Major Hurricanes: Potential Health and Medical Implications

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This ASPR TRACIE resource was developed to provide a short overview of the potential significant health and medical response and recovery needs facing hurricane- and severe storm-affected areas, based on past experience and lessons learned from Hurricanes Katrina, Sandy, Harvey, Maria, and others.

The list of considerations is not exhaustive but does reflect a thorough environmental scan of publications and resources available on past storm response and anecdotal information from first responders who were on scene. The intent of the document is to aid the "ESF-8 Family" in thinking through the different potential problems that may present as Requests for Assistance and unmet needs. Our hope is that this document can aid readers in anticipating some of these potential issues to either avoid them or be ready to respond to them as needed. Those faced with leading the response and recovery from a hurricane may use this document as a reference, while simultaneously focusing on the actual assessments and issues specific to their communities and the unmet needs as they develop.

This document is a working draft. It has been reviewed by ASPR staff and members of the ASPR TRACIE Subject Matter Expert Cadre, but additions, revisions, and comments are still welcome. Please submit any suggestions to askasprtracie@hhs.gov.

ASPR TRACIE recently published resources that can help stakeholders prepare for, respond to, and recover from hurricanes: the report Climate Change Resilience and Healthcare System Considerations, the related Topic Collection, and Healthcare System Preparedness for Secondary Disasters during COVID-19. These and other resource are available on the ASPR TRACIE Hurricane Resources Page

Potential Considerations

The following considerations are listed under four headings, based on phases of response/recovery: overarching considerations (these apply throughout the duration of the disaster response and recovery cycle) and three time-specific categories (immediate, short term, and long term/recovery). Relevant informational resources are listed first, followed by potential programs or deployable assets that could be considered to support an unmet need.

Quick Links/Table of Contents

Overarching Considerations

Access and Functional Needs Population Support and Cultural Competency in Disasters

Before, during, and after a disaster, individuals with disabilities and others with access and functional needs may require additional support from the emergency management system. Ensuring response and recovery operations are sensitive to the needs of the communities they serve can support effective response, recovery, and resilience. Pre-event communication as well as dedicated assessments of these at-risk groups can prevent many issues and reduce the potential for harm. Working with local agencies and using Community Resilience Estimates and Social Vulnerability Index (SVI) data can assist with identifying at-risk populations.

In addition, healthcare providers can play a role in combatting increases in human trafficking that may follow disasters.

For More Information:

ASPR TRACIE Access and Functional Needs and Disasters and Healthcare Disparity Topic Collections

Cultural and Linguistic Competency for Disaster Preparedness Planning and Crisis Response
The Role of Healthcare Providers in Combatting Human Trafficking during Disasters

Disaster Behavioral Health Needs

Disasters can lead to significant mental and behavioral health consequences that will directly impact healthcare systems. The demand for disaster behavioral health services spikes immediately following impact and continues over time.

For More Information:

ASPR TRACIE Topic Collections:

- Mental/Behavioral Health
- Responder Safety and Health

ASPR TRACIE Select Disaster Behavioral Health Resources Page
ASPR TRACIE Disaster Behavioral Health: Resources at Your Fingertips
ASPR TRACIE Tips for Retaining and Caring for Staff after a Disaster
Health and Social Services Recovery Lessons Learned from the 2016 Louisiana Flooding
The Exchange, Issue 4: Disaster Behavioral Health and Resilience

Select Programs/Assets to Consider:

Substance Abuse and Mental Health Services Administration Crisis Counseling Assistance and Training Program

Emergency Information and Risk Communication

As the incident evolves from warning to initial impact, then response, and into recovery, risk communication and messaging focuses will shift. Communication includes providing the public with information through verbal, written, or symbolic means. Clear, concise messages provided by trusted leaders before, during, and after an incident can help residents be better informed to make important health-related decisions to help ensure their safety. Messages should be accessible in multiple languages and through multiple media.

For More Information:

ASPR TRACIE Emergency Public Information and Warning/Risk Communications Topic Collections

Family Reunification and Patient Tracking

During hurricanes and mass flooding events friends and family can be separated from each other and reuniting them is a priority for healthcare facilities, health officials, and emergency managers. Establishing a coordinated approach for accessing search and rescue data, shelter rosters, and healthcare facility information is key to reuniting those affected by the disaster.

For More Information:

ASPR TRACIE Topic Collections:

- Family Reunification and Support
- Patient Movement and Tracking

ASPR TRACIE HIPAA and Disasters: What Emergency Professionals Need to Know

The Exchange, Issue 6: Evacuating Healthcare Facilities

Health Information Management

During a disaster, patients may be separated from their "medical home" and medical records. Information technology systems may be damaged in the event and access to the systems may be limited by physical barriers, access issues, power disruptions or other impacts. Patients being evacuated or moved from one healthcare facility to another need complete medical records transferred with them, but that is not always possible if the facility has experienced significant damage and paper records are damaged or missing and electronic records are not accessible. Redundant IT systems and back-up paper records with the critical information are ways to mitigate this issue.

For More Information:

ASPR TRACIE Topic Collections:

- Communications Systems
- Information Sharing

ASPR TRACIE HIPAA and Disasters: What Emergency Professionals Need to Know

Regulatory Concerns

Healthcare facilities in areas affected by hurricanes and flooding will likely be forced to operate outside their normal operating conditions. This situation could include a surge of patients requiring the healthcare facility to implement mass casualty protocols, crisis standards of care, and/or activate their emergency plans. It could also include impacts that cause the facility to be inoperable forcing evacuation, closure, or other alteration of regular operations. Some of these impacts will have regulatory repercussions at the local, State, and Federal level.

For More Information:

ASPR TRACIE Healthcare-Related Disaster Legal/Regulatory/Federal Policy Topic Collection
ASPR TRACIE CMS and Disasters: Resources at Your Fingertips
Post Storm Healthcare Facility Assessment Resources

Select Programs/Assets to Consider:

Centers for Medicare and Medicaid Services Survey and Certification Group
    1135 Waivers
    Re-occupancy Surveys
State Healthcare Facility Licensure
Local Building and Code Inspection

Responder Safety and Health

Protecting the safety and health of disaster responders is critical for obvious reasons, but a safe and healthy workforce is better able to provide the community with an effective, comprehensive response and recovery. This is of particular importance when the impact of the disaster is long term and affects responders directly.

For More Information:

ASPR TRACIE Responder Safety and Health Topic Collection
ASPR TRACIE Tips for Retaining and Caring for Staff after a Disaster
ASPR TRACIE Disaster Behavioral Health Self Care for Healthcare Workers Modules

Immediate Considerations

Extended Loss of Water and Power

If communities face extended loss of power and/or water, residents with chronic medical conditions may experience exacerbated symptoms, people can become sick from lack of water or contract waterborne illness from drinking contaminated water, food can spoil, and medications that need to be refrigerated can lose potency. Local healthcare systems may experience those and a host of additional secondary and tertiary effects can be felt by the healthcare system. Healthcare facilities must have running potable water and power in order to continue operations. Rapid needs assessment of healthcare and residential care facilities and supplementation with external generators may be critical to preventing evacuation.

For More Information:

ASPR TRACIE Topic Collections:

- Continuity of Operations (COOP)/ Failure Plan
- Utility Failures

Planning for Power Outages: A Guide for Hospitals and Healthcare Facilities
Durable Medical Equipment in Disasters

Exacerbation of Chronic Medical Conditions

Any chronic medical condition can be exacerbated in a disaster due to the stress of the event, loss of physical support systems, lack of access to medications, and/or loss of access to equipment or systems needed to support daily medical care. In particular, the following patients are particularly vulnerable during hurricanes/flood events:

- Dialysis Patients
- Patients dependent on medical devices that require electricity (e.g., oxygen concentrators, ventilators, and home dialysis systems).
- Patients who are receiving hospice care.
- Patients whose conditions must be continually managed by prescription medications (e.g., seizure disorders, diabetes).
- Patients with mental health diagnoses and/or alcohol or drug dependency.

Patients need access to healthcare facilities and services, chronic or maintenance medications or therapies, and access to operational medical equipment to return to their pre-disaster health conditions.

The HHS emPOWER Program provides federal data, mapping, and artificial intelligence tools, as well as training and resources, to help communities nationwide protect the health of at-risk Medicare beneficiaries, including 4.2 million individuals who live independently and rely on electricity-dependent durable medical and assistive equipment and devices, and or essential health care

services. State, territorial, and certain major metropolitan areas' public health authorities receive monthly de-identified datasets (hyperlink to: https://empowerprogram.hhs.gov/de-identified-dataset.html). These datasets provide population-level situational awareness that enables public health authorities to conduct targeted emergency preparedness, response, recovery, and mitigation activities to protect those that may be rapidly at-risk in the event of a prolonged power outage or other emergency. In the event of an incident, emergency, or disaster, statutorily authorized state or territorial public health authorities that meet certain requirements may submit a disclosure request for official review and approval of a minimum necessary HHS emPOWER Emergency Response Outreach Individual Dataset to support critical life-saving assistance and response outreach public health activities."

The ASPR TRACIE fact sheet Durable Medical Equipment in Disasters provides information on general DME categories and focuses on electricity-dependent DME that may be affected by disasters and emergencies, including power failures. It also includes information to assist healthcare system preparedness stakeholders plan for medically vulnerable populations who rely on DME.

The Emergency Prescription Assistance Program (EPAP) is a potential resource available for affected areas to support access to prescription medications. In addition, national pharmacy chains have mobile pharmacy units available to deploy to local communities. Rx Open, managed by Healthcare Ready helps patients find nearby open pharmacies in areas impacted by disaster.

Additional information on EPAP and historical use from past activations can be found on ASPR TRACIE:

- EPAP Overview Fact Sheet
- EPAP Louisiana Floods
- EPAP Hurricane Ike
- EPAP Hurricane Gustav
- EPAP Superstorm Sandy
- EPAP Hurricanes Irma and Maria, Puerto Rico
- EPAP Hurricanes Irma and Maria, USVI

For More Information:

ASPR TRACIE Topic Collections:

Dialysis Centers
Homecare and Hospice
Pharmacy

ASPR TRACIE Considerations for Oxygen Therapy in Disasters
ASPR TRACIE Drug Shortages and Disasters
ASPR TRACIE Durable Medical Equipment in Disasters

ASPR TRACIE Clinicians and Coalitions: A Conversation about Finding Solutions for Medication Shortages
ASPR TRACIE Healthcare System Preparedness for Secondary Disasters during COVID-19
ASPR TRACIE Post-Disaster Lessons Learned: Dialysis Patient Management
CMS: Reminder of Pharmacy and Provider Access during a Federal Disaster or Other State or Public Health Emergency Declarations

Fatality Management

Hurricanes and flooding have the potential to cause mass fatalities and these weather events present challenges to death scene investigation, patient identification, decedent transport and storage, and notification of family. Fatality management resources may also be limited due to the storm.

In addition, flooding events can cause damage to cemeteries and burial locations causing disinterment of remains.

For More Information:

ASPR TRACIE Topic Collections:
- Family Reunification and Support
- Fatality Management
- Mental/Behavioral Health

Death Scene Investigation After Natural Disaster or Other Weather-Related Events

Flood Water Health Concerns

Flood water can contribute to numerous health hazards including, but not limited to:
- Contaminated drinking water
- Infectious disease outbreaks
- Air quality issues
- Disease carrying mosquitoes
- Skin disease/wound infections from contact with contaminated flood waters
- Mold

Public health surveillance will be required to test the water and air, and monitor populations for infectious disease outbreaks. Public information and risk communication is necessary to let the public know what to do to mitigate the hazards.

For More Information:

ASPR TRACIE Emergency Public Information and Warning/Risk Communications
Flood Waters or Standing Waters: Health Risks

Flooding and Communicable Diseases Fact Sheet

Food Safety After Power Outages and Flood/Storm Damage

Prolonged power outages, lack of running potable water, submersion in flood water, and "pop up" or "just-in-time" food service establishments all pose potential hazards related to food preparation and consumption.

Public messaging on how to examine food and when to throw it out is critical. Additional staff will likely be necessary to provide inspections for re-opening closed food service establishments and to inspect new facilities, such as shelters and other new incident-related facilities.

For More Information:

ASPR Food and Water Safety
Food and Water Safety During Power Outages and Floods
Food Safety for Consumers Returning Home After a Hurricane and/or Flooding
Keep Your Food Safe During Emergencies: Power Outages, Floods, and Fires

Healthcare Facility Evacuations

Healthcare facilities may need to evacuate prior to, during, or even after the impact of the storm. Anticipating the need to evacuate to avoid emergency evacuation is ideal. The longer a facility has to evacuate, the more orderly the process can be. Sheltering patients in place carries risk, though so does evacuation. These risks must be balanced and consideration for capacity of the region to transport, track, and accommodate patients must also be considered. Healthcare coalitions and health systems can be excellent resources in making systematic decisions and supporting evacuation operations.

For More Information:

ASPR TRACIE Topic Collections:

- Healthcare Facility Evacuation/Sheltering
- Patient Movement and Tracking
- Pre-Hospital

Federal Patient Movement: Overview Fact Sheet
Post Storm Healthcare Facility Assessment Resources
The Exchange, Issue 6: Evacuating Healthcare Facilities

Medical Services Replacement or Augmentation

Healthcare facilities can be forced to close during hurricanes due to damage or flooding, loss of utilities, or other physical issues and be "off-line" for an indefinite amount of time.

Individual healthcare providers may be personally affected by the storm and unable to report to work. Individual or small-office practitioners may not be able to open their offices/clinics because of lack of staff, physical damage, or loss of communications.

There will be a need to coordinate replacement healthcare services for those that are temporarily unavailable and those that have been permanently damaged. There will also be a need to augment existing healthcare facilities as they see a surge of patients seeking routine care (non-storm related) in new locations, due to a lack of ability to seek care from their pre-disaster providers.

For More Information:

ASPR TRACIE Topic Collections:

- Alternate Care Sites
- Ambulatory Care and Federally Qualified Health Centers (FQHC)
- Crisis Standards of Care
- Hospital Surge and Immediate Bed Availability
- Mental/Behavioral Health
- Pre-Hospital
- Virtual Medical Care

Select Programs/Assets to Consider:

State Medical Response Teams (Inter- or Intrastate)
Emergency Management Assistance Compact

Shelter and Congregate Living Health and Public Health Concerns

Widespread, sustained flooding and/or structural damage can create the need for large and sustained shelter operations. While the goal for emergency management is to return people to their homes or to provide transitional housing that process can take time.

The priority for health and medical response and recovery personnel is to ensure the shelter environment is safe and that shelter residents have access to basic hygiene and healthcare services, clean water, and safe food.

Depending on how long people will reside in shelters, potential health hazards must be monitored (e.g., food safety and hygiene [toilets and showers]). Ensuring surveillance is in place to monitor for infectious disease outbreaks, specifically respiratory and gastrointestinal diseases, is critical.

For More Information:

ASPR TRACIE Topic Collections:

- Access and Functional Needs

Alternate Care Sites (including shelter medical care)
Disaster Veterinary Issues – Shelter Animal Care
Family Reunification and Support
Mental/Behavioral Health

ASPR TRACIE HIPAA and Disasters: What Emergency Professionals Need to Know
ASPR TRACIE Healthcare System Preparedness for Secondary Disasters during COVID-19

Staff Fatigue and Replenishment

In the first few days of a response, staff are focused on rescue and response operations and often can't or won't rest or remove themselves from operations. Staff who maintain facility operations are a critical component of the response phase and expected to care not only for their own loved ones, but community members and the facility, too. Cognitive abilities decline rapidly with fatigue, stress, and inadequate nutrition and hydration. Incident management should prioritize staffing planning including adequate rest and replenishment cycles.

For More Information:

ASPR TRACIE Responder Safety and Health Topic Collection
ASPR TRACIE Disaster Behavioral Health: Resources at Your Fingertips
ASPR TRACIE Tips for Retaining and Caring for Staff after a Disaster
Disaster Behavioral Health Self Care for Healthcare Workers Modules

Surge of Storm-Related Health Emergencies

The typical health-related impacts of hurricanes and floods include:

- Carbon monoxide poisoning due to poor ventilation of gas generators
- Gastro-intestinal illnesses from food sources and person-to-person spread
- Hypothermia from water immersion
- Orthopedic trauma from clean up injuries, crashes, and other incidents
- Respiratory illness
- Skin rashes and wound infections
- Soft tissue injuries from debris and clean up

Hospitals and other healthcare providers should be prepared to handle an increase in patients with a wide range of chief complaints. There are typically three surges of patients related to the storm: those seeking care before the storm due to preparedness injuries, stress, support for chronic conditions, and/or fear of being alone; patients ill or injured during the storm; and the surge of patients who become ill or injured post-storm. Many patients seen in the days and weeks following the storm will display exacerbations of underlying disease due to disruptions in their care or their environment.

State, local, and federal staff should be prepared to receive requests for staff and medical service delivery augmentation to support this storm-related surge of patients.

For More Information:

ASPR TRACIE Topic Collections:

- Alternate Care Sites
- Ambulatory Care and Federally Qualified Health Centers (FQHC)
- Crisis Standards of Care
- Homecare and Hospice
- Hospital Surge and Immediate Bed Availability
- Incident Management
- Mental/Behavioral Health
- Pre-Hospital
- Virtual Medical Care

CDC Natural Disasters and Severe Weather

- Carbon Monoxide Poisoning
- Emergency Wound Management for Healthcare Professionals
- Prevent Illness and Injury after a Disaster

Select Programs/Assets to Consider:

State Medical Response Teams (Inter- or Intrastate)
Emergency Management Assistance Compact

Transportation

Emergency medical services (EMS) may have difficulty accessing patients and/or their fleet may have suffered storm-related damage. Residents may not be able to use traditional modes of transportation to access their healthcare providers or emergency services. Their vehicles may have been damaged or inaccessible, buses may not be running, taxis and car services may not be operational, and para-transit, Handi-vans and other medical transportation providers may be otherwise committed to response operations.

Roads may not be accessible, so physical access to facilities for both ambulances and self-referred patients can be an issue. “Water taxis” may be needed to ferry the injured to functioning hospitals that have become isolated by floodwaters.

Many services that provide support to healthcare facilities will have access issues including courier services that handle lab specimens and delivery services that bring supplies, equipment, linen, food, fuel, and other necessary resources. These services and vendors may also have difficulty crossing security barriers into affected neighborhoods if they lack proper paperwork or identification.

The HHS Healthcare and Public Health Sector Critical Infrastructure Security and Resilience Partnership program released information specific to Hurricane Harvey on how to assist medical supply deliveries to negotiate passage through law enforcement blockades. (Additional information on Hurricane Harvey is provided in this document.) Similar approaches should be considered in future storms.

Additionally, Jones Act waivers can be used to facilitate shipping between U.S. ports by any vessel available for transit.

For More Information:

ASPR TRACIE Topic Collections:

- Patient Movement and Tracking
- Pre-hospital

The Exchange, Issue 6: Evacuating Healthcare Facilities

Short-Term Considerations

Assessment of Healthcare Facilities for Re-Opening After Storm Damage

If a healthcare facility was forced to close due to flooding or other damage sustained during the incident, that closure may trigger the requirement to be re-inspected prior to opening. Additional inspectors and clarification of the federal, state, and local laws and regulations might need to be circulated to all affected healthcare facilities. Coordination of patient repatriation can be complicated. Healthcare coalitions can be a valuable asset in these operations.

For More Information:

ASPR TRACIE Topic Collections:

- Healthcare Facility Evacuation/Sheltering
- Healthcare-Related Disaster Legal/Regulatory/Federal Policy

ASPR TRACIE Healthcare System Recovery Timeline White Paper
Post Storm Hospital Assessment Checklist

Exacerbation of Chronic Medical Conditions

(repeated from Immediate Considerations section)
Any chronic medical condition can be exacerbated in a disaster due to the stress of the event, loss of physical support systems, lack of access to medications, and/or loss of access to equipment or systems needed to support daily medical care. In particular, the following patient types are particularly vulnerable during Hurricanes/Flood Events:

- Dialysis Patients

- Patients dependent on medical devices that require electricity (e.g., oxygen concentrators, ventilators, and home dialysis systems).
- Patients who are receiving hospice care.
- Patients whose conditions must be continually managed by prescription medications (e.g., seizure disorders, diabetes).
- Patients with mental health diagnoses and/or alcohol or drug dependency.

Patients need access to healthcare facilities and services, chronic or maintenance medications or therapies, and access to operational medical equipment to return to their pre-disaster health conditions.

The HHS emPOWER Program provides state, territorial, and certain major metropolitan areas' public health authorities with monthly de-identified datasets. These datasets provide population-level situational awareness that enables public health authorities to conduct targeted emergency preparedness, response, recovery, and mitigation activities to protect those that may be rapidly at-risk in the event of a prolonged power outage or other emergency. In the event of an incident, emergency, or disaster, statutorily authorized state or territorial public health authorities that meet certain requirements may submit a disclosure request for official review and approval of a minimum necessary HHS emPOWER Emergency Response Outreach Individual Dataset to support critical life-saving assistance and response outreach public health activities."

The ASPR TRACIE fact sheet Durable Medical Equipment in Disasters provides information on general DME categories and focuses on electricity-dependent DME that may be affected by disasters and emergencies, including power failures. It also includes information to assist healthcare system preparedness stakeholders plan for medically vulnerable populations who rely on DME.

The Emergency Prescription Assistance Program is a potential resource available for affected areas to support access to prescription medications. In addition, national pharmacy chains have mobile pharmacy units available to deploy to local communities. Rx Open, managed by Healthcare Ready helps patients find nearby open pharmacies in areas impacted by disaster.

Additional information on EPAP and historical use from past activations can be found on ASPR TRACIE:

- EPAP Overview Fact Sheet
- EPAP Louisiana Floods
- EPAP Hurricane Ike
- EPAP Hurricane Gustav
- EPAP Superstorm Sandy
- EPAP Hurricanes Irma and Maria, Puerto Rico
- EPAP Hurricanes Irma and Maria, USVI

For More Information:

ASPR TRACIE Topic Collections:

- Dialysis Centers
- Homecare and Hospice
- Pharmacy

ASPR TRACIE Drug Shortages and Disasters
ASPR TRACIE Durable Medical Equipment in Disasters
ASPR TRACIE Post-Disaster Lessons Learned: Dialysis Patient Management
CMS: Reminder of Pharmacy and Provider Access during a Federal Disaster or Other State or Public Health Emergency Declarations

Food Safety After Power Outages and Flood/Storm Damage

(repeated from Immediate Considerations section)

Prolonged power outages, lack of running potable water, submersion in flood water, and pop up or just in time food service establishments all pose potential hazards for food preparation and consumption.

Public messaging on how to examine food and when to throw it out is critical. Additional staff will likely be necessary to provide inspections for re-opening closed food service establishments and to inspect new facilities, such as shelters and other new incident related facilities.

For More Information:

Refrigerated Food and Power Outages
Food and Water Safety During Power Outages and Floods
Keep Your Food Safe During Emergencies: Power Outages, Floods, and Fires

Medical Services Replacement or Augmentation

(repeated from Immediate Considerations section)

Healthcare facilities can be forced to close during hurricanes due to damage or flooding, loss of power/generators, loss of water, or other physical issues. Individual healthcare providers may be personally affected by the storm and unable to report to work or open their offices/clinics.

There will be a need to coordinate replacement healthcare services for those that are temporarily unavailable and those that have been permanently damaged. There will also be a need to augment existing healthcare facilities as they see a surge of patients seeking routine care (non-directly storm related) in new locations, due to a lack of ability to seek care from their pre-disaster providers.

For More Information:

ASPR TRACIE Topic Collections:

- Alternate Care Sites
- Ambulatory Care and Federally Qualified Health Centers (FQHC)
- Crisis Standards of Care
- Hospital Surge and Immediate Bed Availability
- Mental/Behavioral Health
- Pre-Hospital
- Virtual Medical Care

Select Programs/Assets to Consider:

State Medical Response Teams (Inter- or Intrastate)
Emergency Management Assistance Compact

Mold and Other Re-habitation Health Concerns

After a flood, mold can present a significant health concern for residents/business owners, emergency responders/managers, and public health officials. Mold and mildew can start growing within 24 hours. The most effective way to support an affected community is to provide them with educational materials on how to manage mold in their homes and businesses.

For More Information:

ASPR TRACIE After the Flood: Mold-Specific Resources
Dealing with Mold and Mildew in Your Flood Damaged Home
Flood Waters or Standing Waters: Health Risks
Mold (EPA)
Mold (NIH National Institute of Environmental Health Science)
Mold: Cleanup and Remediation
Prevention of Toxic Molds in Army Facilities Using Surface-Applied Biocides

Mosquito Abatement and Other Environmental Health Impacts

Flooding leads to large swaths of standing water and damp earth, presenting ideal breeding grounds for many types of mosquitoes. An increase in standing water could cause an increase in mosquitoes in the affected area.

Note the following language provided by CDC regarding Hurricane Harvey and mosquito-borne viruses:

> "Prior to Hurricane Harvey, no local spread of Zika, dengue, or other viruses spread by Aedes aegypti or Ae. albopictus mosquitoes had been reported in Houston or the areas

affected by flooding. Although the flooding caused by Hurricane Harvey is severe and an increase in mosquito populations is expected in the coming weeks, CDC does not expect to see cases of Zika appear in the area because of flooding.

West Nile virus is primarily spread by Culex mosquitoes. Cases of West Nile virus have been reported in Texas this summer. CDC does anticipate additional cases of West Nile virus to be reported throughout the summer, but not as a result of flooding from Hurricane Harvey."

Post-storm outdoor air and water pollution are additional potential concerns. Environmental health assessments, inspections of hazardous materials sites, and monitoring of air quality will likely be required to assess the environmental impacts. Responders must be made aware of additional hazards that might be present in the community. Water can be contaminated by leaking diesel fuel from submerged vehicles, sewage, and impacted chemical storage facilities.

For More Information:

Mosquitoes and Hurricanes
ASPR TRACIE Zika: Resources at Your Fingertips

Staff Fatigue and Replenishment

(repeated from Immediate Considerations section)
In the first few days of a response, staff are focused on rescue and response operations and often can't rest and remove themselves from operations or won't. After a few days of non-stop operations, they begin to tire and can display signs of stress.

For More Information:

ASPR TRACIE Responder Safety and Health Topic Collection
ASPR TRACIE Disaster Behavioral Health: Resources at Your Fingertips
ASPR TRACIE Tips for Retaining and Caring for Staff after a Disaster
Disaster Behavioral Health Self Care for Healthcare Workers Modules

Long-Term Considerations and Recovery

Change to the Baseline Level of Health

If regular and consistent access to healthcare is impeded due to the impact of a hurricane, the overall health of a community can decline. If the healthier members of the community choose to relocate, leaving behind those with pre-existing conditions and a lack of resources, the baseline health of the community can be affected but with disproportionate effects on those with chronic conditions and those with access and functional needs. During recovery, efforts to assure continuity of services for these populations is critical to health maintenance.

For More Information:

ASPR TRACIE Topic Collections:

- Access and Functional Needs
- Ambulatory Care and Federally Qualified Health Centers
- Recovery Planning

ASPR TRACIE Healthcare System Recovery Timeline White Paper

Loss of Facilities

Many of the healthcare facility closures or disruptions during and immediate following the storm impact are temporary and normal operations can resume relatively quickly, but there will be facilities that will not be able to quickly or easily re-open. Those with significant flooding or structural damage may need major repairs or rebuilding to be operational again. Emergency planners must consider how to support these individual facilities in recovery and also plan to address the impact their loss will have on the overall delivery of healthcare to the community. This impact involves all healthcare facilities, not just hospitals and nursing homes, but clinics, labs, outpatient offices, and individual physician practices. System and facility re-design offers opportunities to enhance service provision and protect critical infrastructure against future threats.

For More Information:

ASPR TRACIE Topic Collections:

- Alternate Care Sites
- Ambulatory Care and Federally Qualified Health Centers (FQHC)
- Continuity of Operations (COOP)/Failure Plan
- Crisis Standards of Care
- Hospital Surge and Immediate Bed Availability
- Mental/Behavioral Health
- Pre-Hospital
- Recovery Planning
- Virtual Medical Care

ASPR TRACIE Healthcare System Recovery Timeline White Paper

Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds: Providing Protection to People and Buildings

Select Programs/Assets to Consider:

State Medical Response Teams (Inter- or Intrastate)
Emergency Management Assistance Compact

Loss of Healthcare Coverage

In past major hurricanes, businesses were unable to reopen after the disaster, leading to job loss. Many workers who lose their jobs also lose their healthcare coverage and may not be able to afford private or subsidized healthcare. This decrease in healthcare coverage could lead to an increase in uncompensated care and enrollment in Medicaid programs.

Loss of Providers

In addition to the loss of healthcare facilities, the impacted area may experience a loss of individual healthcare providers. Those providers may have relocated due to their own personal loss during the storm or may have relocated because there was no available work in the short-term recovery phase due to facility damage or lower patient volumes. Providers who have relocated, found a new job, and resettled may be reluctant to return to the disaster impacted area once their previous facility is operational again.

There were 4500 doctors serving three of the parishes surrounding New Orleans prior to Hurricane Katrina's impact. One year later only 1200 had returned to practice.

For More Information:

ASPR TRACIE Healthcare System Recovery Timeline White Paper
Alternate Care Sites (ACS) Sources of Additional Staff
Staff Absenteeism Resources

Appendix A: Additional and Cited Resources

Select ASPR TRACIE Resources:

- After the Flood: Mold-Specific Resources
- Drug Shortages and Disasters
- Durable Medical Equipment in Disasters
- Emergency Prescription Assistance Program (EPAP): Hurricane Gustav Data Fact Sheet
- Emergency Prescription Assistance Program (EPAP): Hurricane Ike Data Fact Sheet
- Emergency Prescription Assistance Program (EPAP) Louisiana Floods Data Fact Sheet
- Emergency Prescription Assistance Program (EPAP): Overview Fact Sheet
- Emergency Prescription Assistance Program (EPAP): Superstorm Sandy Data Fact Sheet
- Federal Patient Movement: NDMS Definitive Care Program Fact Sheet
- Federal Patient Movement: Overview Fact Sheet
- HIPAA and Disasters: What Emergency Professionals Need to Know
- Tips for Retaining and Caring for Staff after a Disaster
- Topic Collections

Government Accountability Office. (2006). Status of the Health Care System in New Orleans and Difficult Decisions Related to Efforts to Rebuild it Approximately 6 Months After Hurricane Katrina.

Kaiser Family Foundation. (2005). Addressing the Health Care Impact of Hurricane Katrina.

Kaiser Family Foundation. (2007). Health Care in New Orleans Before and After Hurricane Katrina. (Abstract only.)

Manuel, J. (2013). The Long Road to Recovery: Environmental Health Impacts of Hurricane Sandy. Environmental Health Perspectives.

Scott, D. (2017). What Katrina Can Teach Us About Health Care after Hurricane Harvey. Vox.

Saulnier, D. (2017). No Calm After the Storm: A Systematic Review of Human Health Following Flood and Storm Disasters. Prehospital and Disaster Medicine.

Post-Storm Hospital Assessment Tool Resources

American College of Emergency Physicians. (n.d.). Hospital Disaster Preparedness Self-Assessment Tool. (Accessed 3/21/2022.)

> Though not an assessment for post-disasters specifically, this tool may provide some helpful information on categories that should be considered in a post-disaster assessment (particularly sections 3-7). This assessment was developed to assist hospitals in revising and updating existing disaster plans or in the development of new plans.

California Emergency Medical Services Authority. (n.d.). Hospital Incident Command System 251- Facility Systems Status Report. (Accessed 3/21/2022.)

> This HICS form is to be used to determine the status (functional, partially functional, nonfunctional) of a healthcare facility after an emergency event.

Centers for Disease Control and Prevention. (2005). Checklist for Infection Control Concerns when Reopening Healthcare Facilities Closed Due to Extensive Water and Wind Damage.

> This checklist provides guidance for completing building and life safety inspections prior to restoration work, and guidance for infection control review of facilities to be done before the hospital can reopen. Attachment A includes a site specific checklist for selected areas of the facility (e.g., laboratory, pharmacy, etc.).

Harvard School of Public Health, Emergency Preparedness and Response Exercise Program. (2013). Essential Functions and Considerations for Hospital Recovery Version 2. Federal Emergency Management Agency.

> This document helps hospitals prepare to manage recovery from all types of events. Recovery planning benchmarks are included starting on page 34 to help hospitals independently assess their recovery capabilities. The benchmarks are drawn from a variety of sources including the ASPR Healthcare Preparedness and Response Capabilities, Joint Commission Hospital Accreditation Standards, the NDRF, and lessons learned from both recovery-focused exercises and real-world disasters. The document also includes questions to consider during recovery planning starting on page 38.

Pan American Health Organization, World Health Organization. (n.d.). Hospital Administrator, Post Disaster Functional Checklist. (Accessed 3/21/2022.)

> This checklist is meant to be used by a CEO or Hospital Administrator within 24 hours after the impact of a natural or man-made disaster. Its objective is to determine the immediate level of safety and functionality of the hospital. The facility is assessed in three segments: structural, non-structural, and functional capacity.

Raske, K. (2006). Greater New York Hospital Association Recovery Checklist for Hospitals After A Disaster. Greater New York Hospital Association.

Hospital staff can utilize this facility recovery checklist to check for potential issues in the facility after a disaster.

Rudowitz, R., Rowland, D., and Shartzer, A. (2006). Health Care In New Orleans Before And After Hurricane Katrina. Health Affairs. 25(5).

This article highlights healthcare data in New Orleans before and after Hurricane Katrina to illustrate the effects of the storm on the medical field, the city, and the State of Louisiana.

South Carolina Department of Health and Environmental Control. (2016). Post-Disaster Hospital Reopening Procedures.

This document provides a step-by-step guide for hospitals to follow prior to reopening. It includes five primary steps with action items under each.

Zane R, Biddinger P, Gerteis J, Hassol A. (2010). Hospital Assessment and Recovery Guide. AHRQ Publication No. 10-0081.

This guide is designed to help organize the initial assessment of a hospital after an evacuation/closure due to an emergency event. The guide is divided into 11 sections, each with its own team and assessment assignment: Administration, Facilities, Security and Fire Safety, Information Technology and Communications, Biomedical Engineering, Medical, Ancillary Services, Materials Management, Building and Grounds Maintenance/ Environmental Services, and Support Services.