Development of the Japanese National Disaster Medical System and Experiences during the Great East Japan Earthquake

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ABSTRACT

After the Great Hanshin-Awaji Earthquake in 1995, the Japanese national disaster medical system (NDMS) was developed. It mainly consists of four components, namely, a disaster base hospital, an emergency medical information system, a disaster medical assistance team (DMAT), and national aeromedical evacuation (AE). The NDMS was tested for the first time in a real disaster situation during the Great East Japan Earthquake in 2011. Two airports and one base were appointed as DMAT gathering places, and approximately 393 DMAT members divided into 78 teams were transported by Japan Air Self-Defense Force (JASDF) aircrafts to two AE staging bases the following day. Staging care units were installed at Hanamaki Airport, Fukushima Airport, and the Japan Ground Self-Defense Force Camp Kasuminome, and 69, 14 and 24 DMAT teams were placed at those locations, respectively. In total, 19 patients were evacuated using JASDF fixed-wing aircraft. Important issues requiring attention became clear through the experiences of the Great East Japan Earthquake and will be discussed in this paper.

Key words air ambulance; disaster planning; earthquake; emergency; natural disaster

THE GREAT HANSHIN-AWAJI EARTHQUAKE

A magnitude 7.3 earthquake on the Richter scale hit the Kobe and Awaji areas at 05:46 JST on January 17, 1995, leaving approximately 6,434 people dead, over 43,000 people injured, and more than 316,000 people homeless. It is reported that many lives that could have been saved were lost in the earthquake, mainly due to a lack of a national disaster medical system.[1]

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Abbreviations: AE, aeromedical evacuation; DBH, disaster base hospital; DIS, disaster information system; DMAT, disaster medical assistance team; EMIS, emergency medical information system; HEMS, helicopter emergency medical service; JASDF, Japan Air Self Defense Force; JGSDF, Japan Ground Self Defense Force; NDMS, national disaster medical system; MHLW, the Ministry of Health, Labour and Welfare; SCU, staging care unit

Many hospitals were unable to sufficiently function for the following three reasons: the poor structural integrity of buildings, lost hospital infrastructure (i.e., utilities), and the fragility of equipment. Nishi-shimin Hospital, one of two municipal hospitals in Kobe, was composed of seven stories, five of which had been constructed 25 years before the earthquake, while the two stories at the top had been added seven years later. The fifth floor had partially collapsed, trapping 44 patients and three nurses inside. Many hospitals lost their ability to function due to stoppages in electricity, water, gas, and communication lines. Kobe City General Hospital, the other municipal hospital, with 1,000 beds, had buildings tough enough to withstand the earthquake but damages to its utilities (water and gas) and the fragility of its equipment deprived the hospital of its proper functions as the central hospital and emergency center in the disaster. The main causes of hospital dysfunction in this case were destruction of the water reservoir at the top of the building and the insufficient fixation of equipment.

Information sharing between the hospitals was insufficient.[2] It is reported that there were considerable differences among the hospitals in the number of patients that were given medical care on the day of the earthquake. For example, one local hospital received 1,033 patients with only seven doctors present (Pts/MD = 147.6), while a university hospital located only a mile away from that hospital received 366 patients with 112 doctors present (Pts/MD = 3.3).

In the stricken areas, physicians, nurses and pharmacists were in short supply, but the medical response teams were so behind with arrivals that they were not able to offer lifesaving medical care to many patients. Helicopters were not used often enough at that time to transport patients with severe injuries to hospitals outside the affected area to receive necessary treatment.

Tanaka[3] conducted a detailed survey about the morbidity and mortality rates of hospitalized patients during the initial 15 days after the Hanshin-Awaji earthquake. The medical records of 6,107 patients who were admitted to 95 hospitals (48 affected hospitals within the disaster area and 47 back-up hospitals in the surrounding area) were examined. Significant differences in the mor-

tality rates of patients with crush syndrome were observed between those seen in the hospitals within the disaster area and those in the back-up hospitals outside the affected area (17.8% and 9.1%, respectively). Significant differences in the mortality rates for patients with other injuries were also observed between the two groups (6.8% and 2.3%, respectively). In contrast, there were no significant differences found between patients admitted with illnesses. These data indicate that patients with crush syndrome and other disaster-related injuries should have been transported to and treated in hospitals outside the affected area (Table 1).

JAPANESE NATIONAL DISASTER MEDICAL SYSTEM (NDMS)

After the Great Hanshin-Awaji Earthquake, the Ministry of Health, Labour and Welfare (MHLW) issued, on May 10, 1996, a core plan entitled "Improvement of initial emergency care system reinforcement at disasters" (Table 2).

Disaster base hospital

The disaster base hospital (DBH) is a hospital that plays an important role in preparing for and managing disasters. It is required to have a quake-resistant construction, firm lifelines, and will become the center for the acceptance of patients or the dispatch of required personnel when a disaster occurs. In 1996, the MHLW issued requirement criteria for the DBH and ordered all prefectures to designate DBHs (Table 3). By April 2012, 653 hospitals had been appointed as DBHs.[4]

Table 1. Mortality of hospitalized patients after the 1995 Hanshin-Awaji Earthquake[3]

	Total No. of deaths/total No. of patients (%)	Affected hospitals, No. of deaths/total No. of patients (%)	Backup hospitals, No. of deaths/total No. of patients (%)
Crush syndrome	50/372 (13.4)	33/185 (17.8)*	17/187 (9.1)
Other injuries	128/2,346 (5.5)	112/1,644 (6.8)*	16/702 (2.3)
Illnesses	349/3,389 (10.3)	216/1,988 (10.9)	133/1,399 (9.5)
Total	527/6,107 (8.6)	392/4,333 (9.0)	166/2,290 (7.3)

*Significant difference versus in the backup hospitals.

No., number.

Table 2. Improvement of initial emergency care system reinforcement at disaster

1. Promotion of the participation of medical personnel in local disaster prevention meetings
2. Arrangements of the mutual aid agreement at disaster
3. Maintenance of Emergency Medical Information System for a wide-area disaster
4. Maintenance of the disaster base hospitals
5. Reinforcement of the public health center function to affect disaster medical care
6. Spread awareness about the disaster medical care, the training, and enforcement of the drills
7. Practical use of hospital disaster prevention manual preparation guidelines
8. Cooperation with the firefighting organization at disaster
9. Maintenance of the postmortem examination system at disaster

Issued on May 10, 1996 by the Ministry of Health, Labour and Welfare Health Policy Bureau

Table 3. Disaster base hospital designation requirements

1. Accept all seriously injured or ill patients from the stricken area around the clock
2. Conduct the aeromedical shuttling by helicopter for patients and medical supplies between the disaster base hospital in the stricken area and disaster base hospital outside the stricken area
3. Hold disaster dispatch medical care team (DMAT)
4. Have surge capacity (two times for inpatients and five times for outpatients)
5. Earthquake-resistant structure
6. In-hospital generator, capable of operation 60% of the hospital's electrical needs, and with fuel for three days
7. Tray water tank of appropriate capacity, possession of the well
8. Helicopter landing pad at the hospital site
9. Have the following practice equipment
   - Satellite phone
   - Satellite line Internet
   - Multiple means of communication
   - Emergency Medical Information System (EMIS)
   - Lifesaving medical care kits for the seriously ill emergency patients
   - Carrying-type lifesaving medical care equipment, medical supplies, tent, generator, drinking water, food, life supply, and triage tag
   - Emergency vehicle or ambulance

DMAT, disaster medical assistance team; EMIS, emergency medical information system.

Emergency medical information system

An emergency medical information system (EMIS) is a medical information sharing system using the Internet. The purpose of an EMIS is to share information about hospitals, patients, disaster medical assistance teams, medical evacuation, medical supplies and medications, shelters, and so on with all personnel who are involved in disaster medical activities. An EMIS is able to integrate this information in order to effectively deal with needs and demands, and adjust the distribution of patients, medical supplies, medications, DMATs and transportation means.[5]

Disaster medical assistance team

A disaster medical assistance team (DMAT) is a medical team consisting of doctors, nurses and co-medical personnel dispatched to an affected area immediately after a disaster happens to provide acute care for victims.[6] Although one DMAT consists of only four or five members in order to easily move to the designated area as quickly as possible, 30 to 50 DMATs are assembled to help at the DBH and aeromedical evacuation (AE) staging bases or airports in an affected area to stabilize and transport injured patients.[7, 8] DMATs also play an important role in gathering medical information in a very acute phase and inputting it into the EMIS to map out a strategy for providing lifesaving interventions and coordinating their activities.

Aeromedical evacuation

A large number of people are wounded, often seriously wounded, at the time of a large-scale earthquake disaster in the stricken area. In addition to this, it is expected that sufficient medical services become impossible due to lost infrastructure from the damage to medical facilities and the lack of healthcare workers.[9] A strategy to send the required personnel to a stricken area, and to stabilize and transport patients to receive treatment outside the stricken area, is necessary. Therefore, a DMAT should be dispatched from an outside area into the stricken area to stabilize patients and transport the seriously injured to DBHs outside of the stricken area, to offer definitive medical care, such as surgery, hemodialysis and intensive care. Since continuous observation and seamless care by a DMAT is required, the series of activities to transport severely injured patients is called medical evacuation (Fig. 1), AE when aircraft are involved.

Fig. 1. Picture in a C-1 aircraft flying with the patients. During the flight, continuous observation and seamless care by a DMAT is required.
DMAT, disaster medical assistance team.

A

B

C

Fig. 2. Aircraft used for national aeromedical evacuation.
A: C-1 aircraft **B:** CH-47 helicopter **C:** C-130 aircraft

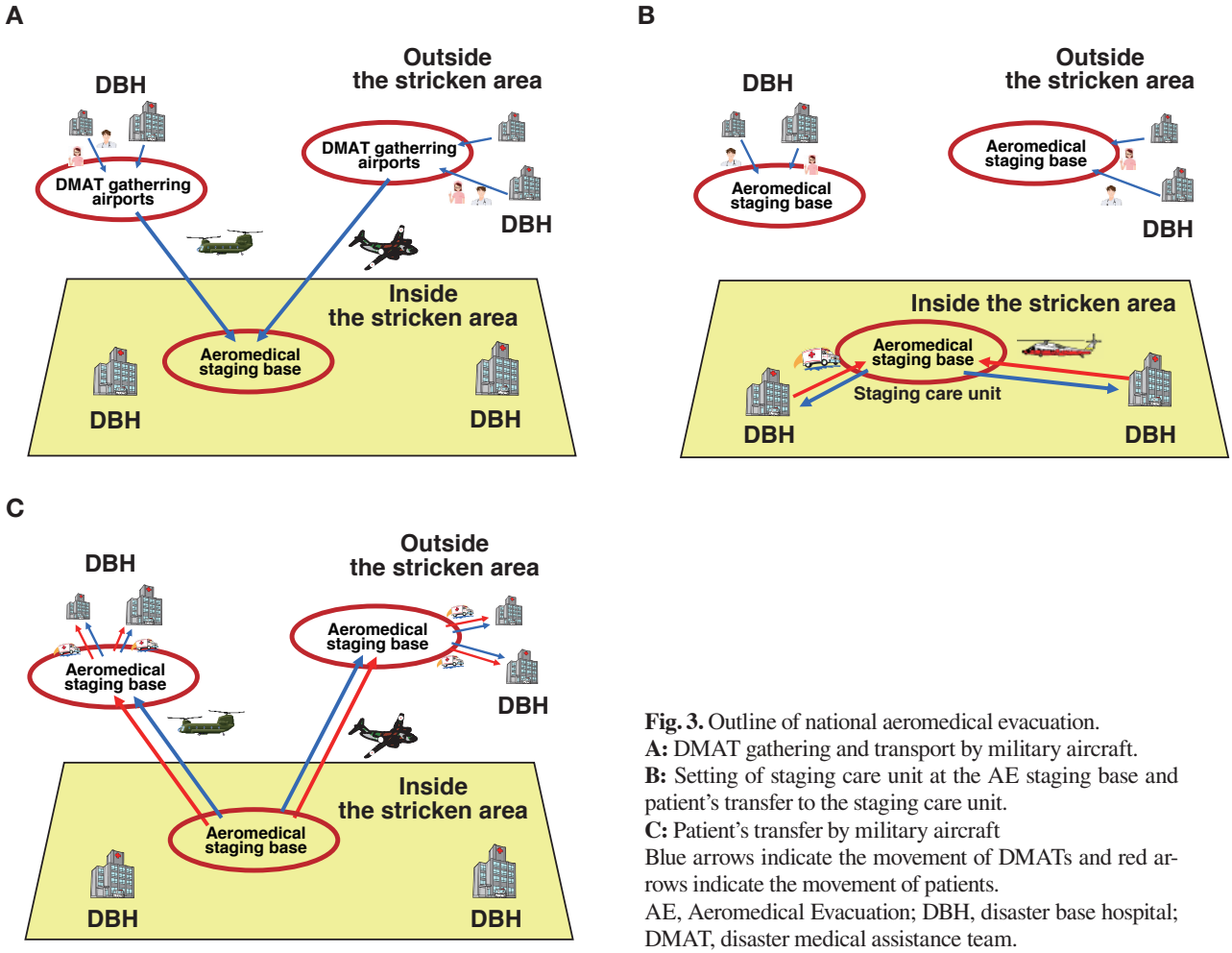

Fig. 3. Outline of national aeromedical evacuation.
A: DMAT gathering and transport by military aircraft.
B: Setting of staging care unit at the AE staging base and patient's transfer to the staging care unit.
C: Patient's transfer by military aircraft
Blue arrows indicate the movement of DMATs and red arrows indicate the movement of patients.
AE, Aeromedical Evacuation; DBH, disaster base hospital; DMAT, disaster medical assistance team.

Medical evacuation is classified into three categories: i) long-distance evacuation by military aircraft (Figs. 2A, B and C), which are mainly operated by the Cabinet Office headquarters (national AE); ii) moderate-distance evacuation to a neighboring prefecture by a helicopter (Fig. 2B), which is mainly operated by the prefectural headquarters (local type-1 AE); iii) short-distance evacuation inside the affected prefecture by ground or air transportation, which is mainly operated by the city government or fire department's headquarters (local type-2 medical evacuation).

The national AE plans mainly consist of three parts: DMAT gathering and transport by military aircraft (Fig. 3A), AE staging activities (Fig. 3B), and patient transfer by military aircraft (Fig. 3C).

EXPERIENCES OF THE GREAT EAST JAPAN EARTHQUAKE

On March 11, 2011, a huge, magnitude 9.0 earthquake and subsequent powerful tsunami hit the Tohoku area of Japan, leaving 15,891 people dead, 6,152 injured, and 2,579 missing. Immediately after the disaster, 383 DMATs, comprising 1,852 members from all over Japan, were involved in acute phase activities in the affected area for 12 days, such as headquarters administration, hospital support, AE staging activities, and patient transport by land and air. In this paper, I describe the details of the AEs performed by DMATs.

Decision on national AE enforcement

In general, it is extremely difficult to accurately grasp the severity of damage immediately after the occurrence of a large-scale earthquake. A Disaster Information System (DIS), which the Cabinet Office has developed, can be used to estimate the gross damage situation using a geographical information system, which integrates information, such as topography, the ground situation, population, buildings, disaster prevention facilities, into a digital map on the computer. Based on results from the DIS and the damage reports provided by each ministry and government office, it was estimated that the number of casualties would be greater than 10,000 just after the

earthquake and tsunami took place.

The national AE adjustment group (C5 Group) from the Extreme Disaster Management Headquarters at the Prime Minister's Office, the Anti-Disaster Measures Room at the MHLW, and the DMAT Secretariat at the National Disaster Medical Center decided to give the go-ahead for national AE by 2:00 on March 12, which was approximately 12 hours after the occurrence of the earthquake. According to the pre-existing national AE plan, a DMAT gathering order to the designated bases was made for DMAT members all over Japan, and AE staging bases inside and outside the stricken area were designated (Table 4).

Wide area emergency transportation of DMAT members

Since Chitose Air Base of the Japan Air Self-Defense Force (JASDF), Kasuga Air Base of the JASDF, and Osaka International Airport (Itami Airport) had been appointed as the DMAT gathering airports and bases, approximately 393 DMAT members, divided into 78 teams, were gathered and transported by JASDF aircraft to two AE staging bases (Table 5). Other DMAT teams made their way to the AE staging bases by ground transportation.

Table 4. DMAT assembly point, AE staging base inside and outside the stricken area

	AE staging base	
DMAT assembly point	Inside the stricken area	Outside the stricken area
JASDF Chitose Airbase	Iwate Hanamaki Airport	JASDF Chitose Airbase
Osaka International Airport (Itami Airport)	Fukushima Airport	Tokyo International Airport (Haneda Airport)
JASDF Kasuga Airbase	Camp Kasuminome	Akita Airport

AE, aeromedical evacuation; DMAT, disaster medical assistance team; JASDF, Japan Air Self Defense Force.

Table 5. Transport of DMAT by the Self-Defense Forces Aircraft

Day	DMAT assembly point	Departure time		Carriers		Wayport		Arrival airport	Arrival time	Number of DMATs	Number of members
12-Mar	JASDF Chitose Airbase	5:15	→			C-1	→	Iwate Hanamaki Airport	6:45	5	24
12-Mar	Osaka International Airport (Itami Airport)	6:57	→			C-130	→	Iwate Hanamaki Airport	8:42	13	69
12-Mar	Osaka International Airport (Itami Airport)	7:53	→			C-130	→	Iwate Hanamaki Airport	9:20	13	69
12-Mar	Osaka International Airport (Itami Airport)	14:24	→			C-130	→	Iwate Hanamaki Airport	16:10	12	58
12-Mar	Osaka International Airport (Itami Airport)	15:34	→			C-130	→	Iwate Hanamaki Airport	17:30	11	55
12-Mar	JASDF Kasuga Airbase	6:00	→	C-1	→	JASDF Hyakuri Airbase	→	CH47 → Camp Kasuminome	9:53	8	38
12-Mar	JASDF Kasuga Airbase	7:20	→	C-1	→	JASDF Hyakuri Airbase	→	CH47 → Camp Kasuminome	10:50	7	38
12-Mar	JASDF Kasuga Airbase	10:00	→	C-1	→	JASDF Hyakuri Airbase	→	CH47 → Camp Kasuminome	24:20	9	42
	All									78	393

DMAT, disaster medical assistance team; JASDF, Japan Air Self Defense Force.

Setting of staging care unit at the AE staging base

From the early morning of March 12, a Staging Care Unit (SCU), which is a medical facility at the AE staging base, was installed at Hanamaki Airport, Fukushima Airport, and at the Japan Ground Self Defense Force (JGSDF) Camp Kasuminome, where 69, 14 and 24 DMAT teams were placed, respectively. At Hanamaki and Fukushima Airports, where runways were long enough for JASDF fixed-wing aircraft to take off and land, a national AE with such aircraft was planned. On the other hand, both Sendai Airport and JASDF Matsushima Air Base in Miyagi Prefecture were buried under water and unusable for the taking off and landing of these aircraft; therefore, Camp Kasuminome, which did not have a runway, was appointed as a substitute AE staging base. In addition, a helicopter emergency medical service (HEMS) gathering base and a HEMS adjustment headquarters were set up at Hanamaki and Fukushima Airports, but not at Camp Kasuminome.[10] Summaries of the activities of each SCU are shown in Tables 6 and 7.

Summary of the national AE (Table 8, Table 9)

In total, 19 patients were transported by JASDF fixed-wing aircraft as part of the national AE. Four patients were transported by a JASDF C-1 carrier from Hanamaki Airport to the JASDF Chitose Base on March 12 and arrived at hospitals in Sapporo and nearby soon thereafter. Three patients were transported from Fukushima Airport to Haneda Airport, and then transported to hospitals in Tokyo. Six patients were transported from Hanamaki Airport to Haneda Airport by a JASDF C-1 carrier on March 13, and then transported to hospitals in Tokyo. Three patients were transported from Hanamaki Airport to Akita Airport by a JASDF C-1 carrier on March 14 and 15, and then transported to medical institutions in Akita City. Because there were many patients with hypothermia and pneumonia (tsunami lungs) as a result of the tsunami, as well as inpatients of the hospitals in coastal areas that had lost functionality, some patients with malignant tumors and those in a postoperative state were included in addition to those injured by the earthquake and tsunami.

Table 6. The number of DMATs involved and the number of transports in each SCU

		Iwate Hanamaki Airport SCU	Fukushima Airport SCU	Camp Kasuminome SCU	All
Opened		12-Mar	12-Mar	12-Mar	
Closed		16-Mar	14-Mar	16-Mar	
Number of DMATs involved		69 teams	14 teams	24 teams	107 teams
National AE		16	3	0	19
Local	Type 1*	0	0	8	8
	Type 2†	120	0	190	310
All		136	3	198	337

*Type 1: Transportation to neighboring prefecture. †Type 2: Transportation inside the stricken prefecture.
AE, aeromedical evacuation; DMAT, disaster medical assistance team; SCU, staging care unit.

Table 7. Activities of each SCU

	Iwate Hanamaki airport SCU			Camp Kasuminome SCU			Fukushima Airport SCU			All
	Local type 1*	Local type 2†	National	Local type 1*	Local type 2†	National	Local type 1*	Local type 2†	National	
12-Mar	0	66	4	3	6	0	0	0	3	82
13-Mar	0	33	6	5	16	0	0	0	0	60
14-Mar	0	17	3	0	150	0	0	0	0	170
15-Mar	0	4	3	0	18	0	0	0	0	25
16-Mar	0	0	0	0	0	0	0	0	0	0
All	0	120	16	8	190	0	0	0	3	337

*Type 1: Transportation to neighboring prefecture. †Type 2: Transportation inside the stricken prefecture.
SCU, staging care unit.

Table 8. Summary of National AE

Flight	Date	Departure AP	Departure time	Carriers	Arrival AP	Arrival time	Number of patients
#1	12-Mar	Iwate Hanamaki AP	19:55	C-1	JASDF Chitose AB	20:40	4
#2	12-Mar	Fukushima AP	21:48	C-1	Tokyo International AP (Haneda AP)	22:15	3
#3	13-Mar	Iwate Hanamaki AP	21:25	C-1	Tokyo International AP (Haneda AP)	22:25	6
#4	14-Mar	Iwate Hanamaki AP	19:50	C-1	Akita AP	20:20	3
#5	15-Mar	Iwate Hanamaki AP	14:55	C-1	Akita AP	15:41	3

AB, Airbase; AE, aeromedical evacuation; AP, Airport.

Table 9. Patient list of national AE

No.	Age (years old)	Sex	Duration*	Distance (km)†	Diagnosis
1	66	F	1:38	756	ARDS, pneumonia, left upper arm degloving injury
2	34	M	1:40	722	Right hip dislocation fracture
3	45	M	1:48	814	Bilateral hemothorax, pulmonary contusion, multiple rib fractures
4	99	F	1:35	730	Humerus fracture
5	64	M	1:26	677	Crush syndrome
6	61	F	1:32	682	Right leg amputation
7	40	M	1:37	672	Crush syndrome
8	89	F	2:17	698	Cholelithiasis, cholangitis, cholecystitis
9	58	M	2:15	696	Colorectal cancer, ileus
10	72	M	2:45	704	Small intestine malignant lymphoma
11	Unknown	M	1:57	690	Seizure, epilepsy
12	77	F	1:50	689	Postoperative ileus
13	70	M	2:08	701	Ileus
14	82	F	1:18	261	Pneumonia
15	86	F	1:10	235	Diabetes, hypertension
16	78	F	1:05	235	Multiple rib fracture, left fibula fracture, lumbar fracture
17	86	F	1:39	268	Brain contusion
18	83	M	1:35	275	Bilateral pneumonia
19	71	F	1:35	280	Left hemothorax, atelectasis, right subdural hematoma

*The duration between departure from SCU in the affected area and arrival at destination hospital.
†The distance between hospital in the affected area and arrival at destination hospital.
AE, aeromedical evacuation; F, female; M, male; SCU, staging care unit.

Summary of local government AE operated by Miyagi Prefecture Headquarters (Table 10)

In Miyagi, transport by helicopters from a hospital in Sendai City to Yamagata, in the neighboring prefecture (local type-1), was carried out via Camp Kasuminome on March 13. This was performed under the supervision of the Miyagi Prefectural Disaster Management Headquarters.

DISCUSSION AND PERSPECTIVE

The Japanese NDMS, consisting mainly of four parts, namely, DBHs, an EMIS, DMATs and AE, has been developed over the past 16 years since the Hanshin-Awaji Earthquake and was tested for the first time in a real disaster situation as a result of the Great East Japan Earthquake. The following issues became evident through experiences with the latter earthquake.[11, 12]

DMATs worked well according to the preexisting plan and exercises but had some problems in terms of logistics and accommodations

The Japanese DMAT, which is composed of only a few people and, therefore, dispatches quickly, is gathered in the affected area, works systematically on activities such as establishing headquarters, treatment and evacuation activities at hospitals and AE staging bases, and monitoring and caring for patients in helicopters and fixed-wing aircraft according to the preexisting plan and

Table 10. Summary of local government transport that was performed by Miyagi prefecture

	Date	Age (years old)	Sex	The departing hospital	The receiving hospital	Mode of transport	Distance (km)*	Diagnosis
1	12-Mar	28	M	NHO Sendai Medical Center	Okitama General HP	Helicopter	105	Crush syndrome, thoracic injury
2	12-Mar	68	M	NHO Sendai Medical Center	Nihonkai General HP	Helicopter	177	Hypothermia, right leg buttocks ache
3	12-Mar	56	M	NHO Sendai Medical Center	Yamagata Prefectural Central HP	Helicopter	73	Subarachnoid hemorrhage
4	13-Mar	about 50	M	Tohoku University HP	Yamagata University HP	Helicopter	67	Splenic injury, right pneumothorax
5	13-Mar	72	M	Tohoku University HP	Yamagata City HP Saiseikan	Helicopter	64	Brain contusion, cerebral hemorrhage
6	13-Mar	27	F	NHO Sendai Medical Center	Shonai HP	Helicopter	161	Spinal cord injury, pelvic fracture (post-TAE)
7	13-Mar	49	M	NHO Sendai Medical Center	Yamagata Prefectural Central HP	Helicopter	73	Multiple fractures, Schizophrenia
8	13-Mar	37	F	NHO Sendai Medical Center	Yamagata City HP Saiseikan	Helicopter	75	Pelvic fracture

*The distance between hospital in the affected area and arrival at destination hospital.
F, female; HP, Hospital; M, male; NHO, National Hospital Organization; TAE, transcatheter arterial embolization.

exercises. For many of the members, the food support, transportation, and accommodations were not sufficient.

AE plans should be continued in all metropolises and districts

The carrying out of such a wide area AE for the first time in the aftermath of the Great East Japan Earthquake deserves significant praise. On the other hand, it took 29 hours for the first flight to take off after the occurrence of the disaster. The reasons for the delay included that there was no national AE plan for an earthquake in the Miyagi area due to low prior damage expectations. Before the Great East Japan Earthquake happened, the Japanese government had been focused on the Tokai, Tonankai, and Nankai regions, or a Tokyo Inland Earthquake, and developed the national AE plan only for those areas. Given our experiences after the Great East Japan Earthquake, all metropolises and districts in Japan should have an AE plan and should choose an AE staging base or airport where all required equipment will be prepared, stored, and training exercises with them will be held.

SCU with cooperation of HEMS effective for mobile patient transport in early period of disaster

At the Hanamaki Airport SCU, 109 patients were attended to for two days in the immediate aftermath of the disaster, and national AE and local type-2 medical evacuation were carried out. On the other hand, the number of accepted patients at the SCU was confined to 30 at the Camp Kasuminome SCU in the initial two days. Various factors may have contributed to this difference, but the positioning of a HEMS base at each SCU is believed to be a big factor.[10]

At the Hanamaki SCU, DMAT dispatch to the coastal region and patient tranport from the coastal region were carried out by HEMS. At the Camp Kasuminome SCU, the peak of the transport was late, on March 14, the third day after the disaster occurrence, due to a lack of early mobile DMAT transportation and patient transport, because a HEMS base was not located at the Kasuminome SCU.

In addition, at the Fukushima Airport SCU, a huge area above Fukushima Prefecture was appointed as a no-fly zone because of the accident at the Fukushima Nuclear Power Plant, and it is believed that patient rescue and transport using HEMS was difficult.[13]

Need for national AE was low, although the need for local AE and ground transport was high

A wide area AE plan had been developed based on an assumption of damage caused by the collapse of buildings, as was the case in the Great Hanshin-Awaji Earthquake and the Tokai Earthquakes before it. Therefore, the victims expected for the wide area AE were considered to be those with severe injuries and burns, and crush syndrome. However, in the case of the Great East Japan Earthquake, there were many patients with predominantly internal injuries caused by the tsunami, such as hypothermia, pneumonia and dermatitis.[12] Above all, there were many inpatients such as those in a postoperative state, as well as cancer patients or elderly cerebral, cardiovascular, pneumonic and mental patients in those hospitals that lost functionality due to the damage caused by the earthquake and tsunami.

CONCLUSION

The Japanese NDMS, consisting mainly of four parts, namely, DBHs, an EMIS, DMATs and AE, has been developed over the past 16 years since the Hanshin-Awaji Earthquake and was tested for the first time in a real disaster situation as a result of the Great East Japan Earthquake. It became clear that the Japanese NDMS played an important role in the Great East Japan Earthquake.

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