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Chapter 1

Synthesizing Healthcare and Public Realms During Crisis

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Introduction

No matter the crisis—conflict, contagion, or catastrophe—healthcare facilities endure as the frontlines of human service and survival. Over the years, with advancements in technology and medicine, we assumed that well-funded and modern healthcare facilities were prepared to handle major health crises. However, the COVID-19 pandemic exposed a critical flaw in the preparedness and adaptability of healthcare infrastructure worldwide in moments of emergency and health crisis. As the crisis appeared, even nations with well-funded healthcare systems struggled. Hospitals reached capacity, supply chains failed, and they paused their essential services. Makeshift hospitals—established in the parks, parking lots, stadiums, and even in airports —became symbols of improvisation rather than planning. This exposed an alarming reality: this revealed not only a logistical failure, but also an architectural one. Despite technological and operational advancements, healthcare architecture was never ready to scale swiftly in acute need and bend under pressure. Healthcare facilities stood rigid while the cities around them fractured.

This revelation underscores an urgent need to reimagine healthcare infrastructure as an essential dimension of the urban system. Under the thematic lens of **Resilient Heritage & Adaptive Urbanism**, this chapter proposes a new theoretical framework for integrating healthcare facilities into the public realm to enhance cities' response to different health crises. Centered on Miami, Florida—a city vulnerable to hurricanes, flooding, and health emergencies—the study employs comprehensive site analysis, a 5x5 risk matrix, and scenario planning to design adaptable small-scale healthcare infrastructure. The proposed solution connects healthcare facilities to elevated MRT transit systems and evacuation centers, ensuring accessibility for vulnerable populations. By leveraging public transit networks, the proposed design connects healthcare hubs to underserved communities and evacuation centers.

Simulation outcomes from Miami's Civic Center Station demonstrated that elevating healthcare functions within MRT-linked modules maintains continuous service delivery even during severe flooding. By connecting healthcare facilities to public spaces, the design ensures seamless emergency services while supporting sustainable and adaptable layouts for crisis-specific needs and enhanced accessibility for underserved populations. The findings highlight the role of architecture as a systematic process of converting public places into a crisis management mode, merging healthcare in mitigating urban vulnerabilities and improving disaster response through flexibility and functionality under various crisis scenarios.

Looking globally, Dhaka, Bangladesh, offers a critical parallel context, reflecting similar vulnerabilities—dense urban fabric, flooding, and severe traffic congestion. Inspired by historical precedents such as the Bhopal Gas Tragedy, where train stations became vital emergency hospitals when trains were used, this study suggests adapting Dhaka's developing MRT network to function as modular healthcare units in the event of an emergency. Shahbagh, a major node in Dhaka, close to major hospitals, can act as a key emergency hub that can connect the adjacent major hospitals to other MRT stations during a time of crisis. Ultimately, this chapter argues that architecture should evolve from passive, rigid structures into active, flexible, and embedded systems capable of adapting to unpredictable urban challenges.

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Modern Healthcare Facilities: Limitation, Urban Isolation, and Present Strategies

Limitations of Traditional Health Infrastructure

Time and again, we see the same response when crisis strikes: build fast, serve a purpose, then dismantle. Temporary field hospitals erected during the COVID-19 pandemic are prime examples. Some, like the one in New York's tennis center (Figure 1), cost millions but barely served a hundred patients. Others were shut down due to staffing shortages or improvements in conditions (Hamis et al. , 2023).

Figure 1. The Tennis Court at Queens, which turned into a field hospital, served 79 patients (Source: The New York Times, July 2020)

Meanwhile, permanent hospitals built during the pandemic now face reduced demand, making their rigid forms and high costs questionable. Historically, this is not new. Once repurposed from a private estate to treat tuberculosis patients, Louisville's Waverly Hills Sanatorium (Figure 2) now stands abandoned, more a tourist attraction than a healthcare legacy. These examples expose a critical flaw: our crisis-built infrastructure rarely survives beyond the crisis. We keep building structures without thinking about their second life.

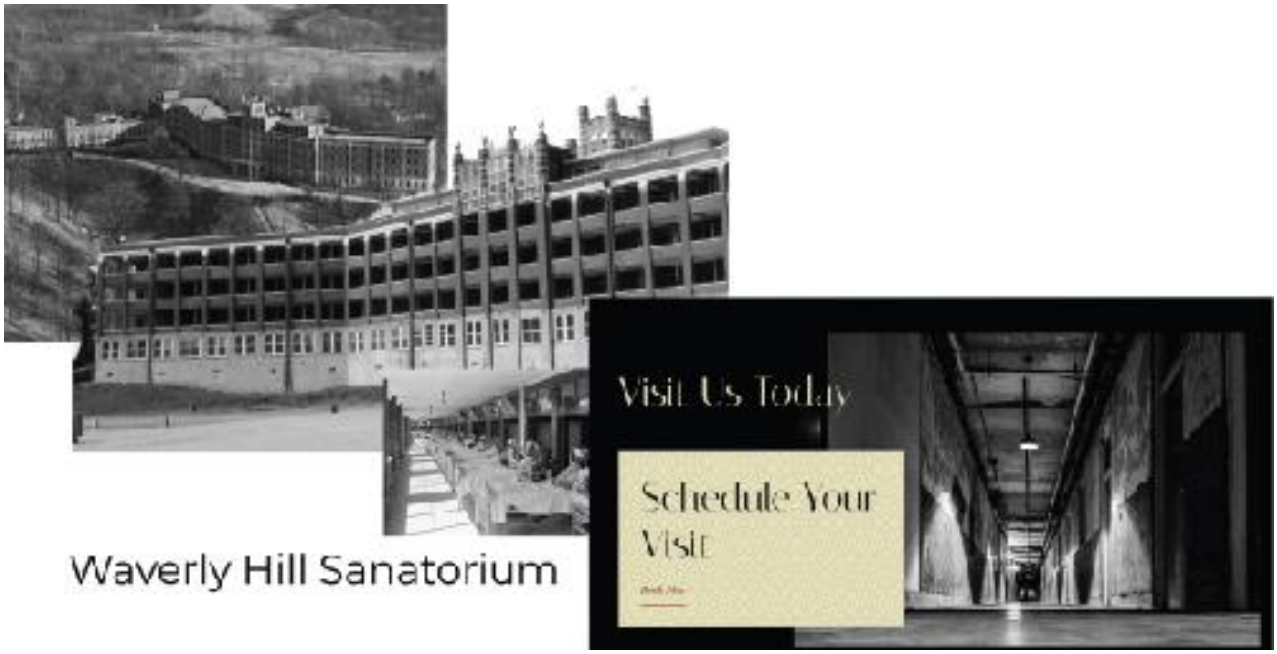


Figure 2. Louisville's Waverly Hills Sanatorium (Developed by Author)

Healthcare design today remains overly dependent on static, isolated hospital models that lack agility and integration with community systems. These buildings often fail to meet the needs of vulnerable populations during emergencies. They aren't built to adapt, move, or scale with changing demands. Instead, they reinforce spatial inequity. Research by OMA (Figure 3) shows that many modern hospitals have the shortest life spans in healthcare history. If our solutions during crises continue to rely on inflexible design, we'll keep repeating the cycle—build, use, abandon.

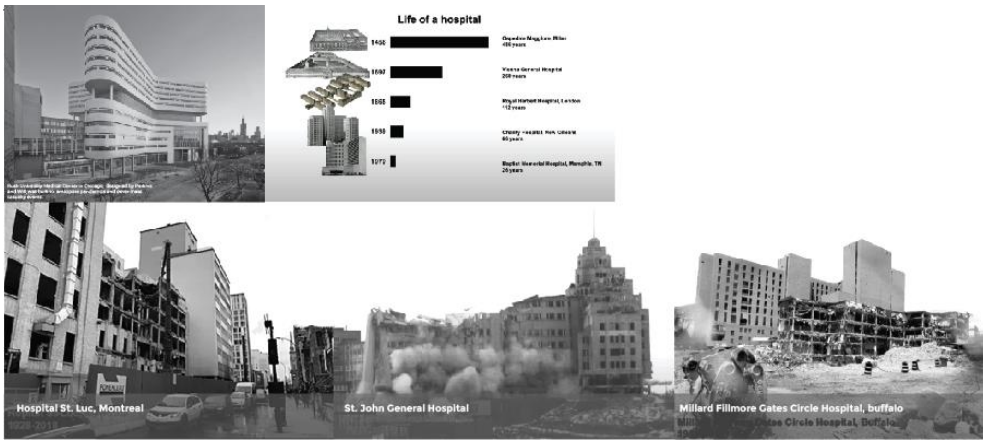


Figure 3. OMA's Study on Rigid Healthcare Facilities (Developed by OMA)

The Role of Architecture in Health Emergencies

Architecture has the potential to go far beyond sheltering medical functions in healthcare facilities—it can act as a proactive system for public health resilience and more prepared cities. Back in 19th-century New York, during the tuberculosis outbreak, city planners created Central Park not just for recreation, but to clean the air and give people room to breathe. Hospitals around it adapted too, adding balconies so patients could rest outside, close to the trees and fresh air. Years later, that same park helped again—during the World Wars, and most recently, during the COVID-19 pandemic (Figure 4) (Fink, 2020). It shows how public spaces often become something more during a crisis—they become part of the care system. But what if that wasn't just a coincidence? What if public spaces were designed to anticipate those moments? OMA's research raises this very question, critiquing the fortress-like isolation of modern hospitals and proposing horizontally expandable, automated healthcare environments. Their vision—where the public realm and healthcare facilities merge—challenges conventional models and opens new questions: Should we build more hospitals or reimagine our parks, metros, and civic infrastructure as flexible extensions of care? What if we redefined the boundary between the public realm and healthcare, allowing them to coexist rather than collide?

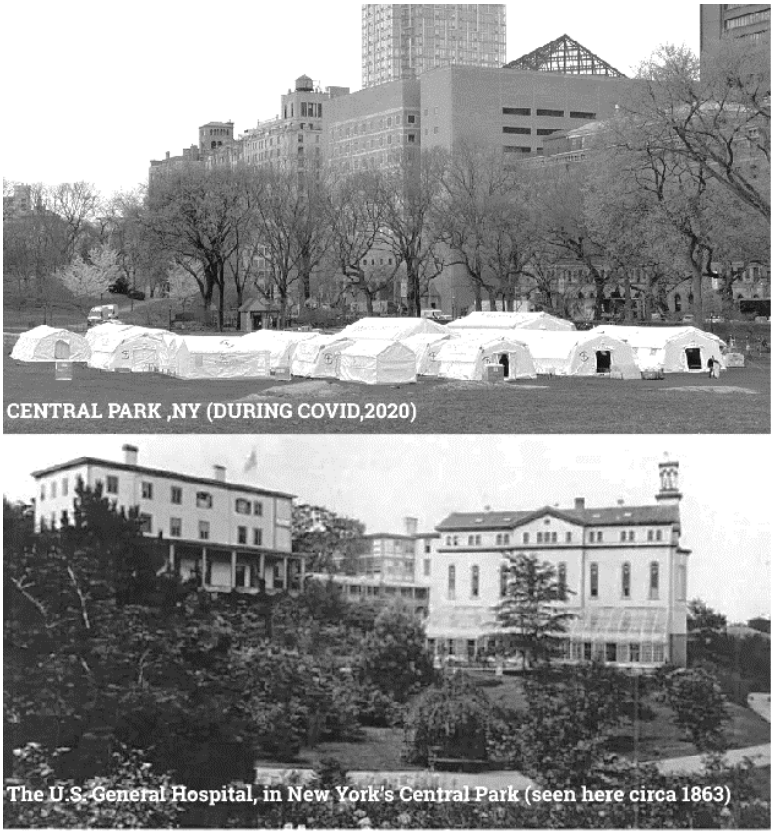


Figure 4. The adaptive use of Central Park over the centuries

Research Gap and Study Objectives

This research responds to a critical gap in both urban and healthcare planning: the disconnect between health services and the spatial and mobility logic of cities. Public spaces are typically designed for recreation, while transit systems prioritize movement and efficiency—yet neither is optimized for delivering care in times of crisis. The question arises: what if these spaces could be reimagined to provide adaptable, mobile healthcare systems embedded in daily urban life?

Focusing on Miami, a city highly susceptible to both public health emergencies and environmental threats, this study explores the integration of modular healthcare units into the elevated MRT network. Through this approach, the research sets out to explore three key goals: to understand how mobile, modular health units can boost emergency responsiveness; to analyze Miami's spatial vulnerabilities and the unique risks faced by different communities; and to develop a design model that can be adapted and scaled in other urban contexts to connect transit and healthcare delivery. At the same time, contemporary healthcare experts are raising vital questions about the role of public engagement in shaping health infrastructure. Should communities have a say in the design of the very facilities that serve them? And more importantly, can these communities take part in maintaining and sustaining these facilities during crises? (Figure 5)

Figure 5. Healthcare facilities and design approach proposed by OMA (Developed by Author)

This thesis argues that during times of public emergency, healthcare facilities must transcend their conventional role. They must become extensions of the public realm—approachable, accessible, and deeply embedded within the community (Fisher, 2022). Instead of viewing hospitals as isolated entities that only encroach into the public realm during a crisis, this research proposes a regenerative, two-way system. By intentionally linking healthcare facilities with civic infrastructure, we can design spaces that not only treat illness but also restore and support the community in moments of need.

Structure of the Paper

The paper unfolds through five key sections, beginning with an introduction that contextualizes the global healthcare breakdown in the time of COVID-19, highlighting the vulnerabilities of existing infrastructure. It moves on to describe the materials and methods used, focusing on Miami as the study site, supported by spatial analysis and architectural precedents. The results section showcases the design solution—MRT-integrated mobile health units—while drawing parallels to the urban context of Dhaka. This is followed by a discussion on the broader implications of architecture in crisis, examining both strengths and challenges of such integrated models. The final section concludes with key insights and lays out directions for future urban-health design strategies.

Materials and Methods

The initial phase began by identifying the nature of the crisis the design intends to respond to—primarily pandemic-related challenges—and how architecture can play a proactive role in health emergency management. The hypothesis driving this study is that healthcare infrastructure, even in well-funded systems like that of the U.S., has proven inadequate in times of crisis due to its rigid, centralized structure. A comparative review of national and global responses to past pandemics supports this claim.

The research method is segmented into four key steps (Table 1):

Table 1. Research Methodology.

	Methodological Step	Purpose	Output
1	Literature Analysis and Case Study	Establish theoretical foundation and precedent strategies using literature and global case studies.	Flexible, modular design principles and strategic insights for health-integrated public space.
2	Comparison and Typological Mapping	Categorize and evaluate case studies based on adaptability, context, and crisis responsiveness.	Typological matrix for comparative evaluation of healthcare infrastructure.
3	Contextual Sorting	Filter relevant case studies to align with Miami's demographic, infrastructural, and environmental needs.	Site-specific case study selection and relevance mapping.
4	Scenario Building and Prototyping	Develop design interventions through crisis scenario analysis, site modeling, and contextual validation.	Crisis-responsive design prototypes and context-sensitive architectural models

Literature Analysis and Case Study

This study is grounded in an evolving body of literature that addresses healthcare capacity building, crisis-responsive architecture, and adaptive spatial systems. Although the idea of flexible and modular architecture in emergency contexts is not new, recent global events—particularly the COVID-19 pandemic—have dramatically shifted its urgency and application. A range of literature was reviewed, from theoretical frameworks to precedent case studies, with an emphasis on spatial resilience, modular healthcare deployment, and public integration.

Key texts include Rethink Design Guide: Architecture for a Post-Pandemic World (RIBA Publishing), which provides a comprehensive strategy to reconfigure public and healthcare spaces in response to COVID-19. Thomas Fisher's Space, Structures and Design in a Post-Pandemic World further explores how design norms must evolve in everyday architecture. Meanwhile, The Pandemic Effect by Blaine Brownell compiles insights from ninety global experts on how cities and buildings must transform to withstand future crises.

Flexibility as a design principle was also central to this research. David and Robert Kronenberg's Flexible: Architecture that Responds to Change outlines historical and conceptual perspectives on adaptability, proposing that buildings must be capable of adapting, transforming, moving, and interacting with their context. Their insights reinforce the architectural argument for modularity, particularly in health infrastructure, where rigid typologies often fail during crises.

This research also drew from global case studies that redefine the relationship between hospitals and public infrastructure. OMA's Al Daayan Health District in Qatar, for instance, proposed a horizontally expandable hospital system with modular components, including prefabricated nursing units and 3D-printed corridors. The design integrates open courtyards not only for healing but also for medicinal plant cultivation, turning healthcare infrastructure into part of the ecological and social fabric (Stouhi, D., 2022).

Le Corbusier's unbuilt Venice Hospital offered another provocative model. Based on the mat-building concept, it dissolved the boundaries between hospital and city through interconnected courtyards and clustered room arrangements. Rather than enforcing sterile separation, it invited openness, air, and community into the healthcare experience, blurring the institutional edges (Yoon, E., & Lim, Y. , 2020).

Archigram's Plug-In City imagined architecture as a living system—mobile, responsive, and reconfigurable—offering a visionary approach that informed this study's emphasis on modularity and prefabrication at the urban scale. Similarly, Cedric Price's Thinkbelt proposed using obsolete rail infrastructure for a network of movable learning and healthcare modules. Both projects emphasize adaptability as a civic quality, suggesting that flexibility must be embedded in infrastructure, not retrofitted into it. (Aureli, P. V., 2011) (Cook, P., 1999)

Collectively, these studies helped frame the architectural strategy of this paper: to design modular healthcare nodes connected to public transit that could operate across emergency and non-emergency conditions. The literature offers both the rationale and reference models for thinking of healthcare not as a destination, but as a distributed, mobile, and embedded civic function.

Contextual Sorting Scenario Building and Prototyping

Selected case studies were categorized based on flexibility, modularity, response time, context relevance, and crisis scale. This comparative matrix allowed for identifying typologies of effective healthcare responses during COVID-19 and similar emergencies.

Case studies were filtered and refined to match the specific site conditions of Miami. The goal was to select precedents that align with the local demographic, environmental, and infrastructural challenges.

Design interventions were proposed by analyzing crisis scenarios and site-specific data. Using diagrams and modeling tools, the research visualized potential architectural outcomes, ranging from portable mobile healthcare units to hybrid public-health spaces that operate between hospitals and civic environments. The design process included site analysis, problem definition, scenario development, and design evaluation. Final solutions were tested against sociocultural context and community needs to ensure validity and responsiveness.

Study Area and Site Justification

The guiding question behind this research is how healthcare facilities can be expanded or reimagined to respond effectively during the next major health crisis. The initial phase of the study involved mapping U.S. cities most susceptible to future health crises, environmental threats, and demographic stressors. A vulnerability index, incorporating metrics like population density, healthcare infrastructure, and senior population rates, was used to evaluate potential sites. Among these, Miami, Florida, surfaced as a high-priority zone for both its critical exposure and intervention prospects. (Figure 6)

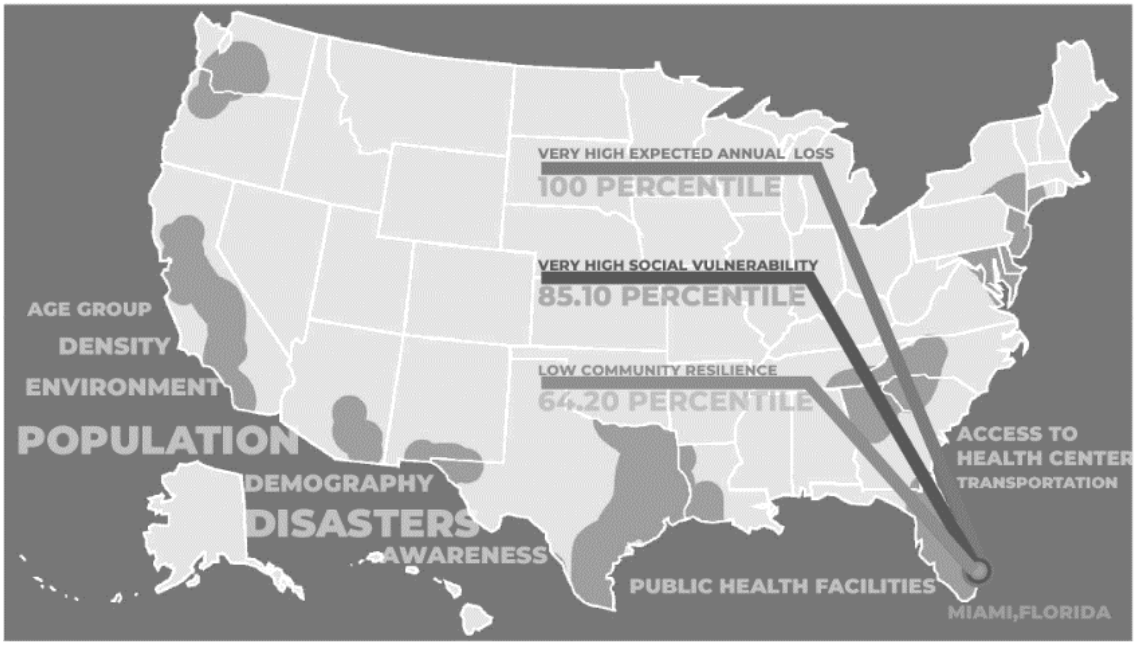


Figure 6. Site Selection Parameters (Developed by Author)

Though this research looks toward scalable, global outcomes, the U.S. provided a clear context where public health, mobility, and environmental challenges meet. Miami quickly rose as a fitting site—one where the urgency of the problem is matched by the infrastructure to test new ideas. Coastal and aging, the city is increasingly exposed to hurricanes, sea-level rise, and the realities of an older population. These conditions don't just threaten infrastructure—they affect people's lives, especially during a health emergency. The presence of one of the nation's largest medical hubs—the Miami Health District (Figure 7) —further strengthens its case as a launch point for new healthcare design interventions that are resilient, inclusive, and forward-thinking.

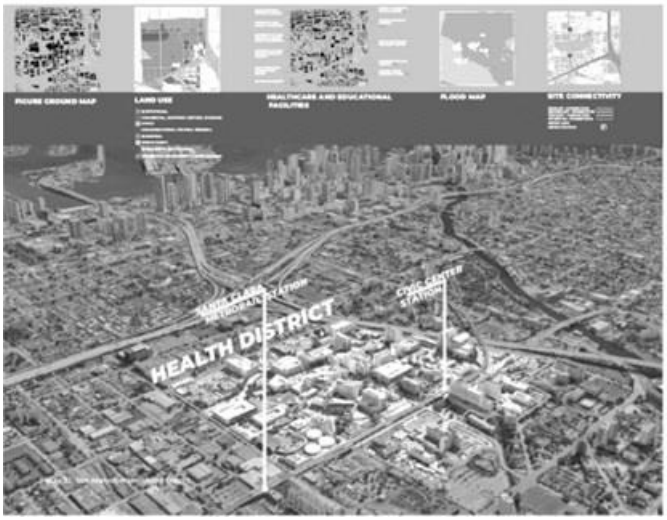


Figure 7. Site Analysis: Miami Health District (Developed by Author)

To better understand Miami's readiness, the research examined its current crisis management framework and assessed its strengths and limitations in dealing with public health emergencies. A hypothetical yet contextually grounded scenario envisions Miami being struck by a Category 5 hurricane in 2025, with wind speeds reaching 205 mph and leaving the city devastated. Though speculative, this projection mirrors the growing intensity of climate-related events already impacting the region.

Figure 8. Miami Elevated Metro Rail (Source: Miami Herald)

Given this backdrop, the study applies a layered analysis to evaluate how a city like Miami could adapt its infrastructure to withstand and respond to dual crises—climate and health. By understanding the city's demographic makeup, geographic exposure, and healthcare network (Figure 9), the research positions Miami as a laboratory for testing a scalable, modular, and mobility-integrated healthcare solution. Ultimately, the selection of Miami is not only driven by its risks but by its potential. The integration of mobile healthcare hubs with the city's Metrorail (MRT) system offers a pathway toward more distributed, accessible, and responsive emergency care, especially for underserved or immobile populations. This site-based approach anchors the conceptual design in real-world urgency, where architecture must engage both infrastructure and community in shaping a resilient future (Staletovich et al., 2022).

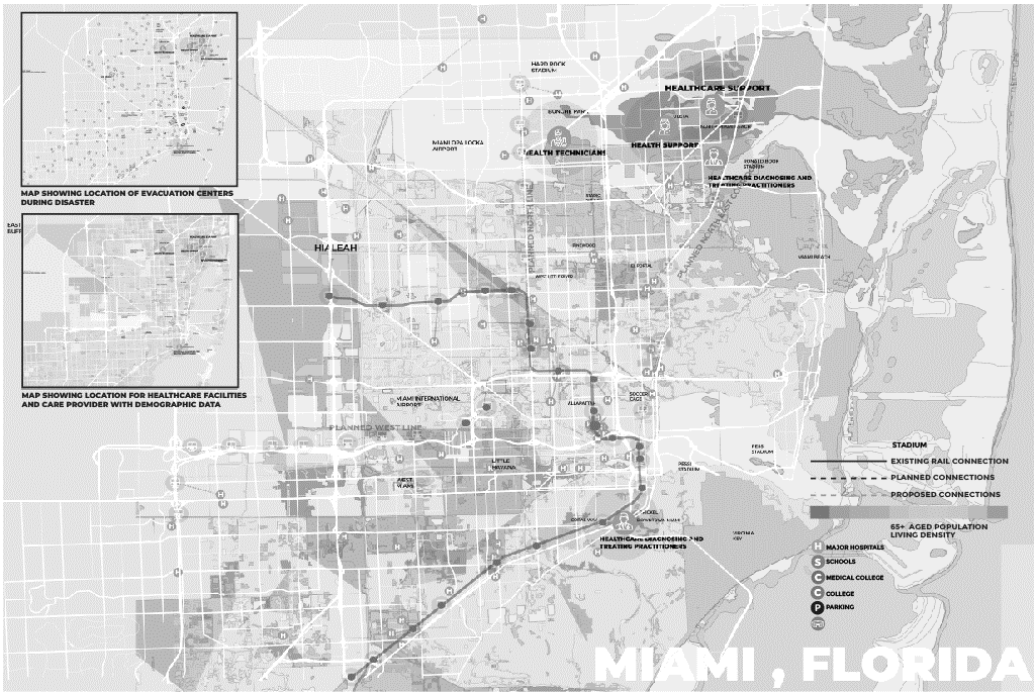


Figure 9. Site Analysis for Miami, Florida, based on the residence of healthcare providers and facilities, and connection to the MRT (Developed by Author)

Risk Mapping and Urban Vulnerability Assessment

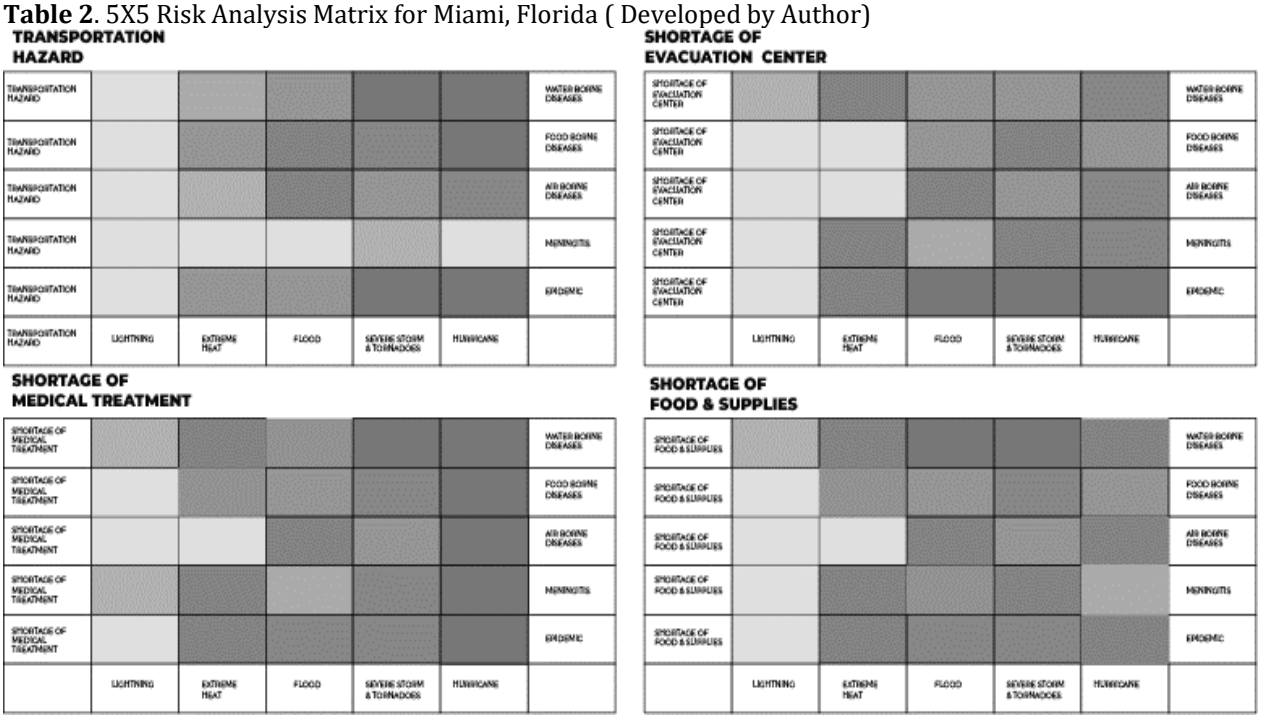
This study explored Miami's vulnerabilities to rising seas, climate-related disasters, and pandemics through the structured lens of the 5x5 risk matrix from the Department of Defense. This matrix guided the evaluation of Miami's crisis response across health, transportation, disaster management, evacuation, and healthcare capacity (RiskFactor, 2024).

Figure 10. Analysis of Miami's Flood Scenario

Two central scenarios anchored this analysis, both emphasizing Miami's elderly population, a group increasingly at risk (Figure 10). First, during floods or hurricanes, how could elderly residents safely access distant evacuation centers or hospitals? Second, in a health emergency, how could essential medical staff living far from healthcare facilities quickly reach their workplaces?

By concentrating specifically on Miami's Health District—one of the largest medical and research hubs in the United States—the study explored new ways to integrate healthcare facilities with public spaces and transit networks. A detailed analysis of demographic patterns, flood risk zones, and transportation infrastructure revealed critical gaps and opportunities. These insights positioned Miami as an ideal testing ground for innovative architectural solutions that enhance adaptability, accessibility, and community resilience during future crises.

Table 2. 5X5 Risk Analysis Matrix for Miami, Florida (Developed by Author)



From Research to Design: Scenario Testing and Modular Prototypes

This chapter translates the theoretical groundwork and site-specific research into tangible architectural proposals, emphasizing modularity, adaptability, and scenario responsiveness. The goal is to create an innovative healthcare infrastructure that operates seamlessly across everyday and crises, bridging the gap between healthcare facilities and the public realm.

At its core, the design explores creating a dynamic and transformable spatial system, situated between healthcare facilities and public spaces. This intermediary environment serves multiple roles, easily shifting functions according to community needs or crisis conditions. (Gow, 2022) The design is built around three interchangeable programmatic scenarios (Figure 11):

Table 3. Conceptual Framework of Proposal Idea

Conceptual Framework		
A Space for Community Engagement	**A Space for Crisis Preparation**	**A Space for Crisis Management**
Initially, this area functions as a vibrant public space—imagine a gym, community park, or cultural center. It is intentionally flexible and adaptable, encouraging community interaction and public health awareness. It integrates complementary healthcare activities such as counseling and rehabilitation, which have social value beyond medical treatment. During non-crisis periods, it is essentially a civic space where public engagement and preventative health activities flourish. (AMA,2019)	When a crisis looms, the flexibility embedded within the design enables rapid transformation of the community-focused space into a crucial support hub for nearby healthcare facilities. At this stage, the space expands healthcare capacity by serving as patient care units, quarantine zones, additional staff accommodation, or even storage areas for medical equipment and emergency supplies. The key strength here is modularity: the facility can swiftly adjust according to immediate needs, effectively expanding the healthcare infrastructure before the full impact of the crisis.	In extreme situations, such as severe pandemics or major natural disasters, the facility transitions fully into an emergency care unit. Here, the space's modular nature is pushed to its full capacity, providing critical care services tailored specifically to the crisis at hand. It becomes an integrated part of the healthcare infrastructure, operating as an essential medical resource directly responding to the severity and urgency of the situation.

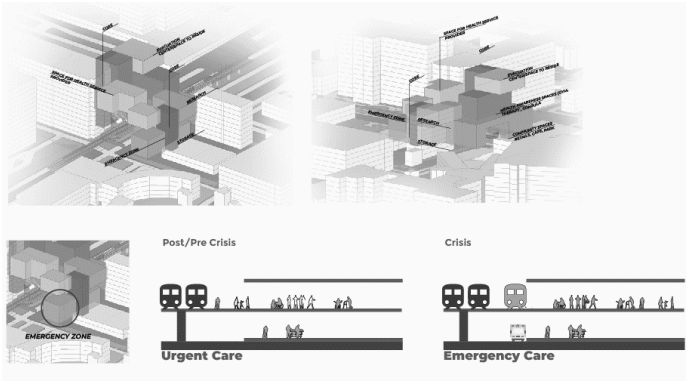


Figure 11. Initial Site-Specific Conceptual Development for the design

Recognizing Miami's vulnerability to flooding, the scenario considers the facility's physical and operational resilience during severe weather events. The core design strategy integrates elevated rail (MRT) infrastructure, ensuring continued operation even in flood conditions. By situating critical healthcare services at elevated levels, the design ensures uninterrupted medical care during floods, preserving critical connectivity between healthcare facilities and transportation nodes. Given the increasing risk of sea-level rise in Miami's health district, the design incorporates a strategy for relocating facilities inland, leveraging existing elevated rail infrastructure and replicating this resilient healthcare network throughout vulnerable urban areas.

Results

Urban Challenges in Miami: Aging Populations and Service Gaps

Miami presents a unique combination of urban vulnerabilities, primarily driven by two interconnected factors: an increasingly elderly population and growing environmental risks due to climate change. As more retirees continue to settle in Miami, the city's healthcare system faces growing demands. For elderly residents living far from main hospitals and medical hubs, accessing timely care becomes even harder, particularly during crises.

Our detailed demographic mapping revealed that these vulnerable populations are primarily concentrated in zones with limited transportation and high exposure to flooding and hurricanes. Miami's existing healthcare infrastructure, while robust in some central areas such as the Health District, does not adequately reach these peripheral communities, leaving them underserved precisely when help is most critically needed. (Figure 12)

Figure 12. Hypothetical Scenario Analysis: Miami Flood Scenario and Its Impact on the Aging Population's Access to Health Facilities, and an Alternative Solution Using Health Facilities. (Source: Prepared by Author)

Replicable Healthcare Units Linked to MRT Infrastructure

To directly address these identified challenges, we developed an architectural proposal involving modular healthcare units strategically integrated into Miami's existing elevated Metrorail (MRT) infrastructure. These modular units offer transformative capabilities, rapidly converting public spaces at MRT stations into temporary healthcare hubs. During non-crisis periods, these spaces serve as community engagement centers, offering services such as rehabilitation, preventive care, and health education.

During emergencies, these same spaces transform seamlessly into patient care units, quarantine centers, medical supply hubs, and temporary shelters for healthcare workers. Their integration with the MRT system ensures critical connectivity, enabling quick mobilization of medical resources and personnel across the city. This modular and transit-oriented design significantly closes the existing gap between healthcare facilities and underserved communities, allowing rapid, targeted response in crises.

Simulation Outcomes: Flood-Resilient, Transit-Ready Design

Simulation scenarios specifically considered the dual threats of hurricanes and severe flooding events, common to Miami. Using Miami's Civic Center Station as a primary testing site, we explored design solutions to maintain operational resilience under extreme conditions. Our scenario testing validated that elevating healthcare functions within MRT-linked modules ensures continuous service delivery, even when lower-lying areas become inaccessible due to floods.

The simulations highlighted several benefits, including accessibility, operational resilience, and community Integration. MRT-linked modules facilitated rapid evacuation and the timely arrival of medical personnel, and elevated healthcare modules remained functional during flood events, ensuring uninterrupted critical care. In non-crisis times, units effectively served community wellness, enhancing public health outreach. This design methodology demonstrates a robust, flexible, and scalable model of healthcare infrastructure, uniquely capable of adapting dynamically to changing environmental and urban conditions.

Dhaka as a Parallel Context: Health Infrastructure in the Global South

Dhaka represents a reality familiar to many cities in the Global South: crowded neighborhoods, frequent flooding, and severe traffic congestion that can make even routine healthcare access a challenge. During emergencies, these challenges become dangerous obstacles, significantly delaying critical medical responses and endangering lives. By examining Dhaka alongside Miami, we aimed to ensure our design was not only innovative but genuinely meaningful and responsive to communities around the globe.

Drawing inspiration from historical precedents, such as the Bhopal Gas Tragedy (Figure 13)—where trains became crucial lifelines in emergency healthcare delivery—we propose leveraging Dhaka's newly developing MRT infrastructure for modular healthcare deployment. (Broughton, 2005)

Figure 13. Historical Link: Bhopal Crisis & Railway-Based Medical. The 1984 Bhopal Gas Tragedy saw Indian Railways used to deliver emergency medical aid, turning train platforms into makeshift hospitals. (Image by Bhopal Medical Appeal, Martin Stott)

Stations like Shahbagh, strategically located near major hospitals, could become essential emergency healthcare nodes. Modular healthcare units positioned at these MRT stations could provide immediate crisis care,

rapidly deployed and operationalized (Figure 14). This approach dramatically reduces response times, enhances patient accessibility, and strengthens urban resilience.

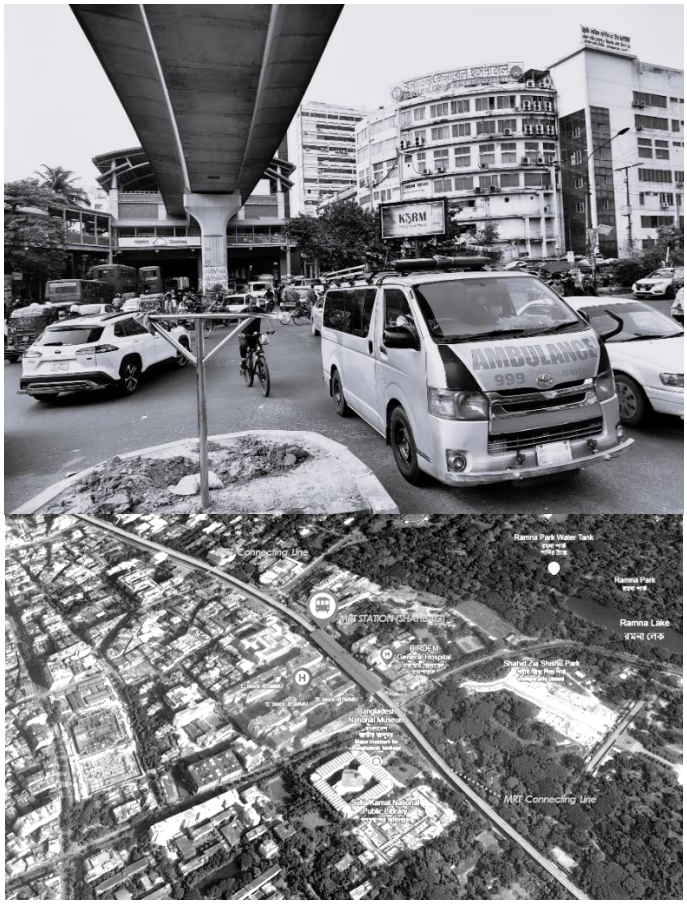


Figure 14. The major part of Dhaka, an important node with MRT and major hospitals, faces critical delays in emergency care due to severe traffic congestion and poor healthcare accessibility.

Our findings strongly indicate that modular MRT-integrated health systems are universally applicable and particularly impactful in cities experiencing rapid urbanization, infrastructure constraints, and significant vulnerability to natural and health disasters. Adapting such innovative, flexible designs globally could significantly enhance preparedness and responsiveness, transforming urban transit nodes into critical lifelines during times of crisis.

Discussion

Architecture as a Tool for Crisis Preparedness

Throughout this study, architecture emerged clearly as more than just a passive container for services—it became a dynamic and proactive agent in crisis management. Traditionally, healthcare facilities are static and rigid, designed for predictable operations rather than rapidly changing scenarios. However, recent global crises, especially the COVID-19 pandemic, have revealed the urgent need for adaptable, flexible, and responsive designs. By integrating modular healthcare units within public transportation hubs, this research demonstrates how architectural solutions can swiftly transition between everyday community needs and emergency healthcare provision. The Miami Civic Center MRT-linked units illustrate a promising pathway: spaces that seamlessly switch from vibrant public realms to essential medical care units during times of urgency. In essence, this approach redefines architecture's role—from passive infrastructure to active resilience-building tool.

Our research highlights the profound potential of integrating healthcare with existing public infrastructure to enhance equitable access. In cities like Miami, many elderly residents and underserved communities often face significant hurdles in accessing timely medical care, particularly during emergencies. By embedding healthcare facilities directly into public transit systems, we not only bring medical services closer to vulnerable populations but also ensure continuity of care during environmental or health crises. This approach transforms public transit nodes from mere commuter spaces into critical lifelines, substantially reducing disparities in healthcare accessibility. Moreover, because these public spaces are already integral to daily life, community acceptance and interaction with healthcare services become more natural and seamless, fostering a stronger overall sense of social equity

From Miami to Dhaka: Lessons, Limitations, and Transferability

The primary testing ground for this research was Miami. The fundamental challenges addressed—aging demographics, climate vulnerability, transportation gaps, and healthcare accessibility—resonate deeply with other urban centers worldwide, particularly in the Global South. Dhaka, Bangladesh, emerged as a valuable parallel context for exploring global scalability. The dense urban fabric, regular flooding events, and chronic traffic congestion in Dhaka mirror many of Miami's challenges, albeit intensified by resource constraints and infrastructure gaps typical in rapidly urbanizing cities.

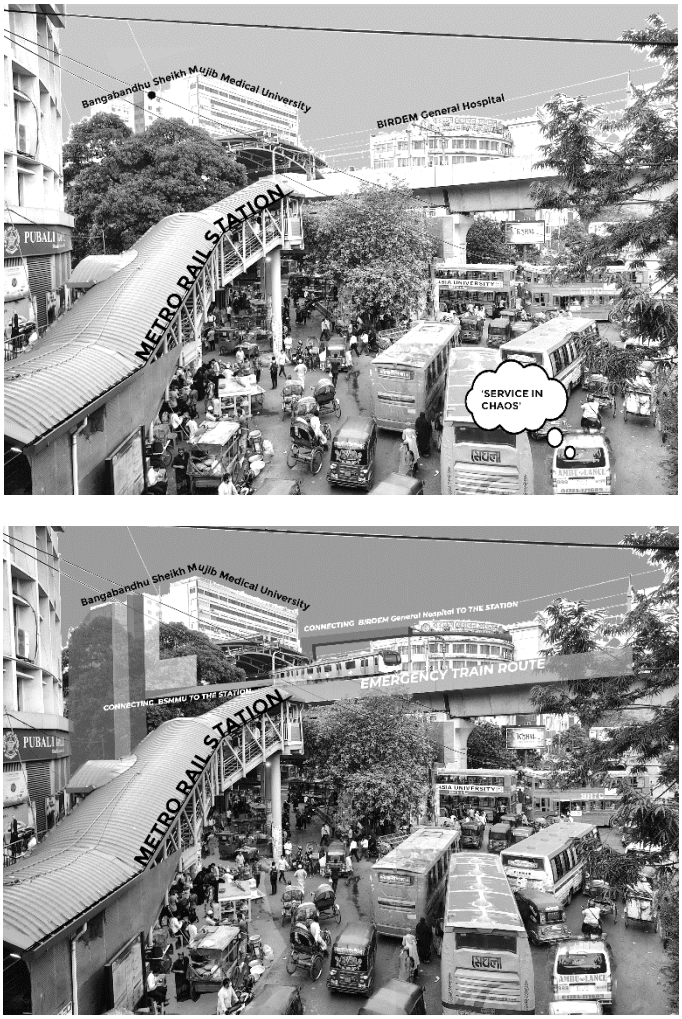


Figure 15. Possible Scenario Analysis in Dhaka: Integrating Metro rail in Shahbagh to adjacent healthcare facilities to increase the efficiency of patient mobilization (Developed by Author).

Despite differences in cultural context, governance structures, and available resources, the core principles of modularity, adaptability, and transit integration hold significant promise in Dhaka. However, several critical limitations and challenges must be recognized. Implementation in Dhaka and similar cities would require tailored local adjustments, including careful consideration of infrastructural capacities, community engagement strategies, financial sustainability, and local disaster management frameworks. Thus, while Miami serves as an effective model, successful global transferability demands flexibility, context-sensitive design adjustments, and collaborative partnerships across multiple stakeholders.

Global Implications: Toward a Scalable, Civic-Embedded Health System

The insights from Miami's case study and the parallel scenario testing in Dhaka underline the global potential of civic-embedded healthcare infrastructure. This research illustrates a universal truth: traditional healthcare delivery, isolated from everyday urban life, falls short during emergencies. Instead, we must move toward flexible, modular, and community-integrated healthcare designs that leverage existing civic resources, particularly public transportation, to deliver equitable and resilient health services worldwide.

Historical precedents, such as the Bhopal Gas Tragedy, where trains became critical lifelines, reinforce the validity of this strategy. By embracing modular healthcare units integrated into transit stations, cities globally can quickly respond to diverse crises, enhancing preparedness and significantly improving health outcomes, especially in underserved or disaster-prone areas. The modular MRT-linked health units proposed here are

scalable, replicable, and adaptable, offering a versatile blueprint for cities facing varying degrees of urbanization, resource constraints, and environmental threats.

Ultimately, this research advocates a new paradigm: one where architecture does not merely shelter health services but actively integrates them within the civic fabric. By embedding resilience directly into urban infrastructure, we can better safeguard communities and foster long-term, sustainable health outcomes globally.

Conclusion

This research has shown that metro stations can be more than just transit points—they can become vital support systems during times of crisis. By rethinking healthcare not as something locked inside a distant facility, but as something that moves with the city, we explored how to embed care directly into public infrastructure. Miami, with its climate risks, aging population, and uneven access to health services, offered the right mix of urgency and opportunity to bring this vision to life. By closely examining Miami's specific risks and resources, we illustrated how cities can proactively integrate healthcare with everyday civic life.

What this study showed is simple but powerful: cities can—and should—do more with the spaces we already use every day. By turning transit stations into healthcare-ready spaces that serve both public life and emergency healthcare, we're not just improving access—we're making cities more human and more prepared. It's a way to make healthcare more accessible, especially for those who need it most. This isn't just a design solution—we're proposing a city that's more responsive, more inclusive, and ultimately more prepared for whatever comes next. It's a shift in how we think about equity, resilience, and the role of public space.

Although promising, our proposals remain theoretical. For this concept to become reality, Real-world testing, prototyping, and careful evaluation are essential to truly understand how this system would function—logistically, financially, and operationally. Its success also depends on how well it adapts to different urban conditions, which vary widely depending on local governance structures, infrastructure limitations, and how communities interact with public healthcare.

While Miami provided the initial context, our approach holds global potential. A preliminary parallel analysis for Dhaka, Bangladesh—a city facing similar yet distinct urban challenges—suggests significant applicability. Although Dhaka differs in its density, resource availability, and infrastructural constraints, the core design principles of modularity, flexibility, and transit integration remain relevant. Applying similar scenario analysis methods to Dhaka can demonstrate how modular healthcare strategies could effectively mitigate disaster risks and enhance healthcare accessibility in diverse global contexts.

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Conflict of Interests

The author(s) declare(s) no conflict of interest.

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