Medical Preparedness for Water Contamination Events: “Lessons Learned” from Katrina

Case Study – Session 5.05

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Medical Preparedness and Response for Water Contamination Events

The massive water contamination caused by Katrina highlights the critical need to incorporate disaster preparedness for *water supply disruption* and *contamination* into every community’s emergency response and public health planning.
Medical Preparedness and Response for Water Contamination Events

Many unique medical, public health, and preparedness challenges are created when water systems are damaged by natural disasters, man-made accidents, or terrorist activity.
Contamination of water reserves is a serious public health threat since…

- Safe drinking water is vital for human survival.
- Water is essential for basic hygiene and modern sanitation.
- Water use is key to every sector of our industrialized economy.
- Uncontaminated water is crucial to food production and livestock health.
Contamination of a community’s water supply with biological, chemical or radiologic agents may result from:

- Natural disasters such as hurricanes, floods, and earthquakes
- Manmade accidents such as chemical or radiologic releases in source water
- Intentional contamination or acts of water terrorism
Even short-term disruption of potable water supplies can significantly impact a community.

Contamination of municipal water systems can lead to serious medical, public health, and economic consequences for a community.
Serious Health Consequences of Water Contamination and Waterborne Disease

Waterborne Cryptosporidiosis Outbreak in Milwaukee, Wisconsin (1993)

- 403,000 Milwaukee residents developed diarrhea reflecting an **attack rate of 52%** of the population.

- Over 4,000 residents hospitalized with cryptosporidiosis listed as the underlying or contributory **cause of death in 100 patients**.

- 725,000 productive days lost costing **$54 million** in lost time and associated expenses for the Milwaukee community.
Serious Health Consequences of Water Contamination and Waterborne Disease

Waterborne E. coli O157:H7 Outbreak in Walkerton, Ontario (2000)

- 2,300 residents severely ill with seven deaths, mainly children
- $70 million attributed to class action settlement
- $11 million spent on reconstruction of municipal water system
- Total cost of outbreak $155 million to date
Disaster Preparedness and Response for Water Contamination Events

HURRICANE KATRINA’S IMPACT ON WATER SYSTEMS

Photo/Associated Press/National Oceanic and Atmospheric Administration
Preliminary Damage Estimates to Water Systems Resulting from Katrina

- 1,236 public water systems damaged or destroyed in LA and MS alone
- 200 sewage treatment plants affected in LA, MS, AL
- Loss of power to lift stations created sewage overflow into homes and streets
- Fecal and chemical contamination of water distribution pipes and source water
In the hardest hit, high impact counties of Louisiana and Mississippi, the estimated cost of repairing just the water supply infrastructure…

$2.25 Billion
Preliminary Cost Estimates of Public Water Systems Damage by Katrina

This $2.25 billion cost estimate does NOT include...

- Remediation costs from Hurricane Rita
- Costs of repairing and replacing wastewater treatment plants
- Clean-up costs of source water contamination
- Costs of providing alternative water until remediation completed
Disaster Preparedness and Response for Water Contamination Events

UNIQUE CHALLENGES FOR WATER CONTAMINATION EVENTS

“LESSONS LEARNED” FROM KATRINA
Water systems are complex networks with components that need to be prioritized during and after a water disaster in order to protect the public’s health.
Provide and distribute alternative potable water to thousands of residents impacted by the disruption of water distribution systems throughout the Gulf Region.
Post Katrina Water Contamination Challenges

Remove and dispose millions of gallons of contaminated and standing water from residential areas and industrial facilities throughout New Orleans.
Post Katrina Water Contamination Challenges

Repair and restore more than 1200 water supply facilities including clean up of contaminated water plants, distribution pipes, water storage units, mechanical and electrical equipment, and related computer control systems for each utility.

Courtesy of the US EPA
Flush and sanitize every contaminated water distribution line including service to all residences and industrial facilities and repair hundreds of underground water main pipe breaks resulting from flood damage.
Drain and repair hundreds of wastewater treatment systems including cleaning, vacuuming, and pumping contaminated storm drains – total of **55,000 storm drains** in New Orleans alone.
Remediate and restore quality source water including rivers, lakes, and groundwater that supply water to public drinking water systems and test thousands of private wells supplying drinking water to rural areas in the Gulf.
Key Disaster and Terrorism Preparedness Strategy for ALL States

Preventing water contamination resulting from natural disasters, man-made accidents, or water terrorism is critical for ALL local and state disaster response and public health protection.
Key Disaster and Terrorism Preparedness Strategy for ALL States

Careful disaster preparedness for water contamination events may make the difference between a *controlled response* to a water contamination event versus a *public health crisis* in your community.
Water contamination poses several unique preparedness challenges that require specific pre-incident planning and post-event response strategies.

Disaster response strategies for water contamination have broad application to preparedness for all types of hazards from natural, manmade, and intentional contamination of water.
Disaster Preparedness and Response for Water Contamination Events

KEY WATER DISASTER RESPONSE STRATEGIES

Courtesy of FEMA
Key Water Disaster Response Strategies

Strategy One

Appreciate the fact that preparedness for water contamination events is critical in order to reduce...

- *public health and medical impact* of water contamination
- *secondary disruption* to potable water and wastewater treatment necessary for sanitation
- psychological impact of *public’s lack of confidence* in water safety and quality
The wind and rain have died down. But the hurricane left behind a toxic healthcare crisis.

Hurricane Katrina blew the roof off Ron Smith's New Orleans house. He hitchhiked out of town, spent a night in a darkened HoJo's lobby and, later, *waded through fetid waters back home*. But those were the least of his problems. For two decades, Smith, 53, has battled HIV, and in the wake of the storm, with clinics flooded and physicians scattered, he missed more than a month of experimental treatments—treatments he believes were helping to counteract his body's growing resistance to standard drug therapy. He dropped 15 pounds and his healthy T-cell count plummeted. It's an ongoing struggle, says Smith, but "I refuse to give up and die."

http://www.msnbc.msn.com/id/10313007/site/newsweek/
Ensure that alternative sources of drinking water are in place to guarantee affected communities have adequate potable water for days to weeks to months after a water contamination event.
Include advanced planning for provision of other critical water needs for food preparation, sanitation, and commerce.
Key Water Disaster Response Strategies

Strategy Four

Prioritize the special needs of susceptible populations who are most at risk for illness and death from dehydration, waterborne disease, and the health effects of water contamination.

Water-related disease may present as benign symptoms in a healthy population while the same exposure in a vulnerable population may result in significant illness and death.
Dead fish were found floating in the area of Many’s water intake structure after Hurricane Rita caused a buildup of raw sewage to spill from the town’s wastewater treatment plant. However, the water has been tested and found free of bacteria. (Special to The Times)

Many water safe to drink despite fish kill in the area

Officials investigate if sewage overflow is to blame.
October 4, 2005
By Vickie Welborn

Understand the vital role of LOCAL medical and public health practitioners as “front-line responders” in detecting and managing water-related disease resulting from exposure to flooded or contaminated water.
GOVERNMENT & MEDICINE

Preparing for the worst: Are America’s doctors ready?

The Dept. of Homeland Security’s first “top doc” urges physicians to get informed about their communities’ emergency response plans – before disaster strikes.

By Amy Sno Landa, AMNews correspondent. March 6, 2006
Key Water Disaster Response Strategies

Strategy Six

Appreciate the multiple pathways for human exposure to contaminated water during a water disaster or event including...

- Ingestion and aspiration of water
- Dermal absorption during recovery efforts or bathing with contaminated water
- Consumption of food directly contaminated with water during food preparation
- Consumption of food directly contaminated by water via food chain or agricultural practices
Key Water Disaster Response Strategies

Strategy Seven

Recognize that many of the water-related diseases and syndromes associated with disaster events may be unusual presentations of disease not commonly seen in the community.

- Vibrio vulnificus
- Vibrio parahaemolyticus
- Leptospirosis
- Trench foot or Immersion foot
- Legionella sp.
- Waterborne E. coli

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Key Water Disaster Response Strategies
Strategy Eight

Anticipate the specific challenges of evaluating and managing water-related disease associated with exposure to chemical agents in flooded or contaminated water.

The spectrum of medical sequelae ranges from mild symptoms to severe tissue damage depending upon the toxicologic profile of the waterborne chemical agent.
Medical Challenges from Chemical Contamination of Katrina Flood Waters

Preliminary estimates indicate contaminated waters in New Orleans contained:

- **6.7 million gallons of petroleum** from damaged refineries
- Chemical contamination from more than **390 oil spills**
- **1 to 2 million gallons of gasoline** from damaged gas stations
- Chemical release from more than **300,000 flooded automobiles**
Preliminary estimates indicate contaminated waters in New Orleans contained:

- **31 hazardous waste sites** in affected region
- **446 industrial facilities** in flood zone that used hazardous compounds including lead, mercury, hexavalent chromium, arsenic, benzene, and pesticides
Key Water Disaster Response Strategies
Strategy Nine

Appreciate co-infections with waterborne pathogens coupled with multiple chemical agent exposure in contaminated water may result in BOTH acute and delayed symptoms complicating accurate and timely diagnosis.
Understand that with respect to water contamination, disaster planning is critical in both populated and rural areas.

Water systems in small rural communities are equally at risk as large municipal water systems and preparedness is vital -- no matter how small or large the community.
Key Water Disaster Response Strategies

Strategy Eleven

Prepare for significant surge capacity at medical facilities based upon the potential for large numbers of seriously ill patients exposed to contaminated water concurrently.

(CP Photo Kevin Frayer)
Key Water Disaster Response Strategies
Strategy Twelve

Anticipate that water-related illness and injury in vulnerable populations can be deadly and that these patients may require sophisticated medical intervention and emergency evacuation.

 Courtesy of FEMA
Key Water Disaster Response Strategies

Strategy Thirteen

Protect emergency response and medical workers, National Guard troops, and water utility and public works personnel who may be at increased risk for water-related disease during and after a water contamination event.

courtesy of abc.net.au
Key Water Disaster Response Strategies
Strategy Fourteen

Provide emergency and medical workers with special protective equipment and risk reduction training before and during a water disaster.
Health Hazard Evaluation of Police Officers and Firefighters After Hurricane Katrina

Reports of increased injuries and illness among New Orleans police officers and firefighters prompted CDC to conduct a health hazard evaluation of these two groups.
Health Hazard Evaluation of Police Officers and Firefighters After Hurricane Katrina

Results of study indicated Katrina floodwaters contact with mucous membranes (nose, mouth, or eye) reported by:

- 51% of NO firefighters (254 of 500)
- 30% of NO police officers (258 of 864)
- 52% of NO police officers and 63% of NO firefighters reported rescuing citizens from flooded areas.

Courtesy of FEMA
Health Hazard Evaluation of Police Officers and Firefighters After Hurricane Katrina

New Orleans police officers and firefighters reported *similar prevalence of health symptoms* after exposure to floodwater:

**Upper respiratory symptoms (head/sinus congestion or nose/throat irritation)**
- 28% of police officers (236 of 848)
- 31% of firefighters (162 of 525)

**Cough**
- 21% of police officers (236 of 848)
- 23% of firefighters (124 of 525)

**Skin rash**
- 54% of police officers (493 of 909)
- 49% of firefighters (258 of 525)
The prevalence of reported respiratory symptoms, skin rashes, and injuries were similar to those reported by Katrina relief workers through active CDC surveillance in the greater New Orleans area.

Among all police officers, 31% reported seeing a healthcare provider for post-hurricane illnesses and injuries four weeks after the event.
These results underscore the need to incorporate safety and health guidelines for medical and emergency responders, police officers, firefighters, and public works workers into existing disaster preparedness plans.

These plans should include periodic disaster response training and education in tasks unique to disaster situations.
Health Hazard Evaluation of Police Officers and Firefighters After Hurricane Katrina

Clinical *follow-up of the health of emergency responders* should be conducted to better understand, monitor, and treat their health conditions on an ongoing basis.
Every day across the nation, emergencies occur that threaten our lives, well-being, property, peace, and security. Every day, we rely upon our local police officers, firefighters, emergency medical technicians, public health professionals, and others to arrive quickly and do what needs to be done to restore the safety, the security, the peace, and the routine to our lives...

When a disaster, whether natural or manmade, overwhelms the resources and capabilities of local organizations, responders come in from other cities, counties, and states-jurisdictions near and far-as well as from federal agencies, to assist those with local responsibility...
Storm and flood cleanup activities can be hazardous. Workers and volunteers involved with flood cleanup should be aware of the potential dangers involved, and the proper safety precautions. Work-related hazards that could be encountered include: electrical hazards, Carbon Monoxide, musculoskeletal hazards, heat stress, motor vehicles, hazardous materials, fire, confined spaces and falls. Links to information about hazards associated with storm and flood cleanup can be found below. This information is intended to help employers and workers prepare in advance for anticipated response activities, and to prevent work-related injuries and illnesses in the field once rescue, recovery, and clean-up begin.

http://www.cdc.gov/niosh/topics/flood/
Implement preparedness strategies and countermeasures that address BOTH short- and long-term consequences of water contamination events.

Understand water contamination events have the potential to produce delayed, prolonged, and environmentally mediated health effects for weeks or even years in a community.
Prepare for and provide credible and timely risk communication to educate the public about water contamination risks so that they may minimize their exposure.
Key Water Disaster Response Strategies

Strategy Seventeen

*Develop collaborative partnerships with a MULTI-disciplinary TEAM approach to prepare for and respond to water contamination events locally and regionally including:*

- healthcare providers
- public health officials
- water utility practitioners
- emergency management and disaster response personnel
- National Guard and law enforcement professionals
- state/local government officials and community leaders
- public risk communicators and media representatives
- public and private sector industry and small businesses
Appreciate the fact that each member of this team must understand their critical role and the importance of communicating effectively, coordinating their efforts, and collaborating together to protect the public’s health in the event of a water contamination event.
Disaster Response Partnership for Water Contamination Events

Drinking Water & Law Enforcement Professionals

Patients
Water Consumers

Public Health & Community Leaders

Medical & Emergency Response Community
Key Water Disaster Response Strategies

Strategy Nineteen

Include water disruption and major water contamination in local and state exercise scenarios, comprehensive table top exercises, and emergency response plans.

Customize these scenarios to reflect field conditions at the local, state or regional level that address water hazards specific to area needs.

Courtesy of FEMA
Key Water Disaster Response Strategies
Strategy Twenty

Arm your medical, public health, emergency response and disaster management teams with information and ready made disaster tools addressing biological, chemical or radiologic contamination from natural, man-made or intentional contamination of water.
Recognizing Waterborne Disease and the Health Effects of Water Pollution

Medical On-Line Reference Guide (WaterHealthConnection.org)

Created to assist the medical, public health, and emergency response community recognize and manage waterborne disease and the health effects of water contamination from either *natural OR intentional* contamination of water.
Medical Preparedness for Water Contamination Events

www.WaterHealthConnection.org

A “ready made” disaster tool for the public health, medical, and disaster preparedness community who may be faced with managing water-related disease resulting from ALL types of water hazards and disasters in their communities.