

## Review

# The World Trade Center Attack Observations from New York's Bellevue Hospital

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## Abstract

This report describes selected aspects of the response by Bellevue Hospital Center to the World Trade Center attack of 11 September 2001. The hospital is 2.5 miles (4 km) from the site of the attack. These first-hand observations and this analysis may aid in future preparations. Key issues described relate to communication, organization, injuries treated, staffing, and logistics.

**Keywords** communication, disaster, preparation, terrorism, triage

Bellevue Hospital Center is a large, metropolitan, Level I trauma, tertiary care teaching hospital 2.5 miles (4 km) from the World Trade Center. Despite the inevitable chaos and confusion surrounding the attack on 11 September 2001, we were able to organize and deploy effective resources within hours. In this article, we describe and retrospectively analyze our actions in the hope that it will lead to improved response to future disasters.

## Responding to facts, not rumors

In the first few hours following the attack, communication was poor and rumors were rampant. The hospital's internal and external phone lines were overloaded and a dial tone was unavailable; internal and external pagers and cell phones were working only intermittently. Given the sketchy and unreliable nature of the information, our hospital's response was to fully prepare all areas for a worst-case scenario involving high volumes of critically injured patients. The Anesthesiology Department alone reported a cost of over US\$20,000 for the period 11–12 September 2001, which was attributed to setting up all operating rooms, drawing up drugs, opening consumables, and lending out equipment that was never returned. Much of this expense could have been prevented.

Better media equipment and handheld two-way radios could have overcome the communication problems. Hospital command centers should be equipped with radios, cable and antenna television, and Internet access. Broadband Internet

access and certain satellite-linked devices, neither of which depend on telephone landline integrity, proved themselves reliable sources of media information. Our broadband Internet backbone performed flawlessly, enabling us to download media news sites, such as CNN. Some portable personal digital assistants have satellite-based Internet capabilities and, in fact, traders on Wall Street found these worked throughout the attack. Future preparations may be able to take advantage of these reliable components and applications of the Internet. To date, however, this technology is not widely available.

At Bellevue, with better communication, staff in secondary and tertiary care areas could have anticipated the lag time from triage to the patients' arrival in the departments. Instead of opening kits and trays, spiking extra intravenous drips, and moving patients, staff could have waited until there was some indication from the triage areas (either within the hospital or at the attack site) that such actions would be needed. Furthermore, the Outpatient Department was converted into a makeshift emergency room, and the cystoscopy and obstetrics operating rooms were prepared for general surgery and trauma. If resources were to become overwhelmed, however, it would be better to triage and coordinate resources across the whole of the city, rather than adapt current, local resources. In other words, the first step should involve maximizing familiar systems, locations, equipment, chains of command, and routes of communication before mobilizing auxiliary resources.

## Organizing staff and volunteers

The attack occurred in the morning of a normal working day and so the hospital was fully staffed. In addition, hundreds of volunteers arrived. Many were trained professionals. With so many people available it was important to organize them, with face-to-face communication supplementing what technology could not provide.

Medical students were employed as 'runners' within the hospital. They know the personnel, the equipment, and the way around the hospital. Two or three runners were assigned to each organizing attending doctor and senior resident. This enabled people to ask for and have supplies delivered, to communicate back to their superiors, and to keep themselves and others apprised of the situation in other areas of the hospital. At first, identifying staff was difficult, which hampered communication. Eventually we asked each person to affix a piece of tape to their shirt labeled with their name, specialty, and academic training level or title. However, all this was only possible because of the number of staff available. Had the attack occurred during the night or the weekend, it would have been difficult to communicate with staff at home, even if they could have arranged transport in to the hospital.

As well as the health care staff, there are the hospital engineers. Had there been an influx of critically injured patients, most of whom would need oxygen, the hospital's ability to maintain wall oxygen pressure, suction, and electrical power would have been tested, especially if the main power failed and an emergency generator was in use. Often, the capacity of emergency generators is unable to meet the demands of large equipment, such as computed tomography scanners, as happened at New York Downtown Hospital within hours of the attack. Although it was not required in this case, clearly someone should be assigned to control and conserve these resources.

During a terrorist incident, follow-up attacks may be timed to injure the emergency services. In the event of a chemical attack, or especially a communicable biological attack, hospital workers are directly threatened. Adequate security is imperative, the provision of which may be difficult given that hospital security will probably be overwhelmed and municipal police have other obligations.

## Triage and injuries

Given the circumstances, our triage functioned as well as could be expected. As patients emerged from ambulances, they were triaged to one of three areas: green, yellow, or red. The Green Area was for those cases that seemed nonurgent and was managed primarily by our Emergency Department physicians. The Yellow Area was for potentially urgent cases. Patients triaged to the Yellow Area had primary and secondary surveys conducted by a surgical team consisting of a trauma surgeon (the Yellow Area coordinator) and a critical care anesthesiologist. They assessed which other services and staff would be needed and called them forward from an

adjacent staff holding area. Anyone potentially needing airway management or sedation was assigned a senior anesthesiology resident or intensive care unit fellow, who would stay with that patient throughout his/her workup and into the operating room or intensive care unit if necessary. This technique for managing staff limited the crowd at the bedside while ensuring that an adequate supply of experts were at hand. The Red Area consisted of our usual Level I trauma facilities and staff.

Ninety patients were received at Bellevue Hospital Center in the 5 hours following the attack, 56 of which had minor injuries. Most patients treated in the Green Area had respiratory complaints, such as particulate inhalation and toxic fume exposure, and psychological trauma. Five patients were triaged to the Yellow Area suffering from a mixture of fractures, burns, and blunt trauma but with stable hemodynamics. Three patients were triaged to the Red Area: one was in blunt cardiac arrest and pronounced dead after a brief period of advanced trauma life support, one had been trampled, and the third had an open head injury. Five operations were performed during the first 5 hours: two neurosurgical procedures, two orthopedic procedures, and one escharotomy. Over the next 10 hours, a further 80 patients were received with a similar distribution of injury and severity.

## Reacting to the facts

As late as 72 hours after the World Trade Center attack, we were told to be prepared for further building collapses and subsequent injuries. Given the state of the communication, it was difficult to anticipate needs and to deploy personnel. As soon as possible, however, we scaled down and sent staff to rest, dividing teams into shifts while remaining ready for follow-up attacks or continuing casualties. To have our entire force on standby continuously would have severely impaired our ability to respond when asked.

We also had to remember the patients who were hospitalized before the attack. It seems obvious to mention, but the temptation is to focus exclusively on the incident, which can potentially lead to neglect of patients whose condition we presume to know.

## The Chelsea Piers field hospital

A field hospital was set up at Chelsea Piers, which is 2.2 miles (3.5 km) from the World Trade Center and 2.0 miles (3.2 km) from Bellevue. We were asked to provide staff and equipment to the field hospital, but soon realized this did not include provision of anesthesia. Intravenous narcotics and ketamine were sent over, some of which was distributed to other teams and remains missing. This unanticipated issue has to be addressed and, in future, we plan to distribute intravenous drug kits to each provider and expect them to be accountable for their use, wastage or return.

Bellevue Hospital Center staffed three of the 100 Red Area beds set up at Chelsea Piers. However, no significant casual-

ties arrived at that facility and it was dismantled at around 01:30 the next day (Wednesday), 17 hours after the attack. Several of our staff also reported to the area of the World Trade Center where field triage areas had been set up. They assisted in treating and transporting back to Bellevue the few trapped crush victims who were found and extricated that night.

## Conclusion

Practice and drills may facilitate disaster response but most of our staff had not participated in any prior to the World Trade Center attack. Despite this, we were struck with the level of preparedness and resources mustered throughout the city in a short time. Because Bellevue Hospital is a busy, urban, Level I trauma center, we were equipped and capable of treating the types of injuries we saw as a result of the World Trade Center attack. This may not have been the case if the attack had been biological or chemical.

Given the unpredictability of terrorist attacks, disaster plans will inevitably need to be adapted to each institution and situation. In addition to standard protocols, we have identified certain indispensable aspects of preparation based on our observations and experience. Some of these aspects, such as biological/chemical disaster training, security, and reliable communication, will need to be developed and improved. Others such as training for conventional casualties, a clear chain of command, cooperation, flexibility, and resourcefulness are clearly adequate.

JDR is part of the Bellevue Hospital Faculty and is co-director of the Surgical Intensive Care Unit.

## 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.