

Adaptive Urbanism: Transforming Public Spaces into Emergency Healthcare Facilities

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Abstract

Because of the fact that hospitals are being filled up in quick succession and that there has been deprivation in medical care to some people, it is very evident that there is a major problem in the worldwide medical care system owing to the pandemic that is caused by COVID-19. The major aspects of interest in the research include the change in emergency care in public spaces, and how the problem can be addressed through the concept of adaptive urbanism. The major aspects that were highlighted in the research include the need to address the importance of the issue owing to unprecedented surges in resources and spaces, ensuring that there is creativity in addressing the suggested conditions required to adapt to the issue, and seeing some logistical and socioeconomic aspects that can serve as guidelines in establishing the potential transformations in the town.

Keywords: Pandemic Impact, City Space, COVID-19 Pandemic, Public Space Repurposing, Adaptive Urbanism,

Introduction

The COVID-19 pandemic resulted in significant disruption of urban systems, which exposed the failures of the healthcare system, especially the lack of preparedness of the traditional hospital systems to accommodate the crisis that arises in public health issues. Consequently, the new approach to adaptive urbanism that was adopted by various cities across the world to ensure that public spaces were turned into emergency healthcare facilities demonstrates the potential of the city to offer help under adverse conditions. The major themes that can be derived from the research of this topic involve the resilience of healthcare systems in regard to the urban public spaces, the use of proxemics to regulate the arrangement of space within the healthcare systems, and the flaws of the healthcare systems that are under pressure.

The aim of this research is to examine how the successful adaptation of urban spaces, as done by adaptive urbanism, can help improve the ability of cities to deal with the upcoming healthcare crises. By examining the experiences of cities around the world during the COVID-19 pandemic, the aim of this research is to identify the factors that play a crucial role in the successful adaptation of cities, including urban adaptability, preparedness in the healthcare system, and spatial design issues. This research aims to provide practical insights to help urban planners, policymakers, and members of the healthcare community design a more resilient city that can effectively deal with the current and future healthcare challenges.

The COVID-19 epidemic has revealed the need to develop flexible and creative solutions for

addressing urban health issues. In this direction, the need to create public spaces as alternative healthcare facilities has emerged. There is a shortage of bed space due to the current hospital bed occupancy as hospitals have been overflowing with patients even before the COVID-19 epidemic. The current public spaces have become an essential asset in the fight against the spread of the COVID-19 epidemic. This is because most hospitals have been overflowing with patients even before the health scare. There have also been cases where public spaces have been used as healthcare facilities by creating alternatives that demonstrate the possibility of the reuse of the same spaces to provide healthcare services to people infected with the COVID-19 virus at different occasions. For instance, convention centers have been converted to create health care facilities for the infected people. Additionally, due to the need for people to be in quarantine for the purpose of addressing the health issues associated with the epidemic, the reuse and repurpose concept has been used to demonstrate the possibility of meeting health care needs by reusing existing empty public space.

Clearly, cities were challenged by the need to redesign, and design thinking took center stage, encouraging architects and planners to rise to the occasion, redesigning buildings to become capable of servicing health care demands. Indeed, recycling was the answer because, by doing so, it was possible to establish healthcare facilities speedily, laying the foundation for the necessary infrastructure. Re-alerting buildings became not only an effort against COVID-19, but an opportunity to think creatively about the future of cities. For instance, spaces for providing emergency healthcare were designed from modules of reused containers and inflatable components. They were designed to fulfill various healthcare needs, from controlling air contamination to separating patients. It demonstrates that spaces not intended for healthcare can be converted for such purposes, adding to the resilience of cities.

Furthermore, the COVID-19 crisis was a practical demonstration of how adaptive reuse could make a contribution to the health framework of cities. This experience has given practical insights that could be used to inform how future cities are planned to face the challenges of health care. The need to be highly adaptable to challenges, to design with sustainability, and to involve communities has led to the identification of adaptive reuse as one force behind creating a better future in the health care domain.

In conclusion, the adaptive reuse of public buildings during the pandemic not only served as an immediate solution to the crisis but also contributed to reshaping the way cities can prepare for future healthcare challenges [1, 4, 5].

The COVID-19 pandemic has highlighted weaknesses in healthcare systems, underlining the importance of having effective strategies for responding to crises. One of the most important lessons learned is related to the resilience of healthcare systems, which refers to the ability to prepare for, adjust to, and respond to demand in a way that maintains functionality. In particular, issues related to resource management and the absence of coordination between urban planning and healthcare infrastructure have increased pressures on healthcare infrastructure and have been highlighted as weaknesses in emergency response preparedness (9, 14). As such, there is a pressing need to improve surge capacity by creating scalable infrastructure (10, 17).

Proactive approaches in crisis management are also important in minimizing the disruptions of essential health services. Delays in treatment and deteriorating outcomes are indicative of the

challenges faced by many health systems in maintaining a balance between providing essential non-COVID-19 care and responding effectively to the pandemic (11,13). This highlights the importance of creating a healthcare model with a dual-purpose or dual-function focus.

One such factor is proxemics, which is the study of how people move themselves around public places. This factor proved to be one of the most influential, especially as the COVID-19 pandemic was ongoing. In fact, public space was rearranged to ensure people remained distanced from one another yet enabled to carry on their activities. Further to this point, the emergency healthcare zones were arranged considering the study of proxemics to ensure optimum interaction between healthcare professionals, workers, and patients (19, 22).

Likewise, proxemics played a role in psychological well-being in terms of designing spatial arrangements that ensure a sense of safety and stress reduction among patients and medical personnel, thus exemplifying a human-centered approach in the design of emergency spaces in urban areas (23, 27). In addition, the incorporation of proxemics in urban design provides understanding on the issue of resilience and the need for dynamic urban designs that can address spatial needs in future health emergencies (26, 28).

The integration of proxemics in adaptive urbanism ensures that public spaces are balanced in terms of physical health needs and social and psychological needs, while also providing a framework for the transformation of urban areas into emergency health facilities. The integration of proxemics in adaptive urbanism improves the ability to react to emergencies and provides adaptable urban spaces for the future.

Proxemics in Adaptive Urbanism: Insights for Emergency Healthcare Spaces

Analyzing the need for adaptation in urban areas for emergency healthcare operations requires the consideration of proxemics, which is the study of human spatial behavior. During the COVID-19 pandemic, public spaces in urban areas, such as parks, sports stadiums, and convention centers, were converted into temporary healthcare facilities. To address the need for infection control while also providing psychological comfort to patients and healthcare workers, these conversions required attention to interpersonal spatial needs.

Empirical research suggests that spatial arrangements affect behaviors such as congregation, queuing, and pedestrian movement, which are essential for reducing cross-infection risks in emergency situations. Using spatial interaction models and simulations, research has shown that pedestrian movements in these converted spaces require consideration of both inherent movement and interaction behaviors and satisfaction of physical distancing requirements (38). To improve efficiency and safety, these conversions of healthcare facilities often require the use of flexible spatial arrangements that emphasize accessibility and clear segregation of zones for different types of patients.

The pandemic has also highlighted the role of spatial rearrangements in human interactions, with proxemics being an essential aspect of crisis urban planning. Using socio-ecological theories of environmental behavior, temporary healthcare facilities require the creation of environments that reduce psychological stress while communicating space use effectively (39).

Examples

Within the tumult of the COVID-19 pandemic, growth and development are seen in the example set by Shanghai, which prioritizes personal space without sacrificing the social connections necessary to bring the community together. As it currently stands, with over 172,000 hectares of green space, the city indicates an important reality: city-dwellers require personal space and opportunities to move and breathe, ultimately as a way to become part of their community, demonstrating that the distance or closeness we maintain between ourselves and others determines who we become as a society, as long as we maintain our connections with one another and our communities, as this is what will cause cities to thrive as truly connected communities.

This can tentatively be seen in the concept of modular healthcare facilities, as in the case of China's Leishenshan Hospital. On the other hand, the concept of proxemics in the layout of the internal space—considering the areas that are already contaminated, semi-contaminated, or clean—can be compared to the usage of "CURA pods," which incorporates the concept of proxemics in creating expanded healthcare space. (41)

These cases illustrate how proxemics can guide adaptive urbanism by aligning human behavior with spatial design, creating safe, functional, and emotionally supportive environments during emergencies.

Adaptive Reuse Of Buildings During COVID 19

The COVID-19 pandemic was definitely a challenge for cities across India as it compelled all of us to think out of the box. There was a flood of patients seeking medical care, so it was necessary that cities required 'ready-to-use' spaces rather than spaces that needed to be built from the ground up. Therefore, government offices, school buildings, sports centers, among others, turned out to be temporary health care facilities. This not only makes sense economically but is also Eco-friendly as it does not involve the construction of more buildings, asserts Shah Kumar (2020). Moreover, as Ghosh (2020) asserts, it was an opportunity that could be used to protect architectural heritage as an older building with a colonial presence could be repurposed as a health care center without compromising the historical character of the building (32). Patel (2020) extends the argument further as the chances of achieving greater energy efficiencies and helping achieve greater sustainability in the future exist with the intervention of adaptive re-use (33).

The pandemic has made it clear that the long-term viability and health of Indian cities depend on the effective implementation of adaptive strategies. In explaining this assertion, Reddy (2020) argues that "urban resilience was built through the creative repurposing of public infrastructure" (p. 35). A review of these examples makes it clear that adaptive reuse is a key strategy for dealing with the challenges presented by a pandemic. By focusing on infrastructure that is both sustainable and adaptable, it becomes possible to improve the scalability and adaptability of the infrastructure of a city in preparation for a future pandemic.

Case Studies

This section embarks upon a thorough and comparative analysis of case studies from a wide array of geographical sites, including North America, Asia, and the Middle East. It brings to the fore the experiences of a number of key sites, including New York City, Singapore, India, and Sharjah, which have been selected owing to the unique approaches adopted to address the challenges that

arose in the wake of the pandemic. For instance, Wuhan had a pivotal role to play in determining the future of the COVID-19 pandemic, while in India, there was rapid and decisive action that included the rapid utilization of large- scale facilities such as stadiums and even train coaches to establish emergency healthcare facilities. At the same time, New York City demonstrated its resourcefulness by utilizing unconventional facilities such as a Navy hospital ship to supplement healthcare facilities. In contrast, Singapore and Sharjah were able to transform field hospitals to further boost their capacity.

New York City, USA

The United States has lost a lot during the pandemic. It still holds the record for the highest number of deaths due to COVID-19. Apart from the criticism that the government did not react proactively, the blame has also been given to the people themselves. The number of vaccinations and boosters has remained low despite the warnings.

The origin of the COVID-19 pandemic in the United States was found to be in New York City. During the early stages of the pandemic, the number of reported cases surpassed 38,000, with 914 deaths (36). At this juncture, the total number of hospital beds in the state of New York was estimated to be 53,000, with 3,000 of these being ICU beds. In a bid to ease the burden on the healthcare system, the governor directed an order to permit hospitals to increase their bed capacity by as much as 50 percent. Additionally, for those hospitals that possessed the capacity to double their bed capacity, an additional 5,000 beds would be provided, enabling a full 100 percent increase in bed capacity (37).

The USNS Comfort, a Navy medical ship that has a bed capacity of 1,000, was deployed in Manhattan as part of the overall city strategy to make use of any large facility that could be used in case of emergencies

(36). The ship had 12 operating rooms, a well-stocked pharmacy, several laboratories, and a medical staff consisting of 1,200 professionals. In addition to the Comfort, other temporary facilities such as the Brooklyn Center and the Javits Convention Center (37), among others (Figure 1), were erected.

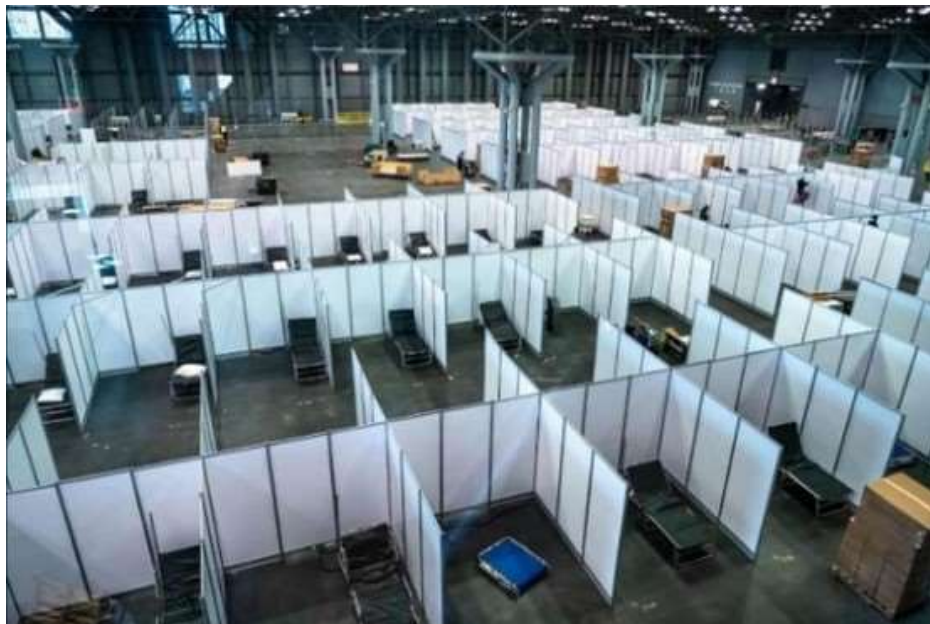


Figure 1. Javits Convention Centre (Lopez, 2020)

In March 2020, the global humanitarian organization named Samaritan's Purse erected an emergency field hospital in Central Park in partnership with Mount Sinai Hospital (Figure 2). The hospital has 68 patient beds and 72 health care workers who assisted in operating the hospital (36). The hospital is flexible and has been designed to meet the specific needs of the people living in the area that has been affected by the pandemic. The hospital would cover nearly half a hectare of land when fully operational and would have facilities such as an emergency room, lab, ultrasound and digital x-ray, two operating rooms, a surgical sterilization tent, critical care unit, and over 50 inpatient beds (42).



Figure 2. Samaritan's Purse emergency field hospital- site (Samaritan's Purse, 2020)

Wuhan, China

Huoshenshan Hospital was built as a response to the COVID-19 pandemic. This is an emergency field hospital that covers an area of 60,000 sqm with 30 intensive care units. It was built within 10 days (January 23rd to February 2nd) to curb the spread of the virus. According to (43), the 1,000-bed treatment center has a total of 1,400 doctors and nurses. Huoshenshan hospital modeled its hospital after Xiaotangshan Hospital in Beijing, which was built during the time of the SARS outbreak in 2003. Although there were many similarities in the designs of the two hospitals, Huoshenshan Hospital has its own uniqueness to fit the nature of the coronavirus and the environment of the city (43).

Also, to prevent any further spread of COVID-19, the ventilation system had to be carefully designed to allow the airflow from the wards to be collected and disposed of appropriately (43). Ventilation can help improve indoor air quality by reducing any potentially infectious COVID-19 droplets.

India**Case Study 1: Conversion of Bengaluru's International Exhibition Center (BIEC) into a**

COVID-19 Care Facility

Collaboration was critical in this transformation. The state government worked closely with private organizations to quickly build infrastructure, including sanitation, ventilation and medical supply chains. Volunteers, health workers and non-governmental organizations supported the operation. BIEC's large, open halls were ideal for accommodating large numbers of patients, while its central location allowed easy access for ambulances and medical staff. By relieving the burden on regular hospitals, this adaptive solution allowed intensive care units to focus on critically ill patients. The initiative highlighted the importance of identifying and utilizing unused urban spaces for emergency medical care needs.

Collaboration was one of the major factors in this process. The state government collaborated with other private companies to establish infrastructure such as sanitation, ventilation, and medical supply chains. Volunteers, doctors, and other non-governmental organizations assisted in the management of the facility. The large open halls of BIEC were appropriate for accommodating a large number of patients, and the facility was centrally located, making it easily accessible by ambulances and health professionals. This project was a major example of the need to identify and utilize unused spaces in urban areas for emergency medical facilities.

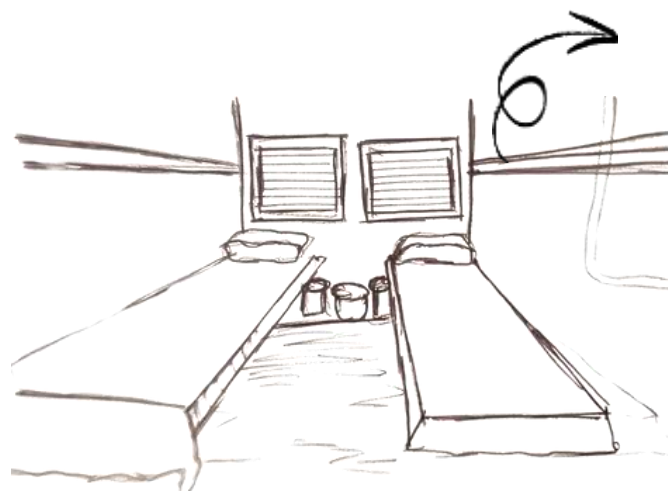
Case Study 2: Maharashtra's Use of Mumbai's Railway Coaches for Isolation Wards

The problem in Mumbai was severe, but Indian Railways, along with the government, came up with a brilliant solution to address it. They took about 5,000 train cars, converting them into isolation units, thus adding about 80,000 beds to accommodate those in need.

The remarkable part is that it was all done in a short period of time. Buses were stationed in different areas to ensure that people from congested areas were taken to medical care quickly, considering that hospitals in those areas were already congested, thus bringing much relief.

The solution not only worked effectively, but it also brought much relief to hospitals in congested areas, thus ensuring that medical help was accessed quickly. Not only was it effective, but it also brought much relief to hospitals in congested areas, thus ensuring that medical help was accessed quickly. The solution to the problem was not only effective, but it also brought much relief to hospitals in congested areas, thus ensuring that medical help was accessed quickly.

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Comparative Analysis

Aspect	BIEC (Bengaluru International Exhibition Center)	Mumbai Railway Coaches
Type of Space Repurposed	Exhibition center used for trade fairs and exhibitions.	Train coaches, typically used for passenger transport.
Scale of Conversion	Converted into a 10,100-bed COVID-19 care facility.	5,000 railway coaches converted into isolation units for 80,000 beds.
Location	Located centrally in Bengaluru, accessible to multiple healthcare zones.	Located at multiple railway stations throughout Mumbai, targeting local needs.
Targeted Patient Group	Mild and moderately symptomatic COVID-19 patients.	Asymptomatic and mildly symptomatic COVID-19 patients.
Key Features	Oxygen supply, sanitation, basic medical care, and social distancing layouts.	Oxygen cylinders, separate entry/exit points, and basic medical supplies.
Implementation Speed	Fast-track conversion within weeks, aided by government-private partnerships.	Swift conversion using existing infrastructure, operational within a short time.
Collaborators	Karnataka state government, private healthcare providers, NGOs.	Indian Railways, Maharashtra state government, healthcare organizations.
Resource Utilization	Utilized a large underused exhibition space, ideal for large patient flows.	Repurposed idle railway coaches, effectively using existing transport infrastructure.
Impact on Healthcare System	Alleviated pressure on local hospitals, supporting critical care facilities.	Helped reduce hospital bed shortage, serving as a supplementary care option.
Public Perception	Positive response due to efficient use of space and proximity to healthcare hubs.	Positive feedback, especially from communities with limited access to traditional hospitals.

Singapore

Singapore has had two large outbreaks of COVID-19. The majority of infections were among migrant workers. The infections among migrant workers totaled over 55,000. However, it has been established that the figure among migrant workers was higher. This implies that more than 150,000 may have been infected. The second wave had fewer infections compared to the first

In the midst of the COVID-19 surge, hospitals globally were overwhelmed with demand and had limited capacity for new admissions. Consequently, various countries converted large facilities to cater to the influx of infected persons. In Singapore, four halls were allocated for COVID-19-infected patients, while an additional six halls acted as temporary halls to cater to the increasing number of patients. Notably, two halls were combined to create space for 950 patients. The Changi Exhibition Centre had the capacity for 2,800 patients, while the Tanjong Pagar Terminal had the potential for 15,000 patients, as indicated by the Prime Minister's Office. The Changi Exhibition Centre had the advantage of its proximity to the airport as well as its distance from the city center.



Figure 3

Singapore Expo Convention Hall and Exhibition Centre in Changi (Eber, 2020)

As of August 2021, Singapore has dedicated more hotels to quarantining people, resulting in the country having over 90 hotels that could accommodate people from other countries, as well as individuals who have been in contact with a positive case. Moreover, other spaces such as government training facilities, schools and holiday homes were used for people to quarantine (45).

Sharjah, UAE

Since the beginning of the COVID-19 crisis, the UAE has shown resilience through its pandemic management and risk reduction, thereby becoming exemplary in readiness and adaptability. Health authorities continue to ensure the safety and wellbeing of the nation by inaugurating field hospitals throughout the seven emirates, one of them being the Sheikh Mohamed Bin Zayed field hospital in Sharjah. The hospital was built within 10 days and spans over 7000 sqm. It has a total of 204 beds, with 48 reserved for intensive care patients and 156 for those in moderate condition (46)

Comparative analysis of case studies

Having conducted a comparative analysis across the four case studies (Table 1), I realise how each city offered a unique approach to dealing with the critical care surge caused by the pandemic; Notably, the coping strategies used in different countries also varied. The government of the state of New York transformed open spaces into field hospitals. While ICU beds were imported due to patient overflow, medical equipment was in short supply. In Singapore, the government issued

many rules (e.g., curfews and travel restrictions) and a “COVID-zero” strategy was introduced to see an end to the pandemic. The citizens observed the rules by wearing masks and observing curfews, while the city-state also had one of the highest vaccination rates in the world (47)

Conclusion

The global COVID-19 pandemic highlighted the weaknesses of urban infrastructures and healthcare systems, drawing attention to the need for adaptive building reuse in the event of a public health emergency. The research paper's conclusions, which are backed up by case studies from a variety of urban settings, show how different towns made use of pre-existing places to lessen the difficulties caused by the pandemic.

These examples demonstrate the ways in which urban governance can display its flexibility, utilizing the available resources in an appropriate manner. For example, Singapore has utilized expo halls and community centers, while New York has utilized hotels and university residence halls as field hospitals. Another innovative way of overcoming the infrastructure challenges, with regard to the management of the coronavirus, has been displayed in India, where stadiums, coaches, and community centers are being utilized as quarantine centers and COVID-19 care centers, respectively. The need to use public spaces, like stadiums and expo halls, to combat the coronavirus has also been emphasized in Wuhan, China, and Sharjah, United Arab Emirates, as well. However, challenges are also being created with these initiatives, thereby highlighting the challenges associated with adaptive urban governance.

These instances all highlight the need for quick, scalable, and situation-specific solutions in times of emergency. The efficacy of adaptive reuse tactics was ensured by governance activities, such as the "COVID-zero" approach in Singapore, rigorous testing and vaccination efforts in Sharjah, or India's massive immunization program. The pandemic offered a rare chance to rethink metropolitan areas as adaptable structures that might fulfill a variety of purposes beyond their initial purpose, as noted in (43) and other research cited.

This study again emphasizes the importance of adaptive reuse in developing resilience within cities. By utilizing spaces that are temporarily adapted to serve different purposes, cities are able to respond to the crisis without compromising existing healthcare infrastructure. However, as indicated in the experiences outlined in this paper, the need to plan ahead cannot be overstated. The incorporation of adaptability in urban planning, as advocated by (46) and other scholars, may provide a more sustainable solution in the future.

In conclusion, the COVID-19 pandemic has shown that the use of existing buildings as part of the response to disasters represents not just an emergency action but also an important part of building resilience in cities. As such, the planning process should take into account the lessons from the pandemic to build resilience in facing any future disasters, while at the same time recognizing the significance of public spaces.

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