

PROJECTED DYNAMICS OF COVID-19 TRANSMISSION

(Prepared by: Dr. K B Sood, MBBS, DHA, Hospital Consultant, Creator of Hospital Care Systems)

(COVID-19 is a disease, caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a Novel Coronavirus, which emerged in the city of Wuhan, Hubei, China, in early December 2019 and which is transmitted as a Droplet Infection and has spread worldwide as a pandemic. Genetic sequencing of the virus suggests that SARS-CoV-2 is a betacoronavirus closely linked to the SARS virus.)

NOUS has made the following projections for Human to Human transmission of COVID-19 to assist in preparation of control strategies for a possible outbreak, in a given population under normal living circumstances, in a large urban settlement.

The projections shall assist in stockpiling Hospital Beds, requisite Medical and Allied Staff and requisite Medical and allied Equipment. This stockpile shall be used when the pandemic peaks in a given Geographical location. The projections shall assist in use of available resources including Hospital Beds with or without re-modelling, Laboratories and Ambulances and in creation of additional new resources in that order. The projections shall assist in allocating available resources for handling the Pandemic Workload and for continuing to provide the existing Essential Healthcare services.

(Essential Healthcare services include; General OPDs, Routine Immunisations, Emergency Department Services, Hospital Care (IPD) of non-communicable Diseases, Birthing Services, Neonatal Care, Imaging & Diagnostic Laboratory Services, Blood Bank Services, etc.)

The projections have been made for a reasonably large, close knit, population (10 – 20 – 30 million – population of Delhi), of standard age-structure, which is susceptible (No-immunity), and has been exposed to the Virus.

Two age groups have been considered, individuals up to age 70 years and individuals aged 70 and older.

Environmental Factors Assumed:

- Temperature: 16 Degree C (minimum) – 28 Degree C (maximum)
- Average Relative Humidity: 45% – 60%
- Average Precipitation: Not more than 3%

It has been done to provide some insights for a structured model for Triage and Treatment Facility for COVID-19 Pandemic related to projected severity of the disease. It should assist in determining Levels of Isolation and Levels of Critical Care to be provided for different risk groups of General population, when they are Hospitalised.

Interventions, like social distancing (Non-pharmaceutical physical distancing) influence these projections significantly, but no specific data is available to determine these factors and their effect on viral shedding, so these have not been considered. These factors will be established by proper controlled population serology studies, and when available, these may correlated with symptoms and be used to modify the projections.

ALWAYS REMEMBER THAT

- It is wise to err on the side of caution to contain the outbreak during pandemics
- Temporary Healthcare Facilities must remain temporary
- Pandemic Preparedness Stockpiles, of essential Medical Equipment & Supplies, based on assessment of the risk versus consequence, is an Essential Asset for any country and is a key component of any pandemic preparedness plan. It must be carried out as part of National Health Policy,
- Pandemic Preparedness Plan is an amalgamation of medical epidemiology with logistics and supply chain management.

DECISION MATRIX

The projections will assist in formulation of a decision matrix for clinical care, as under.

- 1 Scale of testing Facilities to screen all “at-risk individuals”
- 2 Provision of Infection Control Units at different levels in Healthcare Delivery Structure
- 3 Provision of different levels of quarantine for different levels of risk exposures
- 4 Development of pre-hospital care, patient transportation, and Hospitalisation plans
- 5 Provision of different levels of Hospital Care including Intermediate Care, High Dependency (HD) Care, Intensive Care (ICU), Airborne Infection Isolation Room (AIIR) (Negative Pressure Room) Care, Protected Environment (PE) (Positive Pressure or Reverse Isolation) Room Care, or Biocontainment Patient Care Units (BPCU) for Staff Isolation.
- 6 To record and archive various Healthcare Parameters, Screening Parameters, Quarantine Parameters, Epidemiological Parameters, Outcome Parameters, in a structured format for a detailed analysis at a later date.
- 7 It will provide support to the Physician and the Administration to decide Travel Restrictions, Quarantine, Isolation, or Hospitalisation for individuals exposed to significant risk of disease and later to remove the individuals from Quarantine, Isolation or Hospitalisation to return to Home Care and Observation.

QUARANTINE

Quarantine is a well-known and well-practiced ancient tool, a collective action for the common good, used to prevent the spread of disease. Till recent times, it is generally applied for 40 days in times of epidemics and for varying periods in other times, it is recommended by the practitioners of Medicine and enforced by Police under the authority of a State. When properly practiced as a Public Health Tool, it is a highly effective tool in preventing the spread of contagious disease, especially when prophylactic treatment is not possible.

The practice of Quarantine is defined by USA Centre for Disease Control and Prevention (CDC) as “separation of a person or group of people reasonably believed to have been exposed to a communicable disease but not yet symptomatic, from others who have not been so exposed, to prevent the possible spread of the Communicable Disease”.

People are put in Quarantine when they are not currently sick but have been or assumed to have been exposed to a communicable disease. Quarantine restricts liberty of movement of persons which helps to stop the spread of the disease.

Decision to Quarantine, for all cases other than Voluntary Quarantine or Self-quarantine, shall always be based on a detailed screening process including result of testing.

Quarantine need not be absolute to be effective. Even a partial or “leaky” quarantine, such as occurs with voluntary compliance, will reduce the transmission of disease.

Following three types of Quarantines have been established, based on past epidemic experiences and on the Principle of Progressive Patient Care. Its practice not only contains the spread of disease but also contains the Social and Healthcare costs of containment to the society.

1 Well Persons Quarantine

(Also called Home Quarantine, Self-Quarantine or Voluntary Quarantine)

- 1.1 It is for persons with significant individual or community exposure but no symptoms.
- 1.2 It is practiced at defined Quarantine Stations or at Home.
- 1.3 Its duration is determined by the estimated incubation period of the disease.
- 1.4 It requires some daily contact or surveillance to seek out persons with symptoms.
- 1.5 No medical supervision is provided.

2 Sick Persons Quarantine

- 2.1 It is for persons with significant individual or community exposure, and who have developed mild symptoms, and who do not require Hospitalisation.
- 2.2 It is always practiced at defined Quarantine Stations, away from Home and away from Well Persons Quarantine stations.
- 2.3 Barrier Nursing is always practiced. It includes Hand Hygiene and deployment of proper waste management materials and waste disposal.
- 2.4 Its duration is determined by repeated testing for disease till the person tests negative for pre-determined (generally 2 Days) time and the person is considered non-infective.
- 2.5 It requires daily health check-up of the persons to monitor the health status, and when required, carry out Hospitalisation.
- 2.6 Medical Supervision of Primary Care Level is required and is provided by Nurse Practitioners with a Physician on call.

3 Isolation Quarantine In Hospital

- 3.1 It is for persons with significant individual or community exposure, and who have developed significant symptoms, requiring supervised Isolation and/or Hospitalisation.
- 3.2 Isolation and Hospitalisation, enables focused delivery of specialized Healthcare to persons, commensurating with their Health Status, and at the same time, it protects Healthy People in family and society from getting sick.
- 3.3 It is always practiced at Hospitals, away from Home and away from Well Persons Quarantine stations and Sick Persons Quarantine stations. Ideally, it should be practiced in Infectious diseases Hospitals, when available or in Specially designated and improvised wards in an existing Hospital.
- 3.4 High Level Barrier Nursing, with Healthcare Staff wearing proper Personal Protective Equipment (as prescribed by WHO) is practiced for safety of Healthcare Providers.
- 3.5 In addition to Hand Hygiene and deployment of proper waste management materials and waste disposal, it requires Isolation of Ventilation and Air handling Systems, Isolation of Medical Gas Pipelines Systems, incorporation of HEPA filters in all Suction devices, Disinfection of all liquid Waste from the ward and disinfection of all solid waste leaving the ward..

- 3.6 Its duration is determined by repeated testing for disease till the person tests negative for pre-determined (generally 5 Days) time and the person is considered non-infective and the Health Status is suitable to downgrade the level of Healthcare.
- 3.7 For diseases other than the infective disease, whether pre-existing or developed as a result of suffering from the contagious disease, when the person becomes non-infective, and after completing Isolation Quarantine, the person can be treated at home or in other wards of the Hospital.
- 3.8 When in Isolation Quarantine, Medical Supervision of Secondary Care or Tertiary Care Level is provided by an Internist with all super-specialist available on call. It may provide Class One Intensive Care with more than one organ function support.
- 3.9 Airborne Infection Isolation Room (AIIR) (Negative Pressure Room) Care, Protected Environment (PE) (Positive Pressure or Reverse Isolation) Room Care, or Biocontainment Patient Care Units (BPCU) for Staff Isolation may be deployed.
- 3.10 It may be enforced by Central or State or Local authorities including the Chief Medical Officer of the region, to compel isolation of very sick persons to protect the public, in times of an epidemic.



ESTIMATED HUMAN TO HUMAN TRANSMISSION DYNAMICS

- 1 It is a purely theoretical exercise as no validated data is available.
- 2 Rate of Infection after exposure has not been determined, therefore incidence rate in General Population is not known. It has been estimated that SARS-CoV-2 is highly infective.

(Incidence Rate reported for Influenza, during major epidemics worldwide, in un-protected population is as high as 50%)
- 3 When extensive testing of populace is done, a probable figure must be derived to cater for upgradation of the Infrastructure to handle the pandemic.
- 4 Viral shedding from the Respiratory Tract is the most common form of transmission of SARS-CoV-2. Prolonged Shedding Period in COVID-19 Survivors has been attributed as the main cause for Pandemic.

5 Assumptions

- 5.1 Total Population Size Considered: 25 Million, No variation during study period
- 5.2 Place Considered: State of Delhi in India
- 5.3 Time Period: One (1) Year
- 5.4 Start Time: 01 February 2020
- 5.5 Effect of Classical demographic changes in the population like births, deaths, and ageing has not been considered
- 5.6 Age Categories:
 - 5.6.1 Category 1 Persons up to age 70 years
 - 5.6.2 Category 2 Persons aged 70 years and older
 - 5.6.3 Children and Adults are equally transmissible
- 5.7 Since it is a new virus, all population has been assumed to be susceptible.
- 5.8 Disease Progression
 - 5.8.1 A Uniform Standard Rate (R1) will be assumed for Population in Age Category 1 for acquiring the disease when they are exposed to infectious persons or when they come in contact with an infected person
 - 5.8.2 A double of Uniform Standard Rate (R2) will be assumed for Population in Age Category 2 for acquiring the disease when they are exposed to infectious persons or when they come in contact with an infected person

5.8.3 When applying these dynamics, a higher rate (R3) may be applied to Susceptible Individuals in Age Category 2. Susceptible Individuals include persons with a pre-existing disease like Diabetes, Hypertension, Coronary Artery Disease, Cancer, etc.

- 6 The Estimated Rates as presented are based on probability of an event and represent averaged median.
- 7 A closed but interactive sample, with a stable mixing pattern has been considered. Impact of different interventions aimed at reducing social mixing has been considered and listed, separately.
- 8 Incubation Period has been averaged to +/- 10%
- 9 Duration of Infectiousness has been averaged to +/- 10%
- 10 Modes of Transmission
 - 10.1 Respiratory droplets (>5-10 µm in diameter)
 - 10.2 Direct close contact (within 1 m)
 - 10.3 Indirect contact through fomites in the immediate environment of the infected person
 - 10.4 Airborne Transmission has not been reported so far but is possible, when aerosols are generated, especially during medical diagnostic or therapeutic procedures like nebulisation, ventilation, Nursing care, etc.
 - 10.5 Faecal-oral transmission has not been reported so far.
 - 10.6 Food has not been shown to be infective so far. However, symptomatic patients with febrile illnesses of any sort should not handle or prepare food for others. Hot foods, freshly cooked foods should preferred.
- 11 Routes of Transmission in Human Body
 - 11.1 Mucosa (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets.

12 Estimated Rates (WHO and other sources)

12.1	Incubation Period (the time from infection to appearance of symptoms)	Average 10 days (7 -14 days)
12.2	Duration of Infectiousness	Average 5 days (3 - 7 days)
12.3	Most Susceptible Age Group	Category 2: Persons aged 70 years and older, especially those with co-morbid disease.
12.4	The Reproductive Number – the number of secondary infections generated from one infected individual	Reported: 2 and 2.5
12.5	%age of infections which require Sick Person Quarantine	15% of Total Infected 40% of these will have mild disease Rest 60% may require Oxygen therapy for Respiratory Distress
12.6	%age of infections which require Isolation & Hospitalisation Quarantine They generally are older persons, > 70 years They generally have these complications in the stated order: Acute Respiratory Disease Syndrome (ARDS), Sepsis and Septic Shock, Multiorgan Failure, Acute Kidney Injury and Cardiac Injury	5% of Total Infected Most Common Diagnosis at admission is Pneumonia They require ICU/HDU care, Ventilator Support, Dialysis Support, etc. They have higher SOFA ¹ Score at time of admission Dual infections with other respiratory viral and bacterial infections have been found in COVID-19 patients
12.7	The crude mortality ratio (the number of reported deaths divided by the number of reported infected cases)	Between 3 - 4% 2% - 3 % of these have co-morbid diseases.
12.8	Case-fatality Ratio in confirmed cases	4.8% Median age of deaths 76 years: 81% over 60 years. (Wuhan) Co-morbidities associated with mortality Diabetes, COPD (smokers) and Hypertension
12.9	Average Viral Shedding Duration in Laboratory Positive Cases	20 days (17 – 24 days) Maximum recorded in this pandemic 37 days

¹ The Sequential Organ Failure Assessment (SOFA) Score. It is a mortality prediction score that is based on the degree of dysfunction of six organ systems of the Human Body. SOFA Score range 0-24, Diagnostic SOFA Score: increase in the organ-related SOFA score of ≥ 2 points.

EFFECT OF INTERVENTION

<p>1 Impact of physical interventions (e.g., screening at ports of entry, isolation, Well Person Quarantine, Social Distancing, Barriers, Personal Protection [wearing masks, gloves, and gown], Hand Hygiene - Hand washing more than 10 times daily with soap and water or use Hand Sanitiser) used for the interruption of, or reduction in the spread of, respiratory viruses on exposure rate in General Population in the community</p>	<p>67% reduction in positive cases (Reported for Wuhan)</p> <p>55% - 91% reduction in positive cases, related to number of physical interventions practiced, to interrupt transmission of SARS)</p>
<p>2 Impact of High-Level Barrier Nursing (wearing Mouth masks, thick mouth masks (>12 layers of cloths), one-off paper mouth mask, N95 respirator/mask wearing eye mask, protection for mucosa of nose and eyes, shoes, gloves, barrier gown, gloves, rinsing out mouth, bathing, fresh clothes before going home, avoiding eating or smoking in ward, hand washing and disinfection, nose clamps, taking Oseltamivir orally (Preventive), on Healthcare Workers caring for COVID-19 patients.</p>	<p>85% reduction in risk</p> <p>Always wearing a surgical N95 respirator/mask, (class II devices regulated by the FDA, under 21 CFR 878.4040, and CDC NIOSH under 42 CFR, Part 84) is strongly protective and provides:</p> <p>70% reduction in risk.</p>

Reduction in incidence rate assumed to be 86% with intervention
(Median of 55 – 91)

ESTIMATED WORKLOAD WITHOUT INTERVENTIONS

1 Total Population Considered	25,000,000 persons
2 Probable Rate of Exposure	10 persons per 100,000
3 Probable Rate of Infection (confirmed cases)	9,386 persons per 100,000
4 Estimated workload in General Population without Interventions who have been exposed and will require Home Quarantine for 10 - 28 days	2,346,500 persons ((25,000,000 /100,000)* 9386)
5 Estimated workload in General Population without Interventions who will test positive and will require Sick Person Quarantine for (5+2) = 7 to 14 days	351,975 persons (2,346,500*15%)

6	Estimated workload in General Population without Interventions who will require Isolation & Hospitalisation Quarantine	117,325 persons (2,346,500*5%)
7	Estimated workload in General Population without Interventions who will require Isolation & Hospitalisation Quarantine in ICU @ 16% of Total cases	18,772 persons (117,325*16%)
8	Estimated workload in General Population without Interventions who will require Isolation & Hospitalisation Quarantine in BPCU @ 10% of Total ICU cases	1877 persons (18,772*10%) Of these 16% may require Dialysis for Acute Kidney Failure

ESTIMATED WORKLOAD WITH INTERVENTIONS

1	Total Population Considered	25,000,000 persons
2	Probable Rate of Exposure	10 persons per 100,000
3	Probable Rate of Infection (confirmed cases)	9,386 persons per 100,000
4	Recommended rate of Testing for COVID-19 as General Population screening	5000 persons per million in Catchment Area
5	Recommended rate of Testing for COVID-19 as screening of Contacts in Contact Tracing	100% Requires a BSL 3 Environment and a RT PCR
6	Recommended rate of Testing for Symptomatic Healthcare Workers (including emergency services and non-clinical staff) in designated COVID-19 Treatment and Emergency Centres	100% For non-symptomatic Healthcare Workers, follow Govt Policy
7	Estimated workload in General Population with Interventions who have been exposed and will require Home Quarantine for 10 - 28 days	328,510 persons (2,346,500 - 2,346,500*86%)

8	Estimated workload in General Population with Interventions who will test positive and will require Sick Person Quarantine for (5+2) = 7 to 14 days	49,277 persons (328,510*15%)
9	Estimated workload in General Population with Interventions who will require Isolation & Hospitalisation Quarantine	16,426 persons (328,510*5%)
10	Estimated workload in General Population with Interventions who will require Isolation & Hospitalisation Quarantine in ICU @ 16% of Total cases	2,628 persons (16,426*16%)
11	Estimated workload in General Population without Interventions who will require Isolation & Hospitalisation Quarantine in BPCU @ 10% of Total ICU cases	262 (2,628*10%) Of these 16% may require Dialysis for Acute Kidney Failure

COMMUNITY & HEALTHCARE FACILITIES FOR EFFECTIVE PATIENT MANAGEMENT

- 1 Make available brief profile of all Health Facilities in Catchment Area (Conduct a functional mapping of Health Facilities, if required), including those in Public, Private, Military and other Healthcare Systems.
- 2 Establish a stores Procurement Centre.
- 3 Establish a fast response, HIT based, patient handling system including deaths and disposal of dead bodies and brought in dead cases.
- 4 **Establish Community COVID-19 Emergency Service Centres (COVID ESC) for 24x7 working**
 - 4.1 These will minimise the impact of the epidemic on existing Healthcare infrastructure and Social Service System.
 - 4.2 COVID ESC Functions
 - 4.2.1 Triage
 - 4.2.2 Testing
 - 4.2.3 Targeted Referrals
 - 4.2.4 Patient Transport

Centralised Services

- 4.2.5 Community Communications & Education
- 4.2.6 Training and retraining of Volunteers and Temporary (Surge) Staff
- 4.2.7 Stockpiling Service for Medical and Surgical Stores and Allied Service Stores
- 4.2.8 Surge Staff Payment Service
- 4.2.9 Case Surveillance
- 4.2.10 Contact Tracing of Case
- 4.2.11 Building Sanitising Services for buildings in community
- 4.2.12 Call Centre
- 4.3 COVID ESC Location
 - 4.3.1 In case of incidence of less 25 confirmed cases per day: Suitable location in its catchment area, in Emergency department of existing Healthcare System, Hospital or Dispensary
 - 4.3.2 In case of incidence of over 25 cases per day: Suitable location for access by 20,000 persons in its catchment area, outside existing Healthcare System (COM COVID ESC)
 - 4.3.3 COM COVID ESC should be accessible in less than 60 minutes by all residents in its catchment area.
- 4.4 COM COVID ESC facilities
 - 4.4.1 Unidirectional Movement within the Centre
 - 4.4.2 Screening & Triage
 - 4.4.3 Rapid Testing, Waiting
 - 4.4.4 Evacuation to Hospital ED (Targeted Referrals)
 - 4.4.5 Provision of Medical Supervision by Nurse Practitioner or Resident Medical Officer.
 - 4.4.6 Minimum 2 Patient Transport Ambulances and Minimum 1 Basic Life Support Ambulance
 - 4.4.7 Access to Minimum 1 Advanced Life Support Ambulance
 - 4.4.8 Pantry
 - 4.4.9 Office, Store, Break Room, Toilet, Janitor Room
 - 4.4.10 Optional: COVID-19 Follow up OPD

5 Establish Sample Collection Centre for Ambulatory Persons

- 5.1 Since recommended rate is 5000 Persons to be tested per million of persons in the Catchment area, it requires a facility where the Healthcare Worker – Lab Technician is not infected.
- 5.2 Provide Polycarbonate Shielded cabins for technician and also for sample collection chair, completely isolated from each other. Provide a Glovebox for manipulation. The patient cubicle will be sanitised after each use. The sampling rate is one test every 10 minutes.
- 5.3 At minimum, respiratory material is collected. For serology, Blood Sample is collected. The Sample tube surface must be sanitised before it is sent to main Laboratory.
- 5.4 Establish One (1) Sample Collection Centre for Ambulatory Persons per COM COVID ESC or One (1) Sample Collection Centre for Ambulatory Persons outside ED in every Hospital where COVID-19 patients will be treated.

6 Establish COVID-19 Treatment Centre (COVID TC) for 24x7 working

6.1 COVID TC in Existing Healthcare Services

- 6.1.1 Designate a defined floor or a building block in an Existing Hospital to provide all needed services commensurating with an infectious disease Hospital.
- 6.1.2 Preferable choice is Emergency Ward, if available, as it has facilities for Critical Care.
- 6.1.3 Number of Beds to be provided:
 - 6.1.3.1 Ten (10) beds for intermediate care (Sick Person Quarantine), average, per COVID-19 case admitted per day.
 - 6.1.3.2 Two (02) beds for intensive care average, per COVID-19 case admitted per day.
 - 6.1.3.3 One (01) bed in Biocontainment Patient Care Units (BPCU) average, per COVID-19 case admitted per day.

6.2 COVID TC in Temporary Newly Created Healthcare Service Facility

- 6.2.1 This provides faster response to COVID-19 Emergencies and overall better outcome for Healthcare Services. It also helps to limit exposure to Healthcare Staff.

- 6.2.2 Their establishment must result in isolation of administrative and supply traffic to insulate the established Healthcare System from COVID-19 infection exposure. Special care must be taken for all air exhausts from COVID TC. Deploy as many Virus Burn Out Units as possible.
- 6.2.3 Provide limited Auxiliary services, such as basic Diagnostic Imaging, Laboratory Services, and Blood Bank Services to begin with and augment these related to workload.
- 6.2.4 Provide Trolley Telecom Units for audio-video conferencing for cross consultations.
- 6.2.5 Provide dedicated Mobile Bedside Dialysis Facility
- 6.2.6 Provide Sluice Machines (Automatic Bedpan Washers)
- 6.2.7 This is done to allow all essential Healthcare Services to remain operative.
- 6.2.8 This COVID TC can operate with reduced Medical staff in two shifts.
- 6.2.9 The staff, if tests negative, can relieve regular service staff by rotation.
- 6.2.10 Number of Beds to be provided:
 - 6.2.10.1 Ten (10) beds for intermediate care (Sick Person Quarantine), average, per COVID-19 case admitted per day.
 - 6.2.10.2 One (01) bed for intensive care average, per COVID-19 case admitted per day.
 - 6.2.10.3 One (01) bed in Biocontainment Patient Care Units (BPCU) average, per COVID-19 case admitted per day.
 - 6.2.10.4 Provide minimum 18 SQM per bed
- 6.2.11 Air Handling
 - 6.2.11.1 Patient treatment area is kept at negative pressure by deploying calibrated airflow, which prevents contaminated air from flowing into adjacent areas. The air flows from “clean” to “dirty,” entering at the ceiling, near the patient bed’s foot end and exiting at the room’s most infectious point, just above the floor at the head of the patient bed.
 - 6.2.11.2 Requires 2 Fresh ACH and minimum 12 Total ACH.

6.2.12 Finishes

- 6.2.12.1 Minimum C/C Interbed distance shall be 3000 mm, preferable 3400 mm
- 6.2.12.2 Walls are provided antimicrobial sealant and paint.
- 6.2.12.3 Floors are Hospital grade PVC
- 6.2.12.4 Optional: Sanitise able, sealable, sub-ceilings to be provided
- 6.2.12.5 All Medical and allied Equipment in the room is on wheels.
- 6.2.12.6 Provide, subitizable hard partitions (not curtains) between two patient beds and between Patient rooms and Nursing Station
- 6.2.12.7 Use Wi-Fi for intra unit communication
- 6.2.12.8 Optionally, a BSL cabinet may be provided for Stat Lab Work at Nursing station.

6.2.13 Staff Movement

- 6.2.13.1 Unidirectional: clean to dirty; Access controlled; CCTV monitored
- 6.2.13.2 Staff Enters clean changing room, leaves all personal items in pass-through lockers, enters the Entry Vestibule, scrubs and dons PPE and then enters the unit.
- 6.2.13.3 Staff exits the unit via a pass-through decontamination air shower (or wet shower), enter exit room, access to the opposite side of the same pass-through lockers used when entering, leave.

6.2.14 Patient Movement

- 6.2.14.1 Unidirectional: clean to dirty; Access controlled; CCTV monitored
- 6.2.14.2 Patient enters the Trolley Change Area, then a pass-through decontamination air shower for decontamination, then enters BPCU.
- 6.2.14.3 Patient leaves through a separate exit (not used for staff or material), with or without a decontamination air shower for decontamination (must for immunocompromised patients).

6.2.15 Material Movement IN

- 6.2.15.1 Objective is to minimised Bio-particle count on surface
- 6.2.15.2 All Medical & Surgical supplies material must have GMP certification; 3 Layer packaging system to be followed; All food must be suitable covered in cling film or foil.
- 6.2.15.3 Wherever possible, materials must have undergone 48 hours storage, surface sanitisation and transported in closed trollies
- 6.2.15.4 All material and deliveries enter the unit via a secure, double inter-locked, airtight doors at the primary entrance. If required change the trollies.
- 6.2.15.5 Optional: a decontamination air shower for decontamination
- 6.2.15.6 Move to Clean Utility Room (Negative Pressure) of the unit. Make patient specific trollies here which go to patient care areas.

6.2.16 Waste Handling

- 6.2.16.1 All used or partially used goods, supplies and swill moves to Dirty utility room (Negative Pressure) of the unit.
- 6.2.16.2 All trollies are emptied, cleaned, dried using Hot air and then moved to clean utility rooms.
- 6.2.16.3 All lab samples will leave the unit after surface disinfection (to prevent infection of the main labs) using a pass-through autoclave, a specimen “dunk tank”, & passthrough, etc. as appropriate
- 6.2.16.4 All other soiled materials, linens, swill, supplies, wash waters, liquid waste, etc., leave the unit through a pass-through high-pressure steam autoclave.
- 6.2.16.5 All soiled waste items, swill, supplies, which are non-autoclavable shall be suitably cold sterilised and then put in boxes and hauled away to be incinerated or exit through a separate exit with a sanitisation service to Hospital’s sluice room.

6.2.17 Patient Comfort

- 6.2.17.1 Provide Circadian rhythm stimulating Light Controls

6.2.17.2 Provide fixed video phones for observation, to communicate with family and for remote monitoring

6.2.17.3 Provide speech activated Nurse Call systems

7 Establish a solid waste (including swill) handling unit with crusher cum compactor and Steam Steriliser at every COVID TC and COM COVID ESC.

8 Establish a Body Storage Mortuary(ies) for COVID-19, 24x7 working

8.1 Each COVID-19 Mortuary will have 0.05 Body Storage Drawer per COVID-19 case admitted per day.

8.2 Each COVID-19 Mortuary will have one Body identification platform.

8.3 As per Government Policy, consider obtaining and preserving autopsy material including lung tissue.

9 Water Treatment

9.1 Conventional, centralized water treatment methods that use filtration and disinfection, and chlorination, inactivate the SARS-CoV-2 virus and are adequate.

9.2 Disinfection with Ultraviolet (UV) light and other oxidant disinfection processes are also effective to inactivate SARS-CoV-2 virus.

10 Sanitation and Plumbing

10.1 In managing infectious disease, provision of separate Toilet is preferred.

10.2 All toilets in COVID TC and COM COVID ESC should have minimum 6 ACH to prevent any droplet cross infection. Evaluate use of Virus Burn Out Unit in Toilet Exhaust Air.

10.3 The toilet should be flushed with the lid down to prevent droplet splatter and aerosol clouds. It may require changing all WC seats.

10.4 Toilet facilities for patients and Staff must be separated.

10.5 All toilets in COVID TC and COM COVID ESC should be cleaned and disinfected at least thrice daily by a trained cleaner wearing PPE.

10.6 Carryout Sanitisation of Toilet Enclosure Twice a day.

10.7 Standard STP treatment is adequate for decontamination of Sewage.

10.8 Janitor Sink disinfection using Hot Air is considered adequate to inactivate SARS-CoV-2 virus.

- 10.9 A 10% lime slurry added at 1-part lime slurry per 10 parts of waste is adequate for treating any accidental spills.
- 10.10 Sodium Hypochlorite at 0.5% (equivalent to 5000 ppm) is adequate for disinfecting and sanitising surfaces.
- 10.11 All domestic solid waste shall be disinfected using 0.5% Sodium Hypochlorite, before final disposal.
- 10.12 All biomedical waste shall be treated as per Biomedical waste handling and disposal Rules.

CRITICAL ITEMS LIST FOR MANAGING COVID-19 PANDEMIC

- 1 Diagnostic Equipment
 - 1.1 Cartridges for RT-PCR Automatic Systems
 - 1.2 Chlorine Tablets
 - 1.3 Extraction Kit
 - 1.4 Hand Drying Tissues
 - 1.5 Lab Confirmation Test Kit
 - 1.6 Lab Screening Test Kit
 - 1.7 RT-PCR Kit
 - 1.8 Sharps Container Boxes
 - 1.9 Swab and Viral Transport Medium
 - 1.10 Triple packaging boxes for transport
- 2 Personal Protective Equipment
 - 2.1 Alcohol-based Hand Rub (Hand Sanitiser)
 - 2.2 Face Shield
 - 2.3 Gloves, Examination, non-sterile
 - 2.4 Gloves, Examination, Sterile
 - 2.5 Gloves, Surgical
 - 2.6 Goggles, Protective
 - 2.7 Gown, Protective
 - 2.8 Mask, Particulate Respirator, grade N95 or higher
 - 2.9 Mask, Surgical
 - 2.10 Scrub Suites

3 Clinical Care Equipment

- 3.1 CPAP, with tubing and patient interfaces for adult and paediatric cases
- 3.2 High-flow Nasal Cannula
- 3.3 Infusion giving set
- 3.4 Infusion Pumps
- 3.5 Medical Oxygen, Flowmeters, Humidifiers
- 3.6 Mobile X-ray Units
- 3.7 Nasal Oxygen Cannula
- 3.8 Oxygen Concentrator
- 3.9 Oxygen Masks
- 3.10 Pulse Oximeter
- 3.11 Suction Pump, Electrical or Mechanical
- 3.12 Syringe Pumps
- 3.13 Ventilator Patient, for adult, paediatric with accessories.
- 3.14 Venturi Masks



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