How to Transform
A Hotel, A Furnished apartment, A Residential Building during COVID-19?

Lebanon Green Building Council (LGBC);

&

Pierre Dammous & Partners (PDP);

A leading engineering consulting firm serving multiple industry sectors across the Middle East and Africa;

Joined their ingenuity to work by helping to quickly identify and adapt buildings and spaces into temporary health care facilities for an influx of patients.

PD &P Pierre Dammous & Partners

Engineering Consultants

FIRST AID PATIENT MEDICAL CENTER OBTAINED FROM THE CONVERSION OF: RESIDENTIAL BUILDING-FURNISHED APARTMENTS HOTELS

Beirut, May 2020

Needs for more Beds for Pandemic Treatments

We observed the pandemic effects on different countries having a low hospitalization allowances, with limited number of total beds to be available during the critical pandemic like to Covid-19.

According the WHO the Mena Region specially is lacking for the number of beds it should potentially have.

This paper is prepared to deal with the fact that European country and other rich countries suffered from the influx of patients in needs for hospitalization in the case of pandemic similar to the one encountered recently. Almost most of the above mentioned countries were not prepared and chaotic situation put the human rights and human values below the benchmark we already are proud to preach and to battle for many decades, white papers and conferences, worldwide, years before the actual Pandemic, described clearly the danger we will face from air borne viruses, which was in preparation and under experimentation in many laboratories; at the same time anti-virus are under researchers goals to find an issues in case of proliferation of any of such virus is under attack in any countries, maybe, it was not clear for some, the possible spread in such speed to cover so many countries simultaneously. The actual pandemic attack was unforeseen to many countries, the results was disastrous, medical reserves neither medical supplies with the necessary protected measures for the medical team wasn't enough to protect them from the attack covering the global population worldwide; viruses spread and attacks was already virtually predicted in many fiction movies, the film makers dreams transformed to a reality; a virtual imagination hard to believe it's realization. Adversely, we have seen a tragic situation hard to believe to happen such in Italy, Spain and Brazil, were patients passed away in great numbers without receiving any medical treatment, Nurses, Doctors and the medical team succumbed under the contamination effects due to the missed protocol and supplies of protection instrumental wearing, such as masks, gloves and sterilization means was missing from stocks. Photos spreads by media, shows patients laying on beds waiting for medical support died without receiving any, furthermore, morgues or funeral are no more practiced due to the great numbers to be manipulated and prepared.

GOALS TO BE REACHED

This paper is focusing on approaching a systematic guide helping the medical and local authorities' preparation to overcome a probable pandemic similar to Covid-19, spread rapidly without having enough hospital beds and specialized medical team prepared to fight the viruses.

The needs are observed mainly on many major sectors to be considered as the basic elements to be the first line of the counter attack to gain the antivirus war.

- The medical human aspect of the country.
- The human medical teams are the core value of the counter attack, it is related to the doctors, to the academic students in universities having majors in general or specialized

medicine, or even biology, the nurses in charge or having necessary license including those as students or in the field of biology, researchers, laboratories specialists.
Ministries of health to keep update registers to access all kind of information about the medical human force with their full contact, their addresses with their experiences, such information are to be used for other purposes than the counter attack, it is a useful data for universities orientation, for recruitment and for exchange of specialties between different countries.
-The hospital continuous updating information and data.
A complete data and wide information on the full information about number of bed in each ward including the detailed services with the main equipment they are using and the storage capacity of medical supplies in days, if they are prepared for any shortage.
Schedules also should explain for the government how to orient the investor for the needs the country is needing also to guide the Ministry of Health for the planification of the future governmental hospital needed in each zone whenever the data is showing defects.

- Medical equipment and main medical supplies for treatment and sterilization.

Data showing the number of specialized medical equipment, the supplier availability, the different main treatment supply and medical means for protection against pandemic and virus attack.
Software are available to engage and perform the data collected and facilitate census and updating information.

<u>Potential buildings: residential, furnished apartments, hotels to be converted to a preliminary patient's treatment.</u>

Medical committee in collaboration with engineering one to coordinate and collaborate to dress a schematic map showing the probable usage of these building to allow a first aid treatment whenever pandemic is attacking the country. Hospitals shall not be used as a testing for patients triage and for confinement and simple observation and control on the progress of symptom in case of simple non critical symptoms. **Hospitals should treat only the critical case showing serious unconceived criteria situation.**
The strategy to be followed and accomplished by the above mentioned committees is to indicate in details the potential buildings to be converted, both committees are concerned with this target is that converted buildings should be adequate for medical purpose and the goal for the engineering committee is to validate the building in terms of structural electrical and mechanical situation to serve the main purpose.
We understand that all these potential mentioned construction should needs extra added equipment, and some corrections in their existing situation to serve conversion strategy; **basically the hotels are** the preferable building approach for the strategic conversion to the first aid medical care.

Hotels and furnished apartments, are considered as second options are designed to host people as a guest in independent rooms, some with independent kitchenette to serve in case of confinement, there is a service routing which is generally used to serve the clients having a main kitchen sometimes for foods preparation, enough space could be used for storage of sterilization and medical supplies.
Each of the above building should be labelled with stars:

the residential building with one star, the furnished apartment 2 stars, the hotels to begin 3 stars and above. The labelling should guide to select which level of first aid to use to treat patient and also it will help the application of the different patients to be received.
The schedule should indicate the possible conversion of each of the mentioned buildings with the list of the additional equipment and systems to be updated and or added in order to get the building working normally; special care to be addressed on the ventilation to be enhanced in order to fight the viruses proliferations, to indicate the possible conversion for some rooms for negative ventilation(it is preferable to leave hospital treating very critical cases to deal with negative isolation room) some others to be mechanically ventilated to dilute and to transport rapidly the contaminations effects. Anyhow some recommendation to be indicated separately in annex. Typical details to indicate the principle for negative ventilation and for the tables giving necessary information needed to apply in proper ventilation for medical purpose, as per Ashrae-170-2017 schedule.

Patient categories and triage

Three categories of patient in case of pandemic proliferation, other than healthy normal people without any symptoms.

1. People in suspection with probability carrying the viruses.
2. People with positive confirmed virus carrier without serve symptom.
3. People recovering from the disease but needing continuous observation and needs confinement.

The major case in this respect for our target are the above three case patient are ambulatory and such patient do not need intensive care unit or respiratory machine and they do not need medical gas assistance. This is the major definition for the first aid patient treatment, it is mostly a medical quarantine for observation and simple treatment for the three type.

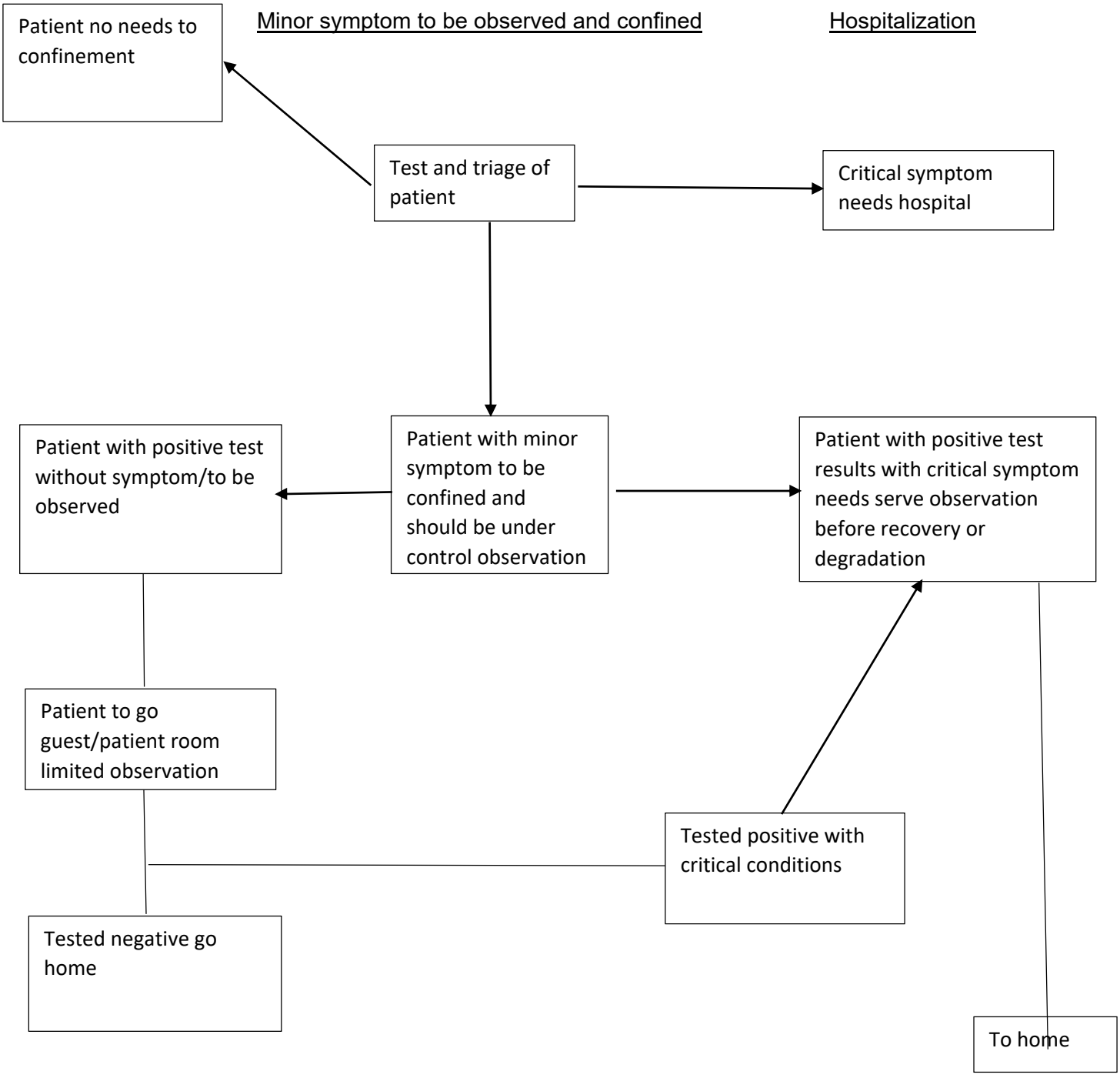
- Type of patient suitable first aid medical care
  we should segregate and indicate the kind of patient to use the converted hotels or other kind of building, the following is the list of the probable patient type:
- Patient needing a confirmed quarantine without having family support and space.
- Patient with positive test that having simple or medium symptoms, without having the possibility to be served and observed at home.
- Patient showing progressive symptoms but not a critical one and there is no beds available in hospitals.
- Patient with positive test but improved with recovery conditions and needs continuous observation.

First step in the first aid configuration

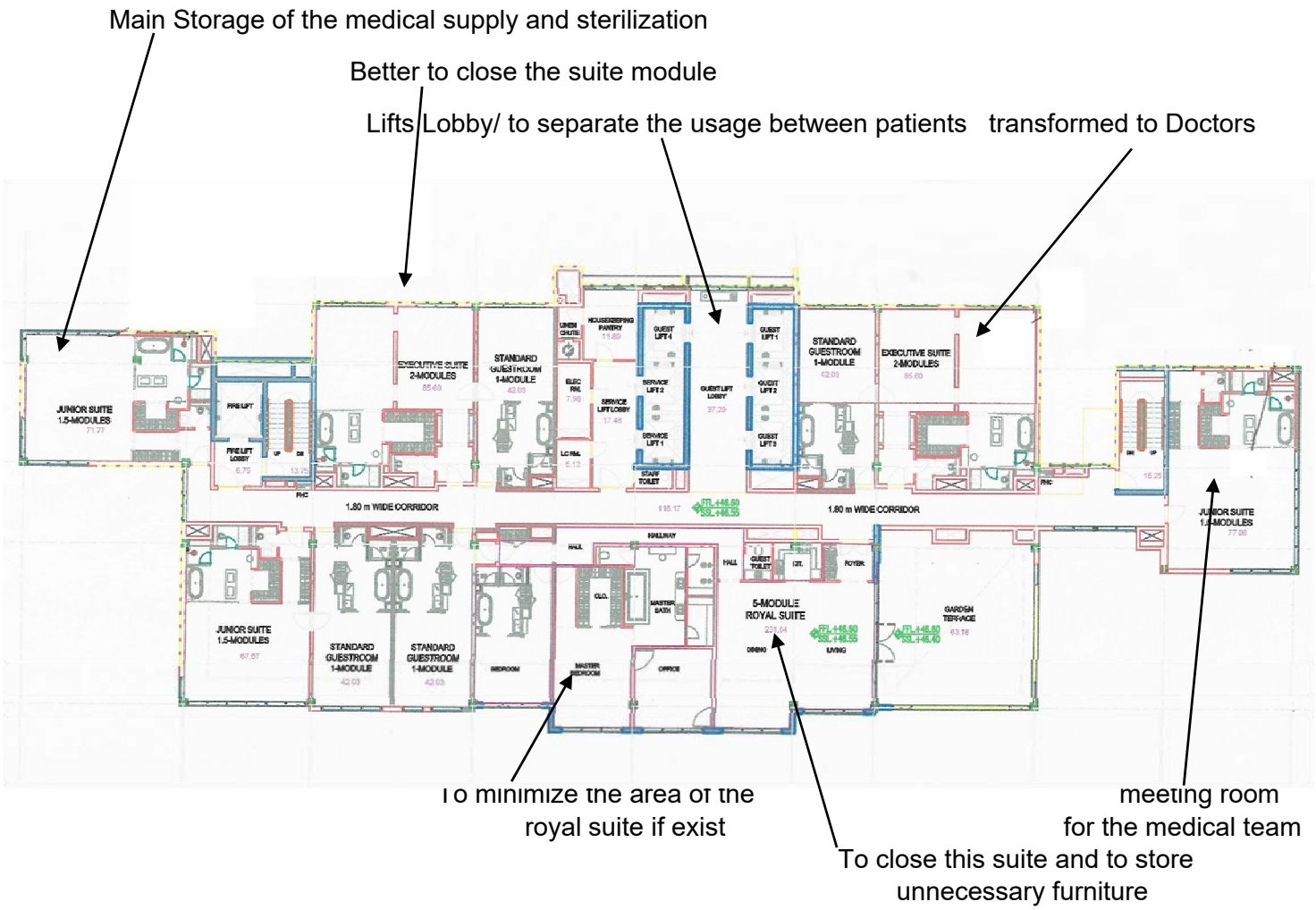
Hospitals are not equipped and designed to treat a pandemic thread, since contamination with such possibility is dangerous for the other patient in the hospitals and spaces are not available to segregate the normal functions from the non-frequent pandemic situation; then hospitals prefer to reserve a distant zone to locate the center of pandemic viruses test which will receive a tremendous number of people to be tested.
The hotel conversion, or the similar buildings to be also converted could host the first step which is the test assessment and the triage of the patients.

Routing to follow when arriving to the converted medical center.

Schematic routing of patient



Typical Guest/Patient floor to be transformed to Medical treatment for non-severe symptoms

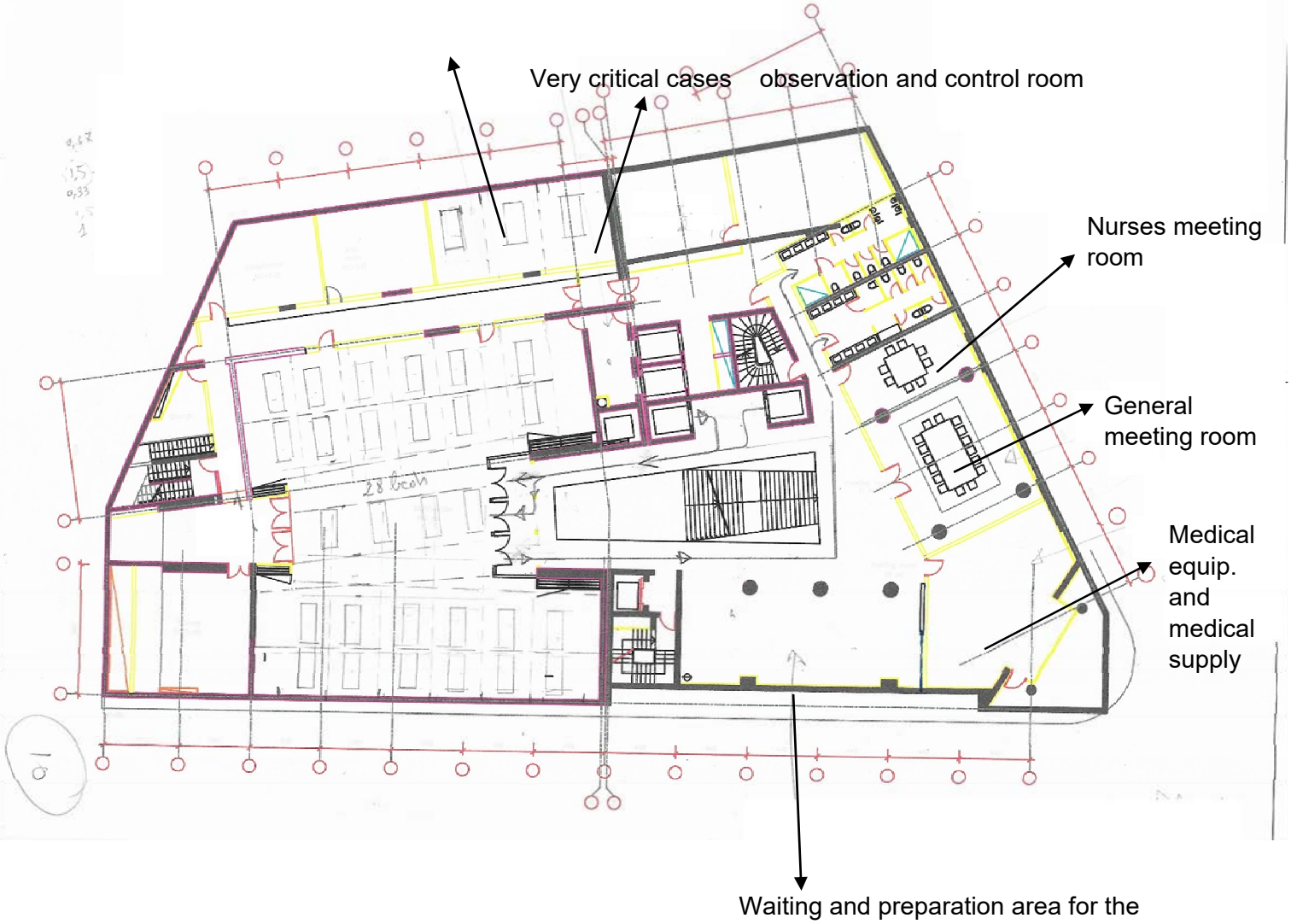


The typical floor for guest rooms to be transformed to patient room should be exploited to create many single rooms except for special request to host a family using a suite . many signage to be used showing the orientation, the restricted areas and the protocols of usage with the methodology for communication and decontaminations,

Special measures for cleaning and floors decontamination to be observed and controlled room services should train the patient about the correct behavior and usage for the sterilization of their rooms, until the arrival of the specialized team and do the daily cleaning.

Lifts to be sterilized continuously and could be labelled indicating which is reserved for separate usage by the medical staff

Banquet Hall to be used for Patient with Critical symptoms before increasing and needs for Hospitalization



TYPICAL meetings rooms and Ball/Banquet Floor

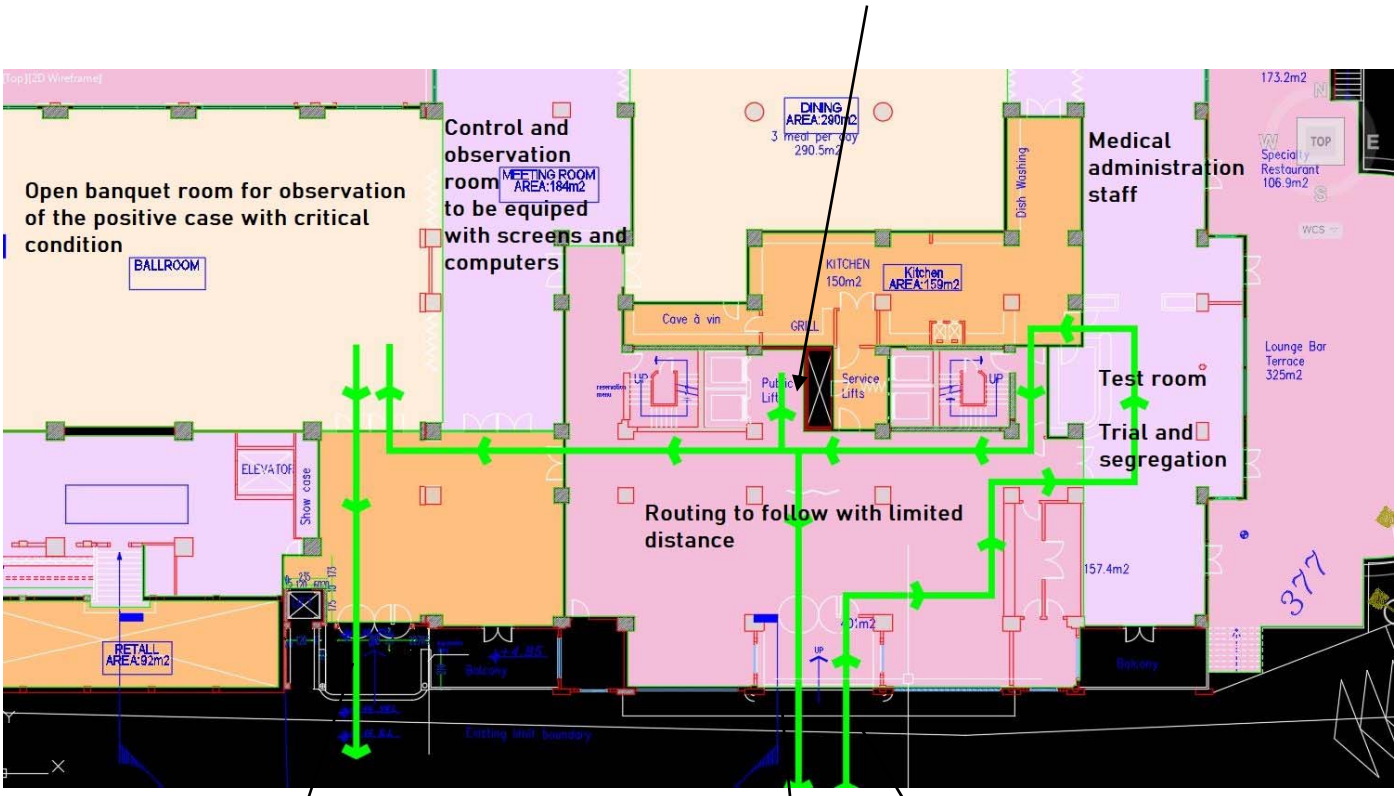
The banquet hall is generally surrounded by conference and meeting rooms, we observe the abundances of the entrances and exit doors allowing easy circulation for the medical staff.

A virtual arrangement for the beds is observed showing approximately 20m2 per bed, curtain to separate for privacy and in case of Doctors tours to be used only. The open spaces for the medium and minor symptoms is preferable in order to limit the number of the medical staff and it will allow a general observation for the entire room visually besides the electronic observation by Camera through the main control room. Special cameras could be requested allowing to detect a change of temperature and faces changes colors.

As per the schematic design if Intensive observation or quick oxygen supply is requested, a separate room could be equipped to receive such conditions with a special care before transporting the patients to the Hospitals

TYPICAL entrance and lobby to be used for test/segragation and triage patient

Lifts lobby to segregate patient between simple symptom from critical one to go to different floors



Exit from the banquet room used for critical patient symptom

Entrance to the test room

Go to outside

We observe the routing for the operational test with continuous flow with distancing rules. The patient with positive test to be guided to the above floors, to patient /Guest rooms for the non-critical symptoms , also for people needing confinement due to family and personal conditions

The patients with medium symptom, with positive test to be guided to the Banquet/Ball room for observation and control

The negative test people without any symptom to be guided to the exit doors, the physical distancing is to be respected all over the process with single routing direction

Preliminary concept for conversion :Program for shifting to Medical Care:

Steps	Program
1	Schedules already prepared covering the different mouhafazat or district showing the probable building or hotels potentially convertible to first aid care in case of pandemic situation.
2	Schedules already prepared showing different hospitals or clinics with extra medical staff to take in charge the new first aid medical care to work in parallel with engineers and contractors to endorse the conversion.
3	Quick and emergency meeting between the medical staff and the engineering team in charge for the conversion. Schematic organizing charts indicating responsibilities and action in charge.
4	Labelling the storage rooms to be used in order to conserve the furniture for the restoration after the pandemic.
5	Team in charge for the mobilization and the transformation to be implied for action and quick utilization.
6	Carpet and fixed furniture to be protected by using special heavy or plastic film.
7	Prepare the meeting room to be used for main medical care equipment and for medical storage of medication and sterilization and others.
8	Use the existing central control room or provide new room for central control and observation of all the cameras controlling moving person and for medical transmission from the observation of the critical parameters of patients.
9	Checking and modifying the necessary electrical circuits UPS, main and secondary electrical boards to meet the new conversion
10	The same as above for the IT systems, Wi-Fi, security & cameras prepare schematics for additional changes to meet the first aid caring institution.
11	Checking the mechanical installation as heating and air conditioning especially the ventilation to check on the possibility to create new separate floor for separate fresh air and exhaust air.
12	Check on the possibility to create a negative ventilation for certain zones or rooms.
13	Prepare on each floor a room for nurses and for doctors, one room for medical supplies and mobile medical equipment when available.
14	Prepare an approximate budget for the transformation of the work to be done without medical equipment and supplies.
15	Prepare an approximate budget for the medical equipment and supplies to be used at the opening of the operation.

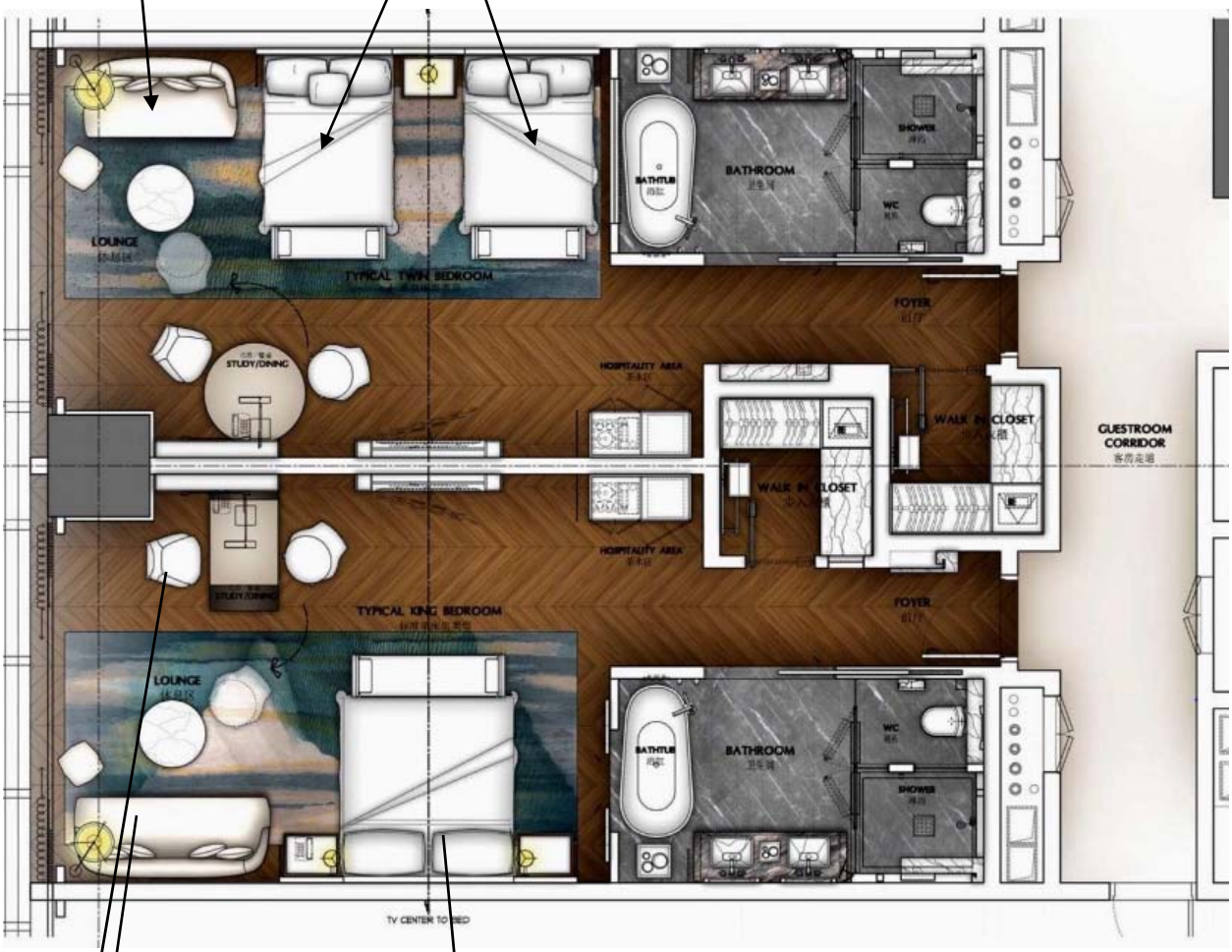
Preliminary guidances: Hotel to patient care – Possibility of conversion

Main entrance lobby & concierge:	Guidance to the test room people to be registered as patient segregated after test for the Deviation after testing to different zone for probable treatment. Rooms for Administration staff to remain for the computer and printing , also for Patient archiving
Administration:	Administration and registration testing entity with medical meeting and medical records.
Banquet/ Ball Room:	Observation of multi bed zones patient with limited or medium critical condition. Could be isolated in group with similar symptoms
Meeting rooms/conference room:	Medical storage supply, main management to be whole operation, main control room. Central observation room. Central and sub centralized management for the whole operation
Kitchen/Dining room/Restaurant:	Remaining unchanged to food supply for patient and staff. The dining room to remain for staff, the room service to be increased and well managed since the patients should remain separated in rooms, nutritional specialist to guide the Kitchen Chef and the food and beverage zone to be controlled for quality and contamination , a
Guest room floor:	To be used as hospital ward for patient to be confined having positive test to be observed without critical symptom.
Roof floor	Inspection of the equipment on roof for the adequacy to the new conditions of Hospital needs, to control the water tank storage, to clean these tanks, to check on the different antenna for SAMTV, control of the exhaust and fresh air distances outlets, to ask the maintenance team to control the pumping and the different equipment
Basement floors	To prepare the storage rooms in order to stock the removed furniture with a complete labelling and scheduling. More storage room to be prepared for the medical usage

Typical single bed Hospital Patient room to approach as much as possible the new transformed Guest room

Could be removed for less contamination

Two beds for a couple patient



Typical design for guest rooms – Hotels to be transformed to a patient room
Confinement condition with simple no symptom

Single bed room to remove for easy medical equipment usage

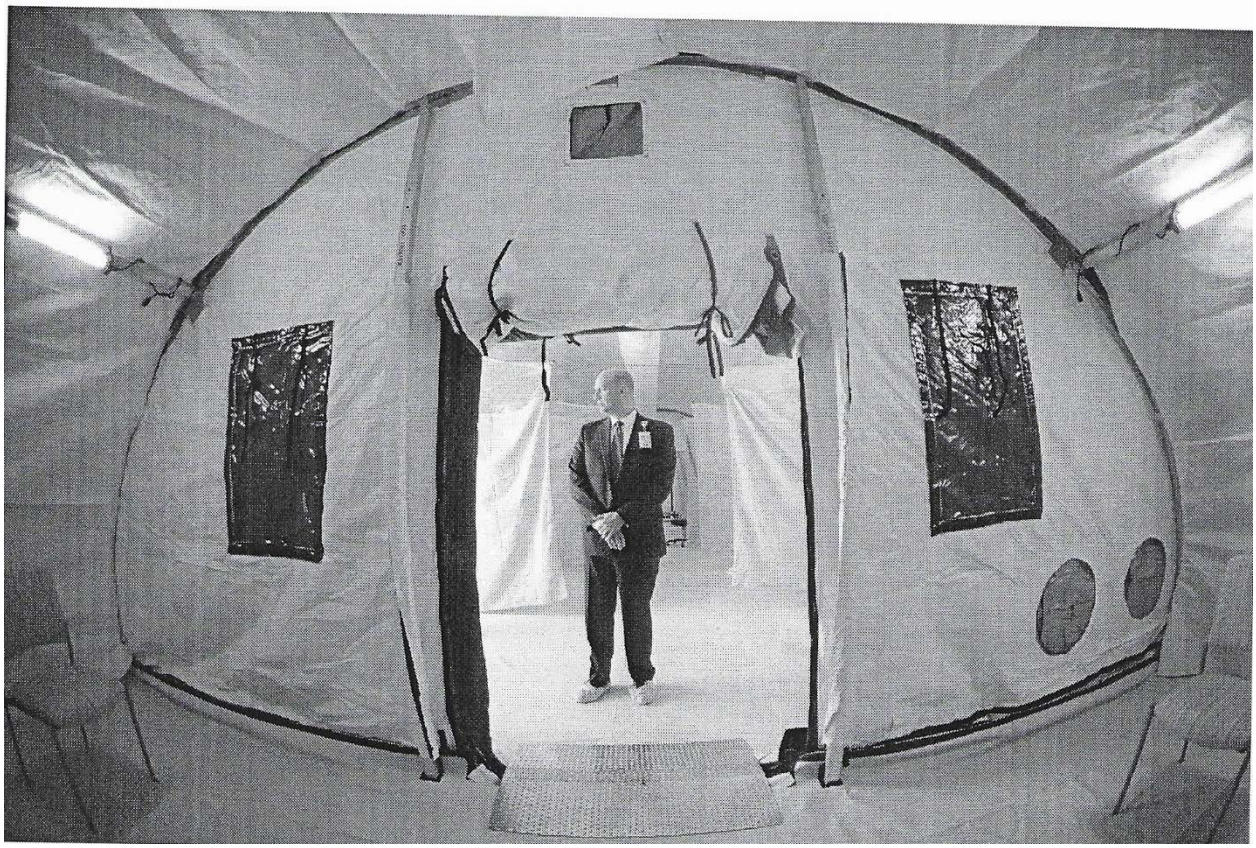
Best to be removed with unnecessary furniture

Keep two chairs with simple desk

NB: the Patient Medical register to be provided at the room entrances or at the bed end, these records to be transformed later to Digital form with specialized medical care software

Schedule for the preparation of the first aid and limited medical treatment

Step	Items
1	Preparation for the protocols related to the allowable treatment dedicated to the new transformed building.
2	Medical routing for medical supply and equipment to be registered with the authorized sectors and person to sign and approve.
3	Financial procedure with the invoices, receipt and purchase team with the organization trees of responsibilities.
4	X Ray organizational chart for complete procedures and utilization protocol.
5	All services related to storage and usage of cleaning, sterilization with the routing to proceed. And the necessary protocol to be observed in each ward and zone
6	Waste organizational process to be prepared, segregated protected and dispatched.
7	Food preparation or catering organization for the chart to be applicable with the team in charge.
8	Housekeeping method with the storage and the cleaning of sheets and towels. The laundry and cleaning adopted preferable to be outside services. To be scheduled and listed.
9	Preparation of the administrative team for the outdoor/indoor, communication and public relation.
10	Medical treatment team schedule for the doctors, nurses, trainee with the necessary shifts, standby personal to support whenever asking for.
11	General organization chart of the designer & contractors to be in charge and executing the transformation from hotel to treatment and confinement center.
12	Mechanical and plumbing team to observe and update the operations of all equipment, preparation of the maintenance team in charges (drawings to be submitted to the team).
13	Electrical power team to observe and check the equipment, the systems and the operational overall of the building. To indicate the availability of the standby power-The UPS etc… Drawings and manuals for the operational protocol to be transmitted to the team.
14	Low current, communication, IT and camera security to be checked and be operational with the requested team.
15	Technicians to control the operational equipment: computers, printers, telephones, scanners, Wi-Fi___.



Ready to fit – Isolation tent to be used for severe case single or multipatient

Separate Room for Minor or Nun-Critical Condition in needs of minor observation

The separate room configuration could be converted either in a residential or hotel buildings.

Preferably when simple confinement or very simple symptoms are observed and in case of the availability of residential building these cases could be handled using the bedrooms as a patient room, minor simple medical equipment could be prepared as a support for any surprise.

In all cases we will encounter a registered medical document to be prepared and hanged for each patient and to be hanged at the entrance of each room. These hard copies to be transformed to digital in order to be observed by the medical team and archived correctly and needed for the statistical purpose at a later stage. The operation of conversion to be similar to the below conversion of the guest room/hotel conversion.

The simple non critical symptoms and confinements for patient without family correct and convenient support should use the separate rooms, these patients should use the same floors whenever having simple symptoms.

The conversion of the guest room to patient room is to begin with getting rid of all unnecessary furniture inside the rooms, only one desk, one armchair one dresser are needed, spaces should be available to the moving of the medical equipment and to make space easy for the medical team and for the sterilization operation and decontamination.

In case of the existence of moquette or carpet, we should protect it with a plastic film with a thickness not less than 4 mil. To press with scotch tape at the border for easy removal whenever the bad event is on retreat.

To take care about the preparation of the communication TV and Wi-Fi to be observed and checked for good operation.

Each floor reserved for such patient care should have a special room reserved for the medical staff one for doctors and one for nurses. One room to be reserved for sterilization supply and medical supplies.

Since the major target for the usage of the patient room is the observation of their symptoms and the progress of the disease for the worse or for the good condition then additional camera to be added to each room connected to the central station of observation at the nurse’s room.

Ventilation and Air Quality

Hotel conversion to a medical care first aid present an advantage to all other buildings since the ventilation is well prepared and fresh air in general is distributed to all zones and areas, extract air then is also good to create the necessary balance.

Most of hotel guest rooms are conditioned in using fan coil unit for air recirculation in case of cooling or heating, supply fresh air is independent per room, extraction of the additional fresh air is done through the toilets. Care to be observed to use rooms above each other vertically using the same condition for patients, infiltration from the exhaust air might cause some defects in such case to transmit contamination from the vertical ducts.

To check on the correct distances between the fresh air inlets and the exhaust outlets to be at least 5 to 8 meters between each other's.

Corridors to be in balance condition with equilibrium between the fresh air and extraction in order to be independent from any mitigation with the patient rooms.

The ventilation principles being of first importance in air borne viruses similar to COVID-19 and similar, therefore the ventilation should be respected. Our guide for this compliances is the AIA/ ASHRAE 170-2017 guide simple schedules are selected from the guide to show some of the rules to be checked in the conversion procedure, without being very picky in this respect, only the principles to be applied, if the air changes are a bit less or more than requested to be accepted.

Some changes might be requested in the Banquet/ Ball room in order to enhance the ventilation then a probable additional air supply and extraction should be performed, with the available mean: flexible or Fabric duct.'

In case of a special request to prepare for an isolation room, which is not common, then to refer to Annex for the special application

Meeting Rooms and Banquet Halls

These rooms are designed to be occupied by a great people number, therefore their ventilation is better observed and it could be used for the critical patient condition and for the medical staff and for the main control room.

The banquet halls could be used for the observation of the medium critical case. Patient being positive tested for the virus needs more ventilation which could be used in these halls. Light separation could be used between the beds with plastic folding tissues, multi bed are used in the banquet halls due to the volume and the extra height they possesses; it will allow for added conduits, cables and whatever needed. In some cases extreme critical cases could be separated in a group of multi beds of 6 to 10 beds. The ideas of grouping the beds is to simplify the observation of the patients with a limited number of medical staff, similar to an ICU in the hospitals. Improvement of the ventilation and the control by camera should be done to increase the safety and medical security of the patients routing to be followed by the patient, the medical staff, the lifts to be well designed to increase the distancing and the safety from contamination.

Advantages of using Conferences, Meeting rooms

These rooms being in proximity to the Ball room it is designed to profit from a special services with respect the entrances and the escape doors with special entrances for food services, it is also designed to have a special communication with Audio/Video services with a good rate of ventilation and independently designed for the HVAC systems, these advantages should allow for the usage of these rooms to host the most efficient and important room of the new Medical care entity to mention the following:

Main observation and control room grouping the screens showing the patients in their different wards, it allow a communication facilities with all inside and outside major responsible in relation to the actual pandemic authorities.

Training room for the medical team, including the preparation of the schedules related to the timing and the recruitment needs also for the observation of the synchronization between the Doctors and Nurses team working together and between the different wards.

Storage of the Medical critical supplies dealing with the sterilization of all kinds and the usual decontaminated supplies used by the Medical teams to be protected from probable contamination.

Storage of Pharmaceutical medicaments and the laboratories supplies for testing utility fittings and fixtures with the different means replacement used in the testing procedures.

These different rooms are generally grouped either in the same floor or in different close floors since they will profit other than the facilities of the room services but also to have many toilets allowing to restrict the usage of these toilets by order of genders or level of safety observed. Two services should be organized for the cleaning and for the sterilization in order to manage these two important issues governing the new converted building.

.

Ashrae Guidances

Our basic references for the ventilation as recommended by Ashrae reference made to AIA/Ashrae X70-201 to be as much as possible to be approach.

We know the difficulties to be encountered in such conversion but the maximum affiliation and compliances to be applied.

The HEPA filter to be used whenever the contamination is probable, extra ventilation could be used when necessary by adding extra fresh air and extra air extraction.

Whenever negative pressure is needed then independent fresh air and extraction are used better to be independently for each room, HEPA filter especially on the extraction is recommended.

Impatient Nursing

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
All Anteroom (u)	(e)	NR	10	Yes	No	NR	NR
All Room (u)	Negative	2	12	Yes	No	Max 60	70-75/21-24
Combination All/PE Anteroom	(e)	NR	10	Yes	No	NR	NR
Combination All/PE Room	Positive	2	12	Yes	No	Max 60	70-75/21-24

Nursing Facility

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Bathing Room	Negative	NR	10	Yes	No	NR	70-75/21-24
Occupational Therapy	NR	2	6	NR	NR	NR	70-15/21-24
Physical Therapy	Negative	2	6	NR	NR	NR	70-15/21-24
Resident Gathering/Activity /Dining	NR	4	4	NR	NR	NR	70-15/21-24
Resident Room	NR	2	2	NR	NR	NR	70-15/21-24
Resident Unit Corridor	NR	NR	4	NR	NR	NR	NR

Diagnostic and Treatment

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Autopsy Room	Negative	2	12	Yes	No	NR	60-75/20-24
Bronchoscopy, Sputum Collection, and Pentamidine Administration	Negative	2	12	Yes	No	NR	68-73/20-23
Physical Therapy	Negative	2	6	NR	NR	Max 65	72-80/22-27
Special Examination Room (aa)	NR	2	6	NR	NR	Max 60	70-75/21-24
Treatment Room	NR	2	6	NR	NR	Max 60	70-75/21-24

Sterilizing

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Sterilizing Equipment Room	Negative	NR	10	Yes	No	NR	NR

Sterile Processing Department

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Clean Workroom	Positive	2	4	NR	No	Max 60	68-73/20-23
Decontamination Room	Negative	2	6	Yes	No	NR	60-73/16-23
Sterile Storage Room	Positive	2	4	NR	NR	Max 60	Max 75/24

Service

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Bathroom	Negative	NR	10	Yes	No	NR	72-78/22-26
Bed Pan Room	Negative	NR	10	Yes	No	NR	NR
Clean Linen Storage	Positive	NR	2	NR	NR	NR	72-78/22-26
Dietary Storage	NR	NR	2	NR	No	NR	72-78/22-26
Food Preparation Center (i)	NR	2	10	NR	No	NR	72-78/22-26
Janitor's Closet	Negative	NR	10	Yes	No	NR	NR
Laundry, General	Negative	2	10	Yes	No	NR	NR
Linen and Trash Chute Room	Negative	NR	10	Yes	No	NR	NR
Soiled Linen Sorting and Storage	Negative	NR	10	Yes	No	NR	NR
Ware washing	Negative	NR	10	Yes	No	NR	NR

Support Space

Function of Space	Pressure Relation Ship to Adjacent Areas (n)	Minimum Outdoor Arch	Minimum Total Arch	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k), %	Design Temperature (I), °F/°C
Clean Workroom or Clean Holding	Positive	2	4	NR	NR	NR	NR
Hazardous Material Storage	Negative	2	10	Yes	No	NR	NR
Soiled Workroom or Soiled Holding	Negative	2	10	Yes	No	NR	NR

ANNEX1: ISOLATION ROOMS GUIDANCES

Consideration of IHFG

(International Health Facility Guidelines)

Isolation Rooms conceptions and Philosophy

The main issues in designing and using the Isolation rooms varies with the restriction and the cases to be treated in similar rooms, there is different level of protection used for such rooms, the actual application for the transformed Hotels to be used for Patients with medium symptom is not imperative and could be used only for a specific request by the medical authorities if seemed a prerequisite condition. In the below description we are giving a briefing on the subject as per the recommendation of the international health facility guidelines.

Isolation facilities include the following types:

- Neutral or standard room air pressure, for example standard air conditioning, also known as **Class S**
- Positive room air pressure where an immune-compromised patient is protected from airborne transmission of any infection, **Class P**
- Negative room air pressure, where others are protected from any airborne transmission from a patient who may be an infection risk, **Class N**
- Negative room air pressure with additional barriers including an Anteroom, also known as **Class Q** for quarantine isolation.

The recommended pressure gradients for each type of isolation room is the following:

Type of Pressurization *	Isolation Room	Anteroom	Ensuite
Class S (Standard pressure)		Not required	
Class N (Negative Pressure)	- 30 Pa	- 15 Pa	- 30 Pa
Class P (Positive Pressure)	+ 30 Pa	+ 15 Pa	+ 30 Pa
Class P with negative pressure Anteroom	+ 15 Pa	- 15 Pa	+ 30 Pa

The individual components for each type of isolation room are identified below:

Component	Standard Pressure Class S	Negative Pressure Class N and Class Q	Positive Pressure Class P
Anteroom	Not required	Optional for Class N Required for Class Q	Not required
Ensuite (shower and toilet)	Yes	Yes	Yes
Hand basin with hands free operation	Yes	Yes	Yes
Pan Sanitiser	Optional	Optional for Class N Required for Class Q	Optional
Self-closing door to room	Yes	Yes	Yes
Grille flap to control room air flow	-	Yes	Yes
Independent air supply	-	Yes	-
100% intake of fresh air	-	Yes	-
Low level exhaust 150mm to 300mm above floor level	-	Yes	Yes
HEPA filter on supply air	-	-	Yes
Pressure monitoring	-	Yes	Yes

Class N – negative pressure rooms and Class Q – Quarantine isolation room will be elaborated in the below section.

Class N – Negative Isolation Room

Negative Pressure Isolation Rooms are for patients who require airborne droplet nuclei isolation (this includes pathogens such as measles, varicella zoster (chicken pox), legionella, tuberculosis).
The aim of placing patients in Negative Pressure rooms is to reduce the risk of infection via airborne transmission to other persons. Negative pressure rooms can also be known as “airborne infection isolation” rooms or “infectious isolation” facilities.

Negative pressure rooms should be located at the entry to an Inpatient Unit, so that the patient requiring isolation does not need to pass other patient areas to access the Isolation Room.

A dedicated exhaust system should be provided to the negative pressure isolation room. To maintain negative pressure the exhaust system removes a quantity of air greater than that of the supply air. The exhaust air duct should be independent of the building exhaust air system to reduce risk of contamination due to back draughts and should discharge away from staff, visitor and patient areas. The Isolation Room Ensuite exhaust should not be connected to the building toilet exhaust system.

The Isolation room pressure is lower than the adjoining rooms or corridor. Pressure differentials should not be less than 15 Pa between isolation rooms and the adjacent ambient air.
An Anteroom is optional for the negative pressure Isolation Room. If an Anteroom is not provided, a PPE bay with a hand basin should be located adjacent to the room entry.

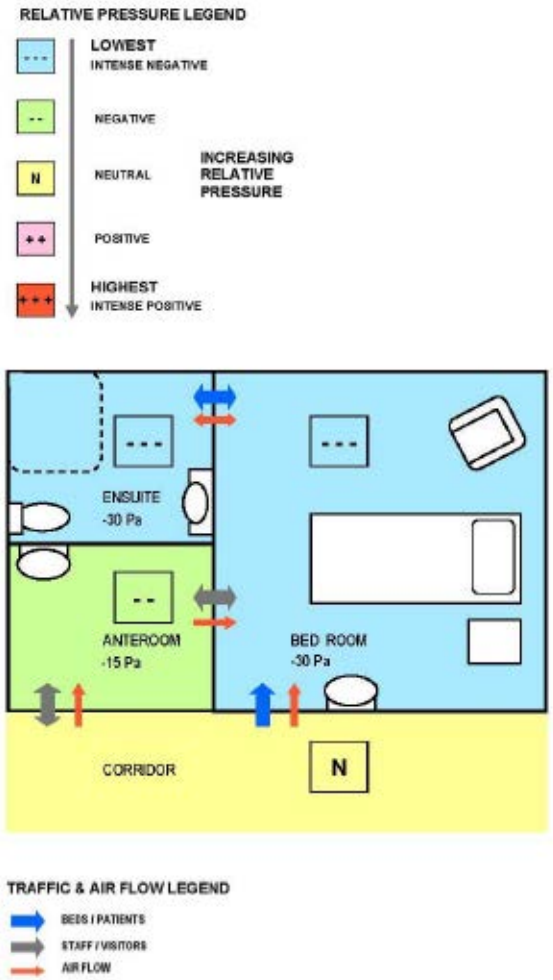
A negative pressure Isolation Room requires the following:

Room layout requirements

- A clinical handwash basin with ‘hands free’ operation in the Isolation Room and the Anteroom, if provided.
- An Ensuite shower and toilet.
- A self-closing door.
- The room requires labelling as a negative pressure Isolation Room.

Ventilation requirements

- 100% outside air ventilation (i.e. no return air permitted), with low level exhaust ducts approximately 150 – 300 mm above floor level to discharge vertically to the outside air.
- Supply air ducts are to be independent of the building supply air system.
- For immunosuppressed and infectious patients, a HEPA filtration system should be provided on the supply air ducting to protect the patient from unfiltered air.
- Exhaust air should be HEPA filtered.
- Differential air pressure instrumentation panels are required external to the isolation and Anteroom in a prominent location. (e.g.: adjacent to the corridor entry door). It is recommended that the isolation room controls are accessible by staff so that when required, the negative pressure system can be switched off.
- Air-conditioning systems for negative pressure Isolation Rooms should be connected to an emergency power supply to maintain air pressurization in the event of a power failure.



Class Q – Quarantine Isolation Room (Negative Pressure)

Class Q Quarantine Isolation requires negative pressure isolation with additional protection for accommodating highly infectious patients with pathogens such as haemorrhagic fever and pneumonic plague.

A briefing on the main principle is indicated in the below principles to be respected when designing and applying the concept of Class Q – Quarantine Isolation room:

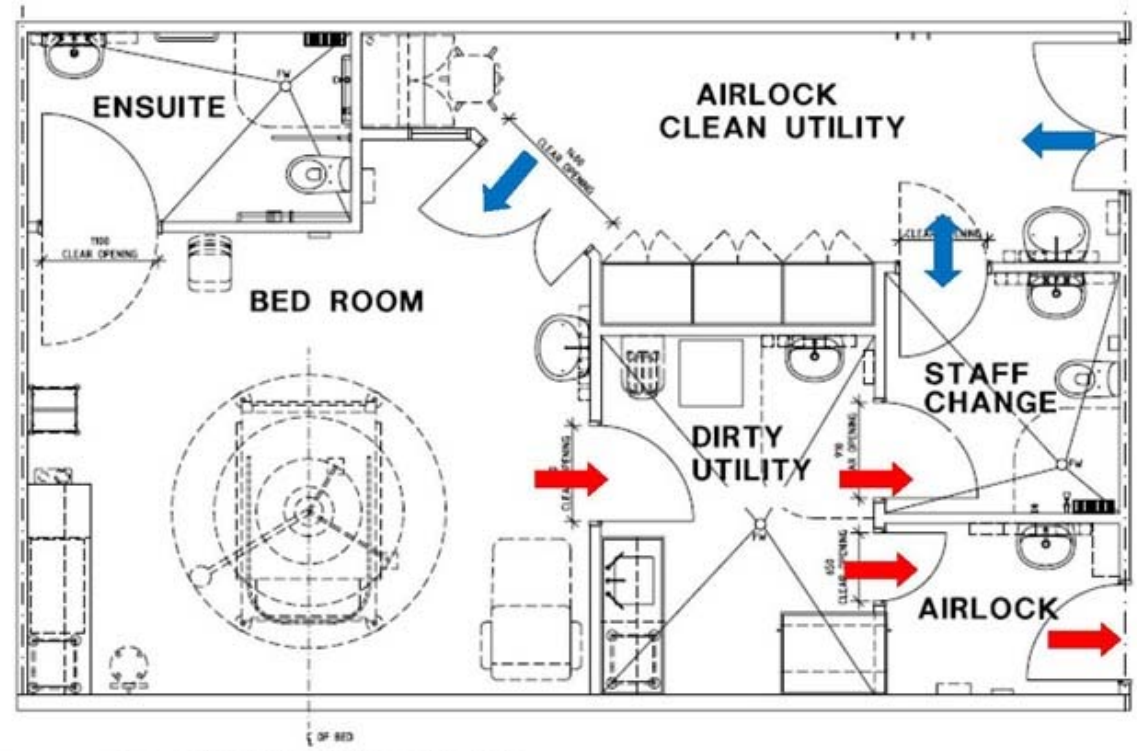
Room Layout requirements:

- Anteroom that operates as an airlock with interlocking doors; both doors must not open at the one time; the Anteroom must be large enough to allow for bed movement
- Self-closing and interlocking doors
- An Ensuite shower and toilet
- A clinical handwash basin with ‘hands free’ operation in the Isolation Room and the Anteroom
  Communication system between the room and the outside area to assist staff movement in and out of the room.
- Pan/utensil sanitizer.

Ventilation Requirements:

- 100% outside air ventilation (i.e. no return air permitted), with low level exhaust ducts approximately 150 to 300 mm above floor level to discharge vertically to the outside air; Exhaust air should be HEPA filtered.
- The Isolation room pressure is lower than the adjoining rooms or corridor. Pressure differentials should not be less than 15 Pa between isolation rooms and the adjacent ambient air. For immunosuppressed and infectious patients, a HEPA filtration system should be provided on the supply air ducting to protect the patient from unfiltered air.
- Alarm to be activated on loss of differential pressure; time delay may be required to permit entry/exit from room.
- Differential air pressure instrumentation panels are required external to the isolation and Anteroom in a prominent location. (e.g.: adjacent to the corridor entry door). It is recommended that the isolation room controls are accessible by staff so that when required, the negative pressure system can be switched off.
- Air-conditioning systems for negative pressure Isolation Rooms should be connected to an emergency power supply to maintain air pressurization in the event of a power failure.

The relationship between the Anteroom, Patient room, Ensuite and support rooms are demonstrated in the diagram below for an Ultra-isolation facility.



Typical plan of Class Q Quarantine Suite.

Legend:

Entry for Patient and Staff

Exit for Staff, decontaminated equipment and waste

The patient is transported on a bed or trolley and enters the patient room through an Airlock. The airlock is sized to fit the bed within the room with interlocking doors, the internal door will not open while the external door is open, to maintain pressurization.

Staff enter the airlock/clean utility, with PPE clothing in the staff change and access the bed room through the clean utility/airlock. Waste is taken to the dirty utility, double bagged and is removed via the airlock, and equipment is sterilized through a pass-through autoclave and is removed via the exit airlock. Interlocking doors are required to the patient bedroom, staff changed and airlocks to ensure that doors are not open at the same time. Exit of staff, equipment and waste proceeds in one direction only, staff do not re-enter the dirty utility of the bedroom from the change room.

Staff re-enter the suite through airlock/clean utility and don clean PPE attire in the staff change.

The patient bedroom should be capable of intensive care treatment with dialysis and able to accommodate and oversized bed. Services pendant arms should be fully sealed, otherwise wall services should be provided.

The above drawing is a typical high level Isolation respecting almost all the prerequisite conditions for the application of the high degree of Isolation allowing for minor imperfections in respect the medical team serving the patient and the separation of the room entity from the outside occupied neighboring zones.