

# Medical Evacuation of Patients to other Hospitals due to the Fukushima I Nuclear Accidents

Youichi Yanagawa, MD, PhD;<sup>1</sup> Hiroki Miyawaki MD;<sup>1</sup> Jirou Shimada MD, PhD;<sup>2</sup> Kazuma Morino, MD, PhD;<sup>3</sup> Ei-ichi Satoh, MD, PhD;<sup>4</sup> Yasuhiro Ohtomo, MD, PhD;<sup>5</sup> Masayuki Ichihara;<sup>6</sup> Hisayoshi Kondo MD, PhD<sup>6</sup>

1. National Defense Medical College, Juntendo University
2. Fukushima Medical University
3. Yamagata Prefectural Central Hospital
4. Saku Central Hospital
5. Tokyo Medical and Dental University
6. Disaster Medical Center

## Correspondence:

Youichi Yanagawa  
Department of Emergency and Disaster  
Medicine, Juntendo University  
3-1-3 Hongo Bunkyo-ku Tokyo,  
113-8431, Japan  
E-mail:yyanaga@juntendo.ac.jp

**Keywords:** medical evacuation; Fukushima;  
nuclear accidents; earthquake; tsunami

## Abbreviations:

DMAT = Disaster Medical Assistance  
Teams

Online publication: 9 November 2011

doi:10.1017/S1049023X11006418

In the course of responding to the 11 March 2011 Great East Japan Earthquake and tsunami, the Japanese government decided to enforce a 30 km evacuation radius on 17 March 2011 due to the Fukushima I nuclear accidents. The Ministry of Health, Labour and Welfare of Japan found that there were 800 patients in this area. From 19 March to 22 March, these 800 patients were transported to the other 11 nearby prefectures based on results of matching for facilities and available staff. These medical mass evacuations induced confusion because: 1) eight hundred patients were evacuated to other areas within 4 days, 2) some medical staffs within 30 km from the Fukushima I nuclear accidents could not help leaving medical facilities, leaving their patients, and did not provide detailed information concerning their patients, 3) some patients were evacuated twice, initially transferred to a hospital within the 30 km radiation radius that was enforced later during the incident. Medical information on many of these patients was lacking because of the loss of their medical charts, 4) communication lines were broken, including information transmission. Later, the staff of the local government of Fukushima prefecture investigated personal inquiries which were received during evacuation from Fukushima prefecture, however, these investigations were hard to resolve. Medical mass evacuation under complex disasters, especially for a combination of natural disasters and a nuclear accident, made obtaining exact personal information prior to transportation difficult and thus resulted in confusion.

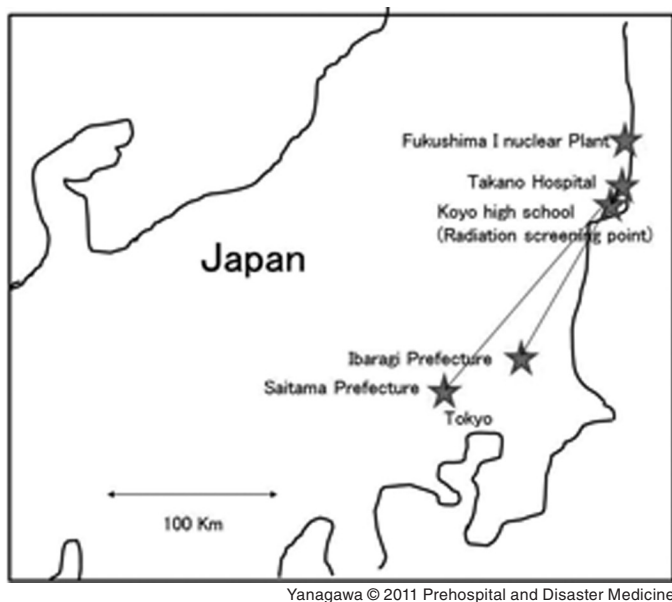
## Summary of Events and Responses:

### 1. The Great East Japan Earthquake and Tsunami:

The Great East Japan Earthquake was caused by a 9.0 magnitude undersea megathrust earthquake off the coast of Japan that occurred on 11 March 2011. The epicenter was in the Sanriku Ocean approximately 72 km east of the Oshika Peninsula of Tōhoku. This was the fourth strongest earthquake ever recorded as announced by the United States Geological Survey. The earthquake triggered extremely destructive tsunami waves, which killed about 27,000 Japanese people.

### 2. The Fukushima I nuclear accidents:

The earthquake and tsunami led to flooding of the Fukushima I nuclear plant, causing loss of all power for cooling, subsequently leading to overheating of the nuclear plant. As a result, it was considered a possibility that a partial core meltdown of the reactors would occur. Fears of radiation leaks initially led to a mandatory 2 km evacuation radius around the plant enforced by the Japanese government on 11 March 2011, followed by enlargement to 10 km on the same day. On 12 March the external wall of the plant was destroyed by a hydrogen explosion. The Japanese government then decided to implement a 20 km evacuation radius. The Tokyo Electric Power Company, which was in charge of the administration of the Fukushima atomic plant, could not prevent the partial core meltdown of reactors, so the government decided to implement a 30 km evacuation radius on 17 March. This nuclear accident was extended to International Nuclear Event Scale level 7, which was the same as the accident at the Chernobyl Atomic Electric Power Station. As the local government in Fukushima prefecture had to manage large numbers of problems concerning the reconstruction of lifelines, disaster victims and the Fukushima I nuclear accidents, it requested assistance from the Japanese



**Figure 1**—A map of Japan showing the location of the nuclear accident and the surrounding areas where patients were transferred

national government to assist in the medical mass evacuation from Fukushima to other prefectures.

### 3. Japan's Disaster Medical Assistance Teams (DMATs):

The Ministry of Health, Labour and Welfare requested that the DMATs gather to discuss the situation with the Fukushima prefectural local government on 19 March 2011.

Japan's DMATs are small-scale units that are designed to be suitable for responding to the demands of acute emergencies.(1) The DMATs were created by the Ministry of Health, Labour and Welfare after the 1995 Great Hanshin and Awaji Earthquake which led to a massive demand for medical care. However, as area hospitals also were damaged by that earthquake, they were unable to perform their usual functions. As a result, the DMAT staffs have been trained to be able to treat injured patients and transport a large number of injured and ill people out of the disaster-affected area. The DMATs are therefore mobile, trained medical teams that can rapidly be deployed during the acute phase (approximately 48 hours) of a sudden-onset disaster. The average DMAT consists of two doctors, two nurses and one logistics person. There were more than 700 teams created by 2010.

### 4. An outline of medical mass evacuation due to the Fukushima I nuclear accidents:

The Ministry of Health, Labour and Welfare collected the data about patients who were hospitalized within 30 km from the Fukushima I nuclear plant. As a result, there was approximately 1,100 patients who had to be evacuated. Of these, 300 patients had already moved to other medical facilities by themselves by 18 March 2011. The remaining 800 patients had to be evacuated under official government support. The Ministry of Health, Labour and Welfare requested multiple local governments near Fukushima Prefecture to receive the patients. In addition, they also requested the



Yanagawa © 2011 Prehospital and Disaster Medicine

**Figure 2**—Radiation screening Patients received radiation screening at Iwaki Koyo High School

other ministries, such as the Self Defense Force, the Fire and Disaster Management Agency, the Japan Coast Guard and the National Police Agency to provide ambulances, buses, helicopters and airplanes for the purpose of mass transportation. The medical mass evacuation commenced on 19 March 2011. The 800 patients were all transported to the other 11 nearby prefectures based on the results of facilities matching and available staff by 22 March.(2)

### 5. An example of medical evacuation from Takano hospital in Fukushima prefecture to medical facilities at other near prefectures:

Takano hospital was located within 30 km from the Fukushima I nuclear accidents. Takano hospital had both an internal medical department and a psychiatric ward. There were 118 beds in this hospital, and 94 patients remained after the nuclear accident. Of these, 37 patients refused to move to another area. The remaining 57 patients were candidates for medical evacuation. The list of patients was made by manually writing using a handyphone because communication lines including FAX and internet was not possible. On 19 March 2011, the 35 patients who could walk were first transported by five buses provided by the police, to nearby Iwaki Koyo High School located just over 30 km from nuclear accident. The patients underwent radiation checks there because the general public, including physicians who check radiation exposure could not enter an area within 30 km from the nuclear accident. After passing the check for radiation, these patients were transported without medical staff to five hospitals in Saitama prefecture which were approximately 170 km from Iwaki Koyo High School (Figure 1). On 21 March the remaining 22 patients who could not walk were transported by six 1.5 ton ambulances provided by the Japan Self Defense Force, which could transfer 4 patients at a time, to Iwaki Koyo High School to undergo radiation checks (Figure 2). All patients passed radiation screening; however, one patient was diagnosed as having hypoxia due to pneumonia by a medical check performed by the DMAT (Figure 3). The DMAT and medical staff of the Japan Self



Yanagawa © 2011 Prehospital and Disaster Medicine

**Figure 3**—Patients received medical checks by the Japan Disaster Medical Assistance Team at Iwaki Koyo High School



Yanagawa © 2011 Prehospital and Disaster Medicine

**Figure 4**—Patients were transported to hospitals in Ibaragi prefecture by 1.5 ton ambulances provided by the Japan Self Defense Force

Defense Force accompanied these patients during transportation. These patients were safely transported to 6 hospitals in Ibaragi prefecture, next to Fukushima Prefecture (Figure 4).

#### 6. Problems with the medical evacuation:

Eight hundred patients were evacuated within 4 days. There were a number of challenges with these evacuations, including: 1) some medical staffs within 30 km from the Fukushima I nuclear plant could not leave their medical facilities because they would be leaving behind their patients, and did not provide exact information concerning their patients, 2) some patients underwent medical evacuation twice after first being admitted to a hospital outside the initial evacuation radius but later within the expanded 30 km from the Fukushima I nuclear plant with medical information within their medical charts lost, 3) communication lines such as telephone and internet,

were non-functional and remained unusable during the evacuation. Under these severe conditions, many patients were transported from the original to other medical facilities as essentially unidentified patients, adding to the confusion of the hospitals that received such patients. Later, the staffs of the local government of Fukushima Prefecture performed personal inquiries for the patients who were evacuated from Fukushima prefecture, however, the results of the investigation were hard to resolve. (3) Medical mass evacuation under the presence of a complex disaster, especially a combination of a natural disaster and a nuclear accident, made obtaining exact personal information prior to transportation difficult, which resulted in confusion. In the future, such confusion might be avoidable if a wrist band or a small chip containing the patient's medical information could be transplanted into the patient's body, thus allowing the information to be retrieved by the receiving hospital.

#### References

1. Kondo H, Koido Y, Morino K, Homma M, Otomo Y, Yamamoto Y, Henmi H: Establishing Disaster Medical Assistance Teams in Japan. *Prehosp Disaster Med* 2009;24:556-564.
2. (Career Brain News 22 March, 2011, <http://headlines.yahoo.co.jp/hl?a=20110322-00000001-cbn-soci>).
3. (Toyokeizai Online, 8 April, 2011, <http://news.nifty.com/cs/magazine/detail/toyo-20110412-01/1.htm>).