

Clinician Recommendations Regarding Return of Children to Areas Impacted by Flooding and/or Hurricanes:

Introduction

Children are especially vulnerable to environmental hazards. Despite being smaller than adults, their metabolic rates are higher relative to their size. They breathe and consume more per pound of body weight than adults. The developing fetus and child are susceptible to toxic exposures which can result in profound negative effects. Common exploratory behaviors often place them in direct contact with materials that adults would avoid.

There may be direct and indirect health consequences of floods. Direct exposure to the water and the flooded environment put children at risk for drowning, injuries from debris, chemical contamination, and hypothermia. In addition, there are risks associated with the damage done by the water to the natural and built environment, including infectious diseases, malnutrition, poverty-related diseases, and diseases associated with displaced populations. Key issues for habitability of an area impacted by flooding and/or hurricanes include restoration of drinking water and wastewater treatment facilities, return of safe road conditions, removal of solid waste and debris, and replacement or remediation of flood damaged homes. Before children return, schools and outdoor play areas should be cleaned and ready for use. Children and, whenever possible, teens should not be involved in cleanup efforts but should return after the area is cleaned up. In short, children should be the last group to return to areas impacted by flooding and/or hurricanes.

These recommendations also apply to pregnant women.

Note: This document does not contain specific criteria or a comprehensive list of environmental hazards. The decision to bring children and other residents back to areas impacted by flooding and/or hurricanes rests with local, State, and Federal officials. Standards for environmental testing and clean up should be adopted by local health officials drawing upon relevant existing evidence-based guidelines and in consultation with experts in children's health and the environment. In the aftermath of a flood, particular attention should be paid to issues relating to water contamination and mold, in addition to common pediatric environmental concerns such as physical safety, lead, asbestos, and chemicals.

Health Consequences of Floods

- **Immediate Health Effects**

- Drownings are the leading cause of death from floods and are more likely to occur from flash flooding.
 - Most fatalities occur when using a motor vehicle and attempting to cross flooded roads or from crashes on wet roadways.
 - Drownings also occur during evacuation and rescue.
- Injuries can occur during the flood or upon return to an unstable structure.
- Water close to electrical lines, circuits, or equipment can cause an electrical hazard.
- Floodwaters may disrupt gas lines and chemical storage tanks leading to burns and explosions.
- Hypothermia can occur in any season as most flood water is well below human core body temperature.
- Health services can be impacted resulting in limited access to care for patients.

- **Secondary Health Effects**

- Floodwaters may increase the potential for infectious diseases.
 - Contaminated water can result in waterborne disease transmission (*E.coli*, *Shigella*, *Salmonella*, and Hepatitis A virus)
 - Fecal contamination of livestock and crops may lead to infectious diseases.
 - Temporary shelters may result in crowded and unsanitary living conditions.
 - Vector-borne disease may increase during flooding.
- Chemical contamination can result from the unintended spread of fertilizers, pesticides, and industrial chemicals. An awareness of local land-use is important for assessing this risk.
- Carbon monoxide poisoning is a common risk due to unventilated gas-powered electrical generators, pressure washers, cooking tanks, and house fires.
- Respiratory problems account for high morbidity due to mold and other materials that can be inhaled.

- Animal displacement increases the risk of bites and transmission of diseases to humans by rodents and sick animals.
- **Long-term Health Consequences**
 - Exacerbation of chronic diseases such as asthma, allergies, or ear, nose or throat conditions can occur during the flood and clean-up stages due to poor outdoor and indoor air quality.
 - Mental health problems are common occurrences after disasters, including floods, especially in children.
 - Management of mental health problems in children have not been fully addressed in many disaster plans resulting in poor accessibility for this population.
 - Suicides are 14% higher in adults compared to pre-disaster rates and can increase the mental health consequences in children.
 - Social disruption can result in significant health consequences.
 - Antisocial/violent behavior (e.g. assaults, gunshots, rape)
 - Destruction of public health infrastructure
 - Poor nutrition due to decreased food supplies and livelihood

Optimal health of children requires completing the following items before children return to areas impacted by flooding and/or hurricanes:

- Basic utilities and public services:
 - The water supply is re-established, and water for drinking and bathing must meet applicable existing standards for biological, chemical, and mineral contaminants.
 - The supply of electricity and gas is restored, as applicable, and damage to the transmission system and/or gas pipes is repaired.
 - A reliable food supply that includes infant formula and food is reestablished and appropriate food storage conditions are in place.
 - The communication system including 911 access is restored, reliable, and readily accessible. Families must be able to contact local authorities and health facilities when necessary.
 - Healthcare services, including mental health services, are available and accessible.

- Families returning know the location and status of their nearest medical treatment facility, and the route to reach it is open and passable.
 - Emergency services are functional.
 - Medications and medical supplies are readily accessible.
- The sanitation system (including sewage) is functional and debris and regular trash collection is re-established.
- Living and learning spaces (including homes, schools, and day-care facilities) are free from physical and environmental hazards to children.
 - Buildings are appraised for damage and, if damaged, a decision made to either destroy/rebuild or remediate.
 - If renovating, all flood hazards are addressed.
 - Grossly contaminated wallboard, insulation, flooring, and other porous materials have been safely removed and replaced following existing EPA guidelines.
 - Work should be done by contractors who are properly trained and qualified.
 - If rebuilding, the new structure is completed to the point of safe occupancy
- Spaces where children play should be clear of debris and free from environmental hazards to children
 - Some designated outdoor areas (parks, playgrounds, yards, etc.) have been cleaned and made free of safety hazards and environmental hazards.
 - Areas not-cleaned should be inaccessible to children.
 - Routes to and from living, learning, and playing places have been cleaned and made free of safety hazards and environmental hazards.

More detailed information about the return of children to these areas can be found at the Centers for Disease Control and Prevention web site (www.cdc.gov) and the US Environmental Protection Agency web site (www.epa.gov).

For additional information, contact the Pediatric Environmental Health Specialty Unit serving your area at www.pehsu.net or 1-888-347-2632 or the American Academy of Pediatrics (www.aap.org).

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