidelines, Sitaram Bhartia Institute Science and Research decided to test the guidelines and see whether it is effective or not. A trial run was conducted and results of test run showed that the decontamination process was ineffective as the biological indicator kept in room for validation came positive and color of vial got changed. The major learning from this cycle is involvement of all the stakeholders during the test run is very necessary to make process smoother and easier for all the staff. It also helps to find gaps and improve the system with every trial run.

The results of first test run conclude that it is important to re-run more cycles to improve the process as per the areas of improvement identified. Few points like fogger flow rate, location of decontamination room, quantity of chemical used, whether the hydrogen peroxide solution is aerosolized or not, placement of machine and biological indicator and aeration process needs to be considered properly before, during and after the decontamination process.

Recommendations for PPE conservation during COVID 19-

There are 3 strategies for PPE conservation-

- Restrict-

1) Restrict the entry of visitors to the patient areas. For e.g. One visitor is allowed with the hospitalized patient.
2) Decrease the number of entrances to the hospitals and screen all the visitors for symptoms before entering the hospital.
3) Develop defined protocols and workflows for screening and communication to visitors.

Identify a person from hospital who will be responsible for maintaining communications with families in order to decrease the burden of clinical staff.

4) Minimize the visits of health care professionals to the room.
5) Group as many tasks together as much as possible (For e.g. if two staff is required, ensure they can group and complete all the essential work at one entry to patient's room.)

- Reduce-

1) Eliminating Elective surgeries and procedures.
2) Decrease unnecessary face to face encounters by organizing telemedicine and by providing virtual care.
3) Reducing nurses visits into patient's room for unnecessary patient care. For e.g. Some healthcare organizations have started to keep IV pumps outside the room by using IV extension tubing to provide care and change medication of patient.

- Reuse-

1) Extending use of N95 masks and face masks between patients and patients and doctors changing their gowns and gloves between patients.
2) Re- using of N95 masks up to 4 times in a week and then masks are stored in a paper bag with 4 separate labels on the outside of the bag.

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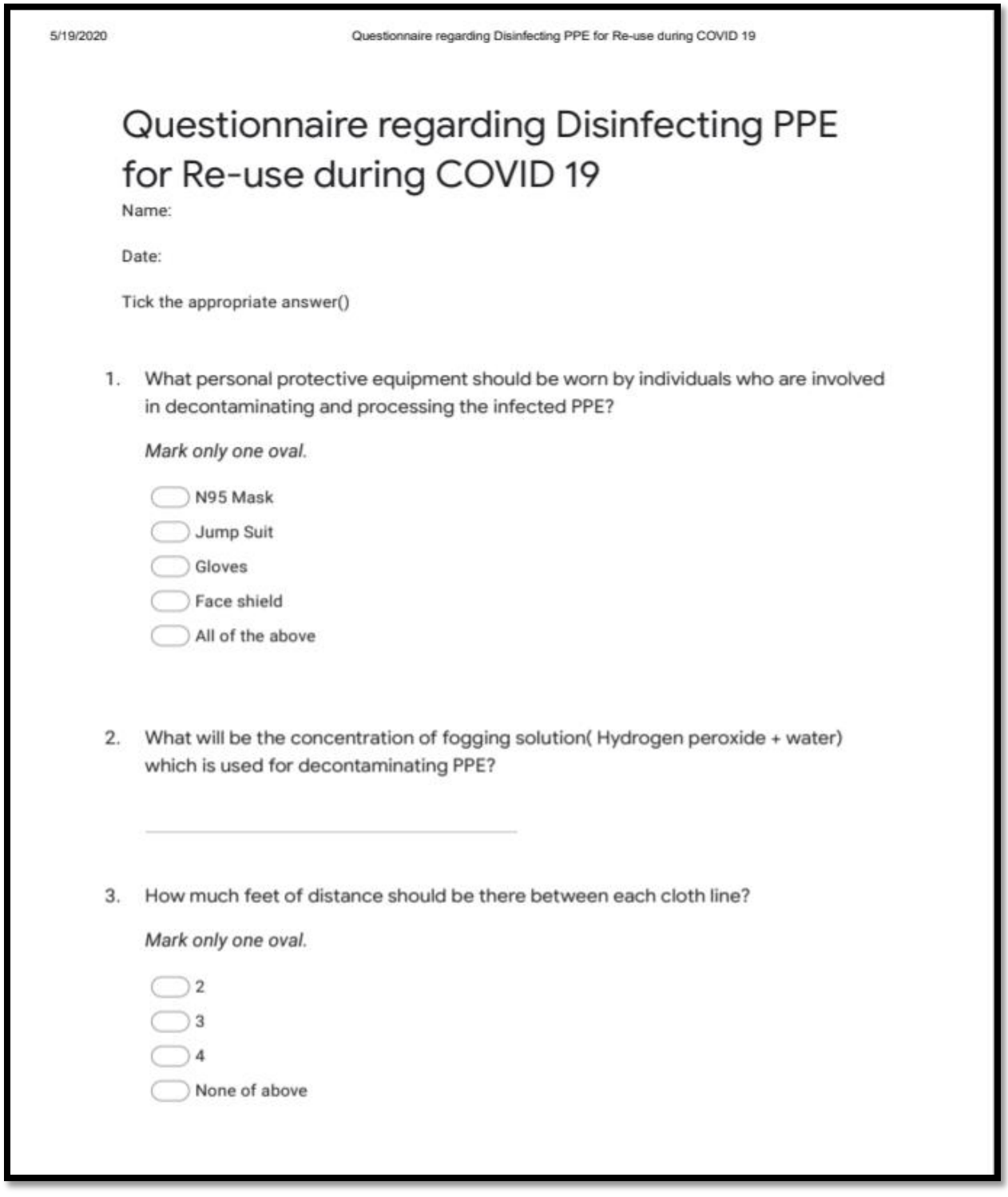
ANNEXURE



5/19/2020 Questionnaire regarding Disinfecting PPE for Re-use during COVID 19

Questionnaire regarding Disinfecting PPE for Re-use during COVID 19

Name:

Date:

Tick the appropriate answer()

1. What personal protective equipment should be worn by individuals who are involved in decontaminating and processing the infected PPE?

   Mark only one oval.

   - ◯ N95 Mask
   - ◯ Jump Suit
   - ◯ Gloves
   - ◯ Face shield
   - ◯ All of the above

2. What will be the concentration of fogging solution(Hydrogen peroxide + water) which is used for decontaminating PPE?

   _____

3. How much feet of distance should be there between each cloth line?

   Mark only one oval.

   - ◯ 2
   - ◯ 3
   - ◯ 4
   - ◯ None of above

4. At what angle the Hydrogen Peroxide machine should be placed in the decontamination room?

Mark only one oval.

- ◯ 90 gegree
- ◯ 60 degree
- ◯ 45 degree
- ◯ None of the above

5. How much gap should be there between each coverall and mask?

Mark only one oval.

- ◯ Coverall- 2 foot, Mask- 1 foot
- ◯ Coverall- 1 foot, Mask- 1/2 foot
- ◯ Coverall- 3 foot, Mask- 2 foot

6. What is the duration of one cycle of treatment ?

Mark only one oval.

- ◯ 6 hours
- ◯ 8 hours
- ◯ 7 hours
- ◯ 5 hours

7. How many treatment cycles can be done in 24 hours ?

Mark only one oval.

- ◯ 5
- ◯ 2
- ◯ 3
- ◯ 4

8. What are the steps of donning of PPE and where will you don the clean PPE?

9. How will you doff the PPE in decontamination room?

10. How will you decontaminate face shields and goggles?

11. In approximately how much time the Hydrogen peroxide solution in the fogging machine will get consumed in 1225 cubic foot room during the disinfection process?

Mark only one oval.

- ◯ 15 minutes
- ◯ 20 minutes
- ◯ 10 minutes
- ◯ None of the above

12. How will you pack the decontaminated coveralls and N95 masks?

Debshreeta Das D report 2

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