National Guidance for the Layout of Isolation Facilities

Ministry of Health and Wellness
MAURITIUS

May 2024

Approval Form

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NATIONAL GUIDANCE FOR THE LAYOUT OF ISOLATION FACILITIES			
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Date of next review: December 2026

National Guidance for the Layout of Isolation Facilities

Challenges faced

During outbreaks of contagious diseases, the design of isolation wards or rooms in hospitals becomes critical to prevent the spread of infection. A comprehensive guide serves as a blueprint for healthcare professionals to create spaces that effectively isolate and treat patients while safeguarding healthcare workers and the broader community.

Challenges in designing isolation facilities include ensuring proper ventilation systems to prevent airborne transmission and optimizing spatial layouts for efficient patient care and workflow. Additionally, considerations such as access to utilities, infection prevention and control (IPC) measures, and patient comfort must be carefully balanced.

A shortage of beds may imply that hospital staff have to devise a less than optimal design for isolation rooms. A lack of knowledge about the layout specifics can make IPC measures fail and allow transmission of infections to healthcare workers or other patients.

Scope

The purpose of this document is to provide examples of how isolation facilities can be designed so as to help administrators and healthcare workers set up appropriate infrastructure to contain contagious illnesses.

Of note, the type of isolation needed depends on the mechanism of transmission of the organism and this is highlighted throughout the document.

It is emphasized that this document is meant to explain the infrastructural aspects of IPC solely. Other features of IPC like the proper use of personal protective equipment, environmental cleaning and the types of equipment that need to be present are not detailed. See other standard operating procedures for information on these topics.

The expected design is based on the “National Infection Prevention and Control Checklist 2023: Layout of Isolation Wards”. Readers should refer to this document for additional guidance.

Attention is drawn to the fact that several designs are possible depending on the needs of the situation and on the level of protection required – all users are expected to choose the most suitable design for their purpose.

Protective isolation has not been included in this document because it is mostly used for stem cell transplant patients; such cases are not carried out in the public sector of Mauritius.

Responsibility

It is the responsibility of the management of each hospital to design its isolation rooms correctly with the support and guidance of its infection prevention and control teams.

Mosquito Precautions

Minimum infrastructural requirements

1. Mosquito net.
2. Closed windows and doors.

Figure 1: Bed net with closed doors and windows.

Figure 2: A ward or bay with multiple patients suffering from the same condition and with all patients under bed nets is also acceptable. Single rooms with attached toilets are not mandatory. See reference 1 for details.

Reference:

1. https://www.comfortmosquitonet.com/mosquito-net-hospital/

Droplet / Contact Precautions

Minimum infrastructural requirements

1. Handwashing facility
2. Beds are separated by ≥ 2 meters
3. Washable dividers in between beds if not a single room
4. Donning and doffing stations

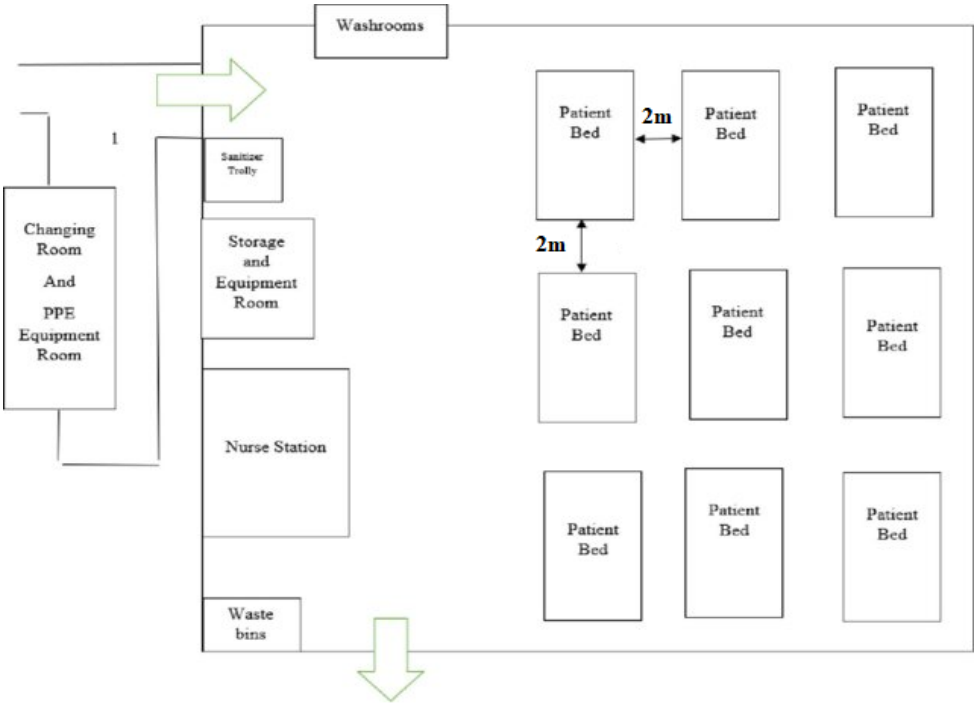


Figure 3: Well-separated beds in cohort bays are useful. Clean PPE is kept outside the room. Unilateral flow can be considered but is not mandatory. See reference 1 for details.

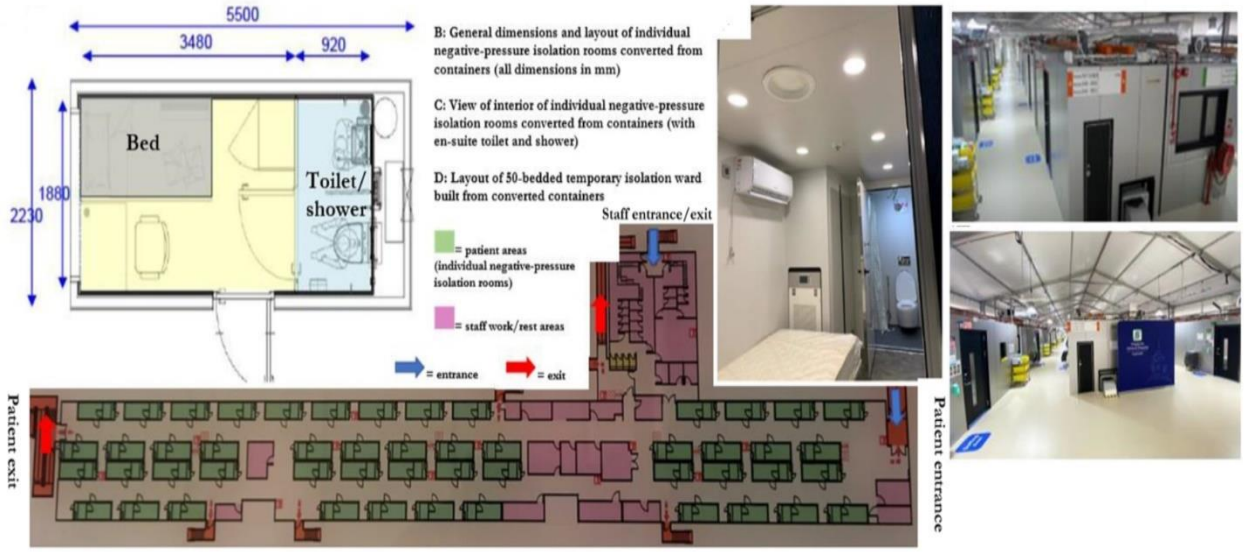


Figure 4: Containers can be converted rapidly into isolation rooms. See reference 2 for details.

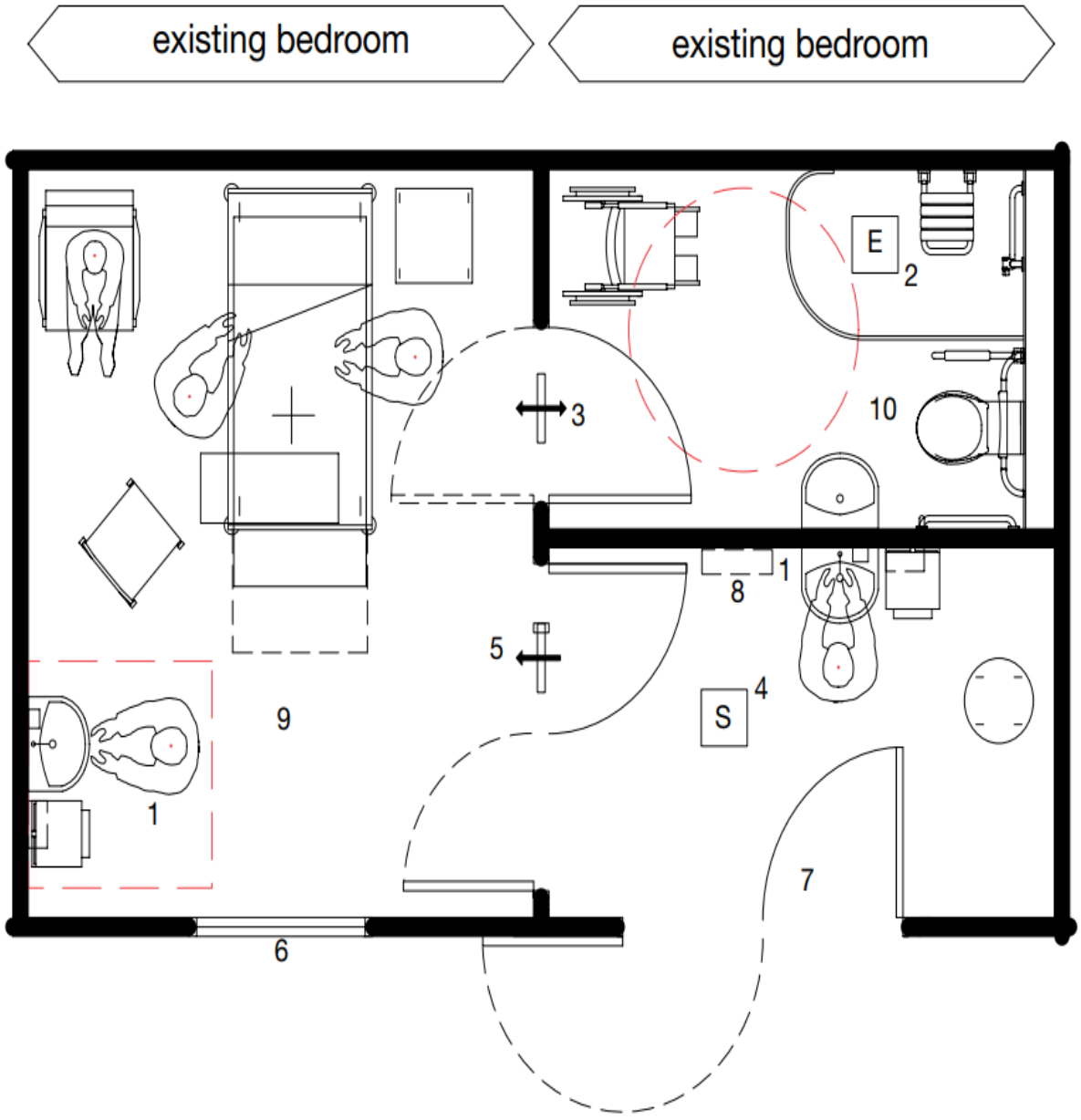


Figure 5: A two-bed room has been converted into a single-bed isolation room with en-suite facilities. No. 6 represents an observation window while no. 8 is a Personal Protective Equipment (PPE) dispenser. See reference 3 for details.

Figure 6: Single en-suite rooms are often not required for patients needing contact or droplet precautions. Simple washable dividers can be placed in between patients and are often cost-effective. Commodes or bedpans should be used; if this is not possible, common bathrooms need to be cleaned more often. The bottom picture is from Dr A. G. Jeetoo Hospital. See references 4-6 for details.

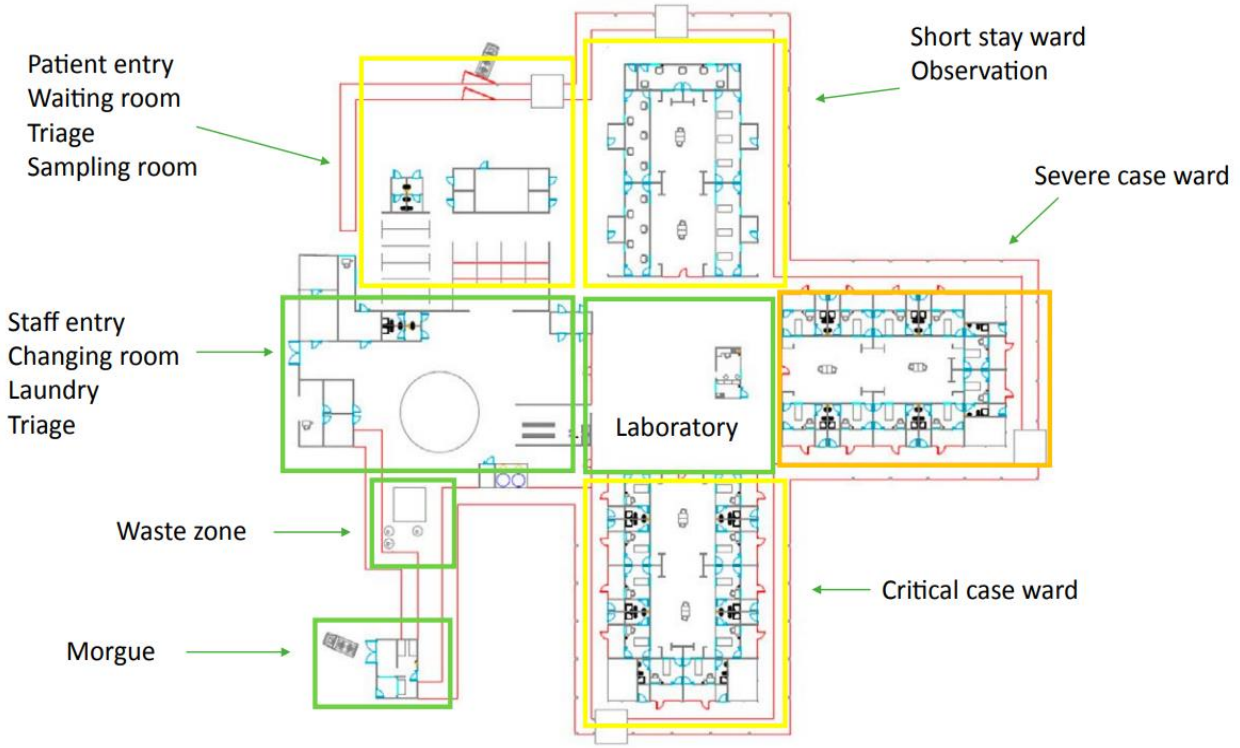
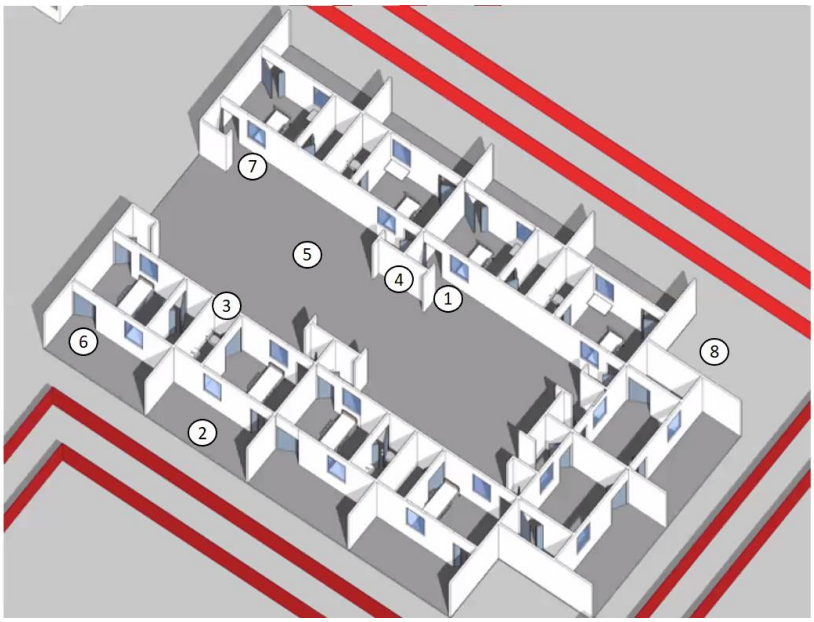


Figure 7: A separate sampling room can be useful, especially if (a) the infection is spread via droplets, (b) re-infections can occur and (c) patients who have just recovered or who are only suspected of having the disease are mixed with ongoing positive cases. See reference 7 for details.



1. Individual doffing [one per room]
2. Self-contained room with individual terrace
3. Individual toilet/shower
4. Shelf for PPE
5. Working area [Staff only]
6. Patient entrance
7. Staff entrance only
8. Space for cleaning and disinfection of items.

Figure 8: A separate patient and staff entrance may be considered if the disease (a) is spreading rapidly and is difficult to control and (b) has a high mortality rate. However, this is not necessary in most cases requiring contact or droplets precautions. See reference 7 for details.

Figure 9: Portable isolation units or containers exist and can be helpful during surges. See references 8-10 for details.

Figure 10: PPE stations / dispensers / organizers are necessary at donning stations. These can range from being sophisticated to being simple drawers. Regardless, hiding PPE inside locked cupboards, while it can prevent abuse, will also lead to under-use and therefore will increase the risk of cross-contamination. Some of the pictures are from the public hospitals of Mauritius. See references 11-14 for details.

Figure 11: Cubicle dividers do not need to be made of aluminum, reach the ceiling or be bulky – these can reduce ventilation and make it difficult to maneuver around patients. Practical alternatives are shown above – they are cheap, mobile and can be made of plywood, glass or plastic. They can be transparent or not. They need to be high enough to be above the nose and should be more than 1.2m tall. The importance of these barriers for patients requiring contact or droplet precautions is mostly to allow signages to be displayed so that appropriate precautions are taken when coming close to the patient. If cloth curtains are used, they need to be sent for laundering during terminal cleaning. The second picture on the right column from top to bottom is from Dr A. G. Jeetoo Hospital. See references 15-17 for details.

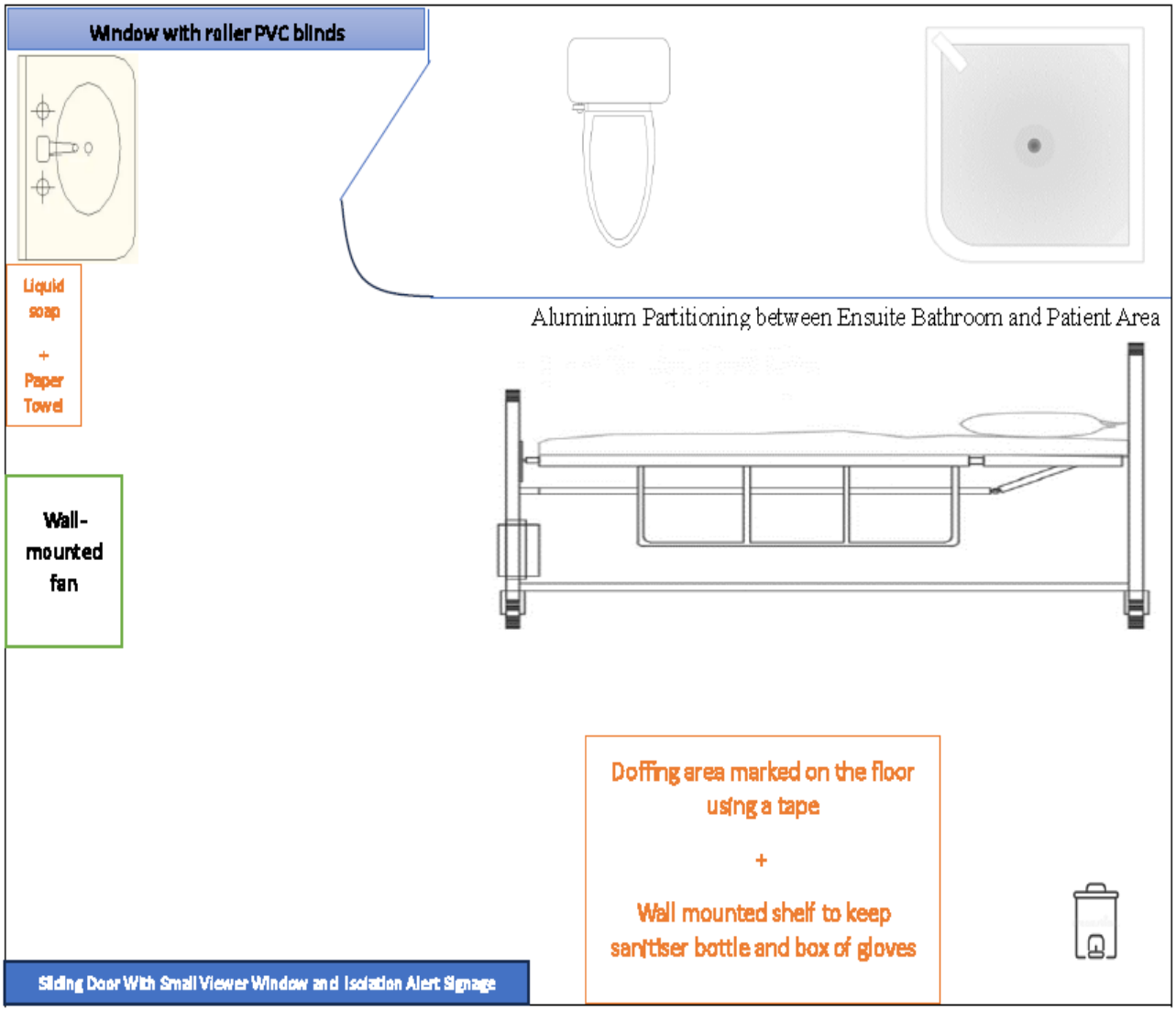


Figure 12: Layout of a side ward at Sir Seewoosagur Ramgoolam National Hospital. Donning is carried out outside the room. A well-designed isolation room to keep patients under contact precautions does not require expensive adjustments. Courtesy of Dr. R. Koonjoo-Beeharry.

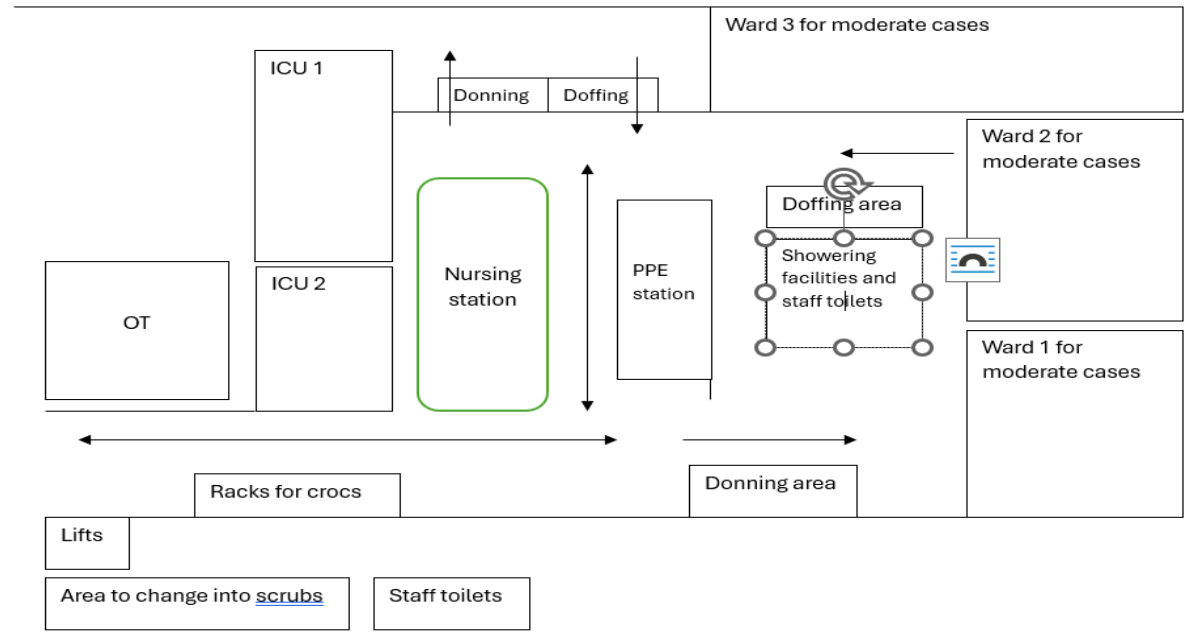


Figure 13: Schema of a COVID-19 ward. Modified from the New ENT Hospital. Arrows represent staff and / or patient flow. Donning and doffing areas, when not in booths, should be at least 2 meters apart to prevent contamination. In this setting, the donning and doffing areas on the right of the layout were more than 10 meters apart. The donning and doffing areas at the top of the schema were in booths as shown in the color picture (the photo was taken from inside the isolation zone). For illustrative purposes only and not to scale.

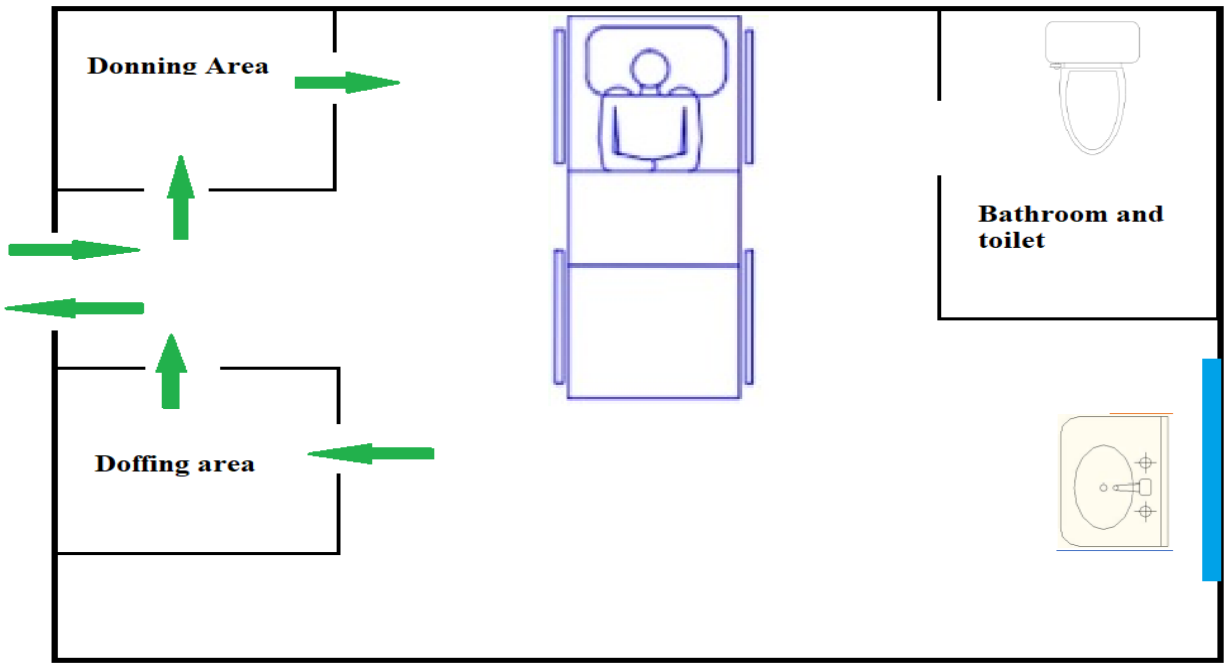


Figure 14: Layout of an isolation ward. Modified from the New Souillac Hospital. Donning and doffing areas are in booths in this hospital. However, for patients requiring contact and / or droplet precautions, booths are not mandatory.

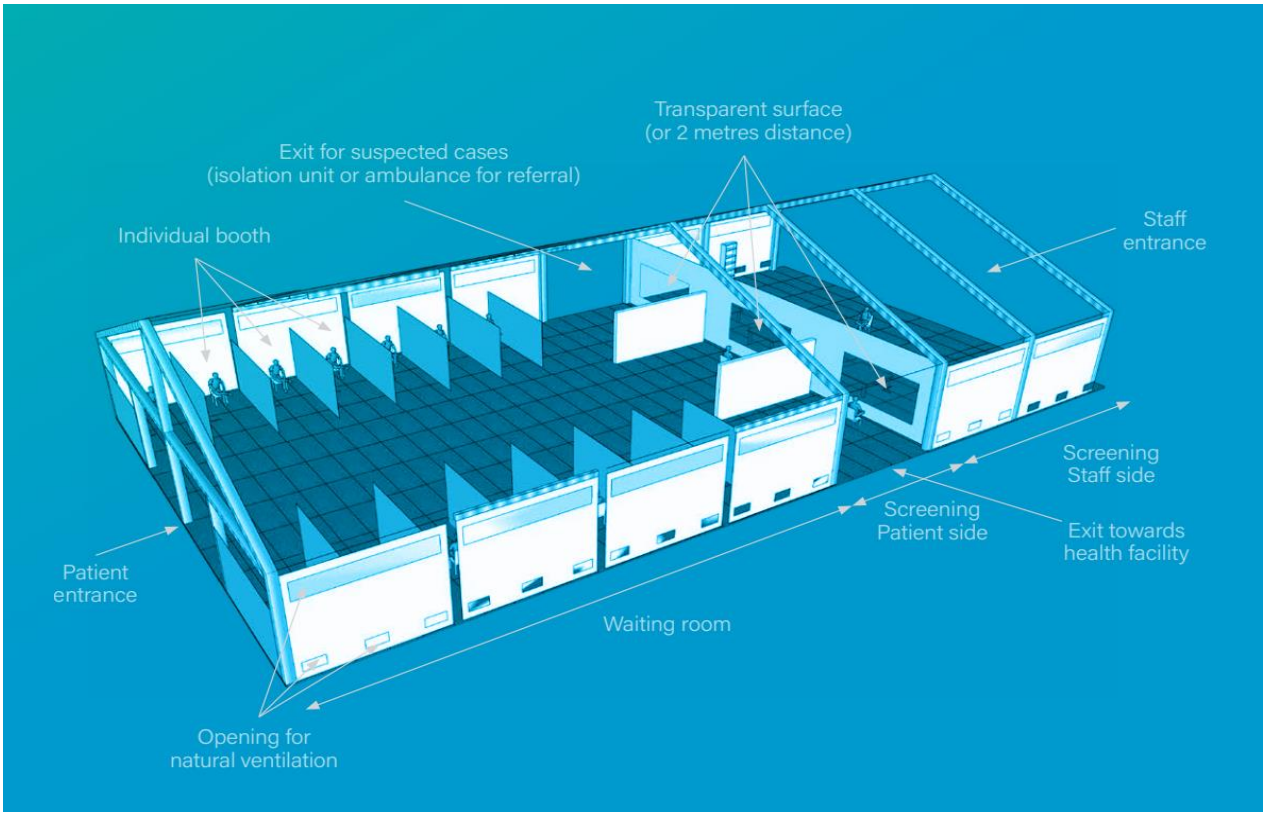


Figure 15: A design for a flu clinic. Individual waiting booths can be helpful to prevent cross-contamination. See reference 7 for details.

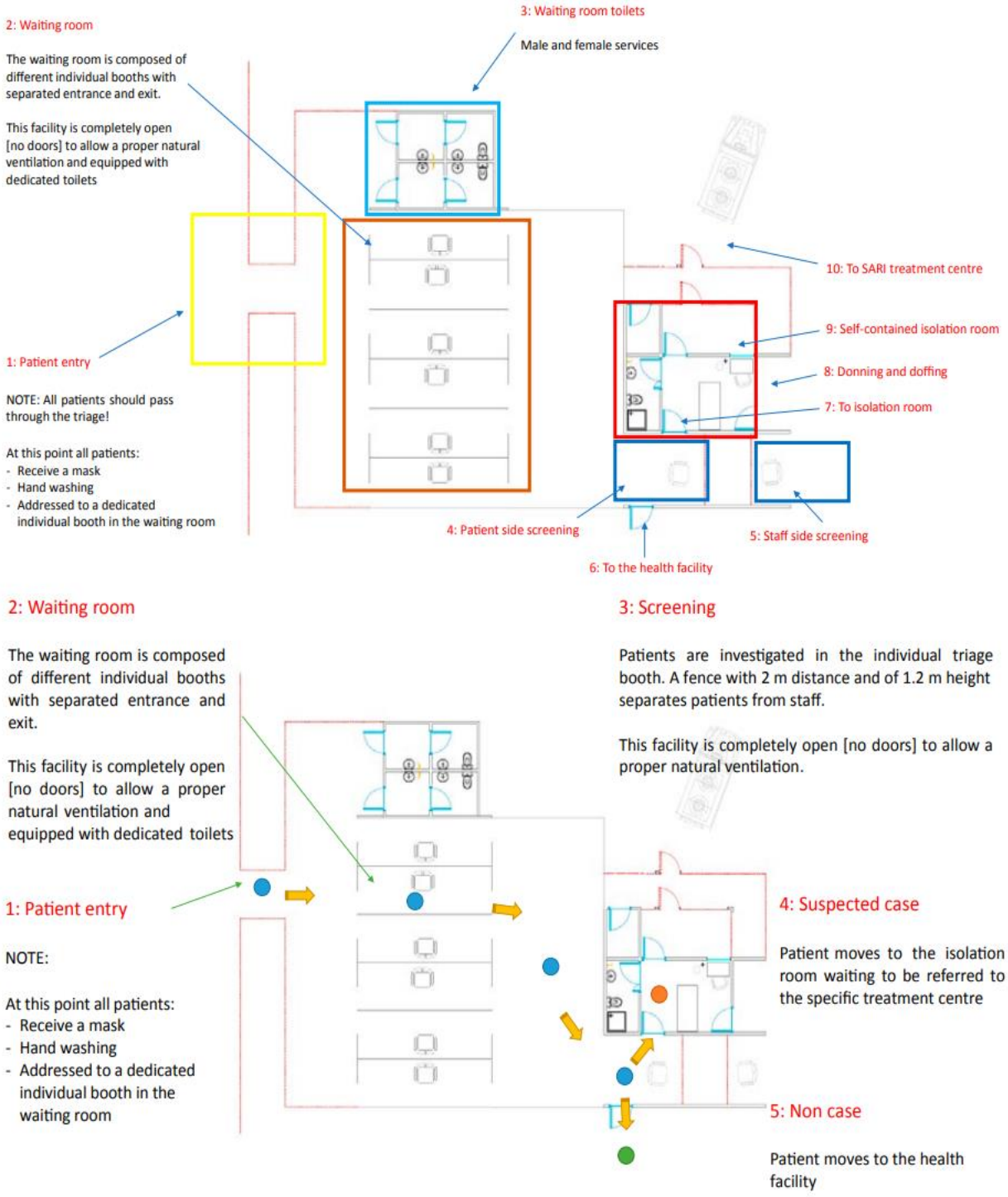


Figure 16: Note the patient flow inside a flu clinic – patients are not returned back to the same waiting area after being tested. See reference 7 for details.

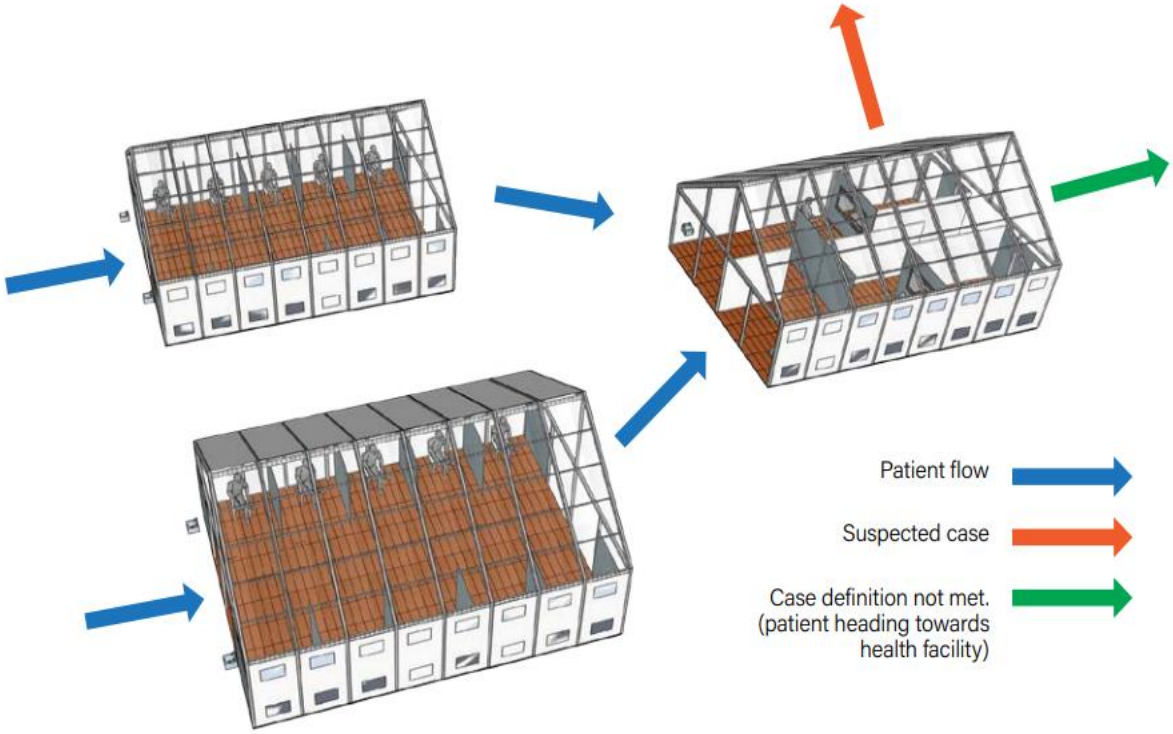


Figure 17: Small tents can be used as waiting areas prior to entering the flu clinic. See reference 7 for details.

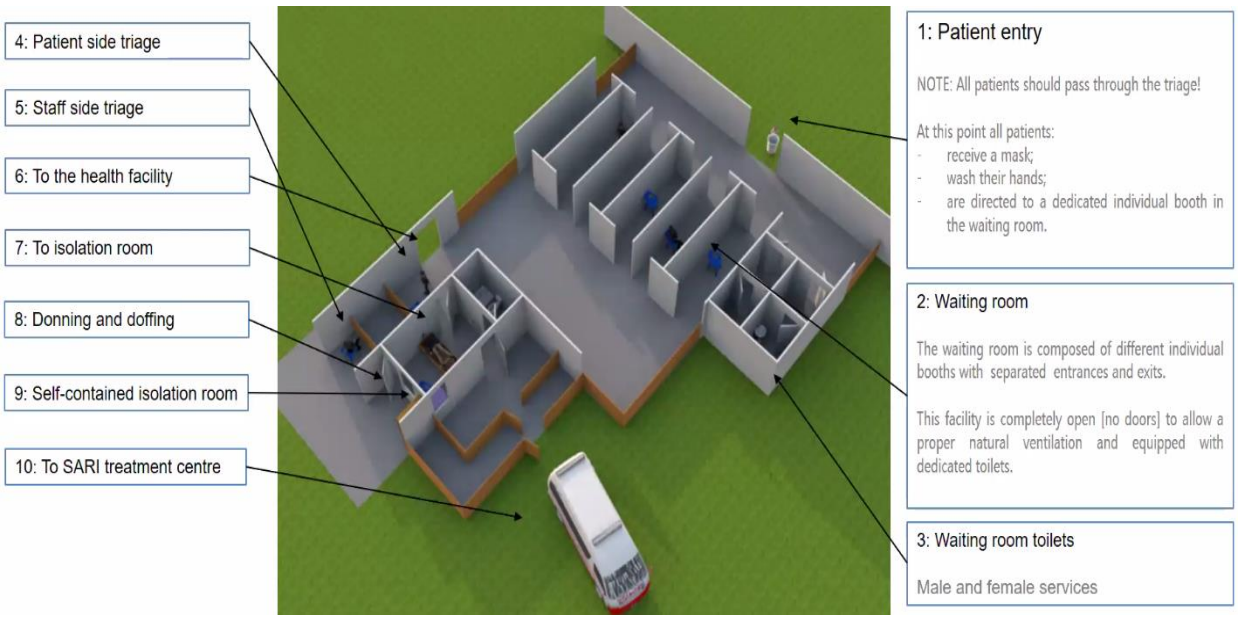


Figure 18: Flu clinics should have good ventilation – open doors and windows can provide natural ventilation. Taken from a WHO webinar on COVID-19 in 2020.

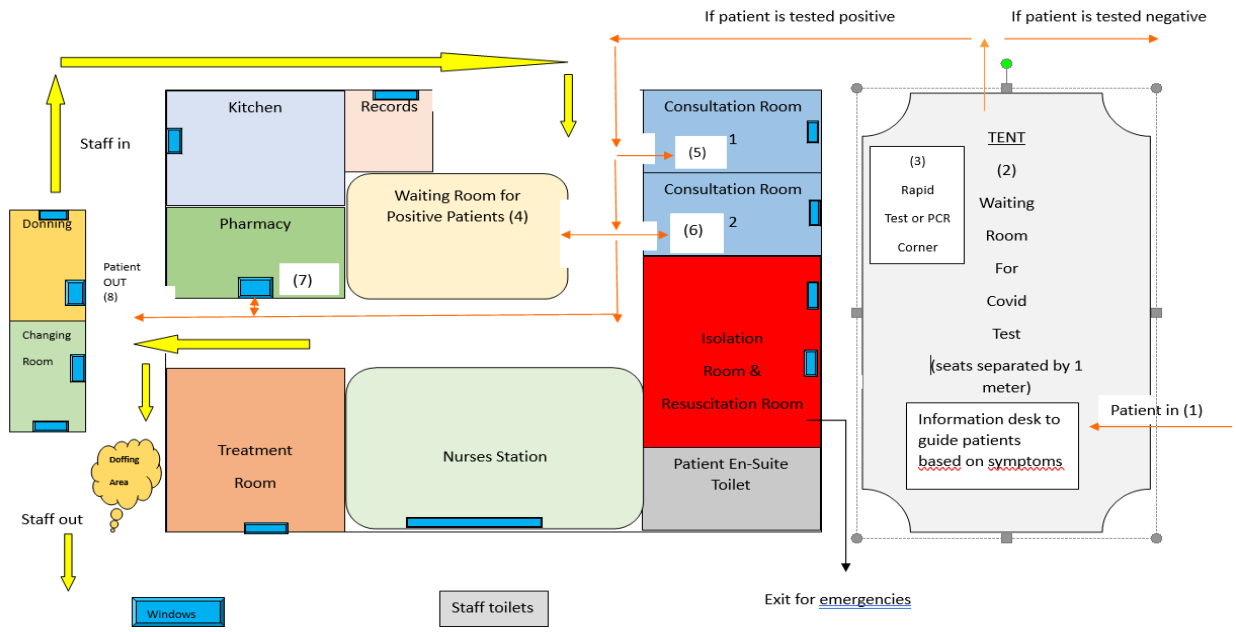


Figure 19: Layout for a COVID-19 clinic. Two waiting areas are useful to avoid placing confirmed cases next to suspected cases. Arrows represent staff or patient movement. Modified from Dr. A. G. Jeetoo Hospital. Courtesy of Mr. T. Ramgoolam.

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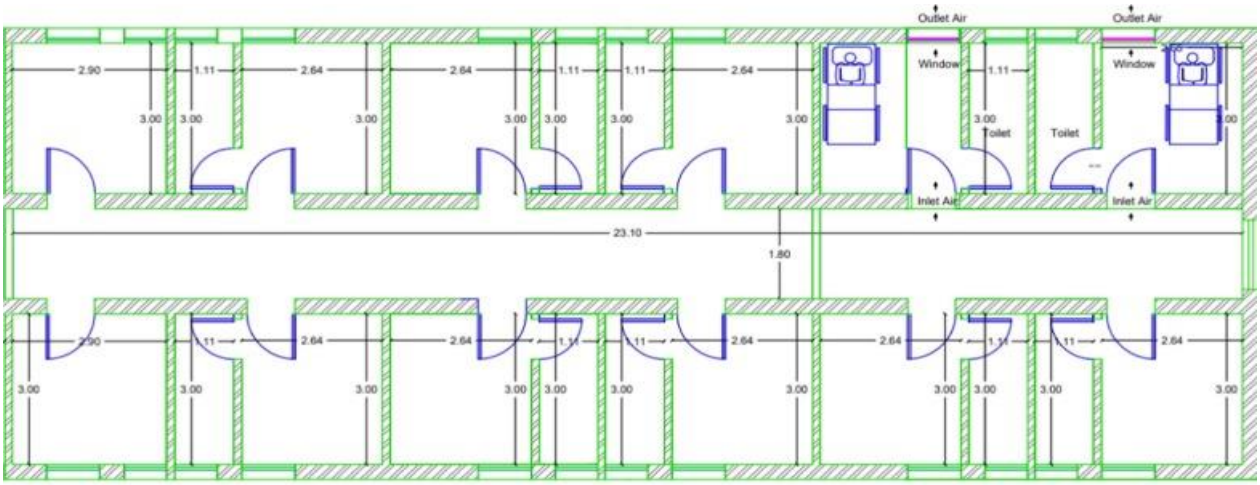
17. https://www.screenflexroomdividers.com.au/photos/hospital-patient-screen/

Airborne Precautions

Minimum infrastructural requirements

1. Handwashing facility
2. Single rooms preferred
3. Donning and doffing stations
4. Good ventilation with HEPA filters & UV disinfection
5. Doors are closed
6. Windows are opened if natural ventilation is needed



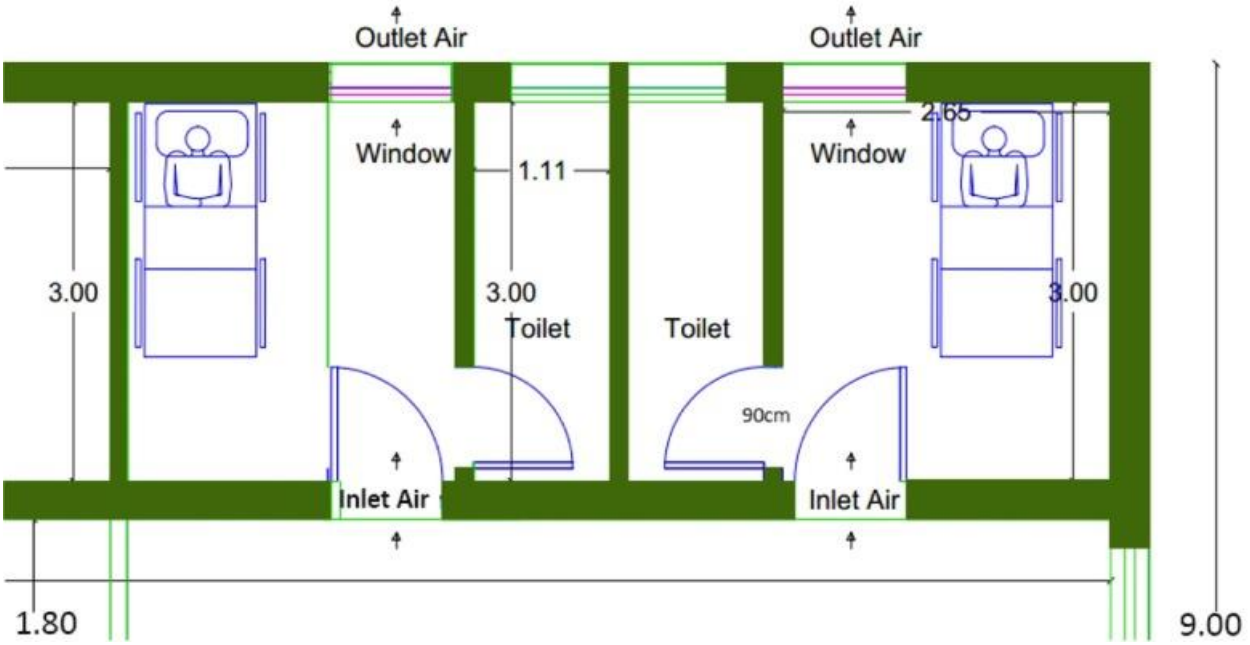


Figure 20: En-suite toilets in single bedrooms are preferred for patients with airborne diseases. Good ventilation can be achieved naturally with open windows, but care should be taken that people without masks do not walk close to these outlets if the room is on the ground floor. In the presence of a person, despite being controversial, carbon dioxide sensors can be utilized to assess how good the ventilation is. See reference 1 for details.

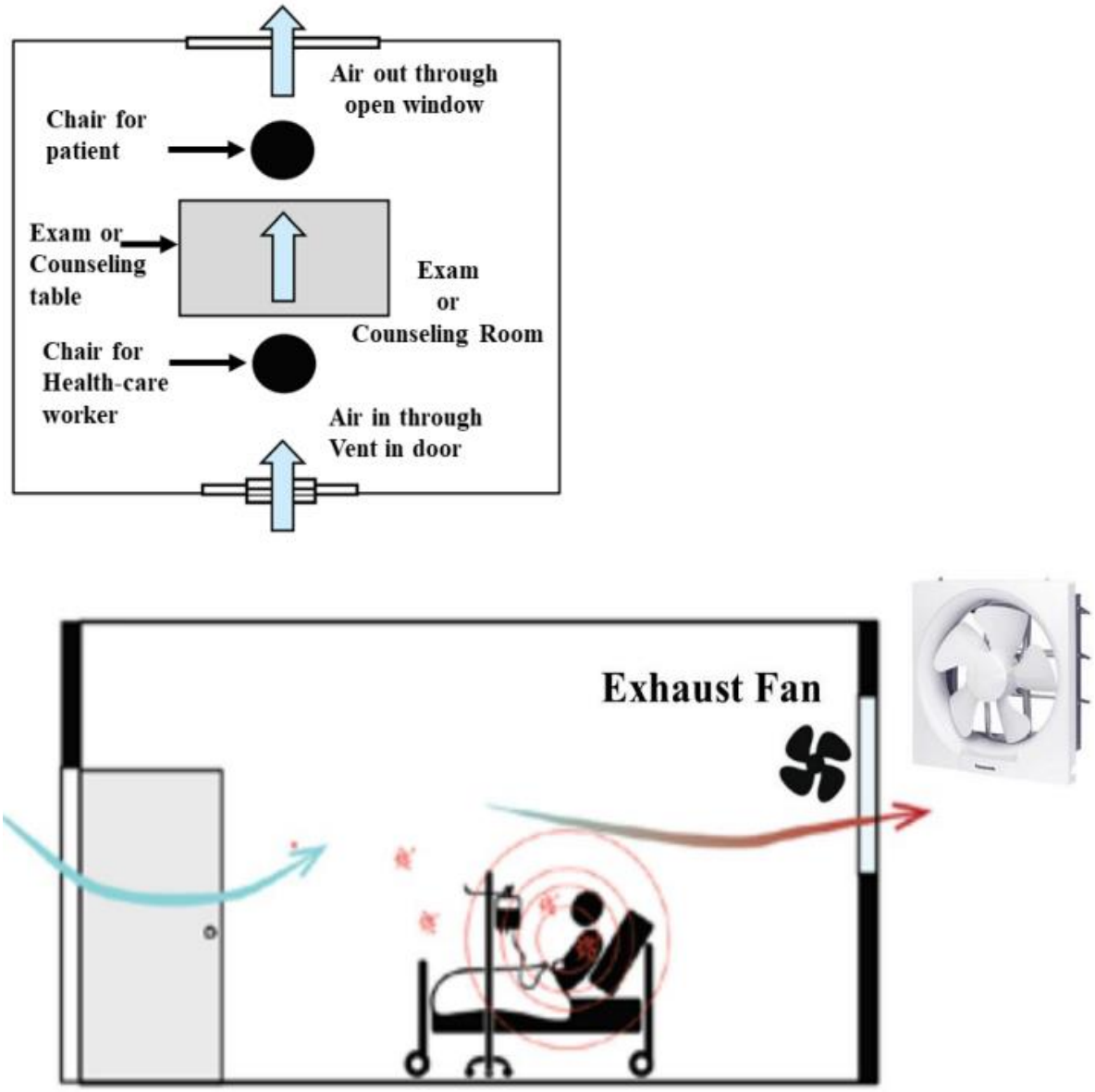


Figure 21: Cross-ventilation is better than single-sided ventilation; however, doors to corridors cannot be left open if the patient is suffering from an airborne illness. Use fans or air extractors to ensure that the air is pulled out of the facility and not pushed inside. Split air and ductless air conditioners should be turned off. See reference 2 for details.

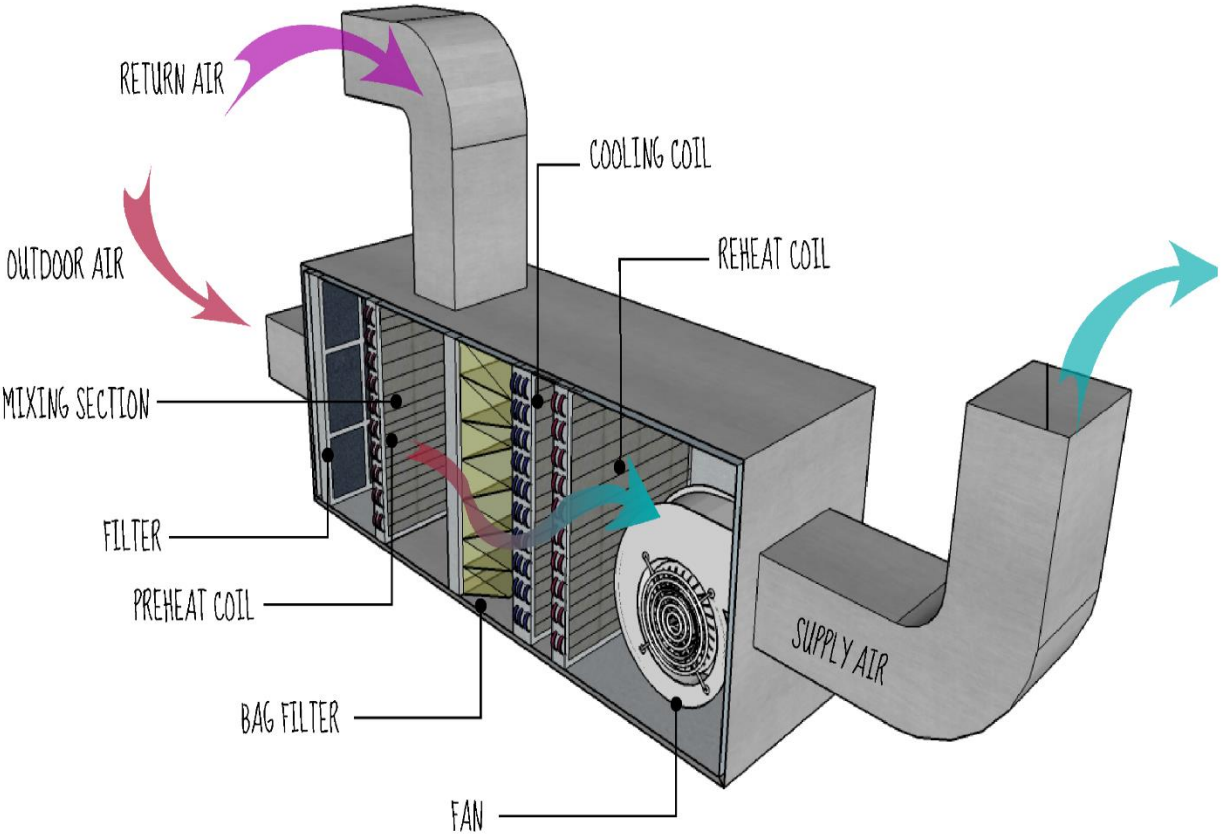


Figure 22: Ducted air-conditioning and mechanical ventilation (ACMV) systems with recirculation mode. If windows cannot be opened and such ACMV are in use, set the system to be mixed with 100% outdoor air (but ensure good control of humidity is maintained) and terminate air return mode. It is preferable to install HEPA filters on the air return duct. See reference 2 for details.

Figure 23: If windows cannot be used and the recirculation mode of the ACMV cannot be terminated, use portable air cleaners with HEPA filters with an exhaust installed to the outside after turning off the ACMV. The air cleaners should be placed close to the head of the patient. See reference 2 for details.

Figure 24: If the portable air cleaner cannot be connected to an exhaust to the outside, use a portable air cleaner with a HEPA filter and UV light disinfection placed close to the patient head. It will recirculate the air after attempting to decontaminate it – set the machine so that at least 12 times the volume of the room can be decontaminated every hour. The above pictures are for illustrations only.

Figure 25: The exhaust fan should be located outdoors and placed as far away from intakes and public areas as practical with discharge above the roof. If serving isolation rooms, such exhausts should be labelled as hazardous. See reference 3 for details.

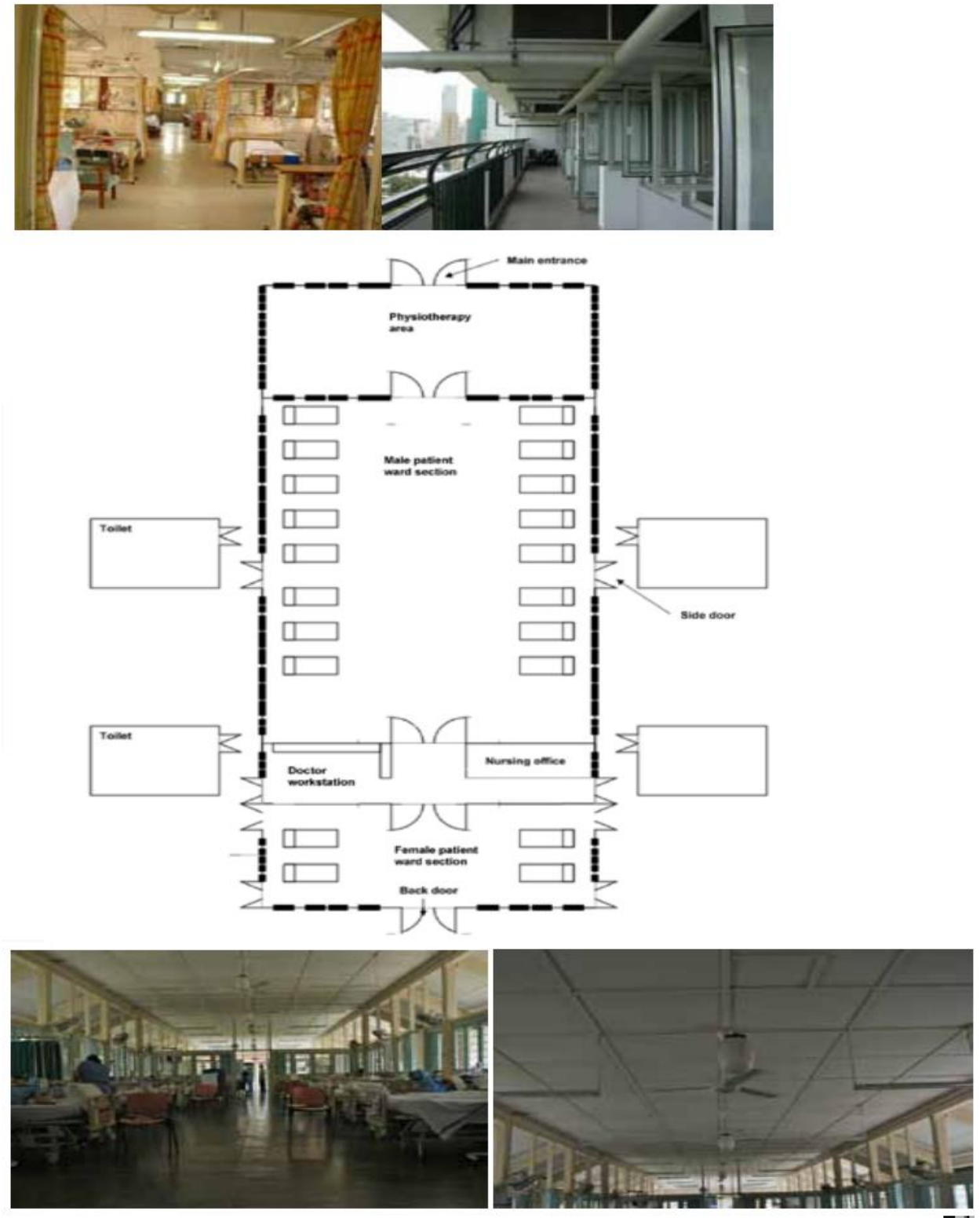


Figure 26: Floor plans for a tuberculosis ward. Tall ceilings, fans and multiple open windows provide good ventilation. Negative pressure rooms are not mandatory. Patients with the same infection can be cohorted in the same room – mixing with non-infected cases should NOT happen. See reference 4 for details.

Figure 27: While closed doors are important, it is also vital to be able to observe the patient closely. Transparent observation windows or doors are therefore required. See reference 5 for details.

Reference:

1. Khaled Ahmed S, Mohammed Ali R, Maha Lashin M, Fayroz Sherif F. Designing a new fast solution to control isolation rooms in hospitals depending on artificial intelligence decision. Biomed Signal Process Control. 2023 Jan;79:104100. doi: 10.1016/j.bspc.2022.104100.
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5. World Health Organization. Severe Acute Respiratory Infections Treatment Centre. March 2020.

Maximum Isolation Precautions for High Consequence Infectious Diseases

Minimum infrastructural requirements

1. Handwashing facility
2. Single rooms
3. Donning and doffing stations
4. Good ventilation with HEPA filters & UV disinfection
5. Doors and windows are closed
6. Strict unilateral flow of patients and staff
7. Negative pressure ventilation with anteroom

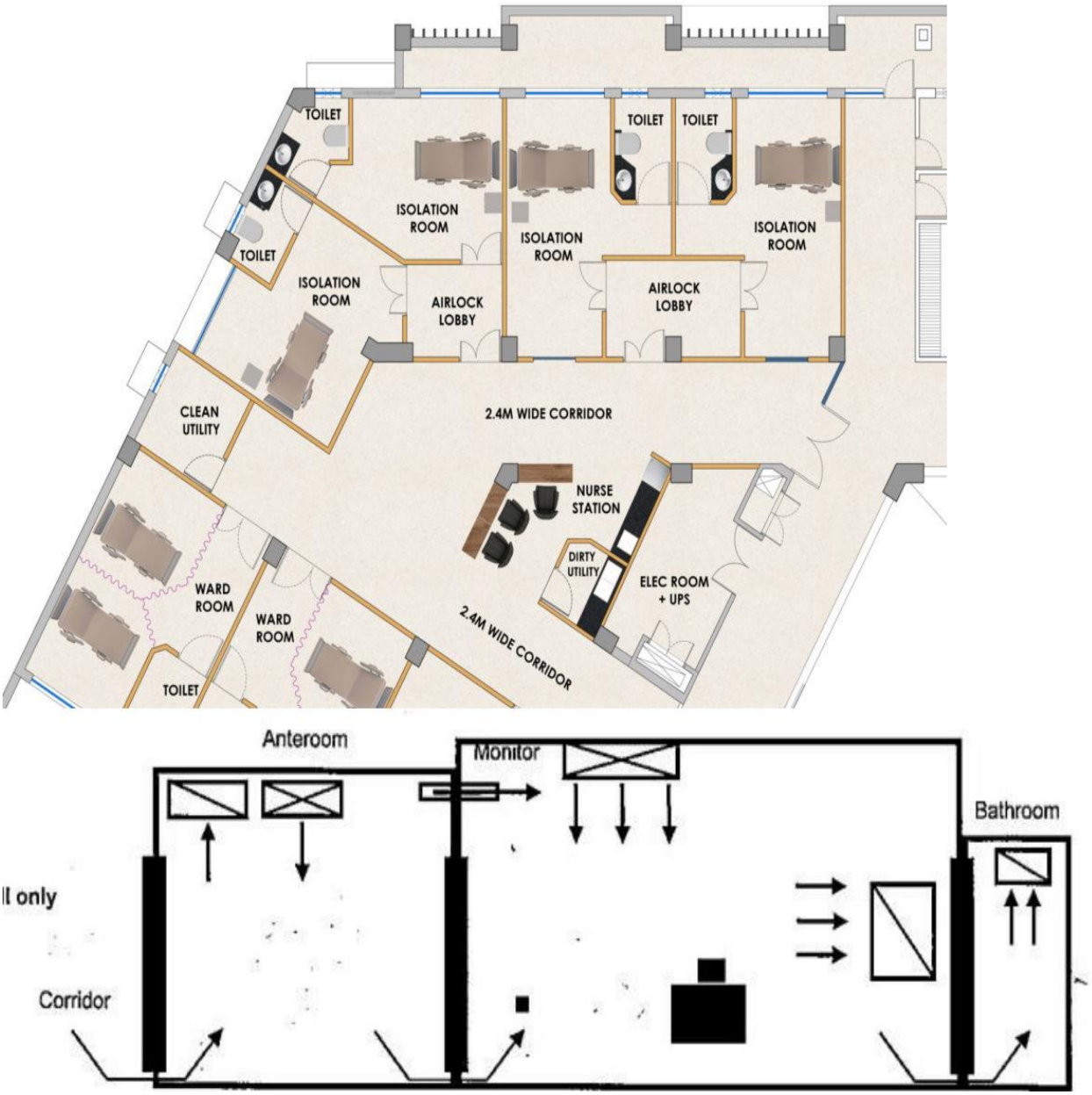


Figure 28: Anterooms / airlock lobbies are considered important to minimize the leakage of air. A washbasin and a donning area are found in the anteroom. See references 1 and 2 for details.

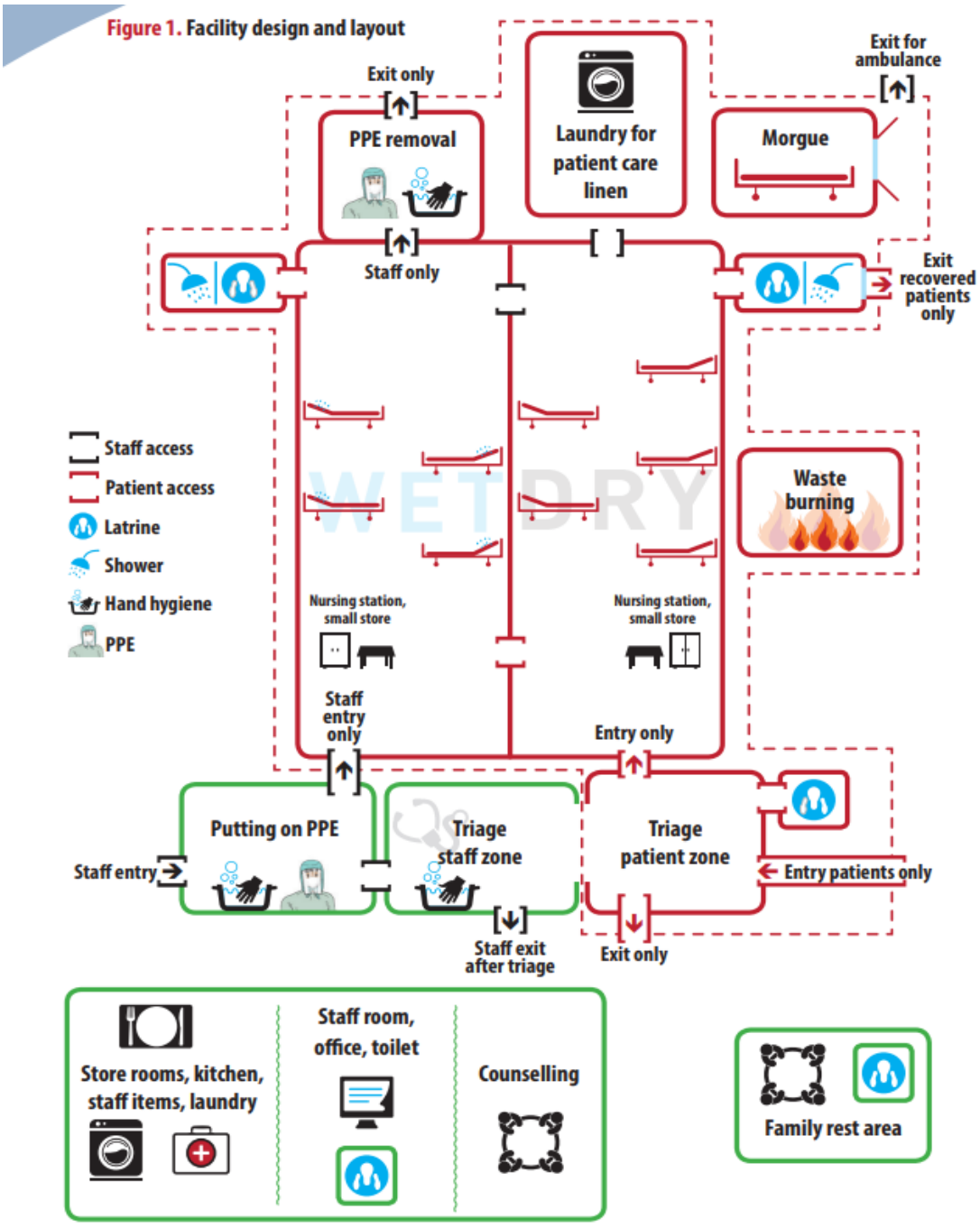


Figure 29: Showering facilities and rest areas should be available. Facilities for waste incineration or autoclaving should be close by. Doffing areas need to be in booths to prevent cross-contamination. See reference 19 for details.

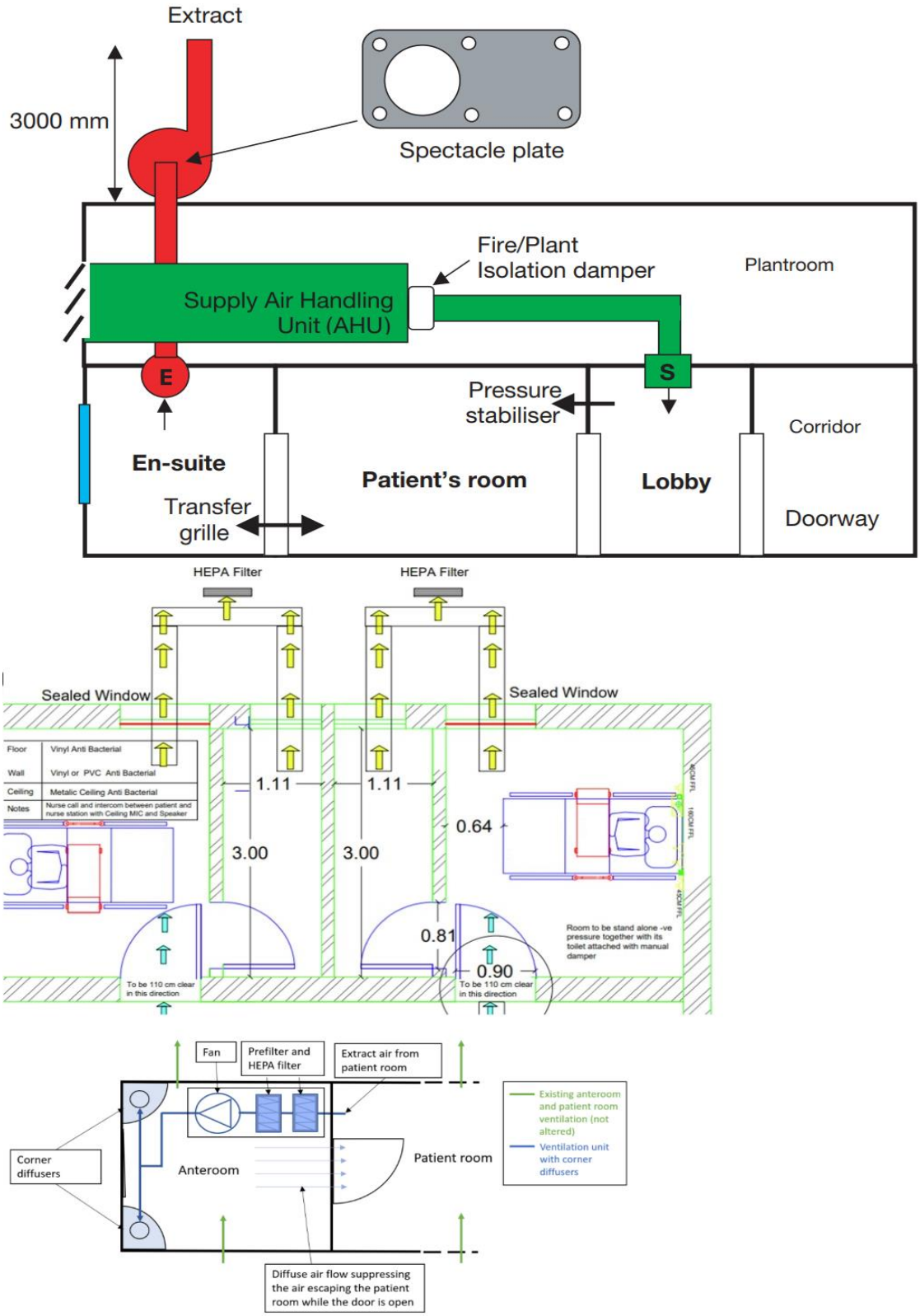
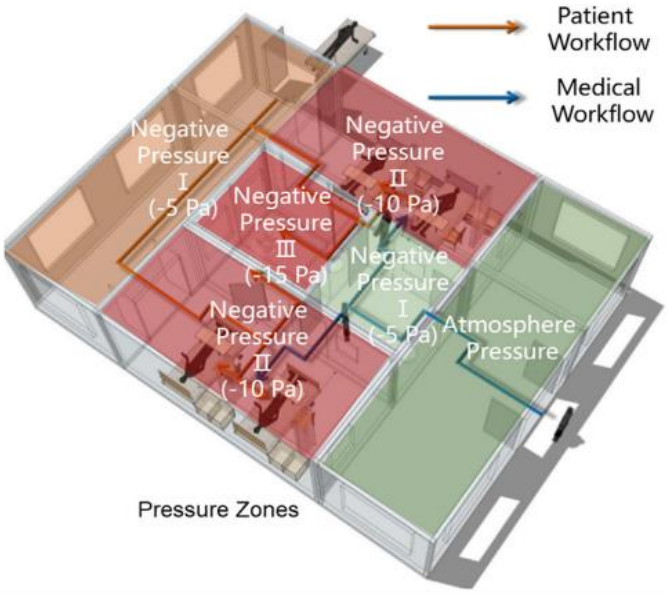


Figure 30: Proper mechanical ventilation is crucial. Specialized air handling units with HEPA filters, diffusers and pressure stabilizers should be installed. See references 3-5 for details.

Figure 31: Pressure monitors are mandatory for negative pressure rooms in order to ensure the absence of leakage of air. Smoke test kits, portable manometers and the paper test can also be utilized. While some of the above pictures depict positive pressure mode, actually, negative pressure is required in order to isolate patients with High Consequence Infectious Diseases. See references 2, 6 and 7 for details.



Airborne Infection Isolation Room (negative pressure)

Daily Pressure Monitoring

Ward: _____

Room number: _____

Date	Time	Pressure Reading (Minimum: - 2.5 Pa)		REMARK (if the pressure not acceptable and document action)
		Yes	No	

Figure 32: Pressure gradients should be followed closely as dictated by guidelines. A daily log of the pressure should be taken so that repairs are not delayed whenever the ventilation system stops functioning. See references 6 and 8 for details.

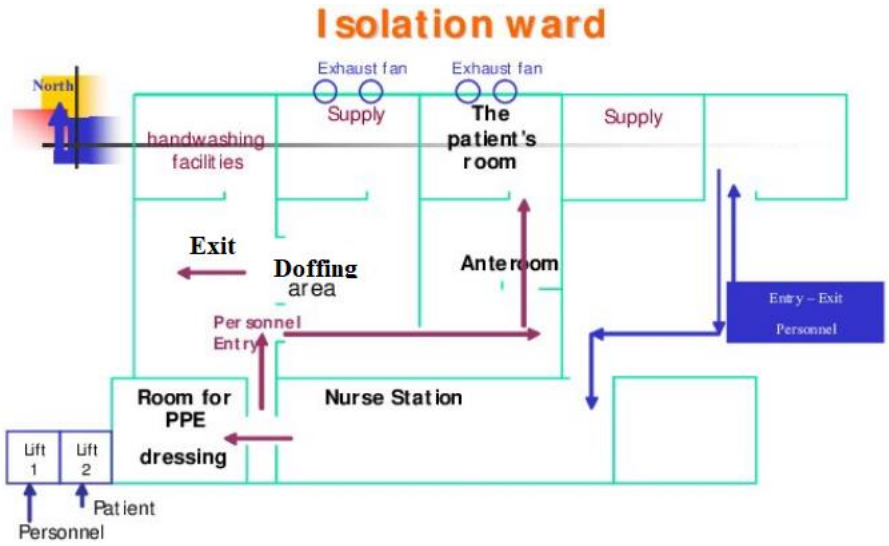


Figure 33: Unilateral flow of staff is mandatory when isolating patients infected with High Consequence Infectious Diseases. A red tape can separate the contaminated zone from the clean zone. People who cross the red tape into the dirty area are considered contaminated. See reference 9 for details.

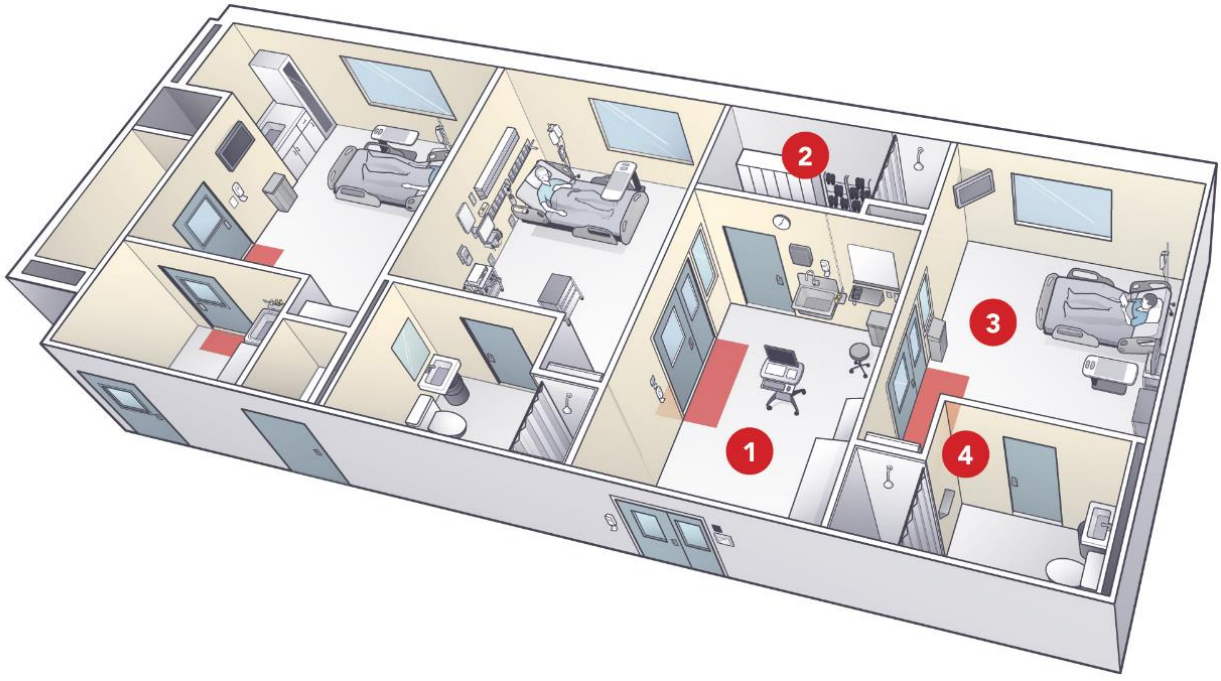


Figure 34: Donning area is in section 1. Family members can use a plate glass window and communication system to safely observe and visit with the patients – while some restriction of visitors is necessary, it is also necessary to show some compassion. All disposable waste is autoclaved (sanitized with pressurized steam) and then incinerated, from coverall suits to food trays, on site i.e., without transport to distant areas. Liquid wastes are disinfected with hospital grade cleaning agents for several minutes and then flushed down the toilet inside the patient room itself. See reference 10 for details.

Figure 35: Staff may need to help each other shower before doffing if the protective equipment used is reusable. The picture shows healthcare workers in powered air-purifying respirators. Staff wearing disposable PPE like gowns do not need to undergo this procedure. See reference 11 for details.

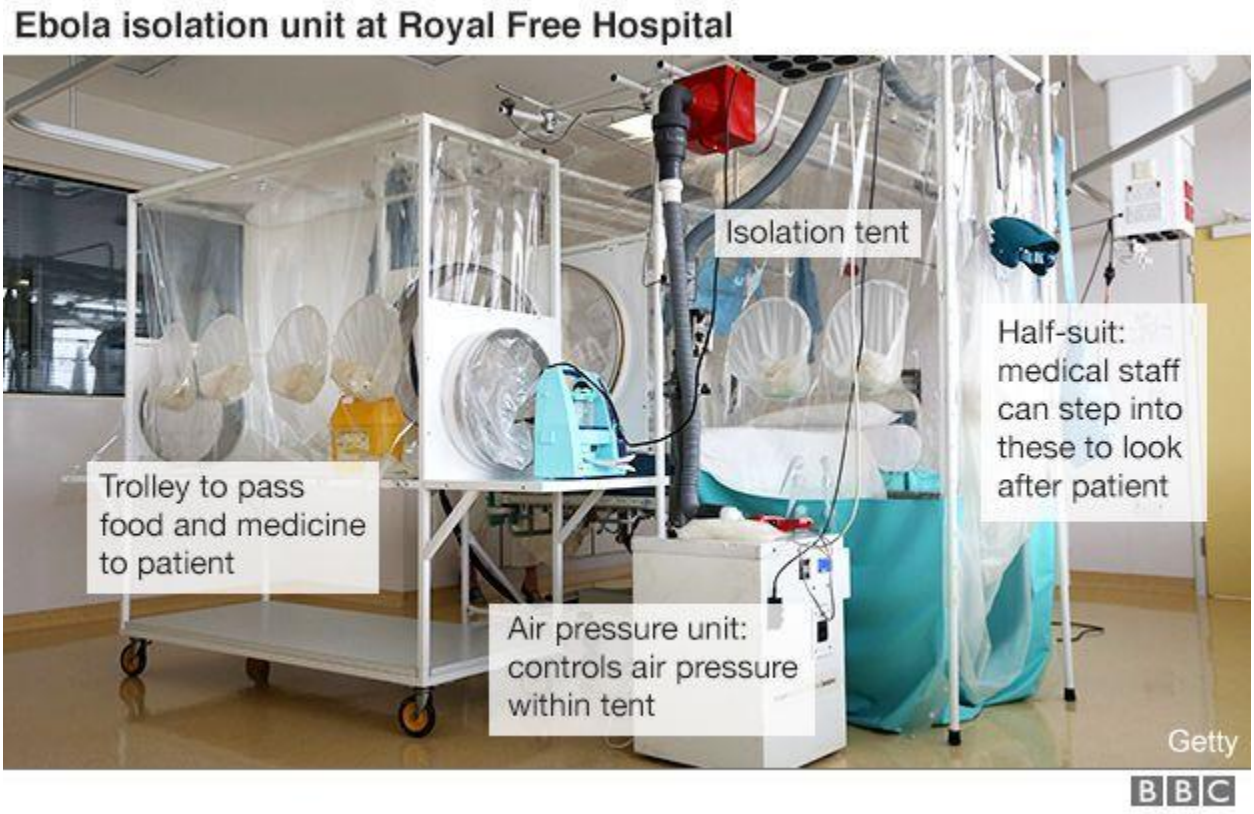


Figure 36: Food must be given and taken away from patients in a safe manner. From BBC - Ebola nurse Pauline Cafferkey 'in serious condition'.

Figure 37: Temporary isolation units using tents and other materials can be created. Such units are sometimes used for several weeks in High Level Isolation Units and High Secure Infectious Disease Units. See references 12-15.

Figure 38: Biocontainment units may be needed to move patients e.g., for x-rays. Mobile Ebola Isolation Units and transport pods also exist. See references 16 and 17 for details.

Figure 39: Médecins Sans Frontières doctors try to feed a young girl in the high contamination risk zone of the Ebola treatment centre in Kailahun, Sierra Leone. Frequently, advanced isolation facilities are not available. This does not mean patients are left without medical care. Patients are kept 15 meters away from other unprotected individuals. Wearing the right PPE in a well-ventilated area and practicing hand hygiene properly are often sufficient to prevent transmission of infections. However, this does NOT meet the minimum requirements of Mauritius. See reference 18 for details.

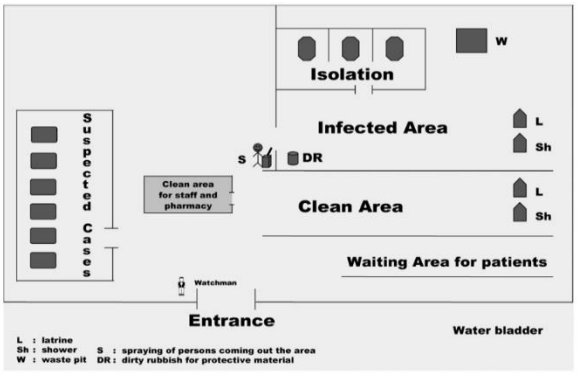


Figure 40: When advanced technology isn't available, contingency plans have to be implemented. Basic facilities like tents, toilets, water, PPE and waste incineration can still be provided. However, this does NOT meet the minimum requirements of Mauritius. See reference 20-23 for details.

References:

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