

# Designing for Safety and Beauty

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By DENIS HECTOR AND DOUGAL HEWITT

**T**he Great Chicago Fire of 1871 killed several hundred people and left 100,000 homeless. Fed by the strong winds and the wood widely used to construct sidewalks, streets and buildings — wood baked dry during a rainless summer — the conflagration wiped out the central business district. Three Catholic hospitals served the city's residents at the time of the fire. The Alexian Brothers Hospital, rebuilt just three years earlier, was one of the more than 17,000 structures destroyed.

The city's remaining hospitals were overwhelmed. These included Mercy Hospital, which had relocated in 1863 to the city's fringe (a decision that brought derision at the time), along with a hospital operated by the Daughters of Charity. The Daughters' hospital was fortuitously spared as the winds changed, driving the flames toward the lake and away from the hospital site. The sisters at both surviving hospitals opened their buildings to serve the injured as well as the homeless, providing medical care and disaster relief.<sup>1</sup>

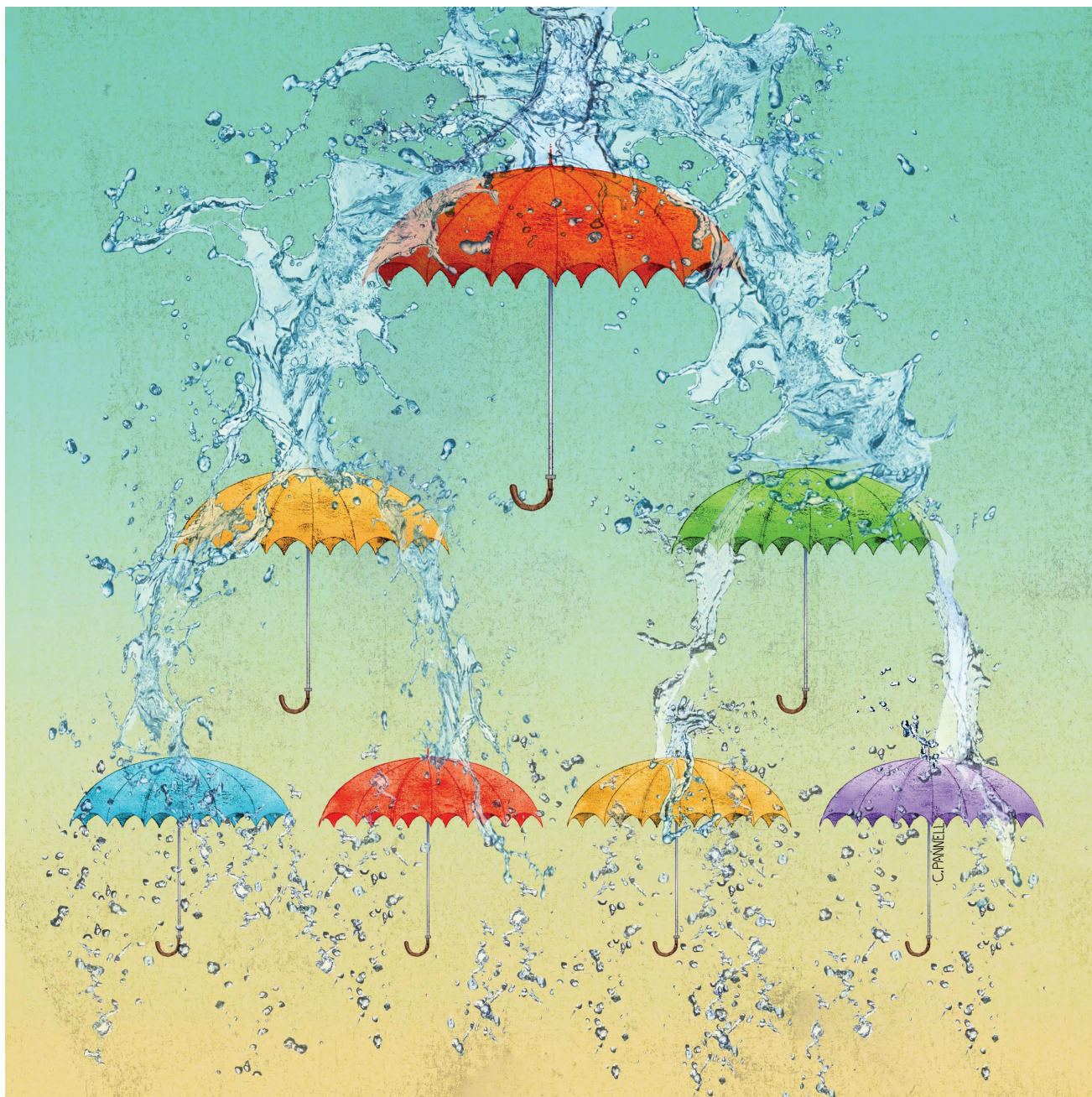
Disasters like the Great Chicago Fire prompted advancement of building codes and infrastructures aimed at protecting people from harm. In

ensuing decades, hospital design continued to evolve to accommodate an ever-growing body of new technologies, new types of surgery and changes in patient care. More recently, architects have begun designing hospitals to reflect growing evidence that attention to beauty and efforts to connect hospitals more closely to surrounding neighborhoods promote healing and offer benefits not only to patients, but also to families, communities and staffs.<sup>2</sup>

Today, as the number and intensity of disasters mount, it is increasingly apparent that hospital design must renew its focus on strengthening infrastructures for safety. Across the landscape of health care, there is an urgent need for an organized, communitywide approach that evaluates the potential impact of a variety of hazards and then develops strategies — both physical and social — for resilience.

Nearly half the population in the United States, for example, lives directly along the Pacific, Atlantic and Gulf coasts,<sup>3</sup> facing the challenges of rising sea levels, storm surges and flooding. Across the U.S., as most recently seen in Colorado, rivers and creeks can spread floodwaters

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across wide areas. The National Oceanic and Atmospheric Administration has mapped almost 100 river gauges throughout the midsection of the U.S. with a greater than 50 percent chance of flooding during the August-October 2013 time frame.<sup>4</sup>

Natural hazards extend beyond flood plains into earthquake zones, Tornado Alley and areas prone to sub-

sidence, mudslides and wildfires. Catastrophic weather events ranging from storms to deadly heat waves to blizzards can strike almost anywhere.<sup>5</sup>

As the Daughters of Charity and the Sisters of Mercy found during and after the Chicago Fire, communities view hospitals as safe harbors. Yet disaster can overwhelm and incapacitate a hospital, along with the commu-

nity around it. The compelling video, “Katrina — Nature at Its Worst. Nursing at Its Best,” produced by the Louisiana State Nurses Association, the Mississippi Nurses Association and Johnson & Johnson, illustrates these conditions in hospitals in New Orleans and Bay St. Louis in the wake of Hurricane Katrina.<sup>6</sup>

Hurricane Katrina unequivocally



demonstrated that generators should be placed above the reach of flood waters. Other changes, such as direct helicopter access, and even something as simple as operable windows, would have helped to offset harmful conditions in New Orleans, where, in addition to the devastation caused by flooding, temperatures rapidly rose inside hospitals and other buildings.

Eight years later, the remnants of Hurricane Sandy hit New York City and the surrounding region. When the storm knocked out power and the backup generators located in a flood zone failed, an evacuation plan ensued. The damage was predictable and affected not only the immediate patient population but the communities served.

As health care leaders are called upon to extend their reach under health reform — to treat not only patients in a facility, but also to attend to the well-being of communities — medical centers are increasingly looked to as partners in public health. The resilience of an institution in the face of disaster is critical, especially in light of the imminent “silver tsunami.” Growth in the nation’s vulnerable aging population will only increase health care’s critical role. Just as health care professionals assess community health needs, they must assess their own institutions in relation to their risks in terms of providing care during and after disaster.

The science of risk is clearer than the science of prediction — and every institution should develop a reliable map of its risks. The starting point is thorough hazard assessment mapping and analysis, closely focused on the facility’s specific location. Every institution, for example should have a detailed understanding of its own ground-floor elevations in relation to flood zone conditions, using the most current information from the Federal Emergency Management Agency (FEMA). Over the last several years, FEMA has been working on a massive review and update of all its flood maps, provoking fundamental reconsideration of flood risks across the country, clarifying risks and probabilities.

Similarly, FEMA has worked with the U.S. Geological Survey and the Building Seismic Safety Council, of the National Institute of Building Sciences in Washington, D.C., to produce maps to assist in understanding seismic design

parameter values.

In addition to considering location-specific hazards such as floods, earthquakes and subsidence, there are climatic conditions such as windstorms, snow and heat events, all of which can be quantified from a risk perspective. Consideration of each of these conditions yields corresponding measures in site planning, as well as architectural and engineering interventions that can reduce harmful impact. Understanding the range of risks and specific impacts on both the population and the institution in terms of health care needs in the

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face of a disaster event is fundamental in order for the institution to effectively develop a strategy to assure uninterrupted functioning.

#### **RESILIENCE ANALYSIS AND PLANNING**

Once the risks have been mapped and analyzed, a facility’s ability to function in the midst of a disaster can be assessed. A vulnerability and resilience analysis examines every hazard and risk in the context of the current facility, its site, neighborhood and region, considering each of the facility’s components in terms of architecture, engineering and infrastructure, both physical and human. The analytical process reviews buildings’ floor elevations, operable windows, daylight accessibility, distances to helipads, locations of generators and fuel, as well as access to potable water and systems of waste disposal. Beyond the buildings, a context vulnerability and resilience analysis examines the interconnections to neighborhoods and accessibility, both physical and virtual. Staff needs are integral. An analysis that reviews the commuting paths and distance of staff, the capabilities of an emergency event team and the potential needs of their families, will enable a clear assessment of a facility’s vulnerabilities and resources in advance of, during and after disaster.



Ideally, precise and focused hazard assessment mapping and analysis, along with thorough analysis of vulnerability and resilience, can be worked into a plan for the institution that addresses each potential hazard in relation to the level of threat and correlates the level of resilience required to meet that threat. Each risk is considered in the context of an event's potential duration and aftereffect in order to determine how long a facility may need to maintain functions without any external support.

It is fundamental to engage staff in developing an institutional resilience plan. A participatory process brings forward a range of ideas, and it encourages staff members to consider planning from an institutional as well as individual perspective. FEMA offers an array of online courses for staff through its national Incident Management System.<sup>7</sup>

A thorough resilience plan also includes community engagement. Planning in concert with regional and local emergency management groups contributes to better understanding of the responsibilities and capabilities of every entity, and including neighbors and community groups in planning enables shared understanding of how the hospital is prepared to deal with disaster.

Further, engaging across institutions with neighboring health care facilities, schools, churches and others can help the community develop a realistic understanding of what is needed in the event of a crisis. The coordinated development of a communitywide plan can focus on the potential contributions unique to each institution. Working together, participants may designate different facilities to respond in specific ways to different events. In the event of a disaster, for example, a hospital may need to accommodate many more patients than usual, and at higher levels of acuity. Plans that address that possibility should be in place.

A resilience plan also can identify situations when the hospital's only option is evacuation and closure. There are hospitals located in coastal cities, for example, whose websites state that in the event of a disaster they cannot provide accommodation for those made homeless. In this instance, hospitals should be active partners with community leaders in developing an evacuation plan in advance. This would mitigate the trauma experienced by families in Katrina and Sandy who

sought out relatives at hospitals with no knowledge of their whereabouts.

A community-based conversation also may indicate the need for hospitals located in evacuation zones to expand their role when there is little hope of evacuating an entire region. At such times, as residents struggle with damage and injury, often without power or water, a functioning institution is an important resource. To what extent and with what external resources may a hospital provide for its neighbors? Should a hospital prepare for parts of its campus to function as relief locations?

The director of an assisted living facility in Florida recently described her own facility's approach during a two-week, post-Katrina power loss. As the only place in the neighborhood with a generator, they provided meals and ice — a much needed item in the August heat. Neighbors flocked to the facility, and many stayed on through the evening, playing cards with the residents and sharing resources. The nursing staff became the neighborhood counselors, and for two weeks, the facility provided a stable presence as the neighborhood dug its way out of storm debris.

Planning ahead to offset harm and to provide for a community is far less costly in human heartache and resources than picking up the pieces after devastation. Developing a communitywide plan through a participatory process also can

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reveal specific, focused opportunities for philanthropic community partners who might provide funding support and help ensure that such an essential community asset as the hospital is secure and effective when people need it most.

#### **STRATEGIES TO IMPROVE OUTCOMES**

Some communities have responded to increased hazard activity, such as Joplin, Mo., experienced in 2011, with even stronger building codes. This results in higher standards for construction in

general, and hospitals in particular, because the design standards for these codes are adjusted in relation to the “importance factor” of buildings covered by the code. Health care buildings are ranked at the top, translating into design standards that may be as much as 50 percent higher than those for a building ranked lower, such as a residence.

Fortunately, engineering solutions can address nearly every potential hazard condition.

In Missouri after the catastrophic Joplin tornado, a new Mercy hospital was planned to replace the one destroyed in the storm. The new Mercy Hospital Joplin will provide a safe zone on every floor; a concrete shell is designed to remain in place even if the roof gives way; and new window systems were developed to withstand wind speeds of up to 250 mph in the most sensitive areas.<sup>8</sup>

## **The impact of climate change and the frequency of disasters has strengthened the efforts of many Catholic health care organizations to be good stewards of creation.**

Meeting earthquake standards employs structural interventions which can provide new capacity for the building to absorb movement without collapse. This process typically involves additional structural elements, the isolation of foundations and strengthening the capacity of individual building elements. After more than 100 hospitals were damaged in the Northridge, Calif., quake of 1994, California mandated, through legislation, retrofit, upgrades or replacement of all hospitals that failed to meet the Alfred E. Alquist Hospital Facilities Seismic Safety Act of 1973. And yet, almost 20 years later, Wanda Jones, in her 2004 report for the California HealthCare Foundation, noted that “83 percent of California’s acute care beds are in hospitals not in compliance, and 26 percent are in buildings at risk of collapse.”<sup>9</sup> It is likely that, given the cost to meet the standards required for seismic design, only those with significant resources and space to either retrofit or build anew will meet the standards.

Like many other hospital leaders, Richard Banta, vice president of construction for Bon Secours Virginia Health System, is addressing directly the potential for hazardous events, with

elevation of all new first-floor construction sufficiently above the flood plain in its coastal Hampton Roads facilities. Bon Secours Virginia Health System also is planning to position generators above the first floor and in a protective enclosure in order to ensure function in the event of power loss in a storm. Similarly, Spaulding Rehabilitation Hospital in Boston was built to withstand coastal flooding.

### **OTHER FACTORS**

Even for institutions with resources to build entirely new facilities, determining a method for both hazard mitigation and resilience is nuanced and can require important community choices. In New Orleans, for example, in 2008, the National Trust for Historic Preservation placed Charity Hospital and its adjacent Mid-City neighborhood on its annual list of “America’s 11 Most Endangered Places.” Preservation-minded citizens, including national preservationists, hoped to prevent destruction of 18 square blocks of historic homes and buildings slated for removal in favor of new Veterans Health Administration and Louisiana State University hospitals. Despite these efforts, construction began on the new complex in January 2013. Although several designers offered alternative proposals that would have saved the neighborhood, an irreplaceable part of the city’s history was lost, demonstrating that a replacement hospital designed for structural resilience alone can do as much damage as a hazard with respect to the local neighborhood. Certainly preservation of the integrity and history of a neighborhood should be included in the considerations of building.

The impact of climate change and the frequency of disasters has strengthened the efforts of many Catholic health care organizations to be good stewards of creation. Sr. Susan Vickers, RSM, vice president of community health for Dignity Health, noted that health care organizations have an ability to make a major impact on the environment through internal changes in the development of environmentally responsible facilities and policies, and externally in relation to community leadership and advocacy. Dignity, based in San Francisco, is a sponsor of the Healthier Hospitals Initiative ([www.healthierhospitals.org](http://www.healthierhospitals.org)), which engages health care organizations in a collaborative effort to address environmental impacts through a broad range of tools, including emission reductions, energy conservation



and purchasing power. Ecological stewardship protects from harm and advances health through advance planning. It can be seen in the design of new facilities, such as the Providence Newberg Medical Center in Oregon, which was awarded LEED Gold status for the development of environmental strategies in their new facility.

As health care organizations sort through the challenges of meeting needs in diagnosis and service, the potential for ameliorating conditions facing communities through climate change and hazards presents an opportunity for reframing the built environment to serve both immediate and longer range needs. The role of the hospital as an important regional resource has never been more necessary, and the reconsideration of the health care facilities as potential “safe harbors” offers a model for related community planning initiatives. Weaving neighborhood and community benefits into the campus design produces an effectively functioning facility as well as a beloved, beautiful and lasting landmark.

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#### NOTES

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