COVID-19 in children: Clinical approach and management

BACKGROUND

COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a major public health crisis threatening humanity at this point in time. The virus possibly originated in bats and was transmitted to humans through yet unknown intermediary animals in Wuhan, Hubei province, China in December 2019. As of 24th March, as per the WHO estimates, there are 375,498 confirmed cases and 16,362 deaths.

The disease is transmitted by inhalation or contact with infected droplets and the incubation period ranges from 2 to 14 d. The symptoms are usually fever, cough, sore throat, breathlessness, fatigue, malaise among others. The disease is mild in about 80% of the reported cases. In those with comorbidities (diabetes, hypertension, immunocompromised, malignancies in adults) and elderly the disease is often severe progressing to acute respiratory distress syndrome (ARDS) and multi organ dysfunction. The fatality rate is reportedly between 2-3% but can vary from 0.5-10% depending on the number tested, the percentage of elderly people in the population and availability of critical care support in the hospitals. So far, pediatric population does not seem to have severe disease commonly and the outcomes are excellent.

Diagnosis is by demonstration of the virus in respiratory specimen (nasal and posterior pharyngeal swab/ endotracheal secretions or BAL) by using specific RT-PCR. Common laboratory findings include normal/ low white cell counts with elevated C-reactive protein (CRP). X-ray and CT scan pictures in moderate to severe disease are suggestive of diffuse bilateral interstitial involvement of lungs.

The findings may be abnormal even in those with no symptoms or mild disease. Treatment is essentially supportive; role of antiviral agents is yet to be established. Prevention is the key and home isolation of suspected cases and those with mild illnesses. Strict infection control measures at hospitals that include contact and droplet precautions may help break the chain of transmission and protect healthcare professionals.

DEFINITIONS

The criteria for suspecting COVID are being periodically updated by the Govt. of India and ICMR.

When to suspect in children:

• All symptomatic* children who have undertaken international travel in the last 14 days

OR

• All hospitalized children with severe acute respiratory illness (fever AND cough and/or shortness of breath)

OR

• Asymptomatic direct and high-risk contacts of a confirmed case (should be tested once between day 5 and day 14 after contact)

Symptomatic refers to any of these: fever/cough/shortness of breath.

Direct and high-risk contacts include those who live in the same household with a confirmed case and HCP who examined a confirmed case.

Confirmed case

A person with **laboratory confirmation of COVID-19** infection, irrespective of clinical signs and symptoms.

CLINICAL FEATURES IN CHILDREN

Three case series reported 20, 34 and 9 children respectively from Zhejiang, Shenzan and from different provinces of China. In the case series of 34 children, none had an underlying disease, 65% had respiratory symptoms, 26% had mild disease and 9% were asymptomatic. Fever, rhinitis, cough, headache, diarrhoea, fatigue are common presenting symptoms. More than 80% children had an affected family member. Most children recover quickly but abnormalities on radiology can persist for months.

The largest series till date of 2143 patients reported **34% laboratory confirmed cases** and **66% suspected cases.** The median age was 7 years (2-13) and 1213 cases (57%) were boys. Over 90% were asymptomatic, mild or moderate cases. The median time from onset of illness to diagnoses was 2 days. The number of cases were high during the early stage of the epidemic and gradually declined after that.

In a series of more than 2000 children, the authors found that proportion of 'severe and critical' cases was 10.6%, 7.3%, 4.2%, 4.1% and 3.0% for the age group of <1, 1-5, 6-10, 11-15 and >15 years, respectively. Young children, particularly infants, were vulnerable to 2019-nCoV infection the authors observed. One interesting finding was there were more critical cases in the suspected than confirmed category. Whether they were caused by 2019-nCoV or other pathogens (RSV, H1N1could not be confirmed. There is paucity of data on COVID-19 in pregnancy and newborn. Available data suggest that in general the pregnancy and neonatal outcomes are good.

LABORATORY DIAGNOSIS

As per directive from MoHFW, Government of India, all suspected cases are to be reported to district and state surveillance officers. **The helpline number is 011-23978046**

Sample collection:

Preferred sample: Throat and nasal swab in viral transport media (VTM) and transported on ice

Alternate: BAL or endotracheal aspirate which has to be mixed with the viral transport medium and transported on ice

General guidelines:

- Samples of the patients will be tested for COVID-19 at Department of Microbiology AIIMS, New Delhi

- Trained health care professionals to wear appropriate PPE with latex free purple nitrile gloves while collecting the sample from the patient. Maintain proper infection control when collecting specimens
- Restrict entry to visitors or attendants during sample collection
- Complete the requisition form for each specimen submitted
- Proper disposal of all waste generated (yellow container)

Respiratory specimen collection methods:

A. Upper respiratory tract

Throat and nasal swab

1. Use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts.
2. Tilt patient's head back 70 degrees. While gently rotating the swab, insert swab less than one inch into nostril (until resistance is met at turbinates). Rotate the swab several times against nasal wall and repeat in other nostril using the same swab. Place tip of the swab into sterile viral transport media tube and cut off the applicator stick.
3. For throat swab, take a second dry polyester swab, insert into mouth, and swab the posterior pharynx and tonsillar areas (avoid the tongue); avoid touching the tongue, teeth, and gums. Place tip of swab into the same tube and cut off the applicator tip.

B. Lower respiratory tract

Bronchoalveolar lavage, endotracheal aspirate: Collect 2-3 mL into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container (can use a mucus trap).

INFECTION CONTROL:

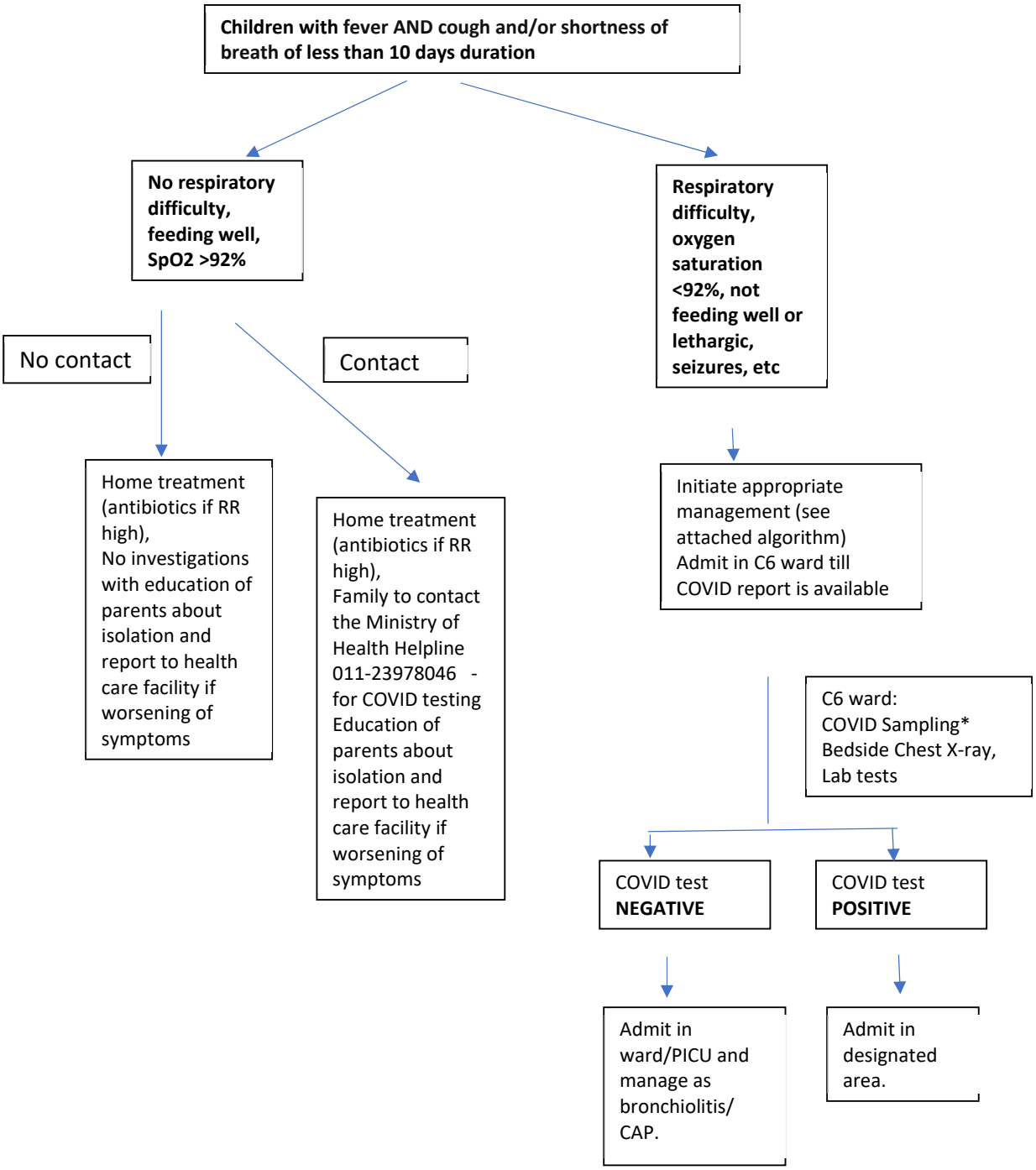
Please refer to the Appendix 1.

Patients suspected of having COVID-19 infection should be shifted to the isolation facility / designated COVID areas from the triage area as soon as possible. The HCP should be handling the patients after donning appropriate PPE according to their level of exposure as described in **Appendix 2**

MANAGEMENT

Figure 1 shows the clinical decision pathway for patients presenting with acute respiratory illness in OPD/ ER.

Figure 1: Approach to child with acute respiratory symptoms during COVID pandemic:



***Testing**
Respiratory sample: Nasopharyngeal swab, posterior-pharyngeal swab, endotracheal aspirate, or BAL.
Investigation: RT-PCR for COVID - 19

Lab investigations:
CXR suggestive of bronchiolitis (hyperinflation, no consolidation), OR lobar consolidation with lymphocyte counts >2500/mm^3: COVID less likely
CXR suggest interstitial shadows, ground glass opacities (GGO), reticulonodular shadows AND/ OR lymphocyte counts <2500/mm^3: COVID more likely
Based on these criteria, clinical teams may consider cohorting similar type of patients

modified as and when required.

Indications for hospital admission

The following criteria may be considered for admission (Any ONE of the following criteria):

1. Respiratory distress
2. SpO2 < 92% on room air
3. Shock/ poor peripheral perfusion
4. Not feeding well/ poor fluid intake, esp. in young children
5. Lethargic, esp. in young children
6. Seizures, esp. in young children

This is general guidance regarding which patients should be admitted. However, the final decision to admit is at the discretion of the treating pediatrician. For children with underlying conditions such as chronic organ dysfunction, immune suppression, immunocompromised conditions, congenital heart disease and infants, a lower threshold may be used when deciding about admission.

Investigations in admitted patients:

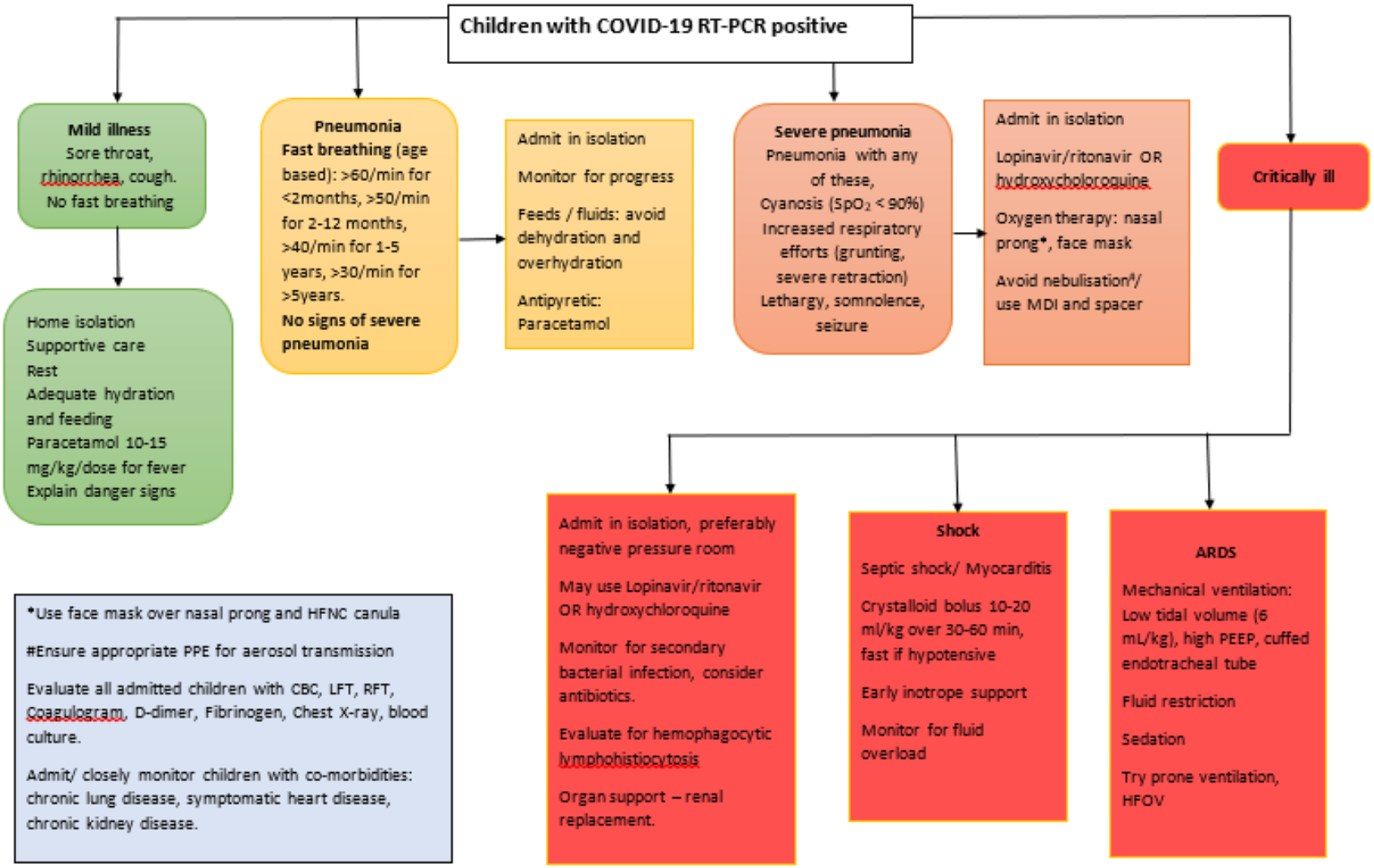
Chest X-ray: In children, chest X-rays and CT scans showed non-specific findings even in asymptomatic cases. **CXR** in COVID patients show interstitial shadows, ground glass opacities (GGO), reticulonodular shadows Chest x rays are not routinely recommended even if they are on oxygen. As it is important to isolate children and avoid movement, so **portable chest X-rays** will have to be done. Typical CT Chest findings reported in adults are bilateral and peripheral ground-glass and consolidative pulmonary opacities. With a longer time after the onset of symptoms, CT findings were more frequent, including consolidation, bilateral and peripheral disease, greater total lung involvement, linear opacities, "crazy-paving" pattern, and the "reverse halo" sign.

- Chest X-rays should be considered in children requiring oxygen on Day 3 of admission (suggesting disease progression or severe illness). This may suggest severe illness or early deterioration. These would be unusual disease progressions and may signify severe illness, or early deterioration.
- Children not admitted to HDU or ICU may require a chest X-ray if they have worsening hypoxemia, particularly if they have pre-existing conditions.

Other investigations include complete blood counts (there may be lymphopenia), serum chemistry to assess organ dysfunction in sick patients, arterial blood gases, especially in those who need mechanical ventilation.

Treatment: Approach to a child confirmed to be COVID-19 by RT-PCR or a suspected case in who COVID-19 virus test is inconclusive or a severely ill patient in who testing is not possible and who fits into the case definition is provided in **Figure 2.**

Figure 2: Summary of management of children with COVID-19



As per the protocol the management would be as follows-

Mild illness: These children have no respiratory difficulty, are feeding well, have SpO_2 >92%.

1. The treatment will be domiciliary.
2. Appropriate antibiotic may be prescribed if respiratory rate is high
3. Supportive care: control of fever using paracetamol (10- 15 mg/kg/ dose SOS/ q 4-6 hrly if required); avoid ibuprofen and other NSAIDs
4. Home isolation
5. Ensure adequate hydration.
6. Danger signs should be explained.

Duration of home isolation:

Afebrile for 72 hours AND at least 7 days after symptom onset

OR

2 negative samples 24 hours apart

Management of hospitalized cases

General Measures:

1. Oxygen supplementation to maintain SpO_2 > 94%
2. Conservative fluid management if there is no evidence of shock (restrict fluids to 80% if urine output is >1 mL/kg/hr)
3. Symptomatic treatment: paracetamol for fever (10- 15 mg/kg/ dose SOS/ q 4-6 hrly if required); **avoid ibuprofen and other NSAIDs**
4. Blood culture to be sent at time of admission before starting anti-microbials
5. Empirical antimicrobials (Ceftriaxone) within 1 hour of admission in case of sepsis;
6. Oseltamivir may be considered if influenza is a differential/ administer if test for influenza is positive
7. Other investigations to be sent at admission include CBC, LFT, KFT, ABG, Chest X-ray (portable) as well as any other investigations deemed necessary by the treating pediatrician (may include throat and nasal swabs for influenza)
8. Systemic corticosteroids are not recommended, unless indicated for any other reason
9. MDI preferred over nebulization to reduce risk of aerosolization
10. Close monitoring for worsening clinical status is of paramount importance

Oxygen therapy:

1. Low flow oxygen cannula
2. Heated humidified High flow nasal cannula (there is controversy for this modality as there may increased risk of aerosol formation)

A medical mask should be secured on face of the child receiving oxygen therapy, if the child tolerates.
Monitoring: Child should be monitored clinically- respiratory parameters including SpO2, hemodynamic parameters, sensorium, urine output.

Specific therapy:

NO SPECIFIC ANTIVIRALS have been proven to be effective as per currently available data. At this time point the drugs may be considered only for COVID-19 positive patients who have features of SARI needing hospitalization. Drugs that may be considered on the basis of registered trials in adults/in-vitro data include:

1. **Lopinavir/Ritonavir**: Suggested dose of LPV/r is10 mg/2.5 mg per kg BD for maximum 14 days; maximum dose is 400 mg/100 mg BD. Choose appropriate formulation to deliver the calculated dose [Syp LPV/r 80 mg/ 20 mg per mL; Tablet LPV/r 100 mg/ 25 mg; Tablet LPV/r 200 mg/ 50 mg].
2. **Hydroxychloroquine** 7- 8 mg/kg/dose BD for Day 1 and then Day 2 onwards, 7- 8 mg/kg once a day for 5 days; **Avoid with Azithromycin, can lead to arrhythmia**

- **These recommendations are based on a recent guidance issued by ICMR for adults. As the dosing studies are not yet available, the doses mentioned above have been extrapolated from the doses recommended for adults.**
- **Be aware about common side effects of HCQ including** headache, dizziness, ringing in your ears; nausea, vomiting, stomach pain; loss of appetite, weight loss; mood changes, feeling nervous or irritable; skin rash or itching; low heart rate, hypoglycaemia etc
- **Caution: DO NOT co-administer Lopinavir/ritonavir and Hydroxychloroquine** due to drug interaction which may cause increased Hydroxychloroquine levels and subsequent toxicity (e.g. QT prolongation, hypoglycemia).

Criteria for ICU admission:

- Requiring mechanical ventilation
- Shock requiring vasopressor support
- Worsening mental status
- Multi-organ dysfunction syndrome

Non-invasive ventilation:

While NIV is commonly considered for children with respiratory failure, in children with COVID-19, the use is currently discouraged because of risk of aerosol generation.

When to intubate:

- Excessive respiratory distress; child likely to tire out
- Child not maintaining saturation >90% on non-invasive oxygen supplementation
- $PaO_2/FiO_2 < 200$
- $PaO_2/FiO_2 < 300$ with hypotension requiring vasopressor support
- GCS < 8 with threatened airway
- Decision to intubate should be taken on a case by case basis based on the clinician's discretion

How to intubate:

- Pre-oxygenation with 100% FiO_2
- Try to avoid bag and mask ventilation (due to aerosol generation) but can be used if required by connecting an HME
- The most skilled member of the team should be identified at the beginning of each shift for performing intubations
- If difficult airway is anticipated critical care physician/anaesthesiologist to attempt intubation using video-laryngoscope
- Rapid sequence intubation to be done
- During induction, monitor for hemodynamic instability and use fluids and vasopressors if required
- Get X-ray chest to confirm correct position of tube
- After intubation, appropriate cleaning/disinfection of equipment and environment should be done

Management strategies for ARDS

The general principles of management of child with ARDS apply to a child with COVID-19 associated ARDS. The principles include lung protective ventilation: appropriate PEEP; low tidal volume ventilation. Children with refractory hypoxemia may benefit from ventilation in prone position.

Care of ventilated patient:

- Fresh, preferably disposable ventilator circuit to be used for every new patient; use an expiratory filter
- HME to be changed every 48 hours or when visibly soiled; use a viral filter in the expiratory circuit.
- Use closed suctioning technique and avoid routine suctioning
- Sedation and muscle relaxants may be used in difficult to ventilation patients

Special considerations during resuscitation

- Minimize the number of people inside the room during high aerosol generating events like cardiopulmonary resuscitation.

- One airway specialist, one nurse/doctor for chest compression and one nurse for administering medications are essential.
- Other assistants may remain outside the room and may enter only if necessary, after donning full PPE.
- Hand bagging needs to be avoided; if essential use an HME with the bag.

Septic shock:

- Recognize septic shock in children with any hypotension (systolic blood pressure [SBP] < 5th centile or > 2 SD below normal for age) or two or more of the following: altered mental state; bradycardia or tachycardia (Heart rate < 90/min or > 160/min in infants and < 70/min or >150/min in children); prolonged capillary refill (> 2 sec) or feeble pulses; tachypnea; mottled or cold skin or petechial or purpuric rash; increased lactate; oliguria; hyperthermia or hypothermia.
- Management should be as per Surviving Sepsis Campaign Guidelines

Supportive treatment in critically ill children:

- Head end elevation; avoid if child has poor perfusion/ shock
- Oral hygiene with antiseptic mouthwash
- Glycemic control to maintain blood glucose in range of 100- 180 mg/dl
- Foley's catheter for accurate urine output monitoring
- Ryle's tube for enteral feeds/ medications
- Central venous catheter
- Bedsore prevention by position change every 2 hours

Discharge Criteria: On resolution of symptoms

- ***Suspected case*** – if the laboratory results for COVID-19 are negative, discharge is to be decided as per discretion of the treating physician based on his provisional/confirmed diagnosis
- ***Confirmed case***– resolution of symptoms, radiological improvement with a documented virological clearance in 2 samples at least 24 hours apart. Transfer to HDU from PICU when off ventilator and needs minimum support and discharged when fulfils above criteria

INSTRUCTIONS FOR COVID POSITIVE MOTHERS WHO ARE BREASTFEEDING THEIR INFANTS

A COVID positive mother who is breastfeeding her infant should continue breastfeeding the infant if her medical condition permits; She should use a medical face mask secured appropriately.

ADVICE FOR PARENTS/ ADULTS WHO HAVE COVID-19 AND ARE STAYING AT HOME WITH A CHILD:

- The affected person should stay in a separate room
- The affected person should use a 3-ply mask
- Household members should stay in a different room and be separated from the person as much as possible
- Only an assigned family member should be tasked with taking care of the person and should help with groceries, prescriptions and other personal needs
- Avoid shaking the soiled linen or direct contact with skin
- Use disposable gloves when cleaning the surfaces or handling soiled linen
- Wash hands after removing gloves and before and after eating, drinking and using the washroom with soap and water (at least 20 seconds) or with alcohol-based hand sanitizer (at least 30 seconds)
- Toys that the child plays with should be washed frequently, wherever possible.
- **Currently, no prophylaxis is recommended for children. They should not be administered hydroxychloroquine.**

Environmental sanitation:

- Immediately remove and wash clothes and bedding that have blood, stool or other body fluids on them
- Clean and disinfect frequently touched surfaces in the quarantined person's room (e.g. bed frames, tables etc.) daily with Sodium Hypochlorite solution (1%) or ordinary bleach (5%)
- Clean and disinfect toilet surfaces daily with regular household bleach solution/phenolic disinfectants
- Wash laundry used by the person separately using common household detergent and dry thoroughly using the warmest temperatures recommended on the clothing label
- Place all used disposable gloves, masks and other contaminated waste in a lined container before disposing of them with other household waste and wash hands with soap and water/alcohol-based hand rub

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APPENDIX 1: INFECTION CONTROL GUIDELINES

In all PICU patients, irrespective of the COVID status, emphasis should be on following standard precautions and cleaning and disinfection routines diligently. These are highlight below.

Hand hygiene

i. HCP should perform hand hygiene using alcohol-based hand rub (minimum 20 seconds) or by washing with soap and water (minimum 40 seconds). If hands are visibly soiled, use soap and water for hand wash.

ii. Performed before and after using bathroom, before, during and after preparing food, before and after eating /drinking, after coughing, blowing or sneezing, after touching garbage, after touching mask or soiled PPE.

iii. Foot operated sanitizers should be put outside elevators, OPDs, screening areas, ICUs and wards.

Figure 3: Hand hygiene technique (WHO)

Mask etiquette

If masks are worn, appropriate use and disposal is essential to ensure they are effective and to avoid any increase in risk of transmission associated with the incorrect use and disposal of masks.

i. Place mask carefully to cover mouth and nose and tie securely to minimize any gaps between the face and the mask

ii. While in use, avoid touching the mask

iii. Remove the mask by using appropriate technique (i.e. do not touch the front but remove the lace from behind)

iv. After removal or whenever you inadvertently touch a used mask, clean hands by using an alcohol-based hand rub for 20 seconds or soap and water if visibly soiled for 40 seconds

v. Replace masks with a new clean, dry mask as soon as they become damp/humid

vi. Do not re-use single-use masks

vii. Discard single-use masks after each use and dispose-off them immediately upon removal

viii. For N95 respirators adequate fit check must be performed after wearing. CDC recommends the following hairstyles styles for male HCP suitable for wearing N-95 respirators

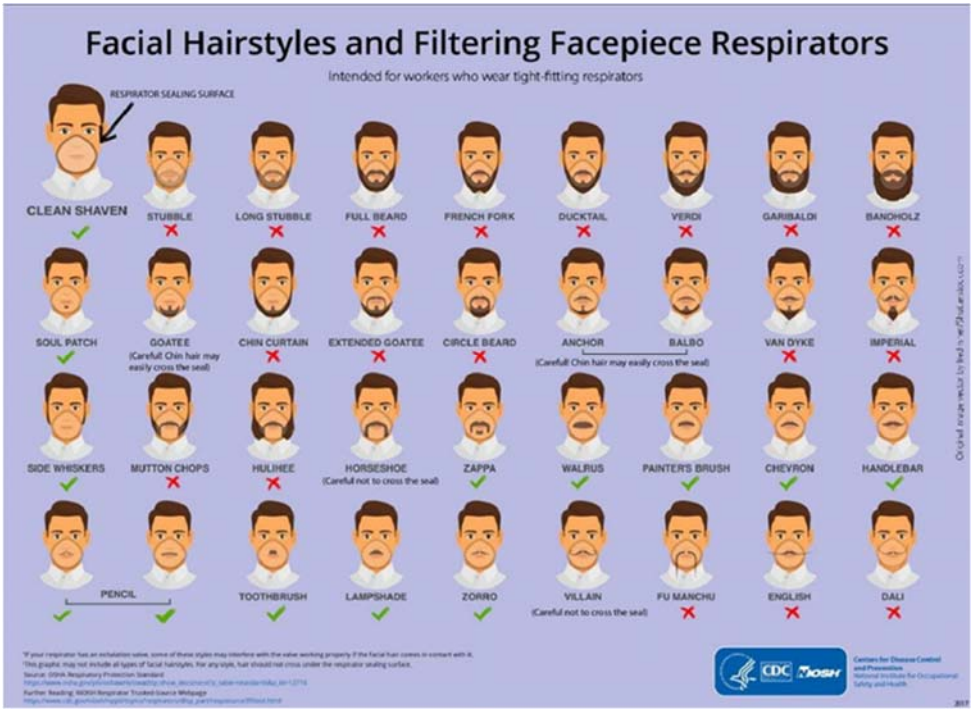

Figure 4: Facial hairstyles compatible with mask (CDC)

Steps of donning PPE (Steps may vary depending on the kit used)**:**

Donning of the PPE must be performed in designated area.

1. Remove home clothes, jewelry, watches, electronic etc. and wear clean hospital scrubs
2. Wash hands with soap and water
3. Wear shoe covers – tie lace in front of the shin
4. Wear first set of gloves – should be smaller than second pair, comfortable size, can be sterile or unsterile
5. Gown – wear a clean disposable non-permeable gown, arm sleeves of gown should cover the gloves at the wrists, tie the lace behind snuggly without wrapping all around the waist. Decontaminate the gown

if it becomes soiled. Remove gown only in designated doffing area and discard the gown (yellow bin) before leaving patient care area

7. Wear the N-95 respirator – cup the mask in hand, place the lower strap behind the neck passing below ears , then place the upper strap over back of head passing above ear. Check for snug fit of mask. There should be no more than minimal air leak from sides
8. Wear eye piece – adjust the strap according to required size, open the ports at upper end to prevent fogging while wearing, upper end N-95 mask should be covered by eye piece
9. Wear the hood – hood should lay over the gown without leaving any open space.
10. Wear 2nd pair of the gloves – should be of larger size than 1st pair, should cover free end of arms of gown. Change gloves if they become torn or heavily contaminated. Remove and discard gloves when leaving the patient room or care area, and immediately perform hand hygiene
11. Gown fitness check: Take help of companion for fitness check.

Steps of doffing PPE:

Doffing to be performed only in the designated area, check for any leak or soiling in PPE before doffing. If any, disinfect the area before doffing. Doffing room should have two chairs, one labelled "dirty" and the other "clean". All the PPE must be discarded in the yellow bin. Hand hygiene MUST be performed after every step.

1. Disinfect the hands wearing gloves by following hand hygiene procedure.
2. Remove shoe covers only by touching the outer surface, and perform hand hygiene.
3. Remove outer gloves and perform hand hygiene.
4. Remove hood and perform hand hygiene.
5. Remove gown slowly by holding the gown at the waist and pullling. Without touching the outer surface, remove with a rolling inside out technique. Perform hand hygiene again.
6. Remove eye piece by holding the straps, and perform hand hygiene.
7. Remove inner gloves and perform hand hygiene.
8. Wear another pair of sterile /unsterile gloves.
9. Remove mask – Do not touch exposed surface of mask. First remove lower strap of mask, remove mask holding upper strap in a slow and steady pace (as to not generate aerosols)
10. Perform hand hygiene
11. Sit over clean chair and clean your shoes with alcohol swabs
12. Remove last pair of gloves and perform hand hygiene

If any leak is found in PPE while caring for infected patients, caring HCPs should self-quarantine.

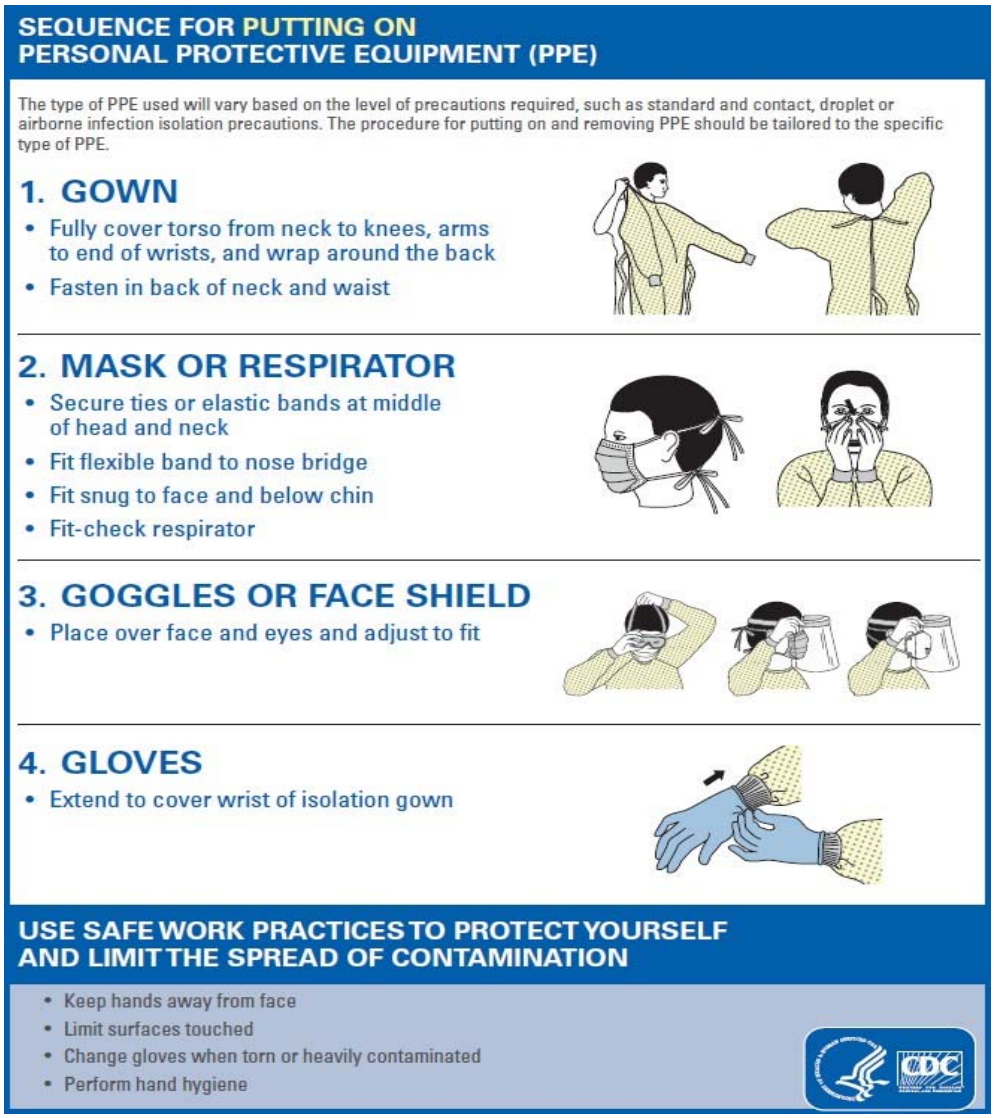

Figure 5: Sequence of donning PPE (CDC)

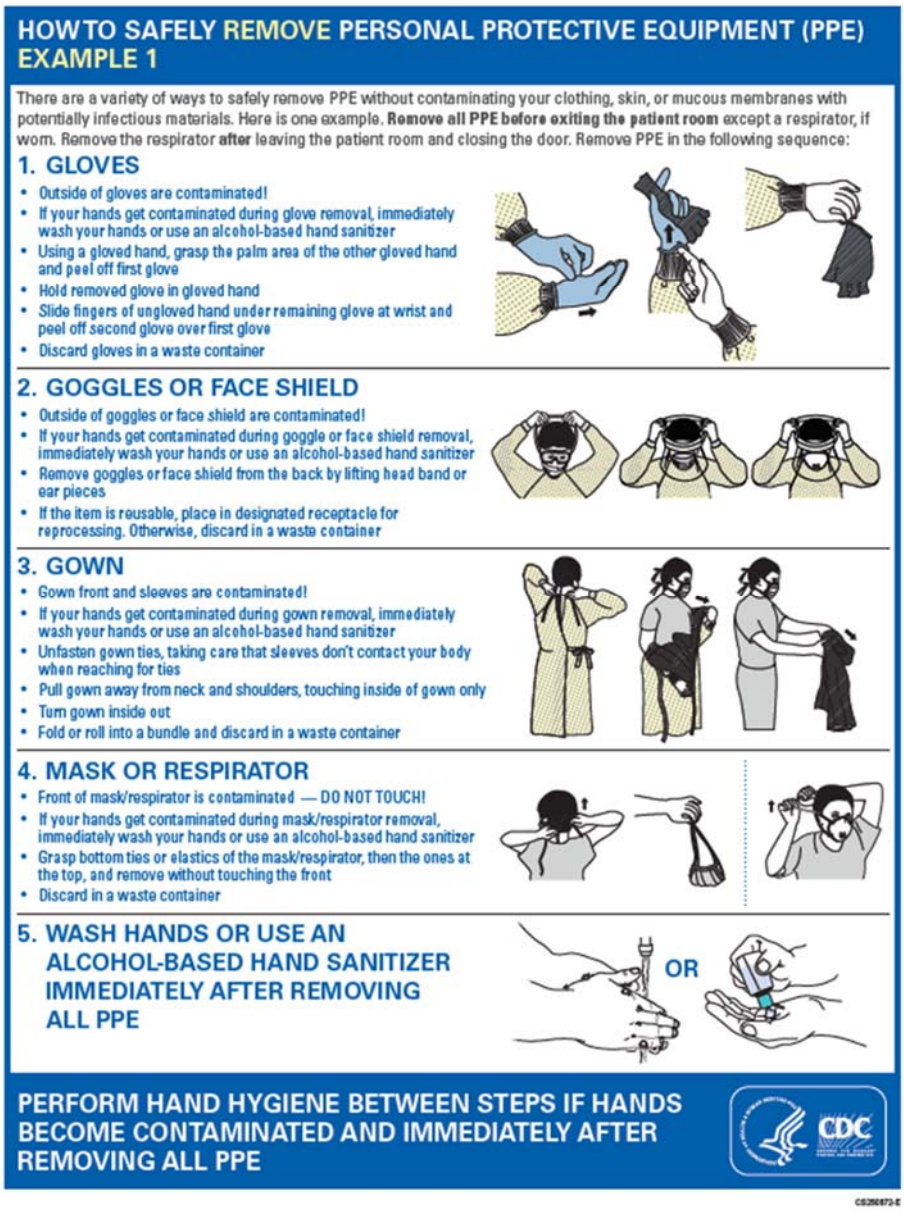

Figure 6: Sequence of doffing PPE (CDC)

Decontamination and waste management:

- Any surface or material known to be, or potentially be, contaminated by biological agents during laboratory operations must be correctly disinfected to control infectious risks.
- Proper processes for the identification and segregation of contaminated materials must be adopted before decontamination and/or disposal.
- Where decontamination cannot be performed in the laboratory area or onsite, the contaminated waste must be packaged in an approved (that is, leak proof) manner, for transfer to another facility with decontamination capacity.

- For details of effective disinfectants, please refer to standard guidelines.

Practices for environmental cleaning in healthcare facilities:

Environmental cleaning is part of standard precautions, which should be applied to all patients in all healthcare facilities. Ensure that cleaning and disinfection procedures are followed consistently and correctly.

Cleaning agents and disinfectants:

1. 1% Sodium Hypochlorite can be used as a disinfectant for cleaning and disinfection
2. The solution should be prepared fresh.
3. Leaving the solution for a contact time of at least 10 minutes is recommended.
4. Alcohol (e.g. isopropyl 70% or ethyl alcohol 70%) can be used to wipe down surfaces where the use of bleach is not suitable, e.g. metals.

PPE to wear while carrying out cleaning and disinfection works:

1. Wear heavy duty/disposable gloves, disposable long-sleeved gowns, eye goggles or a face shield, and a medical mask (please see the PPE document for details)
2. Avoid touching the nose and mouth (goggles may help as they will prevent hands from touching eyes)
3. Disposable gloves should be removed and discarded if they become soiled or damaged, and a new pair worn
4. All other disposable PPE should be removed and discarded after cleaning activities are completed. Eye goggles, if used, should be disinfected after each use, according to the manufacturer's instructions.
5. Hands should be washed with soap and water/alcohol-based hand rub immediately after each piece of PPE is removed, following completion of cleaning.

Cleaning guidelines:

1. Where possible, seal off areas where the confirmed case has visited, before carrying out cleaning and disinfection of the contaminated environmental surfaces. This is to prevent unsuspecting persons from being exposed to those surfaces
2. When cleaning areas where a confirmed case has been, cleaning staff should be attired in suitable PPE. Disposable gloves should be removed and discarded if they become soiled or damaged, and a new pair worn. All other disposable PPE should be removed and discarded, after cleaning activities are completed. Goggles, if used, should be disinfected after each use, according to

manufacturer's instructions. Hands should be washed with soap and water immediately after the PPE is removed.

3. Mop floor with routinely available disinfectant.
4. Wipe all frequently touched areas (e.g. lift buttons, hand rails, doorknobs, arm rests, tables, air/ light controls, keyboards, switches, etc.) and toilet surfaces with chemical disinfectants and allow to air dry. 1% sodium hypochlorite solution can be used. Alcohol can be used for surfaces, where the use of bleach is not suitable.
5. Clean toilets, including the toilet bowl and accessible surfaces in the toilet with disinfectant or 1% sodium hypochlorite solution.
6. Wipe down all accessible surfaces of walls as well as blinds with disinfectant or bleach solution.
7. Remove curtains/ fabrics/ quilts for washing, preferably using the hot water cycle. For hot-water laundry cycles, wash with detergent or disinfectant in water at 70ºC for at least 25 minutes.
8. Discard cleaning items made of cloth and absorbent materials, e.g. mop head and wiping cloths, into biohazard bags after cleaning and disinfecting each area. Wear a new pair of gloves and fasten the double-bagged biohazard bag with a cable tie.
9. Disinfect buckets by soaking in disinfectant or bleach solution, or rinse in hot water before filling.
10. Disinfectant or 1% sodium hypochlorite solution should be applied to surfaces using a damp cloth. They should not be applied to surfaces using a spray pack, as coverage is uncertain and spraying may promote the production of aerosols. The creation of aerosols caused by splashing liquid during cleaning should be avoided. A steady sweeping motion should be used when cleaning either floors or horizontal surfaces, to prevent the creation of aerosols or splashing. Cleaning methods that might aerosolize infectious material, such as the use of compressed air, must not be used.
11. Biohazard bags should be properly disposed-off, upon completion of the disinfection work.

Frequency of cleaning of surfaces:

1. High touch surfaces: Disinfection of high touch surfaces like (doorknobs, telephone, call bells, bedrails, stair rails, light switches, wall areas around the toilet) should be done every 3-4 hours.
2. Low-touch surfaces: For Low-touch surfaces (walls, mirrors, etc.) mopping should be done at least once daily.

Precautions to take after completing the clean-up and disinfection:

1. Staff should wash their hands with soap and water immediately after removing the PPE, and when cleaning and disinfection work is completed.
2. Discard all used PPE in a double-bagged biohazard bag (yellow), which should then be securely sealed and labelled.

The staff should be aware of the symptoms and should report to their occupational health service if they develop symptoms.

APPENDIX 2: GUIDANCE ON USE OF PPE BASED ON LEVEL OF EXPOSURE

Setting	Target personnel or patients	Activity	PPE
DESIGNATED COVID AREAS			
ICU	Healthcare workers (Doctor/Nurses/Technician)	Aerosol Generating procedures	N95 Goggles or Face shield Gown (Water resistant) Gloves (Double) Apron (optional) Shoe cover Hood
	Cleaner/Sweeper/HA	Disinfection	N95 Goggles Gown (Water resistant) Heavy Duty Gloves Boots Hood
Ward	Healthcare workers (Doctor/Nurses/Technician)	Non-Aerosol Generating Procedure	N95 Goggles Gown (Water resistant) Gloves (Double) Shoe cover Hood
	Cleaner/Sweeper/HA	Disinfection/Patient Shifting	N95 Heavy Duty Gloves/ Gloves (Patient shifting) Goggles Gown (Water resistant) Boots Hood
Screening (Burns and plastic surgery)	Healthcare workers (Doctor/Nurses)	Screening	N95 Goggles Gown (Water resistant) Gloves (Double)

	Healthcare workers (Doctor/Nurses)	Sampling	N95 Goggles Gown (Water resistant) Gloves (Double) Shoe cover Hood
	Cleaner/Sweeper/HA	Disinfection/Patient Shifting	Triple layer mask Gloves (Patient shifting) Heavy Duty Gloves
DESIGNATED SCREENING AREAS			
Screening (New RAK OPD)	Healthcare workers (Doctor/Nurses)	Screening	N95 Gloves (Single)
	Cleaner/Sweeper/HA	Disinfection	Triple layer mask Heavy Duty Gloves Boots
Screening (Emergency Medicine; Pediatrics OPD)	Healthcare workers (Doctor/Nurses)	Screening	N95 Goggles Gown [Surgical Linen (OT Gown)] use with an apron Gloves (Double)
	Cleaner/Sweeper/HA	Disinfection	Triple layer mask Heavy Duty Gloves
TRANSPORT of COVID SUSPECT/ CONFIRMED CASE IN AMBULANCE			
Ambulance (HCW travelling in patient compartment)	Healthcare workers (Doctor/Nurses)	Attending patient (Direct contact >15 min)	N95 Goggles Gown (Water resistant) Gloves (Double)
	Cleaner/Sweeper/HA	Disinfection	Triple layer mask Heavy Duty Gloves
	Driver	No Direct contact	Triple layer mask
NON-COVID AREA; MAIN HOSPITAL, CENTERS			
Emergency Medicine (New Emergency;	Healthcare workers (Doctor/Nurses/Technician)	Non-Aerosol generating procedure	Triple layer mask* Gown (In Red area only)

Pediatric Emergency; Surgical Emergency)		Resuscitation	Gloves (Double) *N95 **[Red area only]**
	Cleaner/Sweeper/HA	Disinfection/Patient Shifting	Triple layer mask Gloves (Patient Shifting) Heavy Duty Gloves
General OPD/EHS OPD	Healthcare workers (Doctor/Nurses)	Non-Aerosol generating procedure	Triple layer mask
	Cleaner/Sweeper/HA	Disinfection	Triple layer mask Heavy Duty Gloves
General Ward/Private Wards	Healthcare workers (Doctor/Nurses)	Non-Aerosol generating procedure	Triple layer mask
	Cleaner/Sweeper/HA	Disinfection/Patient Shifting	Triple layer mask Gloves (Patient Shifting) Heavy Duty Gloves
ICUs	Healthcare workers (Doctor/Nurses/Technician)	Aerosol Generating procedures in Non-COVID Area	Triple layer mask Cap Gown (Water resistant) Gloves Shoe cover
	Cleaner/Sweeper/HA	Disinfection/Patient Shifting	Triple layer mask Cap Gown (Water resistant) Gloves (Patient Shifting) Heavy Duty Gloves Boots
EHS Dispensary	Pharmacist	Drug Dispensing	Triple layer mask
Laboratory personnel	Doctor/Technician	Dealing with Respiratory samples	Triple layer mask Gown (Water resistant) Gloves Goggles
Radiodiagnosis	Doctor/Technician	Non-aerosol generating procedures	Triple layer mask
Administrative offices	All staff	No direct/indirect patient contact	No PPE
COVID Confirmed case/Suspect	Patient	For Droplet prevention	Triple layer mask

APPENDIX 3: PRECAUTIONS FOR HCWs CARING FOR COVID-19 PATIENTS

Precautions for residents/ staff caring for COVID-19 patients:

- To stay alone in separate rooms till 14 days after their duties in COVID-19 unit are over
- To avoid meeting friends, colleagues, working staff in hostel. In case of unavoidable circumstances use face mask while meeting them
- Do not travel outside or within country unless absolutely indicated (as per government notifications issued time to time)
- Food should be ordered from canteen to their room (Can order over phone)
- Hand sanitizer should be kept in room and as well as every wing in case of common bathroom
- Common bathroom to be cleaned twice daily
- Residents using common toilets can wipe seats after coming in body contact after each use
- Daily clothes used by the staff to be washed themselves and not to be given to laundry

General Precautions for HCW in non-COVID areas:

- To avoid crowded places such as malls, cinema hall, CME, conferences
- To avoid meeting with residents/ staff who are taking care of corona infected patients
- To defer any plans of travel especially home particularly areas from where COVID-19 cases have been reported
- Practice regular hand washing and hygiene measures with sanitizer, soap and water
- To report to hospital authority if any of their friends, hostel staff develop fever or other respiratory symptoms

APPENDIX 4: MANAGEMENT OF DEAD BODY

Packing and transport of the dead body of patients of potential concern to mortuary:

- Death due to COVID-19 is a non-medicolegal case.
- The deceased must be placed in a zipped body bag immediately after death with identification tag marked 'COVID-19'.
- Ensure that the body is fully sealed in an impermeable body bag before being removed from the isolation room or area, and before being transferred to the mortuary, to avoid leakage of body fluid.
- Transfer the body to the mortuary as soon as possible after death.
- Autopsy for medical/pathological/legal reasons must be avoided if there is no substantial reason.
- If an autopsy is being considered, the body may be kept in refrigeration in the mortuary and the autopsy conducted only when a safe environment is available in that mortuary.
- If body is to be held for less than 48 hours, storage at 6°C or below is appropriate. If longer-term storage is needed, this should be at temperatures of approximately 4°C. Carry out regular temperature checks of cold storage facilities to confirm that refrigeration units are working effectively.
- When properly packed in the body bag, the body can be safely removed for storage in the mortuary, sent to the crematorium, or placed in a coffin for burial.
- The vehicle used for transporting the body from hospital to mortuary or crematorium should be properly disinfected and decontaminated with 1% Sodium Hypochlorite.
- Ensure that mortuary staff and the burial team apply standard precautions (i.e. perform proper hand hygiene and use appropriate PPE, including long sleeved gown, gloves and facial protection if there is a risk of splashes from the patient's body fluids or secretions onto the body or face of the staff member).

If an autopsy is performed, collection of the following post-mortem specimens is recommended:

- Post-mortem clinical specimens for testing for SARS-CoV-2, the virus that causes COVID-19:
    i. Upper respiratory tract swabs: nasopharyngeal swab AND oropharyngeal swab
    ii. Lower respiratory tract swab: Lung swab from each lung
    iii. Separate clinical specimens for testing of other respiratory pathogens and other post-mortem testing as indicated
    iv. Formalin-fixed autopsy tissues from lung, upper airway, and other major organs

General guidance for workers / employee in mortuary:

- Mortuary and death care workers who have contact with human remains known or suspected to be contaminated must be protected from exposure to infected blood and body fluids, contaminated objects, or other contaminated environmental surfaces.

- The number of people allowed in the autopsy room should be limited.
- Use of an oscillating bone saw should be avoided for confirmed or suspected cases of COVID-19. Consider using hand shears as an alternative cutting tool. If an oscillating saw is used, attach a vacuum shroud to contain aerosols.
- After handing over the body of the deceased, the mortuary must be kept cleaned using 1% Sodium Hypochlorite. All the surfaces, instruments and transport trolleys should be properly disinfected with 1% Hypochlorite solution for a minimum period of 10 minutes.

PPE for handling dead bodies:

- Wear a disposable, long-sleeved, cuffed gown; if the outside of the body is visibly contaminated with body fluids, excretions, or secretions, ensure that this gown is waterproof. If no waterproof gown is available, wear a waterproof apron in addition to the gown.
- If splashing of body fluids is anticipated, use facial protection: preferably a face shield, or if not, goggles and a medical mask to protect the eyes and mucous membranes.
- Perform hand hygiene after taking off the PPE.
- Use PPE for heavy-duty tasks (e.g. rubber gloves, rubber apron and resistant closed shoes) in addition to regular PPE.

Personal protective equipment during autopsy:

- Engage a minimum number of staff in the procedure, and perform only if an adequately ventilated room suitable for the procedure is available;
- Scrub suit – tops and trousers, or equivalent garments;
- Single-use, fluid-resistant, long-sleeved gown;
- Surgical mask or certified N95, EU FFP2 or equivalent;
- Either autopsy gloves (cut-proof synthetic mesh gloves) or two pairs.
- Knee-high boots.
- Avoid splashes when removing, handling or washing organs, especially lung tissue and the intestines
- Clean surfaces that have become contaminated with tissues or body fluids and decontaminate by removing most of the tissue or body substance with absorbent materials; cleaning surfaces with water and detergent; applying the disinfectant standardized by the health-care facility – if sodium hypochlorite solution is used wet the surface with the solution and allow at least 10 minutes contact time; rinsing thoroughly.
- Remove PPE before leaving the autopsy suite and follow appropriate disposal requirements. After removing PPE, always perform good hand hygiene practices.

Waste disposal:

- All waste generated from the mortuary or embalming room is potentially infectious and should be dealt with as risk waste.
- Staff that generate risk waste have a duty of care to ensure that it is correctly segregated, sealed and stored and disposed of appropriately, through a licensed agent. Anything that has been contaminated by body fluids should be sealed as risk waste.
- Body fluids and other contaminated liquids may be discharged into the drainage system.
- Liquid products from the management of human remains should not be allowed to drain into surface water, and working sinks in the mortuary and embalming room should be connected to the sewerage system.
- Extreme care must be exercised during the use and disposal of sharps. The use of disposable blades and needles is recommended and should be disposed of by the person who uses them.

Once the COVID-19 patient succumbs expires, the medical professionals should hand over the body of the deceased to relatives and friends for last rites assuring that the there is no spread of the infection preferably in a fluid proof coffin. The methodology to be adopted to make sure that no spread of infection to people who are dealing with the dead body are enlisted below:

- Handling staff should be appropriately dressed in PPE i.e. gloves, water resistant gown/ plastic apron over water repellent gown, and surgical mask. Use goggles or face shield to protect eyes, if there may be splashes.
- All tubes, drains and catheters attached to the dead body should be removed before handing over to the relatives.
- Wound drainage and needle puncture holes should be disinfected, surgically closed and dressed with impermeable material. Secretions in oral and nasal orifices can be cleared by gentle suction if needed.
- Oral, nasal and rectal orifices of the dead body have to be plugged to prevent leakage of body fluids.
- Before packing the dead body, it should be cleaned and disinfected using sterilizing agent based on 70% alcohol or 1% Sodium Hypochlorite.
- Transfer the body to mortuary at the earliest with body covered in a robust, leak proof zipped transparent plastic body bag which is locked properly using nylon cable zip ties to avoid spillage of any fluids. The plastic body bag should not be less than 150 μm thick.
- The bagged body should be either wrapped with a mortuary sheet or placed in an opaque body bag.
- The body bag packing should again be disinfected using sterilizing agent.
- Embalming of such bodies should be avoided.
- Relatives are allowed to view the deceased one last time before last rites after followed standard precautionary measures and unzipping the face end of the body bag.
- For the purpose of last rites, cremation should be preferred for complete elimination of chances of infection in either electric or gas crematorium in situ in zipped body bag. However keeping in mind the religious views of the family, if the burial of the body is requested, then it should be assured that the body is buried

in a thick, air tight coffin and placed at normal depth of burial (4 to 6 feet). It is recommended that the area above and adjacent to the grave should be cemented immediately as an additional precautionary measure and the space should be marked and required precautions should be taken to avoid scavenging by animals.

- As a precautionary measure large gathering at the crematorium/ burial ground should be avoided to maintain a healthy distancing.
- The remains of the last rites like ashes do not pose any risk of infection and can be collected for religious immersion.
- Remove personal protective equipment after handling of the dead body. Then, perform hand hygiene immediately.