COMPENDIUM OF NORMS FOR

DESIGNING QUARANTINE FACILITY
between 10-40 beds in Response to Covid-19
This document is prepared by People in Centre and MHT in partnership with SELCO Foundation under the project “Sustainable Housing Programme”.

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India has been adversely affected by the global pandemic Covid-19. The country has over 3.77 million reported cases of Covid-19 as of September 2, 2020, with more than 2.5 million recoveries and about 61 thousand fatalities. The number continues to increase drastically with each passing day. Reports from MoHFW (Ministry of Health and Family welfare) state that Gujarat has recorded around 1 million coronavirus cases and is one of the highest infected states with a daily increase of 1 thousand cases; Ahmedabad emerged as the most affected - hotspot city with more than 30 thousand cases. The Case Fatality Rate (CFR) is 3.4 %, substantially higher than the national average of 2 % CFR. As the Covid-19 positive cases are increasing at an alarming rate in Gujarat, the State Public Health System and the ULBs are vigorously planning to expand their health infrastructure such as quarantine spaces and shelters at a large scale, especially in cities and districts (Raja, 2020). The government resources and mechanisms both are working hard to cope up with the increasing needs for various healthcare facilities to respond to the pandemic, but there is a dire need to strengthen the community demands and fill the gap in health care facilities.

The recent trends of Covid-19 spread suggests that the infection rates are increasing in smaller centres and villages, which continues to be a major concern. Hence, it is important to prepare smaller towns and semi-urban areas to respond to the needs for quarantine, as most population does not have such facilities at home. These facilities may be required to be of small scale, but large in numbers so as to cater to the needs of rural, semi urban and peri-urban areas.

Mahila Housing Trust (MHT) strongly felt a need to respond to this challenging situation by developing a quarantine facility in Ahmedabad district. In the course of initial discussions, it was realised that since the pandemic situation is relatively new, there are limited resource materials available related to design and construction aspects of Covid-19 quarantine facilities. Most of the existing references are scattered among the guidelines and other documents focusing on medical aspects or procedures of infection prevention and control protocols. Hence, there is no single source of information available while designing such facility. It is felt very timely to provide interpretation of these medical requirements into architectural and spatial terms to help architects and construction project implementers in designing such facility.

These norms are developed by compiling various guidelines and other documents. The personal experiences of medical staff as well as patients facing Covid-19 were also incorporated to understand the requirements. It is hoped that it will be a useful resource not just for designers and construction project implementers but also for administrators who are involved in setting up quarantine facilities for semi-urban or rural areas.
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Bibliography

Acknowledgements
In responding to the pandemic situation, treatment facility for patients with severe infections and the patient care facilities take priority. However, quarantine is an important aspect that helps limit the spread of Covid-19. Due to the recent emergence of the disease, there is nascent knowledge and limited reference regarding spread of Covid-19 and limiting it. In this regards, development of norms for designing quarantine facility is an important step in accumulating knowledge for fight against the pandemic.

According to WHO, the asymptomatic individuals with the potential of developing the COVID-19 symptoms are referred to quarantine and are isolated for 14 to 21 days for symptoms monitoring and test for the Corona virus. Medical care is not required at this stage and persons that develop symptoms are usually admitted to Covid-19 care facilities or hospitals based on the severity of the symptoms and necessary treatment.

Although the home is usually the preferred setting for quarantine, alternative sites for quarantine are necessary usually for the households with lack of spare rooms or separate toilets, such as in the slums and squatter settlements. The risk among such population is highest due to the issues related to density, living conditions, limited access to basic health infrastructure and services, as well as informality/uncertainty in employment. Targeted outreach to these groups in the form of community-based quarantine facility is important to mitigate the impact of Covid-19 infection and spread. At the same time, if proper care is not taken, the spread of the disease can accelerate in such facility since the infected as well as non-infected persons are in the same space for long period.

Many cities have established large scale quarantine centres to cater to their needs, but smaller scale facilities are required for semi-urban, peri-urban and rural areas where the next stage of Corona virus infection is expected to spread.

However, there are no comprehensive reference documents or guidelines available for designing such facility with reference to spatial and infrastructure requirements. Within the available references, infection control and prevention protocols are widely discussed from medical care perspective. However, very little relevant material was found that discussed experience of being in isolation and their needs. The perspective of the quarantine persons would provide important feedback into designing a user-friendly facility that is physically as well mentally accommodative, comfortable and friendly, if not homely.

This compendium of design norms is an effort to put together various hints and observations found from available resources as well as by directly interacting with the recovered patients and healthcare professionals in taking design decisions for quarantine facility of appropriate scale. It is understood that the need for consulting a qualified medical officer cannot be stressed enough, some of the requirements require spatial interpretations for the designers.
According to MoHFW (Ministry of Health and Family Welfare), at State level, a minimum of 50 bed isolation/quarantine ward should be established. At District level, a minimum of 10 bed isolation/quarantine ward should be established. The present design norms are developed considering capacity of between 10 and 40 beds or persons. Hence these norms will help the designers and persons involved with implementation of establishing such quarantine centres at district centres, other urban, semi-urban or peri-urban areas where such facility may be required.

It is also expected that the pandemic situation will ease over time with progress in understanding the disease and developments in medical field for prevention and cure. Hence such facilities would require to be reconfigured to adapt to a different function. The norms encourage the designers or decision makers to deliberate on the further use of the facility developed responding to the pandemic for its next probable use and design accordingly.
1. LEARNINGS FROM EXISTING DOCUMENTS AND INTERVIEWS

To understand the spatio functional requirements for quarantine facility, published documents and existing guidelines were studied. The national and international guidelines provided overview of medical procedures, infection prevention and control norms as well as defined basic functions for quarantine facility. Other documents and guides also provided overview of medical requirements as well as design plan options for quarantine and patient care facilities. However, it was felt that focusing only on medical requirement perspective often falls short of understanding the user needs. The medical staff spends considerable time in the facility and the quarantined persons spend a week to two weeks' time away from their home and family, in isolation. Their perspective regarding the needs, spatio functional requirements and built environment must be considered an important aspect of the design. Their perspective was represented through individual interviews and formed an important part of the learning that helped in developing these design norms. Learnings from both existing documents as well as personal interviews are discussed below.

1.1 STUDY OF EXISTING DOCUMENTS

Several existing guidelines are available that discuss infection prevention, patient care and maintenance aspects for health facilities. Yet, specific references for Covid-19 are fewer. The Covid-19 related guidelines are often modified frequently to include latest research and understanding. Guidelines published by World Health Organisation (WHO) are practical and applicable to several regions and context around the world and accepted as standard reference for Covid-19 related care and treatment. Specific to Indian context, National Centre for Disease Control (NCDC) has developed guidelines for the Ministry of Health and Family Welfare (MoHFW) discussing various aspects of containing Covid-19 infection. These national and international guidelines provided understanding and clarity regarding health-care and medical facilities as well as helped define basic functions and spaces for quarantine facilities. However, design specific references in existing guidelines were limited. Some further documents developed by credible institutes helped identify spatio-functional requirements and architectural programme for responding to Covid-19. These documents discussed capacity, functions and facilities for patient care and some design aspects including materials and construction.

- The WHO guidelines for *Considerations for quarantine of individuals in the context of containment for coronavirus disease (Covid-19)* explains quarantine and isolation, its usefulness and target group. It further discusses the measures required before implementing quarantine to reduce panic, improve compliance and effectively managing the quarantine. It provides infection prevention and control (IPC) recommendations that stresses upon early recognition and controls, administrative controls and environmental controls. Hence, the document provides ideas to ensure appropriate setting for quarantining facility. However, it does not discuss the spatial and functional requirements for quarantine facility.

- The third revision of WHO guidelines on Infection Prevention Control Titled *Infection prevention and control during health care when corona virus disease*
(Covid-19) is suspected or confirmed proposes control and prevention of Covid-19 by strategic recommendations, detailed standard procedures and systematic approach for hygiene of the patients, workers. Screening and triage is one important recommendation. Prevention of transmission at quarantine stage becomes very important as the infection spread can be limited through quarantine. Identifying symptoms, rapid testing and reminders through signs are strategies suggested. It further suggests the administrative controls at all the stages of clinical procedures from specimen collection to surgical procedures and dead body management for controlling the disease. It also provides insights into technical aspect like systems for ventilation and its relevance. It also discusses spatial separation and physical barriers such as glass and plastic panels etc. to reduce exposure in screening or triage areas, registration desk, or the pharmacy window. Also, importance of cleaning and disinfection of surfaces as critical strategy for disease control is discussed.

- Guidelines for Quarantine Facilities by ICMR (Indian Council of Medical Research) discusses the basic functions, space requirements and medical care procedures to be considered while setting up quarantine facility. It covers patient care areas and supporting functions like nursing, laboratory, common spaces, other staff facilities and essential service requirements like medical supply and equipment, food supply, laundry service and biomedical waste disposal services. Further, entry and exit procedures, human resource deployment, etc. are also discussed. It provides framework for risk assessment and helps in efficient layout design. However, the document seems to be taking references from past examples of works, some of these seem not much relevant for Indian context, like reference to provision of heating. Hence, its observations necessitate it to be cross-verified with subject expert and medical professionals for its proposed standards.

- Guidelines for Setting up Isolation Facility by NCDC focuses on establishing Covid-19 specific isolation facility at existing state or district level hospital or healthcare centre. It provides checklists to assess the healthcare centre’s preparedness to upgrade existing infrastructure covering topics such as desired accesses, triage, IPC practices, essential services such as sanitation, BMWM etc. It also discusses the detailed functional requirements in a patient’s ward like entry/exit, spaces for the HCW, ventilation, waste disposal, maintenance of hygiene in the premises, patient’s medical/personal equipment, storage requirements, signages etc. This information has helped to identify the functions and spatial requirements.

- Guidelines for Developing COVID Care Centres (CCC) and Dedicated COVID Health Centres (DCHC) in Resource-deficient Contexts by IIHS focus on execution of CCC and DCHC based on retrofitting model of existing buildings. It provides insights into shortlisting potential sites, schematic functional diagrams, detailed layouts for different typologies, and recommendations on selection of material, construction system and decentralized options for water and sanitation. The guidelines focus on three key aspects; reducing the spread of infection by managing the flow of the patients, efficient options with limited resources and enabling expandability through modular construction.

- Sustainable Energy driven and Climate Responsive Infrastructure for ISOLATION & THERAPEUTIC units for COVID19 by SELCO divides the infrastructure requirements for
isolation into 4 categories based on the patient condition. 1. **Asymptomatic, Quarantine space** - Individuals with the potential of developing symptoms related to Covid19 or being carriers of the virus. 2. **Asymptomatic / Mild, Isolation space** - Tested Covid19 positive cases with no symptoms or mild symptoms, such as fever and Fatigue. 3. **Moderate, Basictherapeutic care** - Patients with fever and breathlessness and/or mild Pneumonia. 4. **Severe, ICU** - Patients with fever, breathlessness and severe Pneumonia. It provides details about building infrastructure and energy infrastructure for each of the category. The focus is on building materials, construction technologies and cost. It also provides detailed listing of energy infrastructure for all typologies.

### 1.2 Needs Assessment From Health Care Professionals and Recovered Patients

The health care professionals interviewed were actively involved in the treatment of Covid-19 and some were engaged in setting up the Covid-19 care facilities at various locations. Their interviews provided insights into the medical requirements, health facilities, procedures, equipment, infrastructure apart from common practices and precautions for infection control while dealing with Covid-19. The doctors and especially the nursing staff stay with the patients for longer hours. Interviews with nursing staff helped understand everyday requirement and challenges faced by them. Interviews with patients were conducted with an aim to understand their personal experiences in care facility and incorporate their feedback in the design norms.

#### 1.2.1 Perspective of the Health Care Professionals

The main observations from interactions with healthcare professionals are summed up below.

- There are various tests for Covid-19 and accuracy of testing methods for confirming the infection varies:
  - RT-PCR (Reverse transcription polymerase chain reaction) technique: result comes in 3 days. Only ICMR accredited labs can conduct these tests. Generally known as swab test, this is always confirmatory.
  - True-net test: result comes within 8 hours to one day. This test can be conducted in a small lab with an efficient lab technician.
  - Rapid Antigen test (RAT): test result comes within 15 minutes. It is cheaper compared to other tests and can be carried out in a small lab with an efficient lab technician.
  - Antibody test: not very reliable, hence not preferred by medical professionals.

- The patient categorisation is the first step towards deciding the path of treatment.
  - Asymptomatic persons who came in contact with positive persons should be quarantined.
  - Symptomatic but not tested (and not confirmed) patients require isolation.
  - Positive persons with mild symptoms require isolation.
  - Positive persons with moderate symptoms may require semi ICU facility.
  - Severely infected positive persons will require ICU facility
• A small-scale quarantine facility with capacity of 10 to 40 beds may not require testing laboratory. Alternatively, it is important to tie up with an existing ICMR approved laboratory which shall conduct tests as required.
• Back up oxygen supply and full-time availability of ambulances in a quarantine facility to handle any emergency is non-negotiable.
• Wash basin/ sink is frequently used and hence should be provided in sufficient numbers and should be easy to access to people.
• Health care workers and service staff are vulnerable. Therefore, following IPC norms is very important.
• The practical aspects and common procedures followed in existing facilities regarding sanitisation and infection control including disinfection process for everyday medical equipment such as BP machine, oximeter, thermometer etc. were also discussed.
• Medical professionals had mixed view regarding interactions among quarantined persons. All of them accepted person’s need for social interaction, they stressed upon the importance of maintaining physical distance. In consideration with that, some were against allowing any interaction for the fear of spreading infection, while others accepted the need and agreed that practically such interactions are difficult to avoid.
• Further, requirements for quarantine ward like kind of beds, storage requirement, partitions, infrastructure and placement of medical facilities, waste collection rooms, staff room, medical essential storage etc. and their interior layouts and interconnectivity were discussed with medical professionals.

1.2.2 Experience of recovered Covid-19 patients and their needs

The recovered Covid-19 patients narrated their experiences in detail. They explained the time they were exposed or infected till their recovery, and post-recovery experiences. They also shared the social exclusion and stigma they faced as Covid-19 patient during and post recovery. They also described the process of admission, treatment, recovery, discharge procedure and their perspective on treatment. The patient perspective helped understand and promote a people centric approach in establishing quarantine facility, which was often unnoticed in existing documents. Key findings from the interviews are summed up below.
• Covid-19 infection is an unexpected and challenging news. It comes as shock and requires time to accept. Often it induced fear of terminal illness in the person and the family.
• The infected person often fears infecting others who are more vulnerable, or close family members. People often opted for isolation to avoid infecting other family members.
• There is sometimes lack of information and uncertainty about availability of hospital beds, which often leads to confusion, waiting and delays.
• The admission process may be time consuming and tiring for patient who is feeling unwell.
• In general ward, personal space and privacy are very important even in form of a curtain. There is additional fear of further infection despite following precautions as others may not be following precautions.
• There was often inadequate storage for various types of personal items, including food, medicines, steam heater, oximeter, other equipment and books etc. Place for smaller items like spectacles also need to be designed such that it is easily accessible from bed.
• Electric vapour heater may require easy access to electrical point as well as flat surface. Such facilities are often missing in the quarantine rooms or patient rooms.
• If people have to wash their own clothes, they need sufficient washing and drying space.
• People often spent time on their mobile phone and internet, communicating with family and friends or getting news. A separate mobile charging point close to bed is essential. Similarly, a well-functioning internet connection (wi-fi) is very important for connectivity.
• Garbage disposal was at times difficult, especially in general ward. Separate close-lid dustbin with enough capacity to dispose used tissue papers, food waste and discarded food packages etc. is important. Frequent cleaning is must.
• Quarantine period can be challenging due illness and loneliness as well as being away from one’s family and friends. This adds to the anxiety, stress and fear. Social interaction is an important aspect of recovery. All patients expressed that they needed social interactions, despite the fear of infection spread. Hence interactive and recreational spaces/ activities may be carefully designed. This could be interactive games or self-help activities etc.
• Some felt that books, talks with other co-inhabitants or short walks helped them passing through difficult times. Some feared the interactions with co-inhabitants.
• Few opined that pleasant interiors and lively paints may help establish a home like environment in the hospital rooms.
• For most patients, window opening was important as it provided light, fresh air and visual connect with people or nature outside. This helped in their mental well-being.
2. GUIDING PRINCIPLES FOR DESIGNING QUARANTINE FACILITY

The following principles represent the values these norms are designed upon as well as the values they present and promote.

- **During the pandemic of such scale, support for infection prevention and recovery is an entitlement for the vulnerable and the poor.** Affected people are entitled to non-discriminatory, equitable, inclusive and respectful access to support from the state and other public agencies for infection prevention and medical treatment including quarantine facility when they do not have resources or capacity on their own. An entitlement perspective implies accountability and transparency by all the stakeholders including infected or exposed people, community, agencies including NGOs and donors, and the Government. The infected people should not be treated as hapless passive recipients of support.

- **The most vulnerable community members tend to be invisible or at the margins; unable to access support.** Targeted attention should ensure their inclusion so that they can access safety and physical separation in quarantine facility. No one should be left behind. The affected individuals and their families may suffer many hardships and hence, face issues of distress conditions, mental trauma, gender-based violence, caste conflicts, social discrimination, increased debt, etc. while trying to cope with the situation with no means and resources. Vulnerable people such as single women, old aged, physically challenged, terminally ill, illiterate, extremely poor, minorities and SC/STs, etc. may require additional support and facilitation to recover like others. The facilitation process must ensure their inclusion with fairness, sensitivity and respect for social and cultural diversity, and be non-discriminatory in provision of assistance.

- **Quarantine facilities should be following the IPC norms strictly and not cause further infection.**
  The quarantine facility accommodates persons who may be infected as well as who may not be infected. Utmost care should be taken to limit the spread of the infection in the facility. The standards and guidelines should be followed strictly to contain the spread of Covid-19 without any compromise.

- **Quarantine facility should instil confidence in people regarding the medical and healthcare system rather than fear.** A friendly and homely environment should be created through people centric design.
  In the context of Covid-19, it is observed that people are scared to get tested due to the fear of being taken away for treatment and in isolation. Same is true for quarantine facility. The facility should provide a friendly and homely environment that instils confidence towards safe recovery rather than the fear of the disease, isolation or discrimination.
• **The facility should be envisaged considering the most efficient and long-term utilisation of the resources.**

The design should consider a long-term view of utilisation of the resources invested. Post the pandemic requirements, the public resources invested should not be wasted and design should provide flexibility for it to be readapted into something the community needs for long term. Design and construction should be carried out considering the feasible and efficient transition.

• **The design should take utmost care that the people are not exposed to other vulnerabilities while they are facing severe situation due to pandemic.**

Design and construction should incorporate all safety norms to provide safe and secure environment to the vulnerable people and avoid any exposure to further vulnerabilities due to natural disasters like earthquakes, flooding or fire etc.
3. DESIGN APPROACH FOR THE QUARANTINE FACILITY

The values discussed through the guiding principles earlier are translated into more detailed design approach providing the base for the norms. Some of the points discussed below are not directly translatable in specific norms, however, they provide base for designing and implementing the facility for quarantining the persons suspected to be Covid-19 positive.

- **Physical distancing, not social distancing: instilling confidence and providing comfort**
  The most important feedback from the recovered Covid-19 patients was that living in isolation is difficult. The mental trauma due to possibility of being infected with the disease is itself very strenuous, where people need social interaction and support. Often the medical professionals recommend strict separation between quarantined people due to infection control measures. In such times, though the importance of physical distancing cannot be over-stressed, people need social interactions or activities they can engage with on their own. Taking in considerations the medical perspective and people’s needs, the norms propose to provide spaces for quarantined persons and spaces for interactions. They are identified as activity spaces in the norms. This will also engage quarantined people constructively, creating positive environment and help reduce the stress they go through.

- **Multi-functional approach in response to Covid-19**
  As a basic principle, the quarantine facility should be thought of from long term utilisation perspective reflecting the same in its design and construction. The emergency situation due the Covid-19 has necessitated a quick response to deal with large number of people who have confirmed or probability of infection. A large sum of money and valuable resources are being invested in responding to the situation. However, it is hoped that this situation will be resolved once the peak is reached or medication/vaccine for the pandemic is available. After that, the facility may not be necessary for quarantining people. It is important to determine the future utilisation of the infrastructure while designing. Multifunctionality is widely used term. In case of Covid-19 response, it is often possible to get engaged with the local community and authority to assess their needs beyond Covid-19 to identify their future needs and can be designed accordingly to readapt it later. Further, the next function can provide clue for the selection of construction system and technology so that least changes may be required for readaptation. In such case, the building can be constructed using permanent materials and techniques and can retain its structure and internal spaces with least changes. Alternatively, certain parts or the entire building can use construction system that can be dismantled or reorganised to accommodate its next function easily. It is important that the design team gets engaged with community to determine the next function and adapt the design as well as construction system accordingly.
Design for poor should not lead to poor design or building—appropriate and energy efficient design and cost-effective construction

- The design for poor should not translate into compromise on minimum standards or quality, either in design or construction. Since it is a health facility, it may prove to be life threatening for people not well-equipped to deal with the situation in the first place. Rather, available resources should be utilised in most efficient way. Hence, climatically responsive energy efficient design and cost-effective construction is encouraged. The designer can respond to such need by bringing in local materials and technologies so that they are easy to implement and maintain. Further, such interventions are beneficial to environment too. The design and construction system should also consider the post pandemic readaptation of the building.

- **Disaster resistant design and construction to reduce further vulnerability**
  The building should be designed incorporating accepted design and construction norms for disaster resistance for the region. These norms are well defined in various guidelines and codes. These norms should be strictly followed. Several natural disasters have devastating effect during the pandemic, and the building should be able to provide safe shelter to the people from natural disasters like earthquakes, floods, cyclones etc. The fire is a very commonly observed occurrence in buildings, and the safety norms must be strictly implemented for fire resistance.
The design norms discussed in this section take references from the existing international and national guidelines and other documents as well as interviews conducted with patients and medical professionals (doctors, nurses as well as administrators involved in treatment and management of Covid-19). It was observed that even though medical and health perspective is well represented through various documents, quarantined person’s needs, specifically for friendly environment and their mental well-being, though accepted, are not well documented or discussed. The presented norms are evolved considering the needs and user-friendly environment for the persons quarantined and general well-being of the medical professionals through the design.

The norms are organised in sequence from site selection criteria, norms for various functions and spaces, building systems and materials for the construction, disaster resistant features and energy conservation. The norms related to design of spaces provide overview of spaces, relation with other functions, internal arrangements of furniture and equipment’s as well as service infrastructure required. The next chapter on building systems and construction materials discusses appropriate systems and techniques using material options available and incorporating disaster resistant features. The further chapters discuss climatic response, thermal comfort, energy consumption and saving as well as alternative energy options.

### 4.1 CRITERIA FOR SITE SELECTION

Site for quarantine facility requires to be selected with careful considerations. The following guiding norms shall be followed while evaluating the possible sites for developing quarantine facility.

- **Location of the site should preferably be away from crowded and populated areas.** In case of urban and dense area, the boundaries of the facility should be well defined and protected to avoid physical contacts with neighbouring population.
- **The site should have hurdle free approach to allow movement of ambulance and other vehicles.**
- **The site should be equipped with enough parking space where at least two ambulances can be parked nearby.**
- **Site should have water-supply facility, sewerage and 24 hours electricity provision.** In case of unreliable supply, it should be feasible to establish its own facilities for the same.
- **A well-equipped and designated Covid-19 hospital with critical care facility should be available and identified in the vicinity.** The quarantine facility should tie up with such hospital for transfer of infected persons.
- **The quarantine facility should be located such that essential services like medicines, medical equipment, packaged food, and bio-medical waste disposal facilities providers can service the facility.**
- **The site should be in low-lying area, landfill area or other such land prone to hazards.**
• The land entitlement should be clear so that it is appropriate for the type of post Covid-19 function that is being envisaged for the facility.

4.2 VARIOUS AREAS FOR QUARANTINE FACILITY

The functions and supporting infrastructure requirements for quarantine facility may vary based on the type and scale of the facility, available resources for implementation, supplementary facilities available in the vicinity of the building as well as the administrative and legal requirements that may evolve from time to time. These requirements are often interpreted and guided by the medical officer and the management of the facility based on their experience and judgements.

The quarantine facility comprises of various functions that can be grouped into four activity areas.

1. Administrative Areas
2. Quarantine Areas
3. Staff Areas
4. Service Areas

Additionally, adequate parking area is also required for the facility. Some of the activity areas can also be carried out in open space if the facility is enough separated from surrounding and has well-defined boundary. This is indicated through following diagram.

Fig 1. Spatial relations of various functions in quarantine facility.
4.3 NORMS FOR ADMINISTRATIVE AREA

The administrative area consists of entrance and reception space for quarantined people, waiting area and administration offices including the space for medical officer. The reception and administration should have active telephone line and internet connectivity. In a smaller facility, medical store can be either combined or kept next to administrative office for ease of operation and to reduce staff.

4.3.1 Entrance and Reception area

Entry to the quarantine facility must be regulated and only the quarantining people should be allowed entry inside the building through this entrance. All entrants should be registered through digital means and the necessary data should be fed into the central register on the ICMR portal. Person being admitted should be provided with protective kit and instructions regarding safety measures at admission. During quarantine period, items brought by the family or friends for the individuals should be deposited at the reception and sent to quarantine rooms.

- The reception desk, though close to entrance, should be well separated and out of the way from the main path to carry out registration and other administrative work while admitting or leaving the facility.
- The reception desk should have work desk with computer, chair, file storage and storage for protection kits. The receptionist should be protected through glass or plastic partition to avoid any infection transmission.
- The reception area should have a collection window on outer wall where the relatives or friends can deposit necessary items for quarantined people. A storage to temporarily keep and sanitise them should be provided.
- Working phone line and internet connectivity are essential and must be provided.
- A hand sanitiser station should be provided next to the entrance door.
- The entrance and reception should have easy access to wash basin and toilet.
- The entry should be accessible. The access ramps for wheelchair and stretchers should be built with minimum width of 1650mm and recommended slope of 1:20. A handrail of 900mm high should be provided at least on one side. The surface of the ramp should be non-slippery. Refer to IS recommendations for buildings and facilities for physically handicapped, Section 5 for more details on building of ramps.¹
- Permanent entry way systems, ex- air curtains, to capture dust particles may be installed at entrance of quarantine area.

4.3.2 Waiting area

“During the patient admission process, basic screening of the patient was conducted at the waiting area. The admission process was time consuming and inconvenient especially when the patients felt tired and exhausted. Provision of resting spaces would have been helpful for the patients.” Shri Sanjay Dave (Recovered Covid-19 patient)

¹ (Indian Standards: Recommendations for the buildings and facilities for the physically handicapped. November, 1987)
Registration should be a quick process, preferably all information should be taken through telephone call or while the person is being brought in ambulance. However, a safe and comfortable waiting area with physical distance between different individuals is important.

- A well separated waiting area should be provided close to reception where the individuals can safely wait while someone else is being admitted or relieved.
- The chairs in the waiting area should be comfortable to rest for person being quarantined.
- The space should be designed such that minimum two people can wait keeping safe distance from each other.
- Distance between two chairs should be minimum 1000mm.
- Drinking water, toilet and hand washing facility should be easily accessible from waiting area.
- Hand sanitizer dispenser and foot operated dustbin should be provided in waiting area.

![Fig 2. Movement from entrance to waiting area to quarantine area. The reception and waiting area are separated and the path to quarantine area is clear of other activities.](image)

### 4.3.3. Administrative office

Administrative staff of at least an administrator and an accountant will be required to run the quarantine facility including to manage the inventory, place and receive orders for medicines and other necessities to run the facility. The medical officer also will need office space.

- The administrative office should have workstations with computers for the staff and necessary storage space.
• It should have a working telephone line and active internet connection.
• In smaller facility, the office can be combined with medical staff room with necessary provisions as described earlier.
• If a separate medical store is not necessary, administrative office can also have cupboards and storage facility for medicines and other supplies for patients as well as cleaning supplies etc. This may be within the office space or nearby where it is easily accessible to the office staff to manage.
• A desk or separate office cabin for the quarantine centre manager may be provided. This should have a workstation, computer with internet connection, chairs and storage cupboards.

4.4 NORMS FOR QUARANTINE AREA

Quarantined persons form the major focus or user group for these areas. This section explains design norms for the functions which are categorised under Quarantine area. The quarantine areas include rooms for quarantine (general room or isolation rooms), toilets for quarantined persons, nursing room, activity spaces either for individual or interactive activities and essential services.

Quarantine people are not necessarily Covid-19 positive but exposed or suspected to be infected. Since some of them may turn positive, utmost care and separation is mandatory to protect the non-Covid-19 positive individuals from the infected ones. Thus, strict adherence to physical distancing and infection prevention & control standards become very critical. Along with physical discomfort, people often face mental stress when in isolation. Therefore, quarantine area should also include spaces for recreation for mental well-being, but maintaining physical distance.

4.4.1 Quarantine rooms

Quarantine rooms accommodate the individuals suspected to have contacted Covid-19, but are not confirmed yet.
• Most doctors recommend individual rooms for containing the spread of infection to uninfected persons.
• While general ward can accommodate multiple individuals, the chances of spread of Covid-19 are higher if care is not taken. Hence, a general room with strict separation between each individual through curtain or partition is acceptable.
• Toilets and wash facility should be well integrated with the quarantined rooms.
• The rooms for quarantine should be close to nursing room so help can be provided as quickly as possible to the individuals.
• One or more isolation rooms should also be provided for individuals who develop Covid-19 symptoms during quarantining. These individuals can stay in isolation rooms and should be shifted to designated medical facility as soon as possible.
• The isolation room should have oxygen supply facility for an emergency situation.
• The isolation room must have washing area and toilet.
• Isolation rooms can also be used for treating quarantined persons having other health emergency.
Along with beds, the quarantine room should be equipped with ample storage spaces for quarantined persons’ belongings such as everyday utilities, extra clothes, medical and food supplies, storage for, partitions / screens for separating individuals, saline bottle stands.

**Beds for quarantine**
- The minimum size for bed is 2m x 0.9m x 0.6m.
- Minimum distance between two beds must be 1m while the recommended distance is 2m.
- Landing area of minimum 1m should be provided on at least two sides of the bed.
- There should not be any movement of HCW and other patients from the side where patient has his head placed while sleeping.
- It is recommended to separate the beds with partitions.
- Beds should be placed near windows to ensure natural light and ventilation. It is advisable to position bed such that it also provides visual connection to the outside.
- Each bed should be having an easy to access foot operating dustbin.
- Minimum area occupied per bed is approximately 9 sqm where 6 sqm is the bed space and storage and 3 sqm is circulation space.

*Fig 3. Each bed occupies 9sqm area*
Storage spaces for quarantined persons

- Plan enough storage for all the personal belongings and medical supplies of individual near the bed for easy access.
- Different types of storage may be required for clothes, vessels, water-bottle, vaporiser, medicines, food, books, mobile phone, as well as spectacles etc. Medicines, food items and clothes should all be kept separately.
- Various types of storage, like closed or open shelves, platforms, portable storage racks can be provided according to the needs.
- A portable serving table may be provided for each bed.
- The furniture should not create hurdles in movement of medical staff or quarantined persons. It may be placed against the wall.

Requirements for ventilation

- Building orientation, layout and location are important for natural ventilation when designing the site.
- Cross ventilation is important aspect of quarantine. The position, types and size of openings should be strategically designed to achieve natural ventilation.
- Windows and beds should be positioned such that there is visual connection with the outside.
- Overhangs and projections should be designed for shading the windows. Additionally, windows may also have shades or screens to prevent direct sunlight and glare.
- The furniture and partitioning must not restrict the intended airflow and ventilation.
- The quarantine rooms should have large windows on opposite walls of the room allowing a natural unidirectional air flow and air changes for healthy and comfortable environment.
- Mechanical ventilation is not mandatory and often not necessary. However, if installed, the system should be designed to create negative pressure such that it prevents transfer of air between two rooms.
- Exhaust fans (considering 12 air changes per hour) can be installed directly in the windows or on the external walls.
- The air from one part of building should not enter any other parts or adjacent spaces
- Pedestal/ceiling fans should be provided for internal air movement. Exhaust fans and fresh air fans on external walls should work in tandem for ventilation.

"The metal table had storage space where medicines could be kept and its top could be used to keep small items, but there was no storage space for personal belongings, steamer, water jug, other items including reading glasses etc. near the bed." Shri Sanjay Dave (Recovered Covid-19 patient)
Partition between beds

“privacy becomes a very important aspect while sleeping as well as eating.” Shri Sanjay Dave (recovered Covid-19 patient)

“It is important to separate beds by providing ceiling to floor partitions to ensure that virus does not spread, this will limit the air circulation from one bed to other” Dr. Surya Prakash

- Partitions between beds should preferably be provided from ceiling to floor to contain the spread of infection. Partition also provides privacy to the quarantined people.
- The partition can be created using plastic curtain, fabric curtain, plywood, various particle boards, glass, metal, or any other appropriate material.

Services for quarantine area

- Quarantine rooms should have drinking water facility and enough number of wash basins or sinks as frequent hand-wash and cleaning of utensils is essential.
- Sufficient number of toilets must be provided for general ward. Isolation room should have attached toilet.
- Area for washing and drying clothes may be required if the quarantined people are washing their own clothes. There should be enough number of washing stations and should be close to the quarantine rooms to avoid any unwanted contact among each other and other staff members.
- Provision for oxygen supply in the isolation room is essential. This could be through piped supply, as oxygen concentrator or by other means.

Lighting, Electrical Points and Connectivity

“Individual plug points would have been appropriate as it would lessen the contact between the patients. We frequently need to charge our phones as we talk to our family and friends.”, Shri Sanjay Dave (recovered Covid-19 patient)

- A well-lit room with good lighting is important to create a healthy environment.
- Each bed should be provided with control switches for ceiling fan and lights to ensure lesser physical contact between patients.
- Each bed must be provided with at least one electric point for charging laptops, phone, water kettle, vaporizer and other medical equipment etc. Two points may be useful.
• Electrical points should be at a distance of not more than 0.3m (one foot) from the bed and at a height of 1.2m for easy access.
• Additionally, each bed may be provided with a night lamp.
• The entire quarantine area should be covered with functional wi-fi with reasonable speed. People need to connect to their family and friends for support. Additionally, internet helps them stay connected with outside for passing time.

4.4.2 Activity spaces

Quarantined people often experience mental stress due to isolation. Recreational activities should be thought of and designated areas should be identified/ designed strictly following physical distancing as per IPC recommendations. Below is a discussion on these activities people can get involved with during the quarantine period. These activities can be individual or group activities as per their liking. These activities or the methods are not exclusive and there may be several others. However, the purpose of this is to generate ideas for designers about such activities and spaces so that it can have positive impact on quarantined people. It is very important to monitor people for maintaining order and physical distance during any group activity.

“Recreational area can be designed for individuals which will help them relieve from mental stress and anxiety of being a Covid patient. This area should be designed by keeping in consideration minimum physical distance.” Dr. Shailesh Chudasama

Nature of activities and spaces

Spaces for individuals should provide opportunities to spend time with oneself. These may be designated spaces, or can be woven into other design elements like corridor, bay-window, a courtyard bench etc. People often just want to listen to music, talk to friends and family, read, write, meditate or contemplate. They may also prefer to take up physical activities like walking, yoga or exercise on their own. The places can be cosier where people can get some privacy. However, such place should not be very secluded so that the people can still be observed by the staff to ensure their whereabouts and well-being.

Interactive spaces should encourage social interactions while still maintaining physical distancing and safety norms. Hospital administrators often mentioned various unplanned interactive activities taking place in their premises not appropriately designed to perform them. Creative ways to accommodate these activities should be thought and spaces should be designed for them. Though this is not an exhaustive list and several activities and games can be explored with appropriate care for infection control. Some of the activities are group readings, antakshari (singing songs), karaoke, dumb charade, Pictionary, yoga or other local games that do not require exchanging objects or coming in close proximity with others can be carried out under observations. Open areas like outside spaces, terrace,
courtyard, balconies etc. are ideal locations for some of them. Some of them can also take place in the quarantine rooms itself. An activity room can also be assigned for such activities with interior layout appropriately designed to carry out such activities. However, parking should not be used for any such activity as there may be chances of others coming in contact with quarantined people.

**Physical distancing, not social distancing: instilling confidence and providing comfort:**
The most important feedback from the recovered Covid-19 patients was that living in isolation is difficult. The mental trauma due to possibility of being infected is itself very strenuous, where people need social interaction and support, to engage themselves constructively in positive environment and help reduce the stress they go through.

**Social interaction with physical distancing**
It is important to encourage social interaction, yet physical distancing cannot be compromised. There are several ways to maintain distance. Some of them are explored below.

a  **Coloured markers on the floor**

![Coloured markers on the floor](image)

*Fig 4. Floor markings with 2m diameter coloured circles to indicate necessary distance.*
One simple way to achieve the necessary 2m distance to avoid infection spread among quarantined persons is by painting 2m diameter circles with different colours on the floor. It is an effective way to keep people apart and also show them how to move in the space with safety. Circles provide enough space for one person. Coloured pattern on floor helps persons to locate themselves. The circles can also be creatively combined with arrows, footprints etc. to indicate direction, sides etc. The circle can also be replaced with any other shape. At times the markers can be created with flooring pattern, materials or finishing etc. This strategy can be used in open spaces or courtyard to mark walking paths, sitting and talking etc. in interior spaces too this can help people maintain safe distance.

**Fig 5. Circles used in a courtyard to define walking paths and indicate seating**

**b Planters:**

Standard planters can be used to distance people in interactive spaces. Planters of size 500mmx1000mmx500mm can be used to maintain safe distance. Planters can be readily available in market, or can be created on site in multiple sizes at affordable cost using available materials they provide quick and sustainable options which along with creating distance, also add green spaces and promote healthy, welcoming environment in a quarantine facility. They can be used inside the quarantine facility, in courtyards, open spaces and terrace. It can be used to allow seating arrangements at specific distances and
can be used to provide interaction or contemplative experience. However, maintaining the planters may require some efforts, but can also be taken as an activity in itself.

![Fig 7. Planters and seats can be combined to maintain distance while interacting with others](image1)

**c Seating arrangement:**

![Fig 8. Different kinds of seats can be used for maintaining distance](image2)

A seating arrangement can be made by strategically placing furniture appropriately to maintain 2 meters distance from each other. They can be unidirectional or multi directional depending on the surrounding and requirements. Timber, plywood, metal, FRP or any other appropriate, easy and light weigh material can be used. One can also make creative use of existing furniture. The furniture can be sized to 500mmx500mmx450mm or any other appropriate size and shape. Their arrangement should encourage physical distance between individuals. This can club with circles or coloured markers and planters to create a meaningful layout. These can be used in indoor spaces or in open areas for individual or group activities.
Distance can be maintained through seating arrangement while watching television or performing different activities in open areas or terrace.

d  Windows and openings:

Windows are vital for ventilation and also visual connectivity. Big windows can provide a relief from the monotony of a quarantine centre and help an individual divert their attention to the outside world. Windows should be appropriately sized. Ideally all quarantined person in the quarantine area should be able to look through the window.

"Both rooms had large windows connecting the inside with the outside. I spent ample time at the window looking out on the road or in the internal road of a residential block. This helped me pass times and felt less lonely" Shri Sanjay Dave (recovered Covid-19 patients)
Partition:

*Fig 12. Plywood and curtain as typical partition options.*
Partitions can be easiest and affordable option to provide privacy to individuals and create barrier for infection spread. They can be made from plastic sheet, plywood, glass, fabric or any other appropriate material. Partitions can be provided in the quarantine area between the beds for creating private spaces for individuals. Different partitions can allow different degrees of visual connect and interaction among people quarantined. If creatively used, they can be useful to allow social interaction maintaining separation.

*Fig 13. Partitions can help providing privacy. Planter can be used to promote better environment while windows allow connectivity with outside*

“The window in hospital room kept me busy as I could look outside even when I was on drip” Shri Bindyaben (recovered Covid-19 patient)
4.4.3 Toilets for quarantined persons

- Ideally, there should be one toilet per patient, but considering the limited resources, ratio of 1 toilet for 5 patients is minimum acceptable.

- Number of toilets for women should be more than for men. Even for smaller facility, there should be at least one men and one women toilet provided for quarantine rooms.

- One toilet for men and women should be disability friendly accessible toilet. Further details on how to design accessible toilet can be found in Design manual for a barrier-free built environment for further details.²

- Female toilet may have vending machine for sanitary napkins and incinerator for appropriate disposal.

- Indian WC are recommended as they are more hygienic and preferred by people. However, water supply in the toilets must be ensured.

- There may be provision of western style WC in one toilet for each male and female where possible.

- Basins with running water should be provided for male and female toilets both.

- There is frequent use of sinks by patients throughout the day. Hence, sinks in the ratio of 1 sink for 5 persons should be provided in addition to the sinks in the toilets.

- Toilets should be adequately ventilated. Exhaust fans may be installed in each of the toilet cabins for air circulation.

- Adequate water supply must be ensured throughout the day. For this, overhead tank may be installed.

4.4.4 Nurses’ station

Nursing or other healthcare staff needs an area close to the quarantine rooms to be able to constantly observe the quarantined persons and quickly reach out to them in case of emergency. This space is also used to store and prepare medicines, and storing daily need supplies for the quarantined persons. The on-duty nursing staff will spend most of their time at the nurses’ station.

The nurses’ station needs to accommodate individual work stations (equipped with computer) for the doctors and nurses.

- The nursing station needs to accommodate storage facilities for everyday medicines (including refrigerator), medical apparatus (like B P machines, thermometers, oximeters etc.), and supplies (like sanitisers, hand-wash, masks and gloves etc.)

- A separate wash for frequent hand-washing and cleaning medical apparatus needs to be provided in nurses’ station.

- The nursing station must have direct access to the quarantine rooms to ensure regular monitoring and quick support during medical emergency.

² (Environmental Planning Collaborative December, 2004)
• Translucent partitions may be provided to ensure visual connectivity with quarantined people.
• There should be a foot operated dustbin to dispose needles and other medical waste.

4.5 STAFF AREA

The medical and healthcare staff usually stay and work from this area when they are attending the quarantined people. This area includes staff entrance, doctor and staff rooms, donning and doffing rooms and toilets for staff.
• As infection control and safety measure, the entrance for staff members is separate from the quarantined people’s entry.
• To segregate the remaining areas from the contagious areas, the staff members always don PPE suits and other safety kits when they go to quarantine areas or physically interact with the quarantined persons. Donning and doffing areas are hence essential as per the IPC protocols.
• Doctors’ room is main work area for the medical staff. They also store their personal belongings here while visiting the quarantine areas.

4.5.1 Staff entrance
• This is a separate entry for medical and healthcare staff as well as support staff. It should be separated from quarantine area entry.
• This should have direct access from staff parking.
• The entry and exit must be guarded and must have a register or preferably biometric scan facility to register all the people moving in or out of the facility.
• Storage or lockers should be provided for the staff to keep their belongings.
• This area should be designed such that the staff or doctors’ room and donning or doffing room open up near this area.
• Other areas like medical store or administrative offices should also be easily accessible from this without entering any quarantine areas or service corridors for biomedical waste disposals.
• A washbasin to wash hands should be easily accessible from here for people entering this area from outside or other areas.

4.5.2 Donning room
A designated room where healthcare workers don PPE kit before entering the quarantine area, the donning room should be accessible only to the authorised staff members.

“Safety of medical staff is very important and hence IPC recommendations should be strictly followed for donning and doffing the PPE kits” Dr Shailesh Chudasama
• A one-way flow from the staff area to donning area to the patient care area must be maintained.
• The room should be spacious enough for one person to don and one more person to help donning the PPE kit.
• One person requires minimum 1.2m diameter space to don the PPE kit.
• A chair and a table surface should be provided in the room for sitting and keeping the clothes while donning PPE kit.
• A mirror should be provided for donning the PPE gears correctly.
• There should be 3 different cupboards for storing scrubs, PPE kits and jump suits separately.
• An open rack to keep a set of clothes for changing after wearing scrubs is recommended.
• Hand wash sinks with running water and hand sanitizing facility should be provided within the room.
• The facility should ensure that there is clear demarcation between storage space of unused equipment and donning space.
• There should be a blank surface where poster with instructions for donning the PPE can be put up.

Fig 14. Wall surface is important for installing instructions chart and a mirror
Fig 15. Storage space is required for PPE suits and safety gears. Chair is necessary for Donning and doffing

4.5.3 Doffing room

Designated area where healthcare workers doff and discard their PPE kit after exiting the quarantine area.
• A one-way flow from the patient care area to doffing area to staff area must be maintained.
• The path from the quarantine rooms to doffing room should be short and clearly defined. The walls and floor should be easy to clean and disinfect.
• The doffing room should be spacious enough for one person to doff. One person requires minimum 1.2m diameter space to remove the PPE kit. It is very important to
ensure enough clearance so that the person does not touch wall surface or objects while doffing.

- An easy to clean and disinfect seat should be provided for removing the shoe covers
- A mirror should be provided for easy removal of PPE kits.
- Three different waste collection bins must be provided for 1) jumpsuits or gowns, 2) shoe covers and caps and 3) eye-shields. These bins must be appropriately colour coded as per biomedical waste disposal protocols.
- Doffing room must have a sink for hand wash.
- Storage for disinfects and for stocking clean gloves should be provided.
- A flat surface to clean the PPE should be provided.
- The room should be well lit.
- There should be a separate exit for collection of discarded PPE kits. The exit should lead to bio medical waste collection room.
- There should be a blank surface where poster with instructions for doffing.

Fig 16. Minimum area required for dustbins, placement of chair and hand wash facility for donning and doffing

Fig 17. (1) Movement from HCW area to Quarantine room through donning room. (2) Movement from quarantine room to HCW area through doffing room.

4.5.4 Medical staff room

The medical staff room is the main working space for medical staff on duty. In the bigger facility a separate room may be required, but in smaller facility, this can be combined with other staff room.
• The room should have workstations with computer and internet connectivity.
• The chairs provided should be comfortable, so occasionally the doctors can rest here during long duty hours.
• for the smaller facility with no separate dining room, this may also double up as dining space.
• It should have lockers or other lockable storage for storing personal belongings
• Provision of a mirror is also desired if there is a separate doctors’ room.
• Depending upon the scale of the facility, there should be a separate area for service staff to rest and eat during their duty hours.

4.5.5 Toilets for staff

Toilets for the staff must be separate from the toilets for quarantined people.
• Adequate water supply and water storage facility (overhead tank) should be made available for toilets.
• Ratio of 1 set of toilets for 5 medical staff is recommended.
• It is desired that female toilet should have vending machine for sanitary napkins and incinerator for appropriate disposal.
• Indian WC may be preferred as they are more hygienic.
• Sinks with running water and hand washing facility should be provided for male and female toilets both.

4.6 SERVICE AREA

For running a quarantine facility, several services are very essential. These include food supply, washing & cleaning, medicines and other supplies, bio-medical waste collection & disposal, etc. These services are in addition to normal service requirements for any building, like water supply or electricity. However, these services also should be running uninterrupted. Service area also provides space for the service staff to rest and eat in between their duty timings.
• Outsourcing most services is advisable as compared to managing them in-house, as it helps in following strict isolation procedures. Washing clothes, food and medicines should preferably be arranged through external agencies instead of managing in-house.
• Bio-medical waste must be collected from quarantine areas and staff areas regularly at least twice a day by trained staff with utmost precaution for safety. The waste should be kept in designated bio-medical waste room in different bins as defined in CPCB (Centre pollution Control Board) guidelines.

“Precooked food brought from outside is preferred option for serving food in quarantine centre than cooking”. Dr. Surya Prakash.
• The service corridors, through which the waste is transferred should have minimum movement of other staff or quarantined people to limit any unwanted infection spread.

• Bio medical waste disposal must be arranged with certified waste management agency as per the CPCB guidelines.

4.6.1 Bio-medical waste collection room

Bio medical waste from the different rooms should be collected at least twice a day or more in different bags as per the protocol. It should be stored in bio-medical waste collection room till the authorised waste disposal team takes it away in their vehicle at least twice a day. This room should be lockable and should have restricted entry.

• Waste is categorized in 4 types according to the CPCB guidelines and is collected in different coloured bags. These bags are temporarily stored in the BMW collection room.

• There should be enough surface area to store these bags and segregate the waste if required.

• Running water to clean the room and hand washing or sanitising facility must be provided for waste collection team.

• The room should have two separate doors, one accessed from inside to deposit the waste collected from different rooms and the other to take it out to disposal vehicle.

• The external door for disposal must be accessible from outside and should be as close to the place where the vehicle for waste collection is parked. Thus, the waste can be disposed without requiring to enter the other parts of the facility.

• A ramp at the exit door should be provided so a trolley can be used to transport the waste.

• Floor and wall finishes should be easy to clean and disinfect.

![Diagram of movement from Quarantine area to BMW room to exit. BMW room has a separate exit.](image_url)
4.6.2 Medical / general store

Medicines, medical equipment, PPE suits, everyday linens, oxygen supply (concentrators, portable cylinders if needed) and other essentials are stored here. The store can be in proximity with administration office for ease of operation.

- The store may or may not have a separate room. However, providing safe, clean and dry environment must be ensured for storing medical and other essential supplies.
- A workstation equipped with computer should be available for inventory management.
- Sufficient number of racks for sterile linen/ PPEs must be provided.
- Medicines should be stored in cool (away from direct sunlight), safe and dry environment. A refrigerator may be provided if needed.
- Storage for sanitizers, cleaning chemicals, disinfectants and cleaning equipment should be well provided.
- Inflammable and hazardous materials shall be stored separately and safely.
- It should be well-lit, well ventilated and pest free.

4.6.3 Pantry

Regarding food arrangement for the people in quarantine facility, the external caterer is preferable over cooking within the facility. The kitchen set up and cooking and cleaning staff may be avoided. However, a pantry may be provided to store the cooked meals or food packets for short time before distributing and keeping dry food items and preparing Ayurvedic medicines etc.

- Adequate storage of some essentials food items for emergency and Ayurvedic medicines etc. should be provided.
- Pantry should have easy to clean, smooth working surface to temporarily store and manage ready to eat food packages. This can also be used to prepare Ayurvedic medicines or basic food and drinks.
- There should be provision for cooking gas and stove for light cooking or heating.
- A refrigerator may also be provided if necessary.
- Pantry should have sink to wash small utensils and water supply to clean the surfaces.
- It should have easy access to bring the supplies from outside.
- Provision of dustbin for dry and wet waste disposal should be provided and serviced at least twice a day.
4.6.4 Laundry facility

For washing quarantined people’s clothes, a contract with professional laundry service is preferred. However, a separate laundry room must be provided to disinfect used linen and other items including quarantined people’s clothes before handing them over to laundry service. In case people wash their own clothes, washing area and drying areas should be provided separately while laundry may be used to disinfect and wash used linens etc.

- Laundry room should be connected with service entry through which service provider can collect the clothes without coming in contact with quarantined people.
- Laundry should be large enough to accommodate buckets to soak linens and clothes in disinfectant for stipulated time.
- It should have running water and drainage.
- Clothes washing area can be combined with common toilets for quarantined people in the general ward if people wash their own clothes.
- There should be enough water outlets and adequate space for washing clothes while maintaining safe physical distance.
- Clothes drying area also should be provided with good light and ventilation.

4.6.5 Generator room

A generator backup in case of power failure should be provided.

- The generator room must be located outside, keeping safe distance from other parts of the building. However, it should be close enough for guard or someone who can periodically observe and maintain.
• The generator should be kept in closed room and protected from rain, dust and direct sunlight.
• Main electric panel for power supply should be located here.
• As far as possible, provision of solar power energy is recommended.

4.7 ENTRANCE GATE, GUARD ROOM AND PARKING

The quarantine facility will need ample parking area. The entry to the facility should be controlled and vehicles coming in and exiting should be recorded. The guard should also be provided with protective gear and sanitisation facility. People coming to deposit items for quarantined persons may leave the items either with guard, or at reception. The guard should also be able to keep an eye on generator room.

• The entry to the facility should be gated and manned with guard. The gates should be secure and lockable.
• A guard cabin with chair and desk to register the entry of vehicle/individuals into the facility is preferable.
• The guard should have place to store sanitiser, masks and gloves. Some storage space may be required to keep and sanitise the items received for the quarantined people from relatives and friends.
• A separate parking place for an ambulance with a clear exit path must be provided. Parking for two ambulances with clear exit paths is preferred.
• Clear demarcation for BMW collecting vehicle to enter, exit and station while collecting the waste near the waste collection service entry must be provided.
• Care in planning the parking should be exercised so that individuals are not compelled to walk behind parked vehicles and are able to have access to the building easily.
• There should be separate parking spaces for cars, motorbikes and bicycles such that they do not block the ambulance path.
• Staff parking may be provided separately while visitor and ambulance should temporarily be able to park near the entrance to drop the people brought for quarantine.
Construction is an important aspect of building that reflects and strengthens the design approach. The construction system encompasses construction materials and construction techniques for different elements of building. Different building systems will have bearing on climatic response, ease of implementation and time taken for construction. These ultimately affects the cost and environmental impact of the building.

5.1 BUILDING SYSTEMS

For quarantine facility, appropriate building system needs to be identified based on the immediate surrounding, local context, ease and desired speed of construction, availability of materials, skills as well as water and maintenance requirements.

5.1.1 Readaptation or relocation and construction systems

One important factor to consider for quarantine facility is the longevity of building considering its usage time. The quarantine facility can be looked at as a temporary facility, where once the emergency situation of Covid-19 is ended, the building can be dismantled and the site can be vacated. Additionally, the same facility can be dismantled and relocated at another location where it will be relevant and useful. Alternatively, the facility may be seen from another perspective, that of readaptation. The building can be repurposed into some other function that is required for long term use, beyond its use for the Covid-19 situation. These two responses will also require different approaches for building quarantine facility and require an appropriate construction system to allow the intended transformation to happen.

The following discussion on different construction system with regards to above discussed aspects will help designers selecting an appropriate option.

- **The conventional building systems** like RCC frame with masonry in-fill walls using bricks or masonry construction with bricks or stone and flat RCC roof may be easy and quick to construct. It does not require frequent maintenance and in general, it is long lasting. The skills, though vastly available often fail to deliver very high-quality construction. Its performance from the view of cost, environmental impact and climate response due to use of materials like cement, sand and steel makes RCC structures not desirable. RCC also requires lot of water for construction and curing, which is a scarce resource. The maintenance of these structure is costly and not easy. Further, extension and readaptation of RCC structures is difficult and leads to problems. If the scale, load requirements and the site conditions allow, RCC roof can be replaced by sloping roof with tiles or sheets. In general, the conventional systems may provide one of most
practical options for construction especially in urban, semi-urban areas and regions where local materials are difficult to procure.

• **The traditional building systems** with load-bearing or simple post & beam structures using stone, timber, bamboo, earthen blocks, bricks walls and sloping roof with tiles are viable options where the local materials and skills are still available for construction. They are easy to maintain, cost effective, climatically responsive and environment friendly in most context. High quality skills were easily available earlier, but now many artisanal skills are lost. Hence these systems are facing problems in terms of good construction quality. They often require frequent repairs and maintenance. In the context of post Covid-19 reuse, these systems are easy to extend and readapt, however there may be limitation to its flexible. Finally, their use in urban areas may be limited due to frequent maintenance and unavailability of skills. In rural context where the skills and material availability permit, these systems may be viable and should be explored.

• There are wide range of **alternative building systems**, some using natural materials, and some innovative materials. The alternate building systems often provide environment friendly option, developed keeping in mind the ecological footprint of construction. Many are often pre-fabricated unit based modular systems focusing on speed and ease of construction. Hence, they may be easy to reconfigure and adapt to different repurpose. However, they often require at times specialised production procedure if market-based solutions are not available and specific skills for construction in case of innovative materials. The limited usage also may imply high cost material and skills. Further the construction details may not be well developed, requiring further inputs to make them work in specific context. In the context of Covid-19, the alternative construction systems may be useful due to speed of construction and possibility of dismantling and reusability.

5.2 **CONSTRUCTION MATERIALS**

The materials selected for construction will have bearing on climatic response, thermal comfort, ecological footprint, energy consumption as well as ease, cost and time of construction. While speed of construction is important, the long-term utilisation of facility is another important aspect for Covid-19 response facility. In context of Covid-19, the interior and finishing materials are important from the perspective of daily maintenance and hygiene.

Use of locally available and natural materials should be explored. Materials like bamboo, timber, earth (in various forms), stone etc. have very low environmental impact, and within local context they are easily available. However, they are not standardised and hence the quality variation and workability issues may raise concerns. Some of these materials also take longer for construction and may require frequent maintenance. However, maintaining them is easy, cheap and usually can be done with local skills.

Construction involving industrially produced materials like steel, cement is expensive and require skilled artisans. Further, in terms of climatic response, thermal comfort and environmental impact they may not be preferred materials. However, they are commonly available in most markets and the skills for implementation are easy to find. Their initial cost as well as maintenance is costlier. Hence their use should be judged based on local
context. Since the quarantine facility may be constructed with limited budget and time, the building materials should be selected after careful review and consideration for its longevity.

Some of the material options discussed based on various building elements are shown in the next page. These building materials should be assessed within the local context where the facility being constructed. However, this list is not comprehensive and there may be many more material options available depending on location and region.

5.2.1 MATERIALS FOR INTERIOR FINISHES

- It is advisable that interior walls of Covid-19 facility are plastered as the exposed surfaces are difficult to clean.
- The wall surface should have the property of resisting and repelling the growth of pathogenic germs and bacteria.
- Use indoor plaster which is easy to clean and does not emit VOC’s and accumulate dust.
- Mud plaster or cement plaster with lime coat/ paint are some of the affordable and easy to implement options for the wall renderings.
- Paints labelled with ‘low VOC’ or ‘no VOC’ should be used. There are multiple paint brands that provide such products.
- Similarly, the floor should preferably have smooth finish without grooves.
<table>
<thead>
<tr>
<th>S No</th>
<th>Construction Material/ Technique</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Foundation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stone strip</td>
<td>Cost effective, low skill requirement</td>
</tr>
<tr>
<td>2</td>
<td>Stone (sand packed) strip</td>
<td>Highly cost effective, quick to construct, low skill requirement, applicable only in firm soil condition</td>
</tr>
<tr>
<td>3</td>
<td>Brick strip</td>
<td>Easily available materials, low skill requirement, expensive to build</td>
</tr>
<tr>
<td>4</td>
<td>Brick stub</td>
<td>Easily available materials, low skill requirement, requires orientation, cost effective, for light-weight structures</td>
</tr>
<tr>
<td>5</td>
<td>RC footing</td>
<td>Required for RCC frame structure, high skill requirement, expensive to build, necessary for high rise or heavy structures</td>
</tr>
<tr>
<td>6</td>
<td>RC pile</td>
<td>Effective for loose and low strength soils, expensive to build, high skill requirement.</td>
</tr>
<tr>
<td><strong>B</strong> External Walls:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stone/ Brick masonry using cement mortar / mud mortar</td>
<td>Comparatively cost effective, provides thermal comfort, Ideal for mid-rise construction with cement mortar, while mud mortar can be used for low strength walls, mud mortar needs protection from rain/ moisture, reusable.</td>
</tr>
<tr>
<td>2</td>
<td>Rammed earth (stabilized/ unstabilised)</td>
<td>Variation in quality of earth leads to problems, requires low level but specialised skills that can be easy to train, design needs adaptation, longer construction time, provides thermal comfort, recyclable</td>
</tr>
<tr>
<td>3</td>
<td>CSEB / adobe block masonry</td>
<td>less availability in market, can be manufactured on site in advance, cost effective, easy to use in construction, provides thermal comfort, CSEB production requires special machinery and skills, adobe requires protection from rain, frequent maintenance required</td>
</tr>
<tr>
<td>4</td>
<td>RC columns (with infill walls)</td>
<td>Good skilled artisans are difficult to get, costly materials, expensive to maintain, faster construction, high water consumption, high environmental impact, useful for high strength – high rise buildings, cannot be recycled/ reused.</td>
</tr>
<tr>
<td>5</td>
<td>Rat Trap bond</td>
<td>high skill requirement, saves material and cost effective if the method of masonry is adopted efficiently, provides thermal comfort, recyclable</td>
</tr>
</tbody>
</table>
### Confined Masonry

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Skill Requirement</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confined Masonry</td>
<td>Medium skill requirement</td>
<td>Earthquake resistant, Ideal for low rise and mid-rise construction, economically viable, recyclable</td>
</tr>
</tbody>
</table>

### Timber/ Bamboo/ Precast RC poles and wattle and daub infill/ timber planks

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Skill Requirement</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber/ bamboo/ precast RC poles and wattle and daub infill/ timber planks</td>
<td>Utilisation of waste or available materials, low skill requirement, quick to construct, cost effective, frequent maintenance, provides thermal comfort, low environmental impact, low strength – low rise construction. Bamboo/ timber may be prone to termites or weather, reusable and recyclable.</td>
<td></td>
</tr>
</tbody>
</table>

### Timber/ Bamboo/ Precast RC poles and prefabricated panels/ board/ CGI sheets

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber/ bamboo/ precast RC poles and prefabricated panels/ board/ CGI sheets</td>
<td>Modular and easy to construct, quick construction, cost effective, low thermal comfort - may require insulation, low strength – low rise construction, bamboo/ timber may be prone to termites or weather, reusable.</td>
</tr>
</tbody>
</table>

### GI pipes filled with sand/RCC and prefabricated panels/ board/ CGI sheets

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI pipes filled with sand/RCC and prefabricated panels/ board/ CGI sheets</td>
<td>Quick to construct, cost effective, low thermal comfort low strength – low rise construction, reusable.</td>
</tr>
</tbody>
</table>

### Internal Walls/ Partitions/ Curtains (in addition to options for exterior walls)

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board with Panelling</td>
<td>Modular, easy and quick to construct, moderate cost, reusable.</td>
</tr>
<tr>
<td>Woven bamboo mat with bamboo/ timber panelling</td>
<td>Cost effective, high maintenance, environmentally friendly, prone to termite – weather, reusable.</td>
</tr>
<tr>
<td>Glass (frosted/ transparent) with panelling</td>
<td>Expensive, requires special skills, easy to clean, reusable</td>
</tr>
<tr>
<td>Fabric / tarpaulin / plastic sheet</td>
<td>Easy to install, easy to clean, temporary in nature, cost effective, reusable.</td>
</tr>
</tbody>
</table>

### Roof

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Construction Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo/ timber under-structure and sheet roofing</td>
<td>Easy and quick to construct, easy to maintain, less thermal comfort, reusable, prone to termite - weather</td>
</tr>
<tr>
<td>Bamboo/ timber frame with thatch/ plastic/ tarpaulin/ similar materials</td>
<td>Easy to construct, cost effective, very temporary in nature, usually not preferred unless in very resource crunch condition, reusable, Prone to weather.</td>
</tr>
<tr>
<td></td>
<td>Building Material Description</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Bamboo/timber frame and clay tiles</td>
</tr>
<tr>
<td>4</td>
<td>Steel pipes/angle sections and sheet roofing</td>
</tr>
<tr>
<td>5</td>
<td>Stone/precast RC joist and stone/terracotta planks/precast planks</td>
</tr>
<tr>
<td>6</td>
<td>RCC slab</td>
</tr>
<tr>
<td>7</td>
<td>RCC slab with filler (clay tiles/pots etc.)</td>
</tr>
<tr>
<td>8</td>
<td>Industrial roof e.g. MoD roof/Eco roof etc. system</td>
</tr>
</tbody>
</table>
Some of the above roofing may also require false ceiling. These materials can be fabric, bamboo mat or panels, Styrofoam, PU foams, mud rolls, etc. with appropriate panelling support.

### E. Flooring:

<table>
<thead>
<tr>
<th></th>
<th>Material</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IPS / cement flooring</td>
<td>Durable, good wearing properties, smooth, cost effective, easy to construct, requires specific skills, easy to clean and low maintenance, high environmental impact and water requirement, non-reusable.</td>
</tr>
<tr>
<td>2</td>
<td>Terrazzo tiles/ other tiles</td>
<td>Durable, good wearing properties, smooth, cost effective, easy to construct, basic skill requirement, easy to clean and low maintenance, high environmental impact and water requirement, reusable.</td>
</tr>
<tr>
<td>3</td>
<td>Natural stone (Kota/ Kadapa/ other local)</td>
<td>Durable, good weathering properties, smooth, cost effective, easy to construct, moderate skill required, easy to clean and low maintenance, low environmental impact, reusable.</td>
</tr>
<tr>
<td>4</td>
<td>Compacted earth</td>
<td>Cost effective, low skill required, highly prone to wear and tear with frequent repairs, less water resistant, high thermal comfort, low environmental impact, reusable.</td>
</tr>
</tbody>
</table>

### F. Door and Window frame

<table>
<thead>
<tr>
<th></th>
<th>Material</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Timber</td>
<td>Durable, easy to construct, ensures insulation, requires special skills, expensive, prone to termite and weather, low environmental impact</td>
</tr>
<tr>
<td>2</td>
<td>Bamboo</td>
<td>Basic skills required, cost effective, easy to construct, frequent maintenance and replacement, prone to termite. Low environmental impact</td>
</tr>
<tr>
<td>3</td>
<td>Precast RC frame</td>
<td>Basic skills required, modular, cost effective, high ecological impact</td>
</tr>
<tr>
<td>4</td>
<td>Stone strips</td>
<td>Basic skills required, cost effective, weather proof, durable and easy cleaning.</td>
</tr>
<tr>
<td>5</td>
<td>Steel pipes/ angle sections / aluminium sections</td>
<td>Cost effective, easy to construct, durable and economical, requires high skills, high environmental impact</td>
</tr>
<tr>
<td></td>
<td>Door and Window shutters</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Timber planks</td>
<td>Expensive, needs high skills, time consuming, prone to termite and weather</td>
</tr>
<tr>
<td>2</td>
<td>Board/ glass with timber frame</td>
<td>Moderately expensive, durable, needs specialised skills, time consuming</td>
</tr>
</tbody>
</table>
6. OTHER DESIGN CONSIDERATIONS

Apart from the design norms, Signages and design for differently abled persons are two essential considerations which are essential for a quarantine facility. Signages along with being an important consideration for differently abled persons, are also vital for naming other activities and spaces in a quarantine facility.

6.1 SIGNAGE AND OTHER VISUAL COMMUNICATION

Signage is important part of a quarantine facility. Apart from standard signage to be provided for medical facility, quarantine facility should have visuals for hand hygiene and precautions for infection control at strategic locations for quarantined persons, medical and other staff. Basic considerations for signage are as below.

- Visual alerts, such as signs and posters, should be placed at entrance gate and building entrances.
- Other strategic locations in reception and waiting, donning and doffing rooms, quarantine rooms, bio-medical waste collection room, toilets, pantry, laundry etc. should be identified to explain necessary Infection prevention measures and hygiene procedures.
- Basic signage should be preferably in local language to designate each area.
- Signage colours should be planned, coordinated and clearly visible. The fonts used must be clear and well contrasted with background colours. The size of the signage should be noticeable and the font size should be easily readable.
- Signage should help make the spaces more accessible for physically challenged people.

6.2 ACCESSIBLE DESIGN NORMS

The facility should be appropriated such that it can be used by differently abled people. Some of the basic design considerations are as below.

- The minimum size of the doorways and entrance ramps should be 900mm for a wheelchair to pass. Self-closing doors and door handles at lower height may be given. This door size should be maintained for all the areas.
- There should be provision of ramps and steps both at all the entrances.
- Floor should not have level difference and raised thresholds should be avoided.
- There should be provision of accessible toilets. The location of the toilets must be accessible.
- Parking space should be sensitively designed so that reaching to the building and entering it is easy for differently abled people.
- Signs should be well-designed and illuminated so that they are easy to read, their surfaces should not cause mirroring or reflection.
- The location of signage should be clearly visible while moving or working but should not pose any obstruction to movement.
- Refer to design manual for a barrier- free built environment for further details. ³

³ (Environmental Planning Collaborative December,2004)
7. SAFETY FROM DISASTERS

7.1 DESIGNING FOR DISASTER RESISTANT QUARANTINE FACILITY

Various probable hazards and their impact on the quarantine facility of up to 40 beds capacity is discussed below. Based on the region, scale of the building and its intended usage period (temporary or permanent), appropriate disaster resistant features should be incorporated in the quarantine facility.

- While designing a quarantine facility, the relevant hazards affecting the region should be identified. Earthquake, floods and high winds are most common hazards. However, based on location and climatic conditions, impact of other hazards like landslides, tsunami or storm-surge etc. needs to be considered.
- Referring to the vulnerability atlas\(^4\) of India which has several hazard maps may be helpful in understanding the possible hazards and their probable severity in different parts of the country.
- Multi-hazard resistant approach may be required for the quarantine facility, based on the hazards expected and their possible impact on the buildings in the region.
- The impact of hazards on different construction materials and building system is different and hence the desired disaster resistant features will vary.
- The building configuration and structural aspects and hence, the design (shape, size, scale and configuration etc.) will be impacted due to desired disaster resistant features.
- The quarantine facility should be designed considering the probable hazards and their intensity in the region, its impact on the building system, construction materials and usage period.

Several natural disasters may have devastating effect. As we have seen in recent times, this can multiply during the pandemic. The quarantine facility should be able to provide safe shelter to the people from natural disasters like earthquakes, floods, cyclones etc. The building should be designed incorporating accepted design and construction norms for disaster resistance in the region. The fire is a very commonly observed occurrence in health facilities and the safety norms must be strictly implemented for fire resistance.

7.1.1 Hazards and their impact on buildings

Most regions in India face several hazards that pose threat to life and damage to building and property. Various building elements like foundations, walls, columns, roofs, openings etc. can be damaged if not constructed in compliance with disaster resistant codes. Further, the fire hazards are often observed as huge threat particularly for health facilities. In many hazard prone areas, there is possibility of more than one hazard, worsening the vulnerability of people.

There are two types of forces acting on buildings in normal conditions. The gravity loads and wind loads. The gravity loads are vertical loads comprising of dead and live loads of

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the buildings. The wind load usually does not require specific measures for low rise structures. Hazard like earthquake, flood or cyclone introduces loads induced by lateral movement, including horizontal thrust, inertia, twisting etc. causing damages to various building elements.

- **Earthquake:** earthquakes induce lateral forces due to shaking of the ground and vibrations. The impact on the building varies based on the intensity and duration of the shake, the distance from the epicentre, the soil conditions, the design, construction type and details. Various building elements like foundation, walls, columns, openings and roof may bend, compress and twist. The building may be severely damaged or can collapse completely. Some of the damages observed may be vertical cracks at the wall corners, diagonal cracks at the openings, horizontal cracks in the gable wall, cracks under the beams, wall delamination, out of plumb walls, sliding and collapsing of the roof, weakening of the junction between slab and wall, collapse from the foundation columns etc. For frame structures, failure due to short columns, stub columns, soft storey and lack of shear walls etc. are important aspects.

- **Floods:** flooding and fast-moving water can cause structural damage to foundations and walls. The water inundation reduces the bearing capacity of the soil and heavy buildings may collapse, sink the building or crack the walls due to differential settlement of the soil. Soil erosion may lead to damage of the foundations resulting in the uprooting of the lighter posts or sinking and tilting of the heavier foundations and collapse of walls. Prolonged flooding may result in scouring of soil near foundation, damage to the walls and mortar.

- **Heavy winds and cyclones:** the severe force induced by heavy winds result in severe pressure on the side of the building facing the wind and suction on the opposite side, resulting cracks, partial or full wall collapse, uplifting of roof or roofing, uplifting of projections etc. The most common damages are observed on the roof, but entire building may be damaged in severe storms.

**7.1.2 Design philosophy for disaster resistance**

It is accepted that the building may be damaged to various extent in the events of hazards. However, the intention of resistant design is not to allow loss of life in any case.

1. **During the minor intensity hazards,** the main structural load bearing elements of the building should not be damaged. However, the non-load-bearing elements may sustain repairable damage.
2. **During occasional moderate intensity hazards,** the main structural elements may face repairable damage. Other parts may need severe repair or replacement.
3. **During strong but rare hazards,** the structural parts also may face severe damage or need replacement, but building should not collapse.

Hence, the effort is put in to overcome the vulnerabilities to the maximum extent possible. It is important to identify the vulnerability and provide appropriate measures to strengthen the building elements.
Four fundamental design aspects should be considered for the disaster resistance of the building:

1. **Good architectural/structural configuration**: The size, shape and structure should be designed to ensure direct and smooth flow of inertia forces to the ground.

2. **Lateral strength**: The building should resist the lateral forces to an extent that these forces do not result in collapse of the building.

3. **Adequate stiffness**: The lateral load resisting system may develop deformations. However, enough stiffness should ensure that the building system is not damaged under low to moderate shaking.

4. **Good ductility**: The capacity of building to undergo large deformations even after yielding under severe impact should be improved by providing enough ductility through good design and detailing strategy.

These aspects can be achieved through introducing various disaster resistant features. The disaster resistance of a quarantine facility depends on multiple factors pertaining to configuration, site and soil conditions, structural and construction parameters, material quality and hazard resistant elements. However, construction and material quality are very important aspects of disaster resilience. A well-constructed building using good quality materials implies lesser vulnerability and better disaster resistance. Hence, strictly following the basics of good quality construction and frequent site visits for construction quality control and advise from structural consultant are essential for a safer quarantine facility.

- Some of the relevant IS codes for developing disaster resistant designs are:
  - IS 1893 (Part I), 2002,
  - Indian Standard Criteria for Earthquake Resistant Design of Structures (5th Revision) IS 4326, 1993,
  - IS 13827, 1993,
  - IS 13828, 1993,
  - IS 13920, 1993, and
  - IS 13935, 1993

These codes address designing specific structures and details for various materials used in Indian context.

- Specifically, for architects and designers, a reference document to further understand these features is *Earthquake Design Tips*, which is a comprehensive collection of various aspects of design to design buildings responding to the risk of earthquakes.


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5 Tip number 11, IITK-BMTPC Earthquake Tips: Learning seismic design and construction. Report prepared by IITK and BMTPC and published on National Information Centre of earthquake engineering website.

6 (IIT Kanpur September 2005)

7 (M. o. BMTPC 2010)

8 (M. o. BMTPC 2010)
7.1.3 Disaster resistant features

The disaster resistant features vary substantially based on location, building scale and structural systems, type and intensity of hazards etc. It is neither possible nor in scope of this document to provide extensive discussion on these features, some basic considerations which are applicable in most conditions are listed below. However, for better understanding of the features, it is highly recommended to study the references given above, including IS codes and specific guidelines for different context.

For the purpose of this document, the main features relevant for architects are discussed below, they are organised under site and soil conditions, design considerations, structural and construction parameters and hazard resistant elements.

Though each hazard may impact the building differently and hence the response may be designed differently, there are common features responding to lateral forces induced by most natural hazards. Measures regarding a particular hazard are mentioned specifically.

a. Site and soil conditions

- Avoid building on loose soil or refilled land. Expansive soil is not preferred for construction.
- Site should preferably be on flat land without level differences, if slope is unavoidable, clear the site such that the building stays away from the falling rocks and its foundation is away from slope to have enough anchorage.
- Site should not be in the path of flowing water and should not have history of flooding.
- Trees are desirable as they act as natural barrier against hazards like heavy winds or tsunami.

b. Design considerations (building shape, size, scale and configuration)

- Use regular shapes for plan. If unavoidable, break complex shapes into simple shapes.
- Use of symmetry is preferred. Symmetry should be followed in plan as well as elevations.
- Avoid too long, too wide or too tall buildings. Long walls should be strengthened by buttresses or cross-walls.
- Openings in a load bearing wall should be restricted to fewer numbers. The opening length should not be more than 40 percent of the wall length.
- For sloping roof, hipped roof performs better than gable roof.

c. Structural and construction parameters

- Foundation should be appropriate to the soil condition and depth of foundation should be adequate according to the soil and structure.
- Avoid soft storey, short columns and stub or freestanding columns.
- Structural clarity and clear load paths must be worked out. Multiple load paths are recommended for taking care of unforeseen failure of any structural element.
• Load bearing masonry is usually weaker in resisting lateral forces due to lack of ductility. Ductility should be induced by providing corner reinforcement in masonry walls or in masonry columns.
• Partition walls should be constructed along with the other walls in order to ensure strong connection between perpendicular walls.
• Roof overhang must not exceed 500mm in cyclone prone area.
• Gable walls act as free-standing walls during the earthquake shake. They should be tied with gable band. Using hipped roof instead of gable wall is a useful strategy to avoid damage to the walls and roof.
• If the structure is more than one storey high risk zones of earthquake, buildings may have heavier load bearing masonry on the ground floor and light wooden or steel portal frame with separate footing for upper floor. This structurally separate systems give both the structures enough flexibility and stability during earthquake.
• RCC slab should not be supported on two walls, it should be supported on four walls.
• Plastering and pointing of the wall should be done to prevent erosion or damping.

d. Hazard resistant features
• For RCC structures, short columns, soft storeys and shear walls play important role in disaster resistance.
• For masonry structures, seismic bands at various levels as per the earthquake resistant design code must be provided.
• Roof purlins and roofing on top of the gable should be adequately strengthened to resist strong winds and upliftment.
• When all walls are tied to each other they allow for the movement.
• Post and beam junction should be strengthened.
• Instead of using a traditional truss system a portal frame can be used. During earthquakes heavier trusses with their rigid joints tend to remain immobile and slide off the roof. A portal frame with pin joint at its junctions and a rigid joint on the ground enables the entire structure to be flexible in case of lateral forces.
• Cross bracings should be provided to resist shear forces in the portal frame, it prevents the structure from collapsing into oneself.
• Outer edge of the roof and window shade should be adequately anchored to resist the strong winds and upliftment.
• The minimum plinth level should be at least 150mm higher than the local average annual flood level.
• Joists and trusses should not be placed directly on the wall, instead place and anchor them on RC band.

7.2 SAFETY FROM FIRE

Unlike other natural hazards like earthquake, flood or heavy winds, fire can often be avoided by taking precautions at individual building level. There are three aspects to fire safety for quarantine facility. The first is to use materials which are fire resistant. The second is to incorporate fire safety norms in the design and planning of the building. The third is to instal fire safety equipment and maintain them regularly. However, one should refer
to National Building Codes for Hospital design for a comprehensive understanding of fire safety norms.

- First and foremost, the construction materials used should be fire resistant or treated to resist fire. The use of inflammable materials like thatch, untreated plywood or timber etc. should be done with necessary precaution and only after treating them.
- Areas where cooking or heating takes place should be carefully furnished such that inflammable materials do not come in contact with fire.
- The electrical equipment and installations including cables should be compliant with fire safety standards.
- However, the aim of fire safety norms is to control and limit the damage caused by fire in terms of loss of life and property. The safety standards should incorporate measures so that there is enough time and a clear and safe path to escape for the occupants.
- Every storey having an occupant load of 50 or more persons, regardless of use, shall be divided into two smoke compartments. The size of each smoke compartment shall not exceed 500 sqm, if it is more than 500 sqm it shall be suitably compartmented with fire resistance of not less than 2 hrs.\(^9\)
- The emergency escape path should be clearly demarcated with signage and lighting for evicting the building in case of fire.
- There should be provision of fire detection alarms and fire extinguishers at strategic locations.
- There should be sufficient open space around the building to allow free movement of people and fire vehicles in case of fire emergency.
- In smaller facility with only ground floor, there should be enough number of doors, and at least two doors that provide direct exit to the outer open areas.
- Fire exit staircase should be constructed out of non-combustible material if the building is higher then ground floor.
- Adequate passage way clearance for fire fighting vehicles to enter the facility premises must be provided.


\(^9\) Chapter 6: (National Disaster Management Authority February 2016)
This chapter describes design considerations for achieving thermal comfort and making the building energy efficient. Further, the section discusses optimising energy consumption and utilising solar energy.

8.1 MAXIMISING THERMAL COMFORT AND DAYLIGHT UTILISATION

Thermal comfort and good lighting conditions are important aspects for well being of a person especially in quarantine facility. Further, better thermal comfort and maximum use of daylight also results in reduced power consumption in a building. The thermal comfort in building depends on the heat gain or loss, air circulation and sun radiation, where direction and orientation of the building and placement as well as size of the openings play an important role. Some important factors affecting the thermal comfort are:

- The heat gain in a building can happen from the roof as well as from the walls.
- The heat gain through the solar radiation is a factor of the windows to floor area ratio as well as the amount of light that can get transmitted through that window.
- The Orientation and facade of the buildings plays a major role in heat gain through incident solar radiation.
- Natural ventilation is directly affected by the ratio of open windows to the floor area.

The below recommendations help take the decisions regarding provision of lighting and ventilation.

**Recommendations -**

- The natural materials with low thermal conductivity and thicker walls usually help reduce the heat gain and are recommended. Thus, earthen, brick or stone walls provide better thermal resistance compared to concrete, glass and metal walls.
- The building should preferably be oriented in North-South direction as the incident radiation on S-W orientation is almost double compared to the N-S orientation.
- The ratio of openable window areas to floor area, for good thermal comfort varies for different climatic conditions. For hot and dry climate, optimal window to floor ratio (WFR) of 10% should be achieved. optimal window to floor ratio (WFR) for hot and dry climate is 10%, hot and humid climate is 16.6%, composite climate is 12.5%.
- Recessed and shaded windows will help reduce the heat gain.
- To reduce heat gain from the windows, double glazed windows with high performance glass of 1.2 U value, side fins and necessary overhangs may be provided.
- Insulated walls with a low U value reduces the thermal transmittance.
- To significantly bring down the U value of the roof, high solar reflective & insulating (SRI) paint may be applied on the roof surface. Alternatively, the roof may be layered with insulating materials such as mosaic tiles for flooring.
- Adequate vegetation on the south and west side of the building will help reduce the heat gain.
• If necessary, the assisted ventilation solution in the building should be designed with turbo fans on top of the service shafts. It will create negative pressure in the shaft improving air-change inside the rooms.

8.2. OPTIMIZING THE ENERGY CONSUMPTION

Energy consumption can be optimized through strategic building design, installation of energy saving lighting and electrical fixtures as well as utilising alternate sources of energy such as solar energy.

• The consumption of electricity through artificial light can be significantly reduced by optimal use of natural lighting in quarantine areas. Large windows and open skylight may be provided to keep the spaces well-lit during the day.
• Wherever possible, energy saving or low energy consuming options for lighting, and other electrical fixtures should be installed. Install energy efficient electrical devices and appliances. The BEE star ratings standards will be helpful in deciding energy efficient appliances.
• Systematic and controlled use of openings can make the natural ventilation and cooling more efficient, resulting in reduced power consumption.

8.3 ACHIEVING ENERGY EFFICIENCY THROUGH SOLAR PHOTO VOLTAIC SYSTEM

It is possible for the quarantine facility to be completely self-sufficient in terms of its power requirements utilising only the installed solar photovoltaic power system. A well designed and executed energy plan is necessary and recommended.

• Power requirements for the facility should be calculated based on the light, fans, electrical equipment (including refrigerators, medical instruments etc.) as well as charging points necessary.
• Water heating requirements can be calculated for installation of solar based water heating system. The water heating requirements can be fulfilled entirely through solar power.
• The Solar PV system may be selected from three major configurations for power integration- Stand-alone (off-grid) solar PV system with dedicated loads, Grid-connected (on-grid) solar PV system with net metering, and Hybrid system (system with grid back-up power). The local context and power-grid situation should be analysed to arrive at the appropriate option. The grid-connected system works better where the existing power supply system is regular and alternative power back-up system is available for quarantine facility in case of power failure. This system is cost effective as the batteries for back up are not required. Stand-alone solar power system stores back up power through batteries which are costly and requires regular maintenance as well as periodical replacement. An optimised hybrid system would work best as it would reduce battery requirement and hence. The priority of requirements should be enlisted and cost-benefit analysis may be carried out to select the appropriate system and capacity for solar power system.
• The priority of requirements should be enlisted and cost-benefit analysis may be carried out to select the appropriate system and capacity for solar power system.
• A solar PV system can be installed on the flat or inclined roofs, chhajjas, or on any other available shadow-free space including on the ground. However, the direction and exposure to sun are important factors. A separate stand-alone structure may need to be provided to install the panels.
• The rooftops of the quarantine facility can be designed for installing the solar PV system.
• The size of a solar roof top system for the facility should determine by the projected power requirement and available shadow free rooftop area.
• Usually a fraction of the roof area can be utilised for harnessing solar energy. Building elements such as water tanks, lift rooms etc. located on the roof can occupy a significant area and cast shadow on other open parts too. The parapet walls further the shadow-reducing the roof area available for harnessing solar energy on the roof.
• Solar panels should be periodically cleaned to avoid dirt from setting on to maintain their efficiency. Hence, they should be accessible for cleaning regularly.
• Often, the building elements such as water tanks, lift rooms etc are located on the roof and can occupy a significant area. Shadow from the parapet walls further reduces the shadow-free roof area. Usually only a fraction of the roof area can be utilised for harness
• The panels need to be installed considering the high winds and secured well to avoid damage to the panels or the cables for power system.
**ANNEXURE 1: AIMS AND OBJECTIVES, SCOPE AND LIMITATIONS, METHODOLOGY**

**AIM and OBJECTIVES**

The main aim of the document is

- To understand and develop **design norms for setting up quarantine centres in the specific context of Covid-19** through relevant and evidence-based research, with capacity for 10 to 40 beds.
- To provide guidance to designers and administrators through document to set up a quarantine facility.

This will focus on achieving the following objectives:

- Carry out secondary research based on study and review on relevant literature including the International and National guidelines as well as other relevant design references.
- Conduct interviews with the relevant stakeholders such as the patients recovered from Covid-19, the health care professionals (medical doctors and nurses) as well as persons involved in setting up facilities for controlling Covid-19 spread to understand the requirements for setting up Quarantine Centre.
- Understand and interpret the design requirements for Quarantine facility based on the interviews and secondary literature with specific focus on small to medium towns, with capacity of 10 to 40 beds.
- Develop norms for designers and administrators to act as reference for designing quarantine facility as mentioned above.

**SCOPE and LIMITATIONS**

- These design norms are developed to help designers and facilitators in developing quarantine facility, keeping in mind the Covid-19 infection and guidelines developed by WHO, ICMR and other relevant authorities/ bodies for containing its spread.
- These design norms do not provide design options for any type of Covid-19 treatment or other medical care facility but are aimed only at setting up quarantine facility.
- The norms cannot be, in any circumstances be interpreted as replacement of medical advice by relevant authorised medical person or official while setting up such facility.
- Alongside these norms, it is recommended to have a certified and authorized medical official to guide the matters related to medical procedures for patient care and precautions for containing the spread of Covid-19 infection while setting up such quarantine facility. These norms would help designers interpret the advice in terms of spatial requirements and implementation.
- These norms would be applicable for small to medium towns and rural areas, where part of the population may require institutional quarantine. In terms of its capacity, the norms are for the quarantine facility with capacity of 10 to 40 beds.
- These norms are not operational guidelines for quarantine facility. Hence, they do not cover management, monitoring and supervision of the quarantine facilities or
providing patient care. The day-to-day running of quarantine facility will require guidance of a medical expert and managerial guidance and it should not be sought through these norms.

- The design norms are particularly for making a new facility and not for converting any existing infrastructure into quarantine facility. However, one can still learn from the document about the spatial and services requirements of quarantine facility.

**METHODOLOGY**

- Relevant national and international guidelines and research on the virus spread and infection were identified. The specific documents on quarantine centres and design of medical facilities as well as quarantine centres were referred to understand the relevance of design in Covid-19 care.
- Simultaneously, patients recovered from Covid-19 as well as medical professionals including doctors, nurses and medical officers working with Covid-19 were identified and interviewed.
- The appointments with medical professionals were challenging, due to their heavy workload and some of them were reluctant to talk about their work due to unfavourable media attention.
- Initial idea was interviewing AMC officials involved in setting up and administering Covid-19 response facilities. However, their appointment was most challenging as they were busy or were reluctant for interviews. It was also understood that the design norms would be developed not for the city like Ahmedabad, but for smaller urban centres or rural areas.
- The inferences from the interviews were noted to understand the various requirements, context and specific reference to quarantine facilities.
- Draft for the design norms was developed based on the literature study as well as interviews.
## ANNEXURE 2: LIST OF PEOPLE INTERVIEWED

List of people interviewed (Health professionals including doctors, support service personnel and quarantined people)

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Date of Interview</th>
<th>Name</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.07.2020</td>
<td>Shri Bindya Patel</td>
<td>Civil Engineer and Project coordinator, MHT. Ahmedabad</td>
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<tr>
<td></td>
<td></td>
<td>(recovered patient)</td>
<td></td>
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<tr>
<td>2</td>
<td>30.07.2020</td>
<td>Shri Sanjay Dave</td>
<td>Development Journalist, Charkha, Ahmedabad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(recovered patient)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>01.08.2020</td>
<td>Dr. Surya Prakash</td>
<td>Post graduate in MD general Medicine, Andhra Pradesh, Government Hospital,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hyderabad</td>
</tr>
<tr>
<td>4</td>
<td>05.08.2020</td>
<td>Dr. Shailesh Chudasama</td>
<td>Epidemic nodal officer, Junagadh corporation, Junagadh</td>
</tr>
<tr>
<td>5</td>
<td>05.08.2020</td>
<td>Shri Madhuri Pandey</td>
<td>Nurse, GCS Hospital, Ahmedabad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(nurse)</td>
<td></td>
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<td>6</td>
<td>09.08.2020</td>
<td>Shri Beniben</td>
<td>Street Vendor, Delhi</td>
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<tr>
<td></td>
<td></td>
<td>(recovered patient)</td>
<td></td>
</tr>
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<td>7</td>
<td>14.08.2020</td>
<td>Dr. Neeta Shah</td>
<td>Resident Medical officer, Petlad, Gujarat</td>
</tr>
<tr>
<td>8</td>
<td>16.08.2020</td>
<td>Dr. Jayesh Parker</td>
<td>TV news reporter, Ahmedabad</td>
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<tr>
<td></td>
<td></td>
<td>(recovered patient)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Dr. Anmol Shah</td>
<td>Pune</td>
</tr>
</tbody>
</table>
Name of person: Dr. SuryaPrakash, Post graduate in MD general Medicine, Andhra Pradesh, Government Hospital
Interview date: 1st August 2020 13.00 to 14.00
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika

- Dr Surya Prakash is currently pursuing his post-graduation, MD in general medicine, in a government hospital in Andhra Pradesh. He has been working in this hospital since the beginning of the Covid-19 epidemic. The hospital has an exclusive 1000 beds Covid-19 care department. They are currently treating 800-900 patients. Their team has been on the frontline since the beginning of March. He shared insights on requirement of infrastructure in Covid-19 treatment and various methods for testing and recommendations for Infection prevention control for a Quarantine centre. They follow WHO guidelines for infection prevention and control at the hospital as it focuses more on treatment as compared to ICMR guidelines which is research oriented.

Hospital and Covid Care department and required functions:
- In tertiary care hospitals there are multiple department/specialties like orthopaedics, general medicine, general surgery, paediatrics, genecology, pathology labs, anatomy labs. The infrastructure which exists for all these departments is not suitable for Covid-19 treatment, hence there was a need of a new block which is exclusively for Covid-19 treatment.
- Covid-19 care block includes testing labs, dialysis centres, eco rooms, stations for nurses and doctors, and sanitation facilities, isolation wards.

Patient categorization:
- They categorize the patients into thee, mild, moderate and severely ill patients.
- For mild cases only isolation rooms are enough, moderate and severe cases need to have semi -ICU like wards and for severely ill cases ICU facility is needed.
- The testing is done in the emergency room (ER), which is the first point of contact between the patient and hospital.
- Any bed ridden or severe ill patients should not be kept in quarantine centre, they should be transferred to hospitals. Patients who a very much ambulant and mobile should be kept in quarantine centre.

Testing Methods:
1. RTCPDR (Polymerase chain reaction) technique: test result comes in 3 days, if the number of patients getting tested are less, then results come in 1.5 days (as their hospital serves four districts, more burden for testing and therefore it takes 3 days for the results to come). Only ICMR accredited labs can conduct these tests. This is the best test and is always confirmatory.
- Setting up RTCPDR testing facility is expensive and can drain much of the budget so for a small-scale project this facility is not required. A tie should be done with a local corporate hospital which is accredited by ICMR to conduct RTCPDR tests for a small-scale quarantine facility.
2 True net- test: results come within 8 hours to one day. This test can be conducted in a small lab with an efficient lab technician. However, it is not recommended for quarantine centre.

3 Rapid Antigen test (RAT): test results come within 15 minutes. It requires less budget compared to other tests. It can be done anywhere in a small lab with an efficient lab technician. If the patient tests positive through this method then there is no need for RTPCR test, but if the result is negative and still the patient is symptomatic then it is advised to take RTPCR test.

- RAT- this is very useful method for a quarantine facility, as first point of contact. It requires 2 machines of a printer size and lab technician. If this test is positive then get a swab test done, if it is positive then treat it according to one of the 3 categories and if the swab test is negative but the patient is symptomatic then go for a confirmatory test in an empanelled laboratory.

4 Antibody test: not reliable, so they don’t encourage

Requirements for establishing quarantine centre:
- At the entrance, along with guard and a health worker, there should be a data operator to record the information regarding the person. Further, the Aadhar number and telephone number should be logged in to the ICMR portal database for the state. This is very important since the database links the Aadhar number as well as also the telephone number to the Covid-19 test history. Hence, if the patient has already tested positive, it can be known and further spread of Covid-19 in the quarantine centre can be avoided.

- Covid patients have Hypoxia (body depriving of oxygen) but they will not show symptoms for the same, unlike other diseases. Since the patients do not show symptoms of low oxygen levels, it puts them in danger and there are chances of rapidly going in to severe case. This condition requires the patient to be given oxygen immediately or get transferred to hospital. A system should be in place in quarantine centre to address this situation.

- There should be availability of oxygen concentrators in the centre. The concentrators serve for 25 hours, and hence repeated refill of oxygen is not required. Concentrators are briefcase size instruments with other attachments and knobs. They do not need large storage space. However, if the budget does not permit and they cannot be made available at the centre, ambulance with oxygen facility for transporting the patient to designated hospital is a must. He recommended more than one such ambulance readily available so that worse situations can be avoided.

- Arrangements for oxygen cylinders can be done as an alternative option.

- Central oxygen supply may not be considered for small size quarantine centres.

Infrastructure for Quarantine ward:
- The ward should be spacious to maintain distance between beds.
- The roof should be higher than usual.
- There is no need of mechanical ventilation system for small quarantine centres. Adequate sunlight and cross ventilation should work. The air should not remain stagnant inside the ward.
- Entrance should have donning area and at the exit point there should be doffing area for PPE kits. Donning and doffing areas should not be the same.
• The nurse station should be placed such that the nurse can monitor all the beds from the station. It could be a glass or any such cabin which separates the observation station from the quarantine room to curtail the infection.
• Separation between patient beds is very important. They should be separation from ceiling to floor between all the beds so that air circulation is limited between two individuals and infection is contained.
• There are two types for bed options for isolation ward which can be chosen according to the budget
  1. Beds with head end elevation.
  2. Beds used in ICU bed. They have a 2mx2m trolley along with it. The trolley has drawers to store patient’s belongings. It is advised that patients store their belongings in the trolley so they do not come in contact with the doctor during examination as there is a possibility of spreading of infection through infected surfaces.
• Keep provision of approximately 10 IV stands/Drip stands if the quarantine facility has capacity of 15 people.
• Dustbins with lid should be available on the bedside for every patient for easy access to reduce patient movement within the centre substantially.
• Precooked food brought from outside is preferred option for serving food in quarantine centre than cooking. However, if required, separate canteen area for food preparation may be provided. However, food should not be served in dining room or any common area where people would interact increasing the chance of virus spread. Instead food should be served at their beds in disposable packages and leftovers should be discarded in the closed bins provided by the person himself/herself.
• Packed water should be given to each individual. Common water dispensers increase the risk of spreading the infection.

Services and medical support
• Customised diet should be provided to individuals based on their medical needs and recommendations.
• BP, Blood sugar, pulse and oxygen should be checked as per the WHO guidelines for each patient. Pulse oximeter can be provided individually as oxygen levels need to be checked thrice a day. If the oximeter cannot be provided individually then it should be sanitised after every examination. Automated BP machine is recommended to be used for every individual so the possibility of transmission of virus through surface is less.
• If there are 15 patients, 30 apparatus can be provided. So, it can used in 2 cycles. The set which is used once should be sanitized and not used minimum for 5 days. After sanitization can be reused. There should be reserve of such apparatus.
• If the individual develops severe symptoms then it should be checked every hour and the person should be shifted to hospital.
• Medicine and equipment to be stored are: NS, DS, RL saline, oxygen, drugs for common cold, cough syrups, cold tablets, vitamin C, multi vitamin, B complex, zinco vita, paracetamol and some antibiotics, 1 or 2 nebulisers.
• Kettle for warm water and vaporizers should be provided to every individual.
• Doctors safety: every 8 hrs PPE kits should be provided to doctors HCW and municipal workers. PPE kit should have double gloves and safety gears.
IPC Recommendations

• There should be no common point of contact between the patients. The movement of the patient within the centre has to be minimized.
• Open spaces like playground etc. may be used to allow some common activities that can be carried out without close contact, and maintaining sufficient distance between individuals. However, in urban context the neighbours may get concerned about their own exposure and oppose the centre. Further, there are chances that someone may be able to go out of the premises unnoticed without proper log when they are out for such activity.
• Once the patient is discharged the bedsheets should be discarded (in case of disposable sheets) or disinfected.
• Process of fumigation should be conducted in the centre for sanitising.
• Sanitizer should be provided at every patient bed.
• Patients are advised to use less number of gadgets, so the possibility of spreading the infection is less.
• Bathing rooms and urinals/ lavatories should be separate. This reduces the chances of spread of infection. There should be separate area where sinks are provided for washing hands, brushing, gargling, etc. A dedicated HCW should be working for sanitization of the toilets.
• Ideally every individual should have own toilet. But due to cost and space constraints it might not be feasible to provide this facility. Additionally, if the Quarantine centre has to house a different function in future after Covid-19 pandemic, the program then, might not require more number of toilets. In this situation, temporary toilets can be arranged.
• General practice doctors use case sheets to note a patient’s treatment but in Covid care they use a software to keep an update regarding the treatment.

Name of person: Dr. Shailesh Chudasama, Epidemic nodal officer, Junagadh corporation
Interview date: 5th August, 2020 19.30 to 20.30
Interviewed by: Rushank, Nishita, Pravalika

Dr. Shailesh is currently working as an epidemic medical officer at Junagadh municipal corporation. He is also a nodal officer of Covid care center and Covid treatment center in Junagadh. According to new state guidelines by ICMR, quarantine facility is required only for international travelers and not for interstate or inter district. Due to this reason they have converted their Covid-19 quarantine center into Covid-19 care Centre now. He has shared insights on infrastructure services required in Covid-19 treatment and given recommendations for Infection prevention control based on his experience. Main learnings from the interview are as below.

Infrastructure

• Dr Shailesh talks about three kind of facility which is operational in Junagadh currently. The facility operates based on protocols and guidelines.
• Covid care center- This facility is for individuals who are asymptomatic or have mild symptoms. Covid care center has two zones, one is for confirmed positive cases and another is for individuals who have tested negative but are still suspected. The
percentage of division of beds is approximately 80-20, out of 220 total beds, 180 beds are identified for positive cases and 40 beds for isolation for negative or suspected cases.

- Quarantine facility for family members of the patient who have tested positive is given in Covid care center if home quarantine is not possible.
- According to guidelines, if an asymptomatic Covid positive patient stays asymptomatic for three consecutive days then she will be discharged from the Covid care center after seven days. After the discharge the individual will have to self-isolate for another seven days. If the individual does not have the facility for self-isolating oneself at home then they will be asked to isolate in Covid care center.

- **Covid treatment center** - This is a second line of treatment center. Patients who have oxygen concentration below 95, and have mild to moderate symptoms, fever and breathing difficulties are treated here. Oxygen concentrators, labs and other medical facility required for a semi ICU setup is available here.

- **Civil hospital** - This is a tertiary care center. Patients who have moderate to severe symptoms and patients with other existing illness along with Covid-19 infection are treated here. It has intensive care units and ventilator infrastructure.

- The campus has an **accommodation and quarantine facility** for the staff working at Covid care and Covid treatment center. Staff is quarantined for seven days in this facility after their duty. There can be two separate zones in the accommodation, one for staff who have finished their duty and are in 7 days quarantine and one for the staff who are in the duty of Covid care and needs accommodation during off duty timings.

**Testing:**

- They use two testing methods, RTPCR and Rapid Antigen Test.
- Rapid Antigen Test is performed for asymptomatic patients. RAT gives test results immediately. Therefore, patients are shifted to different infrastructure according to their test results and the treatment they require.
- RTPCR test take three days for the results to come. If this test has been conducted on an individual then she has to be isolated until the test results come. If there is no adequate facility to get isolated at home and the individual has mild symptoms then she will be shifted to either Covid care center or civil hospital. Only after checking the result it can be decided which facility will the individual be treated.
- The tests are done in urban health centers and civil hospitals. In rural areas, primary health centers, community health centers, sub district hospitals have the facility of testing.
- Government approval is required to set up a testing facility. It also requires additional infrastructure therefore it is not recommended to avail this facility in a small quarantine center.

Quarantine center facilities and services:
• **Quarantine center**- Individuals who might or might not be infected with Covid-19, but are suspected to have contracted infection based on their symptoms are treated in this facility.

• He recommends that there can be two parts in quarantine center, the ratio could be decided, one is for confirmed positive and other for suspected or are still waiting for test results.

• **Donning and doffing area**- A separate room for donning and doffing PPE kits is to be identified. Both should have bathroom facility inside the room. These rooms should be lockable. (It could be approximately 100sqft each). PPE kits are not stored in donning area.

• **Bio medical waste room**- A separate room is to be identified for storing the bio medical waste which is collected from doffing area and patients ward. The method of collection and storage should follow protocols given by central board of pollution control. The room should have sanitizer and a wash basin. There should be different bins for different types of waste. The room should be lockable. As the bio medical waste will be processed separately, there should be a tie up with bio medical waste pick up agencies. The waste has to be discarded according to the guidelines.

• **Recreational activity area**- Recreational area can be designed for individuals which will help them relieve from mental stress and anxiety of being a Covid patient. Indoor games like ludo, carom can be arranged. Television set and library books can be provided. This area should be designed by keeping in consideration distance between seating arrangements for individuals. Seating arrangement can be marked by drawing circles at specific distance. Speakers for playing motivational music can be provided in common areas.

• **Staff room**- One room of approximately 150-200 sqft can be identified for the medical staff. This facility can be used during their duty hours for resting and other needs. Toilet facility for staff has to be provided separate from toilets used by patients. Recreation facility should also be availed to medical staff if possible.

• **Storage room**- A room can be identified where the medicines, medical equipment and PPE kits and masks can be stored in dry area

• There should be attached toilet facility in the ward as individuals are advised to minimize their movement to reduce the chances of spreading the infection.

• There should be facility for drying and washing clothes if individuals bring their own belonging.

• A multi storage table can be provided beside the patient’s bed which can also act as a divider between two beds. It is to store personal belongings of the individual.

• Visual connectivity to outside by providing big windows is recommended.

• Ward should have adequate natural ventilation through windows. The air should not remain stagnant inside.

**Services:**

• A working phone line can be provided at the reception area with contact details of the management to the individuals in case of registering complain or emergency.

• Patients will be provided water bottle which will keep the water warm.

• Food will be provided in the center and individuals are free to bring their own food from home.
IPC recommendations:
- Distance of 2m is advisable between two beds.
- There is no necessity of screen or any kind of screen or separation from ceiling to floor between beds if the recommended distance is maintained.
- The area from entrance to patients’ room should be clear and have minimum things. This reduces the chances of spreading the infection through surface if an individual has Covid-19. The patient should be given mask and gloves at the entrance.
- Bed linens, bed sheets and pillow cover of the individuals should be changed daily. It has to be sanitized first in 5% hypo chloride solution for 2 hours and then give it for cleaning.
- Center will have to be sanitized once in 24 hours with hypo chloride solution along with brooming and floor mopping.
- Blood pressure and oxygen has to be checked twice daily for all the individuals, and other tests are done according to complain from patient. Oximeter can be common between all the individuals in identified risk zones. The instrument used in zone which has confirmed positive cases cannot be used in zone with individuals who are suspected.
- Food is to be given in disposables. Food which is brought from home by individuals is also to be eaten in disposables.
- PPE kit and N95 mask is must for medical while inside the patient’s ward.

Staff management:
- There can be 2 teams with 3 sub teams under each team. Sub teams are made so the staff can work in shifts. The duty timings for 3 sub teams can be from 8.00 to 14.00, 14.00 to 20.00, and 20.00 to 8.00. This means day time shift will be 6 hours and night shift will be 12 hours.
- Each team will be on duty for 7 days after which the team will change. After completing their duty, they have to quarantine for 7 days in the resident facility.
- Each team should have one doctor (doctor need not be MBBS) and 2 nursing staff, if there are a smaller number of patients then one nursing staff is enough. There will be one MBBS doctor for both the teams, who is available in the center for specific time and otherwise available on call if needed.

Name of person: Dr. Neeta, Resident Medical officer, Petlad
Interview date: 14th August 2020 13.15 to 14.00
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika

Dr Neeta is a resident medical officer at Petlad hospital. She has been working in Covid care center since March 26,2020. She was also engaged in converting and remodeling of the exiting hospital at Petlad into a Covid care center.
Hospital and Covid Care department and required functions:
- The existing hospital has been remodeled into a Covid center. The center has 20 beds, out of which 11 beds are with oxygen support, 1 bed is with ventilator support and rest 8 beds are isolation beds for individuals.
• Oxygen tank is constructed on an elevated structure. Oxygen is supplied in the wards through pipelines from the tank like it is done in corporate hospital. Provision has been made to supply oxygen to all the beds.
• As Covid center was remodeled into an existing hospital, separating corridor spaces was not possible, but it is advisable to have separate corridors for patients and HCW.
• Entry and exit for infected and non-infected areas should be separate entrance and exit for HCW, patients and service staff should be different
• In the remodeled center, patient’s entry and exit is the same
• It is advisable to have a separate exit for service staff although they couldn’t do it as it was an upgradation project
• They have not provided waiting area; it is not advisable for the patient to wait as it increases the chances of spread of infection
• Donning area and doffing area should be different
• Doctor station is near to donning area, the doctor uses the station to get the daily report and schedule
• Once a person enters the doffing area then he/she will have to exit from a separate exit. They should not enter the facility again.
• Nursing station: It is marked as green zone. It is also used as a storage room, for extra medicines, equipment, patient details and reports.
• Toilets for patients and staff are separate. For 20 bed hospital they have provided 2 male, 2 female toilets and 2 Female and 2 male bathing spaces as common toilets.
• There should be a provision for separate room for bio medical waste collection. The waste is collected in a trolley.
• Beds: Beds used in ICU are preferred for Covid patient treatment as they are comfortable. Cotton mattress is not advisable as cleaning and sanitizing is not easy.

Patient categorization:
• Patients come in ambulance in their facility, so the primary checkup for symptoms is done in ambulance itself. Patient is allowed inside the facility once her report is ready and the administration gives the confirmation about the availability of the bed. The registration is done before the patient comes inside the facility. Patients are given beds depending on the symptoms and treatment required.

Services:
• Food is prepared in the hospital and packed in disposables and then given to patients
• Once the food is eaten service staff collects the disposable from every individual. This food is then collected by waste management agency who comes twice in a day.
• Patients bring their own clothes. The hospital provides service for laundry. There is laundry service for bed linens
• There is facility of video calling for patients should they want to talk to their family/friends at fixed hours

IPC recommendations:
• All medical staff who enters the facility must wear PPE kit.
• Distance between two beds should be minimum 2 meters
• The distance should be such that trolleys and oxygen cylinder can fit in between two beds and a person can easily examine the patient
• Clinical psychologists and yoga instructor visit patients regularly so there should be enough space between two beds
• Every bed has a dustbin by its side
• Doctors duty will not be more than 8 hours.
• Separate Oximeter is given to each individual but other medical equipment are common which are sanitized after every examination.
• Water is given in PET bottle
• As the Covid center is remodeled into an existing hospital there are other patients in the premise who are not Covid infected. It is therefore strictly prohibited for Covid patients to go out of the ward for any recreational purpose as there are chances of spreading the infection.

Interview with nursing staff engaged in Covid Care
Name of person: Madhuri Pandey
Interview date: 5th August 2020 15.00 to 16.00
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika

Shri Madhuri is a resident of Ahmedabad. She is a staff nurse at GCS Hospital, established by the Government of Gujarat which is remodeled as a Covid Care Centre under the current crisis. Madhuriben is working at the Covid general ward for the past four months. She is the head nurse for a general ward who is highly passionate and motivated to stand by the moral and legal duty to serve the people during this crisis. Her daily work hours range from 6 to 12 hours with morning and night work shifts.

Hospital and COVID Care department:
• The hospital was divided into two zones- Covid and Non-Covid departments ensure separate treatment of people with and without the infection.
• The hospital staff was distributed among various departments and Madhuriben is in a team treating those with mild to moderate symptoms of Covid-19.
• Access to Covid and Non-Covid are different and was only accessed by the relevant health care staff, support staff, doctors and patients.
• At the entrance, biometric system of attendance for the staff was disabled to reduce the risk of contact.
• On entering the hospital, nursing staff collects their PPE kits from the reception. Donning and Duffing rooms were provided in the ground floor at the entrance.
• The health care staff including the doctors were donning PPE suits with masks, gloves, and shoe covers; and proceed towards the lift dedicated for the Covid department.

Donning and Doffing Rooms:
• Separate rooms for donning and duffing Personal Protective Equipment. These rooms are located at a close proximity to both entrance and the lift.
• Spatial requirements for these rooms are: Changing space for one person and provision of wash basin with sanitizer, liquid soaps and a dust bin. It is advisable to limit the equipment inside the rooms to minimum the risk of contact.
• In the duffing room, the used PPE kit is discarded into a yellow bag (denoting biomedical waste) and is usually left behind till the support staff collects the waste.
Provision of dedicated space for placing the used PPE kits (yellow bags) would be useful.

Covid Care Wards:
- There are 30 beds in the Covid general ward. They are attended by 1 or 2 nursing staff depending on the surge.
- The beds are placed at 1 meter apart from each other. There was storage provided with each bed.
- The ward was attached with the toilet. 4 separate toilet and bath facilities are provided with wash area.
- A nursing station was provided inside the ward which was at a distance of 6-7 meters from the patients' beds. Visibility to monitor the patients is the key for a nursing station. The partition walls are usually translucent to ensure visual connect with the patients.
- Nursing station for 30 bed ward needs to be ideally designed 4 nursing staff. (2 on duty nurses and 2 – doctors on regular visits to the ward)

Services and medical support:
- Healthy diet is important for the well-being and speedy recovery of the patients. Customized diet was provided to individuals based on their medical needs and recommendations.
- Food was provided by the hospital in disposable dishes and was later collected by the support staff to discard.
- There was a common water filter in the lobby for drinking water which was provided to patients in individual jugs and bottles. Induction stove was provided in the ward for patients in need of warm water.
- It is essential to consume warm water and to take steam as per individual requirement. (Provision of individual kettle and vaporizers is advisable.)
- Essential apparatus such as Stethoscope, BP machine, thermometers, pulse-oxy meter were shared. However, apparatus was sanitized before each use.
- Bed linens and clothes for patients were provided by the hospital. Thus, reducing individual washing activities in the washrooms.
- The ward was swept and mopped at least three times in a day and was sanitized everyday.
- Doctors visit the patients twice a day and the nursing staff keep a check on the patients throughout the day. Patients were advised to keep their masks on all day.

Infrastructure at the Covid Care Wards:
- The ward should be spacious to maintain at least 1 m distance between the beds.
- Each bed should be provided with a storage facility, a drip stand and oxygen facilities.
- There is no need for screens or partition between the beds were not provided in the general ward.
- There is no need for air conditioning in the ward, especially in rooms with more patients. Adequate natural lighting and ventilation is necessary.
- The nurse station should be placed such that the nurse can monitor all the beds from the station. It also needs to have a designated medical storage space.
Personal experiences:
- Nursing staff were provided with accommodation to quarantine during their 2-week Covid care duty period.
- 3 members shared a spacious room with attached toilet. They were provided with individual beds and storage facilities.
- Food was provided to the staff in their accommodation and are advised to not consume any food during duty hours.
ANNEXURE 4: NOTES FROM INTERVIEW WITH RECOVERED COVID-19 PATIENTS

Interview with recovered COVID-19 patients

Name of person: Sanjaybhai Dave  
Interview date: 30\textsuperscript{th} July 2020 14.00 to 15.00  
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika

Sanjaybhai Dave is a resident of Ahmedabad. He is a development journalist at Charkha, a Non- Profit which works towards the social and economic inclusion of marginalized communities in rural areas through the creative use of media.

Development of Symptoms and Testing
- In early June, Sanjaybhai developed mild symptoms of Covid-19 such as fever, cough etc. Initially, the symptoms felt like normal flu or other viral infection. He consulted his family doctor as well as other doctors. Meanwhile, his wife and one daughter were also developing similar symptoms. As the symptoms became severe, he was advised to test for Covid-19.
- He got tested through a private laboratory in Ahmedabad. Swab test was conducted at his residence. Once the result of the test came positive.
- He was immediately admitted to a private hospital while his family opted for home isolation due to very mild symptoms.

Entry to the Hospital
- The hospital was an existing one where the Outpatient Department (OPD) was dedicated to COVID-19 cases. Main entrance of the hospital was closed and existing OPD entrance was used as common entry/exit for COVID-19 patients, visitors, doctors, and support staff. There was a ramp at the entrance for wheelchair and stretcher access.
- The entrance was manned by a guard and a health care staff. There was a pharmacy near the entrance which could be accessed from the outside. The reception and cash counter were at the ground floor where the visitors were permitted access. Dedicated visitor’s/ patient’s waiting space was provided in the lobby. Additionally, ground floor had two rooms for doctors, nurses and laboratories.
- The health care staff including the doctors were donning PPE suits with masks and gloves; and usually followed physical distancing. He felt that the security guard at the entrance of the hospital who was donning only mask was somewhat casual and was not maintaining physical distance with the patients.
- While admitting, the patients were asked to leave their personal belongings on a desk at the entrance, where they were sanitised and then taken to the room by the support staff to the patient’s room.
- During the patient admission process, basic screening (pulse, oxygen level and temperature check) of the patient was conducted at the waiting area. The admission process was time consuming and inconvenient especially when the patients felt tired and exhausted. Provision of resting spaces (space to sit or lie down) would have been helpful for the patients.
COVID Care Rooms

- First floor of the hospital building was reserved by AMC as general COVID ward. Second and third floors had double and single occupancy rooms for COVID patients and were part of hospital's private services.
- Initially, Sanjaybhai stayed in a double occupancy room with a toilet. The room had basic amenities shared between two occupants. This included beds, two storage desks, fans, two plug points (only one was accessible by both the occupants, while other was near the entrance and not very useful).
- Individual plug points would have been appropriate as it would lessen the contact between the patients.
- A curtain separated the two beds. The room had two windows, one each near the patients' beds, which provided sufficient natural ventilation and day lighting. This also helped the patients maintain good visual connect with the outside.
- Washroom was equipped with a squat toilet, wash basin, buckets, while tumbler was missing. There was no storage or ledge for keeping toiletries and hanger space for drying clothes.

Services in the Room

- After first two day stay, he shifted to the single room, as he preferred to have his personal space.
- Rooms were sanitised, cleaned and mopped everyday by the support staff. Bedsheets were changed daily and washroom was also cleaned daily.
- Sanitisation of room created discomfort in breathing and was immediately followed by floor moping.
- Food was provided by the hospital in disposable utensils. However, the waste collection was not regular. Patients had to dispose the waste in common dustbin in the corridor themselves.
- The metal table had storage space where medicines could be kept and its top could be used to keep small items, but there was no storage space for personal belongings, steamer, water jug, other items including reading glasses etc. near the bed.
- There were no dustbins in the rooms or bathrooms. Disposable bags were used by patient to collect the waste every day. The patient had to put the waste in common waste-bin kept in the corridor.
- Doctors used to visit twice a day and the health care staff visited four times a day to keep a check on the patients. Patients were advised to keep their masks on during these visits.

Single Occupancy Room

- Single room had better facilities than the double occupancy room. This included a bed, air conditioning, fan, lights, TV, small sofa, table to store medicines etc., multiple plug points, oxygen pipeline. There was extra bed in the room too, which he used to keep his belongings.
- Room had an attached bathroom but it did not have hot water. Hot water was supplied in bucket on request.
- There was provision of water bucket and tumbler in the bathroom, but there was no provision of storage for toiletries or any ledge where personal belongings could be stored.
- He specifically felt need for having hangers or twine in the bathroom to dry washed clothes or towels etc. which he had to dry on the extra bed in the room.
• Sofa and table in the room were used to keep personal belongings such as clothes, medicines, water jug etc.

Food Provision
• Food was provided by the hospital in disposable dishes by the support staff. Warm water was provided in steel jugs/ tracks as required.
• Neither rooms had any provision for dining or keeping food items. In the double occupancy room, bed was the only option to store and sit. However, the single occupancy room had an extra sofa which was used for dining.
• The privacy becomes a very important aspect while sleeping as well as eating.

Visual Connection
• Both rooms had large windows connecting the inside with the outside. This was very important as the visual connection established by windows helped him relating to the outside. He spent ample time at the window looking out on the road or in the internal road of a residential block. This helped him during the loneliness.
• Since he likes white or lighter colours, the interior of the single room was appealing and pleasant to him.
• The nursing station was just outside of his room and he felt that easy access of the health care staff was helpful and made him somewhat secure.

Social Stigma
• Sanjaybhai was discharged from the hospital after four days. He was isolated at home for another ten days. Most often he did not feel any discrimination. However sometimes people's behaviour changes towards Covid-19 patients.
• Post his recovery, he faced unusual behavior from one of his neighbors. Though he felt his immediate family and friends were very much supportive.
• He believes that COVID has provoked social stigma and the uncertainty of the impact on life even after the recovery is not helping the patients. People also become insensitive to wards the patients and that does not help keeping the morale of the patients high. Society in general needs to find ways to deal with and accept Covid-19 patients.

Name of person: Bindiya Patel, Civil Engineer and Project coordinator, MHT
Interview date: 29th July 2020 12.00 to 13.00
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika
Admitted: AMC Approved Private Hospital, Special Room
Admitted for: 4 Days

Bindiyaben shared her experience from when she felt when she was infected with Corona, till she again started working after the full recovery in an internet meeting with the team. Main learning points from the interview are as below

Development of Symptoms and testing:
Bindiyaben had symptoms of weakness, breathlessness, low pressure and fever. On recommendation of her family doctor she got Covid-19 test done and was confirmed positive. As she had mild symptoms of Covid-19, she had an option of getting treated at home However, for the safety of others in the household, admitted she opted for
She was treated in hospital for 4 days and was asked to be home quarantined for 18 days post the release from hospital.

Arrangements in the Hospital:
- Since the hospital was treating Covid-19 as well as other patients, the first two floors were kept for other patients while the upper floors were reserved for Covid-19 patients.
- Entry and exit for Covid-19 patients were from the basement. They would take the elevator to reach the floors/room reserved for them with assistance from health worker. The other patients entered the hospital from usual entrance on ground floor and were not allowed to use elevator.
- There was reception desk set up in the basement for admitting the patient, allot the rooms as well as other inquiries. Here the family could also leave food or other supplies for the patient admitted to the hospital for Covid-19 treatment.
- Storage and changing facility for PPE suits was also created in the basement where the health workers would get changed or put on PPE suits before taking the elevator to upper floors.
- The Covid-19 section had three types of facilities, 1. ICU, 2. General rooms and 3. Special rooms. People with severe condition were on different floor. According to their condition the patients were assigned different rooms on different floors.
- No visitors were allowed and there was no waiting area allotted.

Covid-Care Room (Special room):
- The room had all the required health equipment including attached toilet and oxygen pipe.
- Apart from bed, there was a separate sitting space for the patient. The room also has a TV set.
- Warm drinking water was given in PET water bottles in the room.
- There was steaming facility in the room.
- Food was provided and eaten in disposable containers. A separate table was in the room for having meals.
- Patient had a call button for HCW in the room.
- There was a plastic chair, and there was one revolving chair too.
- There was one cupboard, further away from the bed for storing clothes and other personal belongings.
- Any supply that came from home had to be deposited in the basement and was delivered to the room by hospital staff. (storage facility needed to store the supplies from home).
- The window overlooked on to a road where a bridge was being constructed. She could watch the construction activity from her bed. This, along with talking to her family and watching television were the main activities that kept her busy. A bridge construction site.
- The hospital was centrally AC and she was provided with a remote to control the room temperature. The window could be opened; however, she was not specifically instructed to keep ventilating the room and letting the fresh air regularly.

Bathroom facility:
• Bathroom had a bucket, table, urinals, wash basin. Toiletries and essentials were provided in a pouch at the time of admission and later were available on demand.
• Hot and cold-water facility was installed in the toilet.
• Room floor was cleaned and mopped thrice in day by the workers but the toilet was not cleaned even once in 4 days.

Services:
• All the clothes and linen were given fresh daily. Bedsheets were changed daily by the staff.
• The soiled clothes after bathing had to be put on ledge which were collected by the HCW (health care worker)
• Equipment for checking BP, oxygen and fever were brought by the doctor or medical staff whenever they came to examine her.
• Doctor visited twice a day for checkups.

Discharge:
• She had to visit Mediclaim insurance facility at usual reception on the ground floor for finishing the formalities. A separate desk for MedClaim insurance transactions is assigned for Covid-19 patients. A person from corporation is present there to record the number of patients getting admitted and discharged. He keeps a note on these details which is then forwarded to corporation for creating the database.
• Transport to home after discharge was a problem as no auto driver was willing to take the ride as she was a Covid patient (hospital ke bahar likha hota hai Covid). Later she had to take an ambulance ride to home and bearing the expense. Family could not come to pick her up from the hospital after discharge.

Personal Experiences:
• In the morning she used to exercise a bit and walk around in the room, and sit quietly for some time.
• The window in hospital room kept her busy as she could look outside even when the drip was on as it provided visual connection to outside.
• She felt comfortable in the hospital room as compared to the room at her home where she isolated herself for 18 days after getting discharged from hospital. It was mentally depressing as she had to stay in in the same room which had a small window and no TV set.
• She felt that people’s attitude towards Covid-19 patients change. When standing in apartment balcony people feel reluctant to talk to her even though distance between two buildings is enough.

Name of person: Beniben
Interview date: 9th August 2020, 12:00 to 13:00
Interviewed by: Rushank, Nishita, Bhavnaben, Pravalika

Beniben is a resident of Delhi. She is a street vendor living with her family in Bakkarwala community.
Development of Symptoms and Testing:
As the Covid-19 cases in bakkarwala community were increasing, mass testing was conducted to isolate the infected patients and the suspects. This mass testing was conducted by the Delhi Metro Urban Health Centre by a team of medical officer, ASHA worker who identified the suspects with mild symptoms of Covid-19 such as mild fever, body aches, cough etc.

Infected patients with mild symptoms are taken to designated Covid-19 care centers in the vicinity to isolate. These centres are originally DDA flats converted to isolation centers by the Delhi government.

Isolation Centre:
- Beniben was isolated in a five storey building. Each floor has four 4bhk dwelling units. The building was guarded by a security guard who was also the main care taker of the isolation centre.
- Each patient was allotted a separate room to isolate and common areas such as living room and kitchen was accessed by all the patients in the room.
- Each room which was a bedroom has an attached washroom.
- There is no particular procedure for entry or registration. The patients were picked up from their community to the isolation centre by Asha workers in an ambulance.

Services in the Room:
- Each room was equipped with a bed, linens and a Blanket. A hot water kettle was provided in the kitchen.
- There was provision of water bucket, tumbler and toiletries in the bathroom.
- There was no facility or support staff to clean or sanitize the room. Patients cleaned and moped their room by themselves.
- Drinking water was provided in water bottles and was refilled multiple times in a day.
- Food was provided by the Authorities in disposable utensils. All four meals were kept in the kitchen for the patients to collect.
- There were no dustbins in the rooms or bathrooms. Disposable bags were used by patient to collect the waste everyday. The patient had to put the waste in common waste-bin kept on the ground floor every day.
- No visits by doctors or health care. Medicines for each patient were provided in separate packages without any testing done.
- Basic medical apparatus such as thermometers, BP machine, oximeter was also not provided.

Visual Connection and Personal Experiences:
- Beniben was satisfied with the facilities in the isolation centre. She particularly liked the spacious rooms with daylight and natural ventilation. She was able to walk around in the lobby area which was not possible at her home.
- She indulged herself in spiritual reading which helped her stay calm and positive throughout her stay.
WHO: CONSIDERATIONS FOR QUARANTINE OF INDIVIDUALS IN THE CONTEXT OF CONTAINMENT FOR CORONAVIRUS DISEASE (COVID-19)
MARCH 19 GUIDELINE

Summary:
The guidelines define what is quarantine and when it is needed and for whom. It talks about what measures should be taken before implementing quarantine to reduce panic and improve compliance. It gives IPC recommendations which stresses on early recognition and controls, administrative controls and environmental controls. Overall, the document does not give any comprehensive understanding of the spatial and functional needs in a quarantine facility but gives a very brief idea to ensure an appropriate setting for quarantine.

- Quarantine - The quarantine of persons is the restriction of activities of or the separation of persons who are not ill but who may have been exposed to an infectious agent or disease, with the objective of monitoring their symptoms and ensuring the early detection of cases. Quarantine is different from isolation, which is the separation of ill or infected persons from others to prevent the spread of infection or contamination.
- A very important point it says is that if quarantine measures are not implemented properly; it may also create additional sources of contamination and dissemination of the disease; therefore, it is necessary to implement it according to guidelines.
- The quarantine of persons is the restriction of activities of or the separation of persons who are not ill but who may have been exposed to an infectious agent or disease, with the objective of monitoring their symptoms and ensuring the early detection of cases. Quarantine is different from isolation, which is the separation of ill or infected persons from others to prevent the spread of infection or contamination.
- If not implemented properly, quarantine may also create additional sources of contamination and dissemination of the disease.
- Quarantine facility should be adequately ventilated, spacious, with hand hygiene and toilet facility. If cohorting then maintain distance of 1 meter.
- Facility for protection of baggage and other possession should be provided.
- Systems for cleaning and disinfecting frequently touched surfaces and toilets.
WHO GUIDELINES IPC - 29 JUNE, 20
INFECTION PREVENTION AND CONTROL DURING HEALTH CARE WHEN CORONA
VIRUS DISEASE (COVID-19) IS SUSPECTED OR CONFIRMED:

Summary:
It is a third edition of WHO’s interim guidance on Infection Prevention Control (IPC). In
addition to minimum IPC requirements given by WHO these are robust and comprehensive
for Covid-19. It focuses on control and prevention by recommending five strategies. These
strategies detail standard procedures for hygiene of the patients, workers and the
environment where they stay. First half stresses on what systems should be in place in the
quarantine/treatment center and standard precaution to follow for patients and health
workers. It then describes in detail how the virus is spread and precautions to stop the
spread through administrative controls. It then talks about engineering aspect of the
facility and different types of systems for ventilation. At the end it talks about precautions
for all the clinical procedures from specimen collection to surgical procedures and dead
body management.

Five strategies:

Screening and triage
Screening: guidelines for self-awareness of the symptoms with signs on entrance, training
the staff, designing questionnaires to determine the kind of care, social distancing
and reducing the time in waiting and maintaining social distancing. All these requirements
of signage and screening turns into spatial arrangements.
Triage: prioritization of care according to severity using validated tools, a separate area
with appropriate design where suspected patients can wait; should have toilet and hand
hygiene and waste disposal systems and graphics to display (this is important for spatial
design)
To prevent transmission this stage becomes very important as non-patients can be
infected within the facility. This can be done by identifying symptoms, rapid testing and
reminder systems based on signs and symptoms. So, quarantine stage becomes critical.

Applying standard precautions for all patients: this includes hand
hygiene, respiratory hygiene, use of PPE, environmental cleaning, and waste
management. These procedures need design inputs in terms of design layout.

Implementing additional precautions: [3.1] If confirmed or suspected patients
are cohorting in the same room then guidelines for ventilation, distance, transport
routes, surface cleaning, hand hygiene and exposure of health workers should be taken
care of. (details are given in WHO guidelines itself)

Implementing administrative controls: managing visitors by giving them separate
area, routes and maintaining social distancing.

Implementing environmental and engineering controls: focus on adapted structural
design, ventilation standards, spatial separation and environmental cleaning. Three
criteria for ventilation for each space of health care facility. Ventilation rate, airflow
direction air distribution or pattern. Methods used to ventilate the space, and they are
decided based on climate, prevalent wind direction, floor plan, need, availability of
resources, maintenance, potential impact of airflow on other parts and cost. There is
standard requirement is 6 air changes per hour for mechanically ventilated spaces
where Aerosol generating Particles (AGP) is not performed.
In naturally ventilated spaces, contaminated air should exhaust directly outdoor away from air-intake vents and people. Average rate is 160L/s/patient for natural system of ventilation, when this recommendation is not satisfied, hybrid (missed mode) method should be used.

In mechanically ventilated spaces, negative pressure should be created to control the direction of airflow. Rate should be 12ACH which is equivalent to (40-80L/s/patient for 4 x 2 x 3 m³ room) and pressure difference of 0.01-inch water gauge to ensure air flows from corridor to patients’ room.

For facilities where natural or mechanical ventilation is inadequate installation of exhaust fans, whirlbirds, and High efficiency particulate air filters can be installed according to guideline provided. (the basic guideline is provided in the document itself for the three)

Poorly designed or maintained ventilation systems can increase the risk if health care associated infections transmitted by airborne pathogens due to incorrect airflow and poor design.

Spatial separation and physical barriers such as glass and plastic panels can reduce exposure in screening or triage areas, registration desk, or the pharmacy window.

Cleaning and disinfection of surfaces is critical element and should be performed frequently.

COVID-19 OUTBREAK - GUIDELINES FOR SETTING UP ISOLATION FACILITY/WARD
NATIONAL CENTRE FOR DISEASE CONTROL

Summary
The document provides guidance to establish an isolation facility at existing state/district health care facility. The document envisages to guide by providing checklists to assess the health care centre’s preparedness to upgrade existing infrastructure. However, relevant guidelines and checklists with respect to isolation/quarantine facilities, spatial and storage requirements, essential services to be provided have been referred for general understanding.

Setting up Isolation/Quarantine facility

- At State level and district level, a minimum of 50 bed and 10 bed isolation ward should be established respectively.
- Post signages on the door indicating that the space is an isolation area.
- If sufficient single rooms are not available for Covid 19 patients, beds could be put with a spatial separation of at least 1 meter (3 feet) from one another.
- Non-essential furniture needs to be removed to ensure less risk.
- To create a 10-bed facility, a minimum space of 2000 sq. feet area clearly segregated from other patientcare areas is required.
- Preferably the isolation ward should have a separate entry/exit with double door entry. (universal design considerations)
- There should be double door entry with changing room and nursing station with separate waste disposal bins to collect used PPEs. (PPE Disposal as per BMWM guidelines)
- Stock the PPE supply and linen outside the isolation room or area. Setup a trolley outside the door to hold PPE. (need for storage)
• Place appropriate waste bags in a bin. If possible, use a touch-free bin. Ensure that used (i.e. dirty) bins remain inside the isolation rooms. *(space/route design for waste disposal)*

• Keep the patient’s personal belongings to a minimum. Keep water pitchers and cups, tissue wipes, and all items necessary within the patient’s reach. *(need for personal storage)*

• Ensure that appropriate hand washing facilities and hand-hygiene supplies are available. Stock the sink area near the point of care and the room door.

• Ensure adequate room ventilation. If room is air-conditioned, ensure 12 air changes/hour and filtering of exhaust air. A negative pressure in isolation rooms is desirable for patients requiring aerosolization procedures (intubation, suction nebulisation). These rooms may have standalone air-conditioning. These areas should not be a part of the central air-conditioning.

• If air-conditioning is not available negative pressure could also be created through putting up 3-4 exhaust fans driving air out of the room.

• If there is sufficient space, natural ventilation may be followed. Such isolation facility should have large windows on opposite walls of the room allowing a natural unidirectional flow and air changes.

• The isolation ward should have a separate toilet with proper cleaning and supplies.

• Keep adequate equipment required for cleaning or disinfection inside the isolation room or area, and ensure scrupulous daily cleaning of the isolation room or area. *(need for storage)*

**Checklist for Isolation rooms**

Safety equipment such as masks, face shields, gloves, PPE gowns, sanitisers, plastic aprons, disposable bags, towels etc. to be stored in a space outside the isolation area to avoid contamination. *(need for dedicated storage)*

**Donning & doffing areas**

**Entering the isolation area:** - Collect the equipment needed; Perform hand hygiene with an alcohol-based hand rub or soap and water and Put on the PPE. *(Need for a changing room preferably with a wash area)*

**Leaving the isolation area** - PPE needs to be removed in the anteroom or, if there is no anteroom, one needs make sure that the PPE will not contaminate either the environment outside the isolation.

**Checklist to assess the isolation/quarantine facilities**

*Only the relevant points with respect to spatial design are mentioned below*

• Screening rooms identified and available at the isolation area?
• Is there any designated area for sample collection?
• Is there separate entry/exit to the isolation area?
• Dedicated space for staff to put on/take off PPE while entering the isolated area
• Is there separate exit for isolation area?
• Dedicated space for staff to take off PPE near exit?
• Isolation facility is separate and has rooms/wards?
• Are washrooms available as 1 toilet per 20 persons?
• Number of beds in each isolation rooms/wards
• Is the distance between two beds in isolation wards/rooms more than 1 meter?
• Do the Covid care centre have policy to segregate clinical staff (e.g. nurses) for care of Covid19 cases?
• Whether PPEs available and located near point of use? a. Gloves b. Gowns c. Face masks d. 95 respirators
• Whether the hospital limits the movement of patients in the isolation facility outside for medically necessary purposes only?
• Are the known or suspected Covid19 patients placed on contact and droplet precautions?
• Do staff transport the patient wear PPE? While transporting patients are specific routes used to minimize contact with other patients and staff? (designing of corridor spaces)
• Is there Provision food in the isolation area? (is a full-fledged kitchen required?)
• How will the leftover food waste management? (Also, how is the food provided – connectivity)
• Is there an isolation facility attached to the quarantine ward?
• Availability of cross ventilation
• Is there any designated area for sample collection?
• Are they following standard precautions and PPE while taking sample? (furniture requirements?)
• Are the floors of isolation facility suitable for mopping?
• Availability of management protocols for Covid19?

Services
• Does the facility have uninterrupted running water supply?
• Colour codes bins in Bio Medical Waste (BMW) management?
• Is drinking water available at isolation area? (Common areas with drinking water facilities?)

GUIDELINES FOR DEVELOPING COVID CARE CENTRES (CCC) AND DEDICATED COVID HEALTH CENTRES (DCHC) IN RESOURCE-DEFICIENT CONTEXTS BY IIHS

Summary:
The guidelines focus on execution of CCC and DCHC based on retrofitting model of existing buildings. The main points covered are shortlisting of potential sites, functional arrangements that shows schematic arrangements and work flow, detailed layouts for different typologies, material and construction system which contains recommendations on selection of material and decentralized options for water and sanitation. The guidelines have been designed based on three factors, focusing on reducing the spread of infection by managing the flow of the patients, working out efficient options in limited budgets and resource availability and enabling expandability of the centers through modular construction and accounting for life cycle of the temporarily constructed centers.

Part 1: Shortlisting potential site
It gives a checklist for choosing a site based on services and spatial requirements, it then gives a list of recommended sites such as stadiums, exhibition center etc based on the checklist and then gives a (Board July, 2020) list of construction arrangements necessary
for each of the typology of the site. For example, airports and exhibition halls come under large halls with roof category.

**Part 2: functional arrangements**
- It gives a schematic diagram for 5 essential functions which are screening where people get triaged and if required their samples are taken, wards which include observation and isolation, HCW area used by workers, service area for staff for kitchen and pantries and utility area for PPE disposal. The scheme mainly makes the entry/exit of patients and HCW separate and two corridors run around the isolation wards. *(it has 7 entry/exit points which might become difficult to guard and keep a watch)*
- In the waiting area each patient has an individual booth separated by a partition
- Entrance area has a provision of a toilet
- There is separate entry for HCW and separate exit for non-case patient.
- Area requirement for 20/50/100 bed facility has been given for each of the functions

**Part 3: Layouts for different site typologies**
- This part has detailed layouts for each of the typologies identified earlier. It has different combinations of layout with individual toilets and anteroom. Kitchen facility is not designed. It is recommended to separate moderate and severe cases on different floors. Areas with different risk levels must not be along the same corridor. Open corridor spaces should be covered on the sides with plastic sheets, waterproof tarpaulin, or other such material.
- List of functions included:

**Part 4: Materials and construction systems**
- Basic criteria for selecting a construction system given *(the features described are very broad and does not give much insight about what kind of materials. May be a matrix of materials and system can be prepared)*
- Its applicability is tested against each typology
- Onsite fabrication and porta cabins are detailed out with material details and options. And construction process is explained step by step
- Partition options and wall options are detailed

**Part 5: Setting up Water and Sanitation**
- It talks about three aspects Water supply and capacity of storage per number of beds, toilets and containment and options for septic tank and twin pit and construction of porta toilets, and Treatment and disposal recommendation for DEWATS system and desludging.

Schedule of room is given listing each function, access points, area required, ventilation type and detail notes. This could be very helpful while designing layouts.

**SELCO GUIDELINES**
**Sustainable Energy driven and Climate Responsive Infrastructure for ISOLATION & THERAPEUTIC units for COVID19**
**Summary:**
The guidelines give the basic definition for Quarantine and Isolation and divides the infrastructure requirements into 4 categories based on condition of the patients. 1. Asymptomatic, Quarantine space- Individuals with the potential of developing symptoms related to Covid19 or being carriers of the virus. 2. Asymptomatic / Mild, Isolation space - Tested Covid19 positive cases with no symptoms or mild symptoms, such as fever and
Fatigue. 3. Moderate, basic therapeutic care - Patients with fever and breathlessness and/or mild Pneumonia. 4. Severe, ICU - Patients with fever, breathlessness and severe Pneumonia. It provides details about building infrastructure and energy infrastructure for each of the category. The focus is on building material and construction and cost. It gives a detailed listing of energy infrastructure for all typologies.

**Strategy**

- Recommendation for appliances, medical equipment, spatial requirement per bed, sanitation and vestibule for each of the 4 categories is given.
- It identifies the gaps that are there in the infrastructure presently, and based on that suggests two options. (the gaps are not only spatial in nature but also energy requirements)
- Two possibilities when shortfall of infrastructure is: Option1: Existing public buildings such as community centers, panchayat buildings, government residential schools, training center of the NGOs, stadiums, etc. can be upgraded and renovated to function as quarantine or isolation wards. Option 2: Renovation, quick up-gradation and extension of existing hospitals
- Option 1, examples like converting marriage hall, train coach and school is described. Usually energy infrastructure in such laces is less and therefore will require additional budget for upgradation.

**Option 1: conversion of existing infrastructure**

- It recommends demarcation of entry/exit points for different risk zones, segregation of rooms as per containing of contaminants like airlock vestibule, toilets, anteroom. Planning of ventilation system, location of cubicles, demarcating waste collection units, defining workstation for caregiver or medical staff for data logging, kitchen and storage, and utilities.
- The renovation guidelines do not account for energy demands as usually panchayat houses, community halls and makeshift quarantine facility has unreliable power and inadequate services this will demand additional budgets for upgradation.

Three kinds of systems are assessed for all the above factors,

1. Retrofitted shipping containers
2. PVC and heavy-duty containers,
3. prefabricated construction with two types: MS framework; Option 1- Walling: Bison panels; Roofing: Color coated sheet, Option 2: Walling: PUF panels, Roofing: PUF panel Monolith module with MS/ LGS Frame; Materials: Gypsum, EPS, Puff Sandwich

- Based on the comparison the previous page, the Prefabricated technologies were deemed more viable due to their customisability, thermal performance, energy efficiency and ease and timeline for construction. The timelines and skill force for the two recommended technologies have been further detailed for 10/50/100 beds unit.
- Spatial layout is categorized in three broad classification: entry/ exit zones, patient accommodation
• **Entry and Exit zones:** Asymptomatic, medical and HCW, waste handlers and service providers

  A controlled area to transfer supplies. Equipment and persons, a barrier that controls the entry or exit of contaminated air when the anteroom is opened, place for donning or removing PPE proper to entry exit to the isolation ward, storage for PPE, waste disposal area

• **Patient accommodation:** for 4 categories as mentioned initially

  The principles to achieve thermal comfort and ventilate a ward with patients with or without symptoms of Covid-19 are the same — building design, type of building, building function, building form, envelope, natural ventilation strategy, internal distribution of spaces and functions, thermal mass, heating, ventilation and air-conditioning.

• **For Natural ventilation building location,** orientation and layout are critical. Vent opening design depends on position, types and size of openings. Personalized cooling systems for hot and humid climate.

• **Mechanical ventilation:** negative pressure needs to be created to prevent the transfer of contaminants between rooms which is achieved by exhausting a room with higher frequency. 12ACH, and wind chill effect from table top fans for heat stress relief

• **Air conditioning:** the exhaust duct should be independent to general area, negative vestibule to be provided. Air filtration via HEPA filters.

• **Category 1:** quarantine facility: the layout is divided into three area vestibules, which has dirty utility and medical staff station and isolation ward

  Each patient is separated by partition in the isolation area.

  For each area, energy load details and specification of hardware with load wattage, quantity is and usable hours is listed.

  Solar powering for quarantine ward is detailed with load specifications and estimated cost.

  Such guidelines are provided for isolation for (mild, moderate and severe) +ve cases of Covid-19
While establishing quarantine facility, the involvement and support of local government is extremely important. This includes the needs assessment, regular running of the facility and post-Covid-19 utilisation. The design requirements for the facility will also be determined based on the functional spaces necessary as defined by the authority and time to time revisions in government guidelines. Below are some of the points that need to be clarified with local government body for finalising the functional requirements, defining daily operation and maintenance as well as post-Covid-19 utilisation.

**Setting up the facility**

1. **Any permission required from state government/ health department/ MoHFW?**
   - Preferably the local government should apply for any necessary permissions for setting up and running the facility.

2. **Land Requirement**
   - The Panchayat may provide or identify land for setting up the Quarantine Facility with following considerations:
     - The location of the site should preferably be away from crowded and populated areas. In case of urban and dense area, the boundaries of the facility should be well defined and protected to maintain distancing and safety of the neighbours.
     - The boundary wall / fence should be provided
     - There should be no water-logging history and should be drained easily so as to prevent flooding during the rains.
     - The site should have basic infrastructure facilities such as good access, water supply, drainage connection, electricity etc. In case of unreliable power supply, it is must to establish its own power supply facility.

**Operation and maintenance of the facility**

3. **Human Resources for the Facility**
   - The human resource to man the quarantine facility should be drawn by the Panchayat with the guidance of a Resident Medical Officer who may also manage the facility. Following staffing requirements may be clarified beforehand.
     - According to the MoHFW guidelines, the Quarantine Facility should have at least three nurses, one AYUSH doctor, one Allopathic Doctor (remote guidance), two guards and support staff on board. The medical staff usually work on rotational basis. The exact requirement should be determined in consultation with medical officer.
     - Additionally, administration staff is also required to run quarantine facility. A receptionist, general manager and an accountant would be required.
     - Alternatively, a medical agency can be hired for contract-based health care professionals for a period of at least six months or as necessary.

4. **Services for the Facility**
   - Quarantine facility should have tie up with one or more dedicated Covid Health Centres and at least one Dedicated Covid Hospital (with ICU) in the vicinity for referral purpose. Similarly, the facility needs to create a network with nearby hospitals and Govt/approved Covid-19 testing labs.
• A 24/7 Covid-19 telephone service should be set up to refer patients to the appropriate and local hospitals or testing centres as per the national Covid-19 protocol. A trained professional need to be appointed in the facility for providing the tele guidance.

• Quarantine facility should have a dedicated Basic Life Support Ambulance (BLSA) equipped with oxygen support or should be mapped with relevant Ambulance services on 24x7 basis for ensuring safe transport of person quarantined who may need to be transported to hospital.

• Screening patients before they come to the quarantine facility can help identify patients who require additional infection control precautions. This should be preferably done by phone before the person arrives at the facility. The telephone line and trained staff to handle this is necessary.

• The quarantine facility needs essential services like medicines, medical equipment, medical supply, cleaning supply and bio-medical waste disposal facilities providers. They should be identified and ideally located in the vicinity.

• Availability of healthy and hygienic food, customised to the need of patients is essential for the quarantined people. Preferably, a food supplier should be identified and contracted to deliver customised food in disposable containers on daily basis. Alternatively, this can provide livelihood option for a family from nearby settlement. Alternatively, women or men from the surrounding communities can be encouraged to take the role.

• A reliable medical store should be identified nearby, who can deliver medicine supplies, non-medical essentials and equipment as and when required at short notice. Alternatively, equipment and medicine store should be integrated within the facility. However, this will require additional resources and/or staff for stock-keeping and maintenance.

• A licenced bio-medical waste handling company should be contracted for regular and safe disposal of biomedical waste generated at the facility.

• The facility should preferably tie up with laundry services provider. Strict cleaning norms must be followed during clothes and linen washing. The dedicated laundry space within the facility can be utilised. Alternatively, people can wash their own clothes. However, this will require adequate space and facility for washing and drying within or near the quarantine room.

• If needed, residential accommodation must be provided for the medical staff to self-quarantine themselves according to the medical protocol after completing 15 days of duty in the facility.

5 Medical Supplies and Equipment for the Facility

• Hospital cots, oxygen concentrators, air beds, wheelchairs, walkers etc. should be made available within the facility. These will also require maintenance. Such equipment can either be purchased or rented.

• Regular supply of PPE kits, masks, gloves, sanitisers, cleaning supplies and other safety equipment etc. will also be essential along with medicines for patients.

• The facility’s administration should connect with medical equipment suppliers for purchase or rental services; and for regular maintenance of the equipment.

• The facility’s administration should also provide essential medical supplies for health care and support staff such as PPE kits, masks, gloves, sanitizers etc.
The present design norms are developed for a small-scale quarantine facility and is relevant for persons suspected or having high possibility of Covid-19 infection. However, they are not confirmed patients yet. The patient care facility is intended for confirmed patients of Covid-19, which the present norms do not cater to. However, in the course of its development, it was realised that most functions and infrastructure can be easily converted to create the patient care facility by incorporating essential changes. The following table summarises these main differences between a quarantine facility and patient care facility in terms of design and spatial requirements. Such facility should be considered only for the individuals who have tested positive for Covid-19 but are either asymptomatic or have very mild symptoms. It is not intended for the patients with moderate or severe symptoms and requiring intensive care.

<table>
<thead>
<tr>
<th>SN</th>
<th>FUNCTION</th>
<th>REQUIREMENT FOR PATIENT CARE FACILITY AS COMPARED TO QUARANTINE FACILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entrance and Reception area</td>
<td>Required.</td>
</tr>
<tr>
<td>2</td>
<td>Waiting area</td>
<td>Comparatively more capacity of sitting arrangement will be required.</td>
</tr>
<tr>
<td>3</td>
<td>Administrative office</td>
<td>More office space/ Workstations may be required as the staff may increase. But the standards remain the same.</td>
</tr>
<tr>
<td>4a</td>
<td>Quarantine rooms/ General ward</td>
<td>Area requirement will be same as per the number of beds. However, healthcare infrastructure such as oxygen concentrators and other medical essentials and human resource may increase based on advice of medical officer.</td>
</tr>
<tr>
<td>4b</td>
<td>Isolation room/ Semi-ICU rooms</td>
<td>Number of isolation rooms required may increase. Necessary medical equipment may differ and mechanical ventilation may need to be installed to create negative pressure, as per the advice of medical officer.</td>
</tr>
<tr>
<td>5a</td>
<td>Activity spaces: Spaces for Individuals</td>
<td>Required.</td>
</tr>
<tr>
<td>5b</td>
<td>Activity spaces: Interactive spaces</td>
<td>Required.</td>
</tr>
<tr>
<td>6</td>
<td>Toilets for quarantine room/ general ward</td>
<td>Required.</td>
</tr>
<tr>
<td>7</td>
<td>Nurses’ station</td>
<td>As the medical staff may increase compared to quarantine facility, the nurse station will have to be designed with increased capacity.</td>
</tr>
<tr>
<td>8</td>
<td>Staff entrance</td>
<td>Required.</td>
</tr>
<tr>
<td>9</td>
<td>Donning room</td>
<td>Required.</td>
</tr>
<tr>
<td>10</td>
<td>Doffing room</td>
<td>Required.</td>
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<tr>
<td>11</td>
<td>Doctors’ room</td>
<td>More work area and work stations may be required as the medical staff may increase compared to quarantine facility.</td>
</tr>
<tr>
<td>12</td>
<td>Toilets for staff</td>
<td>Required.</td>
</tr>
<tr>
<td>13</td>
<td>Medical/general store</td>
<td>Medical store will require to stock more medicines and additional oxygen supplies etc. and therefore area requirement may increase compared to quarantine facility.</td>
</tr>
<tr>
<td>14</td>
<td>Pantry</td>
<td>Required.</td>
</tr>
<tr>
<td>15</td>
<td>Bio-medical waste collection room</td>
<td>Required.</td>
</tr>
<tr>
<td>16</td>
<td>Laundry facility</td>
<td>Required.</td>
</tr>
<tr>
<td>17</td>
<td>Generator room</td>
<td>Required.</td>
</tr>
<tr>
<td>18</td>
<td>Entrance gate, Guard room and Parking</td>
<td>Required.</td>
</tr>
<tr>
<td>19</td>
<td>Fire norms</td>
<td>May be upgraded based on the requirements for the medical facility and its scale.</td>
</tr>
</tbody>
</table>
**BIBLIOGRAPHY**

(POCAA), Platform of community action and architecture. August, 2020. *Isolation space in our neighborhood to protect ourselves from Coronavirus.* Dhaka, Bangladesh: University press limited.


WHO. 2020. *Infection prevention and control during health care when Coronavirus (COVID-19) is suspected or confirmed.* WHO.
Development of design norms for quarantine facility in response to Covid-19 was a challenging task due to sparsely available and unorganised data available about the pandemic, its spread and treatment. However, it was a necessary preparatory step in responding to Covid-19 and future steps of designing quarantine facility. We are thankful to Shri Bijalben Brahmbhatt (MHT) for identifying quarantine facility as an important aspect in responding to Covid-19 and recognising the need to develop the design norms as reference for wider community of designers and others intending to establish quarantine facility in rural or small urban areas. We also thank Shri Bhavna Maheriya (MHT) for constant involvement at different phases of preparation of the norms and help in identifying the resource people to understand aspects of isolation and patient care. We are also thankful to Shri Siraz Hirani, Shri Bharti Bhonsale, Shri Bindiya Patel, Shri Dipika Vadgama at MHT who provided insights and support during interim discussions and preparations of final norms.

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Several individuals who were infected and had gone through the treatment for Covid-19 agreed to be interviewed and hence shared their personal experiences with us to improve our understanding regarding treatment and quarantine period. Their agreement in improving our understanding is acknowledged.

This is a testing time for the medical professionals and they are the front-line defence for limiting the impact of Covid-19. During this pandemic, several medical professionals – doctors, nurses and hospital administrators took out time from their busy schedule and shared their knowledge with us despite our almost complete ignorance regarding designing the medical facilities. They patiently clarified our doubts about medical terms and treatment procedures. Their contribution in the development of this document is duly acknowledged. We would also like to clarify that whatever the limitations one may find in this document, regarding medical procedures or design norms, are due to authors’ limitation of interpretation, rather than their knowledge.

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Nishita Parmar
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**Mahila housing SEWA trust (MHT)** Founded in 1994, with the mission of promoting sound habitats and living environment of poor women in the informal sector, MHT, believes that if the capacities of the marginalized especially women, are enhanced to exercise their civic rights, poor women can become drivers of sustainable and inclusive urban development in their communities and cities. Key work areas of MHT include WASH, Skill Development and Livelihoods, Sustainable Energy and Climate Change Resilience, Affordable Housing and Land Rights and Democratic Urban Governance and Planning.

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