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A Community Checklist for Health Sector Resilience Informed by Hurricane Sandy

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Abstract

This is a checklist of actions for healthcare, public health, nongovernmental organizations, and private entities to use to strengthen the resilience of their community's health sector to disasters. It is informed by the experience of Hurricane Sandy in New York and New Jersey and analyzed in the context of findings from other recent natural disasters in the United States. The health sector is defined very broadly, including—in addition to hospitals, emergency medical services (EMS), and public health agencies—healthcare providers, outpatient clinics, long-term care facilities, home health providers, behavioral health providers, and correctional health services. It also includes community-based organizations that support these entities and represent patients. We define health sector resilience very broadly, including all factors that preserve public health and healthcare delivery under extreme stress and contribute to the rapid restoration of normal or improved health sector functioning after a disaster. We present the key findings organized into 8 themes. We then describe a conceptual map of health sector resilience that ties these themes together. Lastly, we provide a series of recommended actions for improving health sector resilience at the local level. The recommended actions emphasize those items that individuals who experienced Hurricane Sandy deemed to be most important. The recommendations are presented as a checklist that can be

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used by a variety of interested parties who have some role to play in disaster preparedness, response, and recovery in their own communities. Following a general checklist are supplemental checklists that apply to specific parts of the larger health sector.

Keywords

Hurricane Sandy; Resilience; Health sector; Checklist; Public health preparedness/response; Medical management/response; Hospital preparedness/response

The goal of this project was to develop an evidence-informed checklist that outlines action steps for medical and public health authorities, in partnership with nongovernmental organizations and private industry, to assess and strengthen the resilience of their community's health sector in the face of disasters. Many disasters share common characteristics. Therefore, elements of health sector preparedness and resilience can apply to a range of hazards, which have been described elsewhere and form the basis of official guidance.[1–3] We posited that, in addition to official guidance, there is much to be learned from the lived experience of those who played a role in preparing for, responding to, and recovering from an actual disaster. They are best able to judge which factors were most important to facilitating the resilience of the health sector in which they work and live. Additionally, we believe that compiling the judgments of a diverse sample of individuals is a more reliable means of assessing health sector resilience than relying solely on the perspectives of a few experts. Consequently, this checklist is informed by the experiences of communities directly affected by Hurricane Sandy in 2012.

Although not every lesson from an advance-notice event like a hurricane will apply to no-notice events like an earthquake or tornado, many will. Therefore, because many disasters share common elements that have an impact on health sector resilience, we believe this checklist will have broad applicability and can be useful for natural disasters, including but not limited to hurricanes and coastal storms, as well as other emergencies in a variety of locales, especially those emergencies that result in a loss of critical infrastructure.

We define the health sector very broadly. This sector includes organizations that have long been at the center of preparedness efforts, such as hospitals, emergency medical services (EMS), and public health departments, as well as many entities that have not routinely been part of preparedness efforts. Among these are outpatient clinics, long-term care facilities, home health providers (both formal home health agencies and informal care provided by family and friends), behavioral health providers, correctional health services, and the healthcare providers who work in all of these settings, as well as the unions that represent them. The health sector also includes community-based organizations that support these entities and represent the patients who receive services from them.

We also define health sector resilience very broadly to include any action taken during any phase of the emergency management cycle (ie, mitigation, preparedness, response, and recovery) and any pre-event attribute of the community that preserves public health and healthcare delivery under extreme stress and contributes to the rapid restoration and/or adaption of normal (or improved) health sector functioning after a disaster. This includes

inherent factors such as the underlying health and wealth of a population and the effectiveness of elected leaders and local, state, and federal agencies.[4] It also includes factors that foster greater *adaptiveness* in a crisis such as improvisation and problem solving by all parts of the health sector, the effectiveness of incident command structure, the extent of collaboration between various parts of the health sector, and the availability and effectiveness of mutual aid and outside resources.[4] While acknowledging that several factors, such as current health status, socioeconomic indicators (including levels of inequality), and social capital, can contribute to the resilience of a community that experiences a disaster, we have focused primarily on those relatively short-term interventions that stakeholders in communities can implement before an event to improve the resilience of their communities. These include interventions that either reduce the risk of adverse outcomes or improve the resilience to those damaging events that cannot be avoided.

The Story of Hurricane Sandy

Hurricane Sandy formed in the Caribbean very late in the hurricane season on October 22, 2012. It traveled parallel to the US East Coast before taking a very unusual turn to the west and merging with an intense cold front, forming a unique “superstorm.” The eye of the storm made landfall on the central New Jersey coast on October 29, 2012. The storm pushed a surge of water up the mouth of the Hudson River, reaching an unprecedented 14 feet at Battery Park on the southern tip of Manhattan. The storm caused tremendous damage along the entire New Jersey coast and devastated parts of barrier islands of Long Island. Officials had many days’ warning of the storm, but the height of the storm surge and the extent of damage far exceeded official forecasts. In the end, Sandy killed at least 117 people,[5] injured more than 4,000,[6] and was the second most costly hurricane in US history, causing an estimated $67.7 billion in damages.[7] (The costliest was Hurricane Katrina, which caused $152.2 billion worth of damages to the Gulf Coast region in 2005.)

Sandy was preceded a year earlier by Hurricane Irene. Irene was expected to be very severe in and around New York, and as a precaution a number of hospitals and other healthcare facilities evacuated in advance. Although Irene did cause severe flooding in upstate New York and New England, it mostly spared New York City.[8] In the aftermath of Hurricane Irene, many in New York felt that the evacuations had been an unnecessary overreaction.[9] These feelings were still fresh as Sandy approached.

In New Jersey, Sandy’s wind and storm surge created great damage along the entire coast, extending a considerable distance inland. Roads and bridges were blocked, infrastructure was damaged, and millions of people were displaced from their homes. Two hospitals were evacuated—one prior to Sandy’s landfall in anticipation of flooding and one after impact due to damage sustained from flooding. In New York City, subway tunnels flooded, and the electrical and steam service to portions of lower Manhattan had to be shut off. Electrical power was lost to most of the remainder of lower Manhattan when an explosion occurred at a ConEd substation. Two hospitals in Manhattan, New York Presbyterian Lower Manhattan Division and the New York Veterans Administration Hospital, had evacuated preemptively before the storm. Two large hospitals located next to the East River in lower Manhattan, New York University Langone and Bellevue, decided not to evacuate in advance and

suffered flooding of their basements that resulted in loss of emergency power and subsequent evacuations.[10] Coney Island Hospital in Brooklyn was also evacuated post-landfall due to flooding and storm damage. One other hospital on Long Island, Long Beach Medical Center, was evacuated as a precaution in advance of the storm but was so severely damaged that it never reopened.[11] A psychiatric hospital on Staten Island, South Beach Psychiatric Center, also evacuated, as did 2 hospitals in New Jersey: Hoboken Hospital (in advance) and Palisades Medical Center (due to flooding). In total, across the region, 9 hospitals were evacuated. In New York alone, hospital and nursing home evacuations involved approximately 6,300 patients.[12] Of the evacuated hospitals in both states, 7 had provided emergency department services that were lost for days, weeks, months, or, in one case, forever. The decision making about healthcare facility evacuation was inconsistent and at times confused.[13,14]

In addition to the hospitals, more than 30 nursing homes were evacuated, and many more outpatient facilities, including offices, clinics, dialysis centers, and behavioral health clinics were forced to close. Healthcare workers and patients had difficulty getting to healthcare facilities because of closed roads and lack of fuel. In many cases these healthcare facilities were closed for weeks or in some cases months. Home health care, both formal care provided by professionals and informal care provided by families and friends, was also disrupted. Given the population of 20 million in the New York metropolitan statistical area at the time of the storm,[15] most of which was significantly affected by the storm, it is reasonable to estimate that several million people, especially the most vulnerable members of society, were displaced from their normal sources of care for a period of time, and many of these had to attempt to seek care elsewhere. For example, elderly, homeless, and chronically ill people used emergency departments significantly more than did the general population after the storm,[16] and 95% of primary care sites in the Rockaways temporarily closed or relocated.[17] The healthcare facilities that remained open, or that were able to quickly reopen, experienced high patient volumes—primarily treating people for minor or routine health problems.[18–20]

Methods

Literature Review

We reviewed scholarly literature on health sector preparedness and resilience and after-action reports, news reports, and other available documents related to the impact of Hurricane Sandy on the New York City metropolitan area's health sector. Peer-reviewed publications were identified in PubMed using search terms including "Hurricane Sandy" and "Preparedness," "Evacuation," and "Resilience."

In addition, literature that addresses the impact of other recent disasters on the health sector was also reviewed. Particular attention was paid to sources that provided data on or descriptions of the number and types of injuries and illness that were treated during and after a disaster. In total, we found 61 peer-reviewed articles and media reports worthy of inclusion. The results of the literature reviews informed the selection of participants and the themes discussed during the semi-structured interviews.

Key Informant Interviews

Selection and Recruitment of Participants—From February to October 2015, semi-structured interviews were conducted with key informants from New York and New Jersey, as well as neighboring affected states, including Connecticut and Pennsylvania, to identify factors that either fostered or hindered resilience of the health sector to the effects of Hurricane Sandy in 2012. Potential interviewees were identified based on the study team's prior knowledge of stakeholders operating in these jurisdictions, as well as extensive searches of news media and peer-reviewed literature to identify healthcare and public health organizations affected by Hurricane Sandy. Additional interviewees were added through snowball sampling. Interviewees included representatives from healthcare organizations (both government and private), trade and professional associations, public health organizations, and emergency management agencies. Interviewees possessed direct knowledge of the experiences of public health or healthcare organizations during Hurricane Sandy and, in most instances, had experienced the effects of the storm directly, in their own lives.

Data Collection and Analysis—A semi-structured interview guide was developed based on the literature review and the study team's knowledge from prior Hurricane Sandy research and extensive experience in the field of public health emergency preparedness. Telephone interviews were conducted with 67 key informants between February and October 2015 by at least 2 members of the study team. One member of the team served as the primary interviewer, and the other member was a note taker. Interviews lasted approximately 30 minutes and were audio recorded and transcribed with participant permission. Study materials were labeled with unique, random identification numbers.

The interview team met regularly throughout data collection and analysis to discuss emergent themes and issues. A combined deductive and inductive approach was used to identify themes in interview transcripts and notes. A priori themes were selected on the basis of relevant literature and our research objectives. Additional themes were generated through open, unrestricted coding. Transcripts were coded using QSR NVivo for Mac v10.1.3 (Burlington, MA). Ten percent of interview transcripts were co-coded by the 4 members of the study team who conducted all interviews. Coding was compared and discrepancies were adjudicated. When the team reached a consensus about themes and their application, the remaining transcripts were divided up among the team to be coded.

Focus Groups

Two 2-hour in-person focus groups were held to further explore themes that emerged during key informant interviews. On September 16, 2015, a focus group discussion was conducted with New Jersey emergency medical services providers. On September 17, 2015, a focus group was conducted dedicated to exploring the experiences and resilience of dialysis providers in the greater New York region. Potential participants were identified based on their organization and role during Hurricane Sandy (ie, they worked in either EMS or the dialysis field), during key informant interviews, or by referral of another focus group participant. Although focus group participants held different roles during Hurricane Sandy—some provided direct care, while others served in coordinating or administrative capacities—

all possessed first-hand knowledge about their subsection of the health sector and what fostered or hindered its resilience.

A list of key issues to explore was developed by the study team based on preliminary themes that emerged during key informant interviews and the aforementioned literature review. Focus groups were conducted as open-ended, facilitated discussions. At least 3 members of the interview team, 1 of whom served as a note taker, attended each focus group. Both focus groups were audio recorded and transcribed with participant permission and analyzed in the same manner as key informant interviews.

Limitations

This study was subject to several limitations. First, because the semi-structured interviews were conducted 2 to 3 years after the storm, there is the potential for recall bias among participants. In addition, because of the study design, the sample was not random and may not be representative of all those who were involved in the Sandy response.

Another potential limitation is the generalizability of our findings. The health sector in the New York City area is one of the most resource rich in the nation. The response to a similar event in another part of the county may have looked very different, as differences in bed capacity, health workforce, and other factors may adversely affect response, recovery, and resilience.

Finally, this qualitative study was conducted primarily to identify pertinent themes that, if applied, would strengthen the community's health sector resilience. The authors made no attempt at a quantitative analysis.

The University of Pittsburgh's Institutional Review Board determined this research was exempt from 45 CFR part 46 requirements.

Findings from the Research

The following are the most salient findings of this research based on experiences of the study participants from New York's and New Jersey's health sector.

• Health sector resilience reaches beyond public health agencies and hospitals to include home care, routine outpatient care, dialysis, behavioral health, substance abuse treatment, correctional health, medical transportation, and other auxiliary services

Disruption of these services adversely affects patients not only directly but also indirectly by placing an extraordinary burden on hospitals that are ill prepared for both the volume of patients and the types of problems that these patients experience. For example, hospitals have very limited capacity for dialysis since nearly all chronic dialysis is now done in the outpatient setting. Likewise, hospital emergency departments do not maintain stockpiles of methadone for patients on chronic maintenance programs and do not have much surge capacity for psychiatric patients displaced from their normal sites of care. Much of the post-storm surge in emergency department volume was due to patients with chronic health problems being displaced from access to their normal care. Most of the preparedness

funding and attention over the years has gone to public health and hospital preparedness and very little to the rest of the health sector.

- **Advance preparations, which strengthened organizational resilience to the storm, were uneven across different health facility types; this uneven preplanning led to cascading problems**

  Nonhospital residential facilities (eg, nursing homes, long-term care facilities, and adult care facilities) were less prepared and, therefore, inherently less resilient than hospitals—These facilities have had fewer emergency preparedness regulatory requirements and little emergency preparedness funding. Because they have small staffs, they rarely have anyone dedicated exclusively to emergency preparedness and typically have more difficulty assigning someone to be responsible for preparedness.

  Some ancillary outpatient services were relatively more resilient because of their own independent preparedness activities—Some hemodialysis centers, substance abuse programs, and pharmacies displayed impressive resilience. They had planned and prepared for emergencies separate from the federal healthcare and public health preparedness programs. Generally, across several health sector components, facilities that were part of networks (eg, integrated health systems or chains) were better prepared and more resilient than stand-alone operations, because they had more resources and personnel to apply to preparedness and response activities.

  Restoration of some healthcare services took a very long time, or did not occur at all, disrupting care for many patients—This was particularly true for certain health services in more geographically vulnerable sections of New York, such as the beach communities of the Rockaways and Long Beach. For example, the Joseph P. Addabbo Family Health Center and Long Beach Medical Center were both significantly affected by flooding during the storm and were forced to close, the latter permanently. As a result, health services in the Rockaways and Long Beach were severely disrupted. Had these facilities been more resilient, it is likely that there would have been less disruption of care and some of the secondary burden on other parts of the health sector could likely have been avoided.

- **Vulnerable populations were less resilient, and special needs and medical shelters were inadequately planned**

  Individuals in these vulnerable population groups tend to have fewer resources and were often less prepared—Storm conditions easily splintered the already fragile support systems on which many vulnerable people (eg, elderly, young, chronically ill, addicted, poor, and non–English speaking people) relied, such as home-based care, public clinics, just-in-time medications, and public transportation. As a result, members of vulnerable populations comprised a disproportionate share of the load on acute care facilities. This is not unexpected, as it had been identified in many previous disasters, and individuals who are members of vulnerable populations are known to routinely experience significant inequality in resources as well as social status. Nonetheless, insufficient priority had been given to preparing these populations and those entities on

which they rely to be resilient and to readying hospitals to meet the surging service demands of these populations. In particular, the agencies and institutions that most frequently interface with those vulnerable populations have not historically been included in emergency planning or preparedness networks. As a result, 1 participant noted, “People who have mitigating factors and weren’t doing so well before the storm did not bounce back.”

In many locations there was insufficient capacity of special needs and medical shelters, and the mission, staffing, and concept of operation for such shelters had not adequately been considered prior to the storm—This lack of preparedness in shelters was manifested as:

- lack of coordination,
- lack of staffing,
- unclear operational responsibilities,
- poor communication with other components of the health sector,
- spread of infectious diseases in the shelters,
- problems with food quality,
- lack of medication (including methadone), and
- use of illicit drugs and the inability to access drug treatment programs.

• The scale and duration of the storm’s impacts heaped additional stress on the health sector in the form of unflagging patient demands and a fatigued healthcare workforce

With the aftermath of the storm lasting weeks or in some cases months, patients’ access to health care was disrupted for extended periods, resulting in prolonged burdens on the healthcare facilities that remained open—The overworking of personnel was compounded by work-related stress (eg, the high volume of patients and adverse working conditions facing staff because of power outages, evacuations, etc) and home-related stress (eg, many staff members had lost their own homes or had family members in need). In some cases, the fatigue and stress resulted in “compassion fatigue,” when personnel were no longer able to empathize with the victims or patients. The wide geographic scale of the disaster meant that a substantial number of personnel were unavailable to work because of loss of their homes, family care duties, or loss of transportation. This was a problem especially in communities dependent on volunteer emergency medical technicians.

External support and relief were desperately needed to handle the surge in patients and to backfill local personnel who were unable to report for work or who needed respite after days and weeks of sustained work with little sleep—Because of the multistate scale of the disaster, however, aid was not as readily available as expected and often came from far away. The much-needed backup eventually included support via mutual aid (both in-state and out-of-state), out-of-state deployments through the Emergency Management Assistance Compact, and federal deployments through the National Disaster Medical System.

- **Critical infrastructure disruptions and the immobility of many "critical personnel" stifled care delivery both at home and in healthcare facilities**

  The loss of readily available vehicle fuel, electricity, electronic communications, and transportation threatened people with chronic health needs and greatly hindered the ability of healthcare facilities to respond—Fuel was hard to find because roads were closed, some refineries were shuttered, and many gas stations were without electricity. Emergency vehicles were given priority for fuel, but healthcare workers or first responders in their personal vehicles trying to get to and from work were not—nor were patients traveling in their personal vehicles. Furthermore, nonemergency patient transport services (eg, transport vans) were also not prioritized. This hindered transportation of patients and healthcare workers and compounded the transportation disruptions caused by the closure of major roads, bridges, and tunnels and the discontinuation of mass transit. Furthermore, fuel for generators became hard to find, which threatened facilities and patients dependent on emergency power. Widespread and prolonged electrical power outages affected patients and facilities across the entire region. In New Jersey, some members of the community showed up in hospital waiting rooms just to get access to electricity to charge their mobile telephones and battery-powered medical devices. Emergency power systems such as hospital emergency generators were not always reliable or sufficient for a prolonged power outage.

  The definition of "essential personnel" was unclear, hindering the movement of the many different people who were needed to run healthcare facilities—While some types of hospital workers were given priority for access to restricted roads and fuel, others were not. In a prolonged event, nearly all types of hospital workers are needed to keep facilities operating. Nonhospital healthcare workers were generally not recognized as essential workers for purposes of road access and fuel. Thus, for example, dialysis nurses had difficulty getting to the dialysis centers, thereby putting those patients at risk. Informal healthcare providers, such as family caregivers, were not considered at all. Judgments of who was and was not essential were not uniform across the greater New York and New Jersey area or even within the same jurisdiction. Often, an individual manning a roadblock or gas station made the determination.

- **Unclear responsibilities and an underestimation of the potential storm impacts by some officials contributed to delayed and often chaotic healthcare facility evacuations**

  Patient movement from evacuated healthcare facilities was plagued by lack of coordination and miscommunication—In some instances, once a decision to evacuate a hospital had been made, processes for coordinating patient movement (how they were to be transferred—emergent or nonemergent—where they were to go, and how they were to get there) were unclear, and there was miscommunication between evacuating hospitals, emergency medical services, and receiving hospitals.

  In at least 2 instances, there was a difference of opinion between EMS and a hospital about the urgency of evacuation and in turn the appropriate procedures to use. EMS viewed this patient movement as being similar to a fire evacuation in which speed and getting patients out of harm's way were the priorities. In contrast, hospitals that evacuated before and during

the storm viewed the situation as being more like a normal patient transfer during which customary procedures in line with the Emergency Medical Treatment and Labor Act (EMTALA) are strictly adhered to. EMTALA requires that patients be stabilized prior to transport, transferred only for medical need, accompanied by qualified personnel, and in vehicles equipped for the level of care the patient requires. Furthermore, it requires that direct communication take place between transferring and receiving clinicians. The applicability of EMTALA to emergency evacuations was not clear. There was also confusion at 1 hospital about when an emergency begins (ie, is it an emergency if the storm hasn't made landfall yet?). This confusion is particularly concerning given the significant time required for a hospital evacuation and the need to complete pre-storm evacuation prior to onset of dangerous storm conditions that would place EMS and patients at risk. Facilities that were part of networks (eg, integrated health systems and chains) for the most part attempted to keep evacuated patients within their own networks, even if this meant moving patients over a greater distance. This had the potential benefit of maintaining better continuity of care but complicated transportation and optimal distribution of patient load.

Prior hurricane experience was a double-edged sword, evoking more preparation in some cases and greater complacency in others—Prior experience with Hurricane Irene only 1 year before helped with preparations for Sandy by identifying preparedness gaps and providing useful experience. On the other hand, because Irene was not as severe as predicted in the greater New York City area, some officials and healthcare executives discounted warnings about the seriousness of the impending Hurricane Sandy. This and the financial impact of evacuation during Irene played a role in delaying evacuations. The evacuations that occurred during and after the storm were much less organized than those conducted in advance of the storm. Pre-storm evacuations were also easier—they had the luxury of power and therefore lights and elevators to execute evacuations—and consequently safer for staff who did not have to carry patients up and down stairs in the dark.

- **Existing healthcare assets were creatively deployed, procedures adjusted, and prior relationships capitalized on to manage issues and problems as they emerged**

Mobile health units of various types were very useful—A number of health-related entities, including pharmacies, hospitals, medical clinics, and substance abuse programs, own or have access to mobile units that they use for routine activities. During the response to Hurricane Sandy, these assets were deployed in various useful ways. Often this was done "on-the-fly," as these mobile units had not previously been considered emergency response assets in some cases. For example, in order to restore some measure of primary care services to the Rockaways, a mobile clinic was deployed to that community following the storm. Additionally, a New Jersey hospital deployed a mobile emergency department to enable service provision while the hospital was undergoing repairs from storm damage.

Having preexisting relationships was universally viewed as having been very important—This included relationships within professional communities (eg, among hospital emergency managers) and across professions (eg, between hospital emergency mangers and public health or EMS personnel). These relationships enabled more rapid

communication and, in some instances, alternative modes of communication, such as personal cell phones or email. These relationships also afforded a level of trust that allowed for “handshake” agreements for mutual support. This was generally viewed as positive, but in at least 1 case, such an informal agreement that was not followed by a formal agreement resulted in conflicts over reimbursement and financial responsibility many months later when the bills came due.

Normal procedures and standards of care were adjusted for the purpose of doing the most good for the greatest number—Pharmacies and drug treatment programs provided extra doses of medication in advance of the storm to those who would otherwise run out. Dialysis centers treated some patients in advance and shortened dialysis time for others to accommodate more patients in a short time. One hospital participant reported implementing a task force to expedite the early discharge of patients who could safely be released, thereby freeing up space in the hospital prior to the storm. While early discharge is a common element of hospital emergency operations plans, many of these activities were ad hoc solutions that took place outside of official chains of command and relied heavily on individual and institutional flexibility and improvisation. Whether these actions actually achieved better outcomes or in fact may have caused harm to some individual patients is an area for further study.

- **Political leaders, following the impulse to take action, sometimes deviated from established plans, thus complicating the response**

  Political leaders played an important but not always constructive role. Having high-level support from elected officials for emergency managers and public health officials was essential to both preparedness and response efforts; however, conflicts between political leaders and ad hoc decisions by leaders that were not consistent with response plans or strategies created confusion and complicated the response. Specifically, 1 participant reported tension between political preferences and decision making during the response to Sandy and actions and responsibilities contained in emergency planning documents. This participant noted, “If you spend a year writing a plan and educating to the plan and training to the plan, then you should use the plan.”

Health Sector Resilience: How the Pieces Fit Together

Lessons from Other Disasters

We analyzed the themes from our research on Hurricane Sandy in the context of analyses of the healthcare impacts of other recent US natural disasters.[21–30] Much of this literature focuses on direct casualties of a disaster or follows the impact on healthcare facilities for only a few days. In the immediate several days after a disaster, most injuries are relatively minor and result more often from the clean-up and recovery than from direct effects of the disaster.[22,24] Excluding immediately fatal injuries that do not lead to hospital care, major injuries are much less common than minor ones.

Few studies have examined the overall impact of disasters on the healthcare system over the course of weeks or months. The literature that does exist is consistent with our findings that

after the first few days most post-disaster patients are people who have been displaced from routine healthcare and disproportionately come from vulnerable populations.[22,23,25,27,28] This is especially true for hurricanes, in which the number of injuries is fewer and the number of displaced patients is much greater than, for example, in earthquakes or tornados. Psychological injury is also commonly associated with disasters, both newly arising conditions such as post-traumatic stress disorder and exacerbation of preexisting conditions.[31] In fact psychological injury may be much more common than physical injury.[32] A number of participants in our research reported that, in their experience following Sandy, many if not most of their family, friends, and colleagues experienced substantial psychological stress. This included first responders, healthcare workers, individuals with preexisting behavioral health conditions, and the general public, who faced destruction of property; loss of power, water, and food; and evacuation.

A Conceptual Map of Health Sector Resilience

From our analysis and synthesis, we developed a conceptual map of how the various parts of the health sector interrelate in the context of a disaster such as Hurricane Sandy. From this map we have distilled lessons that we judge to be generally applicable to a variety of disasters in a variety of communities. These lessons have informed the creation of a general checklist of actions that may be helpful to many different health sector organizations as well as supplemental checklists that are specific to various types of organizations. The infographic in Figure 1 illustrates our conceptual map. A short animated video explains the map in lay terms (https://www.youtube.com/watch?v=zW5xCzs0spA).

Pieces of the Map

The hazard—Particular characteristics of this hazard, especially its duration and geographic scale, adversely affected the health sector beyond what would have been expected in a smaller or shorter event. This is similar to findings from other large storms, including Hurricane Katina.

The infrastructure—The resilience of the health sector depends on a resilient infrastructure. The modern health sector needs electricity, communications (eg, landline telephone, cellular telephone, and internet), fuel (for vehicles, heating, and generators), water, and transportation. It also depends on an uninterrupted supply chain for medical supplies, food, and other essential consumables. Rapid restoration of these goods and services is essential when they are compromised, damaged, or made scarce due to a disaster.

The community—The formal healthcare *system* resides within a larger community context that includes civil society, private industry, and public agencies. It is only one part of the larger health *sector* that also includes informal care providers such as family caregivers. These informal caregivers are often the liaison with the healthcare system. The healthcare work force also lives in the larger community and is affected by whatever affects the community. During a disaster both the informal caregivers and healthcare workers may become care seekers, in which case they may not be available to provide care. During disasters healthy community members seek refuge in hospitals for power, shelter, and comfort, further stressing the hospitals.

The healthcare system—The healthcare system is broad and diverse. Patients seek and receive care in many different settings, all of which can be disrupted in a disaster. This includes:

- Hospitals (public, private, federal)
  - Acute care
  - Psychiatric
  - Specialty (pediatric, rehabilitation, etc)
- Long-term care facilities
  - Long-term acute care
  - Nursing homes
  - Adult care facilities
- Outpatient (private or public)
  - Primary care
  - Specialty care
  - Urgent care
  - Convenient care (clinics in pharmacies)
  - Behavioral health
    - General mental health services
    - Mental health intensive case management
    - Substance abuse treatment, including short-term alcohol and drug treatment and methadone maintenance
  - Hemodialysis
- Pharmacies
- Pre-hospital (EMS)
- Home- and community-based care
  - Home health, including visiting nurses, home physical therapy
  - Home respiratory therapy, including portable and home oxygen, continuous positive airway pressure devices, and home mechanical ventilators
  - Peritoneal dialysis
  - Monitoring and maintenance of implantable cardiac devices
  - Durable medical equipment and supplies
  - School-based health care

- Prison health care

- Public health
  - An outpatient provider for certain specific issues, such as tuberculosis, sexually transmitted infections, and vaccines
  - A regulator of healthcare facilities
  - A funder of some facilities and services provided by others
  - An investigator of outbreaks and surveillance provider
  - A facilitator of coordination of healthcare entities, such as special needs or medical shelters, in a disaster
  - A distributor/dispenser of medical pharmaceuticals and supplies
  - A communicator with the public about risks and suggested actions
  - An assessor and regulator of environmental health

Disruption of the operations of various nonhospital healthcare services leads to stress on hospitals. In the event of a disaster, in addition to continuing routine (normal) patient services and treating event-induced injuries and illnesses, hospitals also may have to absorb displaced inpatients from evacuated hospitals and long-term care facilities, displaced outpatients (unable to get needed routine care at normal places), and displaced home care patients.

The health sector is highly regulated by multiple entities that may have overlapping or unclear lines of authority. This includes municipal, county, and state health departments and county and state emergency management agencies as well as the federal Centers for Medicare and Medicaid Services (CMS) and accrediting entities like the Joint Commission. There may be overlap as well between emergency management and public health at each level. These agencies are responsible to or are influenced by elected officials at each level who often have ultimate authority under the law. These various authorities can influence resilience positively or negatively, depending on how well they plan and work together.

Much of disaster preparedness and response is authorized or constrained by public health law. The law provides the legal and policy foundation for disaster response and establishes accountability, but in many cases the law is insufficiently detailed or clear, especially regarding roles and responsibilities. Key individuals such as hospital executives, public health officials, and elected officials may not be aware of the details of existing laws. The law can provide legal approval or waive legal requirements for altered delivery of services (eg, expanded scope of practice, increased bed capacity, EMS transportation to nonregulated medical facilities).

Inherent and adaptive resilience—The resilience of the healthcare system depends on *inherent* factors that exist before a disaster, such as the underlying health and economic status of a population, and *adaptive* factors that occur during and after a disaster, such as the ability of the system to respond quickly and effectively and to improvise.

A resilient health sector depends on each of these parts being resilient and on the various parts working well together. The actions that make up our checklist reflect these interrelationships and seek to foster resilience of the component parts of the health sector, to improve the interaction between the parts, or to enhance inherent or adaptive resilience.

General Checklist of Actions

The following is a checklist of cross-cutting actions that many different health sector organizations can implement to foster resilience.* Following this general checklist, we provide supplemental checklists that are specific to individual components of the health sector. Some of these items may be very challenging to accomplish and may require considerable effort over time as well as collaboration with multiple community partners.

- ☐ **Healthcare Coalitions**
  - ☐ The organization participates in their local healthcare coalition to promote local collaboration and coordination around healthcare emergency preparedness and response. While the core membership of the healthcare coalition includes acute care hospitals, public health agencies, emergency management and EMS, many other health sector entities have a valuable role in resilience and should be participants in ongoing preparedness efforts.
- ☐ **Continuity of Operation/Business Continuity Plan**
  - ☐ The organization has a continuity of operations or business continuity plan that addresses how it will continue to deliver essential services in the event of a disruption. This includes deciding what services are truly essential under various circumstances.
  - ☐ Relevant portions of the plan are shared with patients, partners, vendors, and authorities. Organization confirms that partners and vendors on which it relies have their own continuity of operations plans, which will enable continued provision of goods and/or services on which the organization is dependent.
- ☐ **Surge Capacity and Capability**
  - ☐ The organization has a plan for how it will accommodate increased demand for service—that is, how it will “surge” its capacity. This plan might include augmenting the current workforce with additional personnel from other organizations or jurisdictions or expanding to additional sites. Alternatively, this plan might entail altering routine operating procedures and policies and even standards of care to expand capacity under appropriate circumstances.

*Some items in this checklist may overlap to some extent and are not intended to be mutually exclusive. For example, identifying alternative facilities for conducting operations is an essential element of business continuity planning; however, the overall continuity of operations planning process and the specific planning for alternative care sites are sufficiently distinct as to warrant separate listings.

- The organization has plans, thresholds, and other documentation (ie, memoranda of understanding) in place to help facilitate an emergency evacuation in the event of a widespread disaster.

- **Alternative Care Sites**
  - The organization has identified an alternative site(s) from which it can provide essential services—for example, where patients can receive dialysis or where prescriptions can be picked up. This might include a backup location to which the organization's operations would be relocated, another healthcare facility to which patients would be referred or transferred, and additional provider sites that could augment the capacity of the primary (normal) operating location. This might also include sites where external resources can be located—for example, identifying buildings that will be used to establish federal medical stations.

- **Mobile Healthcare Vehicles and Assets**
  - The organization is aware of existing mobile healthcare assets (eg, vans, buses, RVs) in their communities and has considered how these assets might be used in a disaster such as to augment capacity or to serve as an alternative mechanism for care delivery when regular facilities are unavailable.
  - The organization has considered or established memoranda of understanding or service agreements in advance for how these assets may be used and has obtained any regulatory (eg, cross-jurisdiction licensing) approval that might be needed.

- **Crisis Standards of Care Planning**
  - The organization has a plan for implementing crisis standards of care covering the continuum from conventional through contingency to crisis standards.[33,34] This plan describes how the delivery of health care would be prioritized so as to do the most good for the greatest number. Its ultimate goal would be to put capabilities in place to avoid a transition to crisis care and to attempt to return to conventional care as quickly as possible. The plan depends on close coordination with emergency response partners at the local, regional, state, and federal levels.

- **Early or Alternative Treatment**
  - Where possible, the organization devises creative ways to be flexible in how care is provided in a disaster. This might include the ability to provide care or treatment in advance (eg, early dialysis or early dispensing of prescriptions) or in an adjusted manner (eg, providing patients with limited take-home supplies of controlled medications) or at alternative locations (eg, guest dosing of methadone).

- **Communication, Public Awareness, and Situational Awareness**
  - Mechanisms exist by which the public (care seekers) can obtain information on the status and availability of health facilities and services (eg, whether a pharmacy or dialysis center is open or closed). These mechanisms for ensuring communication with and awareness of the public are distinct from communication that must also occur with the healthcare and public health workforce to ensure situational awareness among providers (see below). At an organizational level, this might include status updates on websites and call lines belonging to the service provider (eg, the individual pharmacy). On a community level, this might include services like 211[‡] or 311.[§] Such information portals or hotlines should be distinct from crisis intervention hotlines or emergency services numbers such as 911. Ideally, information would be aggregated at a high level to provide a complete picture of available health services in an entire community.
  - These mechanisms for ensuring communication with the public are incorporated into emergency plans and provisions exist for ensuring the continuity of these services in a disaster (ie, there are continuity of operations or business continuity plans for 211 or 311 services).
  - A proactive mechanism exists to conduct outreach to patients whose health and mental health services are expected to be interrupted (eg, pharmacies contact patients who are due for refills at a location that has been closed because of storm damage or providers proactively assist in connecting patients to services at an alternative location).
- **Engaging and Supporting Workers**
  - Healthcare facilities and public agencies engage frontline workers, in addition to managers and executives, in planning and preparing for disasters. This involves including them in all aspects of preparedness, such as developing plans, training personnel, and designing and evaluating exercises. Workers should be drawn from a broad sample of the workforce. Such involvement would not only improve the operability of the plans but also foster better adherence and acceptance when implemented.
  - Healthcare facilities and public agencies train their workers on their specific roles and responsibilities in a disaster so that the workers can understand what is expected of them and how they can contribute to the success of the whole.
  - Beyond engaging workers in preparedness, the organization prioritizes worker morale and sense of commitment to the organization.

[‡]The United Way operates 211 call centers in most states, which provide information about social services in the community.
[§]Many jurisdictions operate 311 call centers for the public to use for nonemergency issues.

Willingness of healthcare workers to respond despite personal and professional stress and hardship depends on a personal commitment to the organization and the community grown out of a sense of loyalty and shared mission. Health and public health providers should develop systems and strategies to monitor and address the psychological impacts of a disaster on their workforces.

- The organization finds ways to support workers so as to allow them to successfully work during stressful times, such as providing family daycare or emergency shelter for staff and their families during an emergency. Additionally, employers develop programs and strategies to help their workers develop personal or family preparedness plans and foster their own resilience.

- **Public Health Legal Preparedness**
  - Public health emergency legal authorities are reviewed so that it is clear what authorities and responsibilities exist and who has which powers and responsibilities related, for example, to health facility evacuations or the management of patient needs in the setting of scarce life-saving or sustaining resources. In addition to clarifying the legal authority of public health officials, the roles and authorities of elected officials and emergency management officials should also be reviewed and communicated.

- **Flexibility**
  - The organization seeks ways to foster improvisation and flexibility in response to unknown circumstances. This is distinct from the ability of people to be adaptable, although personnel within organizations should be encouraged and rewarded for improvisation. It is the nature of large organizations to be conservative, risk averse, and rule-bound, but this inhibits the adaptation that is essential for resilience. Organizations should consider creating broad-based committees to review internal policies, practices, and cultural norms that hinder flexibility in disaster response.

- **Infrastructure Continuity and Restoration**
  - The organization has undertaken efforts to “harden” its facilities, making them less vulnerable to disruption by a variety of likely hazards. This might include, in the case of a hurricane, for example, moving generators, fuel pumps, and related electrical equipment out of basements, installing watertight doors, or building berms.
  - The organization has robust response plans for loss of power, potable and nonpotable water, and communication and information technology infrastructure. This includes emergency backup systems (and perhaps redundant backup in some cases), adequate fuel supplies for emergency generators and reliable sources for fuel resupply, and

procedures for continuing operations without this infrastructure. To the extent possible, these plans should minimize dependence on external help and maximize self-reliance. Plans should consider the possibility of prolonged interruption of services. There should be plans as well for rapid recovery of services when the infrastructure is restored.

- In addition to having redundant backup communications using different technologies, organizations should have a strategy for dealing with limited communications and information flow (ie, determining what information is essential).
- Healthcare facilities are identified as critical infrastructure in community disaster planning, and, therefore, jurisdictions prioritize rapid restoration of power and other essential utilities to all electricity- and utility-dependent healthcare facilities (eg, hospitals, nursing homes, long-term care facilities, dialysis centers).

- **Transportation Continuity, Restoration, and Access**
  - The organization plans for transportation interruptions and considers how they will adapt to such interruptions, including possible alternative transportation for and sheltering of staff and patients.
  - Jurisdictions plan for rapid restoration of transportation including mass transit, roadways, and vehicle fuel. Fuel is needed for emergency vehicles but also for essential personnel using their own private vehicles to travel to and from sites of patient care.
  - Policies are reviewed to limit as much as possible large-scale restriction of local travel, such as closing all access roads, shutting down mass transit, or restricting travel to “essential personnel” during disasters.
  - Downstream consequences of travel restrictions (especially on the health sector), such as interruption of supply chains and loss of staff, are carefully considered and planned for.
  - If travel restrictions must be implemented, provisions are made to enable healthcare, allied health, and support personnel who are all essential to the delivery of health services to travel to and from all care sites, not just hospitals. These provisions should include family caregivers.
  - Jurisdictions work in concert with healthcare facilities to ensure that patients are able to travel to and access needed care after disasters and in particular when travel restrictions are implemented.
- **Supply Chains**

- ☐ The organization has plans for maintaining needed supply delivery during and after a disaster. The plan includes redundant supply sources and sources of emergency alternatives.
- ☐ The organization has determined which supplies are mission-critical and has plans for crisis standards of care if mission-critical supplies run out.
- ☐ The organization has stockpiled or worked with others in the region to stockpile essential mission-critical supplies that are sufficient to last until resupply can be reasonably expected.
- ☐ The organization has established written assurances with essential suppliers in advance of an event to assure timely resupply.

Supplemental Checklists for Components of the Health Sector

The following supplemental checklists are specific to different entities that play important roles in health sector resilience to disasters. They should be used in conjunction with the general checklist above. In some cases the specific checklists repeat actions included in the general checklist for emphasis. All users of this document are encouraged to read the general checklist first and then read the specific checklist that applies to them. Many of the items in the checklists can be found in other existing guidance, such as from the Joint Commission or CMS,[35] but here we emphasize those items that had greatest salience to health professionals who experienced Sandy and that in our judgment are generalizable to other disasters in other locations.

Hospitals

- ☐ In addition to all-hazard preparedness activities as mandated by the Joint Commission and CMS, and encouraged by the ASPR Hospital Preparedness Program, including participation in healthcare coalitions, hospitals place greater emphasis on being prepared for a surge of patients displaced from normal care and needing services not commonly provided, such as outpatient dialysis and methadone maintenance.
- ☐ Hospitals are prepared for community members seeking refuge (eg, food, water, shelter, electrical outlets, accommodations for displaced persons accompanied by a pet) and, in addition, have preestablished agreements with nearby community institutions to help provide similar assistance if conditions permit.
- ☐ Hospitals create an algorithm for evacuation decision making that reflects a clear understanding of who has the legal authority and responsibility for decision making about evacuation and under what circumstances evacuation is appropriate.
  - ☐ The evidence base for assessing the risk of precautionary versus emergency evacuation is reviewed and incorporated into the algorithm.

- Hospitals engage in planning with their local emergency management agency, EMS, and healthcare coalitions to create a centralized system to coordinate patient transportation and distribution in case of facility evacuation, including if multiple simultaneous evacuations are needed.
- Hospitals carefully review EMTALA regulations as they apply to disasters and seek clarification of any unclear aspects.
- Hospitals have processes in place needed for evacuation:
  - the ability to provide secure and confidential access to patient medical information during disaster response and recovery, identification of patient destination, and
  - sharing resources and returning resources to source healthcare facility at the conclusion of the evacuation period.
- Hospital senior executives recognize the importance of preparedness to their organization's and community's long-term well-being and engage personally in ensuring their organization's resilience.
- Hospital senior executives recruit clinician champions to be actively engaged in preparedness activities.

Long-Term Care Facilities

- Nursing homes, long-term acute care facilities, and residential adult care facilities prioritize their own resilience to disaster. They have emergency operation plans and continuity of operations plans that anticipate prolonged loss of essential infrastructure.
- Long-term care facilities' emergency plans include the circumstances under which evacuation might be needed, where the residents would go, and how they would get there. Specific arrangements, memoranda of understanding, and/or contracts are executed with any outside entities that would be needed to aid in sheltering in place or evacuating.
- Long-term care facilities create an algorithm for evacuation decision making that reflects a clear understanding of who has the legal authority and responsibility for decision making about evacuation and under what circumstances evacuation is appropriate.
- The evidence base for assessing the risk of precautionary versus emergency evacuation is reviewed and incorporated into the algorithm.
- Long-term care facilities that are part of larger organizations, such as nursing home chains or integrated healthcare networks, actively participate in the larger organizations' preparedness activities.
- Long-term care facilities are able to provide secure and confidential access to patient medical information during disaster response and recovery.

- Long-term care facilities have robust plans for loss of power, water, and communication and information technology infrastructure. This includes emergency backup systems, adequate fuel supplies for emergency generators and reliable sources for fuel resupply, and procedures for continuing operations without this infrastructure. To the extent possible, these plans should minimize dependence on external help and maximize self-reliance. Plans should consider the possibility of prolonged outages. There should be plans as well for rapid recovery of services when the infrastructure is restored.

Outpatient Medical Facilities

- Physician offices and all types of outpatient medical clinics place greater emphasis on their own resilience to disaster. They have emergency operation plans and continuity of operations plans that anticipate prolonged loss of essential infrastructure.
- Outpatient medical facilities can securely and confidentially access patient medical information during disaster response and recovery.
- Outpatient medical facilities have robust plans for loss of power, water, and communication and information technology infrastructure. This includes emergency backup systems, adequate fuel supplies for emergency generators and reliable sources for fuel resupply, and procedures for continuing operations without this infrastructure. To the extent possible, these plans should minimize dependence on external help and maximize self-reliance. Plans should consider the possibility of prolonged outages. There should be plans as well for rapid recovery of services when the infrastructure is restored.
- Outpatient medical facilities that are part of larger organizations, such as urgent care chains or integrated healthcare networks, actively participate in the larger organizations' preparedness activities.

Behavioral Health Providers

- Mental health and substance abuse clinics emphasize their own resilience to disaster. They have emergency operation plans and continuity of operations plans that anticipate prolonged loss of essential infrastructure. There should be plans as well for rapid recovery of services when the infrastructure is restored.
- Behavioral health providers that are part of larger organizations, such as mental health networks or integrated healthcare networks, actively participate in the larger organizations' preparedness activities.
- Where possible, behavioral health providers devise creative ways to be flexible in how care is provided in a disaster. This might include the ability to provide treatment in advance (eg, early dispensing of prescriptions) or in an altered manner (eg, providing patients with limited take-home supplies of controlled medications) or at alternative locations (eg, guest dosing of methadone).

- Behavioral health providers can provide secure and confidential access to patient medical information during disaster response and recovery.
  - Work with state regulators to create an electronic system by which alternative care locations (eg, other behavioral health clinics and hospital emergency departments) can access patient dosing information.
- Behavioral health providers review relevant public health laws and regulations as they relate to disasters, especially those that relate to crisis standards of care and the prescribing and dispensing of controlled substances.
- Behavioral health providers are prepared to assist the healthcare workforce and acutely affected populations, as well as existing clients.
- Behavioral health providers train non–behavioral health first responders and healthcare providers in recognizing potential mental health issues and delivering simple preventive techniques, such as psychological first aid.

Pharmacies

- Pharmacies emphasize their own resilience to disaster. They have emergency operation plans and continuity of operations plans that anticipate prolonged loss of essential infrastructure.
- Pharmacies can securely access patients' prescription information during disaster response and recovery.
- Pharmacies that are part of larger organizations, such as drug store chains or integrated healthcare networks, actively participate in the larger organizations' preparedness activities.
- Where possible, pharmacies devise creative ways to be flexible in how care is provided in a disaster. This might include the ability to provide treatment in advance (eg, early dispensing of prescriptions) or in an altered manner (eg, providing patients with greater than normal supplies of medications) or at alternative locations (eg, transferring prescription to another pharmacy).
- Pharmacies review relevant public health laws and regulations. The law can provide legal approval or waive legal requirements for adjusted delivery of services (eg, expanded scope of practice and alternative care facilities).

Correctional Health Facilities

- Health clinics and infirmaries in prisons and jails prioritize their own resilience to disaster. They have emergency operation plans and continuity of operations plans that anticipate prolonged loss of essential infrastructure.
- Correctional health facilities' plans include the circumstances under which evacuation might be needed, where the inmates would go, and how they would get there. Specific arrangements, memoranda of understanding, and/ or contracts

are executed with any outside entities that would be needed to aid in sheltering in place or evacuating.

Public Health Departments (State and Local)

- ☐ The public health department has a continuity of operations plan addressing how it will continue to deliver essential services in the event of a disruption. This includes deciding what services are truly essential under various circumstances.
- ☐ The public health department has a plan for how it will accommodate increased demand for service, including augmenting current workforce with additional personnel from other organizations or jurisdictions or reassigning personnel.
- ☐ The public health department has identified an alternative site(s) from which it can provide essential services.
- ☐ Public health emergency legal authorities are reviewed so that it is clear what authorities and responsibilities exist and who has which powers and responsibilities related, for example, to health facility evacuations and alterations in standards of care.
- ☐ To the extent possible under law, public health departments encourage or require that all organizations have robust response plans for loss of power, water, and communication and information technology infrastructure. This includes emergency backup systems (and perhaps redundant backup in some cases), adequate fuel supplies for emergency generators and reliable sources for fuel resupply, and procedures for continuing operations without this infrastructure.
- ☐ The public health department working with other local and state agencies prioritizes rapid restoration of power and other essential utilities to all electricity- and utility-dependent healthcare facilities (eg, hospitals, nursing homes, long-term care facilities, dialysis centers, etc). Healthcare facilities are identified as critical infrastructure in community disaster planning.
- ☐ If travel restrictions must be implemented, the public health department works with other agencies to enable healthcare, allied health, and support personnel who are all essential to the delivery of health services to travel to and from care sites (not just hospitals). This should include family caregivers. The public health department works in concert with healthcare facilities to ensure that patients are able to travel to and access the needed care after disasters and in particular when travel restrictions are implemented.
- ☐ The public health department ensures the development of plans for special needs and medical shelters, which may or may not be operated by public health agencies. Plans ensure that special needs and medical shelters have adequate capacity (including space, staffing, and supplies) for expected volume of citizens requiring electrical power and other assistance related to their medical conditions. Plans address how public health and safety (eg, prevention of infectious disease outbreaks, food safety) at medical shelters will be ensured as

well as how shelter residents will be connected to care that is not available onsite (eg, drug treatment programs).

Patient Transport Providers

- ☐ Emergency medical services and other patient transport providers (private ambulance, ambulette, etc) have a continuity of operations plan addressing how they will continue to deliver essential services in the event of a disruption.
- ☐ EMS agencies have a plan for crisis standards of care that address staffing, scope of practice, patient destination, and the like. The plan incorporates close coordination with local healthcare providers and regional, state, and federal partners.
- ☐ EMS agencies review public health emergency legal authorities so that it is clear what authorities and responsibilities exist and who has which powers and responsibilities related, for example, to health facility evacuations and adjustments in standards of care.

Home and Community-Based Care Providers

- ☐ Home care agencies, companies, and providers of all types emphasize their own resilience to disaster. They have emergency operation plans and a continuity of operations plan that anticipate prolonged loss of essential infrastructure.
- ☐ They have robust plans for loss of power, water, and communication both to their own offices and to their patients. This includes emergency backup systems, adequate fuel supplies for emergency generators and reliable sources for fuel resupply, and procedures for continuing operations without this infrastructure.
- ☐ Home care agencies, companies, and providers can securely access patient medical information during disaster response and recovery.
- ☐ They have plans for dealing with degraded transportation capabilities.
- ☐ They have a process for prioritizing (triage) which patients are to be seen.
- ☐ They have mutual aid arrangements with other home and community-based care organizations.
- ☐ Home care providers that are part of larger organizations, such as home care chains or integrated healthcare networks, actively participate in the larger organizations' preparedness activities.

Local Elected Officials and Jurisdictions

- ☐ Local elected officials ensure that every government agency, utility, and infrastructure provider has a continuity of operations plan or business continuity plan addressing how it will continue to deliver essential services in the event of a disruption. Local elected officials ensure that every government agency, utility, and infrastructure provider has a plan for how it will accommodate increased demand for service, including augmenting current workforce and altering

routine operating procedures and policies to expand capacity under appropriate circumstances.

- Local elected officials ensure that every government agency, utility, and infrastructure provider has identified an alternative site(s) from which it can provide essential services.
- Local elected officials use their ties with community-based organizations to engage them in planning for disasters. Ideally, this engagement is accomplished through a mature healthcare coalition.
- Local elected officials ensure that procurements and contracts with community-based organizations and service providers include provisions in contracts requiring development and occasional exercising of emergency response plans, including engagement with the healthcare coalition and other emergency preparedness and response partners, and sufficient additional funding to do this work.
- Local elected officials have been consulted on plans for crisis standards of care.
- Local elected officials review public health emergency legal authorities so that it is clear what authorities and responsibilities exist and who has which powers and responsibilities related, for example, to health facility evacuations and alterations in standards of care.
- Local elected officials work through their existing incident command structures (jurisdictional emergency management and public health agencies) to take actions during disasters.

Patients and Families

- All members of the public should take actions to enhance their personal disaster resilience, such as:
  - Maintaining a several-day supply of water, food, cash, and medicines;
  - Considering the types of disasters they are most likely to experience and what measures are likely to reduce their vulnerability;
    - This information could be provided by the local emergency management or public health agency.
- Considering what items (eg, important papers and medications) they might need if they must evacuate on short notice and planning where they might go;
- Planning different means by which they can contact family and friends in a disaster and inform them of their plans; and
- Ensuring that they have redundant mechanisms to access information in a disaster, including, if electrical power is out, a battery-powered or hand-crank radio.

- Above and beyond these general measures, patients with serious chronic diseases require additional actions. A comprehensive list of actions for all types of patients is beyond the scope of this checklist, as is a completely detailed list of actions for any particular condition, but the following list addresses some more common situations:
  - Patients and their families who depend on life-sustaining medications should maintain a maximal supply of medications at all times and know how to refill medications in an emergency. They should inquire about their pharmacy's emergency plan and alternative sites if their usual pharmacy is closed. If there is warning of an impending disaster, such as a hurricane, they should request advance dispensing of essential medications. They should maintain a hard-copy list of all medications in case their pharmacy or medical records are not accessible. For medications that require refrigeration, patients and their families should have backup plans to keep medications cold during prolonged power outages.
  - All patients and their families who depend on life-sustaining home care should be familiar with the emergency plans of their home care providers. Since many home care patients depend on more than one provider, they should be aware of the plans of each. They should know how to remain in contact with the providers in an emergency. They should have a backup plan if their provider is not able to reach them.
  - All patients and their families who depend on life-sustaining electrical devices at home should have access to adequate emergency power sources, such as batteries or an emergency generator.
  - Patients and their families who depend on life-sustaining supplies at home (eg, peritoneal dialysis solution, oxygen, or intravenous medications) should ensure they have at least several days' worth of supplies at all times, know how to get resupplied in an emergency, and know what to do if re-supplies do not arrive.
  - Patients and their families who depend on life-sustaining equipment at home should know what to do in case of evacuation and how the equipment can be moved.
  - Some jurisdictions have compiled registries of medically vulnerable individuals; patients and their families should inquire about such registries with their home care providers, utilities, police and fire departments, and public health or emergency management agencies.
  - Dialysis patients (either peritoneal or hemodialysis) should know what alternative dietary guidelines they should follow if their dialysis is delayed.
  - Patients and their families who require complicated or uncommon ongoing treatments (eg, cancer chemotherapy) should maintain copies

of their medical records and treatment protocols or regimens with them if they are evacuated or if they need to seek alternative sites of care.

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A Delayed Evacuation

In one instance, there was a narrow window, during low tide, when patients could be safely evacuated from a hospital that had sustained flooding and lost power. When EMS arrived to execute the hospital-initiated evacuation, patients were not packaged and ready for transport. Patients were still in their rooms, rather than staged in the lobby as EMS had expected; valuable time was lost during a narrow window in which evacuation could be executed without endangering patients, staff, and EMS providers.

Additionally, there was a miscommunication about the destination to which patients would be sent. While the evacuating hospital had coordinated with senior officials at the receiving facility, this information had not been relayed to line staff at the receiving hospital. When EMS arrived with the patients, they were turned away and were forced to attempt to find beds at other facilities.

The consequences of this miscommunication were exacerbated by the fact that most patients were evacuated in medical ambulance buses, which could carry around 20 patients, as opposed to traditional ambulances, which can carry 2 or 3 patients at most. Consequently, when the receiving facility was unprepared to accept the busload of patients, it created a much larger challenge than reallocating patients from a single ambulance. The miscommunication was ultimately resolved and patients were eventually accepted at the initial receiving facility, but valuable time during which the buses could have evacuated another round of patients was lost. It was evident that responsibility and processes for coordination of patient evacuation were insufficient.

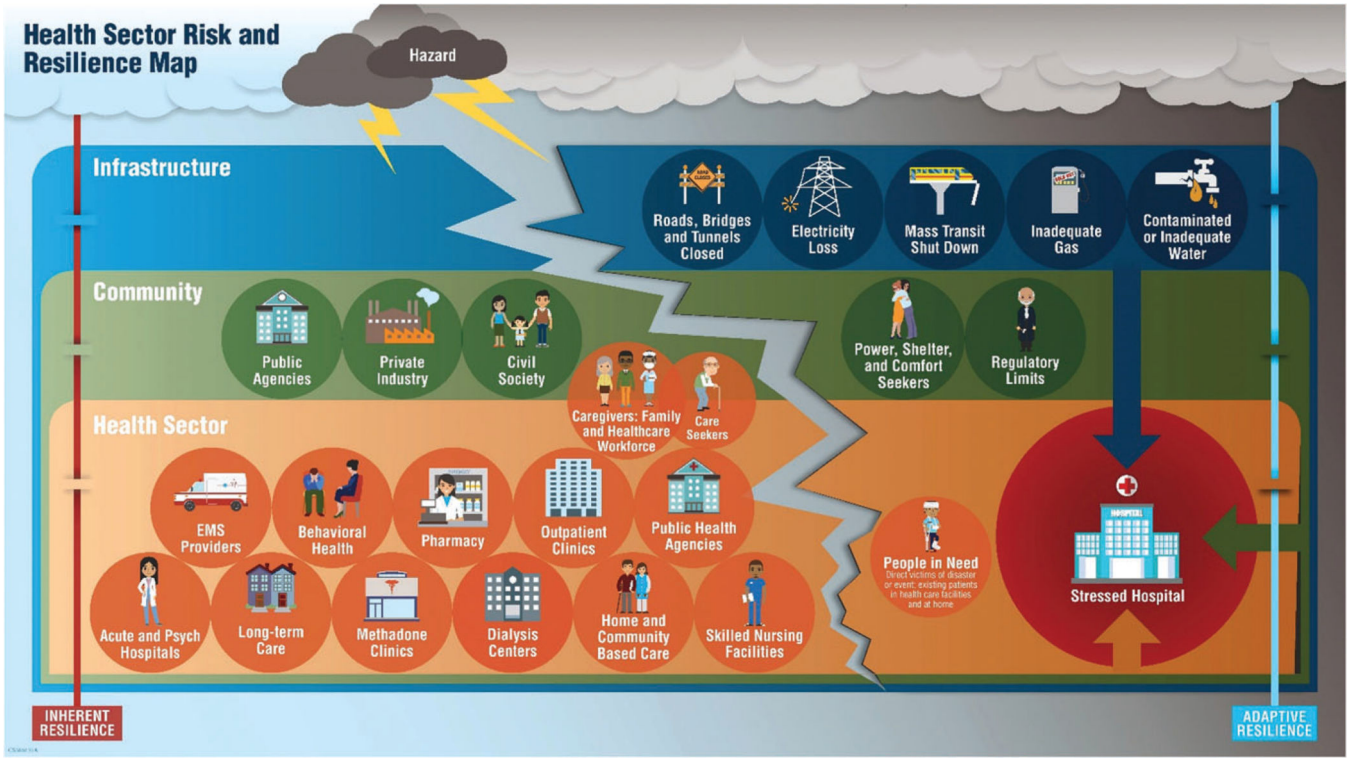

Figure 1.
Health Sector Risk and Resilience Map