

# Resilience 2.0: Healthcare's Role in Anchoring Community Health and Resilience

Boston Summit

January 2017



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# Abstract

Health care institutions and the communities they serve are intimately interconnected, especially during and following extreme weather events and human-made disasters. This Summit focused on leveraging community health and climate resilience as a key strategy in the strengthening the health care sector's climate preparedness. Outputs address health care sector engagement in climate public policy; a business case for climate resilient health care; innovative solutions to backup and reliable power generation for health care facilities and community providers; and creating robust networks of partnerships. The lessons learned, questions raised and next steps are relevant to many places.

# Acknowledgments

The Summit was convened by Health Care Without Harm, made possible in part by sponsorship support from the Barr Foundation and co-hosted by Partners HealthCare. Health Care Without Harm acknowledges the important contributions of all the Summit's presenters and the work of the Summit Organizing Committee: Paul Lipke, Hubert Murray, Bill Ravanese, Jessica Wolff, and especially Robin Guenther of Perkins + Will, who assembled this document.

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



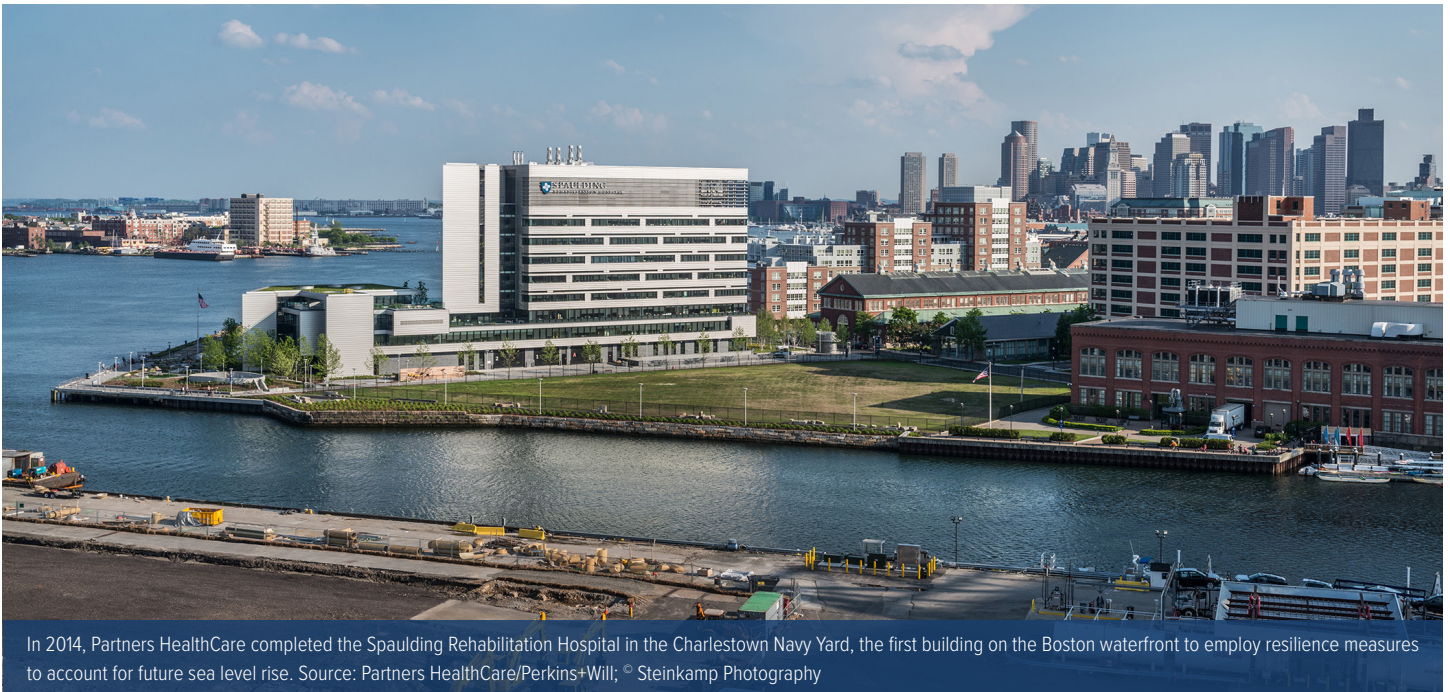
With offices in the United States, Europe, Latin America, and Asia, HCWH is an international coalition of hospitals and health care systems, medical professionals, community groups, health-affected constituencies, labor unions, environmental and environmental health organizations, and religious groups.

Visit [www.noharm.org](http://www.noharm.org) for more information.

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# Part I Introduction & Executive Summary



In 2014, Partners HealthCare completed the Spaulding Rehabilitation Hospital in the Charlestown Navy Yard, the first building on the Boston waterfront to employ resilience measures to account for future sea level rise. Source: Partners HealthCare/Perkins+Will; © Steinkamp Photography

## INTRODUCTION

None of our institutions, least of all hospitals, are islands unto themselves. While any one facility may strive to make itself watertight or “event-proof,” each one is critically dependent on a range of infrastructure systems beyond their four walls:

- personnel being able to get to work – by car, by bus, by train or subway
- supplies to be safe from harm, available and deliverable
- utilities to be uninterrupted – power, water, gas, sewage, waste disposal

Most importantly, it is about the very reason that health care settings exist - to continue to care for patients within our buildings *and* to be available as a refuge of last resort for the neighborhoods and communities of which we are a part in times of crisis. As we learned from the New York experience, nursing homes, elder-care centers and community clinics may be particularly vulnerable elements in this network of care. As Dr John Balbus and Robin Guenther made clear in their report, *Primary Prevention*: community engagement is a key element of health care system resilience.

The role of the Boston area hospitals, and testimony to their collaboration and skills, was amply demonstrated at the time of the Boston Marathon bombing in April, 2013. While climate challenges are markedly different in nature, not least in the likely effect of climate crises to be more widespread, the collaboration and preparedness of the health care network for helping the population at large to overcome the effects of crisis, trauma and the associated stress are essential to our continued well-being as a community.



This Summit takes our institutional concerns and scales them to join with cities and agencies and the communities they represent to ensure that we are helping both our institutional-level resiliency and the communities we are pledged to serve.

“Community engagement is a key element of health care system resilience. Communities face unique extreme weather risks and have varying levels of resilience to those risks. Social factors affect the capacity of communities to prepare for and recover from weather related damage. Because access to health care services is a key element of disaster survival and recovery, health care organizations cannot undertake infrastructure resilience without understanding the role of all hospitals, residential care facilities, ambulatory and home care programs in the health and wellbeing of community residents, and the social and environmental justice issues that define their communities.”

– John Balbus, MD MPH and Robin Guenther, HHS, 2014

This Summit takes our institutional concerns and scales them to join with cities and agencies and the communities they represent to ensure that we are helping both our institutional-level resiliency and the communities we are pledged to serve. The original 1810 fundraising letter of appeal for the founding of Massachusetts General Hospital contained this phrase: “When in distress every man becomes our neighbor.” If we add women and children to this appeal, it is a call that can just as readily be followed today, over 200 years later. This is not only a moral imperative but a matter of practical importance.

## Obligation Versus Opportunity

There is a tendency in discussions of climate change and its consequences – sea level rise, storm surge, extreme precipitation, heatwaves, high winds – to frame this all as tales of gloom and doom. A consequence of that approach is that we prefer to avoid and deny the bad news. But we can decide to frame these challenges as an opportunity to do our jobs better, to think more creatively about how our neighborhoods thrive in good times and in bad, to think ahead, and to figure out “work arounds” for the inevitable event of systems failures.

In this approach “sustainability” and “resilience” become two sides of the same coin, a positive currency for practical, long-term, economically viable and socially just solutions. One of the key characteristics of successful design for resiliency is that the “solution” solves more than one problem at a time. Some examples:

- The drive towards lower carbon emissions and improved energy efficiency has led to the installation of local combined heat and power plants – reducing dependency on central power generation and

distribution and the potential for regional blackout. Reducing energy consumption not only achieves cost and carbon savings, it also means that with any given amount of fuel a hospital can extend its viability for more hours off-grid.

- Roof gardens are increasingly employed to reduce the surge of rainwater runoff from extreme downpours. They are also highly attractive, and in hospital settings have been shown to be an effective contributor to the healing process.
- Tree planting, the creation of Victory Gardens and recreational open spaces make a significant contribution to reducing the heat island effect (that will become increasingly important with the projected longer and more severe heatwaves, especially in cities); they are also a present asset for recreation and public health, encouraging biking and walking in cool shade.

Notably, it has been documented that one of the effects of climate related events (think of Tropical Storm Sandy, Hurricane Katrina, the Chicago heatwave of 1995) is the extreme mental stress suffered by the population. Any measure to reduce such stress, particularly that associated with apprehension (before an event) or loss (after an event) can be considered a contributor to resilience and public health, including green space in otherwise dense urban areas.

These are just three examples of challenges being turned into opportunities. In discussing the challenges of flood, fire and tempest, I urge you to view them not as the End of Times but as prompts to help us think about what we are doing, how we are doing it, and how to do it differently and better. We have a huge challenge ahead of us, and this is a positive start.

# EVENT OVERVIEW

## Why Resilience 2.0?

First, what is resilience? According to 100 Resilient Cities, *resilience* is the capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. This broad definition of resilience requires us to examine an equally broad definition of health, recognizing that health is a state of physical, social and emotional well-being, not simply the absence of disease. Resilient populations require adaptation to both chronic stresses and acute shocks.

Why 2.0? Health care systems, to date, have perhaps been engaged in improving their infrastructure resilience to extreme weather events, but have focused less on this broader definition of health, and with it, the chronic stresses faced by their communities in the face of climate change. As they are reducing greenhouse gas emissions through important energy conservation work, they are not necessarily framing this work around community health. This Summit seeks to begin a broader dialogue about the pivotal role of health care in facing this broader task of anchoring community health and resilience – hence, 2.0.

Health care institutions and the communities they serve are intimately interconnected. At no time is this connection more critical than during and following extreme weather events: from heat waves to flooding, droughts to blizzards. Boston public policy makers and health care institutions are focusing on improving health care resilience to climate change impacts, with an emphasis on anchoring community health and resilience. Health Care Without Harm convened this one-day “by invitation” event, made possible in part by sponsorship support from the Barr Foundation and co-hosted by Partners HealthCare, to catalyze climate action planning for metro Boston health care service providers and allied stakeholders in the communities they serve.

The goals of the Summit included the following:

- Provide updates on the interconnected climate resiliency initiatives happening within the greater Boston area.
- To learn from New York City through an examination of post-Sandy health care sector initiatives and lessons learned from impacted providers.
- To foster a new dialogue about the role of the health sector in anchoring community health and resilience.
- To create a network of organizations and champions who recognize each other, know what each other does, and can find ways to provide mutual, complementary support.
- To share tools, resources, and stories of efforts to advance climate resilience in the health sector and community.
- To continue a dialogue about the barriers and challenges facing our collective efforts, and create a prioritized list of common concerns that can define an agenda to begin the process of collaborative problem-solving.
- To define institutional mechanisms (or identify existing ones) to ensure that progress and collaboration on these important issues is maintained.

This event was designed to engage a broad cross-section of stakeholders, including federal, state and local agencies, elected officials and their staffs, health system representatives and health providers, local public health and planning professionals, utilities, academics, environmental advocates, architects and designers. See Appendixes A-C on pages 37-42 for the Event Agenda, Speaker Bios, and a list of Participating Organizations. It is our intent to inspire

health systems and policymakers across North America to host similar meetings to accelerate the critical work of enhancing health care sector climate resilience as part of broader community resilience efforts. While this meeting was largely a local audience, participants also came from British Columbia, Ontario, New York, Washington DC and North Carolina.

The program included remarks from the Boston Chief Resilience Officer, moderated panel discussions, interactive sessions, “shout-outs” from session participants about their related activities, facilitated small group discussions, and networking time. Over 110 participants spent the day working

together to brainstorm ideas, share tools and resources, and co-create an initial set of learnings based on a set of key questions.

Following the event, participants returned surveys about the effectiveness of the Summit and their interest in continued engagement. Most also participated in a March, 2017 webinar to discuss the Summit’s results and potential next steps. See [Appendix D](#) on pp 43-51 for the webinar’s slide deck. Interested participants have formed a working group tentatively titled: Resilience 2.0. The outcomes of the one-day event are summarized in this report.



# EXECUTIVE SUMMARY

“ On the Northeastern coast of the United States, the expected maximum rise in sea level of 26 inches by 2050 would threaten in five cities alone—Baltimore, Boston, New York, Philadelphia, and Providence—assets worth about \$7.4 trillion. In Boston, losses could reach \$460 billion, or the equivalent of 20 Big Digs. ”

– Corydon Ireland, Harvard University Center for the Environment

## The Boston Context

Health care is the largest single segment of the Boston economy. Taken together, health care and university education account for more than 20% of local employment. In addition, hospitals are critical infrastructure – their uninterrupted operation during and after extreme weather events is crucial to providing essential medical services. At

the same time, healthcare is uniquely positioned to deliver not only clinical care, but influence the health and resilience of communities they are situated within.

Climate change factors related to increasing greenhouse gas concentrations have a range of impacts on health care service delivery and resilience, as illustrated here.

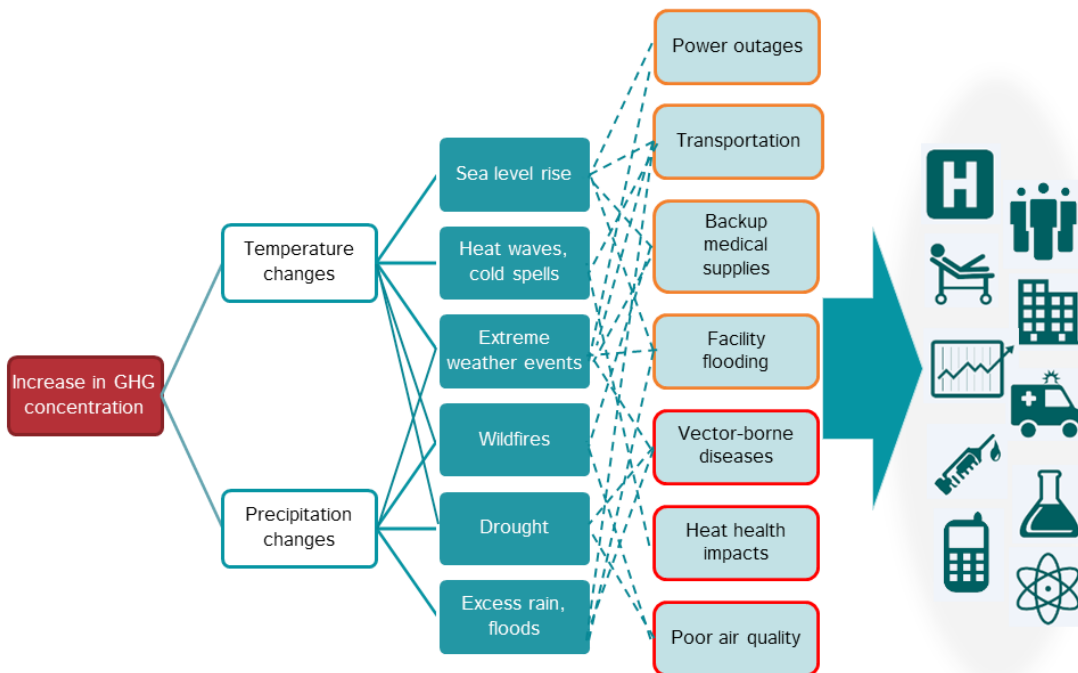


Figure 1-2 This diagram illustrates the relationship between increases in greenhouse gas concentration and health service delivery. Source: 427 Climate Solutions

This meeting brought together leaders from health systems, federal, state and city agencies, utilities, non-profits and architectural firms to develop institutional mechanisms for the deeper engagement of the health sector in creating a more resilient Boston.

## Key Learnings

***The healthcare sector has a key role to play in assisting the City of Boston in supporting population health initiatives that reduce the impact of climate stressors on health; in some instances, they have a direct role in reducing the stressors.*** Examples of stressors include chronic unemployment, deteriorated and unsafe physical environments, environmental pollution, and underlying chronic disease burden. As medical care moves to more convenient community-based settings, a greater range of services are being provided in places that may be at risk.

***The healthcare sector has a key role to play in demanding performance from urban infrastructure – utilities, public transit, water management.*** As a major sector of the Boston economy, health care relies on key infrastructure elements to maintain reliability in health service delivery. They are a critical “voice of the customer” as public agencies and utilities debate and plan infrastructure improvements; their voice must be strong in advocating for transit investments, coastal protection systems, and green infrastructure. Hospitals rely on community infrastructure, so they cannot become resilient alone.

***Health systems should accelerate the completion of infrastructure resilience assessments to determine key vulnerabilities to uninterrupted operation during and following extreme weather events.*** Identifying priority facilities, sharing data among systems, and developing robust emergency management and associated adaptation plans is a key element of creating a more resilient Boston.

***Health systems must embed equity, social justice and social cohesion into resilience planning and policies,***

***and help to shift the structural situations that embed inequities into the fabric of Boston life.*** The health sector, as a major employer, has a key role to play in advancing this work as they proceed with climate adaptation and resilience strategies. The bottom line: disaster is very unfair: those least able to prepare are also those most likely to be negatively impacted.

***Health system response benefits from the “three c’s:” Coordination, Collaboration and Communication.*** Relationships built during preparedness are invaluable during response. Multi-disciplinary resilience planning is necessary to solve these complex issues: knowing what everyone does and developing mutual support strategies is imperative.

## Key Actions

***Broaden health care sector engagement both in policy and at a facility level. Expand sector engagement in 100 Resilient Cities, Climate Ready Boston, and Green Ribbon Commission, and other state adaptation plans.*** Case study data, “stories” and business cases will assist hospital leadership; there is also a role for a collective group in Boston from among these participants to continue to pursue integrating resilience thinking into institutional-level planning and local policy making. Specific actions might include:

- Develop a regional healthcare resilience campaign.
- Organize a Climate Bootcamp for healthcare C-Suite leaders in the greater Boston area.
- Ensure that all hospitals and health systems assess climate vulnerabilities and develop resilience assessments.

***Develop a compelling business case for health care climate resilience.*** How does a hospital measure the probability of failure? What is the cost of failure? How do you cost resilience strategies? How do you measure the intangibles, like incalculable research interruptions, loss of reputation, or loss of economic cohesion in a community from a major health care failure?

- Develop information on the links between sustainability and resilience. Compile case study data, including more examples of how health care owners and designers make the case for the “multiple benefit” strategies.

***Explore innovative solutions to backup and reliable power generation needs for both hospitals and community health providers.*** Identify and implement next-tier opportunities with packaged, islanded co-generation, fuel cells, energy storage and micro-grids that can improve health care reliability *and* support community cohesion. More creative financing mechanisms may be required to better support the under-resourced communities our health providers are passionate about protecting. That is the work ahead, both on acute care hospital campuses and beyond.

- Explore innovative funding solutions. Factor resilience into municipal bond rates and offerings, both to reflect climate risks and to generate funds for infrastructure investments, such as municipal green bonds.
- Identify and support demonstration projects.

***Create a robust network of partnerships with one another and our communities to advance community health and resilience.*** More exploration of community health stressors and vulnerabilities, local micro-grid utility solutions, shared

backup power sources, as components of more creative solutions for community-based providers to reduce the risk of long-term outages that cripple their ability to provide care.

- Assess to what degree ambulatory networks and outpatient facilities are currently engaged in resilience planning throughout the greater Boston area.

Ultimately, healthcare has the unique opportunity to work both “bottom up” within the communities they serve and “top down” in advocacy and policy arenas. As Bud Ris, co-chair of the Climate Preparedness Working Group of the Green Ribbon Commission and advisor to the Barr Foundation, noted in his closing remarks: “Linking mitigation efforts to resilience propels mitigation efforts.” It is the work ahead to build on both existing collaborations and emerging opportunities for the future health, safety and prosperity of the City of Boston and surrounding region.

To further this work, during post-Summit discussions the well-established Boston Healthcare Preparedness Coalition agreed to support periodic engagement with the stakeholders brought together by the Summit, and to evaluate, develop and work towards implementation of the Summit’s recommendations. The Coalition partners coordinate to plan for, respond to and recover from emergencies affecting healthcare and/or its infrastructure.

# Part II

## The Event



## BOSTON'S RESILIENCY INITIATIVES

This session presented the current state of climate resiliency initiatives in the Greater Boston area, including Climate Ready Boston, the Green Ribbon Commission, 100 Resilient Cities, and the current efforts of Partners HealthCare to develop a system-wide climate resilience plan. In a series of brief presentations, leaders from these initiatives laid out the particular challenges and opportunities for the health sector to participate in addressing the challenges. A summary of key climate issues is included here.

“ Boston is ranked 4th most vulnerable city to climate change in the US, and 8th most vulnerable city in the world to economic losses. ”

– Hallegatte, Stephane, Colin Green, et al.,  
“Future Flood Losses in Major Coastal Cities.”  
Nature Climate Change, Aug 18th, 2013, pp 802-06

## Climate Ready Boston

### CARL SPECTOR

COMMISSIONER OF THE ENVIRONMENT FOR THE CITY OF BOSTON



“Climate risks are not new for Boston, but they will continue to increase as the global climate changes.”

- Climate Ready Boston

Carl Spector led the session by suggesting that we need to develop a better rhetoric to discuss the imperative of resilience with health and hospital systems. He challenged the health systems to think about their value as community institutions, and their perhaps less than obvious role as “respite from the storm.” He framed the role of healthcare as a “graceful gift” to communities, and suggested a roadmap for sector engagement in Climate Ready Boston initiatives.

The Climate Ready Boston Initiative is one of the supporting plans under the [Imagine Boston 2030](#) initiative, the first multi-stakeholder citywide plan in 50 years. The goal is to create a systematic and comprehensive resilience framework for the city, coordinated with 100 Resilient Cities. [Climate Ready Boston](#) released its first full report in December, 2016; Carl Spector presented key findings from the document.

Updated climate projections suggest that extreme temperatures, sea level rise, extreme precipitation and storms will create increased local vulnerabilities:

- Extreme heat
- Stormwater flooding
- Coastal and riverine flooding

Using the three emissions scenarios from the Intergovernmental Panel on Climate Change, the Boston Research Advisory Group (BRAG), overseen by the University of Massachusetts Boston School for the Environment, developed consensus data about how Boston’s climate will change over the course of the twenty-first century. These data, excerpted from Climate Ready Boston’s report, are summarized here.

Guided by these vulnerability findings, Climate Ready Boston identified a set of eleven climate resilience initiatives to address climate risks. These initiatives are based on the following principles:

- Incorporate local involvement
- Generate multiple benefits
- Leverage the building cycle
- Design in flexibility and adaptability
- Create multiple layers of adaptation by working at different scales

Relevant strategies presented at this meeting include:

- **Strategy 2:** Expand education and engagement to prepare Bostonians for climate change. Gatherings such as this one, with engagement across sectors, is vital to adaptation. Healthcare can also play a key role in community education
- **Strategy 4:** Implement climate adaptation through Resilience Area Plans. Adaptation will be implemented at a neighborhood level. Health systems should consider their own resilience adaptation plans in the context of neighborhood level initiatives.
- **Strategy 5:** Create a coastal protection system. Ask the question: what is the role of healthcare in advocacy and leadership for effective coastal protection systems, such as parks, levees, and floodwalls.
- **Strategy 6:** Establish Infrastructure Coordination Committee (ICC) to facilitate climate adaptation.
- **Strategy 8:** Expand the use of Green Infrastructure and other natural systems to manage stormwater, mitigate heat islands, and provide other benefits. Health system campuses have the potential to implement Green Infrastructure strategies and advocate for enhanced green infrastructure in neighborhood ‘health districts.’
- **Strategy 9:** Update building regulations to support climate change. The example of Spaulding Rehabilitation Hospital, in the Charlestown Navy Yard, shows the power of healthcare buildings to model innovative building infrastructure solutions.
- **Strategy 10:** Retrofit existing buildings. Using the principle of leveraging the building cycle, healthcare can strategically retrofit infrastructure to meet the climate challenges identified above.

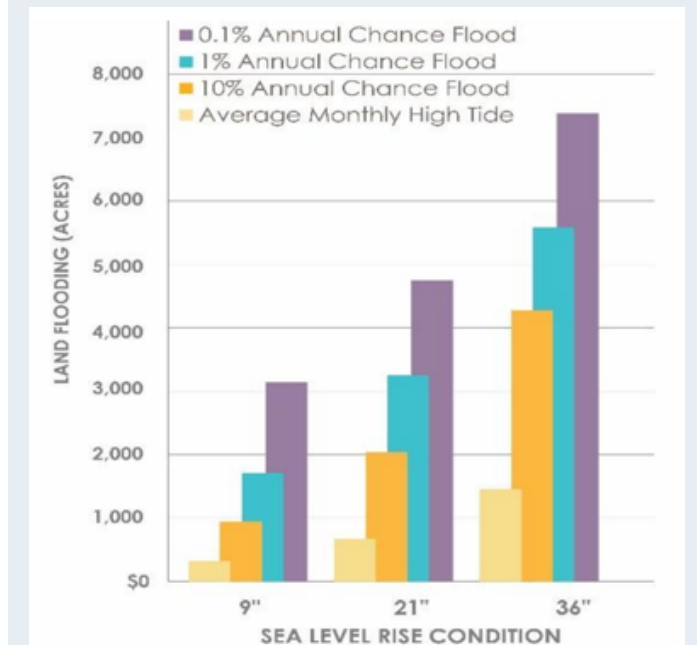
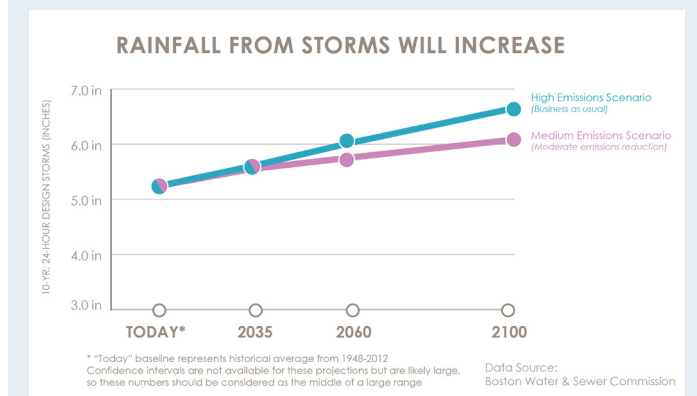
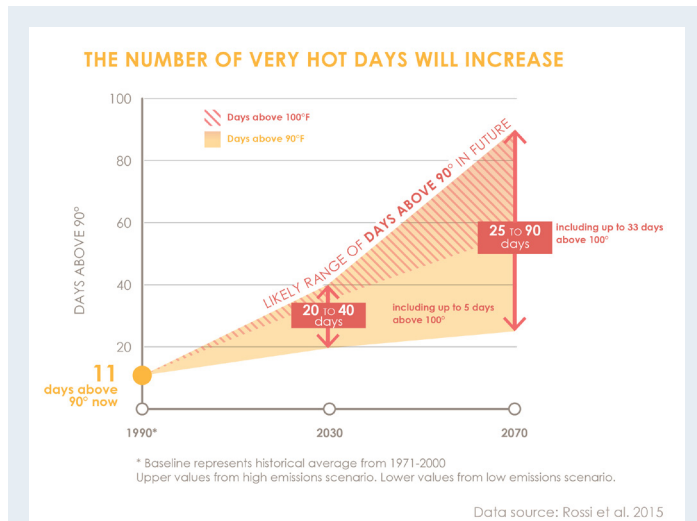


Figure 2.1 (a-c): These graphs chart projected climate impacts in Boston: increased temperatures, severity of storms, and sea level rise. Source: Climate Ready Boston

## Green Ribbon Commission

### JOHN CLEVELAND

#### EXECUTIVE DIRECTOR OF BOSTON'S GREEN RIBBON COMMISSION

Climate resilience requires dramatic transformation of the City of Boston over the next few years: “We have redesigned Boston before (e.g. the Big Dig) and we can do it again.” The [Boston Green Ribbon Commission](#) is a group of business, institutional, and civic leaders in Boston working to develop shared strategies for fighting climate change impacts in coordination with the City of Boston’s Climate Action Plan.

“We are America’s climate champion, with a target date of 2050 for going 100% carbon-neutral.”

– Mayor Martin J. Walsh  
State of the City 2017

John Cleveland emphasized that to accomplish this transformation, many established patterns of behavior need to change: “fundamental changes are required in planning infrastructure as well as financing mechanisms. This process needs to begin now, and be undertaken with a high sense of urgency.” Healthcare institutions can play a unique role in this transformation, a role that will require them to “move beyond their comfort zones” in some areas. He stressed the importance of healthcare leaders in raising their voice around the health issues associated with climate change;

the public health challenges and social stressors that climate projections suggest will accelerate.

The Health Care Working Group of the Green Ribbon Commission has been focused on meeting 100% reduction in greenhouse gas emissions by 2050 while improving resilience. The Green Ribbon Commission website celebrates the significant achievements of the sector to date, which have been accomplished through a focus on energy efficiency and a widespread shift to on-site or district Combined Heat and Power (CHP) systems, which improve efficiency and offer enhanced resilience to utility disruptions.

There is a significant opportunity for Boston healthcare to be viewed as a national leader in this effort, and to use its ability to innovate as a model for other sectors, including the public sector. Continued efforts to achieve this carbon-neutral goal will be disruptive. It is an incredibly challenging task, and requires new governance models, new finance tools, and new technical capabilities. His final words: “There is urgent and continued need for the moral voice of the healthcare sector in this work. Not doing something is a violation of the Hippocratic Oath. We need healthcare to demand performance from infrastructure systems—because even the most resilient hospitals won’t operate if people can’t flush the toilets and can’t get to work.”

“There is urgent and continued need for the moral voice of the healthcare sector in this work. Not doing something is a violation of the Hippocratic Oath. We need healthcare to demand performance from infrastructure systems—because even the most resilient hospitals won’t operate if people can’t flush the toilets and can’t get to work.”

– John Cleveland  
Executive Director, Green Ribbon Commission

## 100 Resilient Cities

### AUSTIN BLACKMON

CHIEF OF ENVIRONMENT, ENERGY AND OPEN SPACE, CITY OF BOSTON



“ The health risks from climate change are not equally distributed among the populations and neighborhoods of Boston: the elderly, young children, low-income communities bear disproportionate health and safety risks. ”

– Austin Blackmon  
Chief of Environment, Energy and Open Space, City of Boston

Boston is proactively demonstrating leadership in climate resilience through the Green Ribbon Commission and Climate Ready Boston; a key focus of the [100 Resilient Cities](#) program is how these policies are communicated and translated to our diverse communities. The health risks from climate change are not equally distributed among the populations and neighborhoods of Boston: the elderly, young children, low-income communities bear disproportionate health and safety risks. How do low income seniors in East Boston, for example, access quality healthcare providers without public transit? How will extended heat waves affect our most vulnerable populations?

100 Resilient Cities supports the adoption and incorporation of a view of resilience that includes not just the shocks — earthquakes, fires, floods, etc. — but also the stresses that weaken the fabric of a city on a day-to-day or cyclical basis. The healthcare sector has a key role to play in assisting the City of Boston in supporting population health initiatives that reduce the impact of these stressors on health; in some instances, they have a direct role in reducing the stressors. Examples of these stresses for Boston include:

- high unemployment
- an overtaxed or inefficient public transportation system
- endemic violence, and
- chronic food and water shortages.

CONCENTRATIONS OF SOCIALLY VULNERABLE POPULATIONS<sup>41</sup>

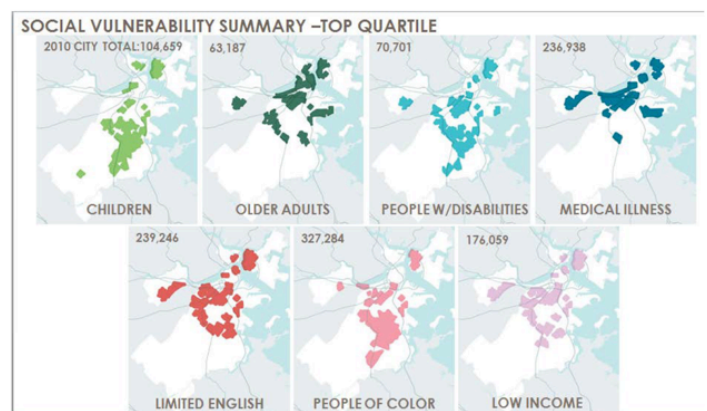


Figure 2.2 These maps outline concentrations of socially vulnerable populations in Boston. Source: Climate Ready Boston.



## Partners Strategic Resiliency Plan

HUBERT MURRAY, PARTNERS HEALTHCARE AND  
LISA DICKSON, ASSOCIATE PRINCIPAL, RESILIENCE LEADER, ARUP



“ Climate risks will require the system to change how services are delivered, and accept that changing conditions will be the new normal. ”

- Hubert Murray, Partners HealthCare

Climate change has been identified by Partners leadership as a significant potential business risk. In 2014, Partners began a system-wide process of evaluating the range of potential impacts on facilities and medical services in the face of future climate projections. The goal was to develop a comprehensive response, identify and address codes and procedures that conflict with best practices in resilient design, and implement short and long-term interventions to improve resilience and mitigate risk. Climate risks will require the system to change how services are delivered, and accept that changing conditions will be the new normal.

The process includes three phases; Partners has completed Phase 1 and Phase 2 is underway. The Partners study includes consideration of seismic and wind events, in addition to increased heat, precipitation/storms, and sea level rise:

- **Phase 1:** developing climate scenarios and hazard assessments for all campuses in the system,
- **Phase 2:** conducting a vulnerability assessment of critical facilities and clinical operations,
- **Phase 3:** developing capital prioritization and plans for implementation, operations enhancements, and long term adaptation efforts

For each campus, Partners outlined a summary of vulnerability and exposure for each risk, using three time frames: present, 2030, and 2070. Near-term strategies will be implemented through enhanced operations and ongoing capital upgrades to address 2030 challenges. More aggressive investments in high performance resilient buildings going forward will address the 2070 challenges (see Figure below).

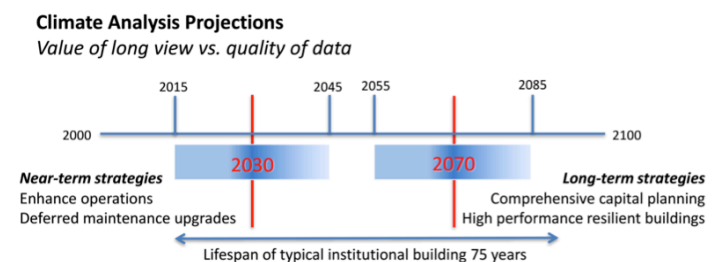


Figure 2.3a This diagram illustrates the power of climate analysis projections to influence decision-making in the built environment. Source: Partners HealthCare

Each campus prepared a resilience assessment using the [US Department of Health and Human Services Climate Resilience Toolkit Checklists](#). Results from individual campuses were then aggregated on a compiled checklist (see example) to identify key vulnerabilities within the system.

Figure 2.3b. Partners HealthCare is aggregating checklist data from all campuses to visually assess the potential climate vulnerabilities across their health system infrastructure. Source: Partners HealthCare

This assessment process yielded the following:

- Identified *priority facilities and criticalities in need of urgent mitigation efforts* (eg, emergency preparedness planning, work with vendors, utilities, facilities, etc).
- Consideration of specialties, *and non-transferable services populations* (e.g. ICU, NICU, psychiatric care, etc).

- Identified priorities for investigative study regarding *medium to long-term mitigation strategies*.
  - Developed *strategies and standards* for ongoing and future capital improvements.
  - Set priorities for *system-wide action* and support.

Finally, Partners HealthCare’s interest in resilience has a long history, beginning with their 2006 commitment, following Hurricane Katrina’s devastating impact on healthcare infrastructure, to construct a [resilient Spaulding Rehabilitation Hospital](#), located on the Charlestown Navy Yard waterfront. This building was the first structure on Boston Harbor to account for sea level rise, move infrastructure to the roof, and incorporate passive survivability measures such as operable windows and a highly insulated building envelope. This more recent undertaking, moving outward to the larger system, shows a continued interest in improving healthcare resilience in Boston, and their interest in joining with other local and regional health systems to develop a learning community that will benefit the greater City of Boston and the healthcare systems that serve it.

## LEARNING FROM NEW YORK CITY



Pictured: Dr. Celia Quinn, New York City Department of Health and Mental Hygiene; Jennifer Kearney, Gotham 360; Louis Wetstein, PhD, NYU Langone Medical Center

“ In our vision of a stronger, more resilient New York, many vulnerable neighborhoods will sit behind an array of coastal defenses...In other areas, permanent and temporary floodwalls will hold back rising waters, and storm surge will meet raised and reinforced bulkheads, tide gates, and other coastal protections. Water that makes its way inland will ...be absorbed by expanded green infrastructure, or diverted into new high-level sewers. Meanwhile, power, liquid fuels, telecommunications, transportation, water and wastewater, healthcare, and other networks will operate largely without interruption, or will return to service quickly when preventative shutdowns or localized interruptions occur. ”

– A Stronger, More Resilient New York, City of New York, 2013

Hurricane Sandy (2012) was the largest Atlantic hurricane on record and the second-costliest hurricane in United States history, with winds spanning 1100 miles. Estimates of damage to date have been about \$75 billion (2012 USD), a total surpassed only by Hurricane Katrina. Early on October 29, Sandy moved ashore in New Jersey as a post-tropical cyclone with hurricane-force winds. Later that evening, its storm surge hit New York City, flooding streets, tunnels and subway lines and cutting power in and around the city. It became the worst natural disaster ever to hit New York City. [A Stronger More Resilient New York](#) is a comprehensive report on the effect of the event on the city, with a [full chapter](#) on the impact to provision of health services.

The storm completely shut down six hospitals and 31 residential-care facilities. More than 6,400 patients were evacuated before and during the storm, including NYULangone Medical Center and Bellevue Hospital. This session explores the ongoing work to improve health sector resilience following this event, including public policy initiatives, utility infrastructure innovations, and individual health system recovery and adaptation efforts. It opened with excerpts from a feature length documentary, [Hurricane Sandy – What Really Happened](#) and [NYULangone’s documentary, Powered by Our People](#) on their campus evacuation and recovery efforts.

## Health and Healthcare Overview: Lessons Learned from Sandy

**CELIA QUINN, MD, MPH**

EXECUTIVE DIRECTOR OF THE BUREAU OF HEALTHCARE SYSTEM READINESS,  
DEPARTMENT OF HEALTH AND MENTAL HYGIENE, OFFICE OF EMERGENCY PREPAREDNESS  
AND RESPONSE, CITY OF NEW YORK

“Healthcare services are interdependent. Vulnerabilities in non-acute care sectors have direct and immediate (and potentially longer term) impacts on hospitals.”

- Celia Quinn, MD, MPH

It is important to understand how Hurricane Irene set the context for Sandy. There is a tendency to base planning decisions for the future on past experiences, but that is not always effective. In Irene, there were pre-emptive evacuations and preparedness efforts for a storm that did not materialize at the anticipated levels; in Sandy, the storm surge impacts, given the confluence of high tide and landfall, were difficult to predict or assess.

Key impacts to the healthcare sector included the following and are illustrated in the table that accompanies this list:

- 6,451 people evacuated from hospitals and residential care facilities; 1,800 long term care patients placed in Special Medical Needs shelters
- 10 hospitals remained open despite power outages and flooding
- 65 long term care facilities lost power during the storm
- 500 buildings housing community-based providers were in inundated areas (5% of total capacity)
- 1,200 buildings housing community-based providers lost power during and following the storm
- patients with immediate and chronic care needs (dialysis, methadone maintenance) sought care in emergency departments
- home based care significantly impacted by transportation disruption

| Providers                            | Impact                                  | Building   | Equipment (elevators, imaging) | Utilities (power, water)               | Heating/cooling | Communications/ IT      | Staff                 | Supplies           |
|--------------------------------------|---|--|--------------------------------|--|-----------------|-------------------------|-----------------------|--------------------|
| Hospital                             | Evacuations/ closures/ reduced services | Flooded  | Flooded                        | Back-up failed                         | Flooded         | Phone/ internet outages | Staff couldn't travel | Limited deliveries |
| Nursing homes/ adult care facilities | Evacuations                             | Flooded  | No back-up power               | Back-up failed (NH) / no back-up (ACF) | No back-up      | Phone/ internet outages | Staff couldn't travel | Limited deliveries |
| Community-based providers            | Closures / reduced services             | Flooded  | No back-up power               | No back-up                             | No back-up      | Phone/ internet outages | Staff couldn't travel | Limited deliveries |
| Home-based providers                 | Reduced services                        | Disruptions in patients' homes/residences, e.g. loss of power, elevators not working |                                |  |                 | Phone/ internet outages | Staff couldn't travel | Delayed deliveries |

■ Primary reason for disruption    ■ Secondary reason    ■ Tertiary reason

Figure 2.4a This table diagrams the causes of disruption to healthcare services during and after Hurricane Sandy. Note that often there are multiple causes beyond physical healthcare delivery infrastructure.

Immediately following Sandy, hospital bed capacity was reduced by 8 percent. In addition, displaced nursing home and adult care patients were moved to available hospital beds, stressing capacity for weeks and months. Some hospitals experienced storm-related surges in ED visits for basic medical needs: methadone, oxygen, dialysis, medications. In the outlying Rockaways, 95% of primary care providers were closed or relocated; 38% remained closed for more than 30 days. Transportation system disruptions, including public transit shutdowns, gasoline rationing, and restrictions on single-occupancy vehicles or access checkpoints, presented significant challenges for healthcare workers and the home-care sector.

may be uncertain. The risks of evacuating fragile patients may outweigh the risks of shelter in place strategies, and the consequences of this decision may impact life and death.

- **Hindsight will always be 20/20.** Decisionmakers will be criticized for bad outcomes.
- Large-scale multi-facility evacuations require planning and response coordination. Particular challenges: lack of standardized definitions for bed types, patients may lack critical demographic and clinical information, receiving facilities may not have access to records (not a single system of records), and receiving facilities may not be able to rapidly credential caregivers that accompany patients from a closed facility.
- **There is need for surge space of different types.** Special Medical Needs Shelters (SMNS) are not appropriate for nursing home and long term care patients; long term care facilities do not have the capacity to absorb surge, and there are barriers to increasing surge capacity in that sector.
- **Planning needs to account for immediate and long-term interruptions to healthcare services.** Ambulatory care facilities may remain closed for weeks; mental health and behavioral health services must also be considered. Some facilities never re-open. Better coordination of mobile medical clinic resources may help mitigate access to care challenges.

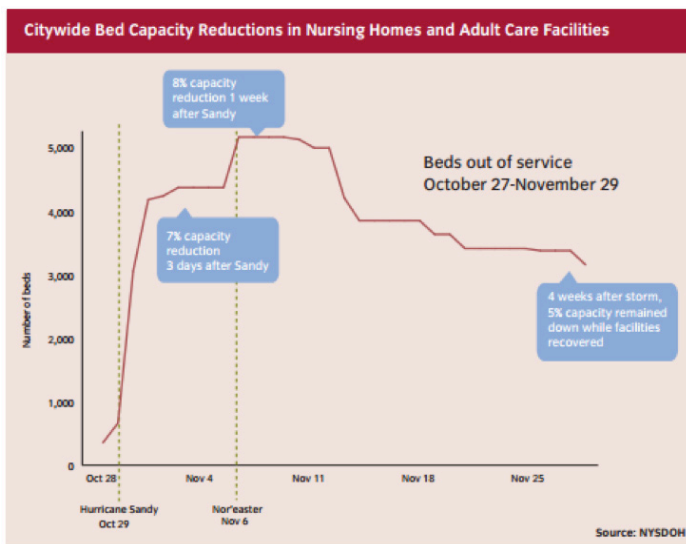


Figure 2.4b: Citywide nursing home bed capacity reductions in New York City continued for more than 4 weeks following Hurricane Sandy, stressing acute care beds well beyond the immediate event period. Source: NYDOH

Key lessons learned:

- **Healthcare services are interdependent.** Hospitals have well-developed emergency plans, while long term care facilities are more vulnerable. Vulnerabilities in non-acute care sectors have direct and immediate (and potentially longer term) impacts on hospitals.
- **Healthcare evacuation decision-making is complex.** Decision must be made to evacuate a large facility more than 72 hours before the event, when storm forecasts

Since the storm, New York City and the Greater NY Hospital Association have instituted a Patient Movement Workgroup that has developed standard patient transfer forms; planning worksheets to expedite medical records access, and standardized bed definitions. They have a draft disaster credentialing guide and toolkit.

One final key message: Consider the importance of the three 'C's': Coordination, Collaboration, Communication. Relationships built during preparedness are invaluable during response. These are complex and challenging problems that require a team approach.

## Innovative Energy Systems for Resilience

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JENNIFER KEARNEY

FOUNDER, GOTHAM 360 LLC

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“Hospitals need backup power, but more importantly, they need to select the right backup power. Reliability and climate considerations are driving the adoption of distributed generation systems, from cogeneration (CHP) to micro-grids to renewables. It’s an important moment.”

– Jennifer Kearney, Gotham 360

One of the key climate change mitigation and adaptation solutions for healthcare is the introduction of on-site or district level Combined Heat and Power (CHP) systems. As John Messervy noted in his opening remarks, these systems both improve electricity generation efficiency (which reduces greenhouse gas emissions) and, if they are capable of disconnecting from the grid (also termed “islanding” or “blackstart” systems), provide a high-reliability form of backup power and thermal energy for hospitals.

In New York, hospitals began implementing CHP systems as far back as 2004, but complexity of interconnection standards and utility regulatory structures slowed approvals; the first system in Manhattan became operational in 2010. The impetus for these systems pre-dated Sandy; in the 20 years before 2012, New York City experienced 9 coastal storms and 6 multi-day heat waves (with grid outages). Widespread power outages occurred in 1977, 2003 (the Northeast blackout), and 2012 (Sandy). These events caused billions of dollars in damage to buildings and infrastructure.

Like Boston, future climate projections suggest an increasing incidence and intensity of heat waves, heavy rain and storm surge flooding, which are likely to continue to stress the grid and cause power failures. To address these challenges going forward, New York City convened its first [Building Resiliency Task Force](#), which produced a series of recommendations for building code changes focused on stronger buildings, backup power, and essential safety.

One of the key outcomes is the significant expansion of distributed generation capability in New York City, including co-generation (CHP) and solar. These systems increase the probability that power will work when the grid fails, reduce

reliance on potentially unreliable fuel deliveries during and after an emergency, and reduce air pollution and cost. Since 2012, the City has worked to remove barriers to these technologies. In 2016, ConEdison introduced the Distributed System Implementation Plan, which calls for the installation of 800MW of distributed energy resources by 2020. A key market for this effort is hospitals.

In 2014, New York State announced a major initiative titled [Reforming the Energy Vision](#) aimed at transforming the retail electricity market and overhauling New York State’s energy efficiency and renewables programs. In addition to shifting to more efficient energy generation, the program is aimed at avoiding billions of dollars in investments to repair or replace our aging energy infrastructure. One of the key elements of this vision is the emergence of the microgrid, small distributed energy plants nearby to critical facilities: hospitals, schools, police and fire stations. Microgrid generation can be solely cogeneration, or can combine technologies ranging from CHP to solar.

The New York State Energy Research & Development Authority (NYSERDA) launched a three-tier [“NY Prize” microgrid competition](#). The 83 Tier 1 submissions are available for review on their website, and offer important insights into the anchor role that hospital campuses play in microgrid development economics, given their 24/7/365 operation and energy needs. Among the New York Prize/REV demonstration projects is the Buffalo Niagara Medical Campus Distributed System Platform (Project 80), in partnership with National Grid, that includes both CHP and community rooftop solar in an adjacent Fruit Belt low-to-moderate income neighborhood.

## The Story of Hurricane Sandy and NYU Langone Medical Center

LOUIS WETSTEIN, PHD PE SENIOR DIRECTOR OF ENGINEERING,  
STRATEGY AND SUPPORT, NYU LANGONE MEDICAL CENTER

“ Calamity presents people with choices that are as clear as choices ever get. You can surrender, or you can pick yourself up and vow to come out stronger than you were before. ”

– Robert I. Grossman, MD, The Saul J. Farber Dean and CEO, NYU Langone Medical Center, in *Powered by our People: The Story of Hurricane Sandy, NYU Langone, and New York*

NYU Langone evacuated its mainframe hospital facility in the midst of Hurricane Sandy. 320 patients were safely moved to neighboring acute care facilities, and the 2.3 million square foot campus, which suffered extensive damage totaling close to \$1 billion, remained closed for two months. The hospital ultimately received \$1.13 billion in recovery aid, the second-largest award for a single project in the history of FEMA. This session focused on the recovery effort and lessons learned.

In the immediate aftermath of the storm, basements were flooded. Hazardous materials remediation, pumping and drying was required before detailed damage assessments could begin. Hazardous areas remained throughout the stabilization and remediation phases of recovery. The assessment included federal, state and local representatives, and involved an iterative process with FEMA.

A detailed risk assessment led to the formulation of a campus-wide flood protection strategy and revised flood plain elevations. NYU Langone adopted a strategy for designing to maintain critical functions in a 500-year future event. This assessment process revealed that the FEMA 100 and 500-year advisory projections may or may not reflect climate change impacts that have already occurred and, even if based on recent analysis, FEMA only publishes backward looking projections that do not account for sea level rise and increasing frequency of future events. Hence, NYU Langone looked to New York City’s SIRR science for establishing new design flood elevations, which are more conservative than FEMA data alone.

| Annual Probability | % Chance in 10 Years | % Chance in 50 Years | Return Period | Desirable Performance       |
|--------------------|----------------------|----------------------|---------------|-----------------------------|
| 1%                 | 10%                  | 39%                  | 100 years     | Minimal Impact              |
| 0.2%               | 2%                   | 10%                  | 500 years     | Maintain Critical Functions |
| 0.04%              | 0.4%                 | 2%                   | 2500 years    | Preserve Life Safety        |

Figure 2.5a This chart captures the three level of probability that were considered across each hazard. Source: NYU Langone Medical Center

One key lesson: Failure to mitigate risks can cause losses in the billions of dollars with associated loss of life and reputational risk. Even if mitigation measures are costly, the economics of the expected return may be good.

“ Failure to mitigate risks can cause losses in the billions of dollars with associated loss of life and reputational risk. ”

– Louis Wetstein

Campus resiliency strategies include:

- **Cogeneration:** a 42MW on-site micro-grid facility will provide thermal energy and power for the entire 2 million sf campus
- **Enhance infrastructure capacity and redundancy.** Redundant campus data centers, diverse and redundant distribution pathways, redundant points of entry to data. A combination of cogeneration powered chiller plants with additional backup steam chillers provide diversity.

- *Elevate critical infrastructure, patient care and support functions above new Design Flood Elevations (DFE),* including linear accelerators, radiology, energy plant, emergency generators, etc
- *Protect the campus perimeter below the DFE with a range of automatic flood protection barriers,* including flood gates, vertically rising flood walls, hinged and sliding doors to compartmentalize below flood level areas in case of breach. Passive measures are highly preferred; the less focus required for manually placing flood protection the better.

Making the decision to shelter-in-place during a major storm event is complex, and depends upon the storm intensity and wind direction, which impacts surge. Preparations must begin days in advance, long before OEM issues an evacuation order. It is difficult to disrupt a facility for a future event; gaining consensus is difficult. The New York State DOH has developed a [Facilities Evacuation Timeline](#) and [Guidance Packet](#) to assist hospitals in preparation.



Figure 2.5b NYU Langone as seen from the East River, 2018. The Energy Plant is the foreground lower building in the middle of the image. Source: NYU Langone



## Primary Protection: Improving Healthcare Resilience

**ROBIN GUENTHER, FAIA**

LEED FELLOW, PRINCIPAL, PERKINS+WILL AND SENIOR ADVISOR, HEALTH CARE WITHOUT HARM

*[adapted from Robin Guenther's lunchtime keynote remarks to the assembled audience]*

“The effects of climate change are being felt today, and future projections represent an unacceptably high and potentially catastrophic risk to human health. Tackling climate change could be the greatest global health opportunity of the 21st century.”

– The Lancet Commissions, 2015

This is a time of massive change in the US healthcare system, with changes in payment mechanisms, the rise of value based care, and the shifts from infectious disease to lifestyle diseases, from cancer to diabetes, asthma and heart disease. At the same time, the reality of increasing extreme weather events brings devastation of physical environments, escalating risks to human health through heat waves, droughts, water contamination and air pollution. Will the US healthcare system seize the opportunity to tackle climate change outlined by The Lancet Commissions?

Against this backdrop, health systems are shifting beyond sick care to address the larger social determinants of health. The goal: to create a healthier, more resilient population that ultimately lowers the cost of care. What makes us healthy? The Robert Wood Johnson Foundation, in Health Beyond Healthcare suggests that “although medical care is important, our reviews of research and the hearings we’ve held have led us to conclude that building a healthier America will hinge largely on what we do beyond the health care system.” This means moving past clinical care to address the more global causes of health: the social cultural environment, the physical built environments of neighborhoods, and equitable opportunity for economic and educational advancement. Kaiser Permanente, with the Prevention Institute, suggested this three-part framework in Adverse Community Experiences and Resilience.

In 2005, Hurricane Katrina devastated the healthcare delivery infrastructure of the Gulf region; seven years later, the images of hospital evacuations in New York City during Hurricane Sandy reinforced how little had changed to make our healthcare infrastructure resilient. In 2013, President Barack Obama issued The President’s Climate Action Plan, which “launched an effort to create sustainable and resilient hospitals.” This session is the story of that effort, and what we have learned about the resilience of US healthcare infrastructure along the way.

### *Two Problems: Health Impacts of Fossil Fuel and Extreme Weather*

The Lancet Commission describes the global fuel mix as contributing to a range of negative human and environmental health impacts, due to direct exposures to reduced air quality or local contamination of air, soil, water related to fossil fuel extraction and processing. Extreme weather includes negative health impacts of heat waves, ice storms, water and food-borne diseases, vector borne diseases, food and water shortages, and trauma/mental health.

### *Cascading Benefits: Mitigation and Adaptation Responses*

Many mitigation and adaptation responses to climate change are win-win, creating multiple benefits: reductions in the burden of ill-health, enhance community resilience, alleviate poverty, and address health inequity.

## Improving Health Care Resilience

The goal of Health Care Without Harm’s work with the health sector on climate issues is to build greater understanding of the major role health systems can play in reducing climate impacts while improving population health and community resilience. The Lancet Commission on Health & Climate notes: “By moving toward low-carbon health systems, health care can become more resilient to the impacts of climate change, save money, and lead by example.” Climate and health work focuses on the three pillars shown in this diagram: mitigation, adaptation, and leadership.

1. *Mitigation.* Reducing resource use, fossil fuel emissions, transportation impacts.
2. *Adaptation.* Improving infrastructure resilience, engaging communities to reduce health stresses, and linking sustainability to quality initiatives
3. *Leadership and Advocacy.* Supporting local and national policies, and improving public understanding of climate and health risks.

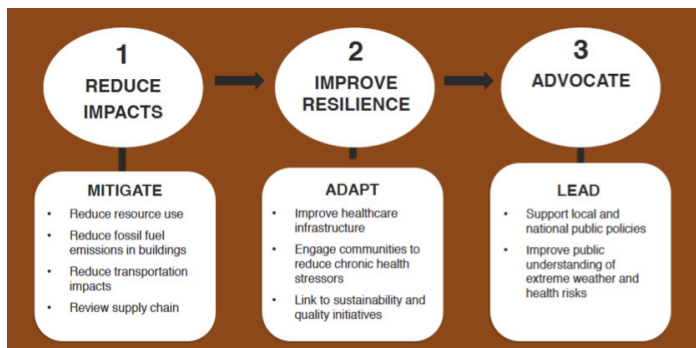


Figure 2.6 Healthcare has a pivotal role to play in mitigation, adaptation, and leadership.

In fact health systems need to engage in all three areas, focusing on the place where the three streams intersect.

### Mitigation

Healthcare has a significant carbon footprint; a study released in 2016 suggests that if US healthcare was ranked as a country, it would be the 13th largest carbon emitter. Hospital buildings are the second most energy intensive type, but they can save significant amounts of energy through efficiency measures and innovative new building design strategies. Increasingly, hospital systems are linking mitigation efforts to health. Dr. Jeff Thompson, former CEO of Gundersen Health System, explains their energy conservation and shift to renewable sources this way: “We

set out to make the air better for our patients to breathe, control costs and help our local economy.” In 2016 Kaiser Permanente, one of the nation’s largest health systems, announced an aggressive goal to be carbon positive by 2025.

### Adaptation

Adaptation includes work on both ensuring infrastructure resilience, as well as the broader role as an anchor for community health, increasing the ability of healthcare settings and populations to handle both extreme weather shocks and community stresses. First, is our healthcare infrastructure resilient to extreme weather? In 2014, Dr. John Balbus and I set out to answer that question by examining extreme weather related hospital infrastructure failures as far back as 2000, along with emerging best practices in infrastructure design. That research is summarized in a document titled: [Primary Protection: Enhancing Health Care Resilience for a Changing Climate](#). We learned that there are four basic factors:

- *More severe weather intensity* – design thresholds, such as temperature, wind velocity, mean flood elevations, are exceeded
- *Longer severe weather durations* – test the limits of on-site fuel, water, and food storage
- *New or expanded geographic regions* – extreme weather is happening in places it has never occurred before, so different building requirements must be enacted
- *Damaged community and utility infrastructure* – hospitals increasing need for reliable power is outpacing the utility’s ability to supply such power; when outages happen, they are lasting longer; disrupted roads and bridges cause long disruptions.

In addition to the report, we developed a [Healthcare Climate Resilience Toolkit](#), with a series of self-assessment checklists that Partners HealthCare and other health systems have been utilizing to understand their climate risk and infrastructure vulnerabilities. This Toolkit, which also includes resource lists and case studies, is based upon two important reference documents, The Canadian Coalition for Green Healthcare’s [Health Care Facility Climate Change Resiliency Toolkit](#) and WHO’s [Smart Hospitals Toolkit](#).

Beyond infrastructure concerns, health systems across North America are engaging in a broad range of programs to enhance community health and resilience. From hosting farmer's markets to investing in cooperative, locally owned businesses, healthcare has a key role to play in working with other community leaders to improve health status. In Cleveland, the Cleveland Clinic, University Hospitals and Case Western University, with funding from the Cleveland Foundation, have established the [Evergreen Cooperatives](#), a series of locally owned cooperative businesses that grow organic vegetables, provide laundry services, and retrofit lighting and solar energy systems. These businesses not only reverse the cycle of economic disinvestment in the midtown neighborhood, they contribute to a more resilient Cleveland, less dependent upon long distance supply chains.

Leadership: Healthcare has a key role to play in advocating for local and national public policy that supports enhanced health and resilience. In an effort to build a unified voice among hospitals committed to addressing climate change, Health Care Without Harm established the [Health Care Climate Council](#). When these leaders advocate for reducing greenhouse gas emissions and rapid adoption of a renewable energy economy, they are doing so for the health of the communities they serve. In many instances, there is economic payback for these investments today; in some instances, as we are learning today, healthy solutions require public investment. More investments in resilient infrastructure, robust public transit, healthier food systems, and expansion of renewable energy infrastructure are important places for healthcare to demonstrate leadership.

“When Health Care Climate Council leaders advocate for reducing greenhouse gas emissions and rapid adoption of a renewable energy economy, they are doing so for the health of the communities they serve.”

- Robin Guenther FAIA

# ANCHORING COMMUNITY HEALTH AND RESILIENCE

This session focused on the questions of how the healthcare sector ensures that facilities remain operational to care for communities across the entire continuum of care. The health threats from extreme weather are varied; health

systems have varying levels of preparedness; communities have variable levels of resilience due to social determinants, access to infrastructure and healthcare.

## Anchoring Resilience in Healthcare

**PAUL BIDDINGER, MD**

**MEDICAL DIRECTOR FOR EMERGENCY PREPAREDNESS, MASSACHUSETTS GENERAL HOSPITAL AND PARTNERS HEALTHCARE**



“ I have a special worry: how will our facilities remain open during disasters? Services are curtailed; supplies are tight; people aren’t available. Access to chronic care - methadone, dialysis - drives surges in acute hospital care. We need to be resilient in the face of climate change, with or without operational community infrastructure. ”

- Paul Biddinger MD

Climate drivers, as they filter through environmental, institutional, social and behavioral contexts, create exposure pathways that cause a range of negative health outcomes: heat related illness, cardiopulmonary illness, vector-borne diseases, and behavioral and mental health needs (see Figure below). As extreme weather events increase in frequency and intensity, these physical and behavioral healthcare needs will also increase. Are we preparing for this future?

The US Climate Resilience Toolkit Climate Change and Human Health literature portal has gathered the growing database of global scientific literature on this topic and Partner’s, as discussed by Hubert Murray and Lisa Dickson in the earlier session, has embarked on an infrastructure resilience study.

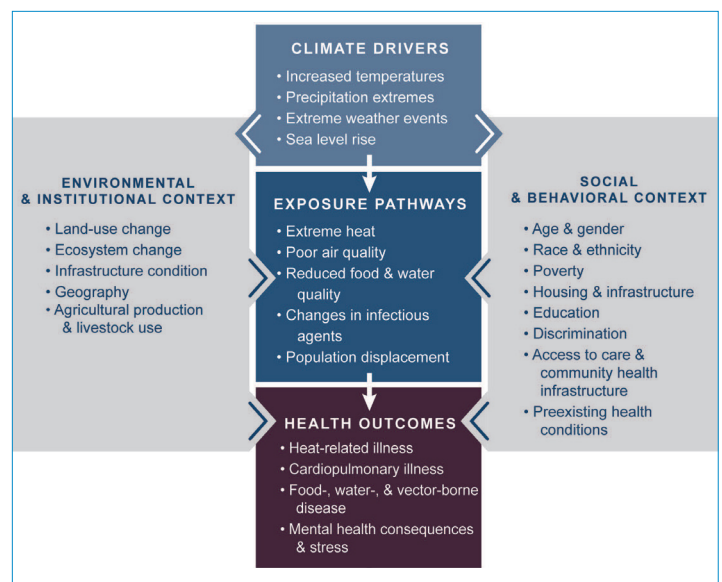


Figure 2.7 US Global Change Research Program (2016). The impacts of climate change on human health in the United States: A scientific assessment.

But let's focus on what happens during and after these events. Increased threats to health mean greater demand for healthcare services. During a disaster, healthcare providers and facilities:

- Care for the newly sick and injured
- Continue to provide routine, chronic health care services, from cancer to dialysis to drug and alcohol treatment
- Sometimes serve as a place of refuge for those needing water or electricity, cooling or food<sup>1</sup>

While hospitals must strive to become more resilient, they all rely on community infrastructure to some degree, so they cannot become resilient alone. As more care moves to lower cost, convenient neighborhood settings, a greater range of services are being provided in places that may be at risk. According to [Primary Protection](#), there are important planning considerations for healthcare with respect to resilience:

- Health care facilities and services cannot rely on community infrastructure
- Hardening health care facilities, including hospitals and sub-acute facilities is vital
- Resiliency includes planning for staffing and supplies in addition to physical structures
- Green design serves a dual purpose
- Protecting research must be part of the plan

Protecting research is essential: at NYU Langone, research losses were estimated at \$700 million, including invaluable tissue samples, cancer research samples, etc. It is imperative that academic medical centers use the best data to prepare for crises. Biddinger noted: "But beyond looking at our own campus vulnerabilities, we also need to understand other healthcare system vulnerabilities in the region, both acute and sub-acute care settings. If another hospital needs to evacuate, we need to be in a position to receive patients in a time of crisis." To prepare for this future, health systems actions should include:

- Monitoring and improving patient's health to better face climate impacts
- Advocacy at all levels to combat climate change
- Enhanced emergency planning at a system level
- Medium and long term capital investments, including for energy redundancy/independence
- Building for the future, anticipating change

Biddinger concluded: "Ultimately, we need to revisit what we think we know. We need to question every assumption about our future, because it is unlikely to resemble the past. NYU Langone thought they were prepared when they built a 13' wall after Katrina; Sandy was 14'-6". Preparedness is a team effort, and we are just beginning to fully understand and develop responses."

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1 Paterson, J., et al. (2014) Health care facilities resilient to climate change impacts. *International Journal of Environmental Research and Public Health*. 11:13097-13116; doi:10.3390/ijerph111213097

## Boston’s Resilience Strategy: Resilience and Racial Equity

**DR. S. ATYIA MARTIN**

CHIEF RESILIENCE OFFICER, CITY OF BOSTON



“ We have to address the day-to-day issues that are tearing at the fabric of our communities—the chronic stressors—that are deeply rooted in the historic context of our cities. Racism, economic opportunity needs to be talked about—we need to acknowledge the disproportionate burdens of inequities. We need to embed equity, social justice and social cohesion into our resilience policies, and shift the structural situations that embed inequities into the fabric of Boston life. ”

– Dr. S. Atyia Martin, Chief Resilience Officer

Boston’s resilience efforts, which have been underway since September, 2015 are about the larger concept of resiliency: the capacity of people and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. The work goes beyond consideration of climate stresses and threats. Dr. Martin began: “Our individual and institutional responsibility starts with understanding and confronting a basic truth: that the largest social determinant of health is race. We need to embed equity into our resilience policies, and shift the structural situations that embed inequities into the fabric of Boston life.” Continuing to do things the way they have always been done perpetuates these inequities.

The organizing principle is simple: The only way to create citywide resilience is to embed racial equity, social justice and social cohesion in infrastructure, environmental and economic aspects of resilience. [The Blueprint for Boston Resilience Strategy](#) has four visions:

**Reflective City, Stronger People**

**Collaborative, Proactive Governance**

**Equitable Economic Opportunity**

**Connected, Adaptive City**

Doing things differently requires addressing racism at every level: individual/internalized racism among citizens; institutional racism at a business level; and structural racism that is embedded in social structures and policies. The Blueprint is suggesting a series of goals that can begin to build a more resilient Boston; many of those goals intersect with this meeting today.

The health sector, as a major employer, has a key role to play in advancing this work as they proceed with climate adaptation and resilience strategies. Key questions: ask yourself, at any meeting, who is not at the table? How many people in your community are physically incapable of evacuating? These assessments should be done in collaboration across institutions, public health departments, and with community leaders. The bottom line: disaster is very unfair: those least able to prepare are also those most likely to be negatively impacted.

## HOW THE BOSTON RESILIENCE STRATEGY IS STRUCTURED





| <b>GUIDING PRINCIPLE</b><br>(Blueprint, 2016) | <b>RESILIENCE, RACIAL EQUITY, AND SOCIAL COHESION</b>  |  |  |   |
|---|--|--|--|---|
| <b>RESILIENCE VISIONS</b><br>(STRATEGY, 2017) | <p><b>VISION 1</b></p>  <p><b>REFLECTIVE CITY, STRONGER PEOPLE</b></p> <p><i>A Boston that reflects upon its history and confronts present realities of racism in daily life and during emergencies to learn and reduce the impact of trauma on individual and community health and well-being.</i></p>   | <p><b>VISION 2</b></p>  <p><b>COLLABORATIVE, PROACTIVE GOVERNANCE</b></p> <p><i>An inclusive and collaborative City government culture that offers residents a meaningful role in decision-making processes and facilitates cross-departmental partnership.</i></p>   | <p><b>VISION 3</b></p>  <p><b>EQUITABLE ECONOMIC DEVELOPMENT</b></p> <p><i>Access to economic and social pathways that support closing the wealth gap to ensure our quality of life is not determined by our race or ethnicity.</i></p>  | <p><b>VISION 4</b></p>  <p><b>CONNECTED, ADAPTIVE CITY</b></p> <p><i>Increased connectivity of communities of color while adequately preparing for threats to infrastructure used by all Bostonians.</i></p>   |
| <b>RESILIENCE GOALS</b><br>(STRATEGY, 2017)   | <p><b>GOAL 1.1:</b> Advance the ongoing development of community training for healing, well-being, and preparedness in the face of chronic stresses and traumatic events.</p> <p><b>GOAL 1.2:</b> Facilitate an open, ongoing dialogue for healing, learning, and action to address racism and strengthen social cohesion in communities.</p> <p><b>GOAL 1.3:</b> Acknowledge the damage that systemic racism continues to inflict on our communities and develop deliberate institutional approaches to achieve and sustain racial equity in Boston policies, practices, and culture.</p> | <p><b>GOAL 2.1:</b> Ensure employment equity and better serve all Bostonians by increasing the representation of the city's diverse population in city government.</p> <p><b>GOAL 2.2:</b> Enhance decision-making capacity in city government by bringing together our residents' and our government representatives' knowledge and skills to better develop policies, practices, and processes.</p> <p><b>GOAL 2.3:</b> Improve the collaboration, evaluation, and delivery of city services to better meet the needs of all Boston residents.</p> | <p><b>GOAL 3.1:</b> Increase access to good-paying jobs, entrepreneurial opportunities, and asset building strategies.</p> <p><b>GOAL 3.2:</b> Ensure safe, affordable, stable housing for all Bostonians.</p> <p><b>GOAL 3.3:</b> Enhance digital equity by increasing access to technology tools, computers and the Internet.</p> <p><b>GOAL 3.4:</b> Prioritize equitable education opportunities to close the gap for young people of color.</p> | <p><b>GOAL 4.1:</b> Develop a redundant and reliable public transportation network to provide equitable accessibility for all Bostonians.</p> <p><b>GOAL 4.2:</b> Prepare for the impacts of climate change and other threats while accelerating sustainable infrastructure, environment, and communities.</p> <p><b>GOAL 4.3:</b> Improve the collaboration of partners working in Boston communities to address climate change and other emergencies.</p> |

Figure 2.8 This excerpt from The Blueprint: A Preview of the Principles and Framework for Boston's Resiliency Strategy outlines a number of goals that intersect with healthcare sector resilience

## Addressing Barriers to Resilient Healthcare Infrastructure

**JOHN BALBUS, MD MPH**, SENIOR ADVISOR FOR PUBLIC HEALTH TO THE DIRECTOR OF THE NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES (NIEHS);  
**ROBERT BIGGIO**, VICE PRESIDENT OF FACILITIES AND SUPPORT SERVICES,  
BOSTON MEDICAL CENTER

This session initiated a series of facilitated conversations among participants about identifying and addressing the key barriers to resilient healthcare. Facilitated by Dr. John Balbus and Robert Biggio, participants identified a broad range of challenges to achieving a more cohesive and dependable health system in the face of extreme weather events. Dr. Balbus focused at a policy and science level, while Robert Biggio brought the challenges to an individual facility level.



“ There are a lot of cognitive barriers to doing things differently. First, policy responds to experiencing extreme events; it's difficult to change otherwise. Part of the policy solution, unfortunately, is that we need a good crisis. ”

- Dr. John Balbus MD

“ There are cognitive barriers to healthcare looking beyond their four walls and effectively defining their community anchor role. How do we prioritize dealing with longer term resilience issues when we have so many immediate pressing facility needs? How do we get leaders' attention with so many competing priorities? How can we leverage the assets we already have and make our institutions more resilient? ”



- Robert Biggio



**Mental filters:** Research shows that people tend to force the world into their existing frames. Weak signals that don't fit are typically distorted or ignored. Humans see what they expect to see, rather than what is there.

**Overconfidence:** A demonstrated tendency to be too certain also makes people tend to believe that the current view they hold is correct.

**Pentant for confirming as opposed to disconfirming evidence:** It is more difficult to detect disconfirming evidence than confirming evidence, so the mind is more likely to accept than to reject an idea.

**Dislike for ambiguity:** People dislike ambiguity, particularly in organizations in which managers are expected to have answers to questions.

**Groupthink:** Members of organizations take comfort from belonging to the majority and seeing the world in the same way, so there is a tendency to go along with what others say, rather than to use an individual mind to find flaw in the group's thinking.

Figure 2.9 Addressing barriers to resilient infrastructure often requires dismantling deeply embedded cognitive barriers to change. Source: Cognitive Barriers (Day and Schoemaker 2004)

Key gaps and action items identified by the group during this session included:

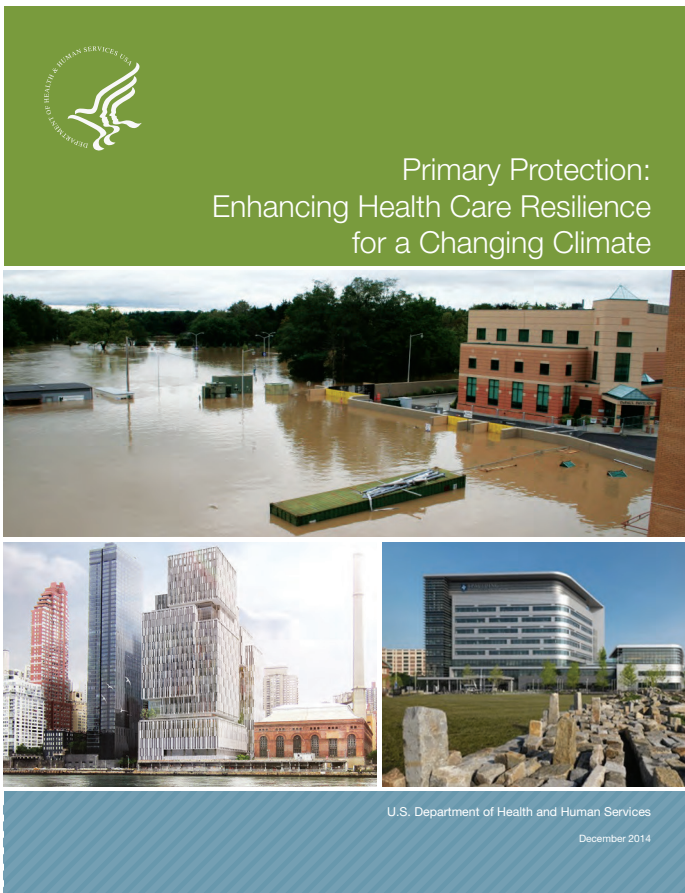
- *Information on the links between sustainability and resilience.* There is a need to compile case study data, including more examples of how healthcare owners and designers make the case for the “multiple benefit” strategies outlined by Messervy and Guenther in their talks.
- *The lack of metrics for measuring resilience.* There are no established measurement tools for presenting resilience; though essential for assessing vulnerabilities, the Toolkits and checklists available today do not contain robust metric measurements for resilience either at a facility or community level. More metrics for resilience are needed.
- *The need for a compelling business case.* How does a hospital measure the probability of failure? What is the cost of failure? How do you cost resilience strategies? How do you measure the intangibles Louis Wetstein mentioned, like incalculable research interruptions, loss of reputation, or loss of economic cohesion in a community from a major healthcare failure? It is time to prepare a business case for healthcare resilience.
- *Accessible and usable climate data.* Not every healthcare owner can undertake the type of climate modelling that Partners HealthCare described. Healthcare needs credible, actionable climate data as a basis of decisionmaking; can local and state government provide that?
- *Achieving a balance between short-term versus long-term thinking and decisionmaking both in policy and at a facility level.* How do we address the cognitive barriers mentioned above? Certainly, case study data, “stories” and business cases will assist hospital leadership; there is also a role for a collective group in Boston from among these participants to continue to pursue integrating resilience thinking into institutional-level planning and local policy making. More creative financing mechanisms may be required to better support the under-resourced communities our health providers are passionate about protecting.
- *Ideological barriers and gaps around climate change.* Will we get to the same resilient outcome without an explicit climate frame? Can we go a day or a week without using the word “climate” to force ourselves to work in another dimension and build greater momentum? We are a divided country and there is not a single rhetorical solution that works – there may be

five or six, depending upon context and audience. It is important to develop resilience communication that works across a range of audiences within the greater Boston community.

- *Opportunities to partner with one another and our communities.* More exploration of local micro-grid utility solutions, shared backup power sources, more creative solutions for community-based providers to reduce the risk of long-term outages that cripple their ability to provide care.
- *Innovative solutions to backup power generation needs.* We must identify and implement the next-tier opportunities with packaged, islanded co-generation, fuel cells, and micro-grids that can improve healthcare

reliability and support community cohesion. That is the work ahead, both on acute care hospital campuses and beyond.

The [Healthcare Climate Resilience Toolkit](#) is a series of self-assessment checklists that health systems can use to understand their climate risk and infrastructure vulnerabilities. This Toolkit, which also includes resource lists and case studies, is based upon two important reference documents, The Canadian Coalition for Green Healthcare’s [Health Care Facility Climate Change Resiliency Toolkit](#) and WHO’s [Smart Hospitals Toolkit](#).



| ELEMENT 1 CHECKLIST   |       | CLIMATE RISKS AND COMMUNITY VULNERABILITIES ASSESSMENT |  |  |  |  |  |
|---|-------|--|--|--|--|--|--|
| GENERAL   | Value | Rank   |  |  |  |  |  |
| <p>1.0.1 Does your health care facility receive notifications of weather warnings, alerts, and advisories for the following hazard conditions?:</p> <ul style="list-style-type: none"> <li>• Extreme heat</li> <li>• Extreme cold</li> <li>• Extreme weather - freezing rain, blizzard, ice storm, hail, snow</li> <li>• Drought</li> <li>• Wildfire</li> <li>• Tornado</li> <li>• Flash Floods and/or Coastal Floods</li> <li>• Hurricanes or Severe storms</li> <li>• Avalanche or landslides</li> <li>• Poor air quality and smog</li> <li>• Water-borne contamination and/or diseases</li> <li>• Vector-borne diseases</li> </ul> |       |  |  |  |  |  |  |
| STEP 1: Understand Climate Risks  | Value | Rank   |  |  |  |  |  |
| <p>1.1.1 Is local or regional government conducting climate risk and vulnerability assessments for the healthcare sector?</p> <ul style="list-style-type: none"> <li>• If "yes", are these assessments regularly updated with emerging data and climate science?</li> </ul>   |       |  |  |  |  |  |  |
| 1.1.2 Does local government communicate to your organization and the community information on local extreme weather hazard trends, including likely hazard impacts?   |       |  |  |  |  |  |  |
| 1.1.3 Does your organization have partnerships with universities or other climate and health-focused organizations to inform your understanding of climate and health risks?  |       |  |  |  |  |  |  |
| 1.1.4 Does disaster risk assessment inform local development policies? (Are local and municipal government authorities acting on climate change information in formulating development policies?)   |       |  |  |  |  |  |  |
| 1.1.5 If the answers above are "no", has your organization conducted an independent climate risk assessment?  |       |  |  |  |  |  |  |
| <ul style="list-style-type: none"> <li>• If the answer is "yes", does your organization utilize the resultant information as a basis of planning?</li> </ul>  |       |  |  |  |  |  |  |
| 1.1.6 Based on your response to the questions above, rank your level of climate risk understanding.   |       |  |  |  |  |  |  |
| STEP 2: Assess Community Preparedness and Vulnerabilities   | Value | Rank   |  |  |  |  |  |
| <p>A resilient health care facility is dependent in part on the climate resiliency of the broader community. Climate variability and climate change may create risks in your community that can affect your health care facility. The community may have limited capacity to cope and certain vulnerability factors (e.g. institutional, demographic, socio-economic) may increase future risks. Step 2 questions should be completed for each campus or unique facility location.</p>  |       |  |  |  |  |  |  |
| 1.2.1 Are local government organizations equipped with knowledge, experience and resources to manage disaster risk reduction and climate change adaptation at a community or neighborhood level?  |       |  |  |  |  |  |  |
| 1.2.2 Are there existing partnerships between the community, healthcare organization and local authorities to reduce climate vulnerability in the surrounding communities?  |       |  |  |  |  |  |  |
| 1.2.3 Does the local government support vulnerable local populations (particularly elderly, children) to actively participate in risk reduction decision making, policy making, planning and implementation?  |       |  |  |  |  |  |  |

Figure 2.10 Hospitals and other facilities find value in standardizing climate vulnerability assessments using guidance documents like "Primary Protection: Enhancing Health Care Resilience for a Changing Climate." Source: US Department of Health and Human Services, December 2014, <https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector>

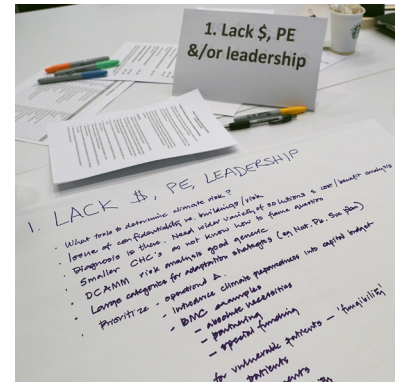
# Part III

## The Work Ahead

### Creating Action Plans and Key Questions: A World Café

JESSICA WOLFF AND PAUL LIPKE  
HEALTH CARE WITHOUT HARM, FACILITATORS

A World Café is a simple, effective, and flexible format for large group dialogue, with 4-5 person groups discussing key questions and creating graphic-rich insights. Nine questions were developed; in some instances, two tables addressed the same question. Participants had the opportunity to either stay with a single question for the entire session, or split their time among two questions. Moderators Jessica Wolff and Paul Lipke helped frame the conversations, kept them moving, ensured that all voices emerged and ideas were written or drawn on newsprint on each table.



#### ***For hospitals with limited financial and engineering resources, and/or lack of leadership engagement, what should be the first steps towards building resiliency?***

Harvest free and low-cost tools to assess climate risk. Use the available climate data from [Climate Ready Boston](#) and [US Climate Resilience Toolkit](#). The Massachusetts [Division of Capital Asset Management and Maintenance \(DCAMM\)](#) risk analysis is a local generic tool.

Harvest free and low-cost tools to assess vulnerabilities and create resilience plans. Use the [HHS Sustainable and Climate Resilient Infrastructure Toolkit](#) checklists to assess infrastructure vulnerabilities. Prepare a system wide assessment by aggregating checklist data in a single location; using this, develop a plan. [The National Park Service Adaptation Plan](#) uses a scenario planning process to develop large categories of strategies for enhancing resilience.

Develop appropriate priorities for limited capital situations. Boston Medical Center contributed their lessons learned to developing this frame for establishing priorities, using emergency preparedness as a driver:

1. Operational changes, including supply chain
2. Partnering with others (including grants and incentive programs)

3. Special funding for absolute necessities
4. Introduce climate preparedness into the capital budgeting cycle (1-3 years)
5. Advocate for legislation to provide incentives for larger investments (like cogeneration or micro-grids, per the NYSERDA example (Kearney talk)

#### ***What changes to City, State and regional policy, planning and/or programs could help advance this work? How might your organization and/or those you know help those changes happen?***

**Funding for prevention and mitigation/adaptation strategies.** Proactive funding to improve population health in order to enhance community resilience along with (FEMA?) funding to invest in proactive improvement of facilities.

**Require or incentivize preparation and submission of mitigation/adaptation plans.** Use this as a tool to unlock funding or incentives.

**Build on MEPA.** Use the Massachusetts Environmental Policy Act (MEPA) Climate resilience policy as a tool for resilience.

**Expand Hazard Vulnerability Assessment tools.** Support an expanded Hazard Vulnerability Assessment (HVA) that includes climate and extreme weather risks. Provide funding,

through the Department of Homeland Security (DHS) to support extreme weather preparedness and resilience efforts.

Work with insurance regulators and insurers to address the market failures and barriers to financing resilience improvements.



Figure 3.1 Professor David Levy, University of Massachusetts Boston, Sustainable Solutions Lab”

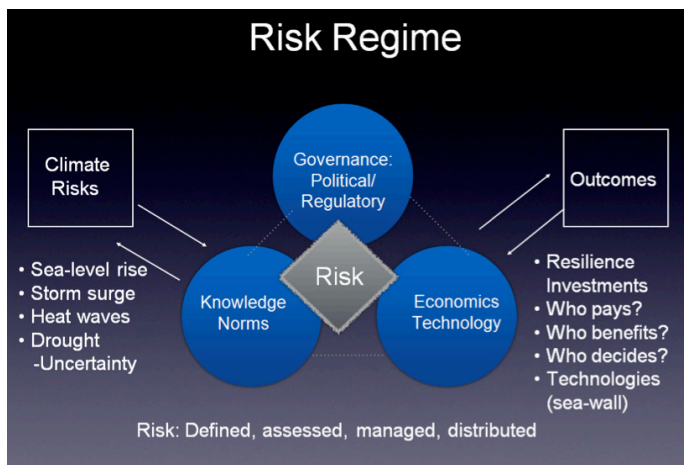


Figure 3.2 Professor David Levy, University of Massachusetts Boston, Sustainable Solutions Lab”

**Provide incentives to encourage public-private planning for resilience integration.**

- Transportation/infrastructure grants
- Expedited permitting and other local regulatory mechanisms
- Encourage multi-site or district solutions

**Organize and launch a statewide “Resilience Campaign.”**

The healthcare sector could play a key role in this.

- Advocate for legislation and policy changes to encourage resilience.
- Master planning at a campus or district level – “resilience districts.”
- Assist in developing a set of pilot projects for private sector or city/state
- Share open-source/ crowd-source models and information with other organizations, sectors, leaders
- Develop metrics for measuring effectiveness
- Promote work to increase visibility

**More healthcare advocacy for resilience investments at local and state level.** Key C-suite leaders must engage in policy development. How do we encourage this?

- ‘Strength in numbers’ can help address concerns about ‘being out in front’
- Educate government relations staff on climate, energy and resilience issues, and how they will impact their institutions
- Clinicians and facility leads need to encourage health care leaders to sponsor/direct gov’t relations staff to engage on this issue
- Multiple institutions can coordinate efforts and/or share costs of hiring the needed policy expertise either through existing channels such as the Conference of Boston Teaching Hospitals’ government relations committee, or some new structure.

***What needs to happen next? What questions need answering?***

**Organize a Climate Bootcamp for healthcare C-Suite leaders in the greater Boston area.** Get this understood as a health issue; include executive leadership, providers, and patient/community advocates.

**Aggregate a metropolitan-level health care risk assessment.** Convene a working group, and publish a sector report. Engage the Massachusetts Hospital Association to play a role.

**Broaden health care sector engagement on state adaptation plans.** Expand sector engagement in 100 Resilient Cities, Climate Ready Boston, and Green Ribbon Commission.

**Financially incentivize resilience measures** through higher recovery reimbursements for more resilient institutions.

**What is needed to pull all these threads together and sustain integration over time? How can you, your organization and/or those you know help this happen?**

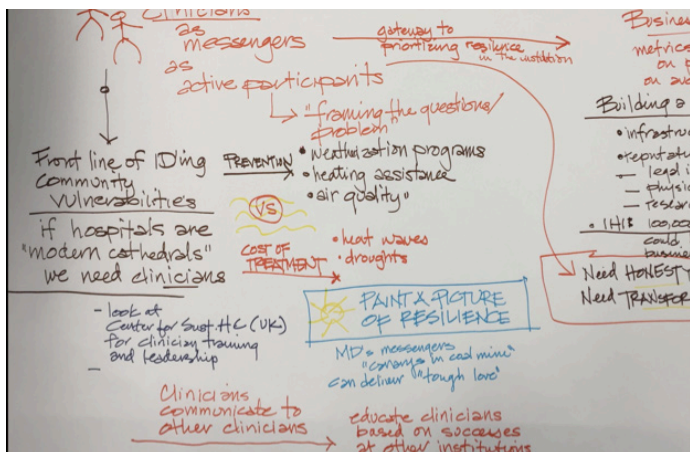
Add climate resilience standards in Joint Commission/CMS standards for accreditation.

Establish clear valuation models for the cost of inaction. Need a “Risky Business” type approach that’s built on health economics

Engage [Pace University Energy and Climate Center](#) on resilience initiatives. Pace is the Department of Energy’s efficiency, CHP and renewables coordinating organization for the Northeast US. Partner with University of Massachusetts Amherst Engineering Department.

Factor resilience into municipal bond rates and offerings, both to reflect climate risks and to generate funds for infrastructure investments, such as municipal green bonds.

**How best can healthcare and others advance climate resiliency for inpatient and research facilities?**



**Engage clinicians as messengers, as active participants in resilience planning.** Clinicians are on the front lines of identifying community vulnerabilities to extreme weather. Clinicians understand tradeoffs between upstream prevention (weatherization, heating assistance, cooling centers, air quality) and ED treatment for heat waves, droughts, etc. Look at the [Centre for Sustainable Healthcare \(UK\)](#) for clinician education and training.

Use the [HHS Sustainable and Climate Resilient Infrastructure Toolkit](#) checklists to assess infrastructure vulnerabilities. Hospitals and research facilities are on the front lines of critical infrastructure in the US.

**Build a robust business case for hospital resilience.** Consider infrastructure costs, reputation loss, legal issues, caregiver recruitment/retention, research issues. Metrics are lacking on business continuity/interruption costs.

**Paint a picture of resilience for hospital leaders.** Focus on leadership, reputation, research grants, and positive values of investments in resilience.

**Assess the subacute and long term care facility vulnerabilities to understand impacts on acute care.** Are facilities planning for acute/subacute/chronic population relocation as sea level rise impacts City of Boston, North Shore/South Shore? Are hospitals prepared for “sheltering-in-place” long term care and ancillary residential care patients during and following extreme weather events?



**How best can healthcare and others advance climate resiliency for outpatient and urgent care clinics?**

Assess to what degree ambulatory networks and outpatient facilities are currently engaged in resilience

**planning throughout the greater Boston area.** Focus on health access and particular community vulnerabilities; assess the gaps in access. Convene a meeting focused on developing an approach to climate resiliency planning for health centers? Engage [Massachusetts League of Community Health Centers](#), [Boston Public Health Commission](#) Health Preparedness, and other existing organizations.

Use the [HHS Sustainable and Climate Resilient Infrastructure Toolkit](#) checklists to assess infrastructure vulnerabilities. There are a range of resources specific to evaluating ambulatory care settings for resilience in the toolkit. What is needed are case studies of innovative ambulatory settings – transportable, or with renewable energy, innovative water solutions and transportation that keep them functioning during and following extreme weather.

Use the [Health and Homeland Alert Network \(HHAN\)](#), a program of the Massachusetts Department of Health and Human Services.

**Improve community preparedness education.** Develop better communication about existing programs and initiatives. Develop additional community resources to empower community members to cope with extreme events or programs (e.g. know your neighbor and neighbor's needs, basic preparedness). Use existing networks (per above) to build communication tools and resources.

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### ***How best can healthcare and others advance resilience for residential adult care and long term care facilities?***

**Assess the subacute and long term care facility vulnerabilities.** Assessment isn't complex; regulations may be lagging and funding mechanisms to enhance resilience are not in place.

Use the [HHS Sustainable and Climate Resilient Infrastructure Toolkit](#) checklists to assess infrastructure vulnerabilities. There are a range of resources specific to evaluating long term care and related residential settings for

resilience in the toolkit. What is needed are case studies of innovative long term care settings.

Senior housing often lacks the corporate/medical leadership structure that long term care and adult day care programs have. This makes it more complex to assess and regulate.

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### ***How can climate resilience in emergency preparedness leverage mitigation: i.e. more efficient energy, transportation, food and renewable power?***

**Sustainable design mitigation strategies often enhance resilience.** Coupling sustainable design and resilience may leverage mitigation, or resilience, depending on the organization. Examples of such features include:

- Rooftop gardens/vegetated roofs: reduce heat load but also mitigate stormwater discharge flows in extreme events
- Drought tolerant landscaping: reduces potable water use during emergencies
- Operable windows: reduce cooling load, enhance comfort and allow for passive cooling when mechanical systems fail
- Rainwater capture or harvesting: can enhance on-site water storage for non-potable uses, conserving potable water reserves for potable uses
- Employee bicycle programs reduce carbon footprint and enhance staff capability to get to work during transit outages.

**Local supply chain and personnel can be an emergency preparedness strategy:** for example,

- Local food purchasing
- On-site electrical power generation, either CHP or renewables (solar, local biomass)
- Hospital personnel living in adjacent neighborhoods, within walking distance
- Hospital waste reduction or zero waste facilitates longer operation without pickup

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## ***What is healthcare's role in anchoring community/public health and resilience, especially for vulnerable communities?***

**First, broaden definition of health and healthcare** – not just clinical “sick care” or hospitals, includes public health, long term care, ambulatory clinics, neighborhoods, and communities. Make change visible so people experience and understand it in a positive way. Improve access to care and navigation of care platforms.

**Hospitals have an opportunity to lead health and resilience initiatives to create healthy lifestyles and social cohesion in preparation for emergencies as a method of building community health and resilience.** Hospitals have resources for convening communities, communication strategies to bridge the gap between hospitals and communities. Healthcare professionals have credibility around health and can effectively partner with other community organizations.

**Understand health needs of various types of populations (e.g. language isolated, disability, age, mental health, etc.). Leverage Community Health Needs Assessments (CHNA) to understand climate vulnerabilities in communities.**

There may be communities with multiple overlapping health needs. There are inherent blind spots to be addressed both in aggregating and disaggregating data and plans. Can we use CHNA's to engage communities and leverage resilience investment resources? Provide community financing options for residential care settings.

**Consider social determinants of health as critical to community resilience.** Implement both top-down and bottom-up community engagement processes. Connect clinical programs to built environment interventions. Connect physiological to psychological care. Improve population health rather than solely focusing on preparing for climate extremes, such as heat waves.

**Make sure resilience infrastructure create co-benefits and encourage healthcare/neighborhood interactions.** Healthcare facilities, particularly hospitals, should not build floodwalls that make a hospital a fortress and separate it from surrounding neighborhoods during extreme events.

**Determine what types of facilities can and should effectively play the role of community anchor.** Ambulatory facilities should be able to reopen quickly to anchor

distressed and damaged communities – places to shelter, charge phones, get information, and other “safe haven” services. Leverage information technology – improve patient/doctor communication assuming compromised transportation systems.

**Combine beautification, community health improvement and quality of life enhancements with resilience,** such as creating sunken outdoor recreational space that can double as a retention pond during extreme precipitation. This demonstrates interconnectedness of the issues to residents. It can also help correct inequitable imbalances in attention, funding, and capacity, and demonstrate the organization cares about its neighbors. Can help residents care more about and care for their neighborhoods.

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## ***What barriers to resilient healthcare, communities and infrastructure do you face? What help do you need?***

**Barrier:** Grid (DOER) + interconnection (distributed power) utilities clogged (2000 projects pending in MA)

**Need:** 1) Interconnection engineers and 2) change queue and project review process; rationalize and prioritize – can health systems move higher in queue?

**Barrier:** Inability to share or connect heat and steam systems (commercial barriers - steam company not interested from business standpoint)

**Barrier:** Technical challenge of upgrading in operating hospital (risks to patients)

**Need:** Training and extra funds for expert staff to do work safely in healthcare settings

**Barrier:** skills of trades often not as state of the art as new equipment demands

**Need:** enhanced training and stricter licensing requirements

**Barrier:** Poor connections between local health departments and healthcare systems outside Boston/Cambridge

**Need:** Relationship building

**Barrier:** Incremental costs of true resilience can prevent good decisions – either modest increment (efficient equipment) or huge increment (retrofit infrastructure vs. new buildings)

**Need:** Finance and funding (grants) to give incentive for better decision

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### ***What lessons and questions from NYC/Sandy and elsewhere need to be pursued here?***

**What does resilient transportation system look like for healthcare?** Test Climate Ready Boston flood maps on the public transportation system and then PANIC. How will personnel get to our hospitals during or following a major extreme weather event? Who starts this conversation? Who leads?

**Consider the future of transportation when considering resilience.** Car share, Uber, driverless cars, BRIDJ (Smart buses). Maybe future transportation modes are as yet unknown. What happens if streets are washed out and flooded? When gasoline is rationed or access to parts of the city are restricted due to reduced bridge and tunnel capacity? Need staff credentialing systems, surge areas to house staff.

During post-Summit discussions, the well-established Boston Healthcare Preparedness Coalition agreed to support periodic engagement with the stakeholders brought together by the Summit, and to evaluate, develop and work

towards implementation of the Summit's recommendations. The Coalition partners coordinate to plan for, respond to and recover from emergencies affecting healthcare and/or its infrastructure.

The Boston Healthcare Preparedness Coalition consists of community health centers, emergency medical services (EMS), hospitals, long term care, public health, and other planning partners. They coordinate to:

- Apply mitigation strategies to minimize the effects of emergencies;
- Plan for and conduct a unified response to emergencies affecting healthcare and/or its infrastructure;
- Create an effective public health and healthcare system recovery from emergencies; and
- Develop and implement improvement plans following emergency responses.



# Appendix A

## MEETING AGENDA

January 11, 2017 | Partners HealthCare, Assembly Row

| TOPIC  | TIME                |
|--|---------------------|
| Introduction, Goals and Purpose  | 8:30 am – 8:50 am   |
| Session 1: Boston's Resiliency Initiatives                                 | 8:50 am – 10:20 am  |
| ◆ Break w/ shout-outs  |                     |
| Session 2: Learning from New York  | 10:40 am – 12:10 pm |
| Lunch: Primary Protection - Improving Healthcare Resilience                | 12:10pm – 1:30 pm   |
| Session 3: Anchoring Community Health & Resilience<br><i>(Interactive)</i> | 1:30 pm – 2:15 pm   |
| ◆ Break w/ shout-outs  |                     |
| Removing Barriers to Resilient Infrastructure<br><i>(Interactive)</i>      | 2:30 pm – 3:15 pm   |
| ◆ Break w/ shout-outs  |                     |
| Creating Action Plans & Key Questions (World Café style)                   | 3:30 pm – 4:30 pm   |
| Closing Remarks React, Inspire, Urgency                                    | 4:30 pm – 5:00 pm   |
| Assembly Row Building Tour and Reception                                   | 5:00 pm – 7:00 pm   |

# Appendix B

## BIOGRAPHIES OF PRESENTERS

### Opening Remarks

#### John Messervy AIA

John Messervy AIA is an architect and the Corporate Director of Design and Construction for Partners HealthCare, Boston, a 12-hospital network that includes the Massachusetts General Hospital and Brigham and Women's Hospital, primary teaching hospitals of the Harvard Medical School. In this capacity, John led the Spaulding Rehabilitation Hospital project team in the development of their new hospital on the Boston waterfront, the first purpose-built resilient hospital in the country. John co-chairs Partners resiliency master plan initiative with Dr. Paul Biddinger. John also manages Partners energy procurement activities, their initiative to be zero net carbon by 2025, and their system-wide sustainability program.

### Session 1 – Boston's Resiliency Initiatives

#### Bill Ravanese

Bill Ravanese has been with Healthcare Without Harm since 1997 and has over 30 years of experience in the nonprofit sector working on health care, public health, environmental, climate and energy issues. Currently, Bill is senior director of HCWH's Green Building and Energy Program. He also covers legislative and regulatory advocacy and policy reform initiatives at the state level. He co-coordinates the Boston Green Ribbon Commission's Healthcare

Working Group, assisting Boston hospitals to reduce energy use and greenhouse gas emissions and to become champions for climate change/resilience.

#### Carl Spector

Carl Spector is Commissioner of the Environment for the City of Boston. He oversees programs related to climate change, environmental protection, historic preservation, and other aspects of sustainability. Before joining Boston City Hall in 2005, Carl worked on a wide variety of environmental and energy issues for the federal government and in private industry. He holds degrees in physics and environmental science.

#### John Cleveland

John is the Executive Director for the Boston Green Ribbon Commission ([www.greenribboncommission.org](http://www.greenribboncommission.org)), a network of business and civic leaders supporting the implementation of the City of Boston Climate Action Plan. The Commission is supporting the City's long-term climate preparedness strategy through the [Climate-Ready Boston](#) initiative, and is supporting the City's long-term de-carbonization strategy through the [Carbon-Free Boston](#) initiative. John is also President and a co-founder of the Innovation Network for Communities (INC), a national non-profit organization focused on helping cities achieve carbon neutrality and long-term resilience to climate disruptions.

#### Lisa Dickson, PG

Lisa Dickson is an Associate Principal in Arup's Boston office and Resilience Leader for Arup Americas, with 20 years' experience working at the intersect of the built and natural environments. She has expertise in regulations and financial markets related to carbon and renewable energy, and more recently with alternative financing and investment options related to resilience. Lisa has led multiple climate resilience projects including work for Boston, Cambridge, Somerville, Washington D.C., the Army National Guard, Partners Healthcare, the World Bank, confidential tech clients, developers and several coastal communities. She has been invited to the Pentagon to advise on her work related to climate security and is a technical advisor on two separate NSF-funded panels related to this work.

#### Hubert Murray, FAIA

Hubert Murray is an architect with 40 years experience working in the United States, Europe, Africa and the Middle East. As president of the Boston Society of Architects, he conceived and co-chaired Mass Impact, two international and multidisciplinary symposia on cities and climate change held at the Massachusetts Institute of Technology in 2008. In recent years he has been employed by Partners HealthCare as Manager of Sustainable Initiatives for 12 hospitals and associated health centers throughout Massachusetts.

In 2013 he helped initiate and continues to advise on the development of a Strategic Resiliency Plan for Partners facilities statewide. He has written and lectured widely on the subject of sustainability, resiliency and the impacts of climate change.

#### **S. Atyia Martin, LP.D., MPS-HSL, CEM**

Dr. Atyia Martin is a Certified Emergency Manager with a diverse set of experiences in public health, emergency management, intelligence, and homeland security. Mayor Martin J. Walsh appointed her as the Chief Resilience Officer for the City of Boston as part of the 100 Resilient Cities initiative pioneered by the Rockefeller Foundation. In this role, she is responsible for leading the development and implementation of Boston's Resilience Strategy. Boston will focus on advancing racial equity as the foundation of the Resilience Strategy process to increase our shared ability to thrive after emergencies. Dr. Martin was previously the Director of the Office of Public Health Preparedness at the Boston Public Health Commission. Her previous professional experience includes the Boston Police Department's Boston Regional Intelligence Center; City of Boston's Mayor's Office of Emergency Management; the Federal Bureau of Investigations (FBI); and active duty Air Force assigned to the National Security Agency.

### **Session 2 – Learning from New York**

#### **Celia Quinn, MD, MPH**

Dr. Celia Quinn is the Executive Director of the Bureau of Healthcare System Readiness (BHSR) in NYC's Department of Health and Mental Hygiene (DOHMH) Office of Emergency Preparedness and Response. She has served in this role since June 2015. Dr. Quinn oversees the Healthcare Preparedness Program for NYC, with the mission of supporting the healthcare system to respond safely and effectively in emergencies. From July 2014 through May 2015, she served as the Medical Director for BHSR and played a key role during NYC's response to Ebola, leading a task force to ensure the preparedness of 5 Ebola Designated Treatment Centers in the NYC area, and co-lead with the NY State Department of Health a multidisciplinary workgroup to ensure that NY State treatment centers were prepared to assess and treat pediatric and obstetric patients suspected of having Ebola. Dr. Quinn is board certified in Pediatrics, having completed residency training and a chief residency year in the Residency Program for Social Medicine at Montefiore Medical Center in the Bronx.

#### **Jennifer Kearney**

As founder of Gotham 360 LLC, [Jennifer Kearney](#) oversees day-to-day operations, including new business development for her full-service energy management consultancy firm located in New York City's financial center. Before founding Gotham 360, Kearney served as the Director of Energy Programs for New York Presbyterian, managing a \$70+ million energy procurement portfolio and overseeing the development and construction of a 7.5 megawatt gas turbine combined heat and power system, the first of its kind to interconnect with ConEdison's Manhattan grid and run in synchronous parallel. Since opening its doors in 2007, Gotham 360 has consulted on a number of major projects including the Columbia University Manhattanville Campus and the "Campus Transformation" at the NYU Langone Medical Center. Kearney has led her team in negotiating deregulated commodity contracts with leading power, natural gas, and fuel oil suppliers to provide reliable energy at economical prices for some of North America's largest energy users.

#### **Paul Schwabacher**

Paul Schwabacher has held the position of Senior Vice President for Facilities Management at NYU Langone Medical Center since 2006. The Medical Center comprises a portfolio of more than six million square feet in New York City and is in the midst of a multibillion-dollar Campus Transformation construction program. Mr. Schwabacher is responsible for Construction Management, Facilities Operations, Security, Environmental Health and Safety and Clinical Engineering. He has an extensive background in facilities management and the design and construction of capital projects, including large-scale building programs. Prior to joining NYU Langone, he held numerous positions at NY Presbyterian hospital over 16 years, including VP of Design and Construction and VP of Facilities Operations. He earned his BS in Mechanical Engineering from the Cooper Union, his MBA from Columbia University and is a licensed professional engineer in the State of New York.

#### **Louis Wetstein, PhD, PE**

Louis Wetstein, PhD, PE is the Senior Director of Engineering, Strategy and Support at NYU Langone Medical Center in New York City. In his twenty five year career, Louis has worked in a variety of capacities in the fields of medical devices and healthcare facilities. Louis has a broad background in biomedical engineering, medical equipment, facilities management, infection control, water and air quality issues

and administrative procedures in the healthcare setting. As part of the ongoing restoration projects underway due to the catastrophic damages sustained during Superstorm Sandy, Louis is leading the effort to develop and execute a strategic plan for building infrastructure throughout the NYU Langone Medical Center, including comprehensive infrastructure risk assessments and implementation of risk mitigation measures. Louis is a licensed Professional Engineer in New York and he holds advanced degrees in Biomedical Engineering.

## Lunch Speakers

### Gary Cohen

Gary Cohen has been a pioneer in the environmental health movement for thirty years. He has helped built coalitions and networks globally to address the environmental health impacts related to toxic chemical exposure and climate change. Cohen is Co-Founder and President of Health Care Without Harm ([www.noharm.org](http://www.noharm.org)), and Practice Greenhealth ([www.practicegreenhealth.org](http://www.practicegreenhealth.org)). In 2006, Cohen received the Skoll Award for Social Entrepreneurship. In 2007, he received the Frank Hatch Award for enlightened public service. In 2011, The New England Office of the U.S. Environmental Protection Agency (EPA) awarded Cohen an Environmental Merit Award in recognition of exceptional work and commitment to the environment. Cohen was named by the Huffington Post as a Game Changer in Healthy Living. In 2013, he was awarded the Champion of Change Award for Climate Change and Public Health by the White House. In 2015, Cohen was named a MacArthur Fellow and was a recipient of a “genius” grant from the MacArthur Foundation.

### Robin Guenther, FAIA, LEED

Robin Guenther, FAIA, LEED Fellow is Principal of Perkins+Will and Senior Advisor to the non-profit Health Care Without Harm. Robin works at the intersection of health care architecture, health and sustainable policy and participates in a wide range of leading edge advocacy initiatives while continuing to practice. Healthcare Design magazine named her the “#1 Most Influential Designer in Healthcare” in 2010 and 2011. In 2012, Fast Company included her as one of the “100 most creative people in business.” She was a TEDMED 2014 speaker. She co-coordinated the Green Guide for Health Care, served on the LEED for Healthcare committee, and co-authored “Sustainable Healthcare Architecture.” She was a founding member of the Health Product Declaration Collaborative, and coauthored the 2014 US Dept of Health and Human Services Sustainable and Resilient Healthcare Infrastructure Toolkit.

## Session 3 – Health Care’s Role in Anchoring Community Health and Resilience

### S. Atyia Martin ([see above](#))

#### Paul D. Biddinger, MD, FACEP

Dr. Paul Biddinger is the Director of the Center for Disaster Medicine, and is Vice Chairman for Emergency Preparedness in the Department of Emergency Medicine at Massachusetts General Hospital (MGH) in Boston. He is also the Medical Director for Emergency Preparedness at MGH and at Partners Healthcare. Dr. Biddinger additionally serves as the Director of the Emergency Preparedness Research, Evaluation and Practice (EPREP) Program at the Harvard T. H. Chan School of Public Health and holds appointments at Harvard Medical School and at the Chan School. Dr. Biddinger serves as a special advisor to the Massachusetts Medical Society’s Committee on Preparedness and serves as a medical officer for the MA-1 Disaster Medical Assistance Team (DMAT) in the National Disaster Medical System (NDMS) in the US Department of Health and Human Services (HHS). Dr. Biddinger completed his undergraduate study in international relations at Princeton University, attended medical school at Vanderbilt University, and completed residency training in emergency medicine at Harvard.

## Session 4 – Removing Barriers to Resilient Health Care Infrastructure

#### John Balbus, MD, MPH

John M. Balbus, M.D., M.P.H., is the Senior Advisor for Public Health to the Director of the National Institute of Environmental Health Sciences, where he directs the NIEHS-WHO Collaborating Centre for Environmental Health Sciences. He serves as HHS principal to the U.S. Global Change Research Program and also co-chairs working groups on Climate Change and Human Health for the US Global Change Research Program and for the National Institutes of Health. He is co-author of the HHS guide document “Primary Protection: Enhancing Health Care Resilience for a Changing Climate.” Before joining NIEHS, Dr. Balbus was Chief Health Scientist for the non-governmental organization Environmental Defense Fund for seven years. Dr. Balbus received his A.B. degree in Biochemistry from Harvard University, his M.D. from the University of Pennsylvania, and his M.P.H. from the Johns Hopkins School of Public Health.

**Robert Biggio**

Robert Biggio is the Senior Vice President of Facilities and Support Services at Boston Medical Center (BMC) and has been in this role since September 2011. At BMC, Biggio directly oversees Facilities, Support Services, Public Safety, Infrastructure and Design/Construction. Due to his work and leadership, the hospital was awarded the 2014 Energy Project of the Year Award by the National Association of Energy Engineers, New England Chapter. Prior to joining BMC, Biggio was the Vice President of Support Services and Real Estate at the Massachusetts Eye and Ear Infirmary. He holds a BS degree in Marine Engineering from the Massachusetts Maritime Academy. He was awarded the United States Merchant Marine Expeditionary Medal for his service during Operation Desert Storm.

**Session 5 – World Café****Paul Lipke**

Paul Lipke is Senior Advisor, Energy & Buildings for [Health Care Without Harm](#), and Co-Coordinator of the [Boston Green Ribbon Commission Health Care Working Group](#). With his support the region's 22 hospitals track and analyze energy use and emissions for 24 million sq. ft. of owned space, implement energy efficiency and renewable energy projects, advance climate-smart public policies, and deliver significant health benefits of climate mitigation and adaptation. Paul enabled MA Dept. of Public Health to be first in the nation in requiring green building evaluation in Determination of Need new construction and gut renovation applications. He created the [Healthcare Energy Impact Calculator](#), a free web tool enabling users to input kWh usage and grid region to estimate the health impacts and medical costs of the resulting premature deaths, respiratory incidents, and other health impacts from power generation. He has been a recognized leader in sustainable strategies for >20 years.

**Closing Session**

**John Cleveland** ([see above](#))

**Paul D. Biddinger, MD, FACEP** ([see above](#))

**John Balbus, M.D., M.P.H.** ([see above](#))

**Bud Ris**

Bud's career in environmental policy and non-profit leadership spans nearly 40 years. Currently he co-chairs the Climate Preparedness Working Group of the Green Ribbon Commission and is an advisor to the Barr Foundation. He has been actively involved in the design and implementation of the Climate Ready Boston project. From 2005 to 2014, Bud served as President and CEO of the New England Aquarium in Boston, where he initiated a nationwide educational program on climate change that now includes more than 100 museums and aquariums. Prior to that, Bud was a Senior Fellow at the World Economic Forum in Switzerland, where he led the Davos group's program on climate change for UK Prime Minister Tony Blair. From 1984 through 2003, Bud served as the chief executive officer of the Union of Concerned Scientists, which has long been in the forefront of research, education, and policy advocacy on climate change and related energy issues. Bud is a Trustee at the Greenway Conservancy and Boston Harbor Now.

# Appendix C

## ATTENDEE ORGANIZATIONS

### GOVERNMENT

#### CITY OF BOSTON

- Public Health Commission
- Office of Public Health Preparedness
- Office of Environment, Energy and Open Space
- Mayors Office of Resilience and Racial Equity

#### CITY OF CAMBRIDGE

- Community Development and Planning
- Cambridge Public Health Dept.

#### CITY OF SOMERVILLE

- Office of Sustainability and Environment

#### COMMONWEALTH OF MASSACHUSETTS

- Division of Capital Asset Management and Maintenance
- Executive Office of Energy and the Environment
- Metropolitan Area Planning Council
- Pioneer Valley Planning Commission
- Department of Energy Resources
- Massport
- Senate / House Committees

#### FEDERAL

- Health and Human Services
- Environmental Protection Agency

- National Institute of Health
- US Dept of Energy
- NOAA

### INFRASTRUCTURE / UTILITIES

- Department of Transportation
- MBTA
- Boston Water and Sewer Commission
- Eversource

### PRIVATE NON-PROFITS

- Chamber of Commerce
- A Better City
- MASCO
- Green Ribbon Commission
- Boston Harbor Now
- Health Care Without Harm
- Health Resources in Action
- Powered for Patients
- Barr Foundation
- Trust for Public Land
- Environmental Entrepreneurs
- Built Environment Coalition

### CONSULTANTS / PRIVATE ENTITIES

- Perkins + Will
- Arup
- Kleinfelder
- HDR
- Payette
- NBBJ
- Shepley Bulfinch
- Tohn Environmental Strategies

### HEALTHCARE ORGANIZATIONS

#### HOSPITALS

- Boston Medical Center
- Beth Israel Deaconess Medical Center
- Massachusetts General
- Brigham and Women's
- B&W Faulkner Hospital
- McLean Hospital
- Spaulding Rehabilitation Hospital
- Newton-Wellesley Hospital
- North Shore Medical Center
- Cooley Dickinson Hospital
- Mass Eye and Ear
- Tufts Medical Center
- UMass Memorial Health Care

#### COMMUNITY HEALTH

- Partners Community Physicians Organization
- Cambridge Health Alliance
- HR&A Advisors
- Linnaean Solutions
- Renew Energy Partners

#### ACADEMIA

- BU School of Public Health
- BU School of Medicine
- Harvard Chan School of Public Health
- Yale Center for Emergency Preparedness and Disaster Response

# Appendix D

## POST-EVENT WEBINAR SLIDE DECK: MARCH 16, 2017

### Resilience 2.0: Health Care's Role in Anchoring Climate Resilience

NEXT STEPS WEBINAR, MARCH 6, 2017

*Sponsorship support provided by the Barr Foundation*



Facilitators: Robin Guenther, Paul Lipke, Hubert Murray, Bill Ravanese, Jessica Wolff



*Boston is ranked the 4th most vulnerable city to climate change in the US and 8th most vulnerable city in the world in terms of potential economic losses.*





John Messervy, Partners HealthCare

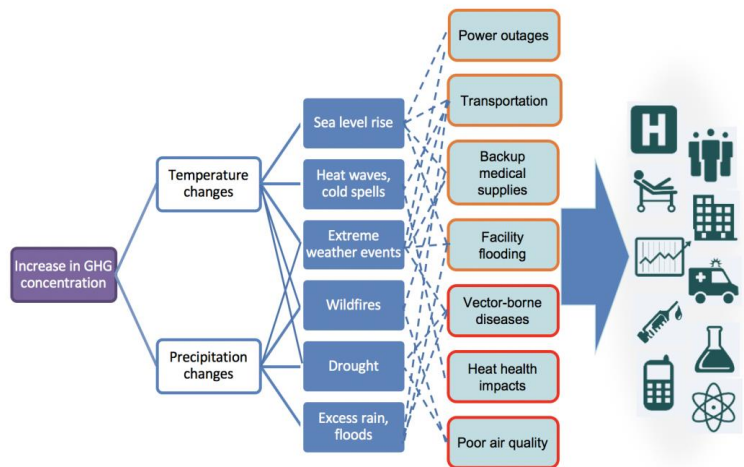


Dr. John Balbus, NIH, NIEHS; Paul Biddinger, Partners HealthCare; John Cleveland and Bud Ris, Boston Green Ribbon Commission



## Key Learnings

*The healthcare sector has a key role to play in assisting the City of Boston in supporting population health initiatives that reduce the impact of climate stressors on health; in some instances, they have a direct role in reducing the stressors*





## Key Learnings

*The healthcare sector has a key role to play in demanding performance from urban infrastructure – utilities, public transit, water management.*

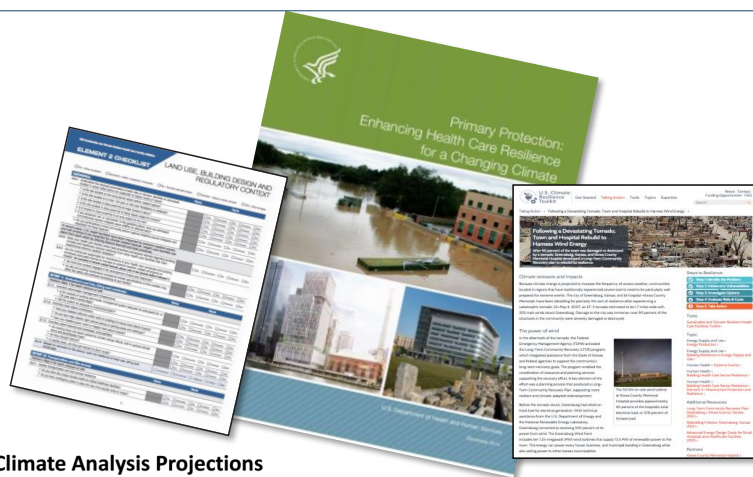


Dr. Celia Quinn, New York City Dept of Health & Mental Hygiene; Jennifer Kearney, Gotham 360; Louis Wetstein, NYU Langone Medical Center



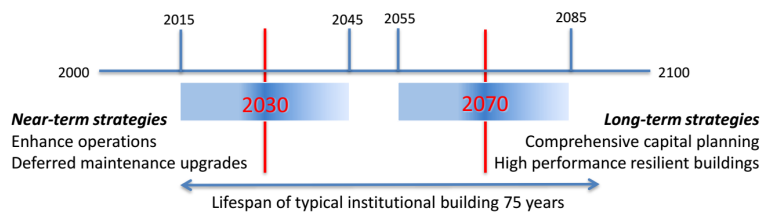
## Key Learnings

*Health systems should accelerate the completion of infrastructure resilience assessments to determine key vulnerabilities to uninterrupted operation during and following extreme weather events.*



### Climate Analysis Projections

Value of long view vs. quality of data



Hubert Murray, Partners HealthCare; Robert Biggio, Boston Medical Center



# Key Learnings

*Health systems must embed equity, social justice and social cohesion into resilience planning and policies, and help to shift the structural situations that embed inequities into the fabric of Boston life.*



S. Atyia Martin, Chief Resilience Officer, City of Boston

| HOW THE BOSTON RESILIENCE STRATEGY IS STRUCTURED |   |  |   |   |
|--|---|--|---|---|
| GUIDING PRINCIPLE<br>(Blueprint, 2016)           | RESILIENCE, RACIAL EQUITY, AND SOCIAL COHESION  |  |   |   |
| RESILIENCE VISIONS<br>(STRATEGY, 2017)           | <b>VISION 1</b><br><br><b>REFLECTIVE CITY, STRONGER PEOPLE</b><br><i>A Boston that reflects upon its history and confronts present realities of racism in daily life and during emergencies to learn and reduce the impact of trauma on individual and community health and well-being.</i> | <b>VISION 2</b><br><br><b>COLLABORATIVE, PROACTIVE GOVERNANCE</b><br><i>An inclusive and collaborative City government culture that offers residents a meaningful role in decision-making processes and facilitates cross-departmental partnership.</i>  | <b>VISION 3</b><br><br><b>EQUITABLE ECONOMIC DEVELOPMENT</b><br><i>Access to economic and social pathways that support closing the wealth gap to ensure our quality of life is not determined by our race or ethnicity.</i>   | <b>VISION 4</b><br><br><b>CONNECTED, ADAPTIVE CITY</b><br><i>Increased connectivity of communities of color while adequately preparing for threats to infrastructure used by all Bostonians.</i>  |
|  | RESILIENCE GOALS<br>(STRATEGY, 2017)  | <b>GOAL 1.1:</b> Advance the ongoing development of community training for healing, well-being, and preparedness in the face of chronic stresses and traumatic events.<br><b>GOAL 1.2:</b> Facilitate an open, ongoing dialogue for healing, learning and action to address racism and strengthen social cohesion in communities.<br><b>GOAL 1.3:</b> Acknowledge the damage that systemic racism continues to inflict on our communities and develop deliberate institutional approaches to achieve and sustain racial equity in Boston policies, practices, and culture. | <b>GOAL 2.1:</b> Ensure employment equity and better serve all Bostonians by increasing the representation of the city's diverse population in city government.<br><b>GOAL 2.2:</b> Enhance decision-making capacity in city government by bringing together our residents' and our government representatives' knowledge and skills to better develop policies, practices, and processes.<br><b>GOAL 2.3:</b> Improve the collaboration, evaluation, and delivery of city services to better meet the needs of all Boston residents. | <b>GOAL 3.1:</b> Increase access to good-paying jobs, entrepreneurial opportunities, and asset building strategies.<br><b>GOAL 3.2:</b> Ensure safe, affordable, stable housing for all Bostonians.<br><b>GOAL 3.3:</b> Enhance digital equity by increasing access to technology tools, computers and the Internet.<br><b>GOAL 3.4:</b> Prioritize equitable education opportunities to close the gap for young people of color. |

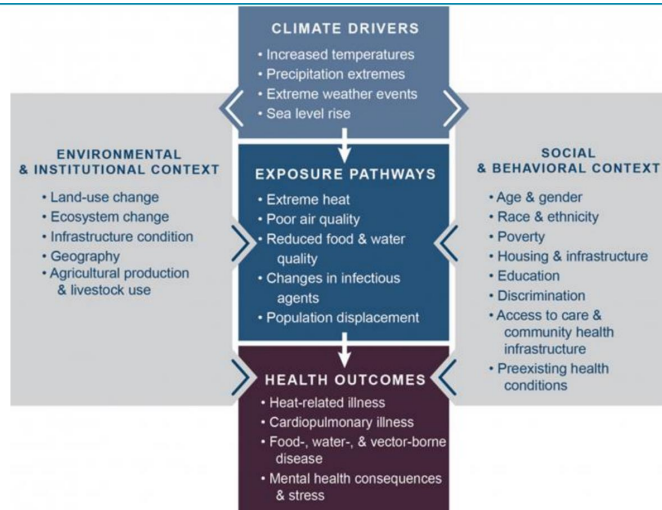


# Key Learnings

*Health system response benefits from the "three c's:" Coordination, Collaboration and Communication.*



Left: Dr. Paul Biddinger, Center for Disaster Medicine, MGH  
 Right: Austin Blackmon, Boston's Chief of Environment, Energy and Open Space



## Key Action 1

***Broaden health care sector engagement both in policy and at a facility level.***

***Expand sector engagement in 100 Resilient Cities, Climate Ready Boston, and Green Ribbon Commission, and other state adaptation plans.***

There is a role for a collective group in Boston from among these participants to continue to pursue integrating resilience thinking into institutional-level planning and local policy making.

- Develop a regional healthcare resilience campaign.
- Organize high level briefings for healthcare leaders in the Boston area to spark deeper action.
- Ensure that all hospitals and health systems assess climate vulnerabilities and develop resilience assessments.



## Key Action 2

***Develop a compelling business case for health care climate resilience.***

How does a hospital measure the probability of failure? What is the cost of failure? How do you cost resilience strategies? How do you measure the intangibles, like incalculable research interruptions, loss of reputation, or loss of economic cohesion in a community from a major health care failure?

- Develop information on the links between sustainability and resilience. Compile case study data, including more examples of how health care owners and designers make the case for the “multiple benefit” strategies.



## Key Action 3

*Explore innovative solutions to backup and reliable power generation needs for both hospitals and community health providers.*

Identify and implement next-tier opportunities with co-generation, fuel cells, energy storage and micro-grids that can improve health care reliability and support community cohesion.

- Explore innovative funding solutions. Factor resilience into municipal bond rates and offerings, both to reflect climate risks and to generate funds for infrastructure investments, such as municipal green bonds.
- Identify and support demonstration projects.



## Key Action 4

*Create a robust network of partnerships with one another and our communities to advance community health and resilience.*

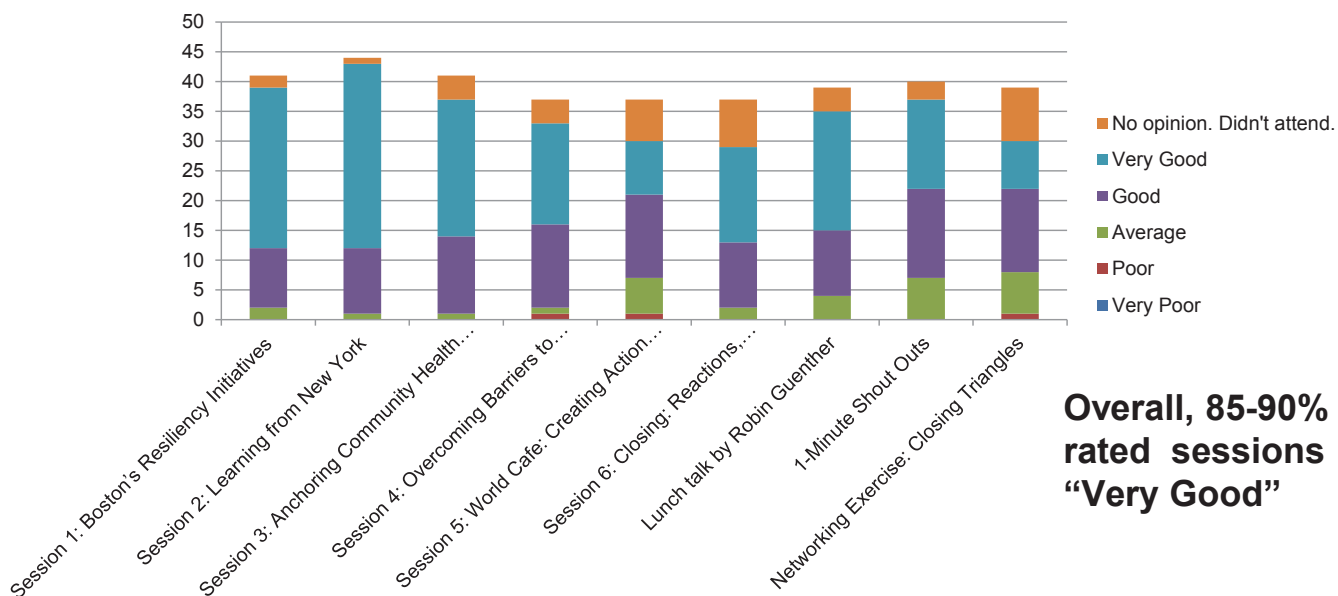
More exploration of community health stressors and vulnerabilities, local micro-grid utility solutions, shared backup power sources, as components of more creative solutions for community-based providers to reduce the risk of long-term outages that cripple their ability to provide care.

- Assess to what degree ambulatory networks and outpatient facilities are currently engaged in resilience planning throughout the greater Boston area



## Post-event survey highlights

46 responses out of 110 attendees (not incl. speakers/organizers) 42% rate



**Overall, 85-90%  
rated sessions  
"Very Good"**

## Respondents' high marks

- 39 of 47 (83%): More networking, time for small group discussion and problem-solving. **These are key next steps.**
- 21 of 40: Using 'closing triangles' to grow the network
- 11 of 40: Learning who was doing what, how advanced some efforts are, complexity of the issue.

## Resilience 2.0: Closing Triangles

Find someone here you don't know (PERSON A). Connect them to someone in your network (PERSON B) using their backgrounds, benefits and a next step.

|            |  |
|------------|--|
| <b>YOU</b> | <b>PERSON A</b><br>NAME:<br>ORGANIZATION:<br>INTEREST/S:<br>EMAIL:   |
|            | <i>Who should I introduce Person A to? Think about points of mutual benefit and suggested first step to connect.</i> |
|            | <b>PERSON B</b><br>NAME:<br>ORGANIZATION:<br>INTEREST/S:<br>EMAIL:   |



Raise your hand to share your story of connection



### RESILIENCE 2.0 ATTENDEE ORGANIZATIONS

#### CITY OF BOSTON

- Public Health Commission
- Office of Public Health Preparedness
- Office of Environment, Energy and Open Space
- Mayors Office of Resilience and Racial Equity

#### CITY OF CAMBRIDGE

- Community Development and Planning
- Cambridge Public Health Dept.

#### CITY OF SOMERVILLE

- Office of Sustainability and Environment

#### COMMONWEALTH OF MASSACHUSETTS

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- Arup
- Kleinfelder
- HDR
- Payette
- NBBJ
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- Tohn Environmental Strategies
- HR&A Advisors
- Linnaean Solutions
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- Cooley Dickinson Hospital
- Mass Eye and Ear
- Tufts Medical Center
- UMass Memorial Health Care

##### COMMUNITY HEALTH

- Partners Community Physicians Organization
- Cambridge Health Alliance
- Blue Cross Blue Shield

##### ACADEMIA

- BU School of Public Health
- BU School of Medicine
- Harvard Chan School of Public Health
- Yale Center for Emergency Preparedness and Disaster Response

**+ THOSE WHO SHOULD BE AT THE TABLE**



# Taking Action

- Resilience 2.0 Report to be published this spring by Health Care Without Harm
- Setting up a small (~ 12) Working Group to meet end of April
  - Modify and develop Action Items

Interested? Send CHAT now or email your name, phone, and organization to: [info@hcwh.org](mailto:info@hcwh.org)



1. *Broaden health care sector engagement both in policy and at a facility level. Expand sector engagement in 100 Resilient Cities, Climate Ready Boston, and Green Ribbon Commission, and other state adaptation plans.*
2. *Develop a compelling business case for health care resilience.*
3. *Explore innovative solutions to backup and reliable power generation needs for both hospitals and community health providers.*
4. *Create a robust network of partnerships with one another to advance community health and resilience.*