



SUMMARY

After the Storm:

The Hidden Health Risks of Flooding in a Warming World

Over the past 30 years, floods have tended to be one of the most deadly and expensive type of natural disaster in the United States. The impact of a flood is typically measured in terms of lives lost and the dollar value of property damaged or destroyed. But the often-substantial public health costs that follow a flood—and the toll that such health impacts may take on families even long after the waters have receded—are rarely included. Heavy rains or storm surges can contaminate drinking and recreational water with sewage, agricultural waste, chemical pollutants, or animal wastes, leading to waterborne gastrointestinal illnesses. Flooded homes and buildings can be a breeding ground for mold, which can cause debilitating respiratory and neurological problems. Mental health problems also tend to increase in the wake of extreme weather disasters.

Extreme rainfall events have become more common in the United States during the same period that the climate has warmed, and it is likely that this trend will continue as temperatures rise. More and more of our growing population will be left vulnerable to the immediate and lingering health impacts of these events. While the risks to our homes and communities from flooding are based on a variety of factors, including where we live, how we develop our land, and what kinds of protective measures we invest in, the influence of climate change can no longer be ignored.

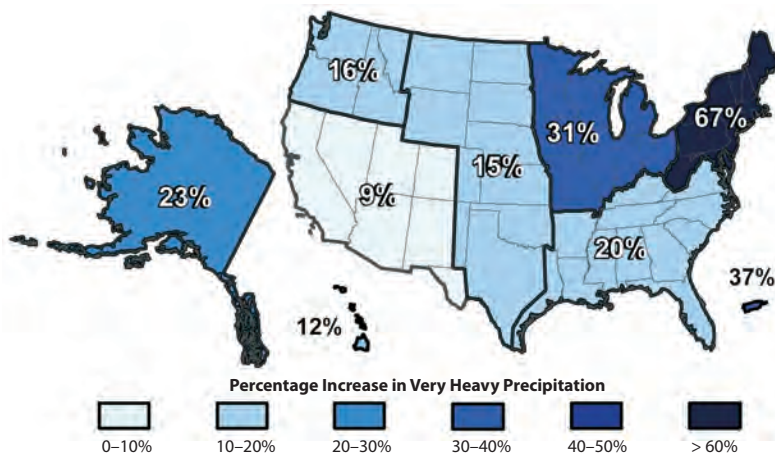
Every region of the United States has, on average, experienced an increase in the heaviest precipitation events over the past five decades. Future climate change is projected to further increase the occurrence of heavy rain events across North America and heighten the associated risk of flooding. The actual increase in extreme precipitation by



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After a 2004 flood inundated this home in Bridgeville, PA, its baseboard and insulation were removed to prevent mold and mildew, which may trigger respiratory illnesses. Floodwaters can pose additional health risks if they become contaminated with chemical pollutants, agricultural runoff, or raw sewage. Even after the water has receded, residents often struggle with stress and other mental health problems.

Fifty years of observations across the entire country reveal that the number of very heavy precipitation events, defined as the heaviest 1 percent of all daily events, has increased.



Source: Karl, Melillo, and Peterson 2009

century's end will depend on the amount of carbon we emit in the next few decades.

The United States must take aggressive measures to reduce carbon emissions (in order to minimize the risks of climate change) as well as to effectively prepare for the climate changes that will occur.

Although the adaptations required to cope with increased flood risk will vary from place to place depending on the type of flooding that is most likely in a given locale, the severity of that flooding, and the existing infrastructure, creating more resilient communities will be essential everywhere.



The Top Five Hidden Health Risks of Extreme Precipitation and Flooding

Flooding presents immediate dangers to human life, such as drowning, physical trauma, and electrocution. Other health hazards associated with flooding, however, are less visible. Here we summarize five of the top hidden health risks and identify some resources to help you protect your family.



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HIDDEN HEALTH RISK #1:

Drowning While Driving

Where It Comes From: Of the people killed in U.S. floods in 2010, 44 percent were in vehicles. A mere 18 inches of water can lift a car or SUV. Once a vehicle is buoyant, fast-moving water can turn it

sideways and roll it over, trapping those inside and washing them downstream.

Ideas to Protect Your Family:

- Monitor local news sources for vital weather-related information.
- Do not attempt to drive through or wade into floodwater; instead, turn around.
- Do not attempt to cross streams. If flooding occurs, get to higher ground.

For More Information: Consult your health department or the National Oceanic and Atmospheric Administration's "Turn Around, Don't Drown" campaign (<http://www.srh.noaa.gov/tadd>).



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HIDDEN HEALTH RISK #2:

Waterborne Diseases Contaminating Drinking Water

Where It Comes From: Extreme precipitation and flooding can sometimes overwhelm potable water infrastructure and wells, reducing or preventing water purification.

Ideas to Protect Your Family:

- Sign up for local boiled-water alerts and have bottled water stored for emergencies.
- Always be wary of foul-smelling or discolored water.

For More Information: Consult your local water treatment facility, health department, or Centers for Disease Control and Prevention (CDC) (<http://www.cdc.gov/healthywater/emergency/toolkit/helpful-tips-drinking-water-outbreak.html>).



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HIDDEN HEALTH RISK #3:

Sewage Backup in Plumbing or Basements

Where It Comes From: Extreme precipitation and flooding can cause local sewage lines and septic tanks to overflow, sometimes causing sewage to back up into people's

homes. Areas with combined sewer overflow systems—concentrated in the Northeast, Great Lakes, and Northwest regions—often experience such overflows.

Ideas to Protect Your Family:

- Install plumbing (a backwater valve) to prevent sewage backup if at risk.
- If you suspect that raw sewage has backed up into your home, hire professionals to do the cleaning.

For More Information: Consult your local health department, sewage treatment facility, or the CDC (<http://www.emergency.cdc.gov/disasters/floods/after.asp>).



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HIDDEN HEALTH RISK #4:

Bacteria and Sewage in Local Waterways, Swimming Holes

Where It Comes From: During flooding, untreated sewage can contaminate local rivers, lakes, ponds, and even ocean beaches; sometimes raw sewage and street contaminants

(e.g., motor oil, dog excrement) or pesticides can flow directly into nearby waterways.

Ideas to Protect Your Family:

- Sign up for local swimming alerts and pay attention to warnings from local health departments regarding the community's lakes, rivers, and ocean beaches.
- It may not be safe to swim in local water bodies immediately after a strong storm.

For More Information: Consult your local health department or the CDC (<http://www.cdc.gov/healthywater/emergency/toolkit/rwi-outbreak-toolkit.html>).



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HIDDEN HEALTH RISK #5:

Dangerous Mold in Indoor Air

Where It Comes From: Water intrusion anywhere in your home can cause toxic mold to grow in ceilings, walls, or insulation.

Ideas to Protect Your Family:

- Try to prevent leaks, maintain gutters, and raise the land around the house so that water can flow away.
- After leakage, dry affected areas thoroughly with a dehumidifier or replace moldy drywall, ceiling panels, carpets, or insulation.
- Plan and implement remediation activities with professional help if possible—or, when cleaning, always wear an N95 protective face mask (available at local home-supply stores).
- Discard waterlogged mattresses, furniture, or rugs.

For More Information: Consult your local health department or the CDC (<http://emergency.cdc.gov/disasters/mold/protect.asp>).