Infection Control Response to Hurricane Ike
Pam Falk, MPH, Director, Healthcare Epidemiology, UTMB
A Webber Training Teleclass

Hosted by Paul Webber
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Evacuation Planning
Houston Galveston Study
Area Mean Sea Level

UTMB Campus

Evacuation Planning

UTMB Campus

Evacuation – 9/11/08
- 469 patients from inpatient tower, correctional hospital and behavioral health facility;
- Transported to Austin, San Antonio and Dallas-Fort Worth
- Patient evacuation completed in approximately 11 hours

Evacuation
- > 140 by Ground Ambulance
- > 82 by Bus / Multipassenger Ground
- 23 via Helicopter Flights
- 48 via Fixed Wing Flights
- 73 discharged, transported by private vehicle
- 102 Correctional by Medical / Security Transport

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Ike Hits Galveston

17FT Seawall

Seawall Boulevard, Friday Morning, September 12, 2008

Ike’s Impact on UTMB

Plaza in front of Ashbel Smith Building, “Old Red,” Friday afternoon

1900 Storm Memorial

1900 Storm Memorial

The Dehumidification of UTMB

UTMB Hospital Main Corridor

Cleaning of Moody Medical Library

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33" Interior Water Mark in office of Healthcare Epidemiology

Temporary Kitchen and Food Tent

Temporary Showers and Portable Toilets

Pumping Water from Buildings

Initial Infection Control Assessment
I. Environmental surface contamination
   A. Bacteria
   B. Fungi
   C. Nontuberculous mycobacteria
II. Water contamination
   A. Bacteria
   B. Fungi
   C. Legionella
   D. Nontuberculous mycobacteria
III. Air contamination
   A. Fungi
   B. Legionella

What should we do now?

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Assessment of Surfaces

**Question?**

- Did the storm cause bacteria and fungi to grow on the environmental surfaces of the hospital that were not wet from storm water or effected by wind?

Assessment of Surfaces

- All environmental sites were first cleaned with a hospital grade disinfectant (quaternary ammonium)
- Beds, chairs, monitors, IV poles, headwalls etc were all cultured with a moistened swab
- The swabs were plated on media for bacteria and fungi.

Assessment of Surfaces

- We cultured 500 sites
- We found very few pathogenic bacteria (primarily gram negative rods) and fungi
- We concluded that the storm had little impact on the environmental surfaces in the hospital

Water Assessment

The water in the hospital plumbing remained stagnant for several weeks.

**Question?**

- Did the stagnant water support the growth of bacteria, fungi or legionella?
- Did a glycocalyx in the pipes support the growth of the bacteria, fungi and legionella?

Water assessment: bacteria

- Random samples of bacteria were taken from the clinical areas
- Threshold for bacteria was <50 cfu/ml
- Results: most unit based handwashing sinks and bathroom sinks had bacteria >50 cfu/ml
- Faucets were flushed (purged) for 5 to 30 minutes over several weeks and periodically cultured
- Eventually bacteria were found to be below the threshold

Water-assessment: fungi

- The same water sampled for bacteria was sampled for fungi
- The fungal growth was so infrequent that the assessment was discontinued

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When 30% of water samples taken from outlets (faucets) of the water distribution system are culture positive for Legionella, patients are at risk for Legionella infection.

10 unique hot water samples are suggested from each water system.

Results: samples showed > 30% of water cultured from all three buildings had legionella pneumophilia type 1.

**Water Remediation: Legionella**

- **Super heating**
  - Bring temperature in all pipes to 60°-77°C
  - Water should remain in pipes 20-30 minutes
  - Take temperature at distal end of the faucet
  - Dead legs can significantly effect results
  - Must flush all faucets in the building after superheating
  - Care should be taken not to scald patient and employees with hot water
  - Process may not offer long-term remediation

**Chlorine dioxide**

- Infuse it into the system by professional
- Required to sit in system until chemical diffuses to distal end for about 1 hour
- ClO₂ test strips or spectrophotometer test to assure chemical is at distal end
- Must flush all faucets in building to eliminate residual chemical

**Water Remediation: Chlorine dioxide**

Chlorine dioxide (ClO₂) can be generated by an electrolytic method from sodium chlorite (NaClO₂).

**Water Remediation: Copper Silver Ionization**

- Attach an ionizer to the hot water system
- The ionizer sends a steady stream of copper and silver ions into the water
- Copper and silver are known to have antibacterial properties
- The number of sites positive for legionella bacteria should be reduced to < 30%
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Water Remediation: Copper-Silver Ionization

Copper and silver ions are introduced into the hot water system at a concentration of:
- Copper: 0.2 – 0.4 mg/L
- Silver: 0.02 – 0.04 mg/L

Flow cell houses electrodes made of copper and silver alloy.

Air Quality Assessment

Question?
- Was the air quality in the Operating rooms and other patient care areas compromised after the hurricane?

Air Quality Assessment: Physical Plant

HVAC System
- Are the filters on the air handlers seated properly?
- Are the fan coils in good repair?
- Was the HVAC system rebalanced?
- Are the air ducts clean and dry?
- Is the insulation clean and dry?

Before Duct Cleaning

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Air Quality Assessment: fungi

- Air cultures were taken with an high volume air sampler called a Casella (flow rate 700 l/min)
- Air cultures were also taken with an air sampler called a SAS (flow rate 180 l/min)
- Thresholds in the OR are <3cfu/m³ and no pathogenic fungi such as A. fumigatus, A. flavus, A. terreus, or Zygomycetes or Fusarium
- Thresholds in the patient care areas are <15 cfu/m³ and minimum pathogenic fungi

Air Quality: Remediation

- Air ducts were cleaned
- Turning veins were cleaned
- Fan coils were cleaned
- Condensation pans were cleaned
- Filters were replaced and gaskets changed
- Filters were upgraded
- Air systems were rebalanced

Air Quality: Epidemiology

- Air samples were taken twice a week
- Results were immediately fed back to a committee
- Experts were consulted about cleaning, filter choices and air balancing

Air Quality: Containment

Air Quality: HEPA FILTERED AIR

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Air Quality: Vacuum off people

Air Quality: Air Tubes

Air Quality: Ducts

Air Quality: Ducts

Air Quality: Ducts

Air Quality: Ducts

Conclusion

• After Ike we were concerned about surface, water and air contamination.
• Surfaces were successfully cleaned with a hospital-grade disinfectant.
• Bacteria and fungi in the water were successfully removed by constant flushing of the system.
• Legionella remediation is an ongoing project (Many institutions have a constant flow of copper silver ions to decontaminate the water).
• Air quality drastically improved after the ducts were cleaned and breaches in the ventilation system were repaired.

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