SMJ Singapore Medical Journal

Operational requirements of medical posts in migrant worker dormitories during the COVID-19 outbreak in Singapore

Ying Jang Mok[1], MBBS, Qi Wei Fong[1], MBBS, Shipei Law[1], MD,
Ee-Jin Darren Seah[1], MBBS, FCFP, Kah Leong Jeffrey Lum[2], MBBS,
Jia Jin Justin Yeo[3], BSc(Hons), Lexin Lee[4], BSocSci(Hons), Sze Wee Erik Ang[5], MBBS, FRCS

[1]National Healthcare Group Polyclinics, [2]OMF International,
[3]Department of Physiotherapy, [4]Department of Psychology, Tan Tock Seng Hospital,
[5]Yap + Ang Surgical Associates Pte Ltd, Singapore

Correspondence: Dr Ee-Jin Darren Seah, Senior Consultant Family Physician, National Healthcare Group Polyclinics, 3 Fusionopolis Link, Nexus@one-north (South Lobby), #05-10, Singapore 138543. Darren_EJ_SEAH@nhgp.com.sg

Singapore Med J 2021, 1–16
https://doi.org/10.11622/smedj.2021218
Published ahead of print: 26 November 2021

INTRODUCTION

The outbreak of COVID-19 emerging from China in early January 2020 soon reached Singapore in mid-January 2020[1] and this was met with a whole-of-government response.[2]

Singapore has a 1.35 million foreign workforce out of a population of 5.7 million; 350,000 are migrant workers (MWs) hailing mainly from South Asia and China, employed in construction, marine and process sectors.[3] Some 200,000 live in 43 dormitories purpose built for housing migrant workers. These dormitories house between 1,500 and 25,000 MWs each.

Prior to COVID-19, migrant workers living in dormitories often did not consult any doctors for their ailments as the majority of these were mild. If they did so, they often visited their private practitioners or workplace doctors. Only 38% of them would stop work when ill.[4]

Small clusters of COVID-19 began forming in construction sites and places frequented recreationally by MWs in March 2020. As workers at a particular construction site were from different dormitories and socialised with different circles of friends, the disease soon spread to many different dormitories and in turn spread to other different worksites.

A Joint Task Force was set up in April 2020 to manage this dormitory outbreak with the immediate objective of minimising the spread to the wider community, delivering essential healthcare services to dormitory residents and managing the impact on public healthcare resources.[5]

Two large dormitories were declared as isolation areas under the Infectious Diseases Act on 5 April 2020,[6,7] and more dormitories were progressively gazetted[8,9] as the numbers of daily new cases began to increase exponentially, reaching 1,000 on a number of days in mid-April 2020 which threatened to overwhelm the national healthcare system. MWs were not allowed to travel outside their dormitories for work or pleasure, and were restricted in their movements within the dormitories. Forward Assurance and Support Teams (FAST) comprising uniformed services personnel from the Singapore Armed Forces and Singapore Police Force

were sent to the dormitories to support the logistics and movement of the quarantined MWs.[10]

Healthcare Systems such as the National Healthcare Group (NHG) were activated to set up medical posts in many of these dormitories in support of these measures[11] with National Healthcare Group Polyclinics (NHGP), the primary healthcare arm of NHG being allocated 14 dormitories in the north of Singapore.

DORMITORY X

Our experience is based on our deployment at Dormitory X. Dormitory X comprises of 11 blocks housing approximately 9,000 MWs. Blocks 1-5 is physically separated from Blocks 6-11. Each block has 4 levels of 12-14 rooms with 8-12 MWs to a room.

Common sanitary facilities including both toilets and baths are shared, with approximately 150 workers sharing a communal facility on each floor. Clean water is easily available. Garbage disposal is done twice daily and pest control operations, particularly against rodents and mosquitoes, are done twice weekly.

Selected sections of the Dormitory were designated as Swab Isolation Facility (SIF), Dormitory Isolation Facility (DIF), In-situ Community Recovery Facility (CRF) and Block for Recovered Workers (BRW). These were separate areas of the dormitory that had been identified to isolate MWs who were ill and had to be segregated away from the rest of the dormitory population.

OBJECTIVES OF THE MEDICAL POST

The objectives of the medical posts were to provide timely assessment, diagnosis and treatment of those who were infected with COVID-19, co-ordinate the isolation and evacuation of cases

requiring off-site medical care, and to meet the primary healthcare needs of non-COVID-19 dormitory residents.

REQUIREMENTS AND OPERATIONALISATION OF THE MEDICAL POST

While based on models of field hospital or field medical station setups, more applicable in armed conflict, natural disaster or humanitarian rescue situations where emergency care of injuries dominate,[12] the medical posts had to be adapted to the context of public health challenges in dormitory medical operations. With different considerations and requirements, we describe our medical post deployment at dormitory X.

Physical location

The medical post requires access to electricity and water, has to be easily accessible by the dormitory residents and away from public view for privacy. The physical footprint of the medical post should be large enough to handle the anticipated number of patients while ensuring safe distancing measures.[13]

A combined on-site assessment by the medical team, logistics personnel and dormitory manager to determine the siting of the medical post would be necessary as there are variations in the vintage, capacity and layout across the different dormitories.

Our medical post at dormitory X was deployed under a canvas tentage, measuring approximately 30m x 20m, with high ceiling, lighting, ceiling-mounted fans and side flaps powered by a diesel generator in the open carpark from 13 April 2020 and equipment brought in the next day (Fig. 2). Senior Consultants from NHGP with experience in public health and field hospitals helped to define the work processes, which were then shared with medical posts deployed at other dormitories over the next few days.

Environmental considerations

The main environmental factors to be considered are the ambient temperature and ventilation. Heat and humidity of the Singapore weather and having healthcare workers donning full PPE in the red zone implied that the medical post should be under shelter with good ventilation.

Sites under consideration would include sheltered but non-airconditioned spaces like gymnasiums, multi-purpose halls, canteens and void decks, and open-air spaces like car parks, basketball-courts and grass patches. Open spaces would require the erection of tents for shelter, with attention paid to its orientation in relation to the sun to minimise solar exposure.

In our deployment, good ventilation and open airflow of at least 270 degrees was achieved by ensuring the tentage flaps were opened during operational hours. At the swab area, an industrial fan blowing away from the medical staff was sited to enhance ventilation. To reduce the ambient temperature, commercial air coolers were used to supplement industrial fans. Four air coolers were placed at high traffic locations like the registration area (Fig. 3).

Medical post stations

The medical post should be divided into a "hot" (red) zone, where all healthcare personnel would be required to don full personal protective equipment (PPE), and a "clean" (green) zone where full PPE would not be required. Fig. 1 shows our medical post setup at dormitory X.

Red zone are areas where there is prolonged contact with known and potentially infected cases. These include registration and triage, consultation, dressing and dispensary, swabbing, and holding areas. The swab area should be well ventilated and situated away from other clinical areas and passageways to minimise aerosol spread to persons within the vicinity.[14]

The staff area should have sufficient space for meal consumption with adequate safe distancing measures, and resting after de-gowning from full PPE. Staggered staff breaks should be considered to minimise prolonged interaction.

In the ideal situation, the medical post should be provided with secured internet connectivity to operate an electronic medical records (EMR) system and queuing system. In its absence, hard copies for clinical notes would suffice. Laptops were used for registration purposes, but due to internet instability and difficulties in addressing infection control concerns (such as cross-infection of IT equipment), hardcopy medical record keeping was used instead. Hardcopy notes were kept on site throughout the deployment. They were subsequently packed and kept in polyclinic storerooms while awaiting scanning to digitise the records for record keeping.

A portable air conditioned 20-ft container was brought in as a supplementary staff rest area.

Logistic support

The timely resupply of medical consumables like PPE and medication, and other consumables like stationery and identification tags would need to be ensured. Another essential requirement would be to establish a system for swab test sample collection by the assigned laboratory, to ensure turnaround time for results is as short as possible to expedite the identification and isolation of a COVID-19 positive MW.

The rest area should be well-stocked with chilled water and isotonic drinks to ensure that staff are adequately hydrated.

Basic medical equipment for consultation (pen torch, blood pressure and oxygen saturation monitor, stethoscope and otoscope) and basic dressing sets (for minor wound

dressing and treatment) were used in our medical post. There was no ECG machine nor X-ray capability.

We used a standard medication list for treating common acute ailments. This helped to streamline the pharmaceutical supply chain. Common chronic medications were available on an ad-hoc basis to be supplied with regular delivery runs.

Daily courier service was arranged with the laboratory to courier swab test samples to backend laboratory to process samples.

Manpower

All efforts should be made to ensure the safety and welfare of care providers. Healthcare workers and all ancillary personnel should be trained in proper PPE donning and de-gowning. The following PPE would be appropriate for the COVID-19 outbreak:[15,16]

- Shower cap
- N95 mask (fitted)
- Clear plastic face shield
- Splash-proof long-sleeved disposable gown[17]
- Nitrile gloves

The risk of heat and physical exhaustion due to a combination of the hot and humid environment whilst clad in PPE would be high,[18] and this should be mitigated by ensuring that healthcare workers are well hydrated and have appropriate rest areas as noted above.

Manpower was drawn from NHG doctors, nurses, allied health and administrators supported by a pool of volunteer locums from the private sector. The medical team comprised 4 doctors and 12 healthcare workers (registered nurses and other allied health practitioners). 2 doctors and 6 to 8 Healthcare Workers would be on duty at any point in time when the medical post was operational.

The 4 doctors and the nurse in-charge remained on the team throughout the entire deployment, while the rest were rotated on a monthly basis. Overall, about 80% of the team remained throughout the deployment, which was important in maintaining high staff morale during the protracted field deployment.

The medical post operated from 0830 to 1630 hours daily throughout the week. With the abating of the outbreak and gradual lifting of movement restrictions, operational hours in the weekends were reduced to 0830 to 1230 hours from 13 June to 20 July 2020.

Maintaining high vigilance for the health of the staff was essential, including twice daily monitoring of fever and ARI symptoms. During the deployment, 2 healthcare workers reported mild ARI symptoms, swab tested negative and were given 5 days of medical leave to recover. Another 2 healthcare workers reported high fever; one was attributed to viral gastritis, and the other was dengue positive. Both were swab tested negative as well.

Security

Appropriate security enforcement assets would have to be on standby, ready to mitigate any potential public disorder incident. Evacuation routes for medical personnel in the event of emergencies would have to be identified.

CLINICAL WORKFLOWS

Given the possibility of asymptomatic COVID-19 carriers spreading the virus, staggered time slots were arranged for each block to report sick to minimise overcrowding and intermingling. Dedicated entrance and exit routes were provided to minimise any cross -interaction of MWs from different blocks. MWs were further segregated at the medical post according to the presence or absence of respiratory symptoms and fever. Wipe-down of high touch point

surfaces, such as tables and chairs, with 70% alcohol wipes were performed twice a day to ensure biosafety.

Overcoming language barriers was a key challenge faced by our team. Various sources helped to provide language aids which included translated phrases for common symptoms in the MWs' native languages. In addition, MWs with reasonably good command of English were engaged as community translators to aid in the medical post, which was useful in addressing language barriers and providing a calming effect on anxious MWs seeking medical attention.

Depending on the result of the medical consultation, each worker attending the medical post had differing dispositions (return to their housing unit, be swab tested and sent to an isolation facility within the dormitory while awaiting results, or sent to the hospital Emergency Department for further medical attention). A visual identification and tagging system was created to enable staff to direct the MWs to their appropriate destinations.

Given the fluid nature of operations, transmission of information occurred continuously throughout the deployment. Instant messaging platforms were used between ground staff and HQ personnel for urgent ground matters and decision. Multiple dedicated chatgroups including a doctors group, operations group and ambulance conveyance services were used to ensure timely dissemination of information and instruction to personnel. Information on latest protocols and changes were communicated through secured emails.

Health Educational material and information updates were continually developed at national level and by various non-government organisations and volunteer welfare organisations. These were disseminated to the MWs using messaging platforms through the dormitory managers. Printed posters in multiple languages with QR codes to link to various websites, and even mobile apps were used.

The medical post was operational only during work hours between 0830hrs to 1630hrs. After hours Care via teleconsultation[19] were introduced to address medical issues that might

arise after the operating hours of medical post. MWs reported their condition to either the dormitory duty managers or FAST teams who in turn would activate these third-party Telemedicine providers. These telemedicine services were part of the national effort to provide comprehensive coverage to all the dormitories. If complaints warranted emergency care, 995 ambulance service would be called upon.

MWs were also paired up for monitoring each other. An alert system, developed with the FAST teams, provided useful and critical information that the medical post might not be aware of.

Monitoring of COVID-19 positives housed in isolation facilities

All MWs who reported to the medical post with ARI symptoms were swabbed and subsequently housed in the SIF. This was a dedicated area to isolate symptomatic MWs awaiting swab test results. MWs who tested COVID-19 positive were then transferred to a separately located DIF where they were isolated for 14 days, and given a temperature record sheet to record their temperature thrice daily.

For those who would be isolated in dormitory isolation facilities, provisions had to be made to monitor them, in particular temperature and pulse oximetry, on a regular basis.[20]

The medical post team conducted a "parameter parade" at the DIF every morning. COVID-19 positive MWs were physically lined up to record their temperature, respiratory rate and SpO2 levels.[21] The pulse oximeter was wiped down with an alcohol swab after each patient. Medical staff were attired in full PPE. Medical staff also took the opportunity to address any medical concerns or anxieties that the MWs may have regarding their illness.

As part of the de-isolating exercise, asymptomatic workers who had completed their requisite isolation of 14 days in the DIF[22,23] were transferred to the CRF where they remained

separate from the rest of the dormitory population for a further 7 days before being deisolated and transferred to the Block for Recovered Workers (BRW).[24]

Referral to external care facilities

In the early stages of the pandemic, only ambulances - mainly emergency ones operated by the Singapore Civil Defence Force (SCDF) - were equipped to handle positive or suspect cases. This resulted in the diversion of limited emergency ambulance resources to support non urgent transport of positive cases, causing a strain on the system.

A dedicated ambulance service was clearly needed to support the dormitories and this was outsourced to accredited private ambulance providers. Two dedicated ambulances to support transfer of MWs from medical posts under NHG were based at Dormitory X. The utilisation of the ambulances was high and up to 24 runs per day were coordinated by a dedicated staff nurse. Cohorting of MWs by COVID-19 status was performed when transferring MWs to hospital. After each transfer, wipe down decontamination of the ambulance was performed to ensure infection control integrity.

There were also conveyance operations for COVID-19 positive MWs, where dedicated transport vehicles send them to external Community Isolation Facilities (CIF) located in multiple parts of the island, whenever accommodation vacancies became available.[25]

During the time period of 15 April 2020 to 1 June 2020, 645 MWs attended the FMP. 74 MWs were referred to hospital with cardiopulmonary complaints such as shortness of breath, chest pain and clinical suspicion of pneumonia forming the majority of reasons for referral. Of these 74 MWs referred to hospital, 37 of them were COVID-19 positive.

TRANSITION TO MID AND LONGER TERM MEDICAL SUPPORT

As the number of infected MWs declined over the course of time and with calibrated progressive reopening of the dormitories to support reopening of various industries, the medical posts were stood down after 5 months of operation, and transited to a private-sector operated Regional Medical Centre model, which would provide services for groups of dormitories with a renewed mandate to ensure sustainability and effectiveness in the medium and long term.

CONCLUSION

The basic principles undergirding the operating model of a medical post deployed at a MW dormitory during this COVID-19 outbreak can be applicable in and adapted to other mass casualty or outbreak situations occurring in confined spaces or densely packed living quarters. Triage is important to efficiently identify those in need of different levels of care, allocate limited resources appropriately and deliver treatment to as many as possible in a safe manner. The safety and welfare of the healthcare workers are of utmost importance as well, and these would include physical, biological, social and mental aspects.

REFERENCES

1. Hsu LY, Chia PY, Lim JF. The novel coronavirus (SARS-CoV-2) epidemic. Ann Acad Med Singap 2020; 49:105-7.
2. Abu Baker J. Singapore forms Wuhan virus ministerial task force, imported case 'inevitable': Gan Kim Yong. In: ChannelNewsAsia [online]. Available at: https://www.channelnewsasia.com/news/singapore/wuhan-virus-singapore-ministerial-task-force-inevitable-12301610. Accessed September 22, 2020.

3. Ministry of Manpower, Singapore. Foreign workforce numbers. Available at: https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers. Accessed August 16, 2020.
4. Lee W, Neo A, Tan S, et al. Health-seeking behaviour of male foreign migrant workers living in a dormitory in Singapore. BMC Health Serv Res 2014; 14:300.
5. Lim TK. The facts, fallacies and uncertainties about coronavirus disease 2019 (COVID-19). Ann Acad Med Singap 2020; 49:343-5.
6. Ministry of Health, Singapore. Additional measures to minimise further spread of COVID-19 within foreign worker dormitories. Available at: https://www.moh.gov.sg/news-highlights/details/additional-measures-to-minimise-further-spread-of-covid-19-within-foreign-worker-dormitories. Accessed September 22, 2020.
7. Chew MH, Koh FH, Wu JT, et al. Clinical assessment of COVID-19 outbreak among migrant workers residing in a large dormitory in Singapore. J Hosp Infect 2020; 106:202-3.
8. COVID-19: Cochrane Lodge 2 dormitory declared an isolation area. In: ChannelNewsAsia [online]. Available at: https://www.channelnewsasia.com/news/singapore/covid-19-cochrane-lodge-2-foreign-worker-dormitory-isolation-12638752. Accessed September 22, 2020.
9. COVID-19: Three more foreign worker dormitories gazetted as isolation areas. In: ChannelNewsAsia [online]. Available at: https://www.channelnewsasia.com/news/singapore/covid-19-three-more-dormitories-gazetted-as-isolation-areas-12650088. Accessed September 22, 2020.
10. Zhou T. Coronavirus: 'Fast' teams in place at all 43 dormitories to tackle situation. In: The Straits Times 2020 Apr 10. Available at: https://www.straitstimes.com/singapore/fast-teams-in-place-at-all-43-dormitories-to-tackle-situation. Accessed September 20, 2020.
11. Koh D. Migrant workers and COVID-19. Occup Environ Med 2020; 77:634-6.
12. Williamson K, Ramesh R, Grabinsky A. Advances in prehospital trauma care. Int J Crit Illn Inj Sci 2011; 1:44-50.

13. MacIntyre CR, Wang Q. Physical distancing, face masks, and eye protection for prevention of COVID-19. Lancet 2020; 395:1950-1.
14. Qian Y, Zeng T, Wang H, et al. Safety management of nasopharyngeal specimen collection from suspected cases of coronavirus disease 2019. Int J Nurs Sci 2020; 7:153-6.
15. Verbeek JH, Rajamaki B, Ijaz S, et al. Personal protective equipment for preventing highly infectious diseases due to exposure to contaminated body fluids in healthcare staff. Cochrane Database Syst Rev 2020; 4:CD011621.
16. Tan JL, Tay VSL, Li H, et al. Otolaryngology surgery in time of COVID-19--what PPE to use when? Ann Acad Med Singap 2020; 49:387-92.
17. Lum KLJ, Fong QW, Law S, et al. The "Jeff" Cuff: one solution to minimise over-riding of the sleeves of the protective gown due to non-fitting cuff or gloves. Ann Acad Med Singap 2020. In press.
18. Morabito M, Messeri A, Crisci A, et al. Heat warning and public and workers' health at the time of COVID-19 pandemic. Sci Total Environ 2020; 738:140347.
19. Watson AR, Wah R, Thamman R. The value of remote monitoring for the COVID-19 pandemic. Telemed J E Health 2020; 26:1110-2.
20. O'Carroll O, MacCann R, O'Reilly A, et al. Remote monitoring of oxygen saturation in individuals with COVID-19 pneumonia. Eur Respir J 2020; 56:2001492.
21. Jouffroy R, Jost D, Prunet B. Prehospital pulse oximetry: a red flag for early detection of silent hypoxemia in COVID-19 patients. Crit Care 2020; 24:313.
22. World Health Organization. Criteria for releasing COVID-19 patients from isolation. Available at: https://www.who.int/news-room/commentaries/detail/criteria-for-releasing-covid-19-patients-from-isolation. Accessed September 22, 2020.

23. World Health Organization. COVID-19 clinical management: living guidance. Available at: https://www.who.int/publications/i/item/clinical-management-of-COVID-19. Accessed September 22, 2020.
24. Ministry of Health, Singapore. Revised discharge criteria for COVID-19 patients. Available at: https://www.moh.gov.sg/news-highlights/details/revised-discharge-criteria-for-covid-19-patients. Accessed September 22, 2020.
25. Awang N. Explainer: What the different types of Covid-19 isolation facilities are and how you can volunteer at them. In: TODAY [online]. Available at: https://www.todayonline.com/singapore/explainer-what-different-types-COVID-19-isolation-facilities-are-and-how-you-can-volunteer. Accessed August 12, 2020.

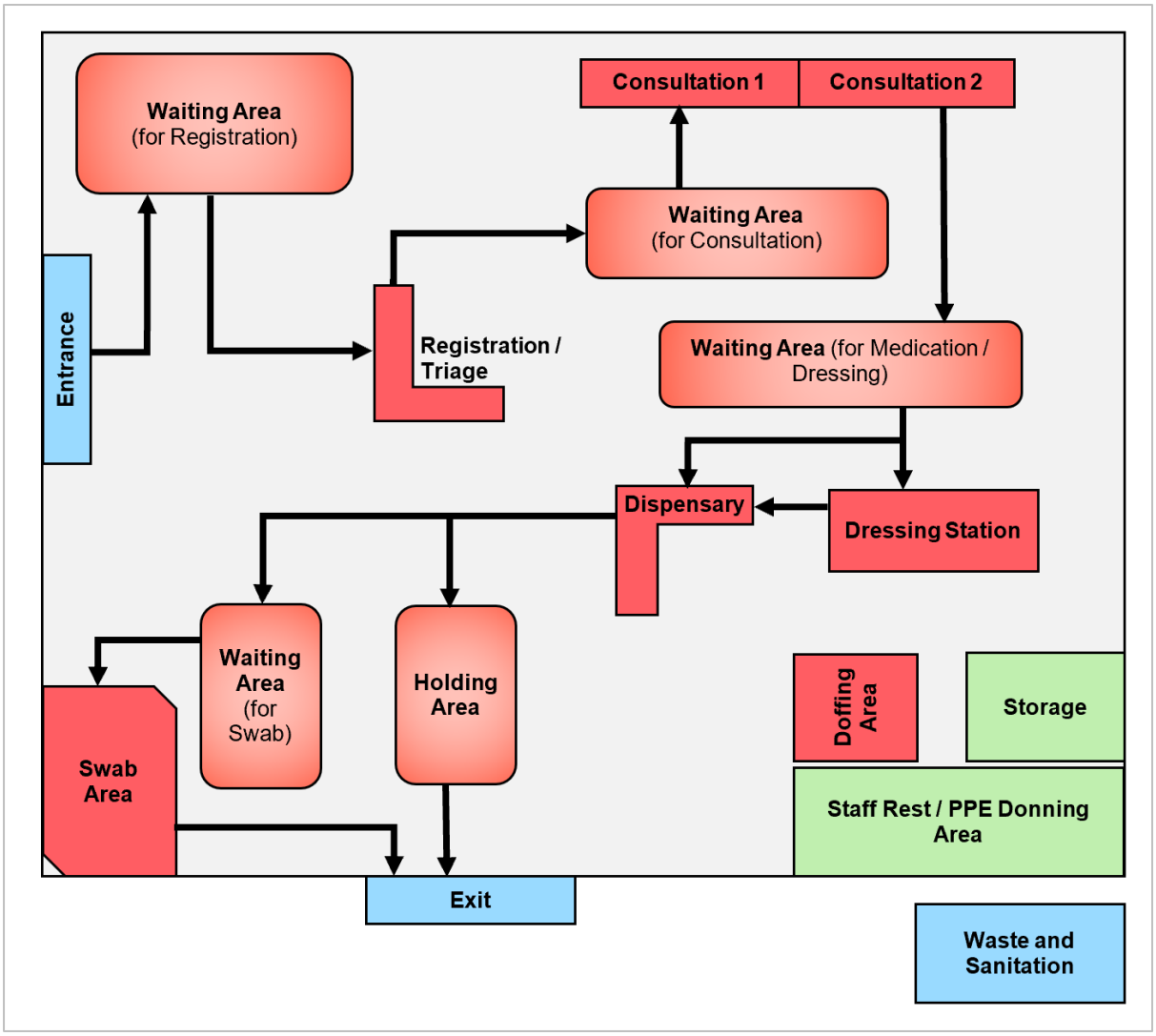

Fig. 1 Diagrammatic representation of Forward Medical Post at Dormitory X (not drawn to scale)

Fig. 2 Interior layout of FMP at Dormitory X showing consult (right), registration (centre), pharmacy (left) and swab area (left background). Note the spaciousness to enable safe distancing measures.

Fig. 3 Close up of registration area with Airbitat air coolers.