Disaster Response Efforts at Juntendo University Urayasu Hospital

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The Great East Japan Earthquake caused unprecedented damage and led to a massive loss of life. Damage spread beyond Tohoku, and Juntendo University Urayasu Hospital, which adjoins Tokyo along Tokyo Bay, suffered from ground subsidence, liquefaction, and disruption of lifeline systems (systems for electric power, natural gas, water and wastewater, and transportation). Starting in the very early stages of the disaster, Urayasu Hospital dispatched a disaster medical assistance team (DMAT) and medical aid team. The hospital's water supply and sewerage systems were damaged and water supply was disrupted, hampering its ability to continue providing care. Based on this experience, a disaster task force member centrally involved in formulating the hospital's emergency response to the water supply disruption, submitted a business analysis report on which large parts of this article are based. We prioritized water uses and cited the need to prepare for disasters. A disaster response hospital, Urayasu Hospital has established committees to prepare for disasters and it continues to conduct drills. The hospital also began operating a Rapid Response Car. Urayasu Hospital seeks to be ready for disasters by drawing on lessons from the Great East Japan Earthquake. Urayasu Hospital seeks to improve patient survival and enhance the local emergency response system by dispatching DMATs and by operating a Rapid Response Car.

Key words: the Great East Japan Earthquake, business impact analysis, disaster response hospital, DMAT, Rapid Response Car

Introduction

An inescapable aspect of disaster response efforts at Juntendo University Urayasu Hospital is the fact that the hospital and community were affected by the Great East Japan Earthquake. Tremors registering a weak 6 on the Japan Meteorological Agency seismic intensity scale were measured in the City of Urayasu during the disaster. Strong tremors struck the ICU, gradually separating the beds of intubated patients from ventilators. Bookshelves in doctors' offices also fell over. Liquefaction and ground subsidence occurred in the City of Urayasu, and the hospital was flooded. Fortunately, the quake did not cause any injuries in Urayasu or the surrounding area, but phone lines went down and hotlines were disrupted. Thus, emergency calls for an ambulance were taken when the disaster occurred without the use of a dedicated line. Fortunately, the disaster did not cause any injuries nearby. Urayasu Hospital dispatched personnel in response to the disaster in its role as a disaster response hospital.

DMAT

This Hospital dispatched a disaster medical assistance team (DMAT) and a medical aid team to Tohoku. The DMAT worked at a Staging Care Unit (SCU) at Fukushima Airport for 2 days after the earthquake. The DMAT was responsible for caring for critically ill patients who had been transported by helicopter to Fukushima Airport while preparing them for transport to Haneda Airport aboard...
Self-Defense Force aircraft. Two weeks after the earthquake, a medical aid team was dispatched. The team provided care to residents of a shelter in the Town of Minamisanriku, Miyagi Prefecture. The team also provided medical support to urban hospitals. Patients had flocked to these hospitals, which were undamaged, since hospitals on the coast had been inundated by the tsunami.

The DMAT worked at the SCU at Fukushima Airport. Around 15 DMATs were working at the SCU. The DMAT from Urayasu Hospital was joined by more than 300 personnel in other DMATs. Within 24 hours, these DMATs entered affected areas (Ibaraki Prefecture, Fukushima Prefecture, Miyagi Prefecture, and Iwate Prefecture), where they began working. Since the area had been hit by a tsunami, fewer critically ill patients needed life-saving care than had been envisioned. DMAT activities were limited. A system was established to accept around 100 patients at Haneda Airport, but ultimately only 19 patients were transported from the SCU using Self-Defense Force aircraft.

Medical aid team

The medical aid team entered the Town of Minamisanriku, Miyagi Prefecture 2 weeks after the earthquake. A fishing port, the Town of Minamisanriku was severely damaged by the tsunami. The team borrowed part of a shelter on high ground to start a temporary clinic. Medical supplies and daily essentials were being delivered, but many of the people whose homes had been washed away by the tsunami had also lost many of their close relatives. Providing care in such unique circumstances was such a trying situation that only someone who had seen it firsthand could understand. However, team members later received letters from residents thanking them for their work.

BIA

Conditions in Urayasu and Tohoku differed, but both areas were affected by the disaster (Figure-1). Urayasu Hospital’s lifeline systems [systems for electric power, natural gas, water and wastewater, and transportation] and specifically
water supply and sewerage systems were disrupted, as happened elsewhere in the City of Urayasu. This hampered the hospital’s ability to continue providing care. Based on our experience with disruption of the hospital’s water supply, a member of disaster task force conducted a business impact analysis of hospital water use based on disruption of the water supply during the Great East Japan Earthquake, and he presented his findings to the Japanese Association for Acute Medicine.

First, business impact analysis needs to be explained. A business impact analysis is conducted by a medical facility at the very start of any plans to continue providing care. This analysis determines whether resources and operations are sufficient to conduct planned activities. This analysis seeks to quantitatively and qualitatively assess the extent to which operations as a whole are impacted where certain operations are halted, and this analysis categorizes operations by the order in which they must be resumed in order to identify critical operations. As an example, imagine the impact of disruption of the water supply. Water used by this Hospital is supplied by water mains off of hospital premises; this water travels via underground pipes until it is collected in a 320-ton water tank. This water is then supplied to individual departments and divisions. The water tank was not damaged during the recent disaster, but underground pipes were damaged by ground subsidence. Water supplied by water mains was disrupted, leading to a disruption of the water supply. In response, initial attempts sought to repair underground pipes, but places where the pipes were damaged could not be identified. The next action taken was to temporarily restore the water supply by installing temporary pipes above ground to bypass those underground. This work was given the highest priority but nonetheless took 4 days until the water supply was restored. In addition, damage to the sewerage system was extensive. All of the drainage pipes on the north side of the hospital had burst, and some of the pipes on the side south of the hospital were clogged with mud. Complete repair of the sewerage systems took 10 days. In other words, the water supply was restored but the sewerage system could not dispose of the waste. Thus, restrictions on water use had to be imposed and partial disruption of the water supply persisted.

A graph of running water usage in this Hospital before and after the disaster is shown in Figure-2. Before the disaster, 500–600 tons were used on a weekday while 400 or more tons of water were used per day on weekends or holidays. In other words, a large amount of water is used. So much water is

![Figure-2 Running water usage before and after the disaster](image-url)
used that a full water tank can be drained empty in half a day if the water supply is disrupted. Running water usage decreased markedly as a result of complete or partial disruption of the water supply for 10 days after the earthquake on March 11th. A water supply was not available, so conserving water was a given. Worse, obtaining water became a major issue. Requests for water supply were made to the government at the municipal, prefectural, and national levels. As a result, a water supply of 40–50 tons a day was obtained via water trucks from municipal water departments nationwide and from a Maritime Self-Defense Force water supply ship at anchor in Maihama. Thus, disruption of the water supply for about 10 days was dealt with.

The business impact analysis was first performed by listing the major departments using water. Three levels of priority for water use were established: S, which meant that disruption of the water supply would significantly impact patients’ lives; A, which meant that water supply in the usual amount would be preferable but that the department could manage with a smaller amount; and B, which meant that water supply to the department in question could be suspended in an emergency. In total, 23 uses of water by departments were identified. Once these uses were identified, a survey was devised and a level of priority was assigned to each use. As an example, departments with dialysis centers were given an S priority (the highest level) since patients’ lives would quickly be impacted if the department was unable to perform dialysis. The estimated water usage by departments with dialysis centers was calculated to be 20 tons a day. Assigning each use a level of priority resulted in 6 uses, such as hemodialysis and food preparation (for inpatients), that were S priority, 6 uses, such as performing blood chemistries, that were A priority (the second highest level), and 11 uses, such as food preparation (for staff), that were B priority. S priority and A priority uses accounted for about half of all of the uses (Figure-3). Next, the proportion of estimated water usage for each level of priority was determined. Estimated water usage for S priority uses was about 60 tons/day, or 20% of total water usage. Together, S priority and A priority uses accounted for about 60% (185 tons) of water usage. The estimated usage overall was about 300 tons a day, but 500 tons of water a day is normally used by this Hospital, which suggests that water is possibly being wasted. If water is using sparingly with conservation in mind, it can last a day without replenishment. A study of water use during the recent disaster revealed that various approaches had been taken to conserve water. One example of a specific approach to conserve water for an S priority or A priority use concerned inpatient meals. Approaches that were taken included using gas or electricity instead of steam to prepare meals, using pre-cooked nonperishable foods, and reducing the number of side dishes offered. Various other approaches were also taken, such as allowing patients to return home and discharging patients when possible and using disposable paper plates in place of dishes. A disaster task force member’s work yielded several findings. In brief, he identified 23 ways in which water was used by 8 departments. S priority uses accounted for 20% of estimated water usage. A priority uses accounted for 42%, and B priority uses accounted for 38%. Estimated water usage was about 300 tons a day. This amount can be reduced by paying attention to water usage. Assuming that the target period for resumption of operations is 4 days, then the amount of water that can be used per day is about 130 tons. Conserving about 55 tons of water a day means that S and A priority uses can be supplied for the most part. This work indicates that hospitals need to be built so that they are ready for disruption of their water supply in the future. Other facilities have implemented the following measures: 1. Increasing the amount of water stored: Certain facilities have designated a
water tank for general use and installed another water tank for use in emergencies. 2. Locating other water sources: (1) Certain facilities have dug wells and filtered groundwater for use. (2) Certain facilities have pumped water from rivers and filtered it for use. (3) Certain facilities have filtered wastewater and reused it. 3. Increasing stockpiles: Certain facilities have increased their stockpiles of bottled water.

4. Using rainwater: Certain facilities have collected rainwater and used it as gray water in toilets. 5. Preventing the bursting of water pipes: Certain facilities have attached flexible expansion joints to pipes used in buildings. Certain facilities have changed pipe materials (e.g., Kanaflex).

In light of the lessons learned from the recent disaster, this Hospital should be able to deal with any impacts that disruption of lifeline systems [systems for electric power, natural gas, water and wastewater, and transportation] has on the provision of care.

Disaster response hospital

The system for disaster response at this Hospital will now be described. This Hospital has already restructured the organization of its disaster response. In terms of a command structure, a Disaster Response Headquarters will be established as usual in the event of a disaster. Personnel under its command, such as members of the in-house fire brigade, DMATs, and medical aid teams, will assemble and this Hospital will serve as a disaster response hospital. Normally, a Committee on Medical Disaster Response meets twice a year to prepare for disasters. This Committee has devised this Hospital’s basic policies for dealing with disasters. Falling under the Committee are 2 subcommittees, the Committee Overseeing the In–house Fire Brigade and the Committee for Operations as a Disaster Response Hospital. The Committee Overseeing the In–house Fire Brigade is a body for disaster response in–house. This committee has set policies regarding the actions of the in–house fire brigade, which is the main force that responds when the hospital suffers a fire or earthquake. The Committee for Operations as a Disaster Response Hospital is a body for disaster response outside the hospital. This committee has devised a system governing how to deal with mass casualties and what personnel to dispatch in response to a disaster, i.e., DMATs and medical aid teams. The 2 subcommittees meet monthly. As part of their work, the subcommittees also regularly conduct a disaster drill once a year. These disaster drills have gradually become more realistic. Drill scenarios are not disclosed ahead of time. First, personnel assemble at the Disaster Response Headquarters, where they are assigned roles and then the disaster response begins. Drill participants are required to establish triage and treatment areas and assemble needed medical supplies and equipment. Although the participants do not provide actual medical care, the drills do involve simulated patients. Participants have practiced carrying patients on stretchers in situations where the elevators are assumed to have stopped working. At this Hospital, an Action Card is used to assign roles in the event of a disaster. In the event of a disaster, the Disaster Response Headquarters has to be promptly established and begin functioning, and operations of individual departments and divisions have to begin. However, not all personnel know the role of each department and division in the event of a disaster. Thus, personnel who have assembled at the Disaster Response Headquarters are given a card describing the specific role that each staff member has been assigned. This approach allows important departments and divisions to begin operation in an orderly manner while avoiding confusion.

Rapid Response Car

This Hospital introduced a Rapid Response Car on September 9, 2013 in order to improve the hospital’s ability to provide pre–hospital care in relation to a disaster. The Rapid Response Car is a passenger vehicle that has been converted into an emergency vehicle. The Rapid Response Car rapidly transports doctors, nurses, and paramedics as well as medical supplies and equipment to emergency scenes.

The Rapid Response Car is intended to rapidly transport medical staff to an emergency scene and safely transport critically ill patients to the hospital while they are initially treated at the scene and in the ambulance. The initial investment for the Rapid Response Car is kept low, unlike that for a
conventional emergency response vehicle. Introduction of the Rapid Response Car should increase the patient survival rate by allowing doctors to begin diagnosis and treatment at the scene. In addition, the severity of a patient's condition can be assessed at the scene and critically ill patients can be appropriately transported to the Critical Care Center.

In the event of a disaster, the Rapid Response Car can also be used to transport a DMAT. In the event of a disaster or mass casualties, the Rapid Response Car is used to coordinate with the fire department, establish a local command, collect information, and coordinate medical care. In the event of a disaster, the fire department receives jumbled information and accurate information is unavailable. However, establishing a command structure at the scene and sharing information with the fire department and other disaster response hospitals leads to organic operations. Incident response efforts utilizing the Rapid Response Car are currently underway in cooperation with Tokyo Disney Resort.

Introduction of the Rapid Response Car should allow a rapid response to sudden local incidents in the future. Urayasu Hospital seeks to draw on lessons from the Great East Japan Earthquake so that it is ready for a disaster.