THE RISK OF PUBLIC HEALTH DISASTERS IN NEW YORK CITY

The 2018 New York City Public Health Jurisdictional Risk Assessment

NYC Health

Contents

List of Figures and Tables 3

Acronyms Used in This Report 3

1. Executive Summary 4

a. Assessing Risk 4

b. A Citywide Approach 4

c. Building Resilience 7

d. Better Management of Disasters 8

e. Understanding Risk for Health Care Providers 9

f. Outcomes 9

2. The 2018 New York City Public Health Jurisdictional Risk Assessment 10

a. Concepts and Terms 10

b. Public Health Disasters 11

c. Disaster Risk 11

d. Contributors 12

e. Public Health Hazards 16

f. Putting it Together 18

g. Using the Results 18

3. Public Health, Society and Vulnerability 19

a. Physical and Social Vulnerability 19

b. Health Impacts of a Disaster 20

4. Better Management of Disasters 26

a. New York City Health Department 26

b. The City of New York 30

5. New York City Health Care Coalition (NYCHCC) 32

a. NYCHCC Governance 32

b. Top NYCHCC Public Health Risks and Contributors 34

c. Hazard Vulnerability Analysis 35

d. Preparing for the Unknown 35

References 36

Appendices 37

a. Nine Hazard Profiles 37

b. Participating Organizations 41

List of Figures and Tables

Table 1. Participation by Stakeholder Group 5
Figure 1. Top New York City Public Health Hazards Ranked by Disaster Risk 6
Table 2. Final Severity Contributors Used to Rank Hazards 12
Table 3. Final Probability Contributors Used to Rank Hazards 12
Table 4. Final Manageability Contributors 13
Table 5. The Jurisdictional Risk Assessment Process 17
Figure 2. Physical and Social Vulnerabilities That Impact Health 20
Figure 3. How Social Determinants of Health Influence a Disaster's Impact 22
Figure 4. Reducing Health Impacts Before and During Disasters 24
Figure 5. The Health Department's Incident Command Structure 27
Table 6. Incident and Response Capabilities 28
Figure 6. How Capabilities Relate to Response Objectives 29
Table 7. Comparison of Hazards Identified in the JRA and NYCHMP 31

Acronyms Used in This Report

AHP	Analytical Hierarchy Process
CBRN	Chemical, Biological, Radiological and Nuclear
CDC	Centers for Disease Control and Prevention
CIMS	Citywide Incident Management System
FDNY	Fire Department of the City of New York
FEMA	Federal Emergency Management Agency
HMP	Hazard Mitigation Plan
HVA	Hazard Vulnerability Analysis
ICS	Incident Command System
JRA	Jurisdictional Risk Assessment
NIMS	National Incident Management System
NYCEM	New York City Emergency Management
NYCHCC	New York City Health Care Coalition
NYPD	New York City Police Department
OEPR	Office of Emergency Preparedness and Response
SPARTA	Strategic Preparedness and Response Total Alignment

Executive Summary

Assessing Risk

What is most likely to cause a public health disaster in New York City (NYC)? How likely are these threats to occur? How well-prepared are the NYC Department of Health and Mental Hygiene (the Health Department) and other City agencies for a public health disaster? When disaster strikes, how will agencies reduce the impact on New Yorkers?

These are the key questions we ask and answer in the 2018 NYC Public Health Jurisdictional Risk Assessment (JRA). Conducted by the Health Department every five years, the JRA gathers information about public health threats, analyzes them, and comes up with a list of the most important threats based on how likely they are to exceed existing City response capabilities and create a public health disaster.

The JRA was conducted two years before the coronavirus disease 2019 (COVID-19) pandemic arrived in NYC in early 2020 and therefore does not include lessons learned during the pandemic response. Analyses from the JRA detailing the City's response capabilities to manage a respiratory virus with pandemic potential were immediately used to identify capabilities that required additional support. This allowed us to more quickly assess what resources were needed for the immediate response and to rapidly obtain and deploy them. Use of the JRA in this manner demonstrates the importance of systematic and all-hazard approaches to preparedness planning, which aid in building flexible and effective response capabilities for emerging threats, such as novel infectious diseases.

In the face of decreasing budgets from the federal government and increasing threats, the JRA results help quantify where resources will have the greatest impact for a public health response. They will guide government agencies, health care coalition partners and community organizations in citywide disaster preparedness work through 2023.

A Citywide Approach

To more accurately and comprehensively analyze the relative risk of public health threats to NYC, it was essential that the JRA be grounded in the lived experiences of a diverse array of local stakeholders. More than 1,800 people from local government, health care organizations, universities, nonprofits and community groups took part in the JRA (see Table 1). Participants included public health practitioners, emergency responders, government leaders, health care providers, community leaders, volunteers, and others with a role in protecting public health during and after disasters. Due to both the scale of participation and diversity of perspectives, it was necessary to create a new JRA model to effectively incorporate and compare participant input. This innovative approach to analyzing risk will be explained further in subsequent sections.

Table 1. Participation by Stakeholder Group

6,680 surveys completed; 1,832 participants
(Note that JRA participants completed multiple rounds of surveys.)

NYC Health Department

Total Participants

782

Representing

100% of Divisions
99% of Bureaus
84% of Work Units
94% of Response Groups

Total includes 16 subject matter experts in public health from 13 universities or think tanks.

NYC Health Care Coalition

Total Participants

709

Representing

55 Hospitals
132 Nursing Homes
292 Medical Reserve Corps Volunteers
65 Other Health Care Organizations*

Other Government Agencies

Total Participants

110

Representing

28 NYC Agencies**
11 NYS Agencies
2 Federal Agencies

Nonprofits, Coalitions and Community Partners

Total Participants

231

Representing

142 Total Organizations:
123 work with "at-risk" populations:
42 focus on people with disabilities
36 focus on immigrants

*Includes Veterans Affairs facilities, NYS Office of Mental Health facilities, Federally Qualified Health Centers and more.

**Excluding the Health Department

Across six months and five rounds of surveys, these experts helped us determine which threats are most important to prepare for based on factors that affect the severity, probability and manageability of the disaster (see Figure 1 for rankings and Page 10 for definitions of severity, probability and manageability). These results allow us to develop an evidence-based strategy for improving our response by focusing our preparedness efforts where they will have the greatest impact.

The following lists show hazards that are most severe, most likely, and best able to be managed by the City in descending order (for example, where 1 is most severe).

Most severe

1. Respiratory virus with pandemic potential
2. Water contamination
3. Coastal storm
4. Cyberattack
5. Chemical emergency
6. Excessive heat
7. Emerging disease with epidemic potential
8. Air contamination
9. Mass casualty incident

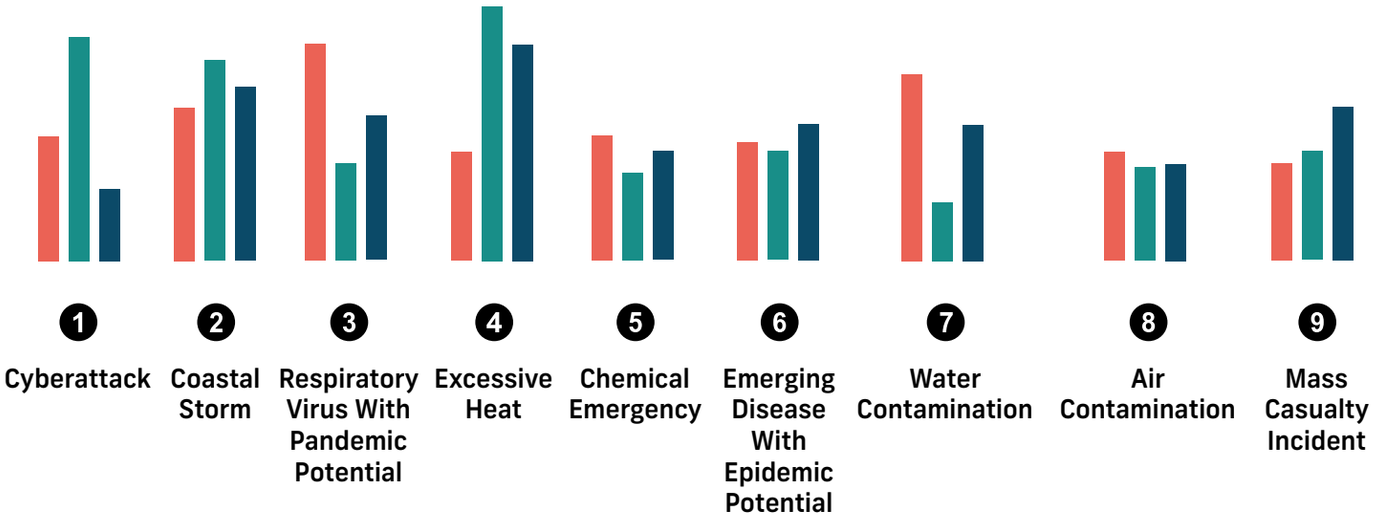
Most likely

1. Excessive heat
2. Cyberattack
3. Coastal storm
4. Mass casualty incident
5. Emerging disease with epidemic potential
6. Respiratory virus with pandemic potential
7. Chemical emergency
8. Air contamination
9. Water contamination

Best able to be managed by the City

1. Excessive heat
2. Coastal storm
3. Mass casualty incident
4. Emerging disease with epidemic potential
5. Respiratory virus with pandemic potential
6. Water contamination
7. Chemical emergency
8. Air contamination
9. Cyberattack

Figure 1. Top New York City Public Health Hazards Ranked by Disaster Risk



NYC Public Health Hazards Ranked by Disaster Risk

Severity Probability Manageability

Building Resilience

A RESILIENCE APPROACH TO DISASTER RISK: KEY GOALS

Our work is based on the **consequences** of disasters instead of known hazards.

Responses fit within a broader **public health framework** and involve the **diverse communities that are impacted.**

Results allow **decentralized response partners** to make decisions according to their needs.

The most extreme events are those that cannot be precisely predicted. Climate change and disease evolution are certain to produce disasters we cannot predict. That is why we focused on identifying the consequences of disasters, separate from their cause, and linking them to a broader public health framework.

Disasters change the conditions in places where people live, learn, work and play. These conditions, known as the social determinants of health, affect a wide array of health risks and outcomes. To understand how we can build long-term resilience in communities before, during and after a public health disaster, we mapped the contributors that impact a disaster identified in the JRA to the social determinants of health. This helps us identify programmatic areas likely to be overwhelmed by disasters, such as access to health care services. By partnering with programs doing work to improve these conditions, we can reduce the vulnerability of our communities to disaster.

The SPARTA Initiative

The 2018 All Hazard Response Inventory and JRA are part of a larger preparedness initiative, the Strategic Preparedness and Response Total Alignment (SPARTA) system.

Built by the Office of Emergency Preparedness and Response (OEPR) within the NYC Health Department, the SPARTA system is intended to help the Health Department set better long-term priorities and allocate limited resources based on evidence of value and effectiveness.

SPARTA links preparedness work and response actions needed to manage disasters, focusing preparedness resources where they can accomplish the most good. After all, preparedness has value only when it helps to improve incident response.

The SPARTA model provides a roadmap for taking the outputs of a public health disaster risk assessment and linking them to response and preparedness activities in an ongoing feedback loop. The result is evidence-based decision-making in preparedness that continuously improves with each response.

Better Management of Disasters

Once disaster strikes, our ability to protect the health of New Yorkers depends on our capacity to manage a complex and dynamic situation. The JRA results allow the Health Department to identify the specific areas of our response structure where additional planning will have the most impact.

To identify what is needed to manage public health disasters, the Health Department created its 2018 All Hazard Response Inventory, describing a broad set of 28 public health **incident and response capabilities**.

- **Incident capabilities** focus on managing specific public health threats.
- **Response capabilities** support the agency in responding appropriately and effectively to incidents.

For each capability, the Inventory catalogs the related **strategic objectives** (Why are we doing this?), **operational objectives** (What are we doing?) **and activities** (How do we accomplish it?). The JRA assessed our relative capacity to perform these objectives for each of the top hazards. We are using these results to prioritize our preparedness work across the Health Department.

Understanding Risk for Health Care Providers

Members of the New York City Health Care Coalition (NYCHCC) play a key role in maintaining health care access and delivery during and after an emergency. NYCHCC hospitals, health care providers, New York City Medical Reserve Corps volunteers and other members of the coalition also help with ongoing preparations for health emergencies and disasters that are most likely to occur. See Page 33 for a list of all coalition members.

When asked to choose the top public health hazards of concern, hospitals in NYC voted for two hazards — community violence and a radiological dispersion device — that did not make the final list. Air contamination and excessive heat were not considered top priorities by hospitals.

These are the top public health hazards (not listed in priority order) as determined by hospital representatives:

- Chemical emergency
- Coastal storm
- Community violence
- Cyberattack
- Emerging disease with epidemic potential
- Mass casualty incident
- Radiological dispersion device
- Respiratory virus with pandemic potential
- Water contamination

Outcomes

For NYC, our JRA findings tell us what public health disaster risks are most critical and most likely. These results will inform our planning and preparation for future emergencies.

Have we thought of every possibility? Of course not. At the time of this report's publication, the City continues to respond to the COVID-19 pandemic. This report and lessons learned from the pandemic response will inform how we reconfigure and enhance our public health preparedness infrastructure to meet emerging threats in our changing world. As new events occur, we will examine what worked and what can be improved. What we learn will be considered in our next five-year assessment, coming in 2023.

The 2018 New York City Public Health Jurisdictional Risk Assessment

Concepts and Terms

A **disaster** is a significant event that causes harm to people and property and challenges a city's ability to respond.

Risk is the potential that a negative event will occur.[1]

- **Relative risk** for a disaster means by how much certain factors can affect the risk of a specific disaster occurring when compared to other public health hazards.

Contributors are the factors that affect the relative risk of a disaster. There are three types of contributors:

- **Severity** – the degree of seriousness an event will have on the public's health.
- **Probability** – the likelihood that something will happen, based on past experience and evidence-based predictions.
- **Manageability** – the ability to lessen the severity of an event's impact. This includes both **mitigation** and **coping capacity**.[2]
  - **Mitigation** covers measures taken to decrease the severity of an event by trying to limit its impacts on human health and health services. Public health-related mitigation efforts can include medical prevention measures, quarantine and physical distancing.
  - **Coping capacity** is the ability of people, organizations and systems to manage risks or disasters using available skills and resources. This requires continuing awareness, resources and good management, both in normal times and especially when disaster strikes.

A **hazard** is something that poses a danger, whether natural or man-made.

- A **public health hazard**[3] is a danger or harmful condition that can cause human injury, illness or death and may result in significant damage to critical infrastructure and the environment.
- A **public health disaster**[4] is any event, often occurring suddenly, that causes sickness, the loss of life or breakdown of health services, requiring a greater response than the Health Department and other parts of the health care system can handle without significant additional resources.

An **epidemic** occurs when there is an increase, often sudden, in the number of cases of a disease above what is normally expected for a population.

A **pandemic** is the worldwide spread of a new disease.

Vulnerability is the increased likelihood of an individual, a community, a facility or a system to be impacted by a public health disaster.

Public Health Disasters

NYC's size, location and elevation make it prone to many hazards. Nearly every one of these hazards can become a disaster with direct impacts on public health.

For a hazard to become a **public health disaster**, it usually involves one or more of these elements:

- Sudden or rapid onset
- Loss of life
- Damage to human health, including illness and injury
- Strain on or loss of capacity in existing health care services
- Urgent need for more resources and outside assistance than normal

Disaster Risk

How do we assess public health disaster risk when comparing very different kinds of hazards? For example, how does the risk of severe coastal storm flooding and infrastructure damage compare with the risk involved in detecting, isolating and treating a rare and severe disease such as Ebola?

The JRA methodology allows us to compare and rank radically different hazards. By asking participants to use their expertise and lived experience to compare hazards along different aspects, we score each hazard in a way that lets us effectively compare different hazards and then prioritize the hazards of greatest concern. We apply a formula, which lets us weigh and score the level of risk for the hazards we are most concerned about, no matter how much they differ. This allows us to rank hazards by their likelihood to strain our resources, leading to a public health disaster.

Not every event rises to the level of a public health disaster risk. For instance, a normal flu season does not put an unusual strain on the Health Department or the health care system. We are prepared and have the resources for flu season, and its impact on public health is manageable. However, a pandemic flu outbreak with more severe outcomes may crowd emergency rooms, exhaust vaccine supplies, and cause high levels of absenteeism among health care workers and others, straining our ability to manage the outbreak. Pandemic flu would constitute a public health disaster.

Contributors

When assessing the risk of potential public health disasters, we think in terms of **contributors** – the factors that affect the relative risk of a disaster occurring.

In the first of three survey rounds about contributors, we asked participants to list and consider the most important contributing factors to disaster risk based on severity, probability and manageability. In the second survey, participants then chose the contributors they felt were most important to measuring disaster risk. In the final round, these "short lists" of contributors were scored to weigh their relative importance using a comparison exercise known as the Analytical Hierarchy Process, a structured technique for organizing and analyzing complex decisions in which participants are asked to compare the relative importance between two items using a specially designed questionnaire. The process produces results that are converted into numerical values that allow for dramatically different variables to be compared to one another.[5] Tables 2, 3 and 4 show the final lists of contributors used to describe a disaster's **severity, probability** and **manageability**.

Table 2. Final Severity Contributors Used to Rank Hazards

	Severe injuries and an increase in illness		Loss of utility-provided power
	Deaths		Reduced capacity of the health care system
	Risk of an associated disease outbreak		Food scarcity*
	Disruption to the drinking water supply		Disruption of communication systems*
	Increase in harmful or life-threatening toxic exposures and environmental contamination		

*Contributor not used for ranking hazards because its low weight (contribution to the final disaster risk score) would not affect the final results.

Table 3. Final Probability Contributors Used to Rank Hazards

	Changes in the environment or threat landscape that make an event more likely to occur
	Forecast models and academic or actuarial (using statistics to assess risk) studies examining disaster risk
	An increasing rate of similar events occurring
	The number of reported occurrences

Table 4. Final Manageability Contributors

Manageability contributors are response activities used to manage a public health disaster. We ranked all 30 manageability contributors based on their relative importance to managing a public health disaster, regardless of the cause. They are grouped into 10 levels, with Level 1 corresponding to the most important response activities. While most of the functions identified are performed by the Health Department, the JRA highlights several functions critical to managing a public health hazard, such as accessible transportation and temporary housing, that are coordinated by other City agencies.

LEVEL 1	
	Prevent the spread of disease due to environmental threats
	Protect human health from hazards in the natural or built environment
	Apply a risk communications strategy and educate the community about disaster-related health risks
LEVEL 2	
	Cohesive citywide response
	Ensure adequate staffing
	Facilitate access to resources to support the public health disaster response
LEVEL 3	
	Identify vulnerable individuals during or after a disaster and connect them with essential services
	Support access to medication to reduce disaster-related morbidity and mortality for at-risk populations
	Assist the health care system with their response to emerging health threats

LEVEL 4	
	Provide accessible transportation to ensure all New Yorkers can be protected during a disaster
	Maintain situational awareness about the impact of the disaster
	Restore or provide and maintain open two-way communications between impacted residents and City agencies
LEVEL 5	
	Make sure disaster services are equitably available to all New Yorkers
	Provide temporary housing for those displaced from their homes by the disaster
	Manage fatalities
LEVEL 6	
	Facilitate the rapid credentialing of medical personnel from other jurisdictions to support the response
	Conduct laboratory analysis of clinical, environmental, food and water samples to identify specific threats
	Provide technical assistance so community groups can better respond to the disaster
LEVEL 7	
	Track the effects of the incident on the public's physical and mental health
	Provide appropriate disaster-related mental health resources to meet the needs of responders and the public
	Widely share disaster-related data and information

LEVEL 8	
	Determine and apply nonpharmaceutical intervention strategies appropriate to the incident
	Connect available financial assistance to those impacted by the disaster
	Develop health policies and advocate for interventions as needed
LEVEL 9	
	Protect the safety of Health Department personnel and coordinate public health guidance for City workers
	Provide the best available evidence-based, response-specific information to health care providers
	Continue the Health Department's essential services at predetermined levels throughout the public health disaster
LEVEL 10	
	Increase law enforcement activities to protect the medical supply chain and health care facilities
	Create widespread knowledge among Health Department staff of the disaster-related health impacts and related guidance
	Provide resources for pets

Public Health Hazards

Starting with more than 100 potential public health hazards gathered from Health Department records and City, State and federal resources, we worked with experts in the Health Department to gather similar hazards into an initial list of 15 broad hazard types, grouped into three categories: biological, natural, and technological or terrorism-based hazards.

BIOLOGICAL HAZARDS

1. Emerging disease with epidemic potential
2. Large-scale release of a biological threat with medical countermeasures (which are medicines and medical supplies used to diagnose, prevent, protect from or treat conditions associated with the threat)
3. Large-scale release of a biological threat without medical countermeasures
4. Respiratory virus with pandemic potential
5. Routine disease outbreaks

NATURAL HAZARDS

1. Coastal storm
2. Earthquake
3. Excessive heat
4. Winter weather

TECHNOLOGICAL OR TERRORISM-BASED HAZARDS

1. Chemical emergency
2. Cyberattack
3. Mass casualty incident
4. Nuclear explosion
5. Radiological dispersion device (or dirty bomb)
6. Water contamination

In the first survey round, we asked participants to review this initial hazard list and suggest any additions.

In the second and third rounds, participants reviewed the final “long” list and reduced the list to the nine hazards they are most concerned about.

Finally, for the fourth and fifth rounds, participants used the Analytical Hierarchy Process and the severity, probability and manageability contributors identified in the previous steps to score these hazards.

Table 5. The Jurisdictional Risk Assessment Process

Terrorism-based threats commonly discussed since the September 11 terrorist attack in NYC (9/11), such as an anthrax attack or a dirty bomb,* did not make the final list. Although these types of terrorist attacks on NYC would still have significant impacts, the City's planning over the last two decades has dramatically reduced the potential for these events to overwhelm the City's capacity to respond.

A number of policy-driven public health hazards were suggested by participants, such as community violence, mass incarceration and obesity. While these hazards did not make the final list, they reflect a change in attitudes about what constitutes a public health emergency.

Putting It Together

All these discussions, lists, surveys and comparison exercises resulted in the top nine hazards of greatest concern to NYC, ranked by their relative likelihood of causing a public health disaster.

1. Cyberattack
2. Coastal storm
3. Respiratory virus with pandemic potential
4. Excessive heat
5. Chemical emergency
6. Emerging disease with epidemic potential
7. Water contamination
8. Air contamination
9. Mass casualty incident

Using the Results

Assessing and agreeing on the top public health hazards we face is just the beginning. These findings provide essential guidance to the Health Department, other City agencies, the NYC Health Care Coalition and NYC communities to more effectively prepare in order to lessen the effects of these hazards and save lives.

Additional Hazards Considered

Participants assessed additional hazards that did not make the final list:

Routine hazards

- Civil disturbance
- Earthquake
- Food contamination
- Routine disease outbreaks
- Space hazards (for example, meteorites)
- Winter weather

Terror-related hazards

- Large-scale release of a biological threat with available medical countermeasures
- Nuclear explosion
- Radiological dispersion device

Policy-driven hazards

- Community violence
- Homelessness
- Mass incarceration
- Obesity and metabolic syndrome

*A dirty bomb is a mix of explosives, such as dynamite, with radioactive powder or pellets. When the dynamite or other explosives are set off, the blast carries radioactive material into the surrounding area.

Public Health, Society and Vulnerability

As large as NYC is, every New Yorker lives in a borough, in a neighborhood and on a street. Where we live and how we live influence how a disaster will affect us. Similarly, where we live, the types of housing, nearby health care facilities, our sense of community and access to public transportation all impact our health. In this section, we will look at how our physical and social environments affect our health when disaster strikes.

Physical and Social Vulnerability

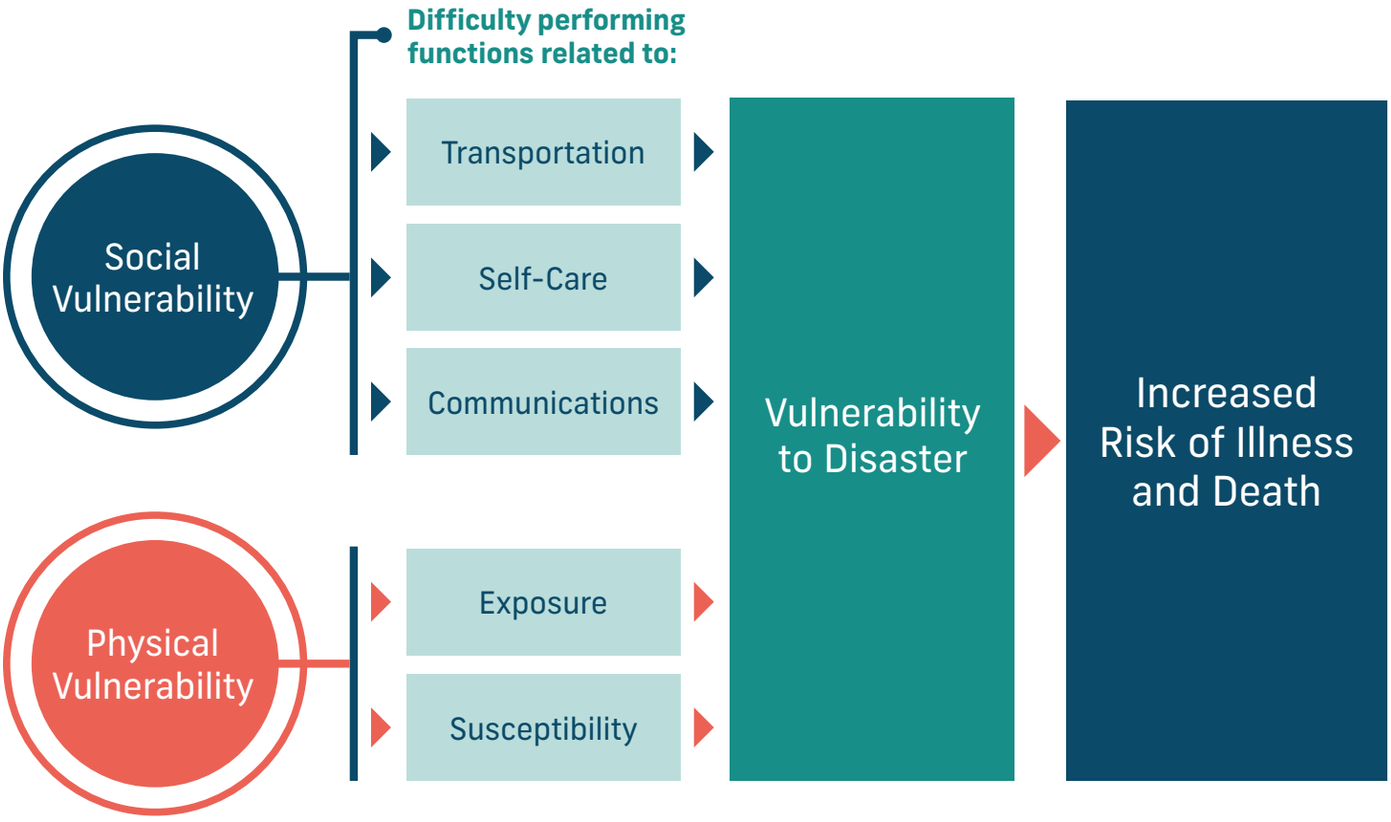
Vulnerability is the increased likelihood of an individual, a community, a facility or a system to be impacted by a public health disaster.

Vulnerability is always based on context. A coastal storm will have very different impacts than a respiratory virus outbreak or a cyberattack, and each will spark a specific set of vulnerabilities. Impacts may be localized (for example, storm surges cause flooding primarily in low-lying coastal areas) or broad (for example, a heat wave causes widespread power outages, with accompanying heat-related illnesses, particularly among older adults).

As individuals, we face both physical and social vulnerabilities. **Physical vulnerabilities** include exposure (in contact with or being near) and susceptibility (more likely to be impacted or harmed) to a particular hazard. **Social vulnerabilities** involve difficulties with activities of daily life, such as transportation, communication or self-care (the ability to live independently). In a disaster, both types of vulnerabilities can increase the risk of illness and death (see Figure 2).

A key structural factor that increases both physical and social vulnerabilities is systemic racism, where discrimination based on race is ingrained within laws, institutions and broader societal relations. In U.S. cities, a long history of residential segregation by race, perpetuated through institutional practices such as redlining and coupled with environmental racism (in other words, inequitable distribution of pollution and environmental resources based on race) has greatly impacted the location of many communities of color and their proximity and exposure to hazards, such as residential areas at greater risk of flooding.[6-8] In addition, communities of color disproportionately experience social inequities, such as poverty and racial discrimination, and barriers in accessing essential resources, including quality, affordable health care and public transportation, all of which increase their social vulnerability to disasters.[9-12]

Figure 2. Physical and Social Vulnerabilities That Impact Health



Health Impacts of a Disaster

A public health disaster can have both immediate and long-term health consequences. Immediate impacts include deaths, severe injuries and increased illness. Long-term consequences can include the worsening of preexisting health conditions, such as asthma or diabetes, and persistent mental health issues, such as post-traumatic stress disorder or depression. A disaster's duration, or a secondary disaster occurring in the same time period, can make these health consequences even more severe and long-lasting.

One important way to reduce individuals' vulnerability is to focus on improving conditions that impact their health *before* a disaster strikes.

To identify social conditions likely to be exacerbated by disasters, we took the full list of severity contributors identified in the JRA and mapped them to the **social determinants of health**. These are the larger economic and social conditions that influence the health of individuals, communities and cities as a whole.[13] The social determinants of health include broad factors such as economic stability (employment, food security, stable housing), neighborhood resources, social connections, educational access, and quality and availability of transportation (see Figure 3 on Pages 22 and 23 for how these factors affect disaster risk). By identifying how the social determinants of health affect disaster vulnerability, we can design infrastructure, services and programs that reduce vulnerability while improving overall public health.

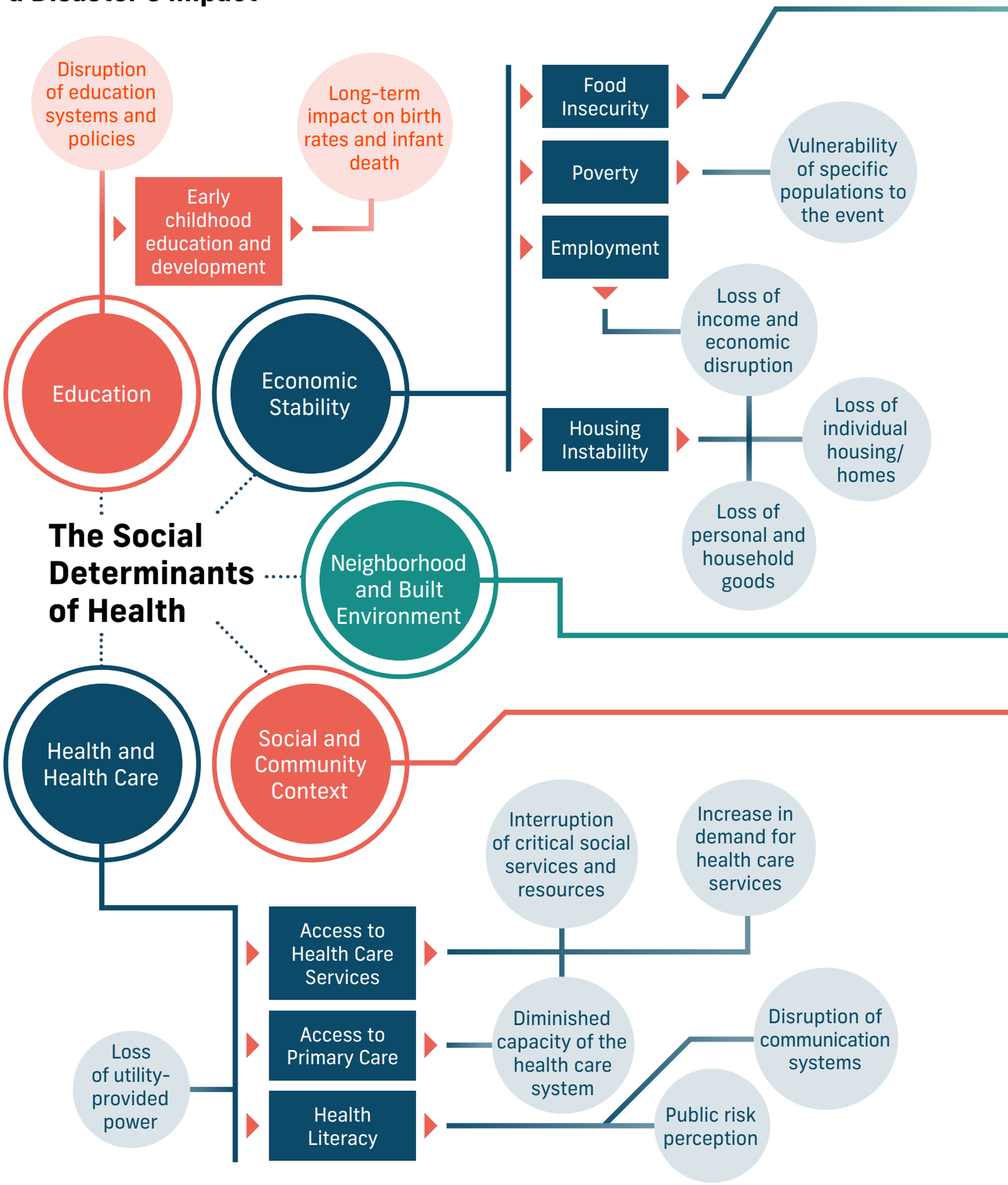
In addition to the four direct health impacts (deaths, severe injuries and increased illness, worsening of preexisting health conditions, long-term mental health impacts), the JRA identified 23 severity contributors that have an indirect but nonetheless negative effect on health:

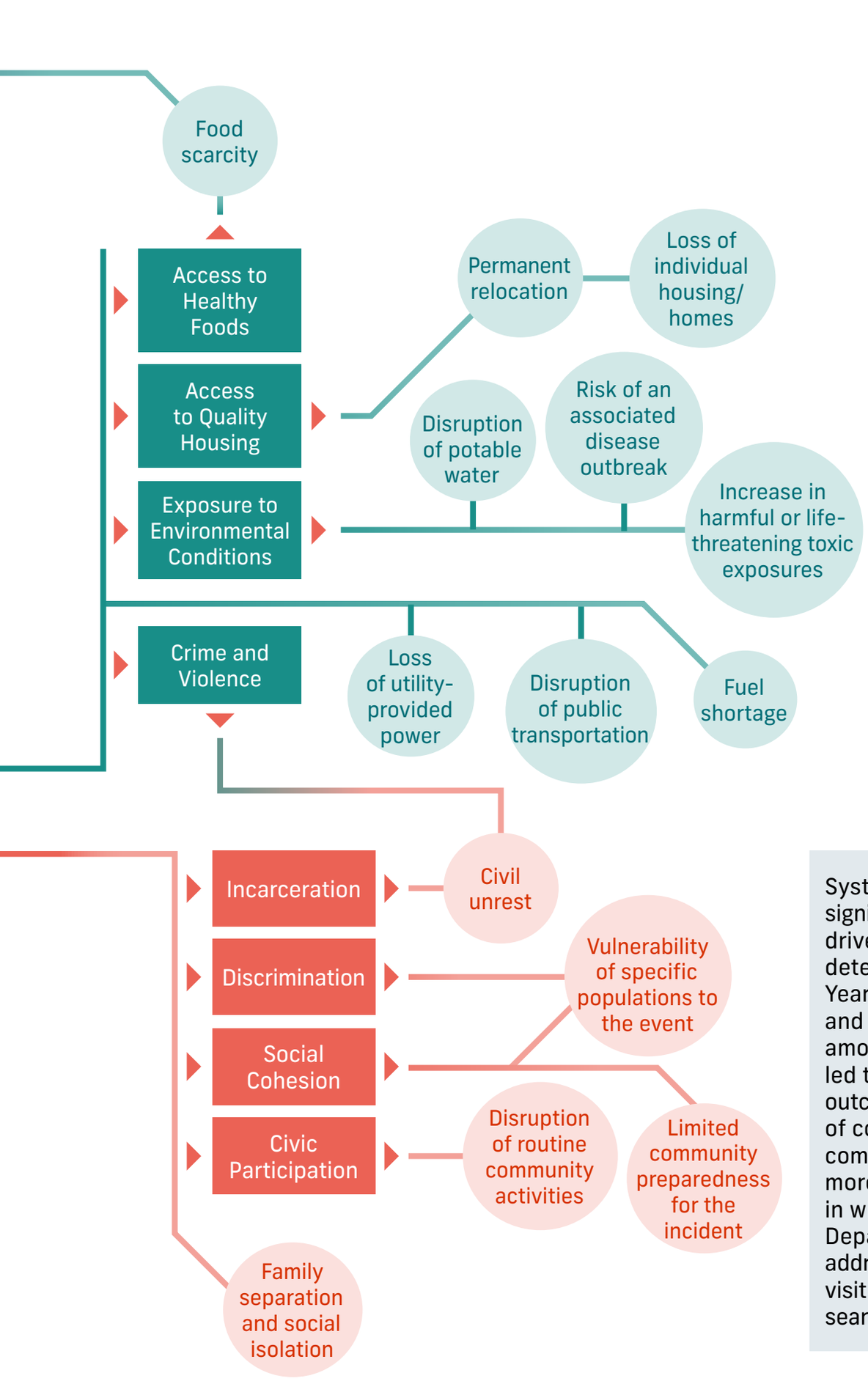
1. Civil unrest*
2. Disruption of communication systems
3. Disruption of education systems and policies
4. Disruption of potable water (drinking water)
5. Disruption of public transportation
6. Disruption of routine community activities
7. Family separation and social isolation
8. Food scarcity
9. Fuel shortage
10. Increase in demand for health care services
11. Increase in harmful or life-threatening toxic exposures
12. Interruption of critical social services and resources
13. Limited community preparedness for an event
14. Long-term impact on birth rates and infant health
15. Loss of income and economic disruption
16. Loss of individual housing or homes
17. Loss of personal and household goods
18. Loss of utility-provided power
19. Permanent relocation
20. Public perception of risk
21. Reduced health care system capacity
22. Risk of an associated disease outbreak
23. Vulnerability of specific populations to an event

Most emergency preparedness work focuses on immediate response needs. By partnering with programs working to improve the social determinants of health, we can reduce the vulnerability of our communities to disasters, regardless of the cause.

*May be associated with inequitable social conditions that impact health, including systemic racism, income inequality and housing inequality.

Figure 3. How Social Determinants of Health Influence a Disaster's Impact





Things That Make the Impacts of a Disaster Worse

- Duration of the incident
- A secondary disaster

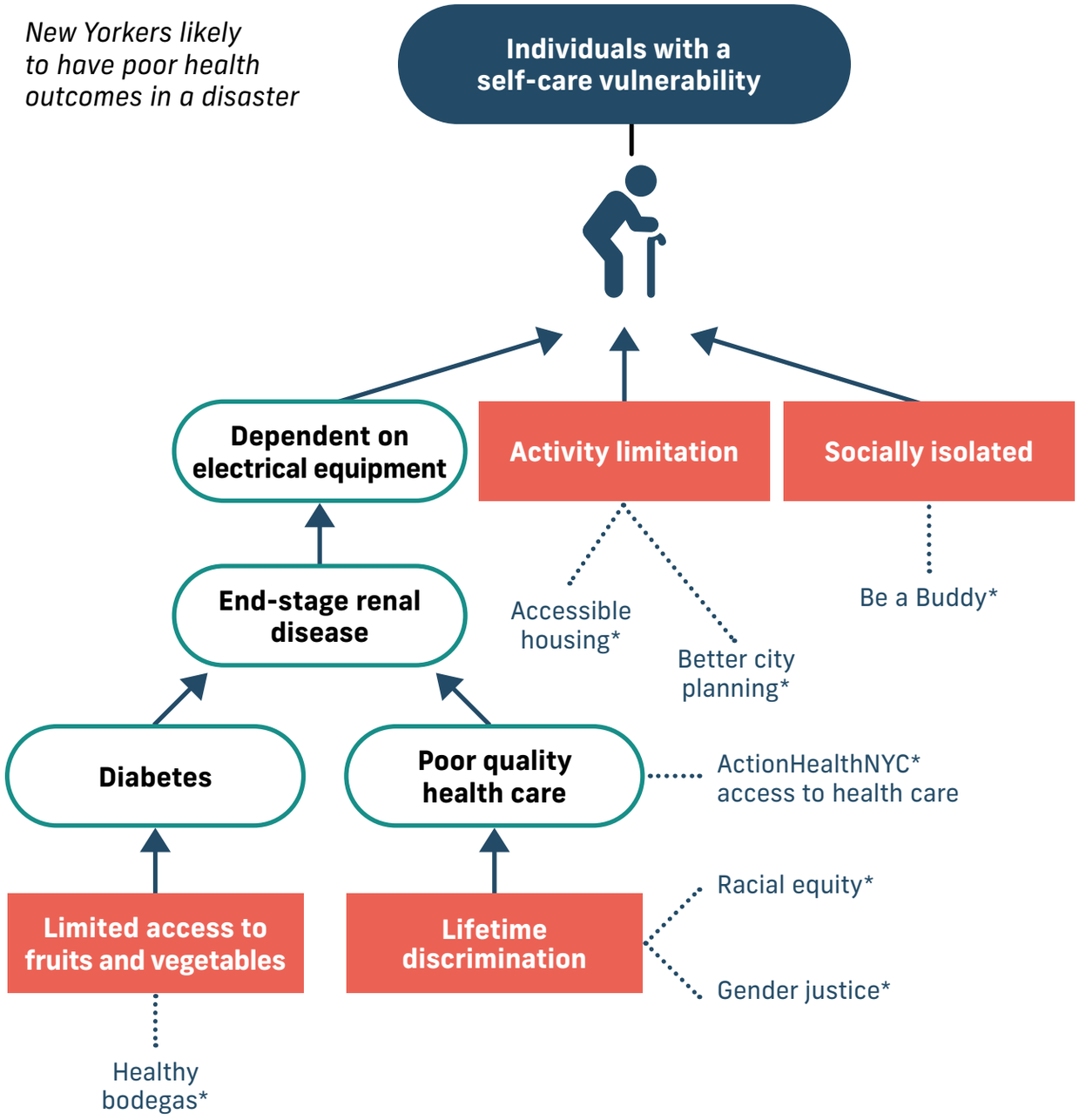
Direct Health Impacts

- Deaths
- Severe injuries and an increase in illness
- Worsening of preexisting conditions
- Long term mental health impacts

Systemic racism is a significant and persistent driver of the social determinants of health. Years of racist policies and unjust practices among institutions have led to worse health outcomes in communities of color than in White communities. To learn more about the ways in which the Health Department seeks to address racial health gaps, visit **nyc.gov/health** and search for **race to justice**.

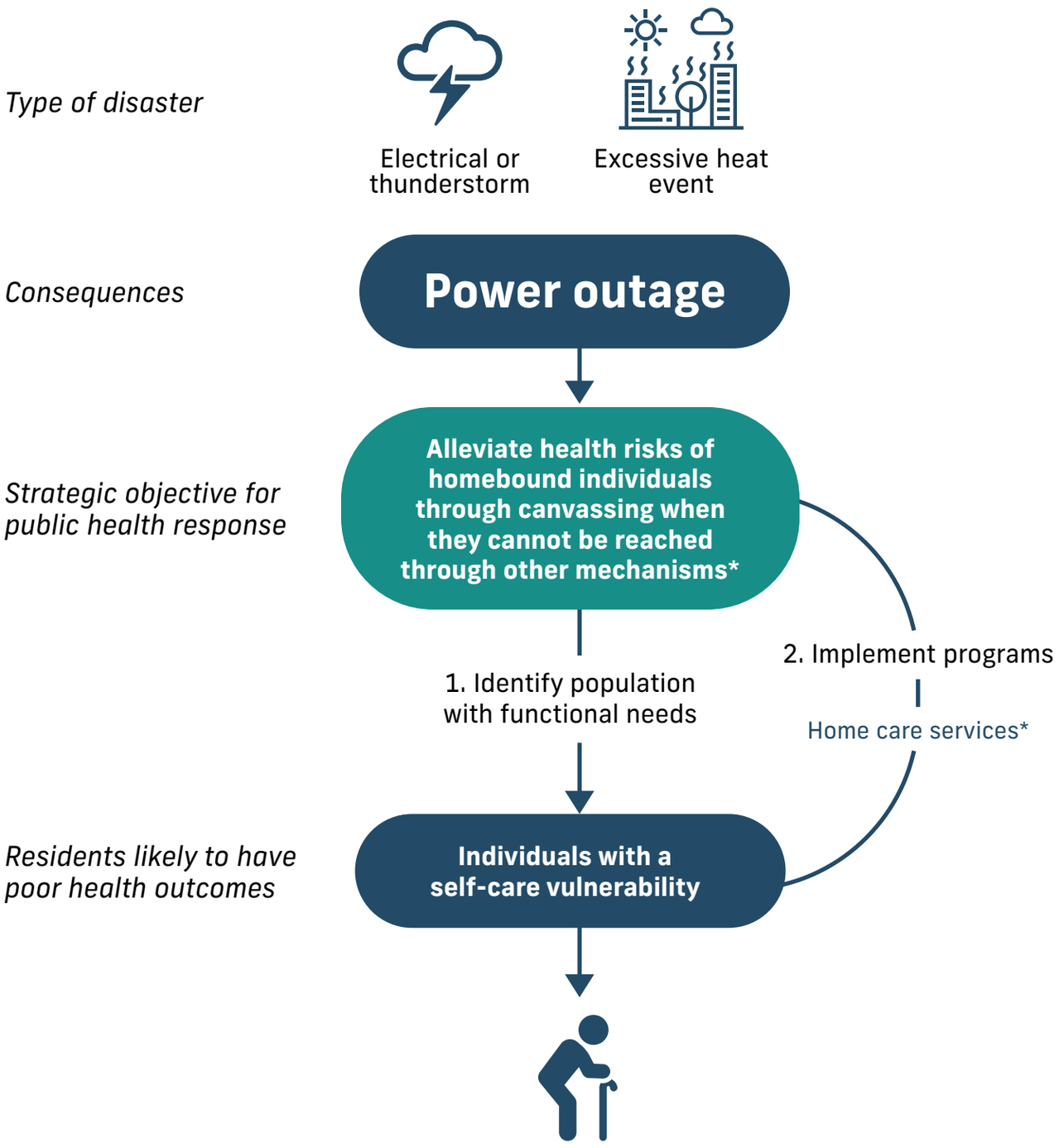
Figure 4 shows examples of what contributes to an individual's vulnerability and what might help lessen their vulnerability before and during a disaster.

Figure 4. Reducing Health Impacts Before and During Disasters



Orange boxes show examples of social determinants of health.
*Programs and City efforts to reduce vulnerability before disaster

Reducing health impacts during disasters



*Response resources to protect health during disasters

Better Management of Disasters

When a hazard strikes the city, the Health Department must effectively manage a wide array of response functions and ensure stakeholders have the necessary resources to help New Yorkers in order to minimize the impact to public health. If we can successfully lessen the impact of a hazard, we can prevent it from turning into a public health emergency.

Public health emergencies vary widely. From disease outbreaks to natural disasters, many different actions may be needed to effectively manage an event. To fully catalog these management functions, the Health Department built a response inventory that ties response capabilities to their responsible owners. The JRA prioritized these response functions according to their importance in reducing the impact of a disaster and assessed the Health Department's current capacity to perform these functions for the top public health hazards.

During emergencies, the Health Department uses the Incident Command System (ICS) to fulfill these responsibilities. Citywide emergencies, that may involve multiple agencies, are coordinated by NYC Emergency Management (NYCEM) under the Citywide Incident Management System (CIMS).

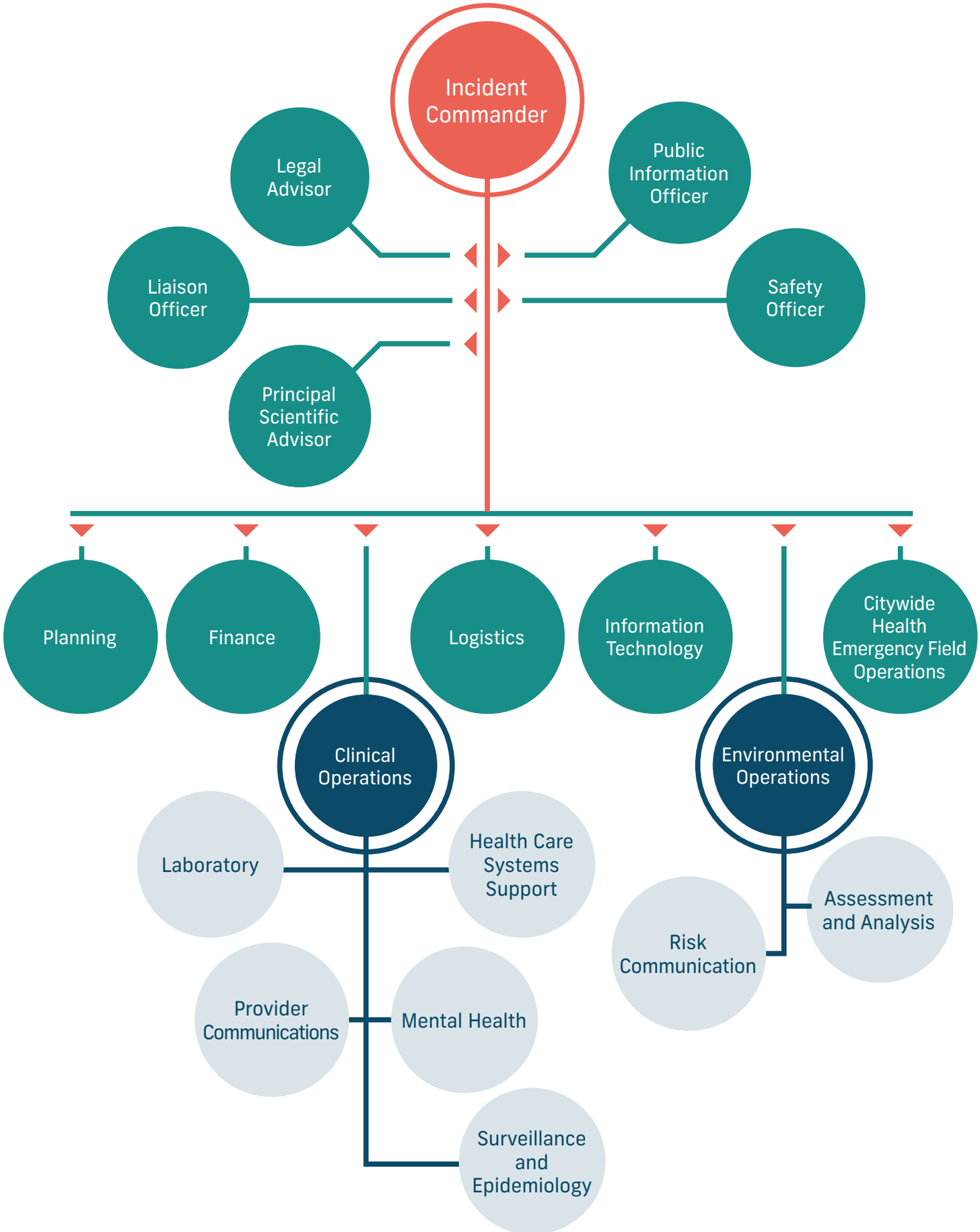
NYC Health Department

The Incident Command System (ICS)

The Health Department has primary responsibility for public health emergency preparedness and response within the five boroughs. To meet this responsibility, the Health Department has an ICS that oversees the response to a public health incident. ICS is a management system designed to organize responders by their role in a common organizational structure to effectively and efficiently respond to the incident (see Figure 5).

Led by an Incident Commander, response objectives (including strategic objectives, operational objectives and activities) are developed to manage an emergency and are assigned to specific components of the ICS structure. Each component of our ICS (for example, Officer, Section or Branch) is associated with an agency bureau or division that does similar work in its day-to-day operations. These agency stakeholders collaborate with the Health Department's Office of Emergency Preparedness and Response (OEPR) to build and maintain the ICS structure and make progress on priorities that are informed by the JRA. During periods of non-emergency, we dedicate time and effort to prepare the ICS for any emergency so that there is a fully functional ICS structure in times of disaster.

Figure 5. The Health Department's Incident Command Structure



All Hazard Response Inventory

OEPR created our 2018 All Hazard Response Inventory, describing a broad set of 28 public health **incident and response capabilities** we use to prevent, address and mitigate public health consequences of an incident (see Table 6). These break down into two categories:

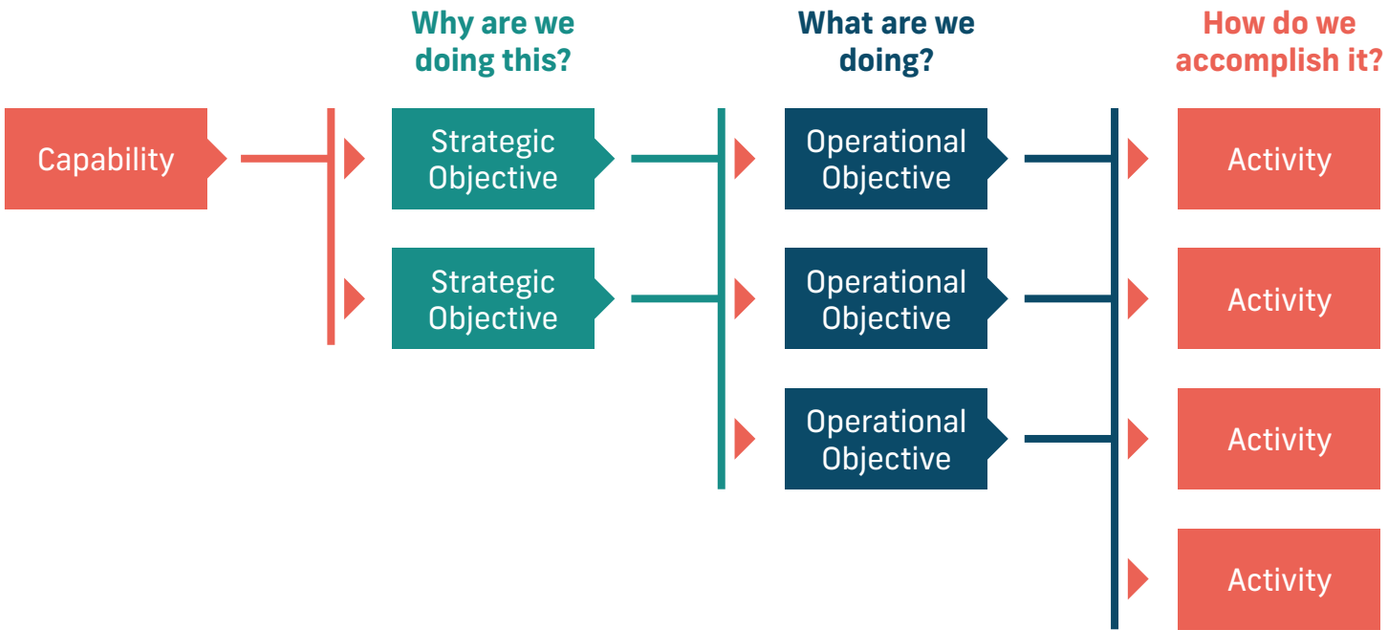
- **Incident capabilities** focus on managing specific public health threats.
- **Response capabilities** support the agency in responding appropriately and effectively to all incidents.

Table 6. Incident and Response Capabilities

17 INCIDENT CAPABILITIES		
Clinical	**Environmental**	**Public Information and Community Outreach**
• Disease Surveillance and Epidemiology • Health Systems and Infrastructure • Mass Vaccination and Prophylaxis • Medical Materiel Management and Distribution • Mental Health Needs Assessment and Service Coordination • Non-Pharmaceutical Interventions • Provider Communications • Public Health Assessment • Public Health Laboratory Testing • Public Health Orders	• Animal-Related Surveillance and Vector Control • Environmental Mitigation • Food Safety, Security and Nutrition • Injury Prevention • Water, Sanitation and Hygiene	• Community Outreach • Public Information and Risk Communication
11 RESPONSE CAPABILITIES		
• Strategic Leadership • Continuity of Operations • Emergency Operations Coordination • Finance • Information Sharing • Information Technology	• Non-Human Resources and Transportation • Occupational Health • Response Management • Staffing • Volunteer Management	

Each of these capabilities is broken down into one or more strategic objectives (Why are we doing this?), which are then divided into one or more operational objectives (What are we doing?). Operational objectives, each with a defined ICS owner, include a list of potential activities (How do we accomplish it?) to meet the objective. Figure 6 shows a breakdown of how each capability is addressed.

Figure 6. How Capabilities Relate to Response Objectives



Identifying Gaps and Setting Priorities

For the 2018 JRA, we matched every strategic objective to a manageability function that was then ranked and assessed for the top hazards. The results allow us to identify key gaps in our planning, both overall and for specific hazards. We are using these results to prioritize preparedness work across the Health Department based on disaster risk.

Because we live in an ever-changing threat environment, this All Hazard Response Inventory is reviewed and updated regularly to incorporate best practices from documented responses.

Exceeding Federal Requirements

To make sure the agency meets both NYC and external requirements, OEPR has aligned its capabilities with requirements set by the Centers for Disease Control and Prevention (CDC), the U.S. Department of Health and Human Services Office of the Assistant Secretary for Preparedness and Response, the U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA), and NYC's CIMS.

The City of New York

Citywide Incident Management System (CIMS)

The CIMS guides the response structure and command in citywide emergencies or multiple large-scale incidents that need many different agencies to respond. Whereas the Health Department's ICS defines emergency response roles and responsibilities within just the Health Department, the CIMS defines core competencies for each agency and establishes the agencies in command that are first to respond to various incident types. The CIMS primarily applies to NYC agencies but can include state and other government entities and nonprofit and private sector organizations, as appropriate. The CIMS sets priorities for incident management and operations, including life safety, investigation, site management, recovery and restoration.

Established in response to the September 11 terrorist attack, the CIMS represents NYC's implementation of the National Incident Management System (NIMS). NYC's compliance with NIMS ensures compatibility with incident command systems used in other states and federal agencies that may be used in national emergencies.

Under the CIMS, the Health Department is the primary agency in command that shares the responsibility in public health emergencies [along with the New York City Police Department (NYPD) and Fire Department of the City of New York (FDNY), with NYCEM as the coordinating agency]. The Health Department may also play a role, along with other agencies, as a primary agency or subject matter expert in chemical, biological, radiological and nuclear (CBRN) incidents, natural disasters and weather emergencies. Since every strategic objective in the All Hazard Response Inventory is mapped to a CIMS core competency, the work we do to improve the Health Department's management functions in public health emergencies serve to strengthen the City's health response to any hazard.

For more information, visit **nyc.gov/health** and search for **citywide incident management system**.

New York City Emergency Management (NYCEM)

NYCEM has plans and systems in place to manage a wide range of potential emergencies affecting our city, its residents and visitors. Many of these incidents have direct or indirect public health impacts. For incidents that are not specific to public health, the Health Department collaborates with City agencies, constituencies and community groups, and serves as a named support agency in citywide emergency plans.

New York City Hazard Mitigation Plan (NYCHMP)

Coordinated by NYCEM, the NYCHMP is the City's assessment of hazards that may harm people and infrastructure. It includes strategies and resources to limit the impact of emergency situations. The NYCHMP should be viewed alongside the JRA for a comprehensive understanding of risks to the city.

Updated every five years as mandated by FEMA, the NYCHMP builds on the City's experience with natural and human-made events, such as fires, earthquakes, hurricanes, cyberattacks and terrorism, to make our people, infrastructure and environment more resilient. Looking beyond

cycles of disaster response and recovery, the NYCHMP stresses learning, planning and mitigation to reduce harm and losses in future disasters.

The NYCHMP describes 11 hazards of concern to the City, with some that overlap with the hazards identified in the JRA (see Table 7). Each hazard is tied to mitigation goals. The final list of hazards includes the larger focus of the NYCHMP on property damage and economic impacts that can be mitigated ahead of a disaster.

Hazard Mitigation Goals

- Protect public health and safety
- Invest in property protection
- Foster an economy that promotes mitigation

For more information, visit **nychazardmitigation.com**.

Table 7. Comparison of Hazards Identified in the JRA and NYCHMP

Public Health Jurisdictional Risk Assessment	Hazard Mitigation Plan
Chemical Emergency	Chemical Releases
Coastal Storm	Coastal Storm
Cyberattack	Cyber Threat
Emerging Disease With Epidemic Potential	Emerging Disease With Epidemic Potential
Excessive Heat	Extreme Heat
Respiratory Virus With Pandemic Potential	Respiratory Virus With Pandemic Potential
Air Contamination Mass Casualty Incident Water Contamination	*Not in NYCHMP*
Not in JRA	Coastal Erosion Earthquakes High Winds Winter Weather Radiological and Nuclear Releases

The New York City Health Care Coalition (NYCHCC)

NYC connects many health care coalition groups, including five borough coalitions, seven health care network coalitions, 15 independent hospitals, three coalitions based on subject matter expertise and seven long-term care associations. All these groups are members of the NYCHCC.

During and after an emergency, the NYCHCC maintains continuity of health care delivery within the NYC area. Working closely with City agencies, the NYCHCC also helps with ongoing preparations for potential health emergencies and disasters.

NYCHCC Governance

The NYCHCC Leadership Council includes leaders from the City's health care coalitions. Leadership Council meetings are a forum to share best practices and ease collaboration between the acute, ambulatory and long-term care sectors. Working together, members of the NYCHCC makes sure that health care systems are ready and can coordinate response to public health emergencies and disasters.

The Governance Board oversees the NYCHCC. Its role is to provide high-level oversight and guidance to the Planning Committee and Leadership Council in setting program priorities and navigating policy challenges that impact the City's health care system during preparedness, response and recovery from emergencies. The Governance Board brings together representatives from the NYCHCC Leadership Council including public health, hospitals and prehospital care.

In addition to the Health Department, the Governance Board includes representatives from the:

- FDNY
- Greater New York Hospital Association
- NYC Health + Hospitals
- New York State Department of Health

NYCHCC Members

GOVERNMENT

Fire Department of the City of New York

NYC Health Department

NYC Health + Hospitals

New York State Department of Health

HEALTH CARE NETWORKS and INDEPENDENT HOSPITALS

Bronx-Lebanon Hospital Center

Brookdale University Hospital and Medical Center

Brooklyn Hospital Center

Calvary Hospital

Hospital for Special Surgery

Interfaith Medical Center

Kingsbrook Jewish Medical Center

Maimonides Medical Center

Medisys Health Network

Memorial Hospital for Cancer and Allied Diseases

Montefiore Emergency Preparedness Coalition

Mt. Sinai Health System Emergency Management Partnership

New York Community Hospital

NYU Langone Hospitals

NYC Health + Hospitals

New York-Presbyterian Healthcare System

Northwell Health System

Richmond University Medical Center

St. Barnabas Hospital

St. John's Episcopal Hospital

SUNY Brooklyn Downstate Medical Center

Wyckoff Heights Medical Center

BOROUGH COALITIONS

Bronx Emergency Preparedness Coalition

The Brooklyn Coalition

Emergency Preparedness Coalition of Manhattan

Queens County Emergency Preparedness Coalition

Staten Island Community Organizations Active in Disaster Coalition

HEALTH CARE ASSOCIATIONS

Argentum

Community Health Care Association of New York State

Continuing Care Leadership Coalition

Empire State Association of Assisted Living

Greater New York Health Care Facilities Association

Greater New York Hospital Association

LeadingAge

New York State Center for Assisted Living

Southern New York Association

SUBJECT MATTER EXPERT COALITIONS

North HELP Coalition

Pediatric Disaster Coalition

Primary Care Emergency Preparedness Network

Top NYCHCC Public Health Risks and Contributors

More than 700 members of the NYCHCC actively participated in the citywide 2018 JRA process. Their input is reflected in our overall assessment.

In addition, we separately analyzed which hazards were of greatest concern to hospitals. While unranked, these results highlight two hazards — community violence and a radiological dispersion device (dirty bomb) — that did not make the final list of NYC public health hazards. Air contamination and excessive heat did not rank as top priorities in the hospital list.

Hospital-Selected Public Health Hazards

Hospital representatives listed the following public health hazards (unranked) as their greatest concern:

- Chemical emergency
- Coastal storm
- Community violence
- Cyberattack
- Emerging disease with epidemic potential
- Mass casualty incident
- Radiological dispersion device
- Respiratory virus with pandemic potential
- Water contamination

NYCHCC Selected Severity Contributors

The top nine severity contributors identified by NYCHCC participants include:

- **Disruption of communication systems,** limiting the ability to reach and provide guidance to people directly affected by a disaster
- **Disruption to the drinking water supply** from contamination, lack of electric power needed for distribution, or damage to water mains and pipes
- **Disruption of public transportation,** including mass transit, making it difficult or impossible for people to leave the affected area or reach health care providers and facilities
- **Fuel shortage** due to power disruptions, storm damage or inability to transport fuel supplies
- **Loss of access to the health care system** caused by facility damage or closure, lack of health care workers or public transit shutdowns
- **Loss of health care workers** due to illness or inability to reach health care facilities
- **Loss of utility-provided power,** leading to loss of elevator service and water in high-rise buildings, mass transit shutdowns and closure of community stores and health care facilities

- **A second disaster** that, combined with the aftermath of an initial disaster, adds to the level of disruption, and extends the time and effort needed to respond
- **Shortages of necessary medical supplies,** making it difficult to care for people who are ill or injured in a public health disaster

  In the final citywide analysis, shortages of medical supplies, loss of health care workers and loss of access to the health care system were combined into "Reduced capacity of the health care system."

For three of these severity contributors — "loss of access to the health care system," "loss of health care workers," and "shortages of necessary medical supplies" — NYCHCC members can set planning and mitigation priorities for their groups and facilities. They may also inform individual facility and systemwide Hazard Vulnerability Analyses (HVAs).

Hazard Vulnerability Analysis (HVA)

Every year, most NYCHCC members are required to complete an HVA for their facilities. The results from the 2018 JRA can inform the development of HVAs for NYC health care facilities.

An HVA is a systematic assessment of the hazards that are most likely to impact the delivery of health care services. This approach to risk assessment may also include potential community impacts, estimates of injured or ill survivors and fatalities, and how the facility or system will meet post-emergency community needs. Emergency response plans, trainings and exercises can be used to evaluate a facility's readiness to respond to the top hazards identified in its HVA.

Preparing for the Unknown

Like the COVID-19 pandemic, it is likely that the next major public health disaster will impact us in new ways that we cannot fully anticipate. However, tools like the JRA and NYCHMP are not only integral to advance preparedness for the host of known threats, but also to build flexibility in a jurisdiction, such as NYC, to rapidly adapt to emerging threats. By regularly conducting these types of assessments, jurisdictions can recalibrate their preparedness capabilities and priorities to new threats. Lastly, by incorporating local perspectives of risk from key stakeholders outside of government, the JRA fosters a more holistic approach to building community-wide preparedness for and resilience to all hazards.

References

1. Arnold JL. Risk and risk assessment in health emergency management. *Prehosp Disaster Med.* 2005;20(3):143-154. doi:10.1017/S1049023X00002363

2. United Nations Office for Disaster Risk Reduction. Capacity. 2017. Accessed December 9, 2021. https://www.undrr.org/terminology/capacity

3. NYC Emergency Management. NYC's risk landscape: a guide to hazard mitigation. 2014. https://www1.nyc.gov/assets/em/downloads/pdf/hazard_mitigation/nycs_risk_landscape_a_guide_to_hazard_mitigation_final.pdf

4. Landesman LY. *Public Health Management of Disasters: The Practice Guide*. 2nd ed. American Public Health Association. 2005.

5. Saaty TL. *The Analytic Hierarchy Process*. McGraw-Hill. 1980.

6. Grove M, Ogden L, Pickett S, et al. The legacy effect: understanding how segregation and environmental injustice unfold over time in Baltimore. *Ann Assoc Am Geogr*. 2018;108(2):524-537. doi:10.1080/24694452.2017.1365585

7. Wilson B. Urban heat management and the legacy of redlining. *J Am Plann Assoc.* 2020;86(4):443-457. doi:10.1080/01944363.2020.1759127

8. Seicshnaydre S, Collins RA, Hill C, Ciardullo M. Rigging the real estate market: segregation, inequality, and disaster risk. The New Orleans Prosperity Index: Tricentennial Collection. The Data Center. 2018. https://s3.amazonaws.com/gnocdc/reports/TDC-prosperity-brief-stacy-seicshnaydre-et-al-FINAL.pdf

9. Cutter SL, Emrich CT. Moral hazard, social catastrophe: the changing face of vulnerability along the hurricane coasts. *Ann Am Acad Pol Soc Sci.* 2006;604:102-112. doi:10.1177/0002716205285515

10. Zahran S, Brody SD, Peacock WG, Vedlitz A, Grover H. Social vulnerability and the natural and built environment: a model of flood casualties in Texas. *Disasters.* 2008;32(4):537-560. doi:10.1111/j.1467-7717.2008.01054.x

11. Méndez M, Flores-Haro G, Zucker L. The (in)visible victims of disaster: understanding the vulnerability of undocumented Latino/a and indigenous immigrants. *Geoforum.* 2020;116:50-62. doi:10.1016/j.geoforum.2020.07.007

12. Kim SJ, Bostwick W. Social vulnerability and racial inequity in COVID-19 deaths in Chicago. *Health Educ Behav.* 2020;47(4):509-513. doi:10.1177/1090198120929677

13. Centers for Disease Control and Prevention. The National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention (NCHHSTP) social determinants of health: frequently asked questions. Updated December 19, 2019. Accessed December 9, 2021. https://www.cdc.gov/nchhstp/socialdeterminants/faq.html

Appendix A: Nine Hazard Profiles

1. Air Contamination

Air contamination is anything that makes the air more dangerous to breathe. Whether released by accident or intentionally, gases, particulates and biological agents are potential contaminants. In certain concentrations, air contaminants present a danger to public health.

Managing exposure to air contamination is difficult. Before the Clean Air Act of 1970, particulates and other common air contaminants were hard to avoid, especially in major cities like NYC. Today, wildfires, industrial chemical releases and volcanic eruptions can unleash contaminants into our air. When an event causes air contamination, effective communication and mitigation efforts to reduce exposure (for example, staying indoors with windows closed, evacuating an affected area) are critical to help reduce the risk of negative health consequences from the event.

Possible health effects of acute air contamination include eye, nose and throat irritation; difficulty breathing; lung damage; worsening of asthma symptoms; and lung, circulatory and other problems, including chest pain.

2. Chemical Emergency

A chemical emergency is caused by the accidental or intentional release of a toxic gas, liquid or solid that can poison people and damage the environment. Rapid identification of the chemical or biochemical agent is crucial because each agent has its own specific toxicity, symptoms, treatment options and decontamination methods.

Ways to reduce the impact of a chemical exposure include evacuation, ventilation of exposed indoor areas, rapid and appropriate first aid, decontamination, and clear communication to affected people and the general public.

3. Coastal Storm

NYC is especially vulnerable to coastal storms due to rising sea levels and an extensive coastline with many low-lying areas. Increasing storm intensity makes dangerous storm surges and power outages ever more likely, causing damage to major infrastructure — such as roads and rails, health care facilities and power plants — as well as devastation to homes and neighborhoods near the coast.

Power and telecommunication outages, water quality issues due to wastewater treatment plant failures, and public transit disruptions often occur when major storms strike, endangering public health.

Health care facilities located on or near the water must be evacuated when strong winds and storm surges are expected. Nearly 12% of nursing homes and long-term care facilities were evacuated for Superstorm Sandy, and 14% for Hurricane Irene.

4. Cyberattack

Computers are the backbone of today's world. But the information technology and digital telecommunications systems we rely on — and the grid that powers them — are increasingly connected to the internet and thus vulnerable to cyberattack, putting essential infrastructure at risk. Foreign states, terrorists and criminal hackers have played a role in past cyberattacks, and the threat is growing. The cyberattack hazard includes "ransomware" — rogue software that locks up and holds critical data and systems hostage unless a ransom payment is made.

Cyberattacks can have severe public health impacts. Health information systems and medical equipment that is connected to the internet are especially vulnerable to a cyberattack, which can disrupt health care facility essential operations and patient care. Furthermore, the loss of patients' electronic health records and test results would compromise their continuity of care. Data breaches can erode confidence in public health systems and their ability to maintain patient confidentiality.

5. Emerging Disease With Epidemic Potential

A new or emerging disease with the potential to cause an epidemic is a hazard that carries significant public health risk and is difficult for public health systems to control. An emerging disease is likely to be a significant threat because available medical countermeasures are either not enough or do not exist.

Efforts to contain or treat an emerging disease outbreak are likely to place significant strain on the health care system and could potentially overwhelm it. Communicating effectively to the public about disease risk will be difficult when the mode of transmission, laboratory identification and effective treatments are unknown.

HIV, Ebola and Zika are examples of past and current emerging diseases. While not an infectious disease, the current opioid epidemic presents similar challenges to the public health and health care systems. The increasing threat of antibiotic resistant organisms will present future challenges to the effective management and treatment of emerging diseases. Over time, the threat of an emerging disease may decrease as it is more fully understood and effective treatments are developed.

This type of hazard also includes the intentional or accidental release of a human-made pathogen for which there is no known antidote or cure. Recent advances in synthetic biology (applying engineering principles to biology), including the availability of DNA sequences in public databases, make it easier to artificially engineer and circulate dangerous new diseases.

6. Excessive Heat

A heat wave is a period of hot weather — typically three days or more — when the temperature reaches 90 degrees Fahrenheit or higher. In NYC, excessive heat events are defined as periods when the heat index (a combination of temperature and humidity) is 100 degrees Fahrenheit or higher for one or more days, or when the heat index is 95 degrees Fahrenheit or higher for two or more consecutive days. Heat waves are the deadliest type of natural weather event.

Excessive heat — several days of dangerously high temperatures, usually accompanied by high humidity and decreased air quality, often cause brownouts (reduced electricity) and power failures — can strain the City's water system. Residents of lower-income neighborhoods with limited resources and infrastructure and lower-quality housing are especially vulnerable, particularly the tens of thousands who do not have air conditioning.

With the growing impact of climate change, higher temperatures on average are occurring now in NYC and the City will continue to get warmer in the coming decades. According to current estimates, NYC can expect, on average, eight to 15 additional days where temperatures reach 90 degrees Fahrenheit or above by the 2020s, and up to 21 to 39 additional days at 90 degrees Fahrenheit or above by the 2050s. The 2050s estimate represents more than a 10% increase over what NYC experiences today.

7. Mass Casualty Incident

A mass casualty incident is an event in which emergency medical resources, personnel and equipment are overwhelmed by the number and severity of casualties. The September 11 terrorist attack was NYC's largest mass casualty incident to date.

Mass casualty incidents include active shooter events, bomb detonations, building collapses and serious transportation infrastructure failures. They do not include pandemics or incidents caused by biological or chemical agents, though the impacts to people and the health care system may be similar.

Any mass casualty incident is likely to strain the health care system and cause significant mental trauma among people who have been affected by the incident, whether directly or indirectly. Families can suffer anxiety as they seek to locate or learn about loved ones who may have been involved in the incident.

As the nation's largest city, NYC remains an important target for global and domestic terrorism of all types. In addition, the wide availability of firearms — including high-powered military-style weapons — and general lack of strict firearms restrictions in the U.S. will continue to increase the likelihood of active shooter incidents with mass casualties.

8. Respiratory Virus With Pandemic Potential

Highly contagious respiratory viruses that spread easily, and for which humans have little immunity, are an ongoing public health challenge. High rates of illness may overload the health care system, force school closings and cause significant labor absenteeism that can undermine the functioning of essential City infrastructure. Physical distancing measures that attempt to isolate affected populations may decrease community trust in local government if community members perceive such restrictions to be unnecessary, unfair or connected to a historical pattern of discrimination.

The COVID-19 pandemic, which emerged in late 2019, is an example of this hazard. Pandemic flu is also a prime example of this hazard. While the 1918 flu pandemic was especially deadly, NYC has since handled several flu pandemics, including the H1N1 pandemic in 2009. Pandemics can present many serious challenges to the health care system, including high patient volumes in hospital emergency rooms, critical shortages of health care staff (including nurses and doctors) and a scarcity of medical supplies. Management of pandemic flu is complicated by the growth of antibiotic resistant organisms that make it difficult to treat bacterial complications of flu.

9. Water Contamination

Chemical, biological or infectious contamination of NYC's complex water system poses an immediate, acute threat to human life and health. Any water contamination incident would challenge both sanitation and health care resources as public water supplies are shut down to resolve the issue. Drinking contaminated water can also carry long-term health consequences.

Climate change presents a particular risk to the City's upstate water supply system. More frequent heavy downpours may cause increased surface water runoff into reservoirs that hold drinking water, causing contamination with higher levels of pathogens and contaminants. This makes the treatment process for clean drinking water more complex and requires more resources.

At the same time, rising sea levels will increase the risk and frequency of storm surges. The flooding of City wastewater treatment plants and pumping stations can damage equipment and cut power, allowing partially treated and untreated sewage to contaminate local waterways and place public health at risk.

For more information and resources about these and other hazards that could impact NYC, visit **nyc.gov/health** and search for **threats**.

Appendix B. Participating Organizations

New York City Government

NYC Administration for Children's Services (ACS)
NYC Cyber Command
NYC Department for the Aging (DFTA)
NYC Department of City Planning (DCP)
NYC Department of Correction (DOC)
NYC Department of Education (DOE)
NYC Department of Environmental Protection (DEP)
NYC Health Department
NYC Department of Housing Preservation and Development (HPD)
NYC Department of Information Technology & Telecommunications (DOITT)
NYC Department of Parks & Recreation (PARKS)
NYC Department of Records and Information Services (DORIS)
NYC Department of Sanitation (DSNY)
NYC Department of Small Business Services (SBS)
NYC Department of Social Services (DSS)
NYC Department of Social Services Public Engagement Unit (PEU)
NYC Emergency Management (NYCEM)
Fire Department of the City of New York (FDNY)
NYC Housing Authority (NYCHA)
NYC Law Department
NYC Mayor's Office for People with Disabilities (MOPD)
NYC Mayor's Office of Data Analytics (MODA)
NYC Mayor's Office of Environmental Remediation (OER)
NYC Mayor's Office of Housing Recovery Operations (HRO)
NYC Mayor's Office of Immigrant Affairs (MOIA)
NYC Mayor's Office of Recovery & Resiliency (ORR)
NYC Office of the Chief Medical Examiner (OCME)
NYC Police Department (NYPD)
THRIVE NYC

New York State Government

Metropolitan Transportation Authority (MTA)
MTA Long Island Rail Road
MTA New York City Transit
NYS Department of Financial Services
NYS Department of Health (NYSDOH)
NYS Office for People With Developmental Disabilities (OPWDD)
NYS Office of Mental Health (OMH)
NYS Office of Mental Health (OMH) Creedmoor Psychiatric Center
NYS Office of Addiction Services and Supports (OASAS)
Port Authority of New York and New Jersey

Federal Government

U.S. Department of Veterans Affairs (VA)
U.S. Department of Homeland Security Federal Emergency Management Agency (FEMA)

Hospitals

Bronx-Lebanon Hospital Center
Brookdale University Hospital Medical Center
Brooklyn Hospital Center
Calvary Hospital
Children's Hospital at Montefiore
Flushing Hospital Medical Center
Hospital for Special Surgery
Interfaith Medical Center
Jamaica Hospital Medical Center
Kingsbrook Jewish Medical Center
Maimonides Medical Center
Memorial Sloan Kettering Cancer Center
Montefiore Medical Center
Mount Sinai Beth Israel
Mount Sinai Brooklyn
Mount Sinai Queens
Mount Sinai Hospital
Mount Sinai Hospital St. Luke's
Mount Sinai Hospital West
New York Community Hospital

New York Eye and Ear Infirmary of Mount Sinai
New York Harbor Health Care System (U.S. Department of Veterans Affairs)
New York-Presbyterian Allen Hospital
New York-Presbyterian Columbia University Medical Center
New York-Presbyterian Lawrence
New York-Presbyterian Morgan Stanley Children's Hospital
New York-Presbyterian Queens
New York-Presbyterian Hospital
Northwell Health Lenox Hill
Northwell Health Long Island Jewish Forest Hills
Northwell Health North Shore University Hospital
NYC Health + Hospitals/Bellevue
NYC Health + Hospitals/Carter
NYC Health + Hospitals/Coney Island Hospital
NYC Health + Hospitals/Elmhurst
NYC Health + Hospitals/Harlem
NYC Health + Hospitals/Jacobi
NYC Health + Hospitals/Kings County Hospital
NYC Health + Hospitals/Lincoln
NYC Health + Hospitals/Metropolitan
NYC Health + Hospitals/North Central Bronx
NYC Health + Hospitals/Queens
NYC Health + Hospitals/Woodhull
NYU Langone Medical Center
NYU Langone Medical Center Brooklyn
Richmond University Medical Center
Robert Wood Johnson University Hospital
St. Barnabas Hospital
St. John's Episcopal Hospital
Staten Island University Hospital North Site
Staten Island University Hospital South Site
Stony Brook Hospital
SUNY Downstate Medical Center, University Hospital Brooklyn
Weill Cornell Medical College
Wyckoff Heights Medical Center

Nursing Homes

Amsterdam Nursing Home
ArchCare Carmel Richmond Healthcare and Rehabilitation Center
ArchCare Mary Manning Walsh Home
ArchCare St. Vincent de Paul
ArchCare Terence Cardinal Cooke
Atrium Center for Rehabilitation and Nursing
Bainbridge Nursing and Rehabilitation Center
Beach Gardens Rehab and Nursing Center
Beacon Rehab & Nursing Center
Bedford Center for Nursing and Rehabilitation
Bensonhurst Center for Rehabilitation & Healthcare
Bridge View Nursing Home
Bronx Gardens Rehabilitation and Nursing Center
Bronx Park Rehabilitation & Nursing Center
Brookhaven Rehabilitation and Health Care Center
Brooklyn Gardens Nursing and Rehabilitation Center
Brooklyn Queens Nursing Home
Brooklyn United Methodist Church Home
Buena Vida Continuing Care & Rehabilitation Center
Caring Family Nursing and Rehabilitation Center
Carnegie Hill Institute
Casa Promesa
Chapin Home for the Aging
Cliffside Rehab and Residential Health Care Center
Clove Lakes Health Care and Rehabilitation Center
Cold Spring Hills Center for Nursing Rehab
Concord Nursing Home
Concourse Rehabilitation & Nursing Center
Crown Heights Center for Nursing and Rehabilitation
Cypress Garden Center for Nursing and Rehab
Ditmas Park Rehab & Care Center
East Haven Nursing and Rehab Center
Eastchester Rehabilitation and Health Care Center
Eger Health Care and Rehabilitation Center
Elmhurst Care Center
Fairview Nursing Home Care Center
Fieldston Lodge Care Center
Fordham Nursing and Rehabilitation Center
Forest Hills Care Center
Gold Crest Care Center
Golden Gate Rehab

Grand Manor Nursing & Rehabilitation Center
Gurwin Jewish Nursing & Rehabilitation Center
Hamilton Park Nursing & Rehabilitation Center
Harlem Center for Nursing and Rehab
Haven Manor Health Care Center
Haym Salomon Home for Nursing & Rehabilitation
Hebrew Home at Riverdale
Highbridge Woodycrest Center
Highland Care Center
Hollis Park Manor Nursing Home
Holliswood Center for Rehabilitation and Healthcare
Hopkins Center for Rehabilitation and Healthcare
Hudson Pointe Center for Nursing and Rehabilitation
Incarnation Children's Center
Isabella Center
Jamaica Hospital Nursing Home
Jeanne Jugan Residence
Kings Harbor Multicare Center
Linden Center Rehabilitation
Long Island Care Center
Manhattanville Health Care Center
Meadow Park Rehabilitation & Health Care Center LLC
Menorah Center for Rehabilitation and Nursing Care
Methodist Home for Nursing and Rehabilitation
Morningside Nursing and Rehabilitation Center
Morris Park Rehabilitation and Nursing Center
New Carlton Rehabilitation and Nursing Center
New East Side Nursing Home
New Franklin Center for Rehabilitation and Nursing
New Glen Oaks Nursing Home
New Surfside Nursing Home
New Vanderbilt Rehab & Care Center
New York Center for Rehabilitation Care
New York Congregational Nursing Center
Northern Manor MultiCare Center
Norwegian Christian Home and Health Center
NYC Health + Hospitals/Coler
NYC Health + Hospitals/Gouverneur
NYC Health + Hospitals/Sea View
Oceanview Nursing and Rehabilitation Center
Oxford Nursing Home
Ozanam Hall Nursing Home of Queens
Park Gardens Rehabilitation & Nursing Center
Park Nursing Home
Pelham Parkway Nursing Facility and Rehabilitation, LLC
Promenade Rehabilitation & Health Care Center
Providence Rest
Queen of Peace Residence
Queens Boulevard Extended Care Facility
Queens Nassau Rehab & Nursing Center
Rebekah Rehab & Extended Care Center
Regal Heights Rehabilitation & Health Care Center
Regeis Care Center
Rego Park Health Care
Resort Nursing Home
Richmond Center for Rehabilitation and Specialty Health Care
Riverdale Nursing Home
Rutland Nursing Home
Saint Joachim & Anne Nursing and Rehabilitation Center
Sapphire Center for Rehabilitation and Nursing of Central Queens
Sea Crest Nursing & Rehabilitation Center
Seagate Rehabilitation
Sheepshead Nursing and Rehabilitation Center
Shore View Nursing and Rehabilitation Center
Silver Lake Specialized Care Center
Silvercrest Center for Nursing and Rehabilitation
Split Rock Rehabilitation and Health Care Center
Spring Creek Rehabilitation & Nursing Care Center
St. Mary's Center
St. Nicks Alliance Home Care
St. Patrick's Home Rehabilitation and Health Care Center
The Chateau at Brooklyn Rehabilitation and Nursing Center
The Citadel Rehabilitation and Nursing Center at Kingsbridge
The Heritage Rehabilitation and Health Care Center
The New East Side Nursing Home
The New Jewish Home

The Phoenix Rehabilitation and Nursing Center
The Plaza Rehab and Nursing Center
Throgs Neck Rehabilitation & Nursing Center
Triboro Center for Rehabilitation & Nursing
Union Plaza Care Center
University Center
Upper East Side Rehabilitation and Nursing Center
Verrazano Nursing Home
VillageCare Rehabilitation & Nursing Center
Waterview Nursing Care Center
West Lawrence Care Center
West Side Federation for Senior and Supportive Housing, Inc.
Windsor Park Nursing Home
Woodcrest Rehabilitation & Residential Health Care Center
Workmen's Circle MultiCare Center

Other Health Care Organizations

American Lung Association
Any-Time Home Care
Bedford-Stuyvesant Family Health Center
BMS Family Health Centers
BronxCare Dr. Martin Luther King, Jr. Health System
BronxCare Health System
Calvary Hospital
CaringKind, The Heart of Alzheimer's Caregiving
Cobble Hill Health Center
Cognitive Behavioral Psychology of New York (CBPNY)
Community Health Care Association of New York State (CHCANYS)
Damian Family Health Centers
East Harlem Council for Human Services, Inc., Boriken Health Center
Fedcap Home Care
Federation of Organizations
Greater New York Health Care Facility Association (GNYHCFA)
Greater New York Hospital Association (GNYHA)
Greater New York Endoscopy Surgical Center
HealthCare Choices
Heritage Health and Housing
Hospice of New York
Hunter Ambulance
Icahn School of Medicine at Mount Sinai
Lighthouse Guild
MediSys Health Network Emergency Preparedness Coalition
Mermaid Manor Home for Adults
Metro Community Health Centers Bronx
Metro Community Health Centers Brooklyn
Metro Community Health Centers Downtown Brooklyn
Metro Community Health Centers Queens
Metro Community Health Centers Staten Island
Mildred Elley Metro
Montefiore Health System
Montefiore Wellness Center
Mount Sinai Health System
New York City Medical Reserve Corps
New York-Presbyterian Lower Manhattan Hospital
New York State Psychiatric Institute
New York State Volunteer Ambulance & Rescue Association
Northwell Health
NYC Health + Hospitals
NYC Health + Hospitals/Brownsville
NYC Health + Hospitals/East New York
NYC Health + Hospitals/La Clinica Del Barrio
Odyssey House
Pediatric Disaster Coalition
Pibly Residential Programs, Inc.
Postgraduate Center for Mental Health
RegionCare Nursing Agency
Riverdale Mental Health Association
Rockaway Home Attendant Services, Inc.
Ryan Chelsea-Clinton Community Health Center
St. Barnabas Hospital (SBH) Health System
Settlement Health and Medical Services, Inc.
Sheepshead Bay Renal Care Center
South Beach Psychiatric Center
Southern New York Association (SNYA)
Staten Island Not For Profit Association
Upper East Side Dialysis
Urban Health Plan
Utica Avenue Dialysis
Visiting Nurse Service of New York
Visiting Nurse Service of New York Home Care

Services
Visiting Nurse Service of New York Hospice and Palliative Care
WellLife Network
William F. Ryan Community Health Center

Nonprofits, Coalitions and Community Partners

82nd Street Academics
9/11 Environmental Action
Abbott House
ADAPT Community Network
African Services Committee
Aging Matters Psychological Services at Kingsbrook Medical Center
Aguila, Inc.
AHRC New York City
American Red Cross
Animal Care Centers of NYC
Argus Community, Inc.
Ascendant Neighborhood Development
Association to Benefit Children
ATLED, Inc.
Beer Hagolah Institutes
Berkshire Farm Center and Services for Youth
Bilingual Head Start, East Harlem Council for Human Services, Inc.
Bowery Residents Committee Incorporated
Breaking Ground
Broadway Housing Communities
Bronx Jewish Community Council, Inc.
BronxWorks
Brooklyn Center for Independence of the Disabled
Brooklyn Community Housing and Services
Brooklyn Defender Services
Brooklyn Neighborhood Improvement Association, Inc.
Brooklyn Youth Chorus Academy
CAMBA
Canarsie Community Development Inc.
CaringKindNYC
Catholic Charities of Staten Island
Catholic Charities of New York
Catholic Charities Brooklyn & Queens
Center for Independence of the Disabled, NY
Center for Urban Community Services
Chinese American Planning Council, Inc.
Church of God Christian Academy (Arverne Church of God)
Churches United for Fair Housing
Clinton Housing Development Company
Columba Kavanagh House
Columba Services
Community Access, Inc.
Community Emergency Response Team (CERT)
Community Parents, Inc.
Comunilife
Cooke School and Institute
COPO Pre-K
Covenant House - New York
Creative Arts Team
Delta Community Supports
Disabled In Action of Metro NY
Disaster Recovery Institute (DRI) Foundation
Dominican Women's Development Center
East Harlem COAD
East Village Community Coalition
ECDO, Forever Harlem
Eden II
Encore Community Services
Encore Community Services 49 Residence
Fort George Community
Geel Community Services, Inc.
Gittens Quick Sale Realty, Inc.
Good Old Lower East Side (GOLES)
Grand Central Neighborhood Social Services Corp.
Harlem Independent Living Center
Health People
Hearing Health Foundation
Hearing Loss Association of America
Housing and Services, Inc.
Ice Theatre of New York
Institute for Community Living (ICL)
IRMA, LLC
Jewish Board of Family & Children's Services
Kings Bay Youth Organization
Kingsbridge Heights Community Center
LES Ready
Lexington School for the Deaf
Lifeline Center for Child Development
Lifespire
Little Sisters of the Assumption Family Health Service
Lutheran Social Services of New York

Lutheran Social Services of New York Bergen St. Residence
Media Adept
Mental Health Service Corps
Metropolitan Council on Jewish Poverty (Met Council)
Neighborhood Coalition for Shelter
New York Disaster Interfaith Services (NYDIS)
New York Foundling
New York Restoration Project
North Shore Waterfront Conservancy of Staten Island, Inc.
Northside Center for Child Development, Inc.
Ocean Bay Community Development
OHEL Children's Home & Family Services
On Your Mark
Organization for Human Development and Social Change
Praxis Housing Initiatives, Inc.
Project Hospitality
Project Renewal
Providence House, Inc.
Queens Jewish Community Council
Queens Law Associates
RiseBoro Community Partnership
Rock Safe Streets
Rockaway Development and Revitalization Corporation
Safe Horizon
Samaritan Daytop Village, Inc.
Scanny Eisman Day Nursery
Services for the Underserved
Sheltering Arms Children and Family Services
Sholom Community Alliance, LLC
South Asian Council for Social Services (SACSS)
Southern Brooklyn COAD
Special Citizens Future Unlimited
St. Dominic's Family Services
Staten Island COAD
Staten Island Mental Health Society Head Start
Staten Island Pee Wee Football League (SIPWFL)
Sunnyside Community Services
Temple Emanuel
The Ali Forney Center
The Child Center of NY, Inc.
The Family Center
The Fortune Society
The Guild for Exceptional Children
The Jericho Project
The Renaissance Charter School
The Salvation Army of Greater New York
The Salvation Army of Greater New York Manhattan Home Health Services
The Single Parent Resource Center
The Trevor Project
Traditional Day Care Center
United Community Centers, Inc.
Urban Resource Institute
Vibrant Emotional Health (Formerly MHA-NYC)
VISIONS/Services for the Blind and Visually Impaired
Volunteers of America - Greater New York
West Bronx Housing and Neighborhood Resource Center, Inc.
West End Residences HDFC, Inc.
Yeled Vyalda Early Childhood Center Inc.
Young Adult Institute (YAI)
Young Israel Programs, Inc.
Youth Advocate Programs

Universities and Professional Organizations

American Institute of Architects, New York Chapter
City University of New York (CUNY)
Columbia University
Columbia University National Center for Disaster Preparedness
Dalhousie University
Fund for Public Health in NYC
John Jay College of Criminal Justice
New York City College of Technology
New York University
One Architecture
The New York Academy of Medicine
University of California Los Angeles (UCLA)
University of Chicago
University of Pittsburgh

U.S. NAVAL HOSPITAL SHIP
COMFORT
621
NYPD
P.O. HARRY R. RYMAN
NYPD
621