

# August 2, 2011 Medical Response to Joplin Tornado May 22, 2011

## **Agenda Items:**

### *Immediate Impact*

Dennis Manley, RN, Director of Risk Management - Mercy St. Johns

### *The Day After*

Steve Bollin, Regional Vice President, Support Services - Mercy St. Johns

### *Clinical Impact*

Dr. Robert Dodson, MD, FACS, Trauma Director, Medical Staff President - Mercy St. Johns

### *IT and the EMR*

Ron Fovargue, Vice President - Mercy Technology Services, West

### *Impact/Surge Freeman Hospital*

Bob Denton, RN, PA, Director of Emergency and Trauma Services - Freeman Health System

Renee Denton, RN, BSN, Director of Medical, Oncology, and Pediatric Services - Freeman Health System

## **Video Materials:**

A DVD of the presentation will be available in approximately 30 days.

## **Background:**

On May 22, 2011 at 5:17 p.m. the National Weather Service issues a tornado warning that included the City of Joplin. The lead-time before impact was 24 minutes. The tornado was rated an EF-5 with winds exceeding 200 mph. The tornado traveled from west to east along 32<sup>nd</sup> street cutting a 3/4 to 1 mile wide over 13.8 miles. The tornado eye was approximately 300 yards wide.

Mercy St. Johns Hospital took a direct hit, initial and secondary, on the west facade with duration of approximately 45 seconds. There was a lull as the eye passed through the facility. 160 deaths in the community resulted from this storm. 8,000 structures were destroyed. 400 business destroyed, 8 school buildings destroyed, 18,000 vehicles destroyed, and 4,500 jobs displaced.

When St. Johns took the direct hit, the generators were destroyed. The roof was peeled off and all rooftop HCAV equipment destroyed, most of which landed in the parking lots and on top of other facility equipment. All communications were immediately lost. The facility fire suppression sprinklers discharged and lines were broken. Several walls moved and the floors lifted vertically. The building shifted off its foundation.

Doors were torn from their hinges, all of the glass was blown out of the building except the high impact shatter resistant glass in the psychiatric ward, gas lines were broken, sewer lines were destroyed with raw sewage projected throughout the facility, and 86 medical offices were destroyed.

The oxygen tank was severely damaged, and discharged all of the liquid oxygen. There was a strong smell of natural gas throughout the building and all over the campus. Water discharged by the fire suppression system left the rooms and hallways with 3 to 6 inches of standing water.

Everything from the size of an IV pole to a chiller became a projectile. Automobiles were 8 deep in the parking lot and several automobiles were deposited in the parking lots from the surrounding community. The air evacuation helicopter was destroyed. Typically the helicopter would have been moved to a local airport; however, the storm track did not predict impact to the hospital and the weather conditions prevented safe flight. All hospital vehicles, except a John Deere tractor, were destroyed and the emergency trailer was found in pieces several blocks away.

Everyone in the facility thought they were going to die. Nurses evacuated patients to the hallways per their procedures, and at the time of impact, nurses covered patients with their bodies to offer as much protection as possible. IVs were ripped from patients' arms, the IV poles became projectiles, and several patients were bleeding as a result.

The ceilings collapsed, electrical, IT, and HVAC equipment dropped and littered the hallways. All emergency lights and exit signs were ripped from their mounts and were useless. The walls of exit stairwells cracked. Extremely heavy doors were ripped from their hinges and became projectiles. The doors were later used as backboards for patients.

Both incident command centers were destroyed and Emergency Operations Plans (EOP) lost in the debris. The facility was filled with hazardous waste and the radioactive material was unsecured. Outside debris was mixed and power lines were down.

Note: If the tornado had moved just two blocks south, Freeman would also have been destroyed. Freeman did suffer some physical damage that resulted in internal evacuation of at least 6 patient rooms.

#### **Immediate Response Considerations:**

- Failure of the generators to start saved lives. Had the generators started there was an extremely high probability of electrocution and possible explosion from natural gas.
- During Code Grey Level I, place patient shoes on bed with patient so they are available in the event of an evacuation.
- Computers will be lost - have recall information in print and located at various points throughout building. See comments below regarding "grab bags" and "downtime kits".
- Disaster planning and exercises are the key to survival - not the disaster plan.
- Use portable DOT flashing roadway signs to instruct employees with contact information.
- Staff management is paramount. You need to have staff available for relief.
- The national exercise occurred just weeks before and the Hospital credits that exercise for the high survival rate and level of preparedness. All presenters talked about the value of exercises and the limited value of written plans.
- Drug dispensing machines are useless in this type of disaster. Staff had to break into the machines to gain access to life-saving drugs.
- ID badges need to be backed up with wallet identification cards for employees. Several staff members lost their homes and automobiles and the badges went with them in many cases. National Guard troops refused to allow staff into the area because of no identification.
- Pharmacies need to be guarded with armed security.
- Have contracts set up with mobile kitchens, pharmacy, and radiology.
- Have plenty of flashlights and fresh batteries.

- Create downtime kits with paper forms and pens/pencils for IT/IS and electrical outages.
- Disaster recall list must be in printed form. Have available in multiple locations.
- Disaster supplies may not be accessible or transportable - consider in planning.
- People will try to recover their cars and will arrive with tow truck drivers. Have a security process in place for proper identification. Several people tried to leave with cars they did not own. Lock down the facility until those procedures are established.
- The hospital needs access to several utility terrain vehicles (UTV) for equipment and patient transport.
- Electronic medical records were essential to the continuum of care for patients and for identifying physicians who were onsite during the initial impact. More to follow.
- St. Johns had a census of 183 at the time the storm hit. They were deliberately at low census because they were in the final phases of EMR implementation.
- When you evacuate patients to the hallways during a Code Grey, consider removing all IV's if there is a reasonable certainty the Hospital will be struck by the tornado. Again, IV poles became projectiles.
- Doctors and Nurses self-reported to EMS sites when they realized they could not access the Hospital. Paramedics and EMTs provided the bulk of the immediate care with several EMS stations (ambulances) set up at various points along the path of the tornado.
- During the immediate response (over a couple of days) 100 EMS units arrived from seven states.
- High-impact shatter-resistant glass survived. Hospital storm shutters did not. The steel shutters on the west side of the building were shredded.
- Communication was reestablished via a trailer dispatched to Joplin with a satellite uplink and an 800 MHz radio system.
- Communications is not yet interoperable. Security forces and public safety could not communicate with each other due to variation in radio systems. Ambulance radios became the communication infrastructure during the initial response.
- Security teams need to be in the same uniform, have common identification, and common radio frequencies. There is a real problem with identification of personnel once the sun goes down. Also, your contracted security officers will be unfamiliar with the site and you will be unfamiliar with them.
- Mercy St. Johns realized the need to retain their employees and kept every employee full on payroll throughout the event and continues to do so. They want to retain the skills of their staff once they recover and knew they could do that if they kept the pay intact. However, when staff was assigned to Freeman, the two hospitals shared in the employee expense.
- Know that you will need to find a way to feed, rest, and provide water and personal comforts to staff. This is very difficult in a destroyed facility.
- During evacuation, the OB nurses placed the babies in the arms of the fathers and assisted with evacuation of the mothers. This was an important step in the process in terms of infant identification and tracking.

### **Evacuation:**

“Evacuation was nearly impossible.”

- Mercy St. Johns used what is described as the reverse START process found in our evacuation plan.

- The team discharged everyone they could; however, most of the patients had no home to go to and elected to stay in the healthcare system as long as possible.
- There will be showers and blowing of glass everywhere in the initial and follow-on storms. Expect to deal with many injuries from the facility debris.
- Doors blown off the hinges served as backboards.
- Privately Owned Vehicles (POV), especially pickup trucks, are vital in transporting patients. Hospital beds were placed in truck beds and nurses rode in the beds holding IV bags as patients were evacuated to Freeman.
- Patient tracking was a nightmare. It took about 4 days to positively locate all of Th. Evacuated patients. Many were sent to hospitals a great distance from St. Johns.
- The heliport was unusable and two temporary heliports were constructed in the parking lot.
- Anything that could be used to move a patient was used. Hospital evacuation sleds, doors, wheelchairs, and mattresses were used to move patients down 9 flights of stairs that were dark and littered with debris.
- Triage: critical patients were sent to Freeman. ED and injured patients were treated outside the ED. The ED did not survive the initial tornado impact. Self-presenting patients were triaged in the parking lot outside the ED.
- By the next morning following the storm, the Hospital was completely cleared of patients and staff.
- The overhead paging system was out and there was no facility-wide communication system. Nursing staff immediately began mass evacuation of the facility as soon as they determined it was as safe as possible to move patients.
- The Hospital had three predetermined collection points (muster stations) to evacuate to. Having this in place assisted with identification of patients and accounting for staff. This is part of their evacuation plan and was either taught or practiced earlier.
- Public self-presented during the evacuation. This is a situation that you have to manage. It is best to include this in planning rather than wait to determine how to deal with it real-time.

Summary: Within a few hours, St. Johns evacuated 183 patients, completed one surgical case while the storm was in progress, had 1 patients in the PACU, 24 ED patients, and 28 critical care patients were among the evacuees.

**Special Immediate Concerns:**

- Physicians and staff experienced having their homes looted while they attempted to save patients' lives.
- One employee, a 22-year-old female, was informed she had just lost her entire family. She volunteered to keep working but was given time off and provided assistance instead.
- There were attempts to loot property and drugs from the hospital and physicians' offices.
- Hospitals need deployable incident command centers rather than fixed.
- Interoperable communications was an immediate and continuing concern.
- Field responders did not know St. Johns was destroyed and attempted to send patients.
- Security forces came in a variety of uniforms, no common identification, and no common radio frequency. Also, in an event of this magnitude, the Hospital will require armed security.
- Paper medical records were drenched and began to grow mold within a day of the event. Special cleaning and recovery was necessary. Iron Mountain managed the Hospital's record recovery.

- Hospitals need the ability to install at a least a 6' steel chain-link fence around the perimeter as soon as possible following the initial event.
- Debris removal will require an extraordinary amount of equipment and resources.
- Alternate Care Sites (ACS) were established, and contributed to saving several lives.
- Hand-pick the ACS staff and be sure they are seasoned care providers capable of handling the stress and the reality of the significance of the injuries sustained.
- Have a plan in place to move IT/IS equipment to your alternate care sites and you will need to establish a PBX phone system on that site with an established set of phone numbers.
- The press needs to be managed and you need to be in control of your message.
- Be sure to have a representative in the City/County EOC.
- Know your staff was personally affected by the storm, many lost family members and homes. Many were not prepared to see the level of trauma and had difficulty dealing with the reality of this event. Nearly all required debriefing and employee support services.
- You will need to get portable toilets to the site as soon as possible.
- Employ a talent-sharing program to deploy your employees to other facilities.
- Know whom your local, state, and federal response partners are and have an established relationship with them prior to any event.
- In an event of this magnitude, if you try to survive in your facility, you cannot do it. You will need to evacuate the facility as soon as it is safe to do so.
- Always assume your facility is structurally unsound until proven otherwise by structural engineers.
- During your emergency planning process, include everyone and do not allow anyone to avoid the planning process, including and especially your medical staff.
- Just-in-time (JIT) delivery systems do not work in disasters. They are great for the bottom line under normal circumstances but will not work during emergencies.
- The 96 hours of self-sustainability is a myth. The 96-hour cache of emergencies was consumed in total in less than 4 hours.
- Hospitals need to consider building bunkers onsite to house incident command documents, back-up communication resources, and emergency supplies. The bunker should be positioned to avoid potential debris fields.
- Is your hospital policy written to allow the public to shelter in your facility? If so, you need to rethink it and plan instead to lock down the facility in the event of a disaster.
- Pre-event MOUs and MOAs are good to have in place; however, it may be several days before you can communicate with your vendors and many of them may be affected by the event. Your only means of communication for a period of time may be EMS radios. While the Hospital is attempting to save lives, EMS crews are also engaged in the same battle and may not be available to assist with communications.

### **Recovery Process:**

Recover from onset of disaster

Reestablish Capabilities

Rebuild

- The first step is security of the facility and campus. The next morning after the event, the mass evacuation was complete and the facility was cleared.

- A Security Rapid Response Team should be established in advance of an event of this magnitude. As stated earlier, contracted security forces need to be in the same uniform and on the same radio frequencies as the Hospital security forces.
- The hospital attempted to use a 4' snow fence for site security but later found it necessary to construct a 6' chain-link fence.
- Vehicles and fuel need to be available and agreements must be in place to have them delivered from locations outside the affected area. The delivery mechanism should be established to happen without telephone contact. No phone service available. The types of vehicles needed should be predetermined.
- Tent operations became the first means of providing medical services followed by portable facilities. The tents required 14 large generators.
- Mercy has a Resource Optimization and Innovation (ROI) process in the Mercy Supply Arm of the business. They had a semi loaded with supplies moving towards Joplin within one hour of the tornado.
- The portable surgical, kitchen, lab, and pharmacy units were leased from Johnson Portables - Meatspace. <http://www.sjohnsonportables.com/meatspace-portable-building>
- The kitchen was provided by Swadley's Relief Trailer Nationwide Mobile Kitchen. One web site for disaster kitchens: <http://www.merkrentals.org/>.
- The Hospital began assembling "Component Built Hospital" space to create a more permanent medical facility. It was suggested that when selecting this system, use a FEMA consultant prior to putting this out for bid to ensure the best possibility of financial recovery.
- Component Built Hospital systems are designed for rapid expansion with quick disconnects between modules for electrical, plumbing, and medical gases.
- Additionally, the Hospital needs to bring a portable shower facility on site.
- IT/IS trailer was essential in connecting all of the portable facilities. "IT in a Trailer".

#### **Lessons Learned at This Point in Response/Recovery:**

- Interoperable communication is a must. The Hospital and response partners were not on common frequencies and could not communicate effectively.
- Purchase solar charging stations for cellular phones and radio batteries.
- Texting and social media did work during this disaster when the phone systems were down. It is suggested that all staff be taught to and have capability to text.
- Hospital telephone numbers were rolled over to a PBX system in Springfield. The PBX system took 2,500 calls the first day.
- Telephone landlines are vital.
- Sprint dedicated one functional tower to the Hospital during the response.
- IT support is critical.
- Electronic Medical Records were essential to the continuum of patient care and for identification of practitioners who were in the facility at the time of impact.
- Know that your reserve supplies will be inadequate or may be lost. A 96-hour cache of supplies may last as few as 4 hours because of the unanticipated demand.
- If the generators operated, the potential exists for several deaths by electrocution or explosion.
- Stairwell lighting will be lost. JCMH egress lighting is all generator-fed with no battery emergency lighting.
- Long hours without relief results in very poor decision-making. Manage staff and provide staff support, including mental health services.

- Security of the building is critical. You have to protect your resources.
- Badges will be lost during this type of event. Have wallet identification cards for your staff.

### **Takeaways at This Point in the Presentation:**

- What you practice is what you do.
- Drill until you fail.
- Know your response partners: local, state, and federal.
- Drill with your community partners.
- Have a strong connection with your hospital associations.
- Add patient slippers/shoes to your weather plan. Have on bed during Code Grey Level I.
- Store emergency supplies where you plan to use them. You may not be able to transport from a warehouse or the supplies may be lost in the storm.
- Make emergency supplies easily portable; they will need to be hand-carried - pallet jacks will not work in debris fields and stairwells.
- Have grab bags throughout the facility with pens, pencils, paper, and medical record forms. Also include gloves, masks, flashlights, and batteries.
- Develop a common triage tag and process. It is best to have the same triage system and tag at all of the hospitals in your region.
- You need to develop a rapid response team for security and a component of the security team will need to be armed.
- Take care of yourself and your family.
  - Have the employee assistance program (EAP) available.
  - Consider staff needs from the beginning of the event.
  - Realize that many employees are caught up in the event. Several in Joplin lost homes and family members. Two employees lost to the storm.
  - Reconnect with staff quickly and get emergency supplies in their hands. The emergency supplies will need to be for patient care and for personal use.
  - Consider staff physical and psychological needs - shift relief, food, rest, and debriefing.
- Paper medical records will be inundated with water and will require mold restoration.
- Typical of this type of storm, subsequent severe storms will move through the area following the initial event. The structure and building envelop is compromised to the point it is uninhabitable and very unsafe during the secondary storms. Glass was showering everything in the building.
- The Joint Commission will arrive onsite to assist with reestablishment of services and they proved to be a valuable resource.
- Establish "Scrub Racks" with many sizes of scrubs to keep staff in suitable clothing.
- How can we organize VHA Hospitals around a common response methodology?
- You may need to provide some form of security for staff using portable toilets, especially after dark.

### **Alternate Care Sites:**

Mercy St. Johns Hospital established an Alternate Care Site (ACS) at Memorial Hall. I understand from the presentation that they practiced this process in the recent past. They used a high school gymnasium as an overflow site.

- IT/IS installed a new PBX system at the ACS and set up an IT infrastructure.
- Incident Command was established in three locations. The primary site was in a rehabilitation building, their sister hospital in Springfield stood up their HCC, and a third HCC was opened at the hospital in Nosh, MO.
- High school buses transported patients to the ACS.
- Mercy St. Johns staffed the ACS through a selective process to ensure seasoned veterans were there to receive patients.
- The emergency supplies at St. Johns were sent to the ACS sites and to Freeman Hospital.
- Food supply for staff and patients is a major logistical problem.
- Municipal water system experienced several breaks throughout the city and water pressure was very low to lost. Water is a vital concern at the ACS.
- The ACS needs to be secure and the Hospital needs to figure out how to deploy security forces to each site while maintaining campus security.
- Staff will need identification to get to the ACS.
- You will need to triage the self-presenting patients at the ACS and have a plan to send critical patients to a hospital with trauma service capability.
- In addition to security, you need to establish communication with EMS, EOC, and HCCs as quickly as possible.

### **Technology Recovery:**

The Mercy system has an off-site technology center with 900 employees to support the entire Mercy system. This is a \$60,000,000 facility in Washington, MO. It is designed as a box-in-a-box with systems mirrored within the facility and backed up at an additional remote site.

The IT/IS objective was to stay focused on recovery rather than response.

- IT/IS plans for and drills for this type of event regularly.
- IT used time clock information to determine who was at the facility at the time of the disaster.
- Physicians do not clock in, so IT used the electronic medical record data two minutes prior to impact to determine which physicians were on duty based on EMR entries.
- IT/IS established a centralized call center for employees to contact throughout the disaster. This is a predetermined process accomplished through planning.
- Immediately, IT/IS dispatched communication and data equipment along with a team of technicians.
- Printed medical records back three years for each of the 183 patients and dispatched to the various receiving hospitals via Mercy employed courier.
- Established communication and data capabilities at ACS and at the tent operations at St. Johns.
- Coordinated communication between the three HCCs, EOC, and the Washington Data Center.

### **Freeman Health System - Joplin:**

The facility lost power, a few windows, and a portion of the roof. Six rooms flooded and had to be evacuated. There was minor damage to the oxygen supply. After the disaster occurred, Freeman had no idea St. Johns was destroyed and realized the magnitude of the situation when patients began to arrive. There was no outside communication to indicate the extent of damage

and injuries in the community. Immediately after the storm hit, 130 patients self-presented to the 40-bed ED. Staff lounges were turned into wound care centers. In total, 1000 patients were treated at the Freeman ED and the Alternate Care Site. 22 life-saving surgeries were performed over the first 12 hours.

- Immediately evacuated the waiting areas to prepare for surge.
- Facility security became a high priority.
- The facility attempted to discharge patients capable of self-care; however, many had no place to go.
- Hospitals need to have an EMS paramedic onsite, with the capability to communicate to a variety of radio systems, to coordinate ambulance movement.
- “Downtime packages” are essential in a disaster situation where IT/IS capabilities are lost.
- X-Rays were limited to life-threatening situations. Those with broken limbs were splinted and sent home with instructions to report to their provider’s office the next day. Freeman did not know that most medical offices in the community were destroyed, and patients instead returned to the ED for follow-up.
- Freeman found that emergency lighting is insufficient for clinical procedures. Recommend all hospitals consider lighting evaluation and providing a higher level for clinical care.
- Many people presented to Freeman for safety and shelter. This impacts the Hospital’s ability to care for the injured. It was described as a “sea of people”. The hospital was the only facility in the community with lights, serving as a beacon to which people migrated.

#### **Key Facts and Lessons Learned at Freeman Health:**

- “As leadership goes, so goes the staff.”
- Must have a plan to manage volunteers. Many will show up unsolicited.
- Security was a huge issue in all respects.
- The media can be your friend if you manage them wisely.
- Just-in-time (JIT) delivery systems failed to provide the necessary supplies at the pace required for care.
- Orthopedic supplies were critically short.
- Lighting needs to be hands-free to provide suitable clinical care.
- Patients could not be cleaned up due to loss of water pressure. Wound sites only were cleaned and treated.
- 200 mph wind drives debris deep into the body. Physicians closed wounds only to perform surgery later to clean out the debris. It is better to leave the wound open/not sutured.
- Adaptable disaster patient ID and triage tags are needed. There needs to be commonality or standardization among healthcare institutions.
- Hospitals need to increase the quantity and quality of radios.
- PACS systems will not be available when IT/IS infrastructure is down.
- Assign a nurse to a physician to improve communication.
- Pyxis Medication Dispensing Systems need to have keys available for the House Supervisor.
- Electronic locks need to have override capabilities.
- Wallet cards are needed in addition to ID badges. See St. Johns’ comments above.
- Transfer patients of lesser severity out of your ED and immediate care areas. Find another place to care for them.

- Physicians have to be engaged in the planning and exercise process.
- Practice, practice, practice your plan. When the event occurs, your EOP documents will have very little value. They are too complicated. Instead of relying on written plans, train and practice. Practice until you fail, and then fix it.
- The staff at Freeman had no idea of the magnitude of the disaster, the size of the storm as it approached, the condition of St. Johns, nor the condition of the community.
- The ED and heliport lights need to be on emergency power.
- Cable feeds for news and weather will not be available. Those systems will be disrupted along with most other infrastructure.
- The event occurred at shift change. We must have a knowledgeable clinical leader to assign staff shifts and deploy staff to ACS sites. The leader must consider the “seasoning and experience” of the individuals being assigned.
- Off-going staff must report to the staging area before leaving the facility.
- Leadership must understand the emotional state of staff and the emotional and physical stress a disaster of this magnitude will create.
- Sanitary bags were used in bedside commodes and then carried to the portable toilets for disposal. This worked for a while but was replaced with the bucket brigades for toilet flushing.
- The 22 life-saving surgeries were performed on emergency power.
- The ACS sites ran out of vents almost immediately.
- When relocating patients to corridors and other non-treatment areas, medical air became an issue. Lines were spliced together to make the connections to the patients. Consider this in planning for patient overflow.
- You will be dealing with the physical and emotional trauma of displaced families. Need strong faith-based presence.
- Using text messages, all employees were contacted within 12 to 36 hours.
- The hospital needs to have an employee hot line established for disaster response.

#### **Facility Considerations:**

- There are never sufficient emergency-powered outlets. Assuming you have or can use generator power.
- Security camera systems need to be on emergency power.
- Lighting on emergency power needs to be evaluated.
- Look for an alternative to traditional placement of exit signs.
- Find alternative ways to mark stairs, i.e. photo luminescent exit signs, tape, and paint.
- Know how to shut down utilities and medical gases quickly, and establish a protocol for this procedure.
- Consider parking lot and exterior facility lighting during the response and recovery phases.
- The facility should be considered unstable until cleared by structural engineers.
- Secure wiring, HVAC components, piping, and light fixtures correctly above ceilings.
- Plan for rapid deployment and connection trailer mounted equipment, portable buildings, and portable equipment.
- Debris removal is lengthy and complex.