

*epi*TRENDS

A Monthly Bulletin on Epidemiology and Public Health Practice in Washington

September 2022 Volume 27, Number 9

Floods and Communicable Diseases

Pakistan has recently experienced severe flooding due to increased monsoon rains and accelerated glacial melting. During 2022 multiple regions of the United States have had extensive flooding. Deaths due to drownings, injuries, electrocutions and even snakebites can occur due to floods. In addition there are also communicable disease risks.

Effects of Floods

Extensive flooding damages or destroys infrastructure: buildings, transportation routes, utilities, food sources, energy systems, potable water, and waste disposal. Health risks that results can include crowded emergency living conditions, water contamination by human or animal feces, or loss of access to healthcare resources.



The chances for infectious disease spread after a flood event vary considerably. Specific risks depend on factors related to the affected population, the surroundings, and the infectious diseases in the area.

Floods: Host, Agent, Environment

Person-related factors in a post-flood situation involve population health. The risks differ for a community with a high level of immunity against an agent and low prevalence compared to a community with low immunity and an ongoing outbreak of that agent. The presence of infectious agents varies considerably across countries and regions. Presence of certain endemic diseases or vector arthropods put the population at greater risk of infections. Risk of adverse outcome can also vary, such as increased for age extremes or immunosuppression.

The scale of the flooding, the geographic area involved, and available resources and remediation will affect resilience. Ability to provide safe drinking water, shelter, and healthcare may affect whether people have acute exposure to infectious agents or can access preventive services. Extended disruption of vaccinations or disease control programs can have long-term effects.



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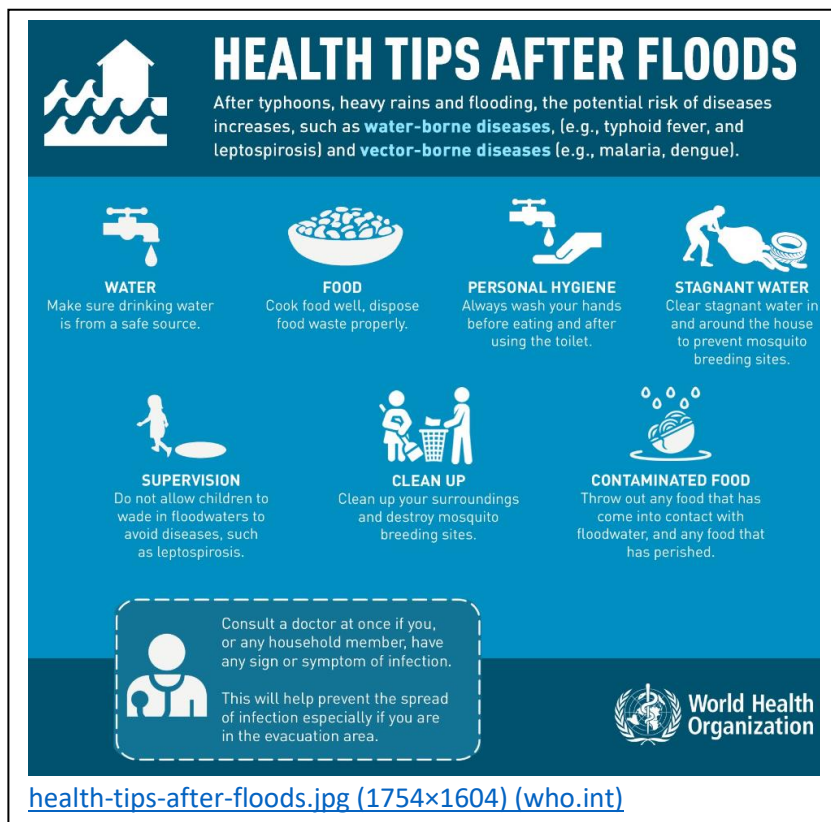
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Infectious Disease Risks

Post-flooding infectious risks can be categorized in various ways including by the type of body system affected. While rare and unusual infections can occur from exposure due to flooding, the majority of diseases would be gastrointestinal, respiratory, or febrile vector-borne illnesses.

Gastrointestinal conditions

Following flooding there may not be access to safe water for drinking, food preparation, and personal hygiene such as hand cleansing. Food may be contaminated without facilities for proper cleaning and preparation. Human fecal-oral transmission occurs for hepatitis A virus, hepatitis E virus, norovirus, rotavirus, poliovirus, and many other agents; hepatitis E has been known to cause outbreaks in refugee camps with unsafe water supplies. Other diseases with human reservoirs also have the potential to spread through contaminated drinking water; agents include cholera, typhoid, and shigellosis. A concern for Pakistan, which has periodic identified infections with both wild poliovirus and circulating vaccine derived poliovirus, would be the potential for spread of these agents in flooded areas.



Manure and wastes from domestic herd animals can wash into flood waters and may carry a variety of pathogens, as can the carcasses of drowned animals. Potential agents include Shiga toxin-producing *E. coli*, *Salmonella*, and *Campylobacter*. These bacteria could be inadvertently swallowed while wading through water or carried into drinking water supplies, particularly surface water or submerged shallow wells. Cases of cryptosporidiosis or giardiasis can also be associated with contaminated and untreated drinking water.

Vector-borne conditions

Increased breeding sites and living unsheltered with loss of typical protection such as window screens or bed nets can result in exposure to mosquitoes and other arthropods that are major disease vectors in some parts of the world. Depending on the region of the globe, vector-borne conditions that may be present include malaria, yellow fever, West Nile disease, dengue, Chikungunya, Rift Valley fever, Ross Valley fever, and Zika. Local populations of mosquitoes would likely increase if water collections remained after flood waters recede, amplifying the risk of vector-borne diseases.

Even nuisance mosquito bites which do not spread infections can result in morbidity. With reduced sanitation and increased exposure of the skin to soil and contaminated water, a wide variety of bacterial infections could develop in arthropod bites.

Respiratory conditions

Displacement of people affected by a flood with subsequent sheltering in crowded conditions can result in the transmission of respiratory conditions. Agents that occur will reflect those common in the affected population. Potential illnesses range from mild viral upper respiratory infections, pertussis and influenza to measles, COVID-19, and tuberculosis.

Other conditions

Leptospirosis exposure can occur through rodent urine contaminating water, particularly if rodent populations expand with increased access to garbage or crops following floods. Injuries may be more common during a flood or during reconstruction work, with risk of tetanus or bacterial wound infections. Contaminated saline water can cause *Vibrio* wound infections; *V. vulnificus* tissue infections can be particularly aggressive. Eye infections may occur with submersion and reduced access to clean water for washing.

While immediate rescue efforts receive media coverage, potential infectious exposures in a flood-affected area may persist. Until access to safe water and food, shelter, and preventive and therapeutic health care are restored, the population faces ongoing risks of exposure at a time when disease surveillance is also curtailed. In high resource settings there may be rapid access to bottled water, emergency shelters, and meal service. In countries with fewer resources, post-flood areas may remain without assistance for extended periods and have ongoing infectious disease risks.

As climate change results in more frequent and more severe flood occurrences, associated infectious disease risks will also increase. A global approach will be needed to address the larger scope of the infectious disease burden of floods.

Resources

Washington State Department of Health:

- <https://doh.wa.gov/emergencies/be-prepared-be-safe/severe-weather-and-natural-disasters/floods>
- <https://doh.wa.gov/emergencies/be-prepared-be-safe/floods/cleanup>

Centers for Disease Control and Prevention:

- <https://www.cdc.gov/disasters/floods/>

National Weather Service:

- <https://www.weather.gov/safety/flood-states-wa>

World Health Organization:

- https://www.who.int/health-topics/floods#tab=tab_1

WHEN IT FLOODS...
Be prepared! Get details about flooding at kingcounty.gov/floodservices

BEFORE

- 1 Know your flood hazard. If you were notified this week, your home or property is in or near a floodplain. Learn more at kingcounty.gov/EM&M or call 206-477-4812.
- 2 Buy flood insurance. Standard homeowners' insurance does not cover loss caused by flooding, and there can be a 30-day waiting period on new flood insurance policies. Learn more at floodednet.gov or call 800-427-6861.
- 3 Protect yourself and your family.
 - Update emergency plans for your family, farm, or business and choose a meeting place in case family members get separated.
 - Know several routes from your home or business to high ground.
 - Use sandbags to protect your home or property (see kingcounty.gov/floodservices for free distribution locations).
 - Pick an out-of-state friend or relative to call with information if flood traps are high.
 - Assemble an emergency kit (see below).
 - Talk to neighbors about flood preparedness, previous experiences, and any special assistance you or they may need.
- 4 Protect your property and pets from flood hazards.
 - Move vehicles, equipment, and livestock/pets to higher ground and store suitable and hazardous chemicals above flood levels.
 - Anchor and secure propane tanks and other fuel containers.
 - Install check valves in building sewer traps to prevent backflow from backing up in severe drains.
 - Never dump waste in storm drains, ditches or other and animal waste in barn yards, and never release gutters, chimes, and other gneat surfaces. Clean storm drains regularly keep maintenance and help keep our rivers and streams clean for drinking, wildlife, and recreation.

REGISTER FOR ALERTS Visit kingcounty.gov/flood to sign up for alerts for different areas in King County.

DURING

- 1 Do not walk, wade, or drive through flooded areas. Turn around. Don't drown.
- 2 If your vehicle stalls in a flooded area, abandon it as soon as possible. Walk back the way you came to safety.
- 3 Call the King County Flood Warning Center at 206-266-8200 or 800-460-5833 for information on flood conditions and forecasts.
- 4 Be prepared for an evacuation notice from authorities. Be advised to evacuate. Do so immediately. Follow recommended evacuation routes as directions may be blocked.
- 5 If you are unable to safely leave your home or a building due to rapidly rising waters, call 911 for help. Then move to a higher floor or to the roof. Take your most important clothing, flashlight, a mobile phone, and a portable radio.
- 6 When flooding is imminent, but only if time permits:
 - Close your main gas valve.
 - Turn off all utilities in your building at the main power switch. Do not touch any electrical equipment unless it is in a dry area or you are standing on a piece of dry wood and wearing rubber-soled shoes and rubber gloves.
 - Record flood evidence such as time, page readings, and local flood elevations for future use in understanding flooding in your neighborhood. Include specific observations at your home or business.

NEED HELP? Call 206-477-4812 if you need help locking up a property, need to confirm your property is in the floodplain, or want more information about elevation certificates.

AFTER

- 1 Before reentering your home, be cautious of potential structural damage, gas leaks, electrical shorts, and fire wires.
- 2 Have a professional check your heating system electrical panel, outlets, and appliances for safety before using. Call the gas company to have the gas turned back on.
- 3 Follow procedures for safe cleanup of household items, food, water, supply, and property.
- 4 Document your losses. Photograph damage and record repair needs. Contact your insurance agent for flood-loss claims.
- 5 Mark the high water point in your home or damaged structure.
- 6 Pump out flooded basements gradually about one-third of the water per day to avoid structural damage.
- 7 Do not dump sand from sandbags into creeks as it impairs water quality. Store for future use.
- 8 Check your local news outlets for updates on disaster assistance and registration procedures.

<https://kingcounty.gov/services/environment/water-and-land/flooding.aspx>