

Infection Prevention and Control for ICU during COVID-19 Pandemic: Position Paper of the Indian Society of Critical Care Medicine

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ABSTRACT

Coronavirus disease-2019 (COVID-19) has very high rates of hospital-related transmission among healthcare workers (HCWs), mandating the need for careful intensive care unit (ICU) designing, optimization of staff resources, implementation of vigorous infection control practices, environmental disinfection, meticulous sample collection, and criteria for staff quarantine. Most of the ICUs are not designed to deal with airborne viral infections and require redesigning for the safety of HCWs and patients. Infection control practices related to the prevention of spread of COVID-19 are unique and are well described. The training of staff on infection control practices reduces the infection rate among HCWs significantly. Adequate staffing not only helps in infection control but also prevents burnout of the staff. In case of infection to HCW, the staff must be assessed systematically, and institute's infection control committee should guide for isolation period as well as return to work based upon standard recommendations. This article focuses on infection control and prevention measures required in ICU during the COVID-19 pandemic.

Keywords: Aerosol, COVID-19, Decontamination, Disinfection, Healthcare workers, Infection control practices, Intensive-care, Quarantine, Specimen, Sterilization.

Indian Journal of Critical Care Medicine (2020); 10.5005/jp-journals-10071-23607

INTRODUCTION

In an outbreak of viral illness, with primary mode of transmission through respiration, the greatest risk is to healthcare workers (HCWs) who are exposed to infected patients or by procedures such as intubation, aerosolized medication, and handling human secretions. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has very high infectivity; therefore, we need to implement infection control practices vigorously in the intensive care unit (ICU), where confirmed as well as suspected coronavirus disease-2019 (COVID-19) patients are treated. The incidence of healthcare-related cross-transmission of SARS-CoV-2 is high up to the tune of 40%.²

INTENSIVE CARE UNIT DESIGN

The ICUs of most hospitals are not designed to deal with airborne viral infections such as the one seen in this pandemic. In fact, some of the ICU designs may be harmful to the staff working in these areas during a respiratory virus pandemic and therefore may require redesigning to minimize the exposure risk to HCWs (Figure 1 depicts a suggested model of ICU for airborne illness like COVID-19).

Infrastructure³⁻⁸

- The fundamental of ICU design is to ensure safety of both patients and HCWs
- To prevent the spread of infection, "COVID ICU" should preferably be located in a separate dedicated building designated as COVID hospital/wing. In case this is not possible, the COVID ICU should be located away from vulnerable areas such as neonatal ICU (NICU), labor room, dialysis, postoperative surgical unit, etc.

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How to cite this article: Sharma J, Nasa P, Reddy KS, Kuragayala SD, Sahi S, Gopal P, *et al.* Infection Prevention and Control for ICU during COVID-19 Pandemic: Position Paper of the Indian Society of Critical Care Medicine. *Indian J Crit Care Med* 2020;24(Suppl 5):S280-S289.

Source of support: Nil

Conflict of interest: None

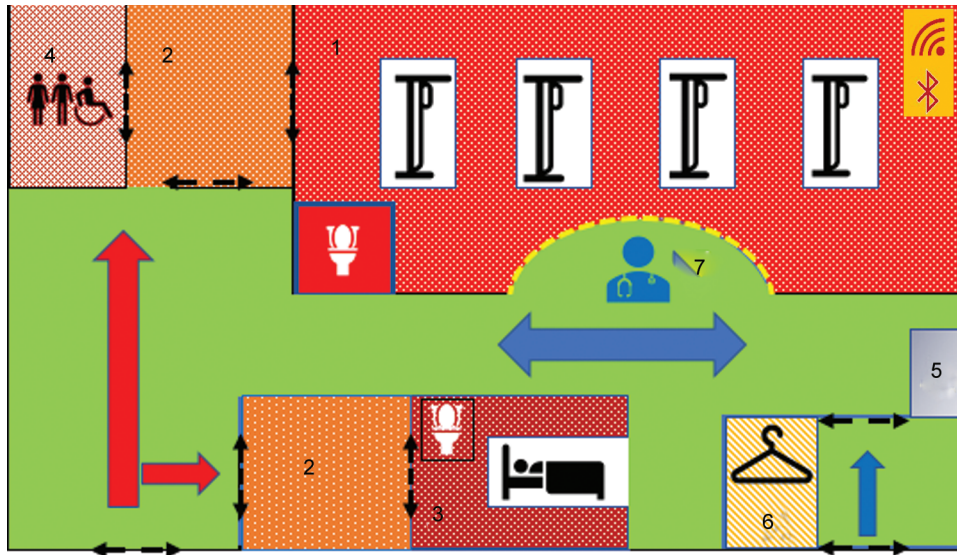


Fig. 1: Suggested model of intensive care unit for airborne illness pandemic like COVID-19. Red arrow: Patient entry, blue arrow: Healthcare worker entry. Black dashed arrows: self-sliding automated doors. 1. Red dotted area: negative pressure isolation area for confirmed COVID-19 patients, 2. Orange dotted area: buffer zone, need full personal protective equipment (PPE), 3. Red dotted area: suspected COVID-19 patients negative isolation area, 4. Common utility area, 5. Blue shaded area: PPE doffing area, 6. PPE donning area, 7. Yellow striped wall: full glass wall for patient observation

- The COVID ICU should be separated from other ICU patients. At no point, suspected COVID-19 patients should be allowed to mix with confirmed COVID-19 patients.
- The COVID ICU should have a separate entry, exit and accessible through a dedicated lift and/or stairs with round-the-clock security to restrict entry into the ICU.
- At entrance signages for direction and do's/don'ts for isolation area should be present.
- There should be provision for increase in bed capacity by at least by 20% in case of surge in patients.
- ICUs must have separate donning and doffing area, preferably located in the anteroom at the entrance of ICU. There should be a provision of a washing/bathing area for the HCW to shower after duty before leaving the premises to prevent transmission of infection.
- There can be a provision for resting chambers for the staff post working hours for freshening up to prevent burnout syndrome. However, the HCWs should be allowed to rest only after complete doffing.

Infection Control Facilities⁴⁻⁷

- Provide appropriate hand washing and hand hygiene facilities in the COVID ICU, preferably with no touch sensors for hand washing.
- There should be provision of shower facility in changing or doffing area for the staff.
- The used linen should be disposed either in a water-soluble bag or in a container filled with 0.5% sodium hypochlorite.
- Provide audio-video communication in ICU patient care areas. This serves as an information channel for the families and communication with their patients, avoiding the necessity of physical visits and reduce cross-transmission risk.
- An ultraviolet (UV) light disinfection chamber should be available in the resting room/ change room for disinfection of personal belongings such as keys, cell phones, etc.

- Alternatively, alcohol-based wet wipes should be available for disinfecting personal belongings.

Air Circulation^{5,6,8,9}

- Air circulation of COVID ICU must be separated from rest of the area of hospital with separate air handling unit (AHU).
- Corridors used for patient's transport should be well ventilated and periodically disinfected.
- COVID ICU should have sufficient number of airborne infectious isolation rooms (AIIR) for aerosol-generating procedures (AGP) whenever feasible. However, if sufficient single rooms are not available, beds can be arranged with a spatial separation of at least one meter (three feet) from one another.
- AIIR room should have fresh air exchange of 6–12 per hour and is at negative pressure in relation to surroundings (ante-room). There is high-efficiency particulate air (HEPA) filter fixed to the outlet of gases to atmosphere and for recirculation.

DONNING AND DOFFING^{6,7,9,10}

Donning and doffing of personal protective equipment (PPE) is a systematic process involving steps to take on and off PPE.

Personal Protective Equipment

The PPE recommended for AGPs is comprised of goggles or face-shield, head cover, N95 mask, surgical gloves, coverall/gowns, and shoe cover.

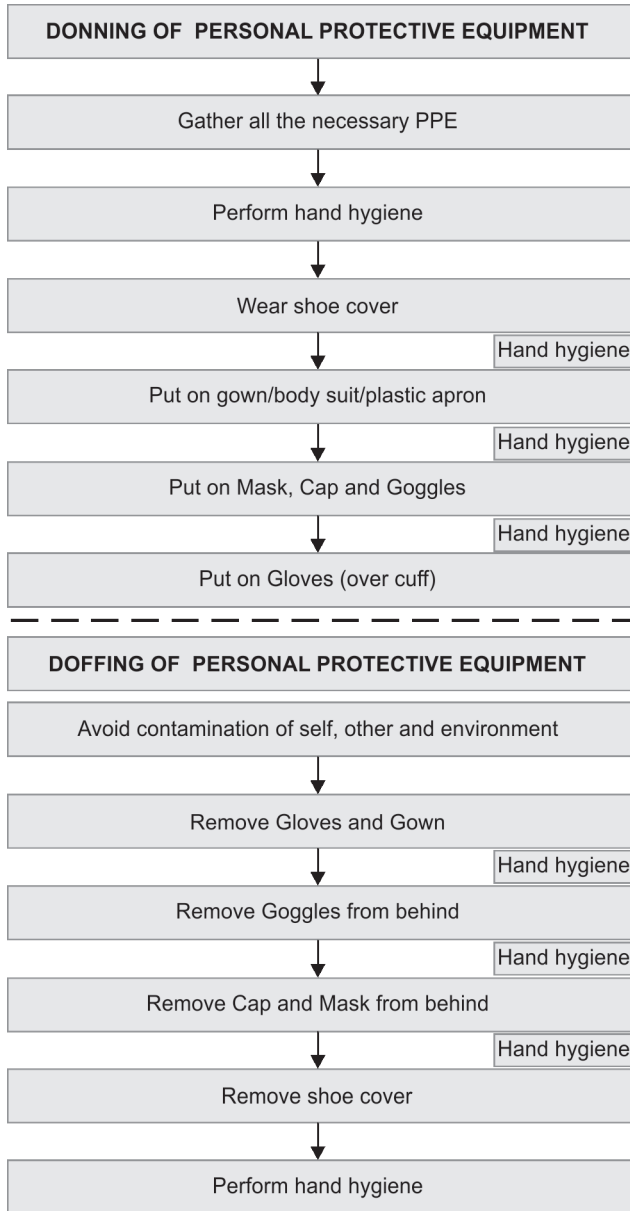
Donning Area

Donning area is a "clean filter" equipped with enough disposable PPE. The other essential items are mirror for donning chairs, surgical scrubs, waste management bin, and hand wash sink with sanitizer.

Donning

There should be a trained observer for review and confirm compliance of the steps of donning process in the donning area.

Flowchart 1: Steps of donning and doffing



Steps for Donning (Flowchart 1)

- HCWs should not wear any jewelry in the workplace.
- Scrubs top must be tucked into the scrub pants
- Perform hand wash with soap and water or hand hygiene with alcohol-based hand rub in case hand wash is not possible.
- Collect all articles of PPE and visually inspect them for any damage.
- The gown should be fluid-resistant, non-sterile, and disposable. Make sure the forearms are fully covered and gown is secured on the back while donning the gown.
- Hold the N95 mask in the hands with the straps dangling free. Place the mask securely at the nose and mouth, followed by straps with top one reaching above the ear at the crown of head and lower one below the ears. Mold the nose piece metal to the bridge of nose for a good seal

- The eyes and face are then covered using proper size goggles or a face shield.
- Use surgical gloves made of either latex or nitrile for hands, and pull them till the sleeves of the gown to ensure no skin is exposed. Make sure that your wrists are covered and that no skin is visible.

Doffing

The doffing of PPE is very critical process, as chances of self-contamination are high. The doffing should be done in presence of a trained observer to ensure compliance like donning.

Doffing Area

Doffing area is a “contaminated filter” equipped with waste management bin as per hospital infection control policy, mirror, hand wash sink, and washroom. It is recommended to take shower with soap and water in the hospital premises after doffing.

Steps for Doffing (Flowchart 1)

- Inspect your PPE for any breach. Hand wash with 70% alcohol after each step mentioned below.
- Remove your gloves carefully without touching the outer portion of gloves using the glove-to-glove technique.
- The doffing of gown should be done in front of mirror, with careful untie of strap. The gown is pulled off the body with carefully rolling the sleeves without self-contamination. The gown is then rolled up like a ball before disposal.
- Remove your eye goggles and/or face shield without having a contact with face.
- N95 mask is to be removed only after exiting isolation area. Do not touch the front surface of the mask. Remove the bottom strap first followed by top strap and discard the mask while holding the straps.
- Clean your hands once again with either soap or water or 70% alcohol.

INTENSIVE CARE UNIT STAFFING

The present pandemic of COVID-19 has caused tremendous strain on the HCWs all over the world and specifically in India. Surge in the cases is expected to continue, and the ICU staff are already being overwhelmed. This causes huge staff burn out and disruption of patient care.³ There is a pressing need for proper staffing strategies for augmentation.

Team-based Approach for Optimization of Staff Resources⁷

- The key is to create a core COVID-19 team urgently, multiple back up teams of HCWs, and to develop coordination between the individual teams.
- The core team should comprise of doctors, nurses, and various other HCWs who are preferably young (<45 years of age) and without comorbidities. Those who are aged more than 60 years, with multiple comorbidities, pregnant or lactating women, and those who are on immunosuppression are not to be included in the team.
- The team should be led by a senior intensivist who can be actively involved in the patient care, thus building confidence in the other team members.



- The core team should be a mix of experts in airway and other ICU procedures, experienced ICU nurses, respiratory therapists, infectious disease (ID) specialists, and heads of other supporting staff.
- The core team should recruit multiple small teams that would work as back up teams in the event of an HCW falling ill or on an emergency leave.
- The teams should be rotated based on their skills, and there should not be any bias in allocation of duties.
- Sources of additional staff should be prioritized to meet the surge capacity.¹¹ Internal resources mobilization include HCWs from non-COVID units of the hospital, non-clinical positions, medical/nursing interns, etc. External resources include tele ICU support, prehospital services, etc.
- Open channels of communication and regular online huddles with the staff are encouraged. Psychological support and local helplines are to be established.

Training in Infection Control Measures³

- HCWs are highly vulnerable to cross-infection, and uncontrollable hospital outbreak could cripple the hospital service in a very short time.
- All of the ICU staff must follow procedures of infection prevention and control (IPC) completely. An infection control coordinator must monitor the compliance of all policies and procedures of IPC.
- Buddy system is a recommended tool that can be tried to ensure good compliance of IPC measures.¹²
- Buddy system: A team of two or more staff is formed with shared responsibilities of each other safety and well-being. Buddy system approach is useful for various critical measures of IPC like (i) Safe donning and doffing of PPEs, (ii) compliance of hand hygiene, and (iii) observation and reporting of any breach of PPEs.^{11,12}

Surge Teams and Tiered Strategies^{13,14}

- It is difficult for any hospital to increase the staff capacity to match the surge in cases.
- Due to surge of cases, normal division of tasks between nursing and medical teams may not be possible. Identification of critical tasks and division of them between the various staff is advised.
- In case of surge, the ICU physician and nurses instead of direct patient care may take a supervisory role, with HCWs from outside ICU may be actually deployed to provide direct patient care.
- Tiered staffing strategy as recommended by Society of Critical Care Medicine (SCCM) could be adopted with a single ICU physician overseeing 3–4 teams led by non-ICU physicians.

Staff Credentialing and Wellness¹⁴

- The credentialing process should be expedited and should be readily reckonable.
- The hospital should ensure that all the staff are medically insured.
- The staff should undergo periodical temperature checks and screening for any symptoms of COVID-19.
- In case of a member of the team developing symptoms of COVID-19, they should be prioritized for the testing.

Table 1: Preparations of sodium hypochlorite solution and its conversion to 1% solution

Product	Available chlorine	Final concentration (1%)
Sodium hypochlorite- (liquid bleach)	3.5%	Dilute 1-part bleach and 2.5-parts water to get final 1% concentration
Sodium hypochlorite- liquid	5%	Dilute 1-part bleach and 4-parts water
NaDCC (sodium dichloro-isocyanurate) powder	60%	Dilute 7 g of powder and one liter water
NaDCC tablets (sodium dichloro-isocyanurate) 1.5 g/tablet	60%	11 tablets are mixed in one-liter water
Chloramine-powder	25%	7 g of powder is mixed to 1-liter of water
Bleaching powder	70%	7 g of powder is mixed to 1-liter water
Any other formulation		Dilute as per manufacturer's instructions to achieve final concentration.

Housing for the Staff and Family Needs¹⁴

- The staff working in COVID ICU should follow the principles of infection control and social distancing in the housing quarters.
- The hospital should address the family needs of the staff who are staying away from their families for long time. This may include HCWs child support, preferential treatment to the families of the staff, etc.

Shift Hours and Payment to Staff

- In view of vulnerability of the ICU staff to high viral load, the shift hours should be short and preferably not to exceed 6–8 hours.¹⁴
- Timely payment of the salaries may boost the confidence of working staff. Reasonable monetary incentives can be considered wherever feasible and applicable.
- As far as possible, the staff on ICU duty should be staying in the premises or nearby (to prevent infection) and easy availability in case of sudden surge.

ENVIRONMENTAL DECONTAMINATION

Hospital Disinfectants^{9,16}

- As far as possible, single-use or disposable equipment must be used. The nondisposable equipment can be disinfected with either 70% ethyl alcohol or quaternary ammonium compounds
- Sodium hypochlorite at 0.5–1% for surface disinfection (Table 1)

Surface Cleaning

Surfaces can be divided into two groups depending on the degree of use to either high-touch surfaces (HTS) or low-touch surfaces (LTS). Wear gloves when handling and transporting used patient care equipment.⁹

High-touch Surfaces

These are with frequent hand contact like door knob, bedrails, light switches, wall area around the toilet and edges of privacy curtains. HTS need to be cleaned and sanitized more frequently.

Low-touch Surfaces^{9,15}

These are surfaces like floor, ceilings, walls, curtains, and blinds. LTS require cleaning less frequently about two times a day and damp mopping is preferred over dry.

Curtains in patient care areas need to be changed when visibly soiled or after each patient discharge, while blinds must be changed when visibly soiled.

Cleaning and Disinfection of Medical Equipment

Medical equipment must also be disinfected before removing equipment from patient’s room.

Noncritical Medical Equipment^{5,9,16}

The examples of noncritical equipment include stethoscopes, blood pressure cuffs, etc. They need low to intermediate level of disinfection after cleaning for removal of any organic matter (Table 2).

Terminal Cleaning after Discharge of Patients^{5,6,15,16}

- Terminal cleaning is complete environmental decontamination of the patient care area after discharge.
- Terminal cleaning includes cleaning for removal of any organic or nonorganic matter followed by disinfectant process
- Housekeeping staff should wear full PPE—surgical mask or N95 mask, protective eyewear, coverall/gown, and gloves—before entering patient-care area
- Clean all surfaces of bed and mattress with 1% sodium hypochlorite.
- Wash the floor with wet mop followed by disinfection with 1% sodium hypochlorite.
- In case of accidental exposure, disinfection should be done according to area exposed (Table 3).

Table 2: Medical equipment cleaning

<i>Items</i>	<i>Agent used</i>	<i>Procedure of cleaning</i>
Stethoscope	Alcohol-based wipes	<ul style="list-style-type: none"> • Clean with soft detergent water for any organic matter, use 70% alcohol wipes for disinfection before next patient use
Thermometer	Detergent and water Alcohol rub	<ul style="list-style-type: none"> • Preferably use new thermometer for each patient • After each use should be stored dry in individual holder. • In case of nonavailability clean with soft detergent and tepid water and wipe with 70% alcohol rub between patient use.
Injection and dressing trolley	Detergent and water	<ul style="list-style-type: none"> • To be cleaned daily with detergent and water • After each use should be wiped with disinfectant (70% alcohol or 1% hypochlorite)

Table 3: Disinfection in case of accidental exposure

<i>Exposure type</i>	<i>Preferred disinfection</i>	<i>Action</i>
Skin	<ul style="list-style-type: none"> • 70% ethyl alcohol • Povidone iodine • Soap and water 	(Low-risk) <ul style="list-style-type: none"> • Rinse with copious amount of water after using disinfectant
Mucous membrane	<ul style="list-style-type: none"> • Povidone iodine gargles (oral cavity) • Saline flush (conjunctiva) • Saline drops (nasal cavity) 	(High-risk exposure) <ul style="list-style-type: none"> • Quarantine as per ICMR policies
Needle prick	<ul style="list-style-type: none"> • Cleaning with soap and water • Povidone iodine rub 	(High-risk exposure) <ul style="list-style-type: none"> • Quarantine as per ICMR policies
Hair	<ul style="list-style-type: none"> • Soap and water • Shampoo 	(Low-risk exposure)
Spills on the floor	Use absorbent tissues to absorb the spill <ul style="list-style-type: none"> • 1% hypochlorite solution • Any contact disinfectant/detergent mixed with water (if nothing is available) 	<ul style="list-style-type: none"> • Discard absorbent tissue containing spill as per the hospital biomedical waste policies. • Use 1% hypochlorite in the bag
Clothes	<ul style="list-style-type: none"> • 1% hypochlorite solution (if single use) • Hot water and detergent (soak for 30 minutes, wash separately) 	<ul style="list-style-type: none"> • Hypochlorite may discolour the clothes • Soiled clothes should be washed separately
Shoes/foot wear	<ul style="list-style-type: none"> • Alcohol wet wipes (70% alcohol) • Soap and water, after thorough rinse with water (if possible) 	<ul style="list-style-type: none"> • Discard soiled foot ware if possible • If not, leave the shoes in the sun or under UV light for >30 minutes

ICMR, Indian Council of Medical Research; UV, ultraviolet



Biomedical Waste Management^{17,18}

- Separate color-coded bins/bags/containers in ICU should be kept for proper segregation of waste based on hospital infection control policy as per Biomedical Waste Management (BMW) Rules, 2016, and Common Bio-medical Control Board (CPCB) guidelines.
- The bags (using two bags) should be covered in double layers for collection of waste in ICU to provide adequate strength and to prevent any leaks.
- The waste collected from COVID area should be clearly marked and stored separately from other BMW, prior to handing over to Biomedical Waste Treatment and Disposal Facility (CBWTF). In case this is not possible, BMW can be handed over directly to CBWTF staff.
- For easy identification of BMW from COVID area, they can be labeled "COVID-19 Waste". This labeling will be helpful for housekeeping staff and CBWTFs staff to identify the waste easily prior to appropriate disposal.
- General waste not having contamination should be disposed as solid waste as per Solid Waste Management (SWM) Rules 2016.
- Maintain separate record of waste generated from COVID-19 isolation wards

Dead Body Management^{19,20}

- The staff responsible for handling dead bodies should be trained by infection control nurse in IPC practices and safety. This include the staff in the isolation ICU, mortuary, ambulance, or those working in the crematorium/burial ground.
- All personnel responsible for handling dead body should take standard precautions, including hand hygiene before and after handling, and use appropriate PPE, including a fluid-resistant apron and surgical gloves.
- Facial protection using a face shield or goggles must be done in case of risk of splashes of either body fluids or secretions.
- Remove all lines, catheters, or other tubes before packing the body.
- Any body fluids leaking from orifices must be properly contained before packing.
- The body handling should be kept as minimum as possible and by restricted trained personnel only.
- The dead body must be placed in a leakproof plastic body bag, preferably double layered; 1% hypochlorite can be used to decontaminate exterior of the body bag.
- It is important to maintain appropriate temperature at the mortuary, as heat and humidity will cause body decomposition.

SAMPLE COLLECTION

Safety Precautions

- All specimens collected from a suspected or confirmed COVID-19 patient are potentially infectious and must be handled appropriately.
- The staff responsible for collection, handling, and processing specimens must be trained by infection control nurse for appropriate specimen collection, storage, packaging, and transport. Appropriate PPE is mandatory for sample collection.

- The PPE includes gown, head cap, face shield/goggles, N95 respirator, gloves, and shoe covers.²¹
- The laboratory staff responsible for handling such specimen should be specifically trained in technical and biosafety measures.
- All molecular diagnostic specimen must be handled only in laboratory with biosafety level (BSL)-2 or equivalent facilities. Any attempt to viral isolation using culture only to be done in a laboratory equipped with BSL-3 or higher as per national guidelines on laboratory biosafety.²²

Requirement for Sample Collection

- Sterile polyester tipped plastic stalk swabs
- Viral transport medium (VTM)
- Tongue depressor
- Plastic zip lock bag
- Cool box with frozen gel pads (-20°C)
- Cryo-labels
- Sealing tape
- PPE equipment
- Alcohol based hand rub
- Biohazard discard bag

Specimen collection should use only synthetic fiber swabs made on plastic or wire shafts. Calcium alginate swabs or wooden shafts should not be used, as it may inactivate some viruses or inhibit polymerase chain reaction (PCR) testing by reducing viral yield.

Specimen Type^{23,24}

- The critical steps in the diagnosis of SARS-CoV-2 using reverse transcriptase (RT)-PCR is collecting the correct specimen from the patient at the right time.
- The viral yield is maximal during first few days after onset of illness onset, and detection becomes less likely after 10 days from symptoms onset.²³ The RT-PCR is useful for SARS-CoV-2 detection in the first week of illness for nasopharyngeal specimen and at weeks 2-3 for stool.²⁴
- Respiratory specimen must be collected from both upper and lower respiratory tract wherever feasible for higher detection (Table 4).

Collection of Specimen

The proper collection of specimens is a crucial step in the laboratory diagnosis of SARS-CoV-2. An inadequate specimen may lead to false-negative test results. Samples must be collected at the earliest once the patient is suspected as infected, regardless of the time since onset of symptoms. The specimen collection guidelines can

Table 4: Respiratory specimens²⁵

Respiratory specimens:

- Lower respiratory tract
 - Bronchoalveolar lavage, tracheal aspirate or secretions, and sputum
- Upper respiratory tract
 - Nasopharyngeal swab and oropharyngeal swab

follow recommendations by World Health Organization (WHO)²⁵ and Centre for Disease Control and Prevention (CDC).²⁶

- The sample vial should be properly labelled and patient under investigation (PUI) form should be filled before collection.
- Patient is seated or lying in a comfortable position on the bed.
- The procedure must be explained clearly to the patient to ensure cooperation.
- Staff for sample collection must be wearing recommended PPE.
- Specimen after collection should be transported immediately to the laboratory in the vial containing viral transport media (VTM).

Oropharyngeal Swab (OP) (e.g. Throat Swab)

Tell the patient to tilt the head back 70° and open his/her mouth. A sterile swab is rolled over both tonsillar pillars and posterior oropharynx without touching the tongue, teeth, and gums. After swabbing, immediately transport the stick into vial containing VTM.

Nasopharyngeal Swab

Take a new sterile swab. In order to obtain an nasopharyngeal (NP) swab specimen, tell the patient to tilt his/her head back at 70° and then insert the swab deep into the nasal cavity parallel (1–2 cm) to the palate until resistance is met at one of the turbinates. Patients may flinch during the process. Gently, rub and roll the swab for five times in either direction and hold the swab in place for few seconds to absorb secretions before removing.

Combined Swab

In case both NP and OP swabs are collected, they can be combined in a single vial for maximizing test sensitivity and limit use of resources.

Lower respiratory tract (LRT) samples are preferred and can be collected if they are readily available (e.g., in mechanically ventilated patients).

Sputum Collection

Sputum for testing is only recommended if patient is having a productive cough. Do not try to induce cough for sputum collection as it is high AGP. Educate the patient and take sputum specimen after a deep cough into sterile leak-proof container with VTM.

Bronchoalveolar Lavage, Tracheal Aspirate, Pleural Fluid, and Lung Biopsy

Fiberoptic bronchoscopy is high AGP and not recommended for routine specimen collection. In case of bronchoalveolar lavage is performed for any other reason then, collect specimen into a sterile leak-proof container with VTM.²

Sample Handling at Collection Site

- Vial/container should be clearly labeled with unique specimen ID.
- VTM containing samples should be wrapped into triple packaging and kept into a cool box immediately after collection (Fig. 2).
- Specimen should be immediately transported to laboratory after collection.
- If the specimens cannot be sent to the laboratory for processing, store specimens at 2–8°C for up to 72 hours after collection. They should be stored at or below –70°C in ultra-low freezer if further delay is anticipated (Table 5).
- Avoid repeated freezing and thawing of the specimen.

STAFF QUARANTINE AND ISOLATION ON EXPOSURE TO COVID-19 PATIENT

The primary mode of transmission in COVID-19 is close personal contact and droplets. Protection of HCWs is of paramount importance. The appropriate PPE use at all times is the most significant step to prevent nosocomial transmission among HCWs. The infections in HCWs is a serious threat to IPC, as one side it will reduce the vital workforce and may impair functioning, and on the other hand, there is risk of amplifying the outbreak in healthcare facility.

Management of Exposed Staff^{28–30}

- The HCWs who are exposed to COVID-19 should be managed as per the risk assessment (Table 6).
- The assessment of exposure and degree of risk involved in terms of exposure and its translation to infection is critical for appropriate management.
- The exposure risk can be assessed through systematic tools available from WHO, CDC, or Ministry of Health and Family Welfare (MOHFW).
- The purpose of risk assessment is to identify the degree of exposure and can be stratified into high and low risk (Table 6).
- Low-risk exposure continues to work with self-monitoring of symptoms.

Staff Quarantine High-risk Exposure

- Staff are immediately sent to quarantine for 7 days with the first day being the day of exposure.
- Staff should be trained for self-monitoring of symptoms consistent with COVID-19.
- As per ICMR guidance, all asymptomatic high-risk exposure should be tested after one week and immediately if symptomatic.³¹

Management of Symptomatic Exposure

- All symptomatic HCWs should immediately stop reporting to work and inform to head of the department (HOD).

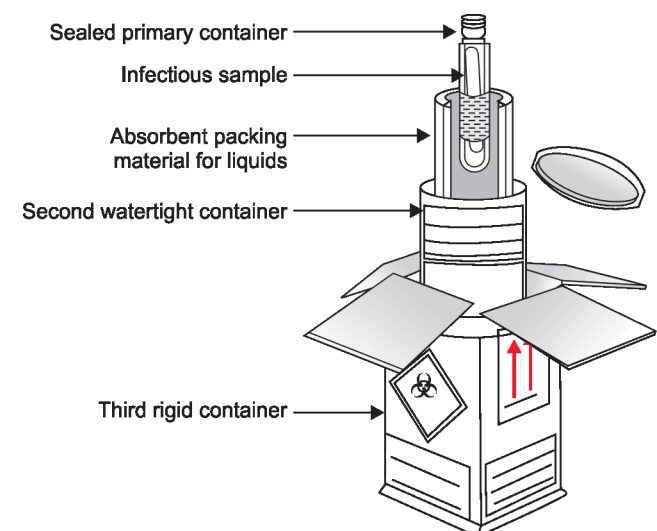


Fig. 2: Triple packaging of specimen (adapted from WHO)²⁷

Table 5: Specimen collection details proposed by the WHO²⁵

<i>Specimen type</i>	<i>Collection materials</i>	<i>Comment</i>
Nasopharyngeal or oropharyngeal swab	Dacron or polyester flocked swabs*	The nasopharyngeal and oropharyngeal swabs sticks are collected in same vial to increase viral load and to reduce wastage.
Bronchoalveolar lavage	Sterile container*	Saline used during lavage may cause dilution so aspirate during bronchoscopy should be collected in a separate sterile container. Lavage specimen then collected into second sterile container.
Tracheal aspirate	Sterile container*	–
Sputum	Sterile container*	Ensure the sputum is collected after deep cough to avoid mixing it with saliva.
Serum (2 samples—acute and convalescent)	Serum separator tubes (adults: collect 3–5 mL whole blood)	Collect paired samples: <ul style="list-style-type: none"> • Acute—first week of illness • Convalescent—2–3 weeks later

*For transport of samples for viral detection, use viral transport medium (VTM) containing antifungal and antibiotic supplements. Avoid repeated freezing and thawing of specimens. If VTM is not available sterile saline may be used instead (in which case, duration of sample storage at 2–8°C may be different from what is indicated above)

Table 6: Management of exposed healthcare workers as per risk stratification

<i>Risk assessment</i>	<i>Degree of exposure</i>	<i>Management of exposed staff</i>
High risk	Duration: Minimum patient exposure of 15 minutes is required. AND Close contact: (a) involved into patient care or came into contact for above time duration and within one meter of a confirmed COVID-19 case (b) Any unprotected exposure to secretions or any body fluids of suspected or confirmed COVID-19 case. PLUS HCW not wearing a facemask OR, NO eye protection if patient was not wearing facemask For an AGP: no exposure time limit is required if not wearing complete PPE as per recommendations (i.e., gown, gloves, eye protection, N95 mask or equivalent)	<ul style="list-style-type: none"> • Staff must quarantine and given rest from work for 14 days after the last exposure. • Staff must be trained for self-monitoring of symptoms consistent with COVID-19 • If develop any fever or any other symptoms then immediately contact HOD or infection control personnel of the hospital for clinical assessment and testing.
Low risk	All other exposures than those risk described above	<ul style="list-style-type: none"> • Continue to work • Continue to follow all infection control practices as per hospital policy. • Staff must be trained for self-monitoring of symptoms consistent with COVID-19 • Inform HOD and stop reporting to work if develop any symptoms. • Follow clinical assessment and testing as required.

AGP, aerosol generating procedure; HCW, healthcare worker; HOD, head of the department; PPE, personal protective equipment

- They can report to hospital COVID Nodal officer/HOD for clinical assessment, testing, and further management as per MOHFW guidelines.
- Those who tested negative for SARS-CoV-2 RT-PCR can be treated for their illness in non-COVID area as per the clinical diagnosis.
- Their return to work will be decided as per the clinical diagnosis and fit to work certificate from the treating doctor.

Return to Work Criteria of COVID-19 Healthcare Workers

The return to work for an HCW who has recovered from COVID-19 is based on the hospital policy and national guidelines. There are

two approaches that can be followed either based on symptoms or based on testing (Table 7).

The HCWs who are returning to work must report to HOD of ICU and infection control nurse (ICN) and advised on

- continue to wear appropriate PPE as per risk at workplace at all times.
- reinforcement of IPC practices, and
- self-monitor for symptoms consistent with COVID-19 and, seek immediate re-evaluation in case symptoms recur or worsen.

CONCLUSION

SARS-CoV-2 can transmit to HCWs in close contact. The spread of COVID-19 infection can occur at various stages in ICU like during

Table 7: Return to work criteria for healthcare workers who are tested positive

Symptoms	Symptom-based strategy	Test-based strategy
Present	Can join work if there is no fever for 3 days not taking any antipyretics. PLUS 10 days have been passed from day 1 of symptoms onset.	No fever without use of antipyretics AND Respiratory symptoms (like cough) have been resolved AND 2 Negative RT-PCR for SARS-CoV-2 taken at least 24 hours apart.
Asymptomatic	Can join work after 10 days starting from the day of positive RT-PCR SARS-CoV-2 test.	2 Negative RT-PCR for SARS-CoV-2 at least 24 hours apart.

RT-PCR, reverse transcriptase polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; HCW, healthcare worker

care of infected patient, doffing of PPE, and cross-infection among HCWs. Effective IPC is cornerstone for the delivery of safe, effective, and high-quality health care. Separate sets of infection control interventions are required to deal with different stages. Simple IPC practices such as hand hygiene and use of mask over nose and mouth are critical to prevent infection among HCWs.

DISCLAIMER

The data and facts expressed in this article are as per data available till date. Implementation of recommendations in this article has to be compliant to the regulatory authority of the region of the healthcare worker of that region. Publishers and authors of these papers cannot be held responsible for the implementation or outcome.

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