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Transforming Adversity Into Opportunity: Assessing User Satisfaction in Hospital Transformation in Lieu of a Pandemic Through the Multi-Corridor Expansion Model for Epidemic Management and Environmental Design Enhancement

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ABSTRACT

The COVID-19 pandemic brought the world to a standstill, demonstrating the critical importance of preparedness and adaptation in the face of pandemics and epidemics. Pandemics and epidemics have been a persistent threat throughout human history, causing significant mortality and morbidity, as well as disrupting economies, societies, and politics. The COVID-19 pandemic, caused by the SARS-CoV-2 virus, had a profound impact on healthcare systems worldwide, leading to hospitals transforming into pandemic centers. This case study, conducted at Riphah International Hospital (RIH) in Islamabad, Pakistan, explores the transformation of an existing facility into a pandemic center, highlighting the challenges faced in managing the pandemic conditions and ensuring the safety of the public and medical teams. The study was based on an observational study and data collection from end users with respect to transformation satisfaction and issues faced. Spatial segregation, logistics, air flow control, managing infection control, etc were major challenges faced and managed. Stress was high for the end users who facilitated in medical teams. The study emphasizes the critical importance of preparedness and adaptation in the face of pandemics/epidemics, including the need for specialized training of medical personnel, dedicated COVID-19 units in hospitals, and a robust and resilient healthcare system that can manage future epidemics.

Keywords: hospital transformation, COVID-19 pandemic, hospital redesign, hospital environment, public health resilience

INTRODUCTION

Throughout the history of mankind, disease has played a crucial role in the form of epidemics and pandemics that the human race has battled to eliminate (Menendez et al., 2020). A recent episode of a pandemic initiated globally in the form of COVID-19 (SARS Corona Virus 2), which started to spread across the world from Wuhan province in China (Król et al., 2020). Being a novel virus, initially for around a year no vaccine was available and hence even the most developed countries faced large scale devastating deaths; no one was safe, and everyone was at risk. It had such a huge scale impact on the healthcare infrastructure and systems that even the most advanced and developed countries failed to manage its impacts (George et al., 2020). Pakistan, being one of the most populated countries in the world and 5th most vulnerable to climate change challenges and impacts, faced the pandemic with multiple scale and levels strategies and actions leading to a 34,000 death toll and millions infected but able to recover (Waris et al., 2020). Healthcare facilities, including hospitals at every level, faced transformational challenges to facilitate the large scale influx of patients along with threatening and life staking conditions for medical facility teams (Brazil et al., 2020). The transformation of such facilities into temporary public health facilities providing pandemic-based healthcare facilitations and services challenged the existing built and developed infrastructure and design of hospitals (Cremonesi et al., 2020). Since each hospital and healthcare facility has its own unique design, each must be explored individually with respect to their existing built form and its context to enable how transformation, expansion, revitalization or temporary designation may help manage such circumstances in the future in regards to better disease management, control, prevention and facilitation for the public at large (Mossa-Basha et al., 2020). Similar transformation happened at one of the hospitals in Islamabad city (Capital of Pakistan), namely Riphah International Hospital (RIH),which transformed its existing operational systems and physical infrastructure to cater for the high influx of COVID-19 patients during multiple waves of the pandemic. The research exploration aimed to address the challenges and opportunities which came along the way through exploration of its unique context and design towards devising strategies and opportunities for future epidemics management.

LITERATURE REVIEW

Pakistan is a South Asian country with a population of over 200 million people. It has seen massive population growth in the last 30 years, leading to an increased risk of infectious diseases and epidemics (Arshad et al., 2022). Pakistan has experienced outbreaks of dengue (Khan et al., 2022), malaria (Fatima et al., 2022), cholera (Naveed et al., 2022), and other infectious diseases during this period (Zohra et al., 2021). The COVID-19 pandemic had a significant impact on public health, hospitals, and other sectors of the economy in Pakistan (Kanwar et al., 2020). The country also faced numerous challenges in containing the virus, such as inadequate hospital capacity, limited access to healthcare, and inadequate testing facilities (Valdenebro et al., 2021). The lack of adequate resources and facilities resulted in a sharp increase in the mortality rate, with the WHO estimating that the true rate of mortality could be higher than reported (Ahmad et al., 2022).The pandemic led to the disruption] of routine health services, such as immunizations and antenatal care, resulting in a decrease in the number of children receiving routine vaccinations and pregnant women receiving antenatal care (Mustafa et al., 2022). Furthermore, the pandemic also led to an increase in mental health issues, with an estimated 70% of people in Pakistan experiencing anxiety and depression due to the pandemic (World Health Organization [WHO], 2020).The increasing number of cases resulted in a surge in the demand for hospital beds (Waris et al., 2020), with hospitals becoming overcrowded and lacking the necessary resources to provide adequate care to all patients, which resulted in an increase in demand and price of services and related medication and products, poor quality of healthcare services provided (Khan et al., 2020), and a lack of satisfaction among the service providers and service seekers (af Ugglas et al., 2020).

The unprecedented pressures on healthcare systems due to pandemic around the world have exposed the need to re-think and re-imagine hospital delivery models in order to meet the needs of the patients and hospitals transformation to manage the burden of disease (Melaku et al., 2020). The most significant challenge was the need to rapidly expand existing hospital capacity to meet the increased demand for the care of Corona virus patients, while also managing the risk of infection transmission (Sagan et al., 2020). This meant that hospitals had to make rapid changes to their physical infrastructure, such as the installation of additional medical equipment and the repurposing of existing spaces to create new patient care areas. In addition, hospitals had to implement new systems and processes to manage the increased demand and to ensure patient safety (Kristal et al., 2020). At the same time, hospitals had to ensure that their existing procedures adapted to meet the needs of COVID-19 patients, including the use of personal protective equipment (PPE) and new approaches to care delivery (Vilallonga et al., 2020). Moreover, hospitals had to make changes to their organizational structures to respond effectively to the pandemic. This included the creation of new roles and responsibilities, as well as the formation of dedicated COVID-19 response teams (Assefa et al., 2021). Based on recent review of literature, some of the major key factors towards transformation and challenges of managing spaces for pandemic included: architectural design based facility typology, overall layout design and spatial configurations, technology used and deployed with aspects of expansion and flexibility, quality aspects of the physical settings, public spaces integration, overall system and transformation management, and the training of teams (Setelo et al., 2022).

In addition, hospitals had to implement new systems and processes to manage the influx of COVID-19 patients and the associated risks. This included the establishment of dedicated COVID-19 wards and the use of contact tracing systems (Capolongo et al., 2020). WHO guidelines related to the epidemic management and preparedness were the most used tool previously and were extensively used across Pakistan during the Dengue and Malaria epidemics as well as allied disasters like floods and earthquakes. Therefore, WHO guidelines became the baseline tool for exploration of the transformation requirements traceability as well as its definition towards implementation and deployment with focus on its successful implementation.

RESEARCH METHODOLOGY

Research exploration aimed to address the issues encountered during the pandemic timeline healthcare facilities transformation challenges and lessons learned so that these could be transformed into better strategies and directions for future transformations in similar epidemic conditions. Overall research was explorative in nature and deployed both a quantitative as well as qualitative approach in multiple phases and steps of the research exploration. It followed the documentation of the existing facility through developing architectural plans followed by breaking down into major zones and facilities designated for the COVID-19 patients and protocols used in these facilities. In the next phase, based on WHO guidelines related to epidemic preparedness and management, a questionnaire with open and close ended questions along with an interview/discussion format was used to collect data from the stake holders of the facility. Later it was followed by analysis of data and a comprehensive observational study along with respondents' data to evaluate the transformation outcomes. Since the users of the facility were mainly distributed into two major categories, i.e., service providers and the service seekers, the sample mainly consisted of these two groups. Service providers mainly included doctors, nurses, paramedic staff, support staff, administration, facility managers and allied technical and non-technical staff. The service seekers mainly included patients, attendants and visitors. Based on the review of literature, the scale of the study and its timeline, the sample size was kept to 100 with service providers 60 and service seekers 40, respectively. A purposive sampling technique was used.Aspects of the questionnaire were the same but different questionnaires were used.

Facility Documentation, Data Collection and Analysis

Key factors were based on the epidemic preparation and prevention guidelines issued by WHO for hospitals, as shown below in Figure 1, which helped to develop the questionnaire relating to data collection from the respondents in the RIH.

Later documentation of the existing facility was done through site visits, photography, taking measurements and developing architectural plans of the facility. Location plans are shown below in Figure 2 and 3.

Figure 1

Key Components of the Hospital Preparedness Checklist for a Pandemic/Epidemic

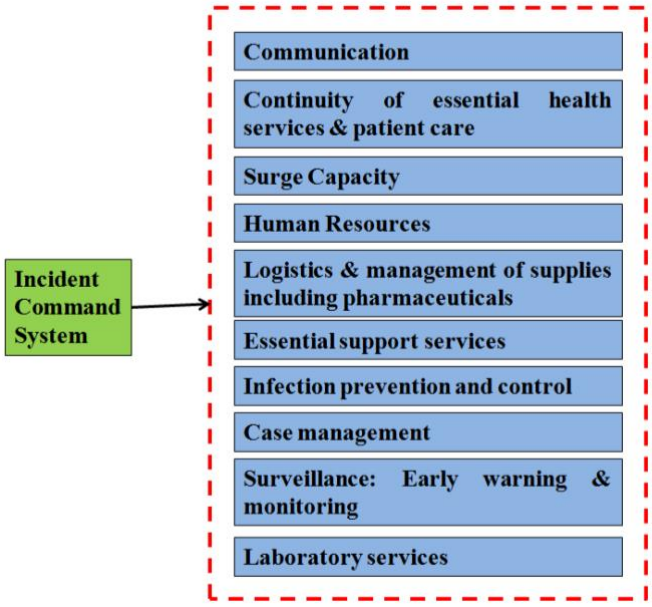


Figure 2

Location of RIH on the Map of Islamabad

Note. From Map of Islamabad by Google Earth, 2022. Copyright 2022 by Google LLC.

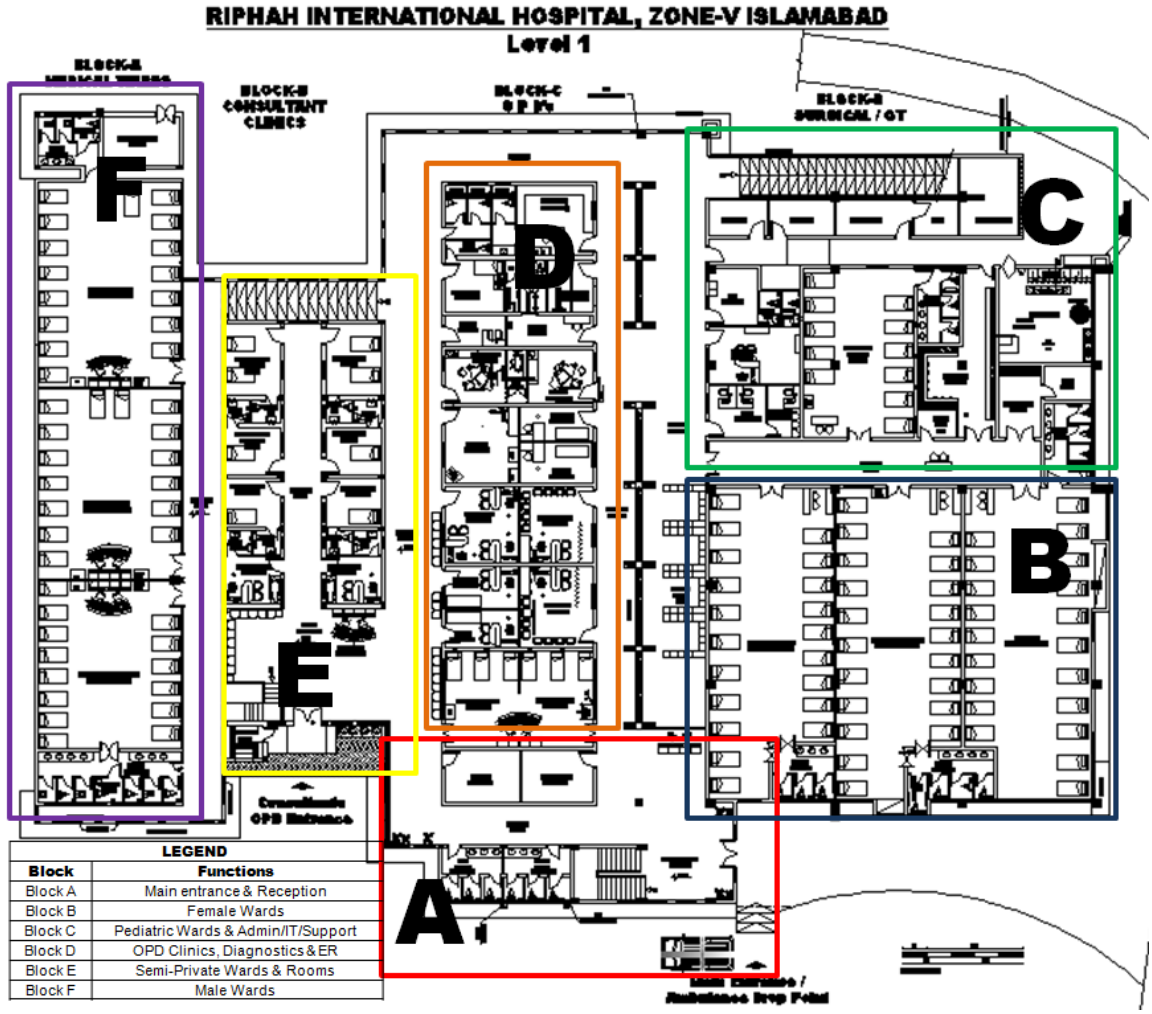
Figure 3

Blow of the RIH Google Earth Image Showing Overall Hospital Site

Note. From Map of Islamabad by Google Earth, 2022. Copyright 2022 by Google LLC.

Figure 4

Overall Ground Floor Plan of the RIH With Multiple Blow Up Areas Shown in Different Alphabetical Codes



Each zone marked above in Figure 4 has separate functions and details. Zone A homes the main entrance of the hospital along with the reception area and allied facilities which include as follows: a reception for the Out Patient Department (OPD), a duty doctor room, Minor Operation Theater (OT), male and female emergency rooms with 3 beds each, male and female toilets, staircases to first floor and mumty (rooftop floor) along with guard seating next to the ramp and entrance. Zone B includes as follows: a female medical ward of 20 beds with allied toilets and a nursing station, a female surgical ward of 21 beds with allied toilets and a nursing station and a gynecology ward of 24 beds with a nursing station and allied toilets, all of which are connected by a 9 foot wide corridor leading from main OPD waiting area.

Zone C has one pediatric ward of 11 beds and allied nursing stations and toilets connected through a common corridor to Zone B. The corridor further leads to a server room, linen store, admin offices, HR and finance offices. From here, the main central corridor is linked to a staff room and FMO office along with the offices of the Medical Superintendent and Deputy Medical Superintendent. The upper allied corridor leads outside towards supporting functional rooms including indoor PHR, HMIS, a bio workshop, a store and medical gases manifolding station. Above these spaces is a ramp connecting ground floor to the first floor through an expansion in the core building setup with the prefabricated building structure.

Zone D is the central facility associated with diagnostics, OPD clinics, a teaching room and emergency rooms with minor OT and a duty doctor room. On the top side, a laboratory with a sampling facility and toilets is followed by an x-ray facility and ultrasound room along with one separating corridor. Below are multiple OPD clinics for different specialties including skin/derma, dental, pediatric, gynecology, orthopedic, medical, surgical and eye OPD clinics followed by emergency rooms with 3beds each for male and female patients, a duty doctor room and a minor OT room. An allied teaching room, which is also used for internal staff and faculty meetings, is also shown in Figure 4.

Zone E has one separate entrance to facilitate OPD patients who are added from a separate waiting area and this leads to the Zone D corridor towards the allied OPD clinics and diagnostics facilities with their allied seating spaces. Next to the reception, private rooms and semi-private rooms along with toilets are provided. Another staircase is provided to link this area to the expansion done on the left side in Zone F consisting of more wards. Since the overall building has been developed in phases and parts, this area is at the same level as the previous zones but the next one, i.e., Zone F is five feet lower and hence another ramp is provided at the end of the private rooms after a segregation wall to link Zones D and E to the low level areas in the Zone F.

Zone F has three different wards. On the top side is an electrical room followed by male medical ward of 17 beds with allied nursing station and toilets, followed by a Male Surgical ward of 15 beds with a nursing station and an orthopedic male ward of 13 beds with an allied nursing station and toilets. All spaces are linked through one 8 feet wide corridor terminating into allied external functional spaces for staff toilets and washing areas. The first floor is connected through a ramp and staircases with allied facilities of Intensive Care Unit (ICU), surgical facilities, labour facilities and NICU. Zone F was only used when high critical COVID-19 patients were taken into the ICU. The overall usage of the ground floor based on segregation of patient centered, admin centered and circulation based areas is shown below in Figure 5. Blow up plans for each Zone are shown below in Table 1.

Figure 5 shows major different zones and functions. During the COVID-19 pandemic, hospital transformation lead to the following major changes as shown below in Figure 6.

As shown above in the Figure 6, the whole wing of thewestern side and its associated corridors along with the necessary amenities were designated and later dedicated as a COVID-19 pandemic center to manage the patient influx. The interior figures and pictures of these spaces are shown below in Table 2.

Table 1

Hospital Zones and Blow Up Plans of RIH

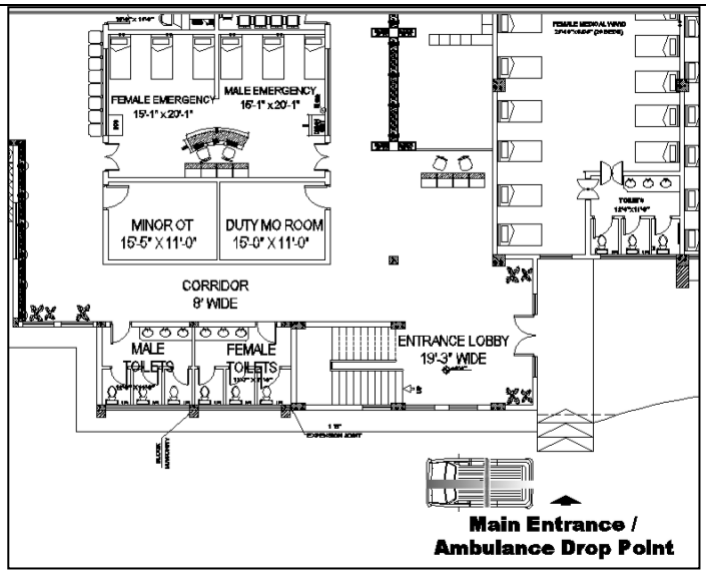
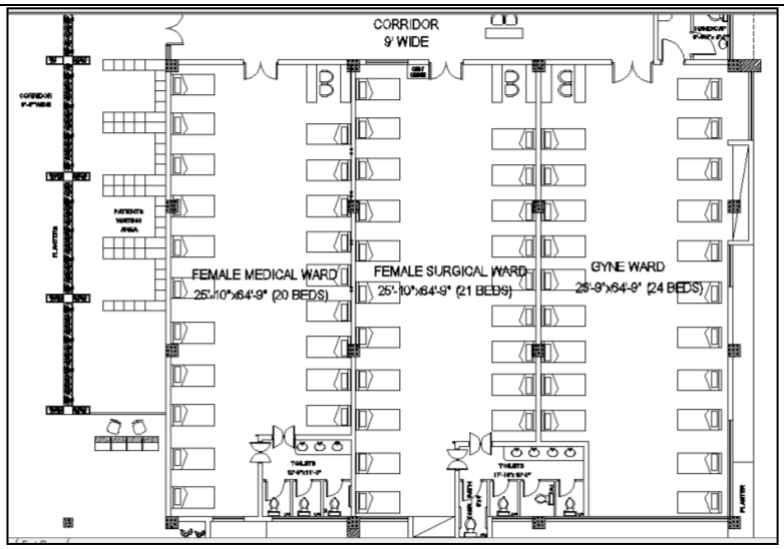
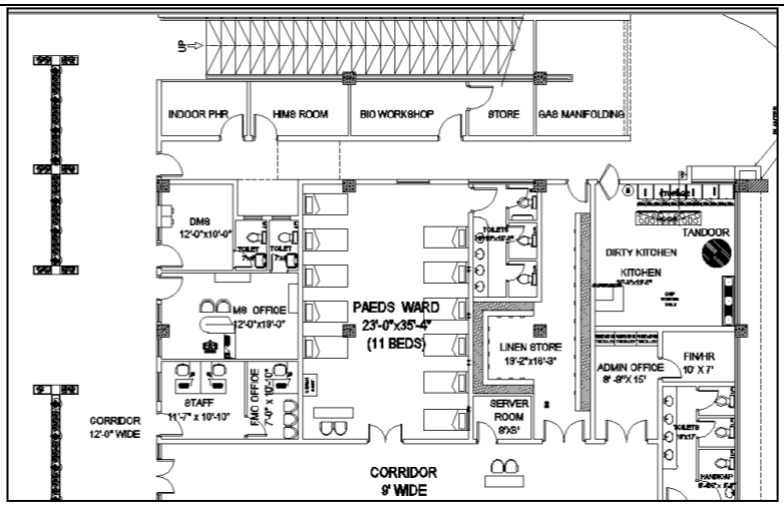
SN	Zone Title	Blow Up Plans
01	Zone A	
02	Zone B	
03	Zone C	

Table 1 (Continued)

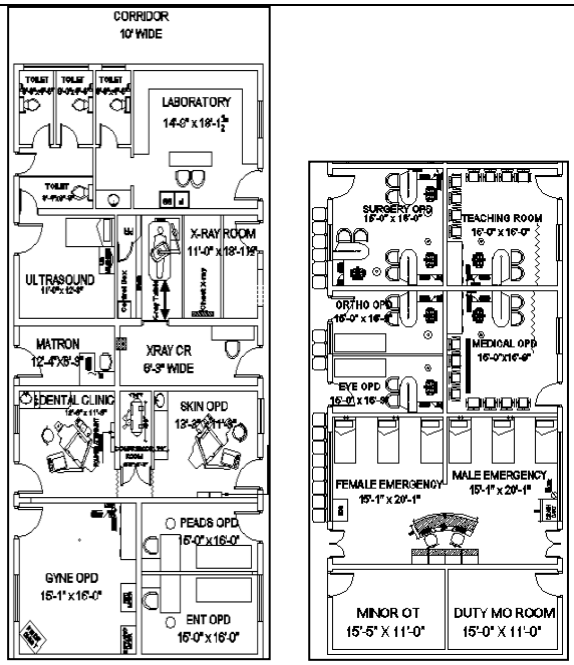
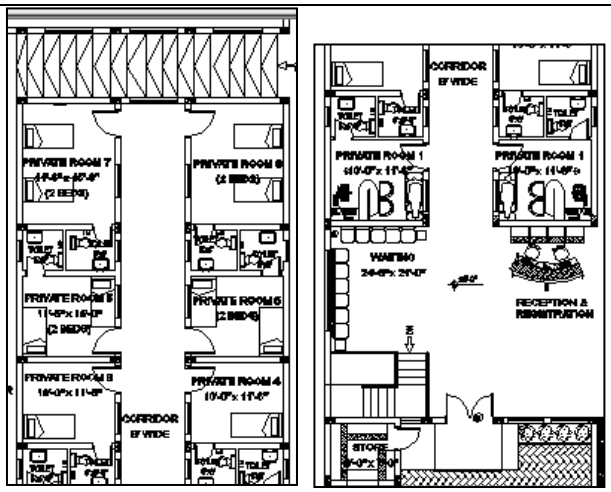
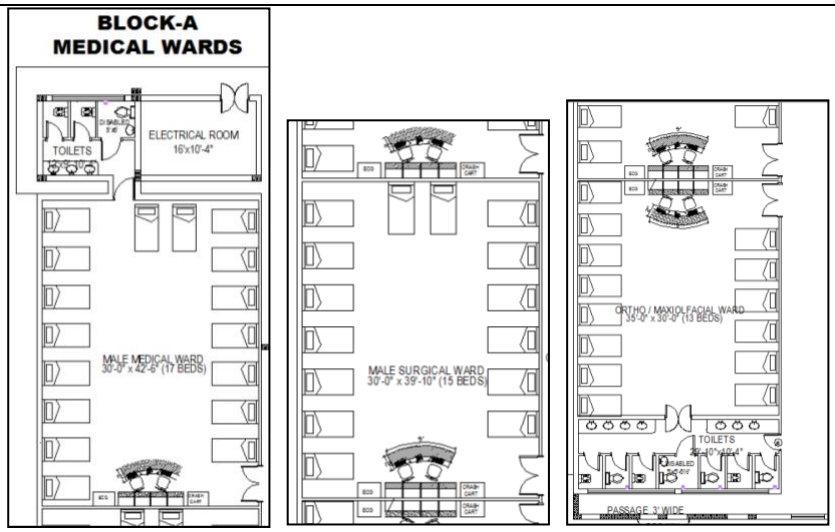
SN	Zone Title	Blow Up Plans
04	Zone D	
05	Zone E	
06	Zone F	

Figure 5

RIH Ground Floor Segregation of Areas Based on Uses in Normal Operations

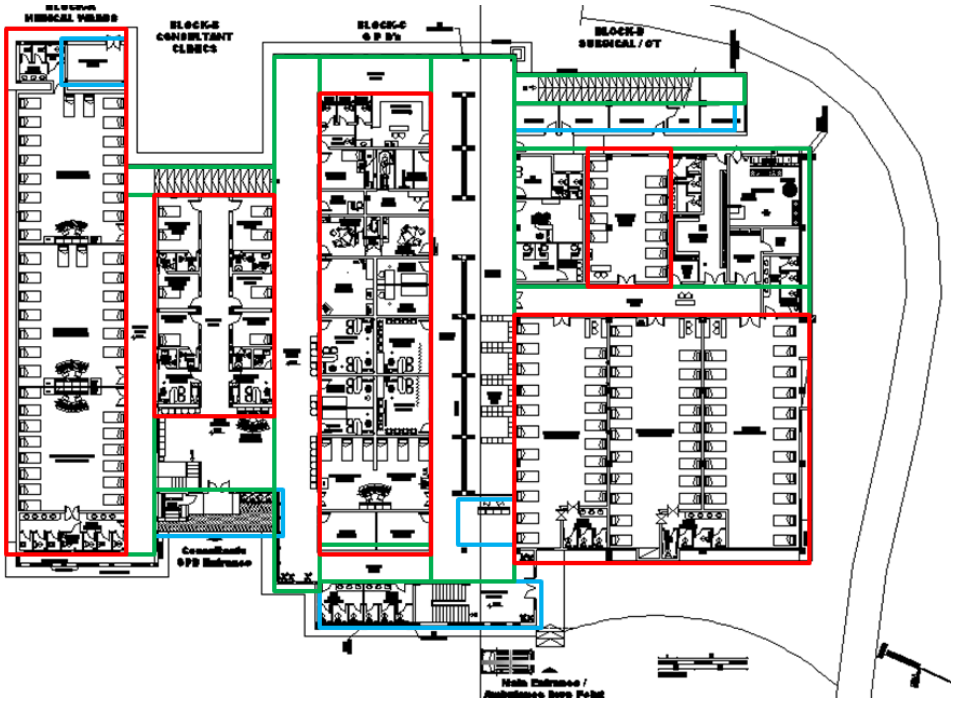


Figure 6

RIH COVID-19 Pandemic Bifurcation and Segregation of Zones

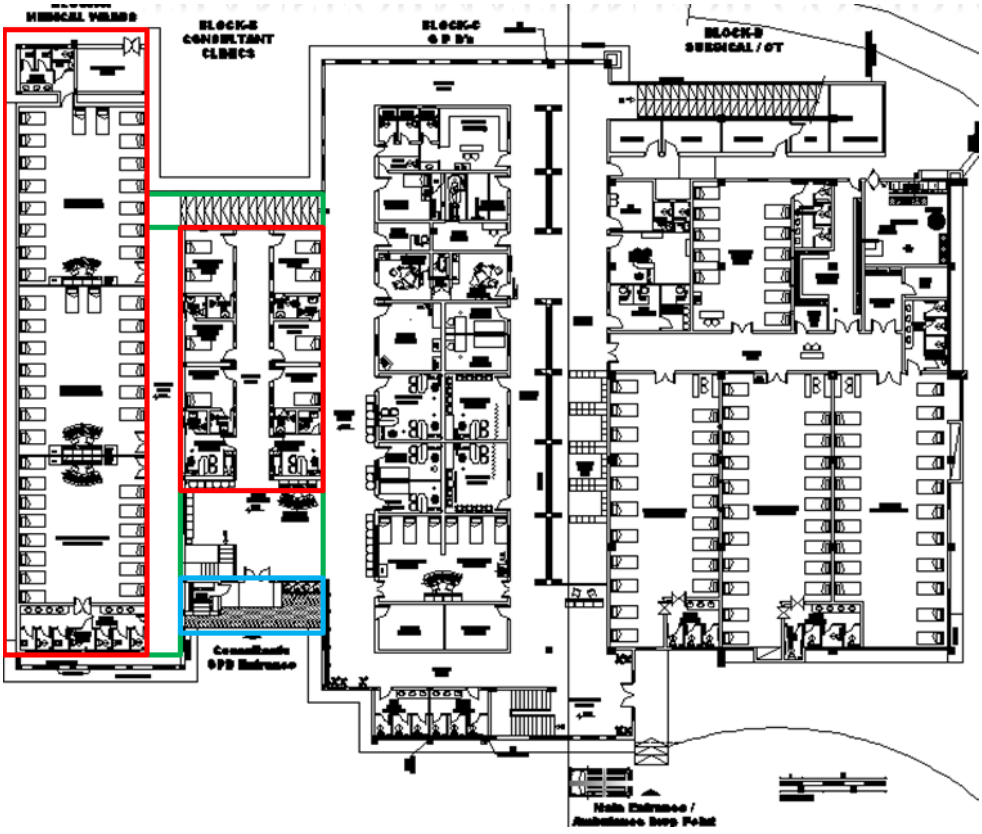
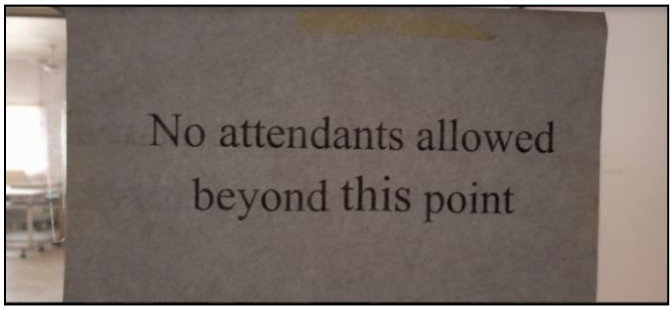


Table 2

Interior Spaces of the COVID-19 Pandemic Center

SN	Space Title	Space Images
01	Entrance and reception areas	
02	Disconnected side corridor	
03	Main segregated entrance for COVID-19 pandemic center– outside view	
04	Main internal corridor connecting the multiple wards accessed from the ramp	
05	Side allied spaces for segregation, PPE, donning/doffing, allied support, etc.	 

Table 2 (Continued)

SN	Space Title	Space Images
06	Wards inside view	
07	Signage	 

As shown above in Table 2, multiple indoor spaces and their images are shown. It was evident from the images above that the facility was designated for the extensive usage of patients with COVID-19 disease and segregation as well as isolation was managed. The overall internal flow and technical flow of facilities and needs were analyzed below.

As shown in Figure 7, one whole separate entrance was dedicated to the COVID-19 pandemic based associated human resource movement. Before the entrance, staff and medical teams would opt for donning and the same space was also used for storage. Next to the main reception was a phlebotomy counter where samples were collected and later sent to NIH for testing purposes. Through this point, staff and medical team would move in via the internal staircase next to storage space and then enter the main central COVID-19 pandemic center corridor before moving to their designated space. Once the shift came to a closure, the lower side toilets were used for donning and waste removal and later outside of the main premises a shower facility was also developed for staff and team members serving in the facility.

Figure 7

RIH – COVID-19 Pandemic Functional Zoning

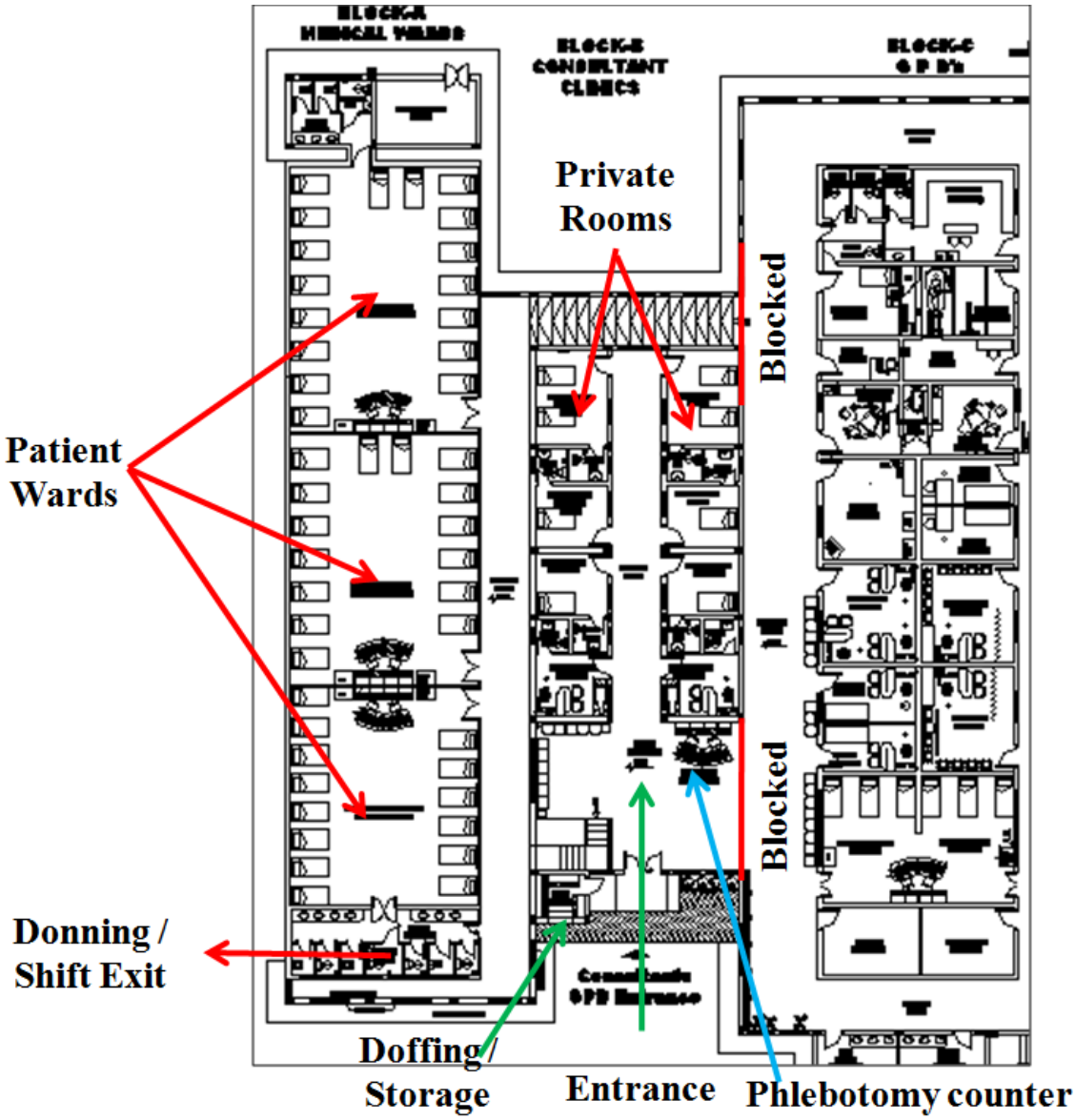
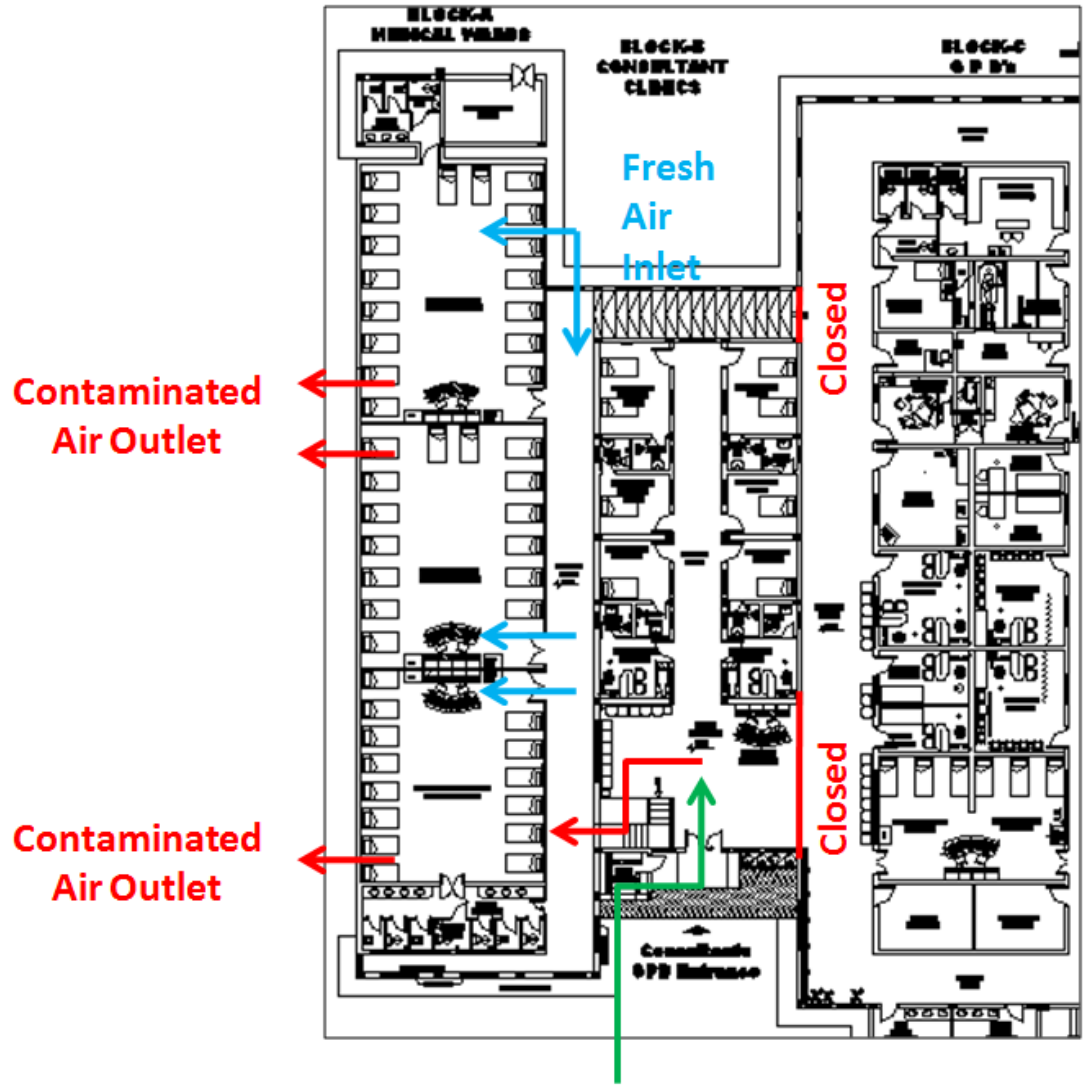


Figure 8

Air Movement in COVID-19 Pandemic Center – RIH



As shown above in Figure 8, air movement acting as the major source of transmission was managed through developing fresh air inlets at the rear side point of ramp leading into the pandemic center main corridor through addition of inverted exhaust fans forcing air to enter the corridor. The fans were installed at height above the false ceiling as well as below to enhance both spaces air movement. The central windows and vents of the wards were kept half open and 2'-0" diameter exhaust fans were installed on the rear side windows of each ward to force the indoor air to move out. Consequently, air movement occurred in one direction to ensure buffer zoning as well as to avoid any contaminated air from moving back into the hospital. The one major issue reported with reference to this transformation was the installation and optimization of air movement, which created issues in severe winters and summers where managing the internal temperature was difficult when the movement was kept limited based on 3-4 times turning on the system and then turning it off. It was extensively used during shift changes. Private rooms were mainly used for very sick patients with high dependency conditions. For the worst cases, patients were later shifted to Intensive Care Unit (ICU) on the first floor. Though this transformation helped the medical team control and manage the situation to the best of their capabilities during the severe crisis, there were still many issues and challenges reported. The primary data collected from the medical team and allied members is discussed below.

Table3

Basic Demographics of Medical Team

S.No	Aspect	Type	Count	%	Type	Count	%
1	**Gender**	Male	44	73%	Female	16	27%
2	**Age Groups**	Below 25	11	18%	26-35	24	40%
		36-45	16	27%	46-60	6	10%
		Above 60	3	5%			
3	**Profession**	Doctor	8	13%	Nurse	18	30%
		Paramedic	12	20%	Medical Staff	8	13%
		Allied	8	13%	Admin	6	10%
4	**Years of Experience**	Less than 5	11	18%	5 to 10	24	40%
		11 to 15	16	27%	16 to 20	6	10%
		Above 20	3	5%			

As shown above in Table 3, 73% of the respondents were male. The major age group was 26-35 with 40% representation of the sample. Three major professional sides contributed to the major share, which were nurses (30%), doctors (13%) and paramedics (2%). 27% of the respondents had 11-15 years of experience while 40% had 5-10 years of experience. However, very few had any major experience associated with isolation except for those 3-4 persons who have served in high dependency ICU units. Respondents data with respect to epidemic emergency preparedness is shown below in Figure 9.

As evident from Figure 9, the overall mechanism used and developed for pandemic management was applicable and acceptable to the medical team with its challenges. They were able to cope with the transformation though one of the biggest issues later identified was that the existing prefab structure had many difficulties with respect to addition of multiple gas supply lines and the installation of additional medical equipment including oxygen supply, suction and allied apart from ventilators and allied systems.

Data analysis, observational study, documentation and design analysis showed that existing design had one unique aspect of multiple connecting corridors, passages and entrances which transformed into a greater opportunity under the pandemic conditions to transform the facility into a COVID-19 center with a separate entry, exit passages and all allied functional needs. In ordinary conditions, this turned out to be a challenge to manage, yet it was a blessing in disguise for the pandemic circumstances. As per respondents' data, transformation major challenges faced by the respondents included: stress, lack of training, fear factor, lack of PPE, SoP's revisions, negative pressure spaces creation, communication, accessibility and triage management. These have been managed through design and administrative interventions during COVID-19. Respondents data collected from patients and attendants is shown in Table 4.

Figure 9

Pandemic Emergency Preparedness

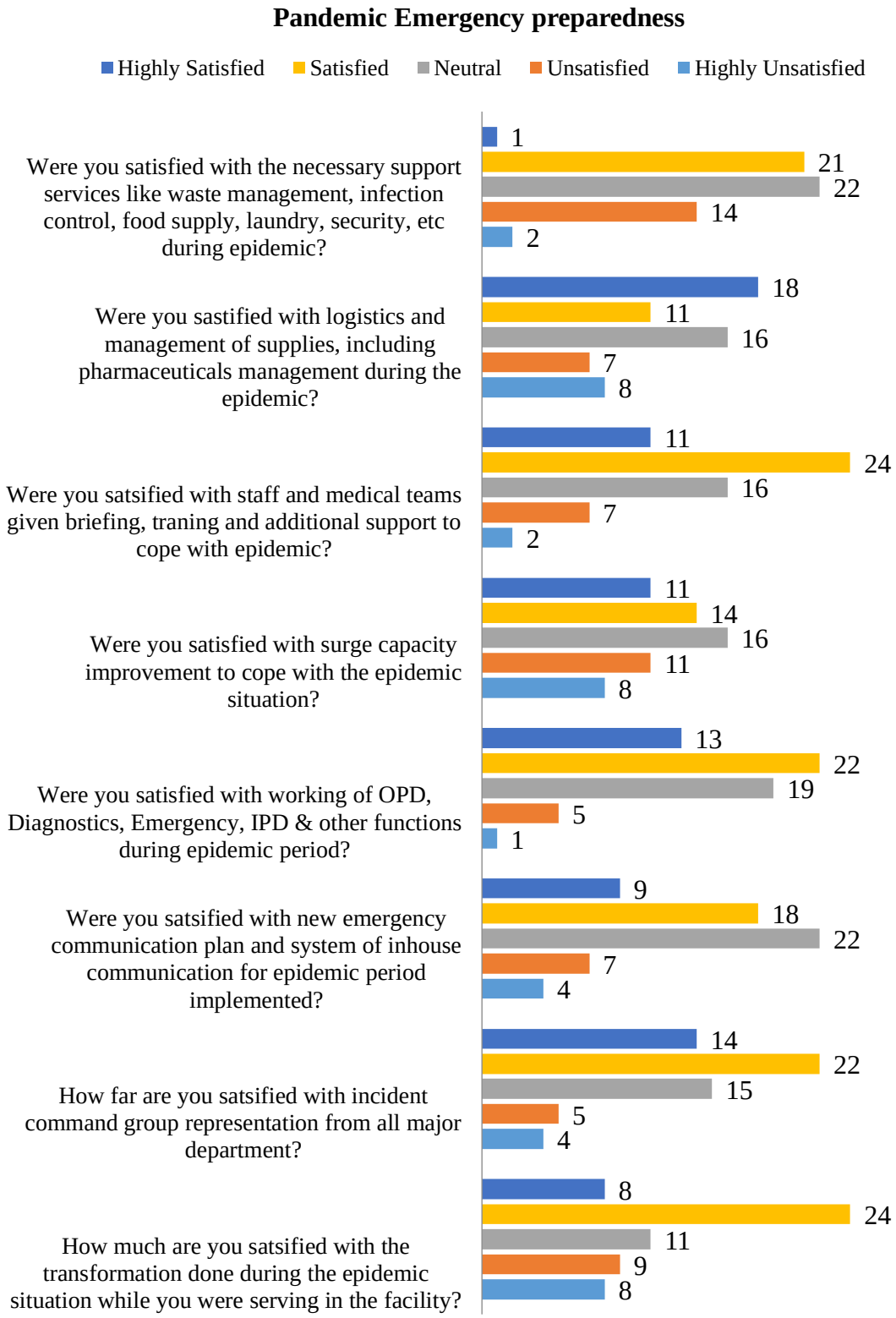


Table 4

Respondents Data – Patients and Attendants

Questions for Patients and Attendants - User satisfaction	Highly Unsatisfied	Unsatisfied	Neutral	Satisfied	Highly Satisfied
Transformation to COVID-19 pandemic center	5%	10%	20%	55%	10%
Emergency communication	10%	15%	38%	20%	18%
Working of OPD, Diagnostics, Emergency, IPD and other functions during epidemic period	3%	8%	65%	20%	5%
Training of the medical team	10%	15%	38%	18%	20%
Logistics and supplies management	23%	45%	18%	15%	0%
Support services like waste management, infection control, laundry, etc.	8%	23%	58%	10%	3%
Triage/emergency services for COVID-19 patients	0%	8%	15%	63%	15%
Separate medical team for COVID-19 patients	5%	10%	10%	63%	13%
Buffer zoning	0%	5%	13%	58%	25%
Separate facilitation for attendants with COVID-19 patients	18%	25%	20%	15%	23%
Counseling, social support, guidance and briefing for attendants	5%	8%	38%	45%	5%
Telemedicine	0%	20%	38%	25%	18%
Epidemic consideration integration in future design of hospitals	3%	8%	18%	63%	10%

The data shown above in Table 4 was of patients and attendants, 40 in total. 75% of the sample size were patients while 25% were attendants. Amongst 40 respondents, there were only 4 females while the remaining were males. The average age was between 21-28 and were mainly from close-by areas of the RIH. The questionnaires were mainly shared with them in person either during their revisit at the hospital or later through accessing them through alternate means like email, WhatsApp etc.

As shown above in Table 4 of respondents' data, there was a mixed response. Both logistics and supplies management as well as the separate facilitation for attendants with COVID-19 patients fall into the unsatisfactory category. The remaining data all fall into neutral as well as satisfactory categories. Based on the discussion/interview with the respondents online or face to face where allowed, it was evident that the patients brought in were mainly either unable to access any major hospital within the twin cities

or were not able to be transferred to any major hospital. Based on the provided data, the transformation of the hospital into a COVID-19 facility was taken as a blessing in highly distressing time. Here the patients were admitted and facilitated, the transformation was taken on a positive note and patients appreciated the hospital taking up the challenge.

However, the variation in user satisfaction mainly varied based on the situation and context on which they were brought to the facility and if they were hospitalized and/or treatment provided. Major gaps were identified in the context of logistics and supply chains apart from other minor areas, which mainly were due to different context based prospects. For example, local cultural aspects were identified for many people if one patient was not incorporated, or since infection spread, even meeting the attendants was a major risk not only for patients but also for the medical team. Overall, respondents believed that the facility made a great effort for the people and due to uncertainty, many challenges transformed into many worst case scenarios as well. In a broader perspective, overall satisfaction was reported. Many advised with respect to the challenges faced for transformation and proposed a number of suggestions.

CONCLUSIONS

Based on the research exploration, it became evident that the transformation of the healthcare facility into the COVID-19 pandemic centre was a major challenge taken up by the facility and they have been able to successfully transform the facility for the time being to manage the higher influence of pandemic patients in the hospital. It was further concluded that some of the challenges, which have been highlighted in the initial stage of the transformation like segregation, isolation and initial identification of the patients and buffer zoning, have been addressed through interventional design ideas as well as implications of design through physical interventions, which resulted in better design transformation for managing higher influx of patients. As a result, it can be concluded that RIH was able to successfully transform one wing of the facility into a COVID-19 Centre to manage the pandemic situation.

One of the major challenges which were faced was the blockage of space, which resulted in segregation of these male wards only to the COVID-19 positive patients and resulted in the other female wards having to accommodate the allied surgical patients as well as medical male patients of immediate care in the pediatric ward. As a result, fewer numbers of male patients could seek treatment due to a shortage of beds and only immediate and sever cases were taken up. As part of the transformation and as multiple COVID-19 pandemic waves continued, it was observed that the stress for the medical team as well as for the attendants was on rise. Hence, it was later decided that medical teams must be facilitated as well. Their facilitation was done in such a way that after doing one duty one day, they were given at least one day off and then they were directed to report right after 24 hours and not before that. By taking one day of leave after duty helped them cope with the stress which they faced during the uncertain situation created by the COVID-19 pandemic.

Among the other major challenges which were faced by the transformation team, one of the key challenges was the facilitation and installation of the medical equipment along with medical gases supply lines throughout these three selected wards. This was because space had to be provided with some basic requirements related to patients who have gone through or passed the ICU level. As a result, providing all these ICU level or allied facilities to each bed, including a ventilator, was a major challenge. Its provision created a lot of issues where allied medical facilitation and biomedical engineering experts were taken on board to cope with the stressful time managing facilitation for the special patients of pandemic under the immediate need of medical treatment.

Air ventilation associated with the nosocomial (air born) diseases was taken into immediate and direct consideration by ensuring that one way air flow mechanism was established with one inlet and multiple outlets so that negative pressure rooms could be created to fulfill requirements of isolation within these rooms where the patients were been kept. Similar was the case and the challenge for the private forms where the high

dependency patients were kept while the facility was working to the optimum.

Overall, the facility was able to manage the stress with the provision of multiple corridor that segregated the overall facility into multiple buildings. Without these multiple corridors, if the whole building was set on one central grid, it would have created a lot of chaos and might not have been able to go with all of these challenges faced during the pandemic circumstances. Hence, this blessing in disguise transformed the hospital into a better opportunity for segregation and later the transformation of the facility enabled the majority of all patients brought in to be easily separated, segregated and treated under the medical supervision.

Yet with all the positive aspects, there were multiple negative aspects as well. It was evident after discussion with the respondents as well as documenting the existing facility that epidemic considerations for these facilities had not been incorporated into the design of the hospital itself. As a result, this hospital transformation into epidemics centre was a major challenge. In fact, it can be stated that epidemic consideration was missed in some of the major hospitals across the whole nation as well as the major cities, which created a burden while transforming these facilities for managing the pandemic situation as well as the previous episodes of multiple epidemics that the nation had faced. Indeed, it is vital to consider these gaps towards transformation for future facilities of healthcare in managing future epidemic challenges as well as any further wave of the pandemic in the future.

With respect to the originality as well as academic contribution, the exploration was able to highlight and identify some of the most critical aspects related to user satisfaction and engagement at multiple stages which are critical towards the success of any hospital transformation challenge taken up in a developing country like Pakistan. Such a lack of knowledge in the current domain became a major hurdle towards highlighting the issues faced as well as defining the actions and methodologies which may help in the identification of hidden potentials of design contributing to uncertain and unprecedented situations which could be addressed through architectural, healthcare and environmental design interventions. The future designers of such facilities must keep their eye and ears open towards the public health challenges already strongly rooted in the current socio-physical and cultural healthcare system, making it more complex and complicated. This case study acts as a baseline for future transformations challenges and how these can be a guideline for future design of hospitals and healthcare settings for the better management of epidemics in developing countries.

RECOMMENDATIONS

Major recommendations included evaluating the existing built-form and infrastructure of healthcare facilities with respect to CDC and WHO guidelines focusing on epidemic preparedness and response. The future design interventions including upgradation and expansion for those facilities should consider epidemic considerations. Upgraded facilities should be flexible to be used as OPD/clinics in non-epidemic time frames while they can be used for epidemics during emergency times.

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