Primary Protection
Improving Healthcare Resilience

December 5, 2016

Robin Guenther, FAIA  LEED Fellow
Principal, Perkins+Will and Senior Advisor Health Care Without Harm
2016 Robert Wood Johnson Culture of Health Leader
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.
Environmental factors = 25% global disease burden

- Poor sanitation
- Outdoor air pollution
- Poor land use practices
- Resource scarcity
- Extreme weather injuries
- Vector-borne diseases
- Unsafe drinking water
“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.”

“Health beyond Healthcare” -- Robert Wood Johnson Foundation’s bi-partisan Commission to Build a Healthier America
MY NEIGHBORHOOD IS KILLING ME
Symptoms of Community Trauma

- Intergenerational poverty
- Long-term unemployment
- Relocation of businesses & jobs
- Limited employment
- Disinvestment

- Deteriorated environments and unhealthy, often dangerous public spaces with a crumbling built environment
- Unhealthy products

- Disconnected/damaged social relations and social networks
- The elevation of destructive, dislocating social norms
- A low sense of collective political and social efficacy
“The effects of climate change...represent an unacceptably high and potentially catastrophic risk to human health.”
The health sector can play a major role in improving population health and community resilience.
Resilience is a new way of thinking that starts by identifying our most important vulnerabilities first.

Improving resilience maximizes the benefits of our investments and keeps government accountable to what people need the most – being prepared for the catastrophic shocks and chronic stresses in a world where crisis is the new normal.
Mapping Climate Impacts on Communities

- Tornado/Winds
- Hurricane
- Inland Flooding
- Drought/Receding Water
- Seismic
- Tsunami
- Extreme Temperatures

Or combinations of these like in Cascadia....
Mapping Climate Impacts on Hospitals & Health

- Increase in GHG concentration
  - Temperature changes
    - Sea level rise
    - Heat waves, cold spells
    - Extreme weather events
    - Wildfires
    - Drought
    - Excess rain, floods
  - Precipitation changes
    - Power outages
    - Transportation
    - Backup medical supplies
    - Facility flooding
    - Vector-borne diseases
    - Heat health impacts
    - Poor air quality
Impact Modeling

Census data

Clinical data

Climate data

Hospital data

Hospital Climate Risk Assessment
Resilient Hospital Dashboard

1. Climate Snapshot™

2. Climate Health Impacts

3. Facility Preparedness
## Risk factors: heat vulnerability

### Medical factors

Indicator: Medical factors (ICD-9-CMs) associated with heat hazards\(^4\)

ICD-9 Code:
- 410-414 - Ischemic heart disease
- 433-436 - Ischemic stroke
- 427 - Cardia dysrhythmia
- 458 - Hypotension
- 250 - Diabetes
- 001-009 - Intestinal infection
- 276.51 - Dehydration
- 584 - Acute renal failure
- 992 - Heat illness

### Social factors

Indicator: Social and demographic factors associated with heat vulnerability\(^5\)

Census Data:
- Age > 65 who are living alone
- Age > 65 years
- Live alone
- Diabetes
- Less than high school diploma
- Below poverty line
- Race other than white
- Area without vegetation
- No AC - (only significant in Pacific and Northeast)\(^5\)

\(^4\) Basu et al., 2012
\(^5\) Reid et al., 2009
Outputs

- Provide a common reference grid that couples high resolution climate projections with zip code-scale social/medical data
- Weighted population exposure to heat hazard
- Hotspots by cross-section of medical and social risks
Health Care’s Role

1. REDUCE IMPACTS
   - MITIGATE
     - Reduce resource use
     - Reduce fossil fuel emissions in buildings
     - Reduce transportation impacts
     - Review supply chain

2. IMPROVE RESILIENCE
   - ADAPT
     - Improve healthcare infrastructure
     - Engage communities to reduce chronic health stressors
     - Link to sustainability and quality initiatives

3. ADVOCATE
   - LEAD
     - Support local and national public policies
     - Improve public understanding of extreme weather and health risks
1
REDUCE IMPACTS

MITIGATE

• Reduce resource use
• Reduce fossil fuel emissions in buildings
• Reduce transportation impacts
• Review supply chain
Fossil Fuels and Health

Exposures
- Temperature increase
- Heatwaves
- Extreme weather
- Precipitation variation

Global climate change

Health effects
- Temperature-related mortality and morbidity
- Extreme weather-related health effects
- Water and food-borne diseases
- Vector-borne and rodent-borne diseases
- Effects of food and water shortages
- Mental health
- Cardiovascular disease
- Lung cancer
- Acute respiratory infection
- Cancer
- Mercury poisoning
- Physical injury
- Mental health

Local air quality

Outdoor air quality

Indoor air quality

Local contamination

Exposures
- Air, soil, water contamination
- Mercury poisoning
- Ionising radiation
- Flooding

Solid discharges

- Ash or slag
- FGD residue
- Sulphur
- Radioactive materials
- Water

Air emissions

- O$_3$
- PM$_{10}$
- PM$_{2.5}$
- SO$_2$
- NO$_x$
- Benzene

HFCs
- N$_2$O
- CH$_4$
- CO$_2$

Percentage (%)

- Oil (32%)
- Coal (27%)
- Gas (22%)
- Modern* biomass (4%)
- Traditional biomass (6%)
- Nuclear (6%)
- Hydro (2%)
- Other renewables (1%)
“Hospitals and health systems, particularly in more industrialized settings, have a significant carbon footprint.”

“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.”
“We did not set out to be the greenest health system. We set out to make the air better for our patients to breathe, control our rising energy costs and help our local economy.”

–Jeff Thompson, MD
Gundersen Health System 2014
Kiowa Memorial Hospital
Greensburg, KN
(EF-5 tornado, 2008)

- Low–energy design
- Passive design strategies – operable windows
- On-site power generation
- On-site renewable energy
- Low water use design
- Recycled and reclaimed water reuse
- Independent water source
Press Release

Kaiser Permanente Pledges Bold 2025 Environmental Performance to Benefit People and Planet

Already a global leader in climate action, organization sets in motion its most ambitious plan ever for a healthier future

May 17, 2016
Lucile Packard Children’s Hospital at Stanford
Palo Alto, California
1 REDUCE IMPACTS
- Reduce resource use
- Reduce fossil fuel emissions in buildings
- Reduce transportation impacts
- Review supply chain

2 IMPROVE RESILIENCE

ADAPT
- Improve healthcare infrastructure
- Engage communities to reduce chronic health stressors
- Link to sustainability and quality initiatives

MITIGATE
- Reduce resource use
- Reduce fossil fuel emissions in buildings
- Reduce transportation impacts
- Review supply chain
IS OUR HEALTHCARE INFRASTRUCTURE RESILIENT TO EXTREME WEATHER?
Increase in Extreme Heat Days

California Heat Wave 2006

- Daytime temperatures >100 degrees for two weeks
- Record night time highs
- 1 million people without electricity
- Death toll estimates 150-450
- 16,000 excess ER visits and 1,000 excess hospitalizations
- 25,000 cattle and 700,000 chickens died
U.S. deaths from natural hazards by category, 1970-2004
NYU Langone and Bellevue
New York, NY
(Hurricane Sandy, 2012)
We can choose to believe that Superstorm Sandy, and the most severe drought in decades, and the worst wildfires some states have ever seen were all just a freak coincidence. Or we can choose to believe in the overwhelming judgment of science—and act before it’s too late.”

- President Obama

The President’s Climate Action Plan- June 2013
Sustainability

- Low VOC Materials
- Local Food Suppliers
- Waste Recycling
- Air Quality

Sustainability and Resilience

- Energy, Water Efficiency
- Daylighting
- Natural Ventilation
- Rainwater Capture
- Solar Shading

Resilience

- Flood barriers
- Elevation
- Backup generators
Fracture Critical

“…going forward, good design and planning will be based on the understanding that nothing will work as planned, or even at all.

We are at our best when we have imagined, and accounted for, the worst.”

–Thomas Fisher
University of Minnesota
Primary Protection: Enhancing Health Care Resilience for a Changing Climate

• Goal: assist organizations in reducing future vulnerabilities and losses, and improve the functioning of a broad range of health care facilities

What happens?

• Increasing design thresholds to recognize **more severe weather intensities**— design temperatures, wind velocities, mean flood elevations

• Increasing warehousing and storage capacities to recognize **longer severe weather durations**— increasing the minimum amounts of on site food, water and fuel storage
Enacting requirements for hardening and adapting facilities in new geographic regions to respond to changing extreme weather patterns

Increasing capabilities for “islanding operation” that recognizes that on site infrastructure may be required for extended periods of time because of damaged community infrastructure
Focus on patient health and safety and provider outages that will strain the healthcare system:

- Reduce the risk of emergency evacuations
- Be able to take on acute emergent patient needs (during and after)
- Avoid extended facility outages that strain the system
- Reduce how many patients cannot access their normal provider

Key strategies:

1. Ensure critical healthcare providers’ operability through redundancy and the prevention of physical damage
2. Reduce barriers to care during and after emergencies
Nursing Homes/ Adult Care Facilities

What happened during Sandy

Patient impact:
emergency evacuations, reduced citywide bed-capacity, hospitals couldn’t discharge

Source: NYSDOH, PLUTO, DOHMH, Mayor’s Office of Analytics, SIRR interviews
In summary, during Sandy, critical system failures - namely power - caused evacuations, closures, and reduced services

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

What is the risk this could happen again to the same number or even more providers?

Source: SIRR interviews
Mapping Climate Impacts on the Bottom Line

Dollars and Cents

- **After Superstorm Sandy**
  - NYC public hospitals: $800 Million in damage
  - Estimated $3.1 Billion recovery costs to healthcare facilities
  - Lost research animals valued at more than $100,000 – Research losses estimated above $200 Million
  - FEMA Assistance: $25.9 Million for Equipment replacement
Texas Medical Center
Houston, TX
Tropical Storm Allison, 2001
Texas Medical Center, Houston, Texas (SOM Site Master Planning)

Completed early in 2006, Brays Bayou Marsh at Mason Park is near the mouth of Brays Bayou. The marsh is an award-winning partnership project.

Texas Medical Center
Houston, TX
Since Tropical Storm Allison, 2001
Charity Hospital and VAMC
New Orleans, LA
(Hurricane Katrina, 2005)
Boston’s Spaulding Rehabilitation Hospital

Was climate-proofed for about a half-percent of total building costs.

Electrical equipment is on the roof in case of flooding.

Windows open, so patients don’t overheat if air conditioning fails.

The ground floor is raised 30 inches above the current 500-year flood level and 42 inches above the 100-year flood level.
Understand and Prioritize Risk

Climate Scenarios

- Identify Critical Facilities and Operations
- Vulnerability & Risk Assessment
- Prioritize Need Across System
The payback for resilience efforts can be measured in many ways, including cost savings from preventing damages and reducing operating costs, as well as revenue enhancements from improved marketing, company brand, and project image.
improving community health

access to healthy food
improving community health

THE FVRx PROCESS

1. Patients are enrolled by a health provider as a FVRx participant.

2. Participants attend a FVRx clinical visit to set goals and discuss nutrition and the importance of healthy eating.

3. Participants receive a FVRx prescription during the visit and health indicators are collected.

4. Prescriptions are redeemed for fresh fruits and vegetables at participating retailer, where redemption is tracked.

5. Participants attend monthly clinic visits to refill their FVRx prescription and set new goals for healthy eating.

prescribing fruits and vegetables
Improving community health

Powell-Poage-Hamilton Historic Neighborhood

Gundersen Medical Center

250,000+ Patient visits / Year
Largest employer in La Crosse, WI

Residents earning 58% less than the city average USDA Food Desert

Community placemaking
City Surgeon: Can The Cleveland Clinic Save Its Hometown?

This story appears in the September 23, 2013 issue of Forbes.

Delos M. “Toby” Cosgrove arrived at the Cleveland Clinic in 1975 as an “incredibly poor” 34-year-old dreaming of a life as a cardiac surgeon. “Heart surgery was the astronaut corps of health care,” he says. He had $3,000 in his bank account, left over from running an Air Force hospital in Vietnam, where he had won the Bronze Star. All his earthly belongings — including a Chevy Vega that was too flimsy to tow, fit in the back of a U-Haul.

During his first year someone was shot dead at the clinic’s front door. The bank in the basement was robbed. To avoid crime, patients were told to take a shuttle bus the half-block back to the hotel where they stayed. The executive offices
Green City Growers Cooperative

Green City Growers Cooperative, Inc. is a 3.25-acre leafy greens, hydroponic greenhouse in the Central neighborhood of Cleveland, OH. The greenhouse, which officially opened on February 25th, 2013, has 15,000 square feet of packinghouse and office space, and is currently producing Bibb lettuce, green leaf lettuce, gourmet lettuces and basil.
Henry Ford Health System
Detroit, Michigan

It pays to live in Midtown!

That is... if you work at the Detroit Medical Center (DMC), Henry Ford Health System (HFHS) or Wayne State University (WSU). As if being a moment’s walk from one of 10 theaters, nine museums, over 40 restaurants, 12 galleries, charming boutique retail, and more, wasn’t enough! Now, there are financial incentives to live here for employees of these three major anchor institutions.

Yes, Live Midtown is a residential living program aimed to entice you, as a DMC, HFHS or WSU employee, to live and invest in a Midtown home. There are four incentive options to accommodate those looking to purchase or rent a home, and current homeowners interested in exterior improvements.

Your housing choices are endless – own or rent; condo or rowhouse; low-rise or mid-rise; historic or new construction – so dive into this Web site and learn more about the incentives and how to take advantage of them.

Most importantly, make sure to Live Midtown, where life is art!
community connected health at the center of civic life
1. **REDUCE IMPACTS**
   - Reduce resource use
   - Reduce fossil fuel emissions in buildings
   - Reduce transportation impacts
   - Review supply chain

2. **IMPROVE RESILIENCE**
   - Improve healthcare infrastructure
   - Engage communities to reduce chronic health stressors
   - Link to sustainability and quality initiatives

3. **ADVOCATE**
   - Support local and national public policies
   - Improve public understanding of extreme weather and health risks

4. **LEAD**
   - Support local and national public policies
   - Improve public understanding of extreme weather and health risks

**MITIGATE**
- Reduce resource use
- Reduce fossil fuel emissions in buildings
- Reduce transportation impacts
- Review supply chain

**ADAPT**
- Improve healthcare infrastructure
- Engage communities to reduce chronic health stressors
- Link to sustainability and quality initiatives
December 2014: the White House highlights health sector resilience
Enable the positives

By valuing our physical and social environment, we can restore our natural environment and strengthen our social assets, whilst enhancing our independence and wellbeing at both a personal and community level. By doing so, we improve the quality of care, build strong communities and generate conditions where life is valued in ways that current generations can be proud to pass on.

Reduce the negatives

By radically reducing the harmful impacts of how we currently live we can stop wasting finite resources, reduce the burdens of preventable mental and physical ill health, reduce social inequalities and reduce risks from a changing climate. In addition, many interventions that reduce harmful impacts also promote positive co-benefits and reduce the burden of disease.
Mitigation
Reducing health care’s own carbon footprint

Adaptation
Preparing for the impacts of extreme weather and the shifting burden of disease

Leadership
Educating staff and the public while promoting policies to protect public health from climate change
131 Participants =
>9,000 Hospitals and health centers
The healthcare sector can help shift the entire economy toward sustainable, safer products and practices.