

FUTURE-PROOFING HEALTHCARE INFRASTRUCTURE STRATEGIES

for Resilience and Adaptability



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Future-Proofing Healthcare Infrastructure Strategies for Resilience and Adaptability

The COVID-19 pandemic has starkly highlighted the vulnerabilities in global healthcare infrastructure, revealing the necessity for facilities that can quickly adapt to unprecedented challenges. As we reflect on the lessons learned, it becomes evident that healthcare systems must not only respond effectively to immediate crises but also proactively prepare for future pandemics and natural disasters. This calls for a transformative approach to healthcare design and management, prioritizing flexibility, sustainability, and resilience to protect both patient welfare and healthcare continuity in the face of potential disruptions.

RIGHT | Contemporary healthcare environments incorporate systems and features, such as adjustable lighting that varies with the time of day and quieter fire alarms in patient zones, that directly enhance patient care.





Addressing Pandemic-Induced Shifts

The impact of the COVID-19 pandemic has changed the design landscape. Now, the emphasis is on creating adaptable spaces that address emerging healthcare challenges. The challenge is meeting established or planned budgets while anticipating and preparing for the unknown. Below are strategies healthcare organizations should consider when addressing their resiliency plans.

Flexible Facility Components

A crucial aspect is designing flexible facility components that can swiftly switch to “pandemic mode”—a setup where specific wings or units operate with 100% outside air (OA), adjusting to create negative pressure in sick patient areas while maintaining positive pressure in core areas for medical personnel. This method ensures the safety of nurses, doctors and patients by preventing the recirculation of contaminated air.

Addressing Utilities Capacity Challenges

Adapting to 100% outside air usage can strain existing hospital utilities systems, as chilled water plants may lack the necessary reserve capacity. Various solutions may be implemented, such as increasing temperature setpoint in non-critical zones and possibly turning off non-essential systems as needed to reduce cooling demands. Such solutions free up capacity to maintain essential ventilation and pressure control in isolated patient rooms and ICUs.

Strategic Load Shedding and Environmental Control

It is vital to have a well-defined load shedding plan that identifies which areas can endure higher temperatures when required. Although not all spaces require cooling by code, it’s crucial to sustain proper conditions in critical care units for the safety of patients and staff. Effective planning is necessary to balance energy consumption, indoor air quality, and thermal comfort,

particularly during emergency situations. Centering the conversation on the impact on individuals in these spaces helps align interests and drive home the importance of these decisions.

Climate and Natural Disaster Resilience

Healthcare facilities need to be designed to withstand and quickly recover from extreme weather events like hurricanes, tornadoes, and seismic disturbances, which pose significant risks to healthcare services and the safety of patients and medical staff. Below are key strategies to enhance climate and natural disaster resilience:

Optimizing HVAC and Building Design

The integration of HVAC systems with the building envelope—walls, windows, roofs, and foundations—is critical. This coordination helps regulate temperatures,

maintain air quality, and manage moisture intrusion, reducing HVAC strain not only during severe weather but also boosting overall energy efficiency. An integrated design approach incorporating higher insulation R-values, correctly placed vapor barriers, better glazing, and shading will prevent the building from becoming overly energy-intensive.

Cost-Effectiveness of Resilient Design

Although initially more expensive, resilient designs—like structural reinforcements, base isolation systems, or designing for higher seismic loads—result in significant long-term savings. Building beyond standard codes enhances safety and minimizes future costs related to damage and disruptions. Healthcare facility owners should weigh these long-term benefits against the initial costs, considering reduced damage and quicker recovery times.

Adapting to Evolving Building Codes

Building codes are continually updated to reflect new research and past disaster lessons. However, the slow pace of updates can lead to inconsistencies and increased costs. Building codes often represent the bare minimum, and relying solely on them may not provide adequate resilience. Designers and owners should consider site-specific factors and the criticality of the structure to determine suitable resilience measures. Employing a risk-based approach can result in more resilient and cost-effective solutions. For example, a critical access hospital that serves as a top trauma center might benefit from installing chilled water backup power, even if not required by code, to ensure patient safety during power outages.

ABOVE LEFT | *The integration of HVAC systems with the building envelope—walls, windows, roofs, and foundations—helps regulate temperatures, maintain air quality, and manage moisture intrusion, reducing HVAC strain not only during severe weather but also boosting overall energy efficiency.* ABOVE RIGHT | *With rapidly increasing demand and need for low voltage systems, healthcare leaders must embrace design principles from cutting-edge data centers and telecom facilities because these systems are mission critical.*

Futureproofing in Healthcare Technology

As healthcare technology demands grow, small spaces once used for telephone closets are now large Integrated Distribution Frame (IDF) rooms. This change highlights the need for foresight in planning healthcare facilities. Effective futureproofing requires collaboration with architects and a deep understanding of growth projections to ensure today's technology stays relevant and functional in the future. Here are three key strategies to achieve this:

Integrating Advanced Systems for Enhanced Patient Care

Contemporary healthcare environments are incorporating systems that directly enhance patient care. This includes features like adjustable lighting that varies with the time of day and quieter fire alarms in patient zones. Planning for the future involves preparing for changes in infrastructure that support both current and emerging technologies.

Adapting Design Principles from Data Centers and Telecom Facilities

With rapidly increasing demand and need for low voltage systems (connected smart building controls, expanding electronic medical records systems, security, personnel tracking, IT networks and advancement in AI potentially layering on top of it all), healthcare leaders must embrace design principles from cutting-edge data centers and telecom facilities because these systems are mission critical. This approach includes ensuring that critical power and building management systems are equipped with robust battery backups to maintain operations during unforeseen disruptions.

Facilitating Stakeholder Engagement

When engaging stakeholders in healthcare infrastructure planning, prioritize resilience and preparedness over immediate cost concerns. It's crucial to emphasize in meetings and workshops that investments in infrastructure not only prepare facilities for emergencies like pandemics but also promote long-term sustainability. Highlight how these investments ensure continuous service and protect against future disruptions to align stakeholders with the strategic vision. Advise clients on prioritizing resilience investments that offer clear financial returns. For other measures, underscore the benefits of environmental stewardship and the positive community impact to foster greater stakeholder buy-in.

Embracing a Comprehensive Approach to Healthcare Resilience

Incorporating lessons learned from pandemics and natural disasters into healthcare infrastructure is more than a necessity—it's a strategic imperative. By embracing advanced technologies, improving stakeholder engagement, and adopting resilient design principles, healthcare facilities can not only withstand future crises but also emerge stronger and more prepared. This holistic approach ensures that healthcare infrastructure not only meets the immediate needs of patients and staff but also empowers healthcare leaders to adapt to evolving challenges, ultimately leading to a safer, more sustainable healthcare environment for everyone involved.

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