Review

The World Trade Center Attack
Lessons for disaster management

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Abstract

As the largest, and one of the most eclectic, urban center in the United States, New York City felt the need to develop an Office of Emergency Management to coordinate communications and direct resources in the event of a mass disaster. Practice drills were then carried out to assess and improve disaster preparedness. The day of 11 September 2001 began with the unimaginable. As events unfolded, previous plans based on drills were found not to address the unique issues faced and new plans rapidly evolved out of necessity. Heroic actions were commonplace. Much can be learned from the events of 11 September 2001. Natural and unnatural disasters will happen again, so it is critical that these lessons be learned. Proper preparation will undoubtedly save lives and resources.

Keywords disaster, HAZMAT, preparation, weapons of mass destruction, World Trade Center

New York City is unique in many respects. According to the 2000 Census [1], over 8 million people live within the five boroughs making it the largest city in the United States. Over 1.5 million people live within the 34 square miles (88.4 km^2) that make up Manhattan Island. Manhattan's population density is the highest in the country, with almost 70,000 people per square mile (27,000 per km^2) [2]. New York City also has more trauma centers than any other city: six in Manhattan, two in the Bronx, four in Brooklyn, three in Queens, and two in Staten Island.

The Fire Department of New York (FDNY) controls the largest number of ambulances but there are numerous hospital-based private ambulance services that also respond to 911 calls. In the event of a natural or manmade disaster, coordination of all aspects of the response would be controlled through the Office of Emergency Management (OEM). The OEM had its headquarters in 7 World Trade Center and communication was based off the antenna on 1 World Trade Center (Fig. 1).

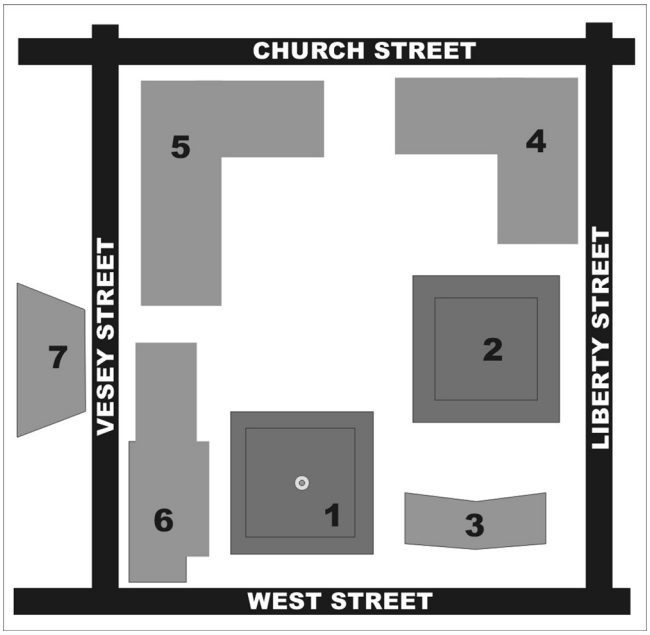
What happened

Soon after the first plane struck the north tower (1 World Trade Center) at 08:46, New York City OEM began directing resources to the area. This role was short lived. Its building was heavily damaged at 10:29 by the fall of the north tower and was evacuated. Command and control was re-established elsewhere. Damage by falling debris and fire caused 7 World Trade Center to collapse less than 9 hours after the initial strike. The coordination of the response of the Emergency Medical Systems (EMS), the New York Police Department, and the FDNY was significantly impaired by the loss of its center of communications and many key personnel.

By 09:00, before the second attack had even occurred, our hospital went into a state of disaster preparedness. Patients in the Emergency Department were quickly moved to our urgent care area adjacent to the main Emergency Department. Plans were made to transfer subsequent acute patients (those unrelated to the World Trade Center incident) to North Central Bronx Hospital, our sister hospital approximately 4 miles (6.4 km) away. Within 3 hours, 20 intensive care unit beds were available. All elective surgery was halted and six operating rooms were fully staffed and open. Within 4 hours, almost 100 critical and acute beds were created and large areas for the minimally injured were prepared. No physicians, nurses or support staff were allowed to go home. All area

EMS = Emergency Medical Systems; FDNY = Fire Department of New York; OEM = Office of Emergency Management.

Figure 1



The World Trade Center. (1) 1 World Trade Center, North Tower – Communications Antenna; (2) 2 World Trade Center, South Tower; (3) 3 World Trade Center – Marriot Hotel; (4) 4 World Trade Center; (5) 5 World Trade Center; (6) 6 World Trade Center; (7) 7 World Trade Center – Office of Emergency Management.

hospitals, including New York, New Jersey, and Connecticut, whether 911 call receiving or not, prepared in various ways to accept the expected hordes of patients.

In the first 2 hours, over 350 patients walked or were taken to New York University Downtown Hospital, a nontrauma center, which is 0.2 miles (0.32 km) from the World Trade Center. St Vincent's Hospital is about 1 mile (1.6 km) from the scene. As the closest trauma center, it was quickly swamped with over 300 walking wounded and critical patients. Bellevue Hospital, a trauma center approximately 2.5 miles (4.0 km) northeast of the World Trade Center, also received some of the early injured patients both directly and in transfer. Nineteen burn patients were taken to New York Hospital-Cornell Medical Center, the only burn center in Manhattan.

Scene management was especially complex during this attack because of the diversity in the EMS response. Communication between most hospitals and coordinators at the scene was almost nonexistent due to the early disruption of its communications tower and, later, the office of the OEM itself. Telephone communication either via landline or cell phone did not exist in lower Manhattan. Helicopter transport did not occur because the skies over New York were closed except for military aircraft. Triage from the scene of more stable patients to hospitals outside the immediate area did not occur due to the loss of OEM coordination. Only FDNY ambulances were in communication with central dispatch in Maspeth, Queens. NonFDNY ambulances took patients to the nearest hospital without any knowledge of available resources, or back to nontrauma centers in Brooklyn and New Jersey where they originated. Physicians, nurses, and ancillary professionals at St Lukes-Roosevelt Hospital, a trauma center only 3 miles (4.8 km) north, sat idle and frustrated, while staff at St Vincent's and New York University Downtown Hospital worked under extreme conditions.

Lessons learned

Communication and coordination

The lack of communication probably resulted in more problems than all other factors combined. Military strategists do not place their headquarters on the front line. The same should be true for all key civil communication and coordination centers. These centers should be housed in areas unlikely to be direct targets or at risk for collateral damage. There should also be redundancy in the communications network so that one blow will not be a knockout. The OEM must be able to communicate with all local and regional hospitals. These facilities must keep the OEM informed of their status on a continuous basis. Constant assessment of operating room, intensive care unit, and floor bed availability must be made. The state of these resources should be used to direct field personnel to the most appropriate facility.

If the OEM is, for whatever reason, unable to assess and direct available local resources, hospitals closest to an incident should be prospectively set up to triage stable patients out to other hospitals. As long as hospitals see patients as their 'property' and do not transfer them until overwhelmed, optimal care in the event of a disaster cannot be possible.

Triage and patient movement from the scene

The belief that patients will lie quietly at the scene while they are evaluated, triaged, tagged and transported does pertain to this type of situation. It is clear from this attack and other disasters that local hospitals will rapidly be swamped by anyone that can get there on their own. Communications will be unreliable and expected transport routes and methods may be unavailable. Without guidance, EMS crews will bring the injured to the closest hospital, further stressing existing resources. The triage of patients in urban and rural disasters is different and needs to be re-examined.

Hospital preparation

Not all hospitals within 100 miles (160 km) of a disaster need to prepare at the same time or to the same extent. Significant time, effort, and resources were wasted and unnecessary anxiety was created at sites remote to the World Trade Center attack because of lack of direction and information. If appropriate communication existed, remote hospitals could begin limited preparation at the time of the incident and would be ready as hospitals near the site reached capacity.

As need became more evident, additional resources could be activated as necessary.

Effective intrahospital communication must be available. At our institution, Nextel DirectConnect cell phones are routinely used for communication. These phones not only act as a standard cell phone, but also act like multichannel walkie-talkies. During our preparation immediately following the World Trade Center attack, additional phones were given to key people in administration and in nursing, improving coordination. We were fortunate that our cell phone service remained intact. If it were interrupted, the Nextel system would have been disrupted. We have plans to obtain backup walkie-talkies in case the Nextel system fails.

Physician response

The concept of 'Mobile Army Surgical Hospital' areas set up at the scene of disasters to receive and dispense initial trauma care is attractive. However, it is unlikely to be effective in this type of situation because of the logistical difficulties in rapidly moving such resources to the scene. Several local hospitals sent teams to the scene early on after the attack. It is unfortunate when a trained rescuer loses his life in the line of duty. However, they are trained and prepared to work in suboptimal and dangerous environments. Most physicians have no such training and it is often a resident who is least prepared for the field environment that is sent. In this scenario, the risks to the providers are high and the benefits small. Optimally, patients should be evaluated and stabilized at the scene by trained prehospital personnel, or even by uninjured bystanders, then triaged and transported to hospitals with available resources. This may not, however, be the optimal response for mass casualties in remote areas where transport times may be prolonged.

If health care providers are not brought to the immediate scene, what about their role at local hospitals? The question here revolves around physician qualifications and credentialing. There is a process via the National Disaster Medical System [3] through which physicians can obtain federal credentials to work anywhere in the country in the event of a disaster. The time commitment for this is so onerous that few physicians have signed on. We need to consider a statewide credentialing system for physicians and nurses to enable them to work in any hospital in their state in the event of a disaster.

The future

The world, and especially New York City, will never be the same after 11 September 2001. We live in a time when movie disaster dramas come true and our very best intentions lay wasted. We need to anticipate all possible scenarios because the unthinkable is now a reality. Cities need to have disaster plans that are tailored to specific scenarios and locations, not preconceived generalized plans. Airport plane crashes, stadium catastrophes, and remote mass transit accidents are all vastly different to this attack and require different responses. Communications need to be standardized and backed up. Triage needs to be thought out more clearly. Scene control to prevent access from unauthorized medical personnel is important. The problems of a collapsing building need to be addressed by engineers and EMS planners. The general public need to be trained in initial care of victims in the same way Basic Life Support is taught. Hazardous material training must become standard not only for trauma centers, but also all hospitals.

I hope that the experience of the World Trade Center attack will lead to a disaster response system that is capable of dealing with the many scenarios possible today and tomorrow.

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Competing interests

None declared.

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This article, and the series it is part of, is dedicated to the first responders – fire, police and medical personnel – who attended the World Trade Center disaster of 11 September 2001. They did not hesitate to place themselves in harm's way to rescue the innocent, and without their efforts many more would have perished. They will not be forgotten.

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