

# Flooding preparedness needs to include infection prevention and control strategies

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Flooding can cause clinical and economic damage to a healthcare facility, but reopening a facility after extensive flooding requires infection prevention and control preparedness plans to ensure a safe environment for patients and healthcare workers. In a study published in the February issue of *Infection Control and Hospital Epidemiology*, the journal of the Society for Healthcare Epidemiology of America, clinical investigators report key findings and recommendations related to the closure and re-opening of hospitals impacted by black-water floods. The guidance builds on lessons learned from Thailand and the United States. The findings come as many flood-damaged healthcare facilities in New York and New Jersey look to reopen in the wake of Hurricane Sandy.

"The decision to close a hospital or healthcare system because of extensive flooding involves risk mitigation for the health and safety of both patients and [healthcare workers](#)," said Anucha Apisarntharak, MD, the lead author and an infectious diseases physician at Thammasat University Hospital in Thailand. "Reopening a hospital should be contingent upon assurance of a safe environment that includes clean water for ingestion, [hand hygiene](#), food preparation, and adequate disposal of sewage, waste water, and medical waste."

Reopening of hospitals after excessive flooding requires a balance between meeting the medical needs of the surrounding communities and restoration of a safe hospital environment. Post-flood hospital preparedness plans require interdisciplinary expertise from infection control personnel, environmental health and safety personnel, structural

engineers, [clinical staff](#), and hospital administrators. The authors discuss several practical issues relevant to reopening a healthcare system after extensive flooding:

- Removal of [flood waters](#) and site inspection
- Cleaning and disinfection of surfaces and materials
- Remediation of mold through evaluation of [mold growth](#) in impacted area, including the heating, ventilation, and air conditioning (HVAC) system
- Restoration of air flow
- Post-flood surveillance of water and air samples and for outbreaks of flood-related infectious diseases

Lessons learned following Hurricane Ike in Galveston, Texas in 2008 provide a foundation for future design, execution, and analysis of black-water flood preparedness. Following the storm many generators and building points of entry for utilities at the University of Texas Medical Branch in Galveston were flooded; electrical power, telephone services, fire alarm systems, information systems, HVAC systems, and most elevators were nonfunctional. The water systems were closed off before the hurricane and remained off for 5-6 days; the linear accelerators in the radiation oncology department were destroyed.

To prevent serious losses from future floods, new linear accelerators were placed in vaults with water-tight doors, all incoming utilities were raised 20 feet, and generators were moved to higher elevations. Three and a half years after the hurricane, a new bed tower is being constructed; all essential services will be located on the upper floors of the support building and new hospital. The first floors of the new hospital and support building will be 12 feet above sea level, and the second floors will be 25 feet above sea level.

Even resource-limited hospitals, like those in Thailand would benefit from such measures. A recent survey of Thai hospitals found that while many hospitals throughout the country had flood protocols similar to those taken in Galveston, only 52 percent had performed protocol-related exercises. The authors estimate that flooding accounted for an estimated loss of \$4.8 million USD per hospital associated with extensive floods.

Additionally, while protocols can be costly, measures to ensure a safe post-flood [hospital environment](#) are not necessarily resource dependent. A post-flood study conducted at a Thai hospital reported use of settle plates, an evaluation measuring the airborne viable particles that settle on a plate of medium, for measuring fungal bioburden where air sampling in open units may be cost prohibitive.

"Time and again, we have seen hospitals worldwide suffer devastating clinical and economic implications as a result of catastrophic flooding," said Apisarnthanarak. "The healthcare community needs to come together, from infection control epidemiologists to hospital administration, to effectively create and implement flood preparedness plans that can mitigate risks both to patient safety and structural damage."

**More information:** Anucha Apisarnthanarak, Linda M. Mundy, Thana Khawcharoenporn, C. Glen Mayhall. "Hospital Infection Prevention and Control Issues Relevant to Extensive Floods." *Infection Control and Hospital Epidemiology* 34:2 (February 2013).

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