Establishing a COVID-19 treatment centre in Israel at the initial stage of the outbreak: challenges, responses and lessons learned

Elhanan Bar-On ,[1,2] Gad Segal,[2,3] Gili Regev-Yochay,[2,4] Galia Barkai,[2,5] Asaf Biber ,[2,6] Avinoah Irony,[2,7] Assaf Luttinger,[1] Hindy Englard,[7] Amir Grinberg,[8] Eldad Katorza,[2,9] Galia Rahav,[2,4] Arnon Afek,[2,8] Yitshak Kreiss[2,8]

ABSTRACT

Anticipating the need for a COVID-19 treatment centre in Israel, a designated facility was established at Sheba Medical Center—a quaternary referral centre. The goals were diagnosis and treatment of patients with COVID-19 while protecting patients and staff from infection and ensuring operational continuity and treatment of patients with non-COVID. Options considered included adaptation of existing wards, building a tented facility and converting a non-medical structure. The option chosen was a non-medical structure converted to a hospitalisation facility suited for COVID-19 with appropriate logistic and organisational adaptations. Operational principles included patient isolation, unidirectional workflow from clean to contaminated zones and minimising direct contact between patients and caregivers using personal protection equipment (PPE) and a multimodal telemedicine system. The ED was modified to enable triage and treatment of patients with COVID-19 while maintaining a COVID-19-free environment in the main campus. This system enabled treatment of patients with COVID-19 while maintaining staff safety and conserving the operational continuity and the ability to continue delivery of treatment to patients with non-COVID-19.

Lessons learnt:

Managerial agility and adaptation of separation strategy according to the patient load enabled treatment of patients with COVID-19 while maintaining operational continuity in treating patients with non-COVID.

The ED is the key to maintaining operational continuity of the main campus and protecting staff and patients with non-COVID from infection and should, therefore, be strengthened with personnel, PPE and logistic support.

INTRODUCTION

In January 2020, following the outbreak of COVID-19 in China,[1 2 3 4] it was determined that Sheba Medical Center, the largest medical centre in Israel, would be on the frontline of receiving potential patients with COVID-19. Sheba Medical Center is a 2000 bed quaternary referral centre, situated in the Dan metropolitan area—the largest population concentration in Israel, counting 3.7 million inhabitants constituting 40% of the national population. It is the nearest medical centre to Ben Gurion International Airport through which the majority of travellers enter the country and it houses the national virology laboratory which, in the early stage of the outbreak, was the only laboratory in Israel capable of performing PCR tests for identification of the COVID-19 virus. It also houses The Israel Center for Disaster Medicine and Humanitarian Response that has a 50 bed rapidly deployable tent-based field hospital.

Initial planning

Establishing a treatment centre for COVID-19 included clinical, organisational and logistic challenges. These were accentuated by the paucity of knowledge regarding the virus as well as lack of experience in operation in a contagious outbreak scenario. Therefore, as soon as the possible need for a response to an outbreak was identified, a task force was created, which included representatives from hospital management, the centre for disaster medicine, the departments of emergency medicine, internal medicine, infectious diseases, infection prevention and control, medical informatics, telemedicine, logistics, human resources and public relations. The task force formulated a contingency plan based on principles outlined in the WHO's directives for Hospital Preparedness for Epidemics[5] and Operational detail of the WHO field hospital layout for Ebola treatment centre.[6]

The goals of the plan included early triage and identification of suspected and confirmed patients with COVID-19, treatment of patients maintaining the highest level of care, prevention of contamination of the main hospital campus and the sorrounding community and maximising protection of medical and logistic staff in order to ensure operational continuity and treatment of patients with non-COVID. Therefore, the plan focused on two major efforts: (1) adaptation of the ED and (2) establishment of a COVID-19 designated facility.

Emergency Department

The ED, being the frontline of any medical centre, poses unique challenges in the COVID-19 setting, which include early triage, identification and treatment of patients with COVID-19, serving as a 'guard dog' preventing contamination of hospital staff and other patients with non-COVID-19. Major changes were

Figure 1 Tented emergency department frontal triage station.

[1]The Israel Center for Disaster Medicine and Humanitarian Response, Sheba Medical Center, Tel Hashomer, Israel
[2]Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel
[3]Internal Medicine K, Internal Medicine T, Sheba Medical Center, Tel Hashomer, Israel
[4]Infection Prevention and Control Unit, Sheba Medical Center, Tel Hashomer, Israel
[5]Paediatric Infectious Disease Unit, Sheba Medical Center, Tel Hashomer, Israel
[6]Infectious Disease Unit, The Center for Geographic Medicine and Tropical Diseases, Sheba Medical Center, Tel Hashomer, Israel
[7]Emergency Medicine, Sheba Medical Center, Tel Hashomer, Israel
[8]Medical Management, Sheba Medical Center, Tel Hashomer, Israel
[9]Medical Management, Department of Obstetrics and Gynaecology, Sheba Medical Center, Tel Hashomer, Israel

Correspondence to Professor Elhanan Bar-On, The Israel Center for Disaster Medicine and Humanitarian Response, Sheba Medical Center, Tel Hashomer 52621, Israel; belhanan@gmail.com

undertaken to face these unique challenges. The factors affecting the decisions behind these adaptations weighed the need to separate the triage area from the ED interior as well as the advantage of constructing it in the fresh air, along with the ability to share material resources with the main ED and improve communication between the two parts of the ED, taking advantage of existing ED architecture including entrance and exit doors, thus reducing the need for structural changes. Therefore, a tented frontal triage area with a swabbing station was erected outside of the ED (figure 1). The ED was separated into two sections; Regular Blue, which was for patients with non-COVID, and Biologic, for suspected or confirmed patients with COVID-19. This biologic zone had a separate entrance via the frontal triage station and was physically separated from the main ED. It contained 31 beds and 2 negative pressure chambers as well as a separate room for immunocompromised patients. Patients were further categorised in this section into:

Green: patients with a history of possible COVID-19 exposure but without COVID-19 symptoms.

Yellow: ambulatory patients with suspected or confirmed COVID-19 diagnosis.

Red: non-ambulatory patients with suspected or confirmed COVID-19 diagnosis (figure 2).

In addition, A dedicated CT scanner for patients with COVID-19 was installed. Staff were equipped with hand-held communication devices. A command and control station was established which manned cameras in all zones. An ED logistic centre was manned by a logistics representative around the clock.

ED Patient Flow: (figure 3)

At the frontal triage station, a staff member in personal protection equipment (PPE) questioned the patient regarding COVID-19 exposure or symptoms. Patients with neither of these were classified as blue and referred to the regular ED. Regulations were outlined demanding mask use of all persons entering the campus and limiting the number of accompanying persons (excepting special populations. Security staff were designated to explain and enforce these regulations.

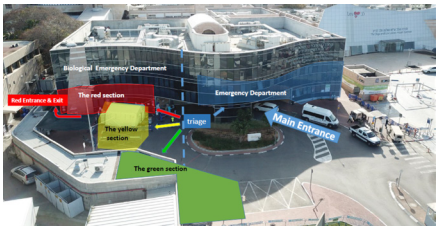

Figure 2 Emergency department adaptation to COVID-19 environment.

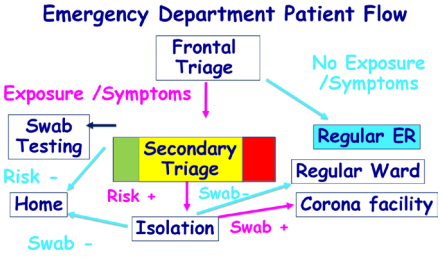

Figure 3 Emergency department workflow.

Symptomatic patients or those with a history of exposure were referred to the secondary triage station where they were classified as green, yellow or red and referred to the respective zone. Blood tests, nasopharyngeal swabs and imaging were performed as needed. Asymptomatic patients were discharged to home isolation where they awaited the results of the swab test. Symptomatic patients were retained in the respective zone where they awaited the test result (~6 hours) and received treatment as needed. On receipt of the test results, patients testing negative were either discharged or admitted to the hospital, dependent on their medical status. Rapid transfer to home isolation of those not requiring hospitalisation served to decompress the ED and was given high priority. Patients testing positive were transferred to the COVID-19 facility.

COVID-19 facility

On 16 Febuary 2020, the Israel Ministry of Health requested Sheba Medical Center to prepare for admission of patients with COVID-19. The specific trigger for the request was a government decision to bring home the 11 Israeli citizens quarantined on the Diamond Princess cruise ship, docked in Japan and the contingency plan was activated. Due to the experience in disaster scenarios and the involvement in the WHO's emergency medical team initiative, the team of the centre for disaster medicine was tasked with leading the execution of the plan.

SITE SELECTION

Three options were considered for the location of the facility site. One was designating one of the main campus hospital wards for treatment of patients with COVID-19; this had the advantage of minimal requirement of logistic preparations, but the disadvantage of possible introduction of contamination into main campus. A second idea was establishing a tent-based field hospital designated for patients with COVID-19, either within the boundaries of Sheba or in a remote location; this had the advantage of flexibility in location selection and the ability to customise the facility layout; however, the facility would be less robust and require construction of logistic infrastructure, a third choice was converting an existing non-clinical structure within Sheba's boundaries but separate from the main campus, to a medical facility. Using the priorities of infection prevention and control, and logistic considerations, the site selected for the COVID-19 facility was an existing complex serving as staff accommodation. The choice of a fixed structure rather than a tented facility was due to the preavailability of water and sewage infrastructure as well as better resistance to winter conditions. Tents were, therefore, used only for housing a command and control centre (CCC) in the outer yard, reserving the rest of our tented facility for surge capacity in Sheba or elsewhere.

FACILITY CHARACTERISTICS

The facility chosen is situated on the periphery of the Sheba grounds campus, 1500 m from the main campus medical facilities. The location of the complex within the boundaries of Sheba Medical Centre enabled utilisation of all hospital resources, while the isolation of the facility from the main campus fulfilled our goal of preventing contamination of the main hospital campus. This distance also served to quell anxiety of hospital personnel regarding acquiring the disease from patients in the facility.

The facility has a built area of 1500 m^2 consisting of 30 rooms and 300 m^2 of indoor space. The separate rooms enabled isolation of suspected patients from each other. The indoor space also enabled rapid erection of additional dividing walls to create separate zones. In addition, the complex had several entry/exit doors enabling unidirectional workflow with appropriately placed donning and doffing stations.

FACILITY ADAPTATION

The adaptation of the structure to serve as a medical facility, considering the unique needs arising during a contagious outbreak, necessitated close collaboration between clinical, operational and logistic sections.

The conversion was performed following the principles outlined in the operational detail of the WHO field

hospital layout for an Ebola treatment centre.[6] These principles include isolating patients with suspected or confirmed COVID-19 and classification of patients into two separate groups:

Group 1: suspected patients based on symptoms and/or a history of possible exposure. Within this group, maximal separation between individuals.

Group 2: patients testing positive on PCR.

Overall, reducing to a minimum physical contact between patients and caregivers.

As the WHO directives are mainly used in field hospitals in low resource conditions, additional components were added to adapt to the Sheba setting, exceeding WHO-Ebola requirements with the addition of intensive care unit (ICU) capabilities.

Physical construction included cordoning the whole complex from the surroundings, construction of internal walls dividing it into separate zones according to contamination level and subsequent need for personal protective equipment, installing infrastructure for medical gases delivery in patient rooms, wiring for information processing, monitoring and telemedicine and constructing a separate lab, pharmacy and ICU. Devices were constructed for obtaining nasopharyngeal swabs, delivery of food and supplies and waste disposal, all directed at reducing physical patient–caregiver contact. This was achieved within 2–3 days and emphasises the importance of a strong logistic force in this scenario.

Operational model—COVID-19 facility

Three zones were defined (figure 4):

Zone A—contaminated: 40 hospitalisation beds in separate rooms and four in a space constituting an ICU with full mechanical ventilation capabilities.

Zone B—intermediate: an anteroom and a cubicle for staff enabling direct observation of the patients in the ICU and containing all patient monitor screens.

Zone C—clean: the open-air internal periphery of the complex in which a tented CCC, staff living quarters and a logistic centre were placed.

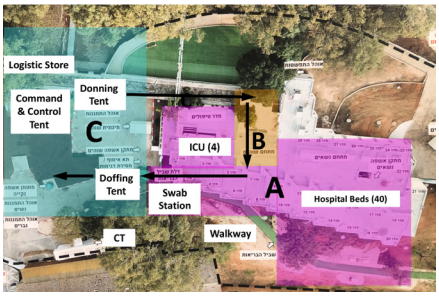

Figure 4 Design and workflow in COVID-19 facility.

Figure 5 Cubicles for delivery of food and supplies.

A point of care laboratory was installed in the ICU (zone A). Mobile radiography and ultrasonography machines were placed in zone B and a mobile CT machine was placed in zone C, thus avoiding patient transfer to the main campus for imaging. A set of cubicles was constructed in the partition wall between zones B and A with a door on both sides. (figure 5). These cubicles were used for delivering meals and personal supplies. A garbage and laundry chute was constructed in zone A, leading to a trolley that was sterilised and disposed daily by Sheba Medical Center (SMC) logistic staff. A walkway was prepared outside the building connected to zone A enabling patients to exercise in the fresh air.

A swab-testing station was constructed consisting of a window with two holes to which long gloves were attached, enabling performance of nasopharyngeal swabs by a staff member without any contact with the patient (figure 6).

Personnel and training

The centre for disaster medicine and humanitarian response in SMC has a core of personnel well experienced in field hospital operation in austere environments and in a wide range of scenarios. Realising that working in the COVID-19 facility will require a large team with appropriate expertise and mindset, we created an augmented team including hospital directors and administrators, physicians, nurses, infectious diseases and infection prevention and control specialists, psychosocial caregivers, logisticians and telemedicine experts. All team members voiced consent to working in the contagious environment. They were subsequently removed from their routine work roster and were totally dedicated to working within the COVID-19 facility.

A 'just in time' training programme was initiated in collaboration with our Infection Prevention and Control (IPC) unit and medical simulation centre, this included instruction on principles of functioning in outbreaks, staff protection routine and use of Personal Protection Equipment (PPE). A model of the facility was constructed in the simulation centre and the teams were trained in various scenarios including patient and workflow routines and operation in various emergency situations.

- The challenges here included planning the patient flow according to the new principles and facility, operating in this unfamiliar location and the need to communicate the patterns of patient flow both to staff and patients. This was achieved by formulating standard operational procedures (SOPs) for each scenario, planning and practicing these SOPs and using our telemedicine system to communicate these routines to the patients. The infection prevention and control department played a key role in planning and operation of the facility with all relevant decisions regarding workflow, patient flow and SOPs being approved by the department. Daily briefings were carried out to maintain and update staff capabilities, awareness, commitment and discipline.

Patient and staff flow

On arrival to the COVID-19 facility, the patient was met by a physician in full PPE and a short history was taken to assess his/her status. The patient was then allotted a bed appropriate to his/her condition in zone A. Asymptomatic patients were accompanied to the room and given a short explanation of the telemedicine tools and then the physician exited. Symptomatic patients were examined and blood samples were obtained.

Once the patient was settled in the room, telemedicine contact was established (mainly via Uniper), a thorough history was taken and a detailed explanation was given regarding further usage of the telemedicine equipment. From that moment, all routine patient–caregiver contact was performed remotely or across a transparent barrier when taking swabs.

In case of emergencies or the need for direct contact with patients, staff enter zone A with appropriate PPE and communicate with the staff in the CCC through the robot and walkie-talkie (figure 7).

Figure 6 Swab testing station.

All patient activities were timed and controlled by the CCC. These included collection of food and supplies, garbage disposal, swab testing and exercise in the outdoor walkway.

The workflow was unidirectional from zone C to B to A with exits back to zone C through a doffing tent (figure 1). PPE was donned in a tent in zone C before entrance to zones B and A. These SOPs were strictly adhered to and supervised by the IPC unit.

Figure 7 Caregiver in PPE treating a patient. PPE, personal protection equipment.

Personal protection equipment

Four risk levels were initially determined and PPE required accordingly. Donning and doffing were always supervised by another person, preferably an IPC staff member.

Zone C: all personnel dressed in hospital scrubs.

Zone B: low risk: two gowns, N-95 mask, shoe covers, hair cover, face shield, gloves.

Zone A: high risk—zone A: hooded coverall, N-95 mask, shoe covers, face shield, double gloving.

Logistic teams: similar to '3' but made of more robust materials.

Our initial personal protective equipment policy was more stringent than that recommended by the WHO,[7] as we used hooded coveralls, long shoe covers and double gloving for our high risk category. This policy was constantly modified by our IPC department based on increasing knowledge regarding the viral spread mechanism, the depletion of our stocks and the worldwide shortage of PPE and debriefing and investigation of events of staff exposure. PPE policies were modified and specified both for different levels of risk within the zones of the facility and on the type and length of staff activity and exposure to patients. In addition, universal mask wearing and social distancing were introduced throughout SMC and central stock monitoring and control of PPE was implemented, all in order to conserve PPE stocks while maintaining adequate protection levels.

Telemedicine utilisation

Early in the process, we realised the great advantages of telemedicine utilisation in minimising direct contact between patients and caregivers. A CCC was set up in an inflatable tent, which contained multiple systems enabling remote monitoring, communication and examination of patients (figure 8). Auxiliary equipment for patient monitoring and communication were placed in the patients' rooms.

Figure 8 Use of telemedicine in command and control centre.

Communication equipment

- A telephone with a direct press button to the CCC and a cellular phone.
- Uniper—a simple TV box turning the television to an interactive platform enabling video communication, as well as virtual group meetings between the patients and the CCC using the television and a very simple-to-use remote control that includes a built-in microphone.
- An Intouch medical telepresence robot and a two-way walkie-talkie were placed in the ICU, enabling communication with the CCC in case of an emergency requiring the staff to treat patients in zone A.
- A public address system with loudspeakers that can be heard throughout the complex, enabling rapid emergency announcements to all patients.

Monitoring equipment:

- A thermometer, pulse oximeter and blood pressure cuff in each room for self-measurement of vital signs.
- Earlysense—a wireless bed sensor that continuously monitors heart, respiratory rate and motion while the patient is in bed and includes an artificial intelligence algorithm that can predict deterioration in case of secondary sepsis.
- Biobeat—a wireless sensor applied to the patient's chest that continuously monitors blood pressure, pulse rate, oxygen saturation, one-lead electrocardiograph, cardiac output, stroke volume, heart rate variability and skin temperature. This sensor is used for moderate to severe patients.

Physical examination:

- Tytocare—a device that enables remote physical examination of the heart, lungs, throat and ears, as well as measurement of vital signs as fever and heart rate. For easier use of this system, a tablet with the Tytocare app was given to the patients, for simple use, in order to avoid the need to download the designated app to their cell phone.
- The whole facility was covered by cameras enabling observation from the CCC. Patients are counselled regarding the necessity of the camera for their safety but can request it to be disconnected.

Prior to the COVID-19 outbreak, the field of telemedicine was in its early stages of development in our centre. The COVID-19 crisis highlighted the possibilities of telemedicine use in this

scenario. However, putting our telemedicine programmes into practice on a short notice was challenging. Some of the technologies used were previously unfamiliar to the staff and an additional difficulty was the need to instruct patients on initial use of the devices remotely. These problems were resolved by designating staff from the telemedicine department as integral team members of the centre for disaster medicine team and their constant presence in the CCC tent.

ED activity

During the first 4 months of the outbreak, 30 860 patients were treated in the ED. A total of 6176 (20%) were referred to the Biologic ED. Of these, 3039 (49.2%) were classified as yellow, 2112 (34.2%) were classified as red and 1049 (17%) as green and

5000 PCR tests were performed with 215 positive results (4.3%). However, during the peak of the outbreak, 18% of patients tested proved positive.

COVID-19 facility activity

During the first month of activity, 150 patients were admitted to the facility. Most were adults with a mean age of 51+20. Sixty-four per cent were men and most had no baseline illness. The rate of deterioration from moderate to severe disease was high, 8% required noninvasive oxygenation and 12% were intubated and mechanically ventilated. Three patients died giving a mortality of 2%.

Later in the process, SMC expanded its capabilities by adapting multiple structures and wards to serve as designated COVID-19 facilities. These included converting an underground emergency facility (which usually serves as a parking lot) into an 80 bed ICU, establishing a COVID-19 hospital with six designated medical wards (226 beds), establishing a COVID-19 designated psychiatric ward (30 beds), establishing a designated COVID-19 haemodialysis unit for chronic haemodialysis patients (eight beds) and establishing three additional designated COVID-19 EDs for special populations: Obstetrics and Gynecology (ObGyn), paediatrics and oncologic patients.

DISCUSSION

The primary goal of a medical facility in routine times is to provide optimal care to patients. In the contagious outbreak setting, additional goals of preventing the spread of disease and staff protection gain utmost importance. When the facility is established within an existing medical centre, another goal is preserving continuity of care to patients with non-COVID-19.

When Sheba Medical Center was given the mission to establish a COVID-19 treatment centre, we set out on this mission bearing in mind the above goals. While initially preparing for a defined small number of patients arriving from the Princess Diamond ship, we rapidly found ourselves in an extremely dynamic scenario with a changing caseload both in the number and severity of patients.

Our main challenges included operation in an unfamiliar contagious outbreak environment, necessitating changes in all aspects of operation both medical, organisational and logistical and a lack of knowledge regarding the clinical and epidemiologic behaviour of the outbreak, posing a major challenge in planning and building our surge capacity.

Lessons learnt

Our complete separation strategy by establishing our COVID-19 facility in a remote location and containing the outbreak within this facility proved effective initially in fulfilling our goals of treating patients with COVID-19 while maintaining operational continuity in the non-COVID-19 part of the hospital. However, once the patient with COVID-19 load exceeded the capabilities of the designated facility with the need for surge capacity, we had to change this strategy with continuous assessment necessary to find the correct balance between COVID-19 and non-COVID-19 zones and adjust the separation policy accordingly.

- The ED is the key to maintaining the safety of both staff and patients in the main non-COVID campus. The modification of the ED should be performed at the initial stages of the outbreak. As this is the only site where there is a mixture of non-affected, suspected and affected patients, the ability to rapidly differentiate between these groups is of utmost importance. As the clinical condition of the patients often does not correlate with their infective status, this is achieved by designating an isolation space and prioritising swab testing from ED patients. ED staff should be given priority regarding PPE level and availability. Due to all these factors, we feel that strengthening the ED capabilities is a high priority in the outbrteak scenario. This will contribute to both the capability to identify and treat patients with COVID-19 as well as enabling proper treatment and safety of those not infected.
- We believe that the ED operational model was successful. The division into different zones proved effective and the establishment of an isolation area for unconfirmed cases helped decrease cross infection as well as increasing staff security. However, due to the difficult physical conditions and the heavy patient load, constant adjustments are required, including staff allocation between the ED, the COVID-19 and the non-COVID wards, increasing laboratory capabilities, rapid placement in wards and establishing channels for early discharge.

While there was a very low rate of staff exposures in the designated COVID-19 wards, our staff exposures were mostly in the non-COVID departments. Therefore, there should be a major effort to protect staff in the non-COVID departments as well as in the COVID-19 wards. Accompanying persons proved to be a significant source of exposures. Their number and access should be limited. Waiting areas should be designated and constant communication with them by staff members should be ensured.

In summary, the factors that enabled us to cope with the unique challenges we encountered included:

- Agility—the capacity to provide rapid solutions to arising problems through collaboration between medical, organisational and logistical divisions with orchestration by hospital leadership.
- Continuous planning process—staying ahead of the events through planning two steps ahead, thus avoiding unavailability of care at any point in the outbreak.
- Due to the dynamic nature of the outbreak, the learning curve and influx of information regarding treatment and the changing needs and availability of diagnostic tests and PPE, we initiated constant on the job learning processes and, consequently, changes in SOPs and directives, communicating them to the staff by frequent briefings.
- Maintaining a low staff infection rate by constant adjustment of PPE policy, strict adherence to SOP's and their communication both to staff, patients and accompanying persons, as well as a major rearrangement of workforce and shifts.
- Maintaining maximal flexibility—making conceptual and geographic changes in the hospital as well as

increasing capabilities through task shifting, team building and just in time training.

- Adapting real-time innovation processes—using our innovation centre to increase our capabilities in specific fields such as mechanical ventilation, telemedicine and information management.
- Maintaining operational continuity with continued treatment of patients with non-COVID-19, initially through the total separation strategy, as well as a public relations campaign encouraging the population to continue arriving in the hospital for routine care.
- Increasing logistic capabilities. These are essential for maintaining patient care, reducing cross-contamination and staff exposure and improving working conditions for staff operating in a strenuous environment. This was greatly facilitated by establishment of the ED logistic command post constantly manned by a logistic representative.
- Immediate meticulous postexposure epidemiological studies as well as staff education and discipline.
- Once again, we learnt the importance of early preparation and readiness for all types of mass casualty scenarios—both seen and unforeseen. This re-emphasises the need for institutional leadership to think out of the box and prepare for events beyond what they think is feasible as this pandemic has taught us that events and their resultant needs can exceed those we plan for using conventional models.

Contributors All authors contributed to writing and reviewing the manuscript. EB-O planned, wrote and submitted this study and is responsible for its overall content as guarantor. GR-Y, GS, GB, AB, AI, HE, AG, EK, GR and AA are contributed to writing and reviewing.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; internally peer reviewed.

Handling editor Ellen J Weber

To cite Bar-On E, Segal G, Regev-Yochay G, *et al*. *Emerg Med J* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/emermed-2020-209639

Received 18 March 2020
Revised 24 January 2021
Accepted 7 February 2021

Emerg Med J 2021;**0**:1–6.
doi:10.1136/emermed-2020-209639

ORCID iDs
Elhanan Bar-On http://orcid.org/0000-0002-5462-8595
Asaf Biber http://orcid.org/0000-0001-6007-0383

REFERENCES

1 Lai C-C, Shih T-P, Ko W-C, *et al*. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): the epidemic and the challenges. *Int J Antimicrob Agents* 2020;55:105924.
2 Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA* 2020;323:1239-1242.
3 Zhao S, Lin Q, Ran J, *et al*. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: a data-driven analysis in the early phase of the outbreak. *Int J Infect Dis* 2020;92:214–7.
4 Kampf G, Todt D, Pfaender S, *et al*. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect* 2020;104:246–51.
5 WHO HP 2014: World Health Organization. *Hospital preparedness for epidemics*. Geneva, Switzerland: World Health Organization, 2014. http://apps.who.int/iris/bitstream/10665/151281/1/9789241548939_eng.pdf
6 WHO/EVD/Manual/ECU/15.1: manual for the care and management of patients in Ebola care Units/ community care centres interim emergency guidance. Available: https://www.who.int/csr/resources/publications/ebola/patient-care-CCUs/en/
7 WHO. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected, 2020. Available: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control