

# Safety Assessment of the Largest Makeshift Hospital for COVID-19 Management in Iran

Arezoo Dehghani <sup>1</sup>, Zohreh Ghomian <sup>2\*</sup>

<sup>1</sup> PhD candidate in Health in Emergencies and Disasters, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

<sup>2</sup> Associate professor of Department, Health in Emergencies and Disasters, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

\*Corresponding Author: Zohreh Ghomian, Associate professor, Department of Health in Emergencies and Disasters, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Tel: +982122432040, E-mail: zghomian@gmail.com.

Received 2021-04-24; Accepted 2021-12-11; Online Published 2022-02-01

## Abstract

**Introduction:** COVID-19 has infected more than 196717202 people and killed more than 4203769 cases worldwide ever since its emergence until July 29th, 2021. The creation of centers for prehospitalization and post-hospitalization of patients as makeshift hospitals were principal actions for Covid-19 management. The study aimed to assess the safety of the largest makeshift Hospital for COVID-19 management in Iran.

**Methods:** This cross-sectional study was conducted in Iran, from March 29, 2020, through May 20, 2020. Ever since the outbreak of COVID-19, the IRAN MALL complex dedicated a part of its exhibition space to the Medical Center in the COVID-19 disaster to help the national campaign. The research team designed a makeshift hospital risk assessment tool based on COVID-19 and visited the big makeshift hospital in Iran to evaluate its non-structural and functional situation. Also, dimensions of setting up a convalescent home and the importance of structural or non-structural items were investigated.

**Results:** The non-structural safety, functional and managerial safety points were calculated separately. The total safety rating was determined at 870 as a very high safety level. In this makeshift hospital, there were 16 items with ultra-low, nine items with low, 18 with moderate, 28 with high, and 134 with very high safety. Most of the low to ultra-low safety issues were related to non-structural items.

**Conclusion:** The non-structural and functional safety is an essential factor to be resilient in disasters and pandemics. Strengthening health infrastructure, empowering health care providers, using new technologies in early warning, assessing the phenomenon, and providing services, will reduce the workload and financial burden of health effects and lead to health system adaptation.

**Keywords:** Makeshift Hospital, Safety, COVID-19, Disasters, Pandemic.

## Introduction

COVID-19 virus is a type of coronavirus, which led to the emergence of a new acute respiratory disease in late 2019 in Wuhan, China, and then spread throughout the world <sup>1</sup>. COVID-19 has infected more than 196717202 people and killed more than 4203769 cases worldwide ever since its emergence until July 29th, 2021 <sup>2</sup>. Health care centers have been set up to manage the patients and provide the required health services <sup>3</sup>. This action took place intending to increase the capacity and provide health care services to two groups of

patients <sup>4</sup>. The first group is the patients with positive PCR tests but did not need to be hospitalized. The second group is the patients who were discharged from the hospital but whose treatment period was not completed and at the same time needed light medical services <sup>5</sup>.

One of the main actions of the Armed Forces and non-governmental organizations since March 20, 2020, in the Covid-19 disaster was the design and creation of centers for pre and post-hospitalization of patients as a makeshift hospital. This hospital had more than 27,000 beds in 300 sites with proper

logistics and a medical system. There were logistics services, medicine, and treatment services in these centers. In addition, more than 3,000 nursing volunteers and 2,000 social worker volunteers served in these centers, where patients were hospitalized for two weeks and received medical services after discharge from the hospital <sup>6</sup>.

There were services such as health care, medicine, nutrition, personal hygiene training, health education, mental health, and spiritual counseling to all patients in the makeshift hospital <sup>7</sup>. In Iran, on average, each makeshift hospital has 90 beds. However, IRAN MALL, with 800 active beds and 2200 potential beds, is the largest equipped makeshift hospital in the country. This makeshift hospital has been the third experience setting up a makeshift hospital in Iran in 40 years. The first experience was when the Iran-Iraq war took place, and the other one was when the Bam earthquake occurred, although, at that time, the makeshift hospital was launched only for trauma patients <sup>8</sup>. One of the first uses of a makeshift hospital in Iran was the establishment of temporary hospitals during the imposed war. One of the combat health activities during the military attack of Iraq to Iran was setting up a makeshift hospital to provide primary and secondary medical services in border cities such as Ahvaz, Kermanshah, Sanandaj, Ilam, Urmia, Piranshahr, and Sardasht <sup>9</sup>.

In the attack on Sardasht on July 27, 1987, the injured who were exposed to mustard gas were transferred to a makeshift hospital in the city's gymnasium to receive medical services. After the nerve gas attack in the Shalamchek city on June 25, 1988, the Seyyed al-Shohada makeshift hospital was set up to assist the injured <sup>10</sup>.

This field visit to Iran's largest makeshift hospital was done in May 2020 to evaluate of makeshift hospital safety in both non-structural and functional areas. Also, the processes and service-providing methods to patients with COVID-19 were assessed in green and yellow conditions. Field observation was performed along with the completion of the researcher-made checklist, photography,

interviews with officials and head nurses and patients admitted to makeshift hospital wards, voice recording, writing field notes and video recording of some wards. In this article, an attempt has been made to use the results and experiences observed from visiting intensive care units, and express the findings regarding patients with COVID-19, as well as the level of service of epidemics, promotion of clinical skills and knowledge, observation, note-taking and service evaluation <sup>11</sup>.

The study aimed to assess the safety of the largest makeshift Hospital for COVID-19 management in Iran.

## Methods

### Setting

This cross-sectional study was conducted in Iran, from March 29, 2020, through May 20, 2020. Ever since the outbreak of COVID-19, the IRAN MALL complex dedicated a part of its exhibition space to the Medical Center in the COVID-19 disaster to help the national campaign. the IRAN MALL complex with an area of 45,000 square meters could equip 3,000 hospital beds and receive patients from 60 hospitals in Tehran. Criteria for selecting IRAN MALL Makeshift hospital for field visit was:

- Iran's largest makeshift hospital for management of COVID-19
- Highest admission of COVID-19 patients in Iran
- Highest occupancy of makeshift hospital beds in the management of COVID-19 in Iran
- The only makeshift hospital with the ability to accept patients from 60 hospitals
- Its availability to the research team.

### Evaluation tool

The research team with the mission in the disasters and emergencies developed a makeshift hospital risk assessment tool for managing COVID-19. The research team decided to conduct a field visit to the makeshift hospital to conduct a visual observation

and fact-checking for the prepared tools extra to evaluating this center to evaluating this center (Table 1) (Fig. 1).

Table 1: A guide to determining the safety level of the entire Makeshift Hospital

Very Low Safety	$165 \geq$
Low Safety	$166 \leq X \leq 330$
Medium Safety	$331 \leq X \leq 495$
High Safety	$496 \leq X \leq 660$
Very High Safety	$661 \leq X \leq 825$



Figure 1: Internal space of Iran Mall makeshift hospital.

### Data collection

Psychometric tools of makeshift hospital risk assessment were included 186 items in three areas of incident and disaster probability (13 items), 112 items of non-structural safety, and 61 items of functional safety. The research team used this tool for the safety assessment of Iran Mall makeshift hospital.

The visit started on Sunday, May 3, 2020, and lasted from 7:30 AM until 1:00 PM. The visiting team consisted of a faculty member and a Ph.D. student of the Department of Health in Disaster and Emergencies. The head nurse of the makeshift hospital with 14 years of experience in nursing management in the hospital, and the executive director of the makeshift hospital with 12 years of experience in Emergency medical services, accompanied the research team in all stages of the visit to provide explanations and answers to our questions. Also, during the visit, four staff and four

patients with the following demographic information were interviewed to evaluate the provision of services (Table 2).

Table 2. Demographic information of participants

Participants	Age	Duration of stay at the makeshift hospital	Gender
Patient 1	64 Y/O	11 days	Male
Patient 2	34 Y/O	14 days	Male
Patient 3	14 Y/O	6 days	Female
Patient 4	59 Y/O	12 days	Female
Participants	Age	Job	Gender
1	41	CEO	Male
2	43	Head Nurse	Male
3	35	Nurse	Female
4	28	Nurse	Male

After the visit and risk assessment of the IRAN MALL makeshift hospital, the data was recorded in the checklist. Furthermore, the non-structural safety, functional and managerial safety points were calculated separately. The total safety rating was calculated at 870 as a very high safety level.

In this makeshift hospital, there were 16 items with ultra-low, nine items with low, 18 with moderate, 28 with high, and 134 with very high safety. Most of the low to ultra-low safety issues were related to non-structural.

### Quantitative findings in field visits

#### Physical characteristics and the location of the arena

IRAN MALL Health Care Center became activated by changing the application of IRAN MALL Business Center and under the supervision of the University of Medical Sciences and Health Services. This 7-year-old building has six floors.

IRAN MALL has been built in the west of Tehran in 45,000 square meters. It accesses the two main east-west highways of Tehran. It also has 17 input and 13 output pathways. This center has three helicopter pads, and in case of accidents, it provides access to the injured and patients by rescue and emergency helicopters. Two floors of this structure were dedicated to the hospitalization of makeshift hospital patients. At the time of its activation, 813 beds were activated on the ground floor, and it

could be to activation another 2000 beds on the first floor (Fig. 2).

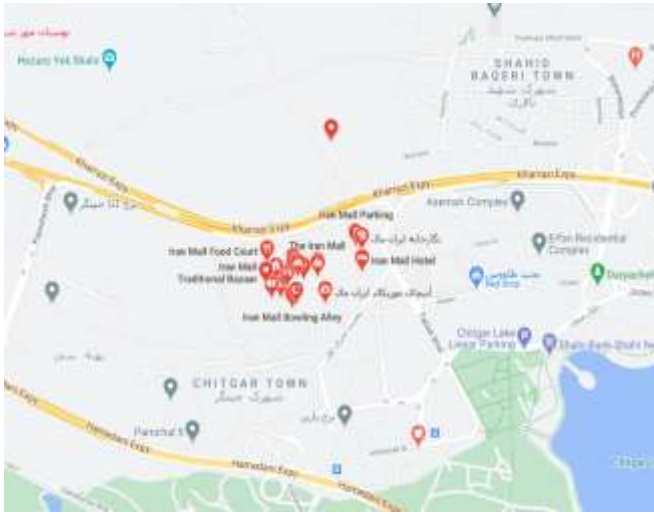


Figure 2: Access to the two main east-west highways.

## Processes and Ground Rules

### 1- Isolation and infection control

Internal and external pathways have specified the entry of patients with colored lines. After the entrance door to the care center, patients were directed to a separate lane with a shower. And after decontamination, delivery of clothing, and personal hygiene items, the patients were transferred to the inpatient ward. There are two men's wards, two women's wards, one CPR room, and a 6-bed room for unwell patients on the E0 floor. It was also possible to hospitalize children as we saw a 14-year-old girl hospitalized.

One of the problems in the environmental health field was the disinfection of patients' belongings (based on the standards, three times a day), but in the makeshift hospital, it was done only once a day. The changing sheets should be done twice a day according to the standards, but in this makeshift hospital, it was done once every three days. Patients' sheets and clothes were transported by cars and in closed bags to Firoozgar Hospital's laundry for washing. Makeshift lunch was prepared by the catering of IRAN MALL complex and dinner by Firoozgar Hospital for this makeshift hospital. Infectious solid waste was packed in specific garbage bags and stored in a dedicated

place outside the hospital, and collected by municipal waste disposal vehicles.

### 2- Fun and entertainment

There was also space for watching TV, sports and leisure equipment, and entertainment on each floor.

### 3- Safety

Suction and air filtration systems were available separately on the floors. Due to the dimension of the foundation, there were three systems of valves and fire hoses with separate tanks. In addition to portable handheld fire extinguishers, fire hydrants, and hoses, the E0 floor was equipped with two ambulances and two fire stations 24 hours a day. They were placed in front of the entrance door within 200 meters in length from the hospitalization space.

The probability of outages of power and water was very low because of the central use of the municipal water and electricity system.

There were two safe electricity generators to supply the electricity in a possible outage outside the structure, which was kept in a safe space and in compliance with safety principles. The foundation had no windows due to the using prefabricated walls in the exhibition space to separate the rooms. There were guidelines from the elevator to different sections with different colors and types in each part. Shelves, cupboards, and their contents were moderately safe, and their doors were open, and in case of an earthquake, the contents would possibly fall out. Shelves and cupboards were off-center of the nurse station. The shelves and cupboards were not fastened and fixed. Some medical equipment was located in front of the entrance and exit of the nurse station (Fig. 3).



Figure 3: Nursing station of Iran Mall makeshift hospital

#### 4- Research

Another positive point of this makeshift hospital was the specific research space for students and professors. The healthcare system faced several challenges for patient management due to the unknown nature of the disease, multiple mutations, and the different course of the disease in individuals. Therefore, strengthening the clinical research will provide the ground to record the lessons learned, review the current situation, assess of dimensions of covid-19, and treatment processes.

#### 5- Incident and disasters

On each floor, there was 1 emergency trolley, central and portable oxygen device, portable and hand-held fire extinguishers, a separate lined bin for separation of infectious and non-infectious waste, one stretcher, two walkers, and six wheelchairs for patients to use. There was an Incident Command System in the ward, and individuals and staff were aware of their roles and responsibilities. The senior safety person was defined but was not present in the ward regularly. An online system for patient information management was not available. Patient data were entered in Excel software, as well as, the entrance and discharge of patients were recorded, but if deleted, there was no backup file.

After reviewing the general information of the makeshift hospital, considering the geographical location and the building conditions, and given that the structure is still being completed, the possibility of natural and man-made disasters was investigated. Iran is facing an earthquake at the rate of more than 90%. The probability of an earthquake is moderate and has a score of three. The probability of storms is also moderate since the construction of structures in the plain area, and is estimated with a score of three.

#### Qualitative findings and experiences in field visits

At visiting different parts of the makeshift hospital, some interviews were conducted with managers, medical staff and patients. In an interview, the head nurse of the makeshift hospital reported that staff and even health care providers, such as those who measure blood pressure and give medication to the patient, are educated in various medical disciplines.

*" There were employees with different levels and fields of study at the beginning of the training course. Therefore, these people have been trained that use personal protective equipment to care for the patient, and train the patient".*

#### Necessity of disaster management

The courses of emergency and disaster management in crisis are necessary for members of the nursing team. Also, a crisis management course should be provided for staff and personnel at the beginning of their service. In addition, specialized training such as employment of equipment is necessary to familiarize them with their duties in the event of a crisis. *"The presentation process of discharge, transfer and evacuation of the makeshift hospital in crisis, also training is critical to the nursing staff."*

#### Necessity of executive instructions and guidelines

During an interview with one of the executive directors

of the makeshift hospital, this point was raised: *"There should be a checklist and guidance to set up a makeshift hospital for example, we had to change the application of IRAN MALL and set up makeshift hospital with trial and error and using hospital instructions. One of the measures taken, was to set up a negative pressure isolation room, which was useless for us and only wasted resources."*

### **The importance of mental health of patients and staff**

In interviewing patients, the use of mental health counselors was very necessary due to the difficult conditions of the disease, being away from the family and sometimes the pangs of conscience caused by the making their family members sick. One patient admitted that *"I came back to life from hell and nothing matters to me anymore."* Providing mental health counseling services can be effective in helping the mental and emotional recovery of these patients.

In an interview with one of the staff members, it was mentioned that: *"Sports, welfare and recreational equipment were applied in order to improve the mental health of patients in the makeshift hospital center. Patients also seek the advice of psychologists several times during their hospitalization based on their condition. "But for the staff of the makeshift hospital, mental health facilities were not provided, even though it was the first experience of treatment and work in a medical center for some people."*

### **The importance of informing the public and volunteers**

Studies show that in total, only 5% of the country's makeshift hospitals were used, while the occupancy rate of Iran's makeshift hospital beds was only 25%. The pathology of the poor reception of makeshift hospital is not fully and scientifically accomplished, but the executive director of the makeshift hospital regarding the problems in this area stated: *"Insufficient information about referral centers for patients and their families, people with COVID-19 are less likely to go to a makeshift hospital, on the other hand, cultural matters*

*also contribute to this issue. "Improving information before and during the establishment of a makeshift hospital, both in public and in medical centers, can solve these problems."*

One of the makeshift hospital employees, noting that he had been informed through a friend and had volunteered to provide the service, said: *"We were short of the staff here, especially on days when there were more patients. The total workforce of the convention includes ten nurses, two nurses, four paramedics and ten service personnel. If the information was provided in a better way to attract volunteers, there would be no shortage of workforce and we would offer better services."*

### **Discussion**

Iran mall Makeshift hospital were set up as the largest makeshift hospital of Iran to manage the rapid growth of patients with Covid-19. In this study, in addition to assessing the safety of Iran mall makeshift hospital, the dimensions of setting up a convalescent home in epidemics and the importance of structural and non-structural items were investigated.

Liu and Zhang showed that criteria for referring the patient to the makeshift hospital should be considered according to the situation of the patients. In this case, the spread of the disease will be prevented<sup>12</sup>. In this study, determining the indicators of referring patients and announcing it to hospitals is one of the functional items that lead to the rapid assignment of patients, preventing hospital congestion, emptying hospital beds in critical situations.

Fang et al. described the importance of re-engineering the building to be used as a makeshift hospital, so the structure must have a proper air conditioning system. Also, there shouldn't be the possibility of contamination of water sources with infectious waste in this place. It is possible to separate infectious and non-infectious wastes, and it is also possible to set up a negative isolation room<sup>13</sup>.

In the study conducted by our research team, one of the most crucial studied items was air conditioning, which the Iran mall makeshift hospital had suction and exhaust air conditioning. Also, due to the separate piping structure, water and sewage could not be contaminated. Also, during the memorandum with the municipality, the process separation and disposal of infectious waste

was specified and implemented.

Zhang et al. showed that in comparison Makeshift to general hospitals or hospitals for infectious diseases, staff working in the Makeshift hospitals was complex. This study found that the makeshift hospital space should be acceptable to protect staff and prevent Covid-19 infection. Staff should be trained to use personal protective equipment and use it before entering the COVID ward<sup>14</sup>.

In the study, the functional and managerial evaluations of Iran Mall Makeshift hospital included disinfection of the nursing station, separation of staff health services from patients, separation of nurses' resting room, adequacy of masks and personal protective equipment for stakeholders.

## Conclusion

In visiting IRAN MALL makeshift hospital, the non-structural and functional safety, management and implementation processes were assessed. The commercial complex changed to the medical center for COVID-19 management. Therefore, some suggestions could help to secure and improve infrastructure and processes. Strengthening health infrastructure, empowering health care providers, using new technologies in early warning, assessing the phenomenon, and providing services, will reduce the workload and financial burden of health effects and lead to health system adaptation.

The field visits to makeshift hospitals, hospitals, and intermediate service centers are recommended for disaster and emergency medical students, nurses, physicians, and environmental health experts to improve the knowledge and skills of service providers in the event of contagious diseases such as accidents and disasters. Some of the requirements of field visiting include accurate planning as holding a short training course which can consist of interviewing staff and patients, using personal equipment, taking notes and taking photos during the visit, and ethical requirements before the visiting. Visitors' follow-ups can be included in post-visit programs to ensure they did not get sick during their visit.

## Acknowledgments

None

## Conflict of Interest Disclosures

The authors state that there is no conflict of interest in the present study.

## Funding Sources

The authors of this article would like to express their appreciation and gratitude to the Vice Chancellor for Research of Shahid Beheshti University of Medical Sciences for funding the research project.

## Authors' Contributions

The authors confirm contribution to the paper as follows:

study conception AND design: ZGH; data collection: AD AND ZGH; analysis and interpretation of results: AD; draft manuscript preparation: AD AND ZGH. All authors reviewed the results and approved the final version of the manuscript.

## Ethical Statement

The study was approved by Shahid Beheshti University of Medical Sciences; with code ethics 104IR.SBMU.PHNS.REC. 1399.

## References

1. Koonin LM. Novel coronavirus disease (COVID-19) outbreak: Now is the time to refresh pandemic plans. *Journal of business continuity & emergency planning*. 2020;13(4):1-15.
2. Yue W, Chen K, Wang K, Zhang S, Tao L. Construction of mobile field hospitals under the condition of informationisation (in Chinese). *Hosp Adm J Chin People's Liberation Army*. 2017; 24:962-4.
3. Liu P, Zhang H, Long X, Wang W, Zhan D, Meng X, et al. Treatments of COVID-19 patients in the Fangcang shelter hospital: clinical practice and effect analysis. *The Clinical Respiratory Journal*. 2020.
4. Li N, Pan J. Study on Integrated Workflow Development and Presentation of Fangcang Shelter Hospitals in COVID-19 Pandemic. *Journal of Emergency Management and Disaster Communications*. 2020;1(01):11-20.
5. Li J, Shu Y, Chen N, Wang F, Li H. 'Re-socialisation' in isolated spaces: A case study on the social organisation of Fangcang shelter hospital patients under extreme spatial conditions. *Indoor and Built Environment*. 2020:1420326X20973745.
6. Raofi A, Takian A, Sari AA, Olyaeemanesh A, Haghighi H, Aarabi M. COVID-19 pandemic and comparative health policy

learning in Iran. *Archives of Iranian Medicine (AIM)*. 2020 Apr 1;23(4).

7. Kassaiean S, Gohari A, Masoumi G, Ghomian Z, Dehghani A. Post-Hospital Discharge Strategy for COVID-19 Treatment and Control: Focus on Fangcang Hospitals. *Disaster Medicine and Public Health Preparedness*. 2021:1-6.

8. MIRHASHEMI S, Mirhashemi S, Ghanjal A, MOHEBI H, DELAVARI A, Saghafinia M, et al. Assessment of triage and transportation in Bam earthquake casualties whom were hospitalized in Baqiyatallah and some other Tehran hospitals. 2005.

9. Tarighi P, Tabibi SJ, Motevalian SA, Tofighi S, Maleki MR, Delgoshaei B, et al. Designing a model for trauma system management using public health approach: the case of Iran. *Acta Med Iran*. 2012;50(1):9-17.

10. Ardalan A, Mesdaghinia A, Masoumi G, Naieni KH, Ahmadnezhad E. Higher education initiatives for disaster and emergency health in Iran. *Iranian journal of public health*. 2013;42(6):635.

11. Donoff MG. Field notes: Assisting achievement and documenting competence. *Canadian Family Physician*. 2009;55(12):1260-2.

12. Liu P, Zhang H, Long X, Wang W, Zhan D, Meng X, et al. Management of COVID-19 patients in Fangcang shelter hospital: clinical practice and effectiveness analysis. *The Clinical Respiratory Journal*. 2021;15(3):280-6.

13. Fang D, Pan S, Li Z, Yuan T, Jiang B, Gan D, et al. Large-scale public venues as medical emergency sites in disasters: lessons from COVID-19 and the use of Fangcang shelter hospitals in Wuhan, China. *BMJ global health*. 2020;5(6): e002815.

14. Zhang M, Wang L, Yu S, Sun G, Lei H, Wu W. Status of occupational protection in the COVID-19 Fangcang Shelter Hospital in Wuhan, China. *Emerging microbes & infections*. 2020;9(1):1835-42.