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CENTER FOR CLIMATE, HEALTH, AND THE GLOBAL ENVIRONMENT

Climate Resilience for Frontline Clinics Toolkit

Module for
Floods

in collaboration with

americares

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How To Use This Toolkit

The Climate Resilience for Frontline Clinics Toolkit includes a wide variety of resources for several different hazards. There is more material here than anyone has time to read in one sitting. The following suggestions may help you make the best use of these resources. These suggestions are based on feedback, focus groups, and interviews with frontline clinic staff that implemented earlier versions of these toolkit materials.

Designate a weather resilience lead

Designate one person at your facility as a weather resilience lead. This person can:

- Take the time to review these documents in detail.
- Identify which materials will be most useful to colleagues in different parts of the organization.
- Track imminent weather threats.
- Sign up for and receive alerts from various systems, if desired.

See **Critical Roles and Responsibilities** for more details.

Identify your clinical engagement strategy

Set up a meeting with members of your healthcare team to determine how you would like to use the clinical and patient facing resources at your facility. Frontline clinics that participated in the development of these resources use them in several different ways, including the following:

- Educating clinicians on the impacts of climate hazards and approaches they can use when counseling patients.
- Making sure printouts of patient facing materials are easily accessible alongside other counseling materials that are used in the clinic.
- Adding patient facing materials to electronic after-visit summary documents so that it is easy to distribute these materials along with other parts of the after-visit summary.
- Printing out patient-facing materials and leaving them in a prominent location in the waiting room.
- Conducting education sessions on the contents of this toolkit for staff, administrators, or patients.
- Assign a specific member of the healthcare team to ask patients about relevant hazards and provide educational materials. This could include roles such as nurses, doctors, social workers, pharmacists, community health workers, and others.

Tailor these resources to the needs of your institution

In some cases, it may be desirable to modify details in these toolkit resources to meet specific needs at your organization or to reflect your local situation. Examples of this could include:

- Adding more detailed information about how to reach local authorities.

- Providing information about specific city, county, or state level resources.
- Providing information about specific policies and practices at your institution.
- Providing information about resources in your community, such as how to find cooling centers available in your city or town.

The easiest way to do this is to modify the provided **Documentation Templates**, which you can import into after-visit summaries for your patients.

Alternatively, you may find it helpful to make a separate flyer with a list of local resources and phone numbers to accompany the materials from this toolkit.

Integrate resources into your electronic health record system

You may find it helpful to integrate resources into your electronic health record system.

- You are welcome to include the attached PDFs and content in after-visit summaries, or to link to them from internal institutional reference documents or databases.
- We have provided a set of documentation templates that you can easily import into your electronic health record system.
- If you need more advanced integration support, such as creating templates of these materials within your electronic health record system, we may be able to help provide the content in a compatible format. Please contact our team for more information.

Share your experience and ideas

Many of the clinics that helped develop these materials found it helpful to share ideas and learn from each other about how they used the toolkit resources. If you have insights or experiences to share, please contact our team. In some cases, your contributions may be shared with other clinics or healthcare workers, with credit to you and your institution if desired. Examples of what you might share include:

- A description of how you have been using a specific resource in the toolkit.
- An anecdote about a climate hazard that you have dealt with successfully.

Conduct periodic reassessments

It may be beneficial to periodically reassess your climate resilience activities. Consider doing this:

- Annually in late fall, after the risk of climate hazards has decreased.
- After specific climate-related events, such as a hurricane or heatwaves, to review and learn from the experience.

Notes:

Flood Action Plan and Tip Sheet

For Patients

Use this plan to stay safe in the event of a flooding in your area. Share this plan with everyone in your home and with friends and family members. Review this information every year so that everyone is ready to act when a flood occurs.

Floods are dangerous to your health

In addition to drownings and injuries, people affected by floods can experience mental health impacts, interruptions in their usual medical care, exposure to toxic or infected floodwaters, breathing problems caused by mold, and other health problems.

Before a flood

Know when flooding may occur

You can check for flood alerts at weather.gov, on your phone weather app, on your computer (such as at weather.com), or through your local news on the radio, television, or social media.

You can look up the risk of flooding at your home's location at riskfactor.com. This site will tell you the likelihood that flooding will occur at your address. You can also look up Federal Emergency Management Agency (FEMA) flood maps on their website (https://www.fema.gov/flood-maps).

A flood *watch* means you should be *prepared* to take action. A flood *warning* means you should *take action immediately.*

FLOOD
WATCH
A flood watch is issued when flooding is possible. Stay tuned to radio/TV/social media and be ready to seek higher ground.

FLOOD
WARNING
A flood warning is issued when flooding is happening or will happen soon. Some roads will be flooded.

To prepare for flooding I will check: _____

Sign up for emergency alerts which you can get to your cell phone or email

You can sign up for emergency alerts at NIXLE.

For general information on alerts: Emergency Alerts | Ready.gov

If you have a car or generator, make sure the fuel tank is full

Consider keeping your car out of the garage in case the door does not open when you need to evacuate.

Know your evacuation route and how you will evacuate (car, transit, etc.)

When evacuation orders are given, they will use your home's specific "evacuation zone" and have a route to follow.

Have an emergency "grab and go" kit and a "stay at home" kit ready

This is a list of things to have ready in case of evacuating from a hurricane. Keep everything together, ideally in a single bag, so you can easily grab it to go. You should also prepare a "stay at home" kit if you need to shelter in place with supplies for a week. See **Building an Emergency Kit** for more information.

Keep copies of important documents ready and safe from flooding

This includes insurance policies, medication lists and birth certificates.

Plan for power outages

- Back up **medical equipment that needs electricity or batteries**.
- Have a backup cooler with ice for **medications that require refrigeration** and a thermometer to check the temperature inside the cooler.
- If you get water from a **well with an electric pump**, have a backup plan to have enough water to drink if the power goes out.
- If heat or air conditioning is not working, **consider going somewhere that heat or air conditioning is available.**
- **See more information on Plan for Power Outages**.

Prepare your home for flooding

You can install sump pumps and backflow valves on drains and toilets to prevent floodwaters from entering.

Look into your local community emergency response team (CERT) and think about signing up to volunteer to prepare yourself and your community for emergencies

Even if you do not sign up, there may be resources to help in disasters
https://community.fema.gov/PreparednessCommunity/s/welcome-to-cert?language=en_US

During a flood

Have a plan for evacuation and know who you can contact for help

Pay attention to local media outlets for evacuation orders. Know how to get out of your house - where the exits are and what windows can be opened.

Identify an emergency contact for everyone in your household to call, and update on plans.

My emergency contact person is: _____

Their phone number is: _____

Identify both a preferred and backup evacuation location that has power if you need it. If possible, these two locations should be in different directions from your home.

My evacuation locations are:

1. _____

2. _____

If I need to evacuate, the vehicle/transport I will use is: _____

Never drive or walk or take transport into standing water.

If I need help evacuating, I can call:

Name	**Phone**
1. _____	_____
2. _____	_____

Prepare your home before you leave to make your return safer

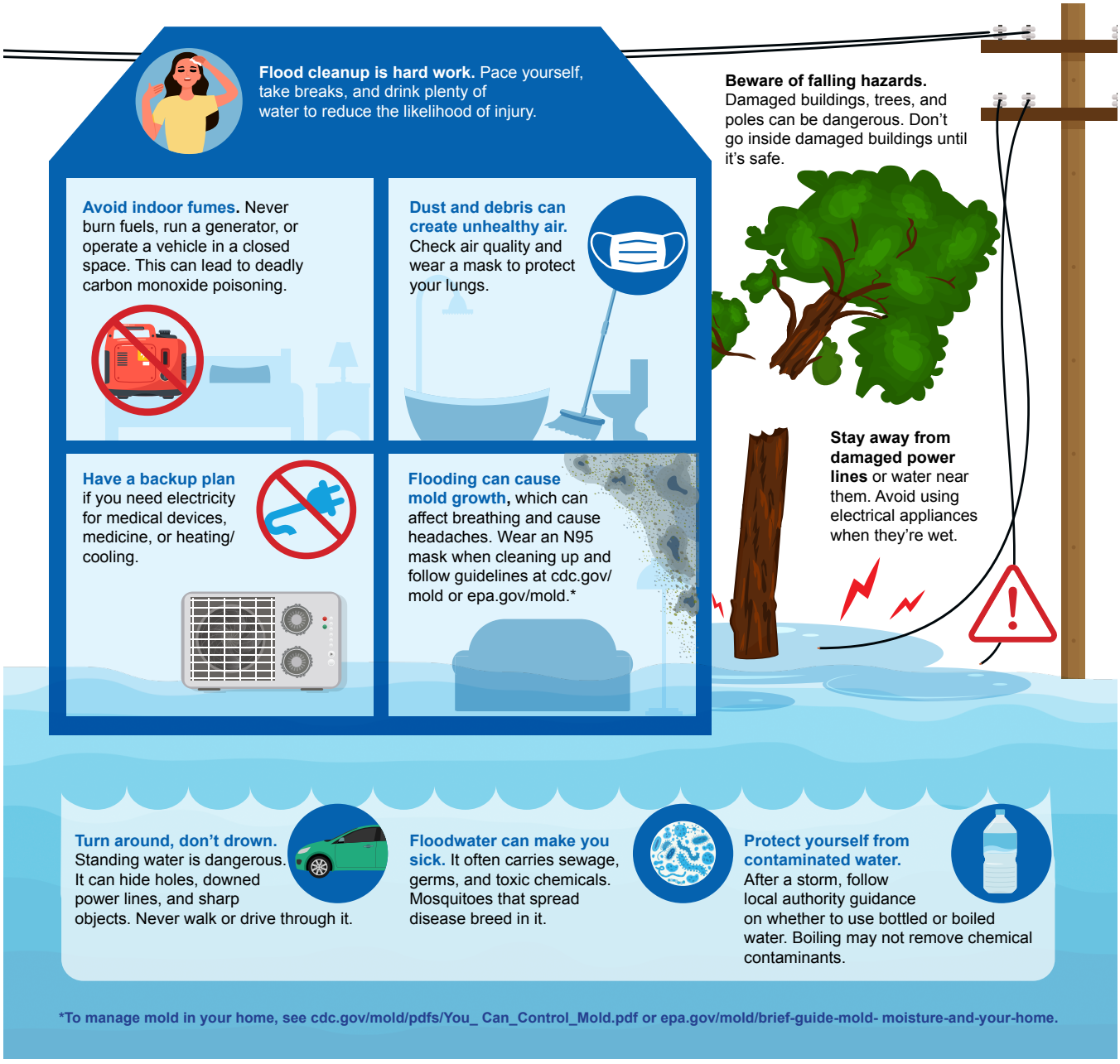
Turn off **electricity, gas, and water** supply.

Turn around, do not drown

Do not walk, swim, or drive through flood waters.

After a flood

Know your health risks during and after floods and how to minimize them



Visit cdc.gov/disasters or FEMA "Returning Home After a Flood" to learn more about risks to your health from floods and hurricanes.

After flooding can be a stressful time for your health. Speak with your healthcare team about taking care of your long-term medical conditions and any mental health concerns after flooding..

Before re-entering your home, make sure it is not damaged, and call the authorities if it is before entering to stay safe.

Notes:

Helping Patients Establish a Flood Action Plan

For Providers

Flooding is increasing in frequency and severity with the changing climate leading to health harms including drowning, infectious disease outbreaks, mold infestations in buildings, mobilization of toxic substances, social upheaval, displacement, and physical and emotional trauma.

Below is anticipatory guidance to help you prepare for completion of the **Flood Action Plan and Tip Sheet** *included in this toolkit with your patients, guiding what to do before, during, and after a flood.*

Before a flood

Make sure your patients and their families know the risks of floods

Ask: Do you know the risks to your health during a flood?

Help your patient identify their health risks from flooding. You can find information to discuss in the **Floods and Health** overview document.

Assess if and how patients access weather reports and extreme weather warnings

Ask: Do you know how to learn if there is a risk of a flood near where you live or are staying?

If not, you can suggest their phone weather app, weather.com, their local news television station, or riskfactor.com. For more detailed instructions, you can provide the **Flood Action Plan and Tip Sheet**.

Encourage patients to complete the Flood Action Plan and Tip Sheet well before a storm is imminent

Ask: Have you completed a Flood Action Plan?

Establishing a plan before there is an imminent threat of flood can be lifesaving, especially if a patient requires assistance to evacuate. We encourage you to complete the evacuation section of the **Flood Action Plan and Tip Sheet**.

During a flood

Determine patients' likelihood of evacuating and help them develop an evacuation plan

Ask: If there was an evacuation order, would you evacuate?

For individuals with chronic medical conditions or who rely on electric medical devices, such as ventilators, reviewing the risks from floods may help motivate them to evacuate when necessary.

Ask: If you need to evacuate, where will you go and how will you get there? If you need help, who will you call?

If a high-risk patient will not have the needed assistance to evacuate, a provider can ask permission to share the patient's contact information with local emergency managers or other resources.

After a flood

Advise them to make sure their home is safe to enter and patients know health risks after floods

Ask: Do you know the risks to your health after a flood?

Help your patient identify their health risks after flooding. You can find information to discuss in the **Floods and Health** document.

Check in with your patients about control of long-term medical conditions and any mental health concerns after flooding

After a flood can be a particularly stressful time, with patients potentially experiencing exacerbations of chronic disease, as well as issues accessing clean food, water, and shelter. Particularly for your higher risk patients with medical comorbidities or living with mobility issues, proactively check in on patients.

Ask: How is your health doing after the flooding? Do you have access to all the things you need- like food, water, shelter?

There can also be significant mental health stresses after a flood, and it is important to bring it up and offer any local resources.

Ask: How is your mental health after the flood? Do you have all the resources you need?

Notes:

Floods and Health

For Providers

This sheet is an overview on floods, providing background on how floods impact health and how providers can help patients prepare.

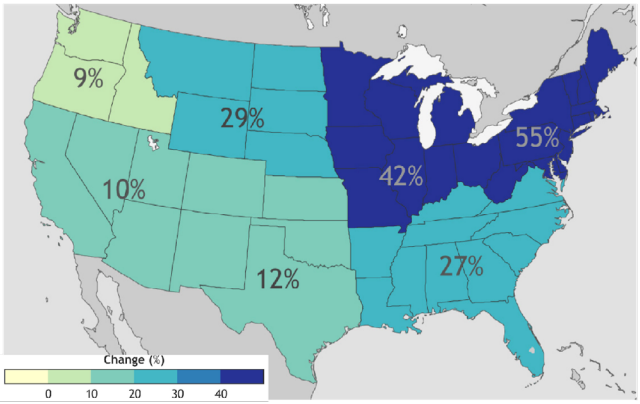
Floods and climate change

Flooding can result from:

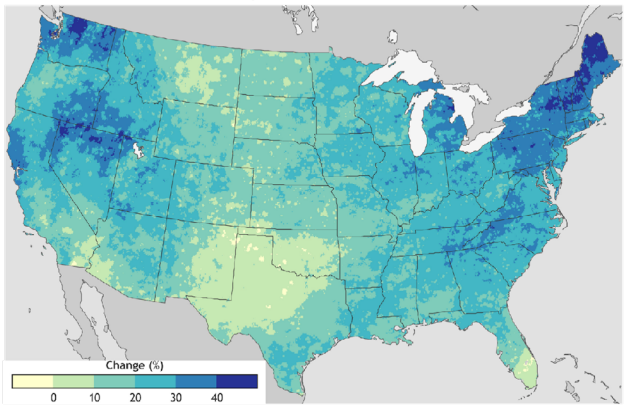
- prolonged or intense rainfall or snowmelt
- failures of infrastructure such as levees or dams
- the built environment, particularly in cities where lesser vegetation and more paved surfaces may increase flood potential

Precipitation events have already become more severe in recent decades in many parts of the United States and, with climate change, are expected to become even more intense.

Observed change in total annual precipitation falling in heaviest 1% of events,1958-2016



Change in total annual precipitation falling in heaviest 1% of events Late 21st Century, lower emissions - RCP 4.5



Source: Fourth National Climate Assessment - Figure 2.6

Health impacts of floods

Floods can contribute to a wide range of adverse health outcomes related to drowning, infectious disease outbreaks, mold infestations in buildings, mobilization of toxic substances, social upheaval, displacement, food and water contamination and physical and emotional trauma. Most direct flood related mortality is from drowning, accounting for up to 75% of immediate mortality.[1]

Patient case

A 37-year-old woman presents to your clinic with concerns about allergies. She says she has had a runny nose and been sneezing a lot and has felt very fatigued since moving back into her home after a recent flood, which inundated their home to a depth of 4 feet and led to them throwing out most of their furniture. She has also noticed that her children have similar symptoms.

What might be causing the symptoms, and what steps can this patient take to protect herself and her family? What other actions would you suggest they take at the same time given the situation?

Immediate health risks from flooding

Common unintentional injuries due to floods include:

- Drowning
- Electrocution
- Cuts, lacerations, and puncture wounds
- Falls
- Traumatic head injuries from falling debris
- Trauma from motor vehicle accidents

Infectious diseases associated with flooding

Flooding has been found to increase risks of infections, including vector, rodent and waterborne diseases, as well as illnesses associated with exposure to fungi. Infectious disease risk after hurricanes appears to peak 2 months after the event, but infections can be seen in the days after a storm occurs.[2]

Timing of post-flood infectious diseases in the United States

Early (<10 d after event)
Cellulitis, including from *Vibrios*
Pneumonias (may be aspiration related and polymicrobial)
Viral respiratory infections
Gastroenteritis (SSYCE, *Vibrios*, viruses)

Late (>10 d after event)
Mosquito-borne illnesses
Skin infection from atypical organisms (fungi, mycobacteria, mold)
Hepatitis A or E

Adapted from Paterson et al. Clin Inf Dis. doi:10.1093/cid/ciy227 and Ivers and Ryan. Curr Op Inf Dis. doi: 10.1097/01.qco.0000244044.85393.9e.

Floods have been commonly associated with outbreaks of waterborne diseases, including from bacterial and viral pathogens, such as those described in the table below.[3] Individuals who obtain water from private wells may be at particularly high risk, but even public water systems can be contaminated during extreme storms.[4]

Precipitation and flooding		
Cryptosporidium, *G. lamblia*	Increased discharge from water treatment plants, industry, and animal-feeding operations due to flooding and infrastructure damage	Increased because of higher pathogen burden in water sources
V. cholerae, hepatitis A virus, other fecal pathogens	Compromised WASH infrastructure (e.g., wells and potable water sources) due to damage from flooding and extreme events	Increased because of higher pathogen burden in water sources

Precipitation and flooding		
Leptospira, staphylococcus, hepatitis A virus, rotavirus	Increased pathogen mobilization and transport due to stormwater runoff and sewage overflow	Increased because of more frequent exposure to contaminated surface water (e.g., floodwater) and soil (e.g., mud)
Escherichia coli O157:H7 and other fecal pathogens from animal and human sources	Increased runoff from non-point sources (e.g., livestock manure, wildlife, or septic system); groundwater contamination with fecal pathogens during heavy precipitation in regions with insufficient water treatment; overwhelmed water treatment, resulting in contamination of water sources and river and lake sediments	Increased because of higher pathogen concentrations in surface water

Standing water may create breeding grounds for disease-carrying mosquitos[5] and fungal growth. Flooded homes are much more likely to have higher levels of molds, such as Aspergillus, Penicillium, and Cladosporium.[6,7] Patients with allergic disorders may be more likely to develop symptoms from mold exposures.[7] Fungal infections are less common, but immunocompromised individuals have developed respiratory fungal infections after flood induced mold exposures.[7]

Population displacement that occurs after floods can result in overcrowded homes and shelters, sometimes with inadequate sanitation. These conditions can result in the spread of many different infections, especially those transmitted by respiratory or fecal-oral routes.[7]

Toxic exposures

Flooding can result in exposure to hazardous substances that are present in and around your community. Hazardous exposures can come from:

- impoundments (e.g., coal fly ash; industrial chemicals in manufacturing facilities; animal wastes in ponds adjacent to livestock operations)
- landfills (flooding causing leaching of materials from landfills)
- soils (e.g., carcinogenic polychlorinated biphenyls or PCBs may have leached over time into soils and flood waters may push them into wells)
- carbon monoxide with power outages (indoor or inadequately ventilated electrical generator use combined with absent or non-functional carbon monoxide monitors.[7] Patients may also attempt to cook or heat their homes by burning fuels, such as wood or propane, indoors, or to run their vehicle for air conditioning in an enclosed garage)

Health risks depend on which toxins are released and the extent of exposure to them. After flooding, monitoring may be done to assess air and water quality but may not be adequate to address all relevant hazardous exposures.

Floods and mental health

Mental health may decline after flooding, with greater reports of depression, anxiety and post-traumatic stress often reported. Individuals displaced by floods, especially when they were unaware of imminent flood risk, as well as those who have been cut off from close friends and family, may be at elevated risk.[9] Mental health symptoms may persist for years after flooding occurs.[10, 11]

Disruption of health-systems infrastructure and displacement

Floods often impede healthcare delivery as they can damage healthcare facilities, cut off essential utilities, disrupt supply chains, and inundate roads. Patients who are displaced by storms may be unable to refill medications, and lack of access to medications after floods has been associated with increased morbidity.[12, 13]

Patients with chronic conditions, including diabetes and cancer, may delay necessary healthcare services because of healthcare facility closure, difficulty with transportation, or competing demands on time[14] and may have worse outcomes as a result.[15]

Populations at greater risk for harm after flooding

Population	Risk
Children	May be more likely to be outdoors and play in flood waters leading to health harms such as drowning or infectious diseases. They are also developing physically and mentally and may be more at risk for mental health harms and poor air quality from mold after floods.[16]
Pregnant and postpartum women	Flooding can lead to increased risks of pregnancy complications such as preterm birth and eclampsia.[16] More likely to: • experience waterborne illness • mental health exacerbations such as PTSD[16]
Rescue workers, first responders and occupational risks	More likely to sustain unintentional injuries during and after storms.[17]
People living with chronic diseases	May be more likely to have disease flares due to: • supply chain disruptions and medication shortages • difficulty accessing treatment or care • power outages affecting electric medical devices[17,18]
People living with disabilities	Face barriers to: • receiving emergency communications • evacuation due to inaccessible transportation options or lack of necessary mobility assistance • access to evacuation shelters[19] May be more likely to live in public housing or in higher flood risk areas.

Population	Risk
Older adults	More likely to have: • medical comorbidities • limited capacity to evacuate or be resilient to a flood, especially if they lose their homes[20, 16]
Minoritized, low-income, and socioeconomically disadvantaged communities	More likely to live: • near industrial facilities that release toxic substances during and after a storm[21] • in areas with high flood risk[20, 22]

Flood action plans and tip sheet for patients

We recommend that you familiarize yourself with the **Flood Action Plan and Tip Sheet** provided in the toolkit and review it with any patient at risk of experiencing a flood. The action plan can be provided during care visits with both adolescents and adults and can be the basis for a discussion around safety planning and care management in the event of a flood. Action plans should be completed before storm season in your locale.

Anticipatory guidance for patients

Anticipatory guidance for floods may contribute to improved health outcomes. The strategies and resources from the **Flood Action Plan and Tip Sheet** and the **Helping Patients Establish a Flood Action Plan** can be used to help patients prepare for floods.

Before a flood

Forecasts

Baseline and future flooding risk for many properties in the United States can be found at riskfactor.com.

Flood risk depends on many factors aside from absolute rainfall, including geography, volume of prior recent rainfall, the built environment, and proximity to rivers (and their levels). The National Weather Service does provide flash flood forecast maps that show where flooding may be most likely given expected precipitation.

Weather alert information available at weather.com or other weather websites can provide real time information on phones or other devices. A flood watch means you should be prepared to take action. A flood warning means you should take action to keep yourself safe.

Reduce risks from floods

We encourage you to provide patients with both patient handouts available in this toolkit (**Flood Action Plan and Tip Sheet**).

In addition, flood preparedness guidance and infographics are available from CDC in multiple languages.

Make sure patients are aware of the Turn Around Don't Drown Guidance from weather.gov on the risks of driving or walking through flood water, as this contributes to over half of flood related drownings.

During a flood

Evacuation

Evacuation may be the best choice when flooding is expected near a patient's home. Patients can be encouraged to pay attention to local media outlets for evacuation orders (i.e., through newscasts, social media, or automated alerts on a smartphone).

Advise patients against walking, swimming, or driving through flood waters as that can lead to drowning.

Responsiveness to evacuation alerts has been found to vary by age, gender, and other factors. Men and full-time residents may be more likely to want to stay and protect their property, whereas homes with children, elderly individuals, pregnant women, individuals with health concerns, or part-time residents are more likely to evacuate early.[11]

Providers can ask whether a patient would be willing to evacuate when asked to do so. For those individuals who are unwilling to evacuate, especially for individuals with chronic medical conditions or who rely on electronic devices such as ventilators, reviewing the risks from floods may be helpful to encourage evacuation to safety when necessary.

If a high-risk patient will not have the needed assistance to evacuate, a provider can ask permission to share the patient's contact information with local emergency managers.

Extensive, multilingual guidance on evacuation planning is available from FEMA.

After a flood

Short-term

If patients have evacuated, they should only return home when authorities say it is safe.

There can be substantial dangers associated with return, including exposure to floodwaters, which can lead to infectious diseases and toxic exposures as described above. In addition, there can be similar toxic exposures when cleaning up after a flood, particularly to mold. Debris can also be dangerous and lead to traumatic injuries. Counsel patients on NOT using electrical equipment in water as it could lead to electrocution. Additionally, counsel on using generators only outdoors or in well-ventilated spaces to avoid carbon monoxide exposure.

Patients with respiratory conditions like asthma or other immunosuppressive conditions should be particularly careful with toxic, mold, and infectious exposures during cleanup.

https://www.ready.gov/floods#after provides additional information that can be used by patients before, during and after floods.

Long-term resilience and recovery

Discuss long term plans with your patients to improve their resilience to future hurricanes. This can include how and where to build their home and what types of building materials may be more able to withstand hurricane winds. It can also include ensuring backup power sources and creating plans for critical utility interruptions.

There may be available local resources to help with long-term resilience that can be shared, or there are federal resources such as FEMA's flooding risk map available here https://www.fema.gov/flood-maps/tools-resources/risk-map that help make you aware of risks in the community to promote informed development or the National Flood Insurance Program to reduce the long term impacts of floods.

Notes:

References

1. Cao W, Zhao S, Sun S. Mortality risks associated with flood events. BMJ. 2023 Oct 4;383:2101. doi: 10.1136/bmj.p2101. PMID: 37793692.
2. Parks RM, Benavides J, Anderson GB, et al. Association of Tropical Cyclones With County-Level Mortality in the US. JAMA [Internet] 2022 [cited 2022 Aug 31];327(10):946–55. Available from: https://jamanetwork.com/journals/jama/fullarticle/2789661
3. Levy K, Woster AP, Goldstein RS, Carlton EJ. Untangling the Impacts of Climate Change on Waterborne Diseases: A Systematic Review of Relationships between Diarrheal Diseases and Temperature, Rainfall, Flooding, and Drought. Environ Sci Technol [Internet] 2016 [cited 2022 Aug 31];50(10):4905–22. Available from: https://pubs.acs.org/doi/full/10.1021/acs.est.5b06186
4. Mapili K, Rhoads WJ, Coughter M, Pieper KJ, Edwards MA, Pruden A. Occurrence of opportunistic pathogens in private wells after major flooding events: A four state molecular survey. Science of The Total Environment 2022;826:153901.
5. Centers for Disease Control and Prevention. Mosquitoes, Hurricanes, and Flooding [Internet]. [cited 2022 Aug 31];Available from: https://www.cdc.gov/mosquitoes/mosquito-control/community/mosquitoes-and-hurricanes.html
6. Barbeau DN, Grimsley LF, White LE, El-Dahr JM, Lichtveld M. Mold Exposure and Health Effects Following Hurricanes Katrina and Rita. Annu Rev Public Health [Internet] 2010 [cited 2022 Aug 31];31:165–78. Available from: www.annualreviews.org
7. Saulnier DD, Brolin Ribacke K, Von Schreeb J. No calm after the storm: a systematic review of human health following flood and storm disasters. Prehosp Disaster Med [Internet] 2017 [cited 2022 Aug 31];32(5):1–12. Available from: https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/no-calm-after-the-storm-a-systematic-review-of-human-health-following-flood-and-storm-disasters/B1548783DC8CD5209C862A8CBCC068F3
8. Centers for Disease Control and Prevention. Carbon Monoxide Poisoning: Natural Disasters and Severe Weather [Internet]. [cited 2022 Sep 1]; Available from: https://www.cdc.gov/disasters/carbonmonoxide.html
9. Tong S. Flooding-related displacement and mental health. Lancet Planet Health [Internet] 2017 [cited 2023 Mar 7];1(4):e124–5. Available from: http://www.thelancet.com/article/S2542519617300621/fulltext
10. Cruz J, White PCL, Bell A, Coventry PA. Effect of Extreme Weather Events on Mental Health: A Narrative Synthesis and Meta-Analysis for the UK. International Journal of Environmental Research and Public Health 2020, Vol 17, Page 8581 [Internet] 2020 [cited 2023 Mar 7];17(22):8581. Available from: https://www.mdpi.com/1660-4601/17/22/8581/htm
11. Raker EJ, Lowe SR, Arcaya MC, Johnson ST, Rhodes J, Waters MC. Twelve years later: The long-term mental health consequences of Hurricane Katrina. Soc Sci Med 2019;242:112610.
12. Ochi S, Hodgson S, Landeg O, Mayner L, Murray V. Disaster-Driven Evacuation and Medication Loss: a Systematic Literature Review. PLoS Curr [Internet] 2014 [cited 2022 Sep 1];6. Available from: /pmc/articles/PMC4169391/
13. Lee S, Jayaweera DT, Mirsaeidi M, Beier JC, Kumar N. Perspectives on the Health Effects of Hurricanes: A Review and Challenges. International Journal of Environmental Research and Public Health 2021, Vol 18, Page 2756 [Internet] 2021 [cited 2022 Sep 2];18(5):2756. Available from: https://www.mdpi.com/1660-4601/18/5/2756/htm
14. Wang C, Bowers BJ. Bracing For Hurricanes: A Qualitative Analysis of the Extent and Level of Preparedness Among Older Adults. Gerontologist [Internet] 2018 [cited 2022 Sep 3];58(1):57–67. Available from: https://academic.oup.com/gerontologist/article/58/1/57/4741067

15. Nogueira LM, Sahar L, Efstathiou JA, Jemal A, Yabroff KR. Association Between Declared Hurricane Disasters and Survival of Patients with Lung Cancer Undergoing Radiation Treatment. JAMA [Internet] 2019 [cited 2022 Dec 9];322(3):269–71. Available from: https://jamanetwork.com/journals/jama/fullarticle/2738278
16. Gamble, J.L., et al. (2016). Ch. 9: Populations of concern. In: The impacts of climate change on human health in the United States: A scientific assessment. U.S. Global Change Research Program, Washington, DC, p. 255.
17. Waddell SL, Jayaweera DT, Mirsaeidi M, Beier JC, Kumar N. Perspectives on the Health Effects of Hurricanes: A Review and Challenges. 2021; Available from: https://doi.org/10.3390/ijerph18052756
18. Powell R, Gilbert S. The Impact of Hurricanes Katrina and Rita on People with Disabilities: A Look Back and Remaining Challenges [Internet]. 2006 [cited 2022 Sep 3]. Available from: https://ncd.gov/publications/2006/aug072006
19. Chakraborty J, McAfee AA, Collins TW, Grineski SE. Exposure to Hurricane Harvey flooding for subsidized housing residents of Harris County, Texas. Natural Hazards [Internet] 2021 [cited 2022 Sep 3];106(3):2185–205. Available from: https://link.springer.com/article/10.1007/s11069-021-04536-9
20. EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S. Environmental Protection Agency, EPA 430-R-21-003.
21. Perlin SA, Wong D, Sexton K. Residential proximity to industrial sources of air pollution: interrelationships among race, poverty, and age. J Air Waste Manag Assoc [Internet] 2001 [cited 2022 Sep 3];51(3):406–21. Available from: https://pubmed.ncbi.nlm.nih.gov/11266104/
22. Bakkensen LA, Ma L, Blomquist G, et al. Sorting Over Flood Risk and Implications for Policy Reform. 2020 [cited 2022 Sep 3]; Available from: https://www.frbsf.org/economic-research/wp-content/uploads/sites/4/Bakkensen_Ma_2020.pdf

Flood Response Actions

For Administrators

Flooding can pose significant risks to the safety, health, and well-being of patients, staff, and the community served by healthcare facilities. As climate change continues to increase the frequency and intensity of extreme precipitation events, it is essential for clinics to have a comprehensive plan in place to prepare for, respond to, and recover from flood events.

This Flood Response Actions document document provides a step-by-step guide for facility administrators and/or the designated Weather Resilience Lead to ensure their clinics are ready to protect the health of their patients and staff during periods of flooding.

The plan is divided into three sections, when a flood watch or warning is issued, during flooding, and after a flood event. The actions and checklist items cover critical areas such as facility preparation, communication plans, patient and staff safety, and post-flood recovery. By following the guidance outlined in this document, healthcare facilities can minimize the negative impacts of flooding on their operations and the health of the communities they serve, while also ensuring a swift and effective recovery process.

Flooding is likely (several days out - active advisory or watch)

- ☐ Monitor local weather forecasts and emergency alerts for updates on the flood situation.
- ☐ Review and activate facility emergency plans. If your facility is likely to be flooded, consider taking proactive steps to cancel patient appointments and send staff home who may get caught in flood waters.
- ☐ Be ready to close the facility and evacuate staff at a moment's notice. Plan evacuation routes based on local response information. Make sure the routes avoid flooded areas or roads.
- ☐ Ensure all staff are aware of the situation and any specific responsibilities during a flood event. Ensure they know to avoid driving or walking in flood waters.
- ☐ Essential equipment, supplies, documents, and medications should be raised off the floor, stored on higher ground, or kept in waterproof containers.
- ☐ Clear exterior drains and gutters.
- ☐ Lock and seal any low-lying windows.
- ☐ If the facility commonly floods in the basement or ground-level, consider renting or purchasing a sump-pump.
- ☐ Check that emergency supplies, such as sandbags, water pumps, soap, and first aid kits, are readily available.
- ☐ If a flood watch is issued, implement measures to prevent water from entering the facility, such as using sandbags and water barriers. Follow guidance from local emergency management and public safety authorities regarding sandbagging operations.
- ☐ Identify and secure important documents, equipment, and medications that may be at risk of water damage.
- ☐ Communicate with patients about potential disruptions to clinic services and provide guidance on staying safe during a flood.
- ☐ Coordinate with local emergency management officials, healthcare facilities, healthcare coalition, and/or local service providers to share resources and information.

Flood warning or facility flooding

☐ Ensure the safety of all patients and staff and evacuate the facility if necessary. Go to higher ground if possible.

☐ If possible, monitor the water levels and the condition of the facility's infrastructure, such as electrical systems and water supply.

☐ Maintain communication with staff, patients, and local emergency response organizations or agencies.

☐ If the facility is closed, consider transferring the main phone line to an on-call medical provider to answer patient questions.

Post-flooding

☐ After the flood, please refer to the **Guidance and Checklist for Facility Repair and Re-Entry After Storms and Flooding** document for guidance

Notes:

Flood Communications Templates

For Administrators

Effective communication is crucial for health centers and clinics to ensure the safety and well-being of their patients and staff during floods. This document provides guidance and sample messages that can be used to disseminate important information and alerts before, during, and after floods.

When flooding is anticipated (flood advisory or watch)

Recorded phone message or email – preparedness and staying informed

Potential heavy rain and/or flooding is expected in [impacted region]. You can look up risk for flooding at your home's location at https://msc.fema.gov/. This FEMA site provides flood maps for your address. Local response authorities and National Weather Service are more likely to provide accurate up-to-date information regarding evacuation statuses, protective action recommendations, and broad public guidance for facilities and individuals.

You can check for flood alerts on your phone, computer, or local news station. You can also get information on flooding at weather.com.

In case you need to evacuate, keep a kit of emergency supplies ready so you can easily grab and go.

[Clinic name] will remain [open / closed]. If open, specify hours and services provided.

Know the difference between a flood warning and flood watch.

Flood warning is issued when flooding is happening or will happen soon. Some roads will be flooded.

Flood watch is issued when flooding is possible. Stay tuned to radio/TV/news media and be ready to seek higher ground.

Floods create conditions where injuries are more common. Know the risks to your health from floods and how to minimize them:

- Standing water – even as little as 6 inches of water can cause you to lose control of your vehicle.
- Power outages – if you use electric medical devices, you will need to have a back-up power plan in case you lose power.
- Infections – Standing water can contain bacteria and viruses that can cause disease. It can also serve as breeding ground for infection-transmitting mosquitos.
- Poor water quality – After severe storms, water may not be safe to drink, especially water from private wells. Listen for boil water advisories. Throw away any food and bottled water that may have contacted floodwater.
- Mold – Molds can grow after flooding, which can then cause coughs, congestion, and headaches as well as asthma flares.
- Electrocution – Strong winds can knock down or damage power lines. DO NOT touch any downed power lines or wade into standing water that power lines may have fallen into because this can electrocute you. Turn off the power to your appliances at the circuit breaker or fuse box if your home has flooded because wet appliances may also pose an electrocution risk.
- Falling trees, utility poles, and buildings – They can become unstable and fall on people and property.
- Carbon monoxide exposure – If you lose power, do not heat your home, or cook by burning fuels such as wood or propane. These can lead to carbon monoxide poisoning.

Social media post or text messages – preparedness (1-5 days in advance)

Potential heavy rain or flooding is expected in [impacted region].

You can look up risk for flooding at your home's location at the fema flood map service center. This site will tell you whether your location is in a flood risk area.

You can check for flood alerts on your phone, computer, or local news station. You can also get information on floods at weather.com.

During a flooding or flood warning

[Clinic name] is open for [specify services] services from [opening time] to [closing time]. Due to damage at our normal location, we are currently providing services at [address / location].

Note: only include the second sentence if your clinic has changed location.

After a flood

Recorded phone message or email – clinic status

[Clinic's name] has / has not experienced significant damage as a result of the recent floods. We are working to get all services up and running as soon as possible.

[To the degree possible, provide a brief overview of the damage and steps taken so far towards restoration.]

Currently [X] services are available at [location]. If you urgently need [unavailable services], please seek treatment at [name and address of partner clinic or hospital.]

Social Media Post or Text Messages – Clinic Status And Safety

Like you, the clinic staff have just been allowed back into [impacted area] and we will begin inspecting the damage to our facility. Stay safe as you begin to assess the damage to your home. Remember:

- Do not enter your home until it is safe to do so.
- Look for obvious structural damage, downed power lines and the smell of gas. Alert utility companies, as necessary.
- Floods can cause contamination of groundwater. Check [local resource] to know what water quality safety measures are in place for your protection.

Notes: