Safe haven in the storm

Protecting lives and margins with climate-smart health care

Health Care Without Harm

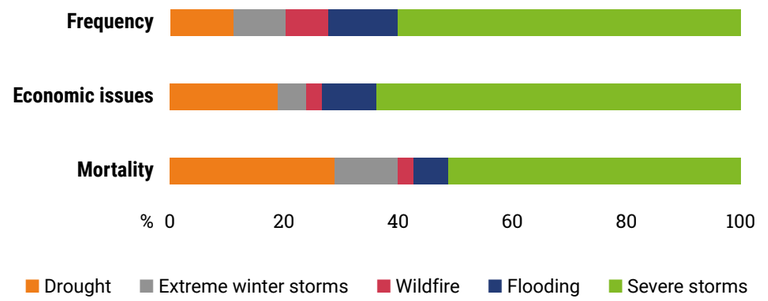
Extreme weather events are a growing risk to health care margins and an opportunity to differentiate

With the continuing squeeze on health care margins, health leaders are highly attuned to the potential for even the smallest changes in demographic, economic, regulatory, or competitive conditions to have a material impact on mission fulfilment and organizational profitability. Many health systems are already falling short of anticipated earnings due to increased costs and falling reimbursement. In this precarious environment, events like heat waves, wildfires, or severe storms can threaten business continuity and wreak fiscal havoc.

Hospitals and health systems are at the front line of natural disasters, reducing mortality rates, and responding to public health impacts. As climate change increases the intensity, duration, and geographic reach of extreme weather events, development grows in high-risk regions, and communities struggle with weak infrastructure, more health care organizations are asking how these factors might make their margins more vulnerable.

In response, a growing number of forward-thinking health leaders are increasing preparedness so that when the time comes, they can continue full operations and be economic and health anchors for their communities. They are also educating policy makers so governments' efforts both support health care resilience, and connect the dots between climate, public health, and the control of health care costs. There may be no better way to stand out from the crowd.

US billion-dollar weather/climate disasters (1980 – mid 2017)[1]



Weather-related risks are rising throughout the US

The yearly average for US extreme weather events costing over $1 billion has shot up from a historic 5.5 events in 2012 to 10.5 events in 2016.[2] The most damaging, well-publicized, and expensive events are often storms and floods, but all regions are at risk, whether through extreme heat, wildfire, drought, or severe winter storms.[3] 2017 events – including multiple hurricanes and wildfires – foreshadow increasing harm, fatalities, financial damage, and displaced populations.

Regional climate trends (2014)[4]

Wildfire
Warmer temperatures and drought linked to climate change have increased wildfires in the Northwest and Rocky Mountain regions. Hotter, drier summers are projected to cause even more large wildfires.

Drought
The West is recording more persistent droughts. In higher emissions scenarios, droughts are projected to become more common across most of the Central and Southern US.

Extreme heat
Western states have seen an increase in heat wave severity and frequency. The number of extremely hot days is projected to increase by late century.

Rising temperatures
US temperatures have increased 1.3-1.9°F since 1895, the majority occurring since 1970, with the greatest increases in the North and West. Temperatures are expected to continue to rise with the rate of change dependent on greenhouse gas emission volume.

Extreme winter storms
Since the 1950s, winter storm tracks have shifted northward with an increased frequency and intensity. Future trends in severe storms (thunderstorms, tornadoes, hail) are still uncertain.

Flooding
Increased precipitation and changes in soil moisture have caused severe flooding in the Mississippi and Missouri River Basins. Flood patterns in this region are expected to worsen over time.

Severe storms
The Southeast has seen an increased intensity, duration, and frequency of hurricanes (including category 4 & 5) since the 1980s. Storm impacts are exacerbated by population growth and urban development patterns – 10 of the 15 fastest-growing US cities are in the South (including Texas).

Extreme precipitation
Over the past 3-5 decades, the US, especially in the Midwest and Northeast, has experienced frequent heavy downpours, particularly in the winter and spring.

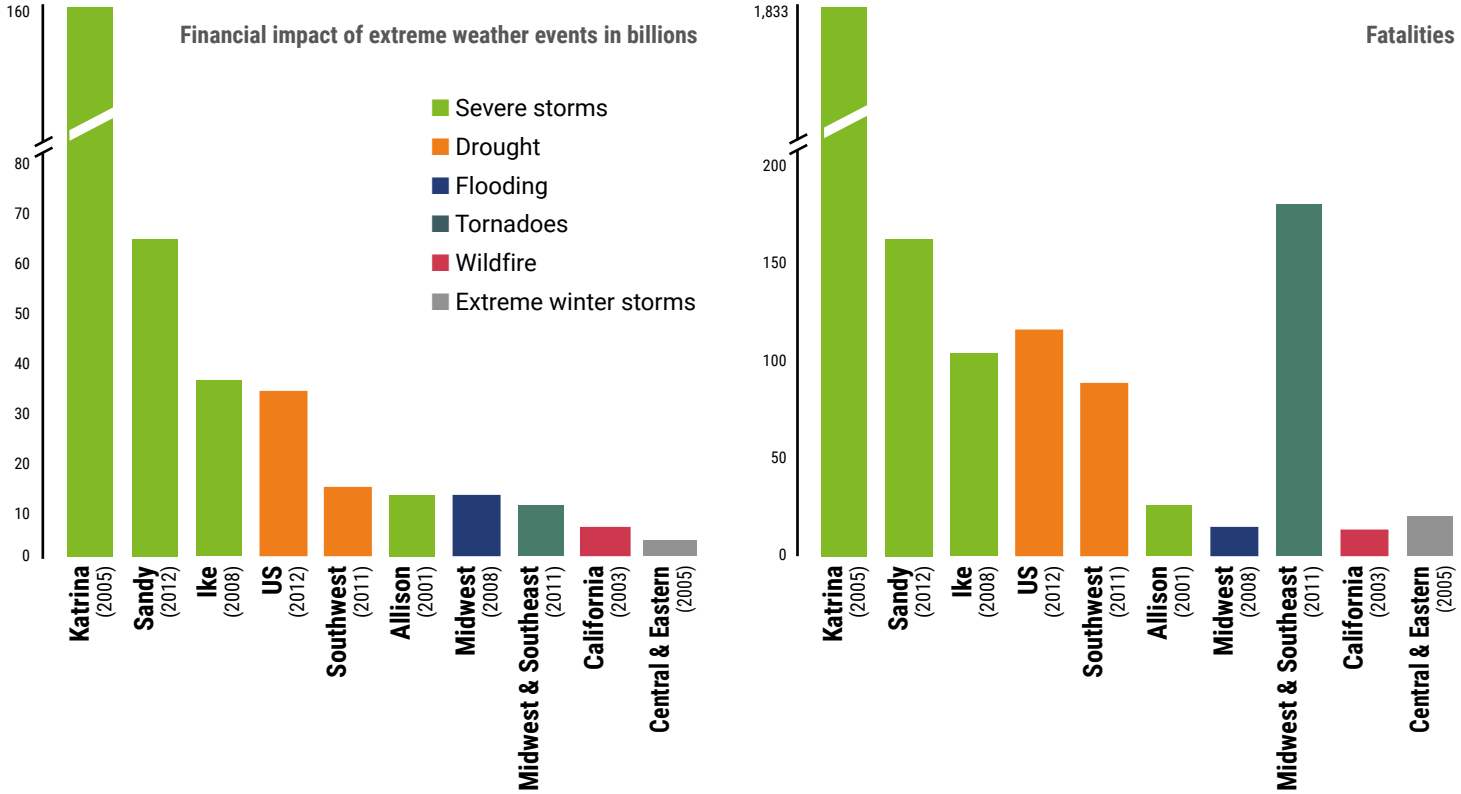
Collaborate and innovate to weather the storm

Major events like hurricanes, floods, and heat waves endanger lives and shatter economies. Hurricane Katrina, for example, caused 1,833 fatalities and $160 billion in damages.

Being resilient to these events requires preparation beyond the facility level. A health organization's ability to survive a major disaster depends on the surrounding social and economic environment, including reliable infrastructure (e.g., transportation, energy, water), secure supply chains, functioning markets, and an agile workforce. The health sector must therefore work together with emergency planning departments, education service providers, community service organizations, and government agencies to build stronger, more resilient communities.

Furthermore, reducing greenhouse gas emissions is critical to addressing climate change, and as energy- and resource-intensive enterprises, hospitals and health care systems have roles to play. Improvements in procurement, resource use, transportation, and other policies and practices can save money, reduce the carbon footprint, and serve as leadership examples to others.[5]

Impact of major events on the US since 2000[6]

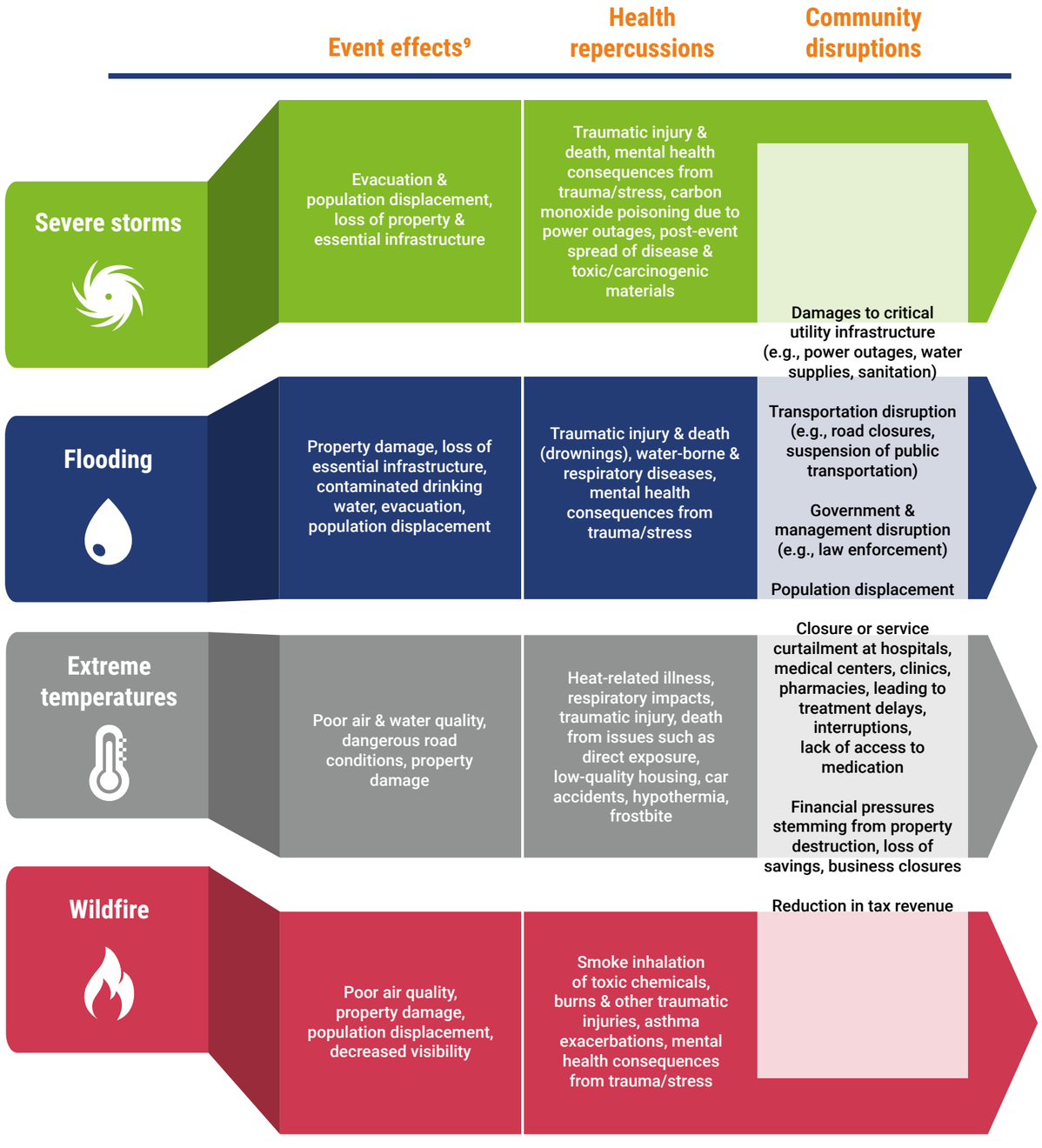


The link between changing weather and public health

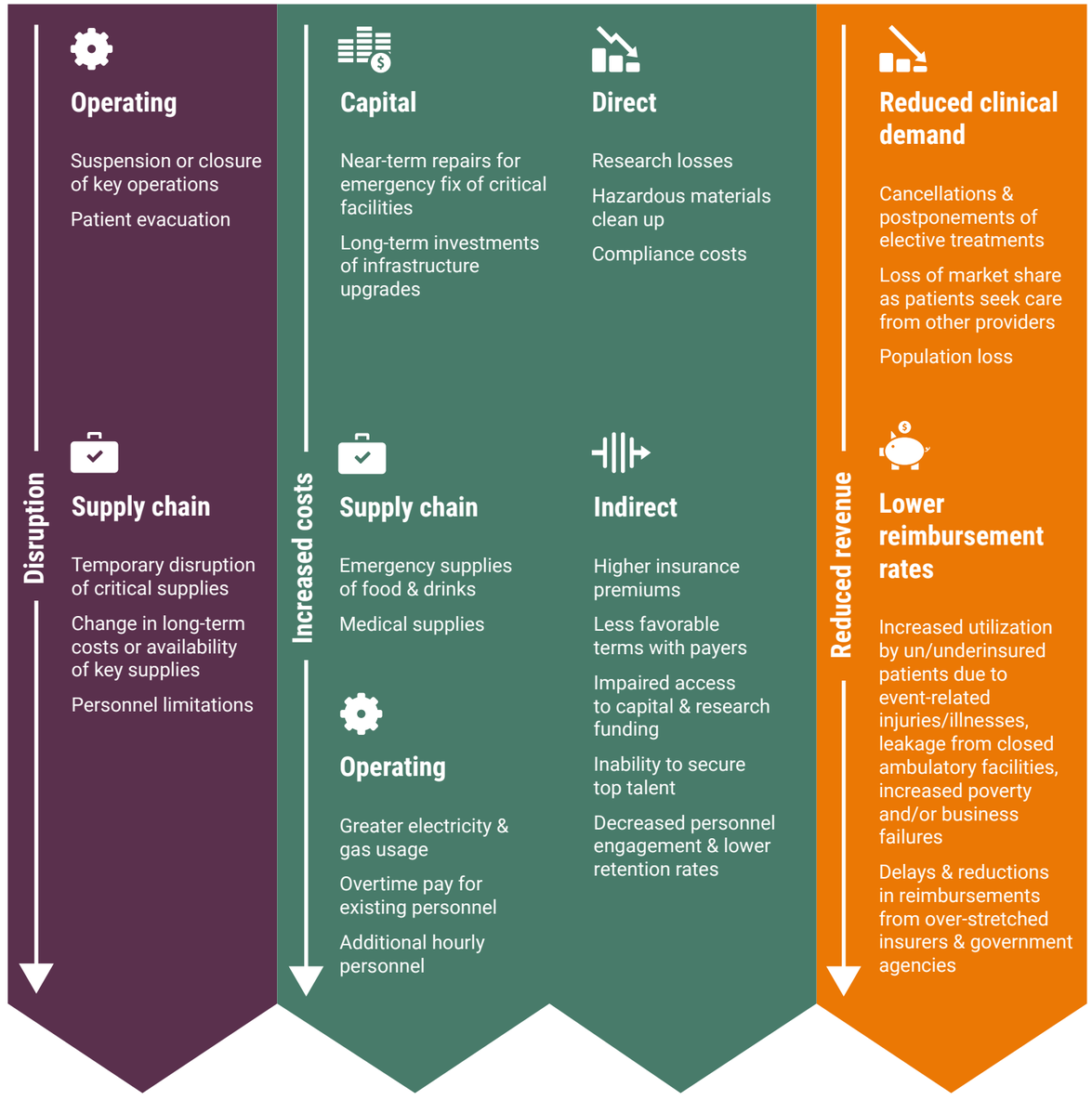
While this paper focuses on the financial impacts of extreme weather, health care leaders cannot ignore the serious impacts that changing weather patterns have on public health. Rising temperatures, drought, wildfires, and air pollution increase the prevalence of heat-related fatalities and illnesses, and exacerbate respiratory health conditions, including asthma. Increased flooding and changing temperatures affect the survival, distribution, and behavior of water-related illnesses transmitted by pathogens, as well as vector-borne diseases transmitted by mosquitoes, ticks, and rodents. A recent study published in *The Lancet* found that climate change has increased global dengue transmission by 3-6% since 1990, and *Scientific American* reported increases in Puerto Rico, Florida, New York, and California.[7,8] Finally, any extreme weather event generates significant mental health impacts, especially for those who lose loved ones, income or jobs, housing, or hard-earned savings.

SECTION ONE

The costs of being ill-prepared



The bottom line damages for health care



The costs of being ill-prepared

Extreme weather events impact a health system's margin in a number of ways. By disrupting operations and utilities, and hindering the delivery of mission-critical supplies, they increase capital, operating, supply chain, and other costs. Extreme weather can also hurt revenue through reduced demand and an increased number of patients whose lower reimbursement rates fall short of costs.

Disruption

Operating disruption

In a best-case scenario, extreme weather events make operating conditions more difficult for a health care facility by triggering the use of protective measures like sandbags or backup power generators. In a worst-case scenario, facilities are forced to evacuate patients and suspend, or even permanently close down, operations.

During Hurricane Katrina, half the hospitals in metro New Orleans and all of the hospitals in the city closed their doors.[10] One year after the storm, bed capacity in Orleans Parish had fallen 79% – from 2,269 beds to just 479 – with only three of the parish's original nine acute care hospitals even somewhat operational.[11]

Tulane Medical School lost approximately 70% of its teaching beds and was forced to relocate to Houston for the 2006–2007 academic year.[12] Charity Hospital, the largest safety net facility in the region, closed permanently, and it took ten years for the Louisiana State University system to re-open a similar suite of services at the new University Medical Center.

The New York City health system had a similar experience during Superstorm Sandy. Six hospitals and 26 residential care facilities were shut down, reducing hospital bed capacity by 8% in the immediate aftermath, and 5% four weeks later.[13] Chronic care patients needing dialysis and drug treatment overwhelmed emergency departments when ambulatory centers closed. According to the City of New York's Special Initiative on Rebuilding and Resilience, "providers who remained open strained to fill the health care void – hospitals repurposed lobbies as inpatient rooms, adult care facilities siphoned gas from vehicles to run emergency power generators, and nursing home staff lived on-site for four or more days until their replacements arrived."[13]

Supply chain disruption

When disaster strikes, the surge in demand invariably puts a strain on the hospital supply chain as facilities are forced to rely on their existing personnel and in-house inventory. Ben Taub Hospital in Houston ran out of food supplies after flooding from Hurricane Harvey contaminated the facility's basement kitchen and food storage, forcing the hospital to put out a call for backup food supplies from local vendors.[14] One-third of hospitals in Superstorm Sandy's declared disaster area reported shortages of clinical and nonclinical personnel, as most public transportation was knocked out and the majority of gas stations in the region closed.[15] Perhaps the most disturbing, yet heroic, aftermath experience happened at Charity Hospital and Lindy Boggs Medical Center in New Orleans during Hurricane Katrina, where personnel worked desperately for four days to keep patients alive as they awaited rescue, operating without power, running water, fresh food, blood for transfusions, and many key medications.[16]

Increased costs

Capital costs

FEMA estimates that extreme weather events can cost a hospital anywhere from $600,000 to $2 billion in infrastructure damages.[17] These damages include both emergency fixes and longer-term recovery efforts such as relocation of critical infrastructure and clinical service programs above flood elevation, hardening of building facades and equipment, and installation of on-site generator capacity.

Most facilities will be able to secure reimbursement for these capital costs from either a private insurer or a government relief program, although the process can be challenging and costly.

The average amount awarded to a health care organization by FEMA's Public Assistance program over the last ten years was $1.03 million, but these grants come with a number of conditions, including: (i) the grant may be restricted to only restore a facility to "pre-disaster" condition, (ii) the grant will only provide support for the most cost-effective option, and (iii) the grant can cover only 90% of a project's total cost, with the facility responsible for providing the remaining 10% in matching funds.[18]

Operating costs

When a disaster knocks out power and other infrastructure systems, facilities are forced to employ expensive short-term solutions. Backup generators can be costly and troublesome to run; overtime wages and benefits add up quickly. Massachusetts General Hospital and Brigham and Women's Hospital incurred $1.3 million and $700,000, respectively, in overtime pay during Boston's historic winter storms in 2015.[19] After Hurricane Katrina, Touro Infirmary was paying a 50–100% premium for nurses willing to come to New Orleans.[20]

Supply costs

Well-organized health systems may be able to secure the supplies they need to weather an extreme event, but they will likely face surcharges on last-minute emergency orders or having to switch sources. Many stories of shortages and higher costs in IV fluids, surgical scalpels, and hernia mesh emerged after Hurricane Maria damaged production plants in Puerto Rico.[21]

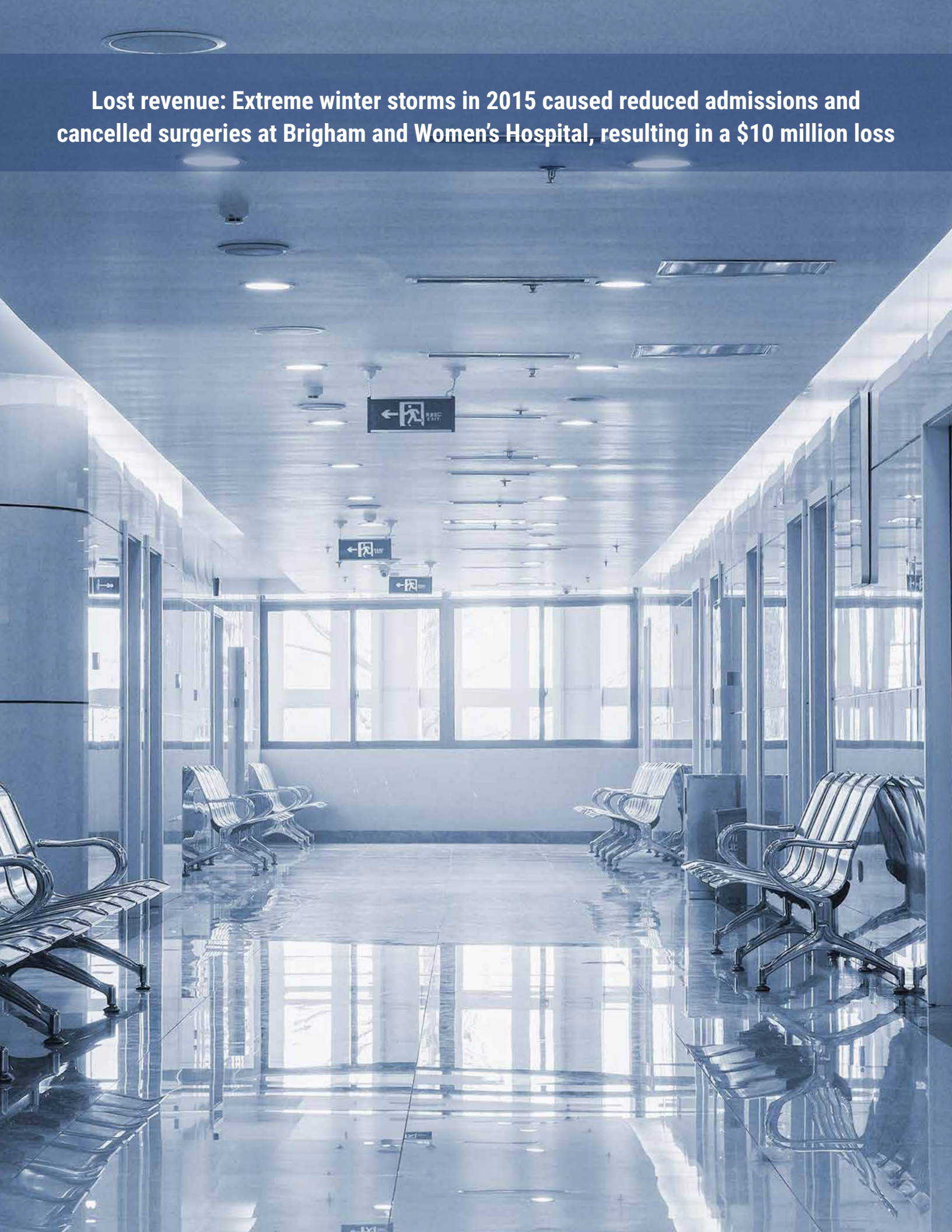
Hospitals and health systems also lose valuable inventory during major disasters. A 2008 wildfire forced the evacuation of 101-bed Feather River Hospital in Paradise, CA, and kept the hospital closed for ten days.[22] The total cost impact of the event on the hospital was about $6 million, of which $600,000 was tied to medications that had to be disposed. Additional supply cost impacts included: replacing all air filters, cleaning all air handling systems and hospital surfaces, replacing all food supplies, throwing out diagnostic media and IVs, testing and recertifying all medical equipment, and replacing or repairing smoke and fire alarm systems.

In addition, due to their role as "neighborhood sanctuaries," hospitals can be responsible for furnishing food and medical supplies to patients, their families, and other community members in times of crisis. In the immediate aftermath of Superstorm Sandy, one hospital was challenged with feeding the community and giving away large quantities of supplies purchased at full retail prices rather than wholesale prices.[16]

Other costs

Research losses are often one of the most devastating impacts of an extreme weather event. After Tropical Storm Allison, Texas Medical Center lost $2 billion in research, including computer data,

Lost revenue: Extreme winter storms in 2015 caused reduced admissions and cancelled surgeries at Brigham and Women's Hospital, resulting in a $10 million loss



tissue samples, and 30,000 research animals. It is nearly impossible to recoup this type of loss, as research materials are very difficult to value.

After 10,000 research specimens were lost in the basement of NYU Langone's Smilow Research Center during Superstorm Sandy, the medical center was reimbursed only for their individual book values, not for the upfront work that had gone into developing the various unique strains, some estimated by personnel to have cost anywhere between $20,000 to well over $100,000 to develop.[23] In addition, a major loss of this nature can jeopardize research grants and make it harder to attract top research talent.

Other costs include hard-to-measure aspects such as reputation loss, personnel mental health, and cleanup of hazardous, radioactive, and other sensitive materials. When Mercy Hospital Joplin, MO, was seriously damaged by an EF5 tornado in 2011, hospital administrators had to rush to barricade and quarantine the medical campus while trained professionals shut down MRI equipment and removed radioactive materials in the cancer center. They also had to secure paper medical records scattered by the tornado.

Reduced revenue

Reduced demand

Acute care facilities that stay operational during a catastrophic event often experience a reduction in non-acute and outpatient volumes. Brigham and Women's Hospital in Boston suffered $10 million in lost revenue during the extreme winter storms of 2015 due to cancelled elective surgeries and reduced general admissions, outpatient services, and visitors.[19] Additional revenue losses are seen at facilities that, due to severe physical damage, are forced to triage patients to other locations or even suspend operations altogether.

Achieving pre-disaster revenue levels requires not only physical repairs to damaged infrastructure, but also the restoration of a strong revenue base. This process can take months, or even years, as evidenced by the fact that twelve years after Hurricane Katrina, the population of New Orleans is still down by 100,000, 20% below pre-storm levels.

Lower rates of reimbursement

In addition to driving down total patient volumes, natural disasters also cause major changes to the patient mix by driving up the number of uninsured or underinsured patients. For example, uncompensated care in the Ochsner Clinic Foundation tripled after Hurricane Katrina.[20]

There are two likely drivers for this trend. First, the economic devastation wrought by a disaster can cause millions to lose employer-sponsored coverage. Second, low-income populations are more likely to be in harm's way, less able to invest in preparations for extreme events, less able to relocate to safer areas, and most likely to suffer from multiple social and environmental health issues over decades. Thus, the hardest-hit neighborhoods are almost always the poorest. In fact, 90 years of FEMA and American Red Cross data indicate that each major catastrophe increases a US county's poverty rate by an average of 1%.[24]

Another complication is the chaotic post-disaster environment, which can delay revenue cycle activities. Patients whose homes have been destroyed may not be able to provide proof of insurance, identification, or a usable address. They may seek care as self-pay patients, delay treatment, or move to other institutions of care.[25] Although the Health and Human Services secretary often approves short-term waivers allowing for expanded Medicaid eligibility and other measures in the wake of a national emergency, delays in government reimbursement for services performed during and after an event are common.[25]

When asked what the government had contributed to the efforts of the Ochsner Clinic after Hurricane Katrina, CEO Patrick Quinlan said, "Nothing. We have asked and asked [authorities] for fair compensation, and perhaps we will get it eventually, but we cannot go on indefinitely providing uncompensated care."[20]

Photo: FEMA/Andrea Booher

Case study: NYU Langone's struggle with Sandy and its aftermath

In October 2012, Superstorm Sandy caused 43 deaths and the evacuation of 6,500 patients from hospitals and other facilities in NY and NJ. NYU Langone Medical Center, which includes a 705-bed hospital, is located on Manhattan's East River, and was one of those affected.[26,27] The facility's 12-foot flood protection proved inadequate against Sandy's greater than 14-foot storm surge. The hospital quickly plunged into darkness as 15 million gallons of water knocked out power, inundated building infrastructure and research laboratories, and forced the evacuation of all 322 patients.[27]

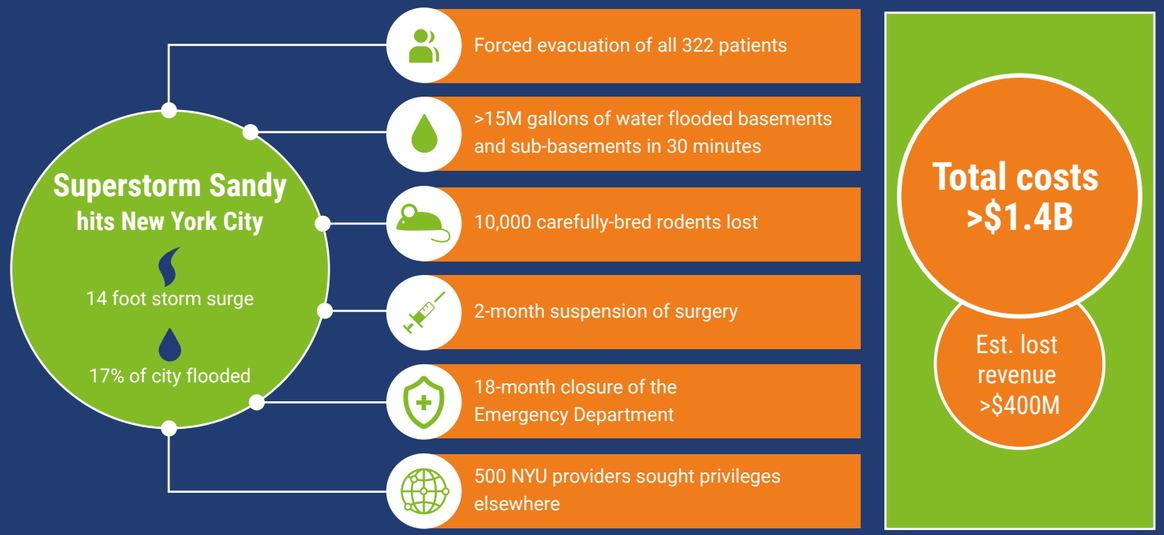
After the event, NYU Langone had to suspend surgery and inpatient admissions for two months and close the Emergency Department for 18 months.[28] Meanwhile, up to 500 providers were forced to seek privileges elsewhere to care for their patients during the months of rebuilding.[29] Leaders estimate lost revenue during this time was at least $400 million.[30]

Total costs – including short-term fixes related to cleanup and emergency repairs, as well as more permanent recovery and mitigation projects – exceeded $1.4 billion.

Thanks to NYU's sophisticated finance and engineering teams, as well as effective advocacy by New York elected officials, the bulk of NYU Langone's physical damages were reimbursed by a combination of private and public insurers, including the National Flood Insurance Program, HHS Social Services Block Grant Program, and FEMA's Public Assistance Program.

Despite these reimbursements, NYU Langone has not received full financial assistance for the entire loss. NYU was obligated to contribute 10% of the $1.13 billion grant awarded by FEMA in 2014. Additionally, certain costs were not eligible for government reimbursement, such as lost research grant opportunities or lost revenue due to business interruption. As a result, NYU is still in active litigation with its private insurer, even five years later.[31]

The cost of Superstorm Sandy for NYU Langone



Total impact: >8x the 2012 operating margin[32]

"We'd just gone through disaster drills, but in all drills, one assumes the building is still standing." –Shelly Hunter, Mercy Hospital Joplin CFO

Case study: Mercy Joplin reels after the deadliest tornado to occur in the US since 1947

On a late afternoon in May of 2011, one of the most lethal and destructive tornadoes in US history devastated the city of Joplin, MO. This EF5 tornado – ¾ miles wide, six miles long, with winds in excess of 200 miles per hour – caused 161 deaths and destroyed 25% of the city.[33]

At St. John's Medical Center (now known as Mercy Hospital Joplin), the chaos lasted a mere 45 seconds, but the impacts were devastating. Every window in the building was blown out and the top two floors were ripped from their structure.[34] Interior walls and ceilings were torn open or destroyed by water from broken pipes. Power lines were downed and the main and back up generators were torn from their foundations. Six people died, five of whom were patients.

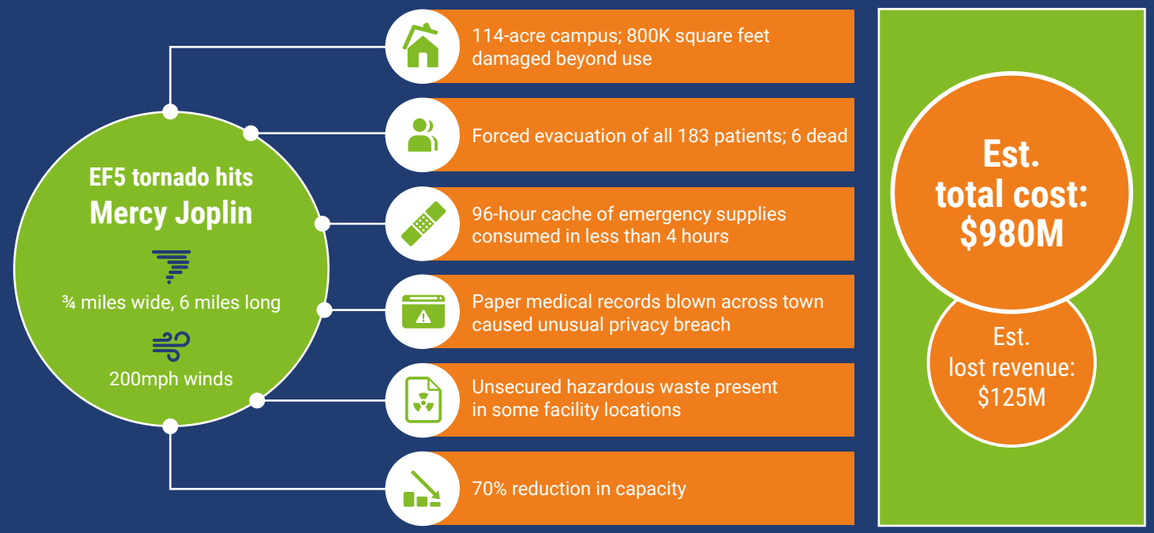
Once the storm had passed, everyone in the building, including 183 patients, 100 staff, and uncounted visitors, required evacuation for fear the structure might collapse.[35] While the hospital did not collapse, it did prove to be unsalvageable.

Within a week, a 60-bed temporary field hospital was established in the parking lot of the destroyed facility, where limited operations were maintained until moving to a portable hospital in October and, ultimately, a 110-bed component hospital in April 2012. The downsize from a 367-bed facility to a 110-bed caused a 20% drop in market share and an estimated $125 million in lost revenue from business interruption in the first year alone.[36,37]

During that time, leadership had the painful, laborious task of tallying the total costs and seeking reimbursement to fund the rebuild. Total costs associated with the write-off of the entire 114-acre campus, and all the supplies within it, were estimated at $980M.[38]

Climate change impacts on tornado frequency and intensity are not yet definitive, but Mercy Joplin provides excellent financial data on a total loss extreme event. Financial aspects of the preparation for, and impacts of tornados can inform risk management of other extreme events.

The cost of the tornado for Mercy Joplin



Total impact: >50x the 2011 operating margin[39]

SECTION TWO

The benefits of preparedness

Emergency preparedness demonstrates clinical and fiscal smarts

Leaders can hope "the big one" doesn't hit during their watch, or try to squeeze each dollar hard enough to weather the impacts of increasing incremental losses. But effective risk management and upfront investments in mitigation and climate resiliency enable smart health systems to come out on top for four reasons.

ROI and risk management

Relatively small investments in hazard management can significantly reduce the costs incurred during an extreme weather event. The World Health Organization estimates that the price for retrofitting non-structural items can cost as little as 1% of the value of a hospital, while possibly protecting up to 90% of the hospital's assets.[40]

Case studies here and elsewhere show smart leaders simultaneously address sustainability, emissions, and resilience to lower the risks of operational disruption. Separate efforts can make sense, but better returns usually come from mutually reinforcing initiatives. Certainly facilities that are designed for passive survivability and are efficient with energy, water, and other critical supplies can last longer when sources are limited or interrupted.

Many of these measures have fast payback periods that make them no-brainers from a financial perspective. The Commonwealth Fund estimates that reducing waste and cutting energy usage in US health care facilities can save an estimated $15 billion over ten years.[41]

The experience at Gundersen Health Systems, a non-profit hospital network serving Wisconsin, Minnesota, and Iowa, proves the potential size of this opportunity. When Gundersen first started working on these issues in 2008, it spent $2 million on energy conservation, with a 60% return on investment. All told, its sustainability efforts save the system $3 million annually.[42]

Fiduciary responsibility

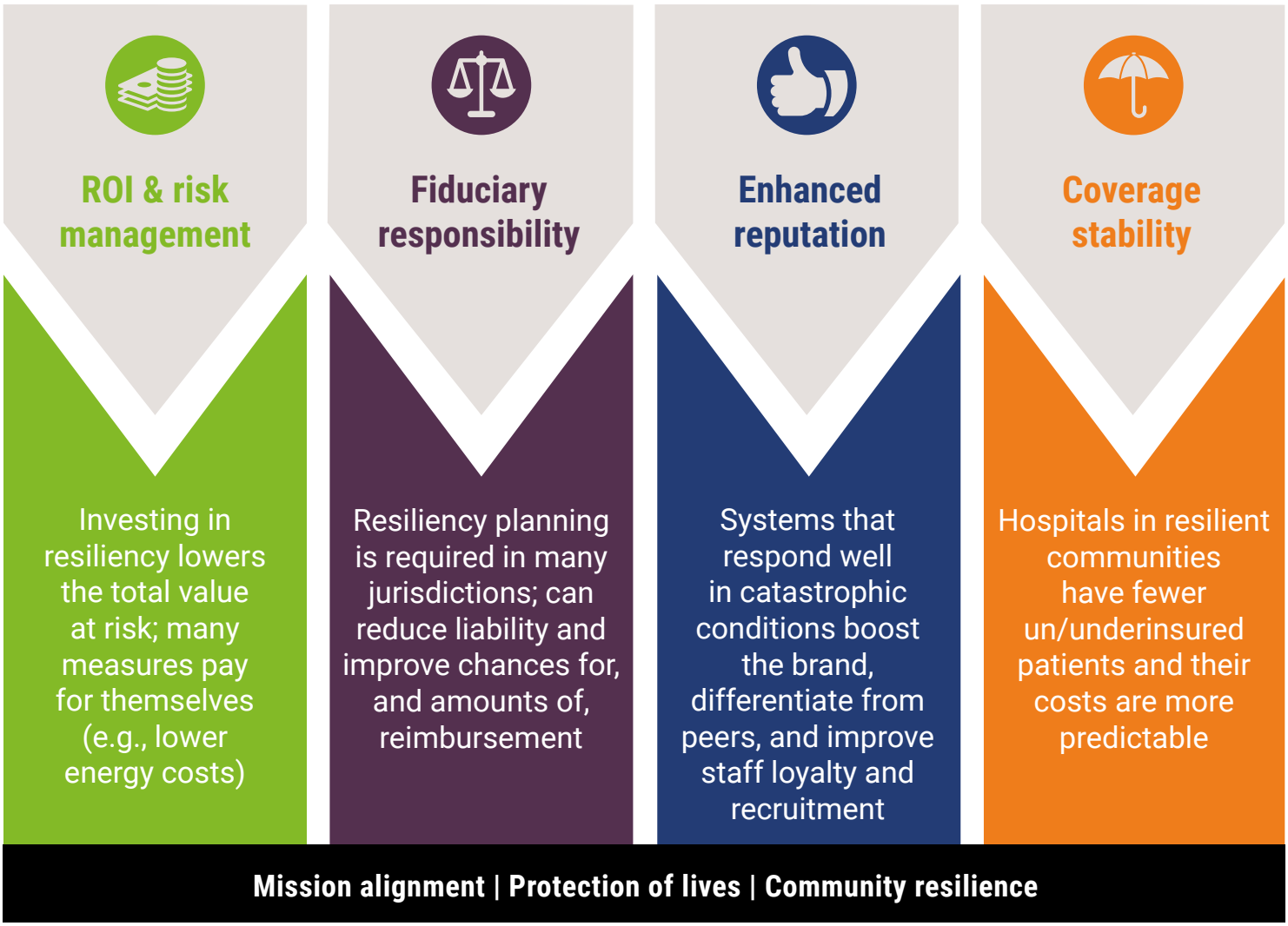
Preparing for disasters is an important part of being a good fiduciary. In many cities and states around the country, resiliency plans are now required. The Centers for Medicare and Medicaid Services (CMS) have finalized the Emergency Preparedness Requirements for Medicare and Medicaid participating providers.[43] It outlines risk assessment, procedural, communications, and training and testing requirements, which providers needed to comply with and implement by November 2017.

Effective disaster planning and mitigation also helps hospitals and health systems secure full reimbursement of property and casualty insurance claims, take advantage of one-time tax benefits, and limit adverse revenue cycle impacts. The CHRISTUS Health Southwest Louisiana system avoided significant disruption of its back-office functions after Hurricane Harvey because it had implemented redundancies while moving many functions to Irving, TX, during a recent consolidation.[44]

Facilities that have taken the time to prepare for disasters are also better able to protect their credit rating and shareholder value. Following Superstorm Sandy in 2012, Moody's put NYU Langone Medical Center's A3 credit rating under review, which had the potential to affect more than $750 million in rated debt.[45]

The ratings agency cited concerns about delayed recovery of funds from insurers, FEMA, and philanthropists, and the potential for decreased patient volume. Moody's ultimately did not lower the rating after affirming that patient volume had recovered.[46]

Photo: FEMA/Win Henderson



Enhanced reputation

The way a health system responds to or prepares for a crisis situation can have a major impact on its reputation. Organizations who put their values on display and successfully rally communities around them benefit from positive media coverage as well as more formal recognition through channels such as “Becker’s 50 Greenest Hospitals in America” list or Practice Greenhealth’s Environmental Excellence Awards.[47,48] This type of brand boost can help stabilize or even grow revenue streams – through increased donations, for example. It can also make recruiting efforts more successful and improve personnel engagement, productivity, and retention.

Boston Medical Center's Senior Vice President of Facilities & Support Services Bob Biggio said, "Don’t underestimate the tangential benefits. Our energy and sustainability efforts have delivered at least $5 million in gifts. In recruiting, candidates routinely cite their knowledge of our sustainability work, and our green bond sold out in a week."

Coverage stability

Making a community more resilient helps to create a more stable coverage environment. Any potential inflow of aid dollars after a natural disaster is generally offset by uncertainty in government payouts and insurance reimbursements, as well as by the economic loss of displaced people and jobs. Communities that rebound quickly are more likely to retain patients with employer-sponsored insurance. Those that don’t are more likely to have patients slipping into Medicaid or other government programs.

In addition, when hospitals invest in resiliency, they also invest in the growing green building and renewable energy workforces and a clean economy with fewer environmental health risks.[49]

Scenario analysis helps to show why investing in resiliency protects margins

Example hospital income statement ($ in thousands)

Operations	Pre-disaster	Scenario 1 No climate prep	Scenario 2 Climate-smart initiatives
Unrestricted revenues			
Net patient service revenue	$ 950,000	$ 855,000	$ 950,000
Provision for bad debts	(60,000)	(63,000)	(60,000)
Net patient service revenue less provision for bad debts	890,000	792,000	890,000
Other revenue	110,000	110,000	110,000
Total unrestricted revenues	1,000,000	902,000	1,000,000
Expenses			
Salaries & wages	500,000	550,000	550,000
Benefits	100,000	100,000	100,000
Supplies	160,000	163,200	163,200
Purchased services	90,000	90,000	90,000
Facilities	40,000	48,000	42,000
Malpractice & general liability insurance	5,000	5,000	5,000
Depreciation & amortization	15,000	15,000	15,000
Interest	60,000	60,000	60,000
Other	5,000	5,000	5,000
Total expenses	975,000	1,036,200	1,030,200
Operating income	25,000	(134,200)	(30,200)
Non-operating gains and losses			
Investments	15,000	15,000	15,000
Disaster reimbursements	0	52,200	46,800
Gifts & other	10,000	10,000	10,000
Total non-operating	25,000	77,200	71,800
Excess of revenues over expenses	$ 50,000	**$ (57,000)**	**$ 41,600**

Net margin difference of ~$100M

Scenario 1:
Hospital makes no investments in resiliency. When a major hurricane hits, the facility floods, loses power, and has to shut down key outpatient services for 12 weeks.

Scenario 2:
Hospital leadership invests in resiliency by hardening and elevating critical infrastructure. When a major hurricane hits, the hospital incurs only minor damages.

Assumed impact for each scenario

Scenario 1: 10% revenue loss from business interruption
Scenario 2: stays fully operational; no revenue loss

Revenue

Scenario 1: 5% increase in un/underinsured patients
Scenario 2: minimal changes to coverage environment

Bad debt

Scenarios 1 & 2: 5% spike in salary costs due to overtime wages; 2% premium for emergency supplies

Staff & supplies

Scenario 1: 20% bump due to major emergency repair
Scenario 2: 5% bump due to minor repairs

Facilities

Scenarios 1 & 2: 90% reimbursement for all physical damages and overtime staff costs; no reimbursement for lost revenue

Insurance

Scenario analysis can illuminate potential financial impacts of severe events, considering likely frequency and ROI recovery period. Here, resiliency could provide an almost $100M net margin improvement, an opportunity twice the size of the facility's pre-disaster margin.

$ Net margin

Case study: Resilience measures that pay for themselves at Partners HealthCare

With 18 million square feet of space, Partners HealthCare is Massachusetts' largest health system. The network, which includes Massachusetts General Hospital and Brigham and Women's Hospital, provides critical services to patients from across the region and operates on very slim margins. Energy and climate issues were on Partners HealthCare's radar after Hurricane Katrina in 2005, but when energy price fluctuations in 2008 and 2009 caused a projected, unbudgeted $20 million in utilities spend, almost 12% of the system's bottom line income, leadership was spurred to make big changes.[50]

Photo: Ameresco

Since then, Partners HealthCare has embarked on a strategic plan to reduce both its energy consumption and environmental footprint while making its facilities more resilient to climate-driven events like flooding and sea level rise. "We need to be a lot more conscious of how we support the health care endeavor and do it as responsibly and economically as possible," said John Messervy, Partners HealthCare's Corporate Director of Design and Construction. Partners HealthCare has reduced electricity use by 25% and lowered energy price volatility using power purchase agreements for three-year, fixed term, low impact hydroelectric power – a potential 10-15% savings from conventional sources even at current low prices. Combined with on- and off-site solar and a 22-megawatt direct delivery purchase contract that is catalyzing the building of a wind farm in New Hampshire, Partners HealthCare's efforts are delivering an 80% reduction in their electricity's greenhouse gas emissions.

Partners HealthCare's increased ability to stay operational during even the most severe weather events is key. Detailed vulnerability assessments are complete for 32 key sites, and five of the system's 13 hospitals now have on-site cogeneration. The new Spaulding Rehabilitation Hospital in the Charlestown Navy Yard sets a leading example of resilient, sustainable, healing design, with passive survivability measures such as a highly insulated building envelope, operable windows, landscaping that helps block storm surge, relocation of all critical mechanical and electrical infrastructure to a rooftop penthouse, and installation of a cogeneration system.[51]

These features and others have helped the new facility become enormously successful: between fiscal years 2012 and 2016, total occupancy jumped from 77.5% to 95.5% and average length of stay went from 22.1 days to 19.8 days. The investments in resiliency have paid for themselves. Reflecting back on recent efforts, David Burson, a senior project manager at Partners HealthCare, said, "close to half of the $1.5 million we spent in resilience investments were recoverable through utility rebates, and, through our annual energy savings of $500,000, we recouped the remaining amount within 18 months."

Partners HealthCare plans for a stable, resilient future

Energy price stability

Energy price fluctuation

- $20 M in additional energy costs due to fluctuations in energy prices in 2008/2009
- Accounted for 12% of operating income in FY2009

10-year Strategic Energy Master Plan

1. Reduce energy consumption through conservation
2. Convert to on-site energy production
3. Move to renewable energy sources

% Cost savings & stability

- 273 energy conservation projects identified
- $20 M in returns
- 35% of power from renewables
- 5 IN 13 hospitals have cogeneration
- 25% energy reduction goal achieved
- New goal to reduce by 40%
- Major capital projects improving energy efficiency and operating costs

Climate resiliency

Weather exposure

- Rising sea levels
- Storm surge
- Localized flooding

Resiliency Master Plan

1. Develop climate scenarios and hazard assessments
2. Identify critical facility and clinical operation vulnerabilities
3. Plan for operational enhancements and adaption efforts

Spaulding Rehabilitation Hospital

- Investment in resilient and sustainable design features paid off within 18 months
- Increased occupancy: 77.5% (2012) 95.5% (2016)
- 30% more efficient than the typical hospital with $500K annual energy savings
- Average length of stay improves from 22.1 days TO 19.8 days

Case study: Successful storm proofing at Texas Medical Center

In 2001, Houston, TX, faced a historic thousand-year flood as a result of Tropical Storm Allison. Leaving 22 dead and causing the county almost $5 billion in damages,[52] the flooding crippled the Texas Medical Center (TMC), the largest aggregated medical complex in the US with 23 hospitals covering 1,345 acres. Water damage to TMC's emergency generators and electrical switchgear caused a complete power outage. Personnel worked by flashlight and ventilated patients by hand as more than 1,000 patients were evacuated from hospital rooms and intensive care units.[53,54] TMC incurred $2 billion in research losses alone, including computer data, tissue samples, and research animals.[55]

In the aftermath of Allison, TMC member institutions united in their resolve to learn from the event and invested more than $50 million to upgrade infrastructure with resilient and sustainable design features. They engaged a broad range of stakeholders in the rebuild, including hydrology experts, Houston city officials, FEMA, county flood control and subsidence supervisors, and utility companies.[56] By 2003, TMC institutions had formed their own Hazard Mitigation Plans and Flood Management Groups to improve the campus infrastructure, flood alert system, and mitigation planning. All critical infrastructure and program areas were relocated above projected flood elevations. A new on-site, 48-megawatt combined heat and power plant, installed by Thermal Energy Corporation, eliminated dependence on Houston's utility grid during both normal and emergency operations while also reducing costs and greenhouse gas emissions.[52] Power service was moved to an elevated utility raceway that also doubled as a pedestrian walkway.

Since then, TMC institutions' resiliency investments have been put to the test with Hurricane Rita in 2005, Hurricane Ike in 2008, and, most recently, Hurricane Harvey in August 2017. Harvey, the largest rain event in US history, flooded the entire Houston area, and yet all hospitals and emergency rooms on the TMC campus stayed operational.

"Years ago with (Tropical Storm) Allison, it was devastating – all the hospitals were shut down," said TMC CEO and President Bill McKeon. "And here we are with even more water and all of them are operational. It's really quite a feat of engineering."[57] Of TMC's emergency plans, McKeon said, "We have every institution online. We know the protocols. There's not a lot of questions. It's very well-orchestrated."

However, TMC's success during Hurricane Harvey was limited by the fact that most patients and emergency vehicles were unable to reach the complex due to massive flooding in Houston streets. The revenue losses associated with the utilization slowdown – including a five-day stretch where all elective procedures were cancelled – are still unknown, but TMC institutions had already been working with local authorities to improve resilience within the city and county. By sharing lessons learned from their own experience and extending the circle of resilience beyond their facilities' walls, TMC leaders are both lowering the odds of similar business interruptions and the potential resulting fiscal impact.

Texas Medical Center: Before & after resiliency initiatives

Tropical Storm Allison - 2001	Hurricane Harvey - 2017
Basement flood control devices failed to activate	Watertight submarine doors in basement tunnels activated as planned
Catastrophic flooding of most TMC buildings	Isolated flooding of a small number of TMC buildings
Widespread patient evacuations	Limited patient evacuations
Poor visibility of storm water rise due to lack of early warning system	Monitored Brays Bayou watershed through flood alert system

Texas Medical Center: Learning from the past

1. The event: Devastation during Hurricane Allison

- 1,000-year historic flood with 3 feet of rain
- 22 dead, $5B in damages to county
- Widespread systems failure and property damage at TMC
- Lost $2B in TMC research (e.g., 60K tumor samples, 30K research animals)

2. The lessons: Protocols & infrastructure

- Housing of vital utility and mechanical controls in the complex's basements made it extremely vulnerable to flooding
- Insufficient infrastructural and engineering fortification against flood damage
- Lack of flood protocols made it difficult to coordinate an emergency response

3. The rebuild: $50M in infrastructure upgrades

- Hazard Mitigation Plan
- Flood Management Group
- Sustainable design measures
- Engagement of stakeholders
- On-site utility plant
- Flood alert system

4. The rebound: Preparedness for Hurricane Harvey

- Largest amount of rainfall on an urban area in US history
- All 23 hospitals and emergency rooms in the complex stayed operational
- Storm gates protected all basements and subterranean parking on campus

5. The focus now

- Mitigating future business continuity risks by sharing lessons learned with local authorities
- Advocating for improved regional resilience measures like elevating streets and improving flood protection

Case study: Wildfire – a growing risk to health care

Wildfire is a real and increasing threat to health systems across the country. The risk is especially high in wildland-urban interface areas in the Western US, where changing climate patterns are heightening the frequency and severity of fire events.

Direct financial impacts

Wildfires can start without warning and move quickly across great distances. The October 2017 fires in northern California were some of the most destructive in recent history, forcing the evacuation of approximately 130 patients from Kaiser Permanente's Santa Rosa Medical Center and 80 patients from Sutter Health's Santa Rosa Regional Hospital.[58]

"The fire was raging all around the hospital…firefighters were defending the hospital right up to the door." –Lisa Amador, Director, North Bay Strategy and Business Development at Sutter[59]

Thanks in large part to heroic firefighting efforts, as well as the underground water tanks and wells that both facilities had in place beforehand, both facilities survived. Total costs, however, are still being tallied. The event caused extensive smoke and heat damage to hospital infrastructure and medical supplies. It also led to major revenue losses: the Sutter hospital, as well as 15 neighboring outpatient and urgent care clinics, were closed for up to eight days.

The relationship to public health

Wildfires pose a business risk to health systems even when they aren't threatening to burn down a facility. The fine particulates found in wildfire smoke have proven links to asthma, chronic obstructive pulmonary disease, and numerous cardiovascular conditions. In California's San Joaquin Valley, which has some of the worst air quality in the country, Kaiser Permanente members have consistently higher rates of hospitalizations and emergency room visits for acute and chronic respiratory conditions on days that have elevated levels of fine particulate pollution.[60]

The health burden caused by wildfires is getting worse. Nearly 57 million people were affected by "smoke waves" – two or more consecutive days of unhealthy air quality from fires – in the five-year period between 2004 and 2009. This number is likely to rise to 82 million by 2046.[61]

The people most impacted by wildfire pollution are often vulnerable populations with one or more high-cost chronic conditions. Providers in fire-prone geographies who care for large numbers of uninsured and underinsured patients will find their margins under increasing pressure as wildfire conditions continue to drive these populations through their doors.

SECTION THREE

How smart executives can take action

Climate change is a critical health care and public health issue

Savvy health care leaders chase down every opportunity to strengthen and protect their operating margins. They capture the cascade of benefits that resiliency provides through four key strategies.

Manage extreme weather risks

There are three main steps to successfully identifying and managing extreme weather risks. The first is to use forecasts and predictive models to consider how changes to climate, extreme weather, and resulting health impacts play out for the organization and its surrounding communities. Large health systems with multiple campuses should conduct both individual site-level assessments to understand risk variations across the portfolio, and a network assessment that considers interdependencies across the system. It is critical to meet with government planners and your regional health care preparedness coalition to understand available resources and explore how to most effectively integrate a "climate lens" into risk assessments, methodologies, and indicators.

Once a health care organization has identified potential risks, the next step is to assess the likelihood and magnitude of each risk's impact to the business. Leaders need to consider more than generic impacts like a patient surge or supply constraints, and think about other types of operational and infrastructural vulnerabilities that could result from an extreme weather event. It may be helpful to bring in specialists – including enterprise risk management, tax and regulatory advisory, claims valuation and actuarial services – to help facilitate this process. Ultimately, the aim of assessing the significance of each risk is to build a comprehensive and data-driven view of risk priorities across the portfolio.

The final step is to establish a response and execution plan that includes strategies to avoid, reduce, and transfer risk. Risk avoidance strategies might include siting new facilities in areas with lower exposure to flood or other hazards. Risk reduction strategies can be implemented across design or procurement standards. Risk transference strategies often involve partnering with others or revisiting insurance policies. The resulting risk plan should include policies and procedures to ensure regular monitoring and updates.

Reduce emissions

Extreme weather events will keep getting worse unless we mobilize our economy to limit the greenhouse gas emissions contributing to climate change. With health care spending representing 18% of GDP in 2015, the health sector has an important role to play in that effort.[62]

Organizations that successfully mitigate their climate impacts start by measuring baselines, setting clear reduction targets, and mobilizing resources from across the organization to implement changes in energy operations, building design and operations, transportation, waste management, and supply chain.[63] Leaders take advantage of on-site measures like energy efficiency, renewable energy, battery storage, waste reductions, and sourcing local, sustainable food. They also employ off-site strategies like renewable energy power purchase agreements, greening fleet operations, and strengthening public transportation.

Manage extreme weather risks

- **Risk identification:** at individual sites and across portfolio
- **Assessment & prioritization:** likelihood and magnitude of business impact
- **Plans & executions:** clean energy, on-site generation, hardening, relocation of critical infrastructure, staff training

Reduce emissions

- **Energy operations:** conservation, efficiency, renewable energy, carbon offsets, revolving funds
- **Built environment:** green building, facility siting, design, construction, facility operations
- **Transportation:** fleet emissions, public transportation for staff and patients, energy-efficient shipping
- **Waste:** reduction, reuse and recycling, local disposal, supply chain management

Invest in community health & resilience

- **Neighborhood & built environment:** access to healthy food, quality of housing, crime and violence prevention, environmental conditions, intermodal and public transportation
- **Health care access:** insurance coverage, provider coverage, location of facilities, health literacy
- **Economic opportunity:** local hiring and purchasing, cooperatives, fair wages, training and education, entrepreneurship

Lead on policy

- **Risk & cost assessment:** energy, climate, transportation and other policies, regulations, standards and codes, both at individual sites and across the portfolio
- **Staff engagement:** education and activation of government relations and communications staff so they can engage on climate and energy issues
- **Climate-smart advocacy:** input and expertise on city, state, regional, and national policies; collaboration with associations and like-minded NGOs

Who to work with

Inside organization

Facilities & infrastructure | Finance, risk, & tax | Community affairs & government relations | Emergency preparedness & medicine

Outside organization

Local & regional government agencies | Emergency management & health care preparedness coalitions | Mission-critical supply & service chains | NGOs & vulnerable community groups | Cultural & academic institutions | Economic development organizations

How to fund

Embed in existing capital improvement plans | Partner in regional development efforts | Pursue resilience grants & gifts | Self-finance via project-related cost savings, green bonds, rebates/incentives, green revolving funds, & lower insurance premiums

US Climate Resilience Toolkit

The Department of Health and Human Services added a health care-specific chapter to the US Climate Resilience Toolkit. This "Sustainable and Climate-Resilient Health Care Facilities Toolkit" includes an overview document and a suite of online tools and resources that highlight emerging best practices for developing sustainable, climate-resilient health care facilities. The guide provides information about threats from extreme weather events and how organizations around the country are responding. It is available here: https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector

Hospital Preparedness Program

The Hospital Preparedness Program is a federally-funded initiative that supports regional health care system preparedness in order to improve patient outcomes, minimize the need for supplemental state and federal resources during emergencies, and enable rapid recovery. The program operates through local health care coalitions (HCCs) that bring together diverse and often competitive health care and emergency management organizations. A list of all HCCs can be found here: https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertEmergPrep/Downloads/By-Name-by-State-Healthcare-Coalitions.pdf

Invest in community health and resilience

Leaders understand that being climate-smart in only their own facilities is insufficient. Their ability to withstand a disaster is deeply intertwined with what happens in surrounding communities. The Robert Wood Johnson Foundation's National Health Security Preparedness Index measures over 130 indicators of community resiliency – including numbers of paramedics and hospitals, hazard planning in public schools, wireless 9-1-1 capabilities, and social cohesion – to assess health security and preparedness of communities around the country. Aggregate US national health security levels are far below optimal, and although scores are slowly increasing, results are widely uneven, with communities in the Deep South and Mountain West regions lagging the rest of the nation.[64]

True leadership requires partnering with other local and regional players to build community health and resiliency. More jobs and better education will increase health coverage among local populations and improve baseline health levels. Better, multi-modal transportation systems make it easier for personnel to get to work and patients to reach the help they need. More vibrant, socially connected, equitable communities make it easier for neighbors to help neighbors before, during, and after a crisis strikes, to heal and regenerate.

Lead on policy

It is impossible to overstate the extent to which public policy can limit or facilitate a health system's climate-smart options. Federal, regional, state, and municipal actions largely determine what changes can be made to institutional and community infrastructure. Public utility departments, energy grid rules, and market structures impact energy options.

As a result, leading health care organizations connect the dots for policy makers between climate-smart policies, public health, and medical cost containment.

Best practices for climate-smart policy advocacy

1. Track climate-related costs in clinical and facility operations, while actively seeking new climate, energy, and resilience funding streams
2. Use cost data and health system expertise to collaborate with regional energy NGOs on policy risks and opportunities
3. Educate and activate government relations staff so they can engage on climate and energy issues
4. Add climate, energy, and resilience to hospital association and medical society agendas to increase leverage and lower engagement risks and costs
5. Participate in national efforts such as the Health Care Climate Council and Medical Society Consortium on Climate and Health

https://noharm-uscanada.org/healthcareclimatecouncil

https://medsocietiesforclimatehealth.org/

Massachusetts' health care leaders have used private meetings, public hearings, and op-eds to educate governmental decision makers and deliver impressive ROIs: many tens of millions of dollars in technical assistance, utility incentives, grants, and awards. In Ohio, health systems and the Ohio Hospital Association have helped counter attacks on the state's energy efficiency and clean energy programs by providing health impact and cost data to the Public Utilities Commission, signing onto support letters, sharing case studies, and publishing physician-led Op-Eds and Letters to the Editor.

Often these advocacy efforts lead to substantive policy change. Dignity Health has insisted climate and energy policy are moral and strategic business imperatives for over 20 years. Recently, this drove them to help secure passage of California Senate Bill 350, the Clean Energy and Pollution Reduction Act, with press conferences, Op-Eds, testimonies, legislative visits, and events in partnership with many businesses and NGOs.

Who to partner with

Achieving true resiliency cannot happen in a vacuum – it requires collaboration within and across organizations. Intra-organizational teaming often includes a mix of functions, including facilities and infrastructure, finance, risk, tax, community affairs, and government relations. The Boston health care Resilience 2.0 report demonstrates how inter-organizational partnerships can be even more diverse and fruitful, with health care partnering with government agencies, utilities, cultural and academic institutions, economic development organizations, NGOs, and community groups.[65] In Cleveland, a collaboration between Cleveland Clinic, University Hospitals, Case Western, and numerous academic and cultural institutions in the University Circle area has been underway for over ten years. The collaboration uses a four-pronged strategy backed by millions in purchasing and other expenditures – to buy local, hire local, live local, and interconnect the community. The Greater University Circle Initiative has improved the prospects and income of the 60,000 people who live in seven surrounding neighborhoods.[66] Similar work is underway in Detroit, where the Henry Ford Hospital partnered with Detroit Medical Center and Wayne State University to incentivize local procurement. Together these systems have successfully redirected $400,000 to local businesses.[67]

How to fund efforts

Resiliency strategies provide many long-term business benefits, but they can require upfront investment. Smart executives jump on existing funding sources while also cultivating new ones. One key win is to integrate resilient, sustainable design measures into existing building retrofits or regional development plans. Another approach is to offset with grants and gifts or self-finance through project-related cost savings projections, green bonds, rebate and incentive programs, and green revolving funds. Boston Medical Center's campus consolidation and $15 million cogeneration plant were made possible in part by a green bond, energy savings, and a $3.7 million grant from the Massachusetts Department of Energy Resources' Community Clean Energy Resiliency Initiative. Finally, organizations will find increasing resilience opens doors to renegotiating financing or insurance agreements, including coverage terms, indemnity periods, limitations, and deductibles.

Together, these strategies can help health care organizations keep their patients safe, their property intact, and their margins stable.

The time to act is now

If you only do one thing, please direct your emergency medicine and preparedness leaders to include changing climate risks in both facility and regional emergency preparedness planning and implementation.

Photo: FEMA/Win Henderson

SECTION FOUR

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Climate-smart health care leaders:

Improve facility and community resilience

Reduce carbon emissions

Invest in community health

Weigh in on energy and climate public policy

"The US experiences more extreme, high-impact weather than anywhere else on the planet – and the frequency of major events is increasing. Communities and their health care facilities have proven quite vulnerable, raising the need for a convincing business case and guidance to inform proactive investments in resilience. 'Safe Haven's' real-world examples and data meet this need."
-Robin Guenther FAIA, LEED AP, ranked "#1 Most Influential Designer in Healthcare"

"Clinicians and health care leaders have a special opportunity and a big role to play in the face of climate change. Our missions, our communities' respect, and the sector's large carbon footprint give us extra responsibility. Leaders can and should set an example, from organizational climate action, to supporting good government policy on renewable energy, reducing emissions, food waste, and more. 'Safe haven' shows the cost of addressing and preparing for climate change is much lower than the cost of business-as-usual."
-Donald M. Berwick, MD, President Emeritus and Senior Fellow, Institute for Healthcare Improvement

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Health Care Without Harm seeks to transform the health sector, without compromising patient safety or care, to be ecologically sustainable, and a leading advocate for environmental health and justice worldwide.