

# “Medical Management in Disasters: Considering the Vulnerability of Medical Institutions”



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*Hyogo Emergency Medical Center*

## Introduction

- **The Great Hanshin-Awaji Earthquake** that hit Japan 23 years ago highlighted various issues in disaster response
- The imbalance between supply and demand for medical services could not be eliminated in the early stages of the disaster, causing **preventable deaths**
- Based on the lessons learned, **the disaster medical system** in Japan was reviewed and has been greatly improved, although work remains to be done

# Introduction

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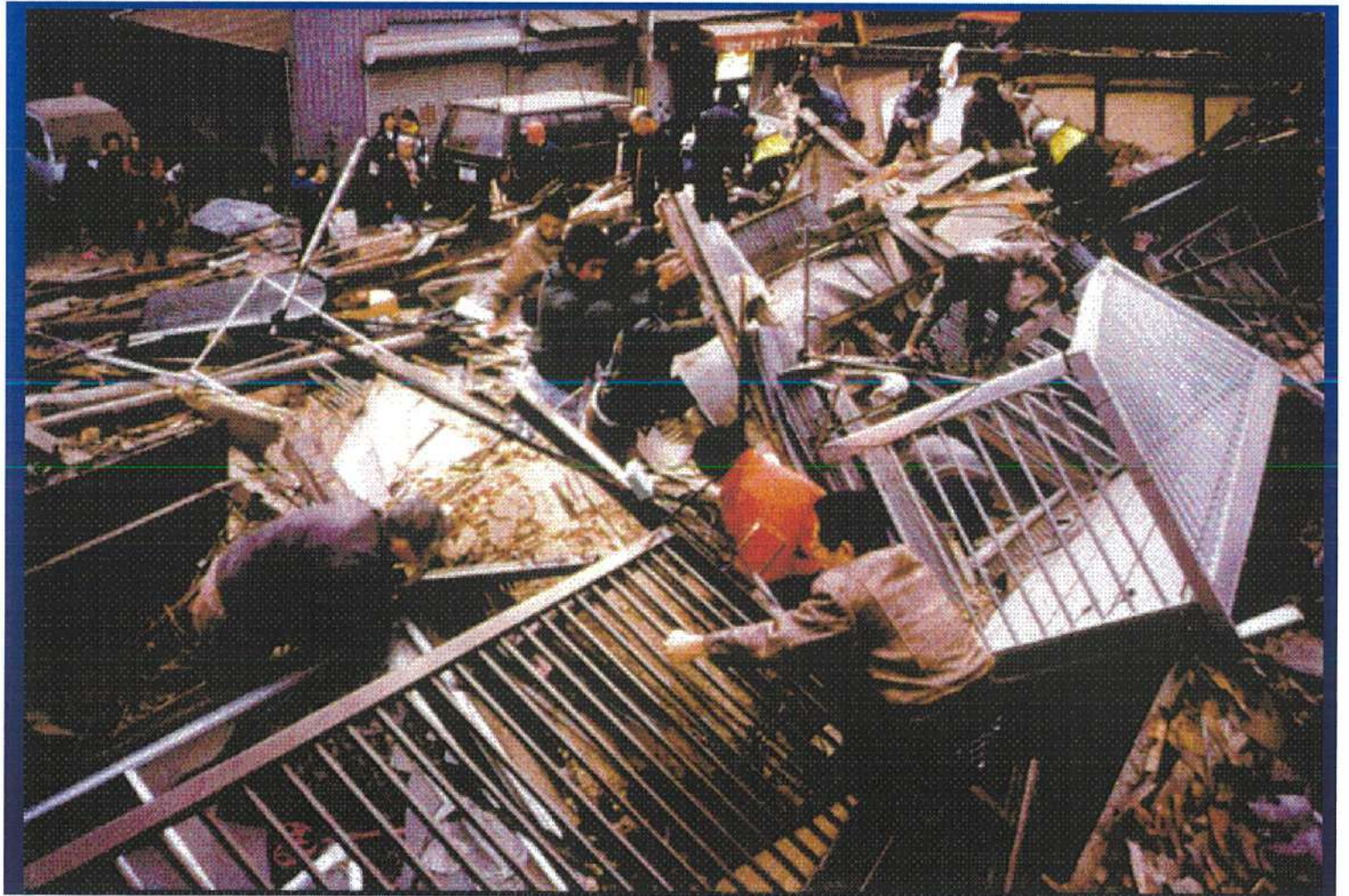
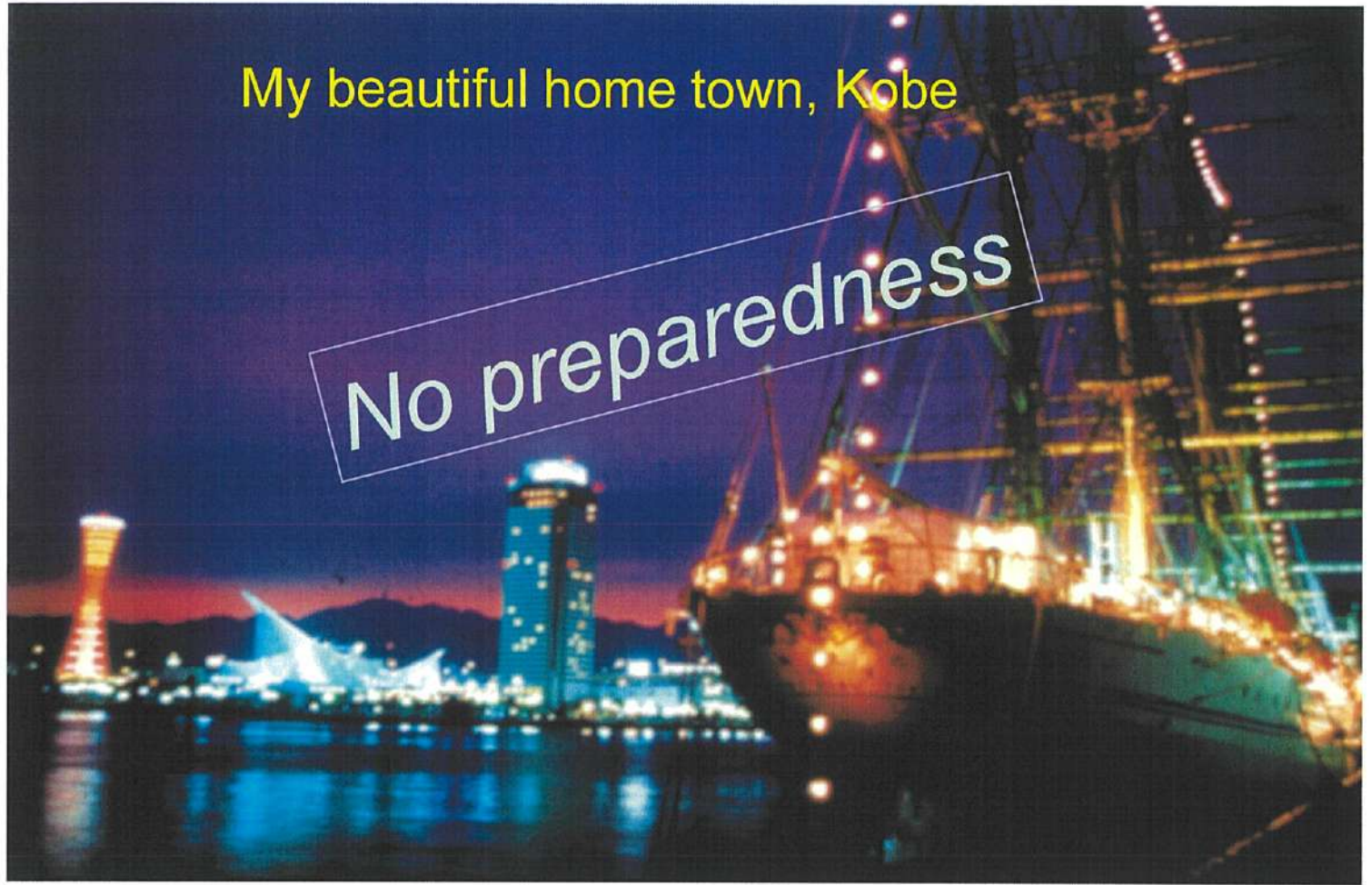
- However, as severe disasters are expected to occur frequently in future, the system is unlikely to function unless we focus on **the vulnerability of medical institutions, which are the “guardians of life”**
- I would like to reconsider the vulnerabilities of medical institutions highlighted by the Hanshin-Awaji Earthquake, the Great East Japan Earthquake, the Kumamoto Earthquake, and other earthquakes, typhoons and flood disasters that hit Japan last year and explore ideas for developing countermeasures

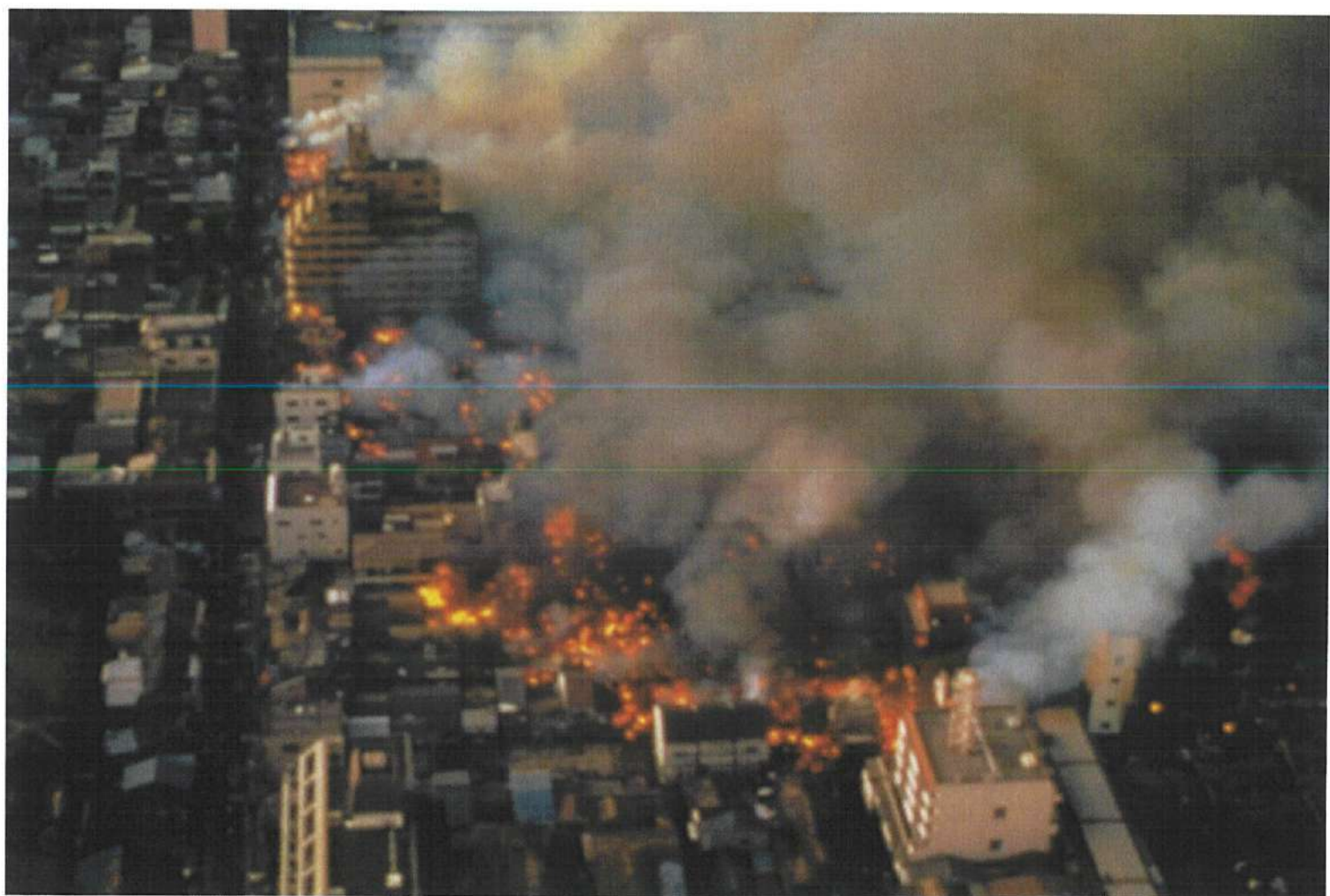
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What happened in 1995 ...

My beautiful home town, Kobe

No preparedness







# Human impact and summary of medical examinees

## - The Great Hanshin-Awaji Earthquake -

- ✧ Fatalities: 6,433
- ✧ Missing persons: 3
- ✧ Injured: 43,792
  - Severely injured: 10,683
  - Slightly injured: 33,109

- ✧ Patients visiting hospitals: 50,655
  - Hospitalized: 8,167
  - Serious condition: 717
  - Severely injured: 2,658
  - Slightly injured: 47,280
  - Death: 749

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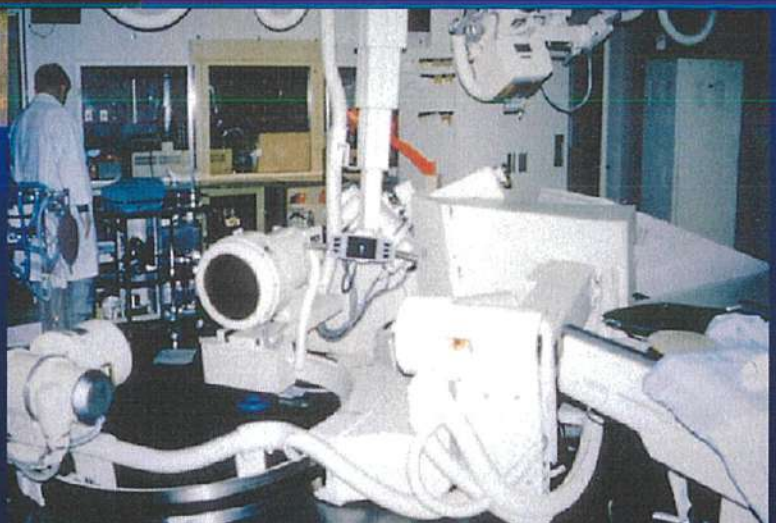
### Cracked Wall of Kobe University Hospital



Electricity: Cut off but quickly restored

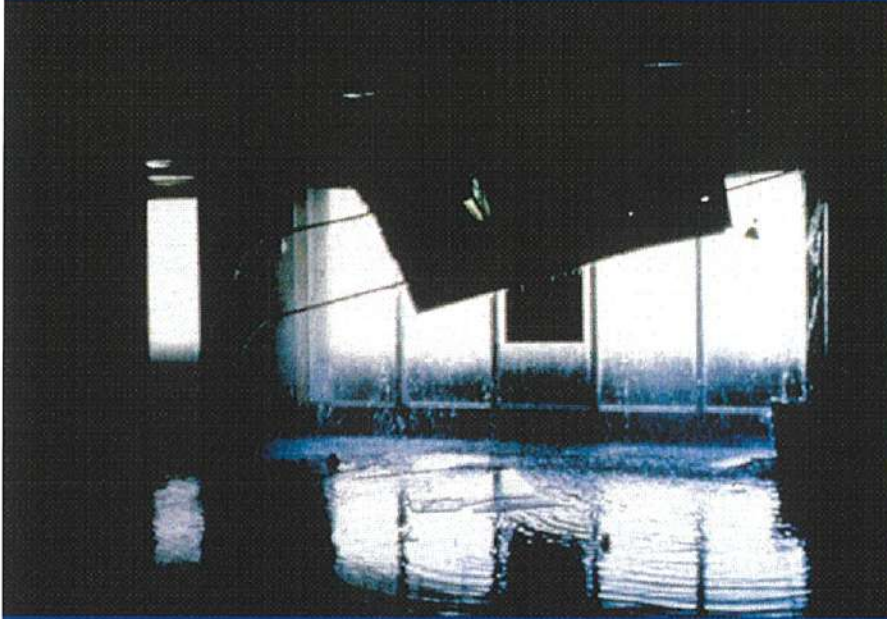
Water supply: Cutoff for 6 days

Gas: 25 days to restoration



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# Kobe City Medical Center General Hospital



*In disasters, both medical facilities  
and medical staff may be victims.*



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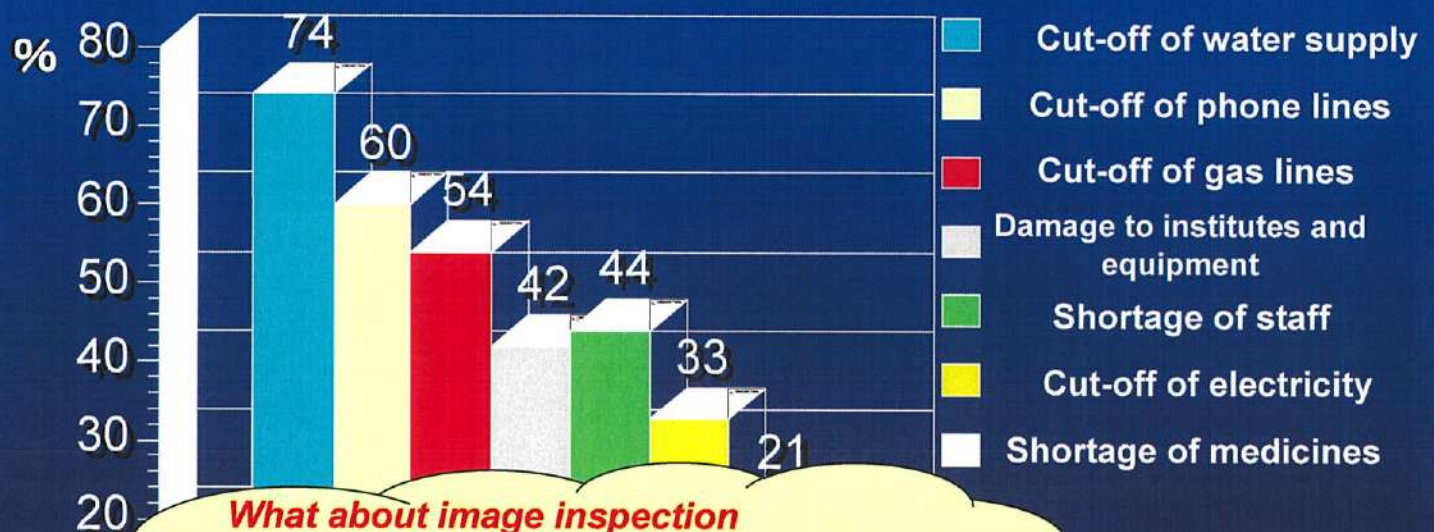
## A Hospital in Kobe



**Medical facilities** were damaged as well as fire departments!  
**140/245 inpatients** were transported to 17 hospitals.

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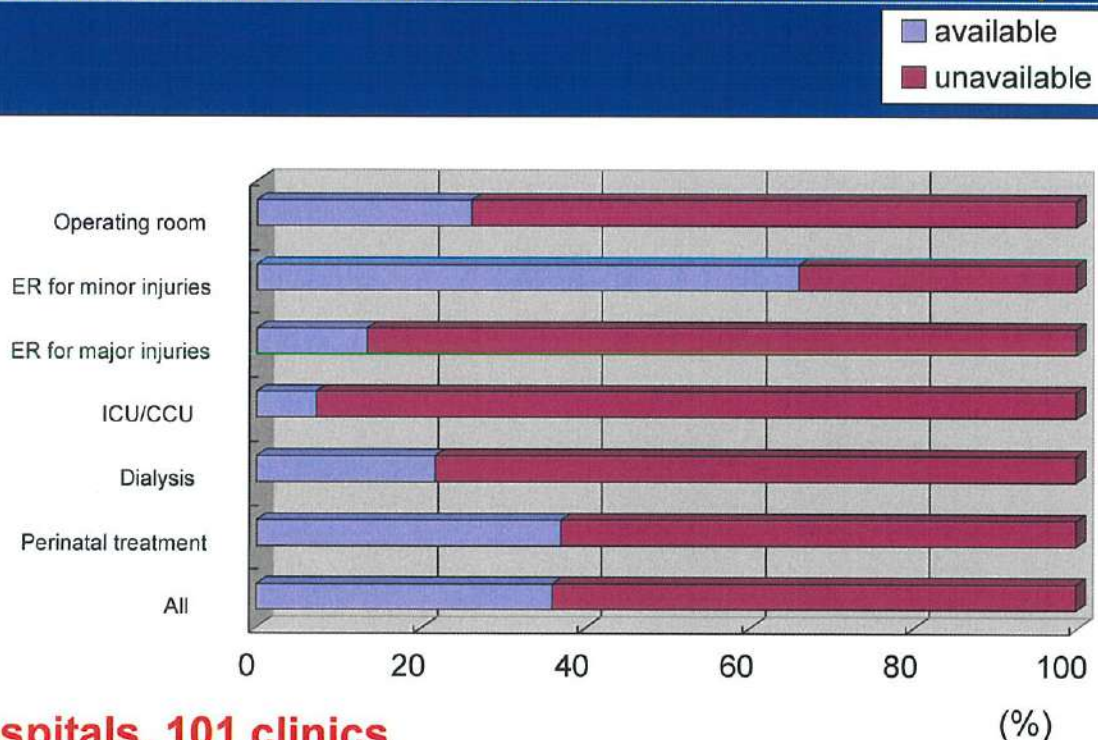
## Major Obstacles against Hospital Functions in Hanshin Area



*What about image inspection equipment such as X-ray, CT, and MRI, which are essential for normal medical care, and advanced medical care?*

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## Impact on Hospitals on the day of the Great Hanshin-Awaji Earthquake (224 medical institutions in the disaster-stricken area)



**4 hospitals, 101 clinics  
completely destroyed or burnt down**

Survey by Hyogo Pref.

# The Great Hanshin-Awaji Earthquake

## January 17, 1995

- ◆ Hospitals were in chaos with patients
- ◆ Utilities cut off (no water, electricity, or phone)
- ◆ Shortage of staff, medical products and beds
- ◆ Lack of support teams in acute phase
- ◆ No transfer by air



***“Let’s save as many lives as possible”***

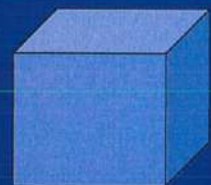
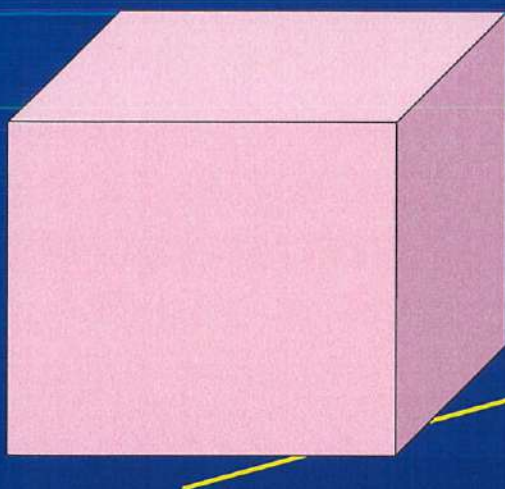
*Science Special Research Report by MHLW in 2001*

*“Study on Standardization of Disaster Medical Assistance Team (DMAT) in Japan”*

### In a disaster

Demand

Resources



*Imbalance*

The greater the imbalance,  
the more devastating the results

The degree of imbalance  
differs by location

# Specificity of medical institutions

Medical institutions will also be damaged,  
yet their workload increases!



\* How can we expand our work in the event of a disaster?

- Secure infrastructure
- Secure manpower
- Secure medicines
- ...

## Items that need urgent reinforcement

(May 29, 1995: Study group on the medical system situation triggered by the Great Hanshin-Awaji Earthquake)

- ✧ Establishment of disaster medical information system
- ✧ Enhancement of disaster base hospitals
- ✧ Strengthening of disaster measures at the regional level
- ✧ Strengthening of disaster measures at the hospital level
- ✧ Enhancement of supply system for medicines, etc.
- ✧ Establishment of disaster transport system and wide-area transport system
- ✧ Promotion of comprehensive research on disasters
- ✧ Implementation of seminars & training programs on disaster medical treatment for medical personnel and utilization of medical volunteers
- ✧ Raise Japanese people's awareness of rapid- response medical care in a disaster

# Improvements of the Disaster Response System in Japan in 23 years

◇ 1996~ Disaster Base Hospitals



◇ 2005~ **DMATs**: Disaster Medical Assistance Teams  
(which are promptly dispatched in acute phase of disaster)

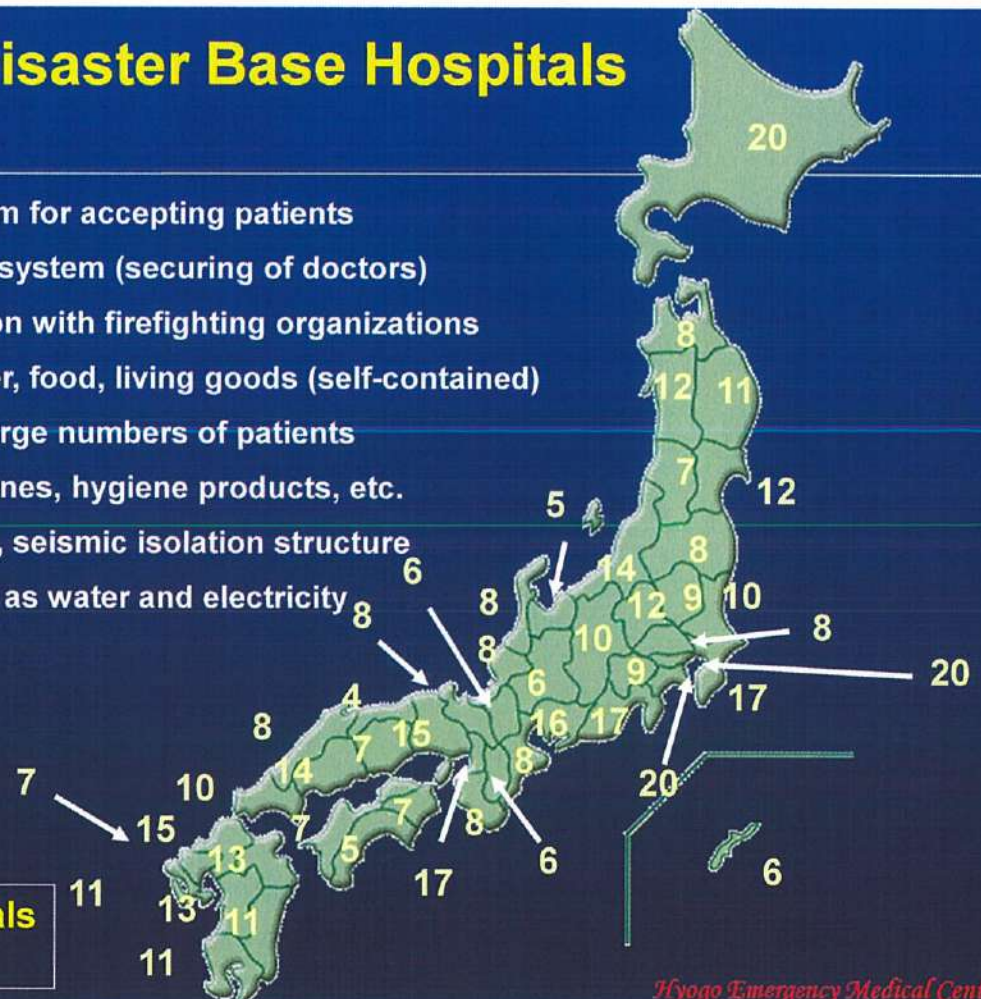
◇ 1996~ **EMIS**: Emergency Medical Information System

◇ 1996~ Disaster Medical Coordinators

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## Disaster Base Hospitals

1. 24-hour emergency system for accepting patients
2. Helicopter transportation system (securing of doctors)
3. Relief team in collaboration with firefighting organizations
4. Generators, drinking water, food, living goods (self-contained)
5. Space to accommodate large numbers of patients
6. Stockpiles of cots, medicines, hygiene products, etc.
7. Quake-resistant structure, seismic isolation structure
8. Maintaining lifelines such as water and electricity
9. Holding triage tags



**684 designated hospitals**  
(as of February, 2015)

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# JDMAT

(Japan Disaster Medical Assistance Team)

## ✧ Definition

DMAT is a medical team which members are well trained, being quickly dispatched in case of disaster.

"The Committee on Japanese DMAT plan"

Ministry of Health, Labour and Welfare

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## DMAT training, and numbers completed

Apr. 1, 2005 - Mar. 31, 2018

Training for volunteer members: 225  
National Hospital Organization Disaster Medical Center: 110  
Hyogo Emergency Medical Center: 108  
National Hospital Organization Osaka National Hospital: 7

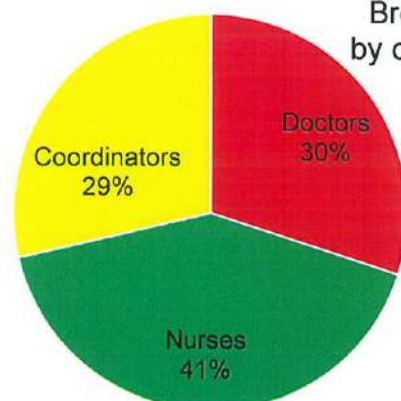
Small group of 4-5  
persons/team!

- Medical institutions receiving DMAT training program 801 institutions
- DMAT teams 1,630 teams
- DMAT members 12,777 persons

Disaster base hospitals 91%  
Other hospitals 9%

\* Percentage of disaster base hospitals and other hospitals was calculated from EMIS data as of April 12, 2018

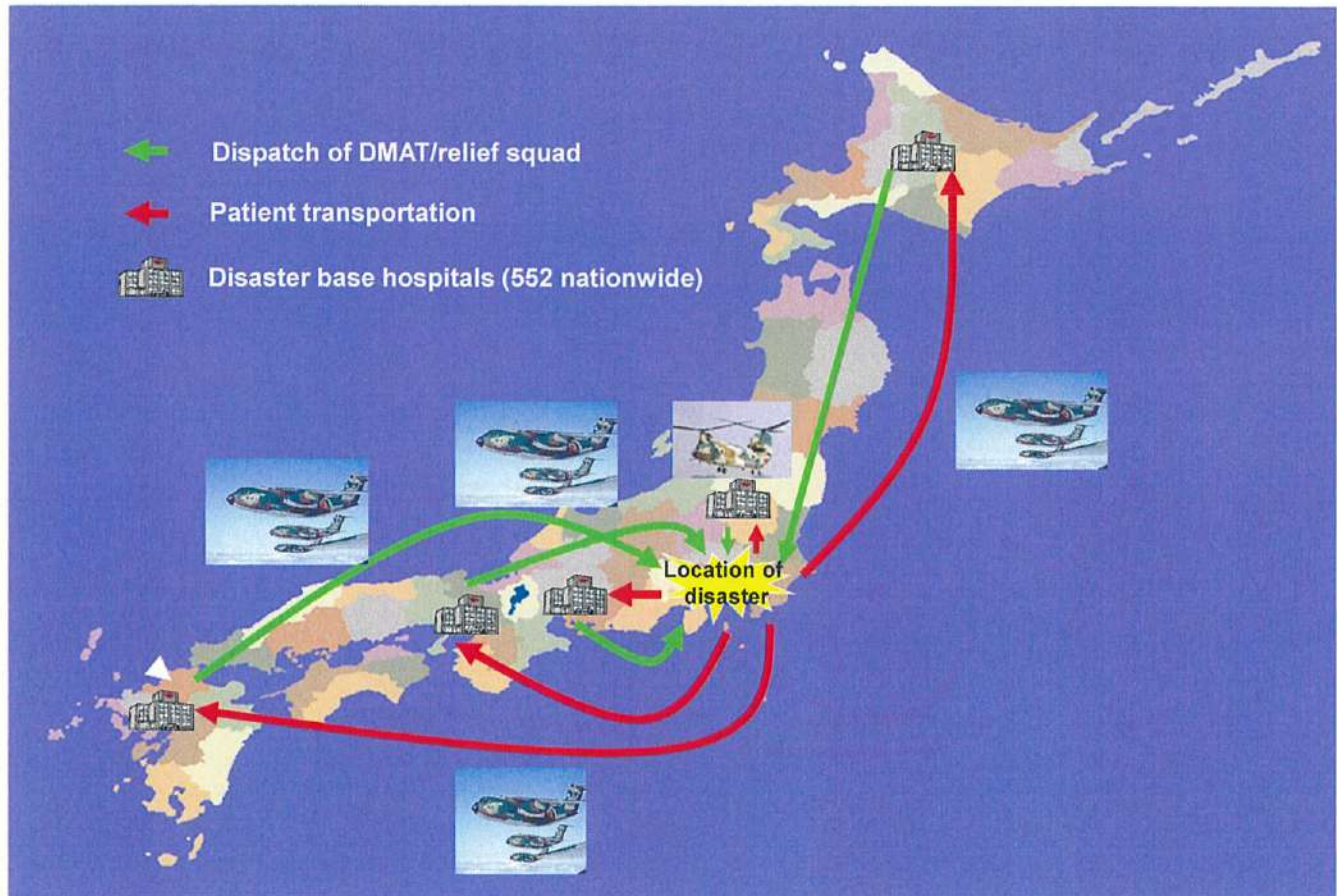
Breakdown  
by occupation



### Breakdown by occupation

- Doctors 3,831
- Nurses 5,285
- Coordinators 3,661

# Wide-area medical transfer



## EMIS (Emergency Medical Information System)

- ✧ Nationwide information sharing among disaster management headquarters, fire departments, hospitals, health offices, DMAT offices, etc.
- ✧ Internet technology
- ✧ Main functions
  - To notify emergency situation of the hospitals to headquarters
    - Damages of the hospitals, lifelines, number of patients beyond capacity, number of Red/Yellow tagged pts., transportation needs, etc.
  - To support DMAT's operation
  - MATTS (Medical Air-Transport Tracking System)

## Form for describing the situation of a medical institution – Items to be entered in an emergency –

### Emergency inputs list

Assumed evacuation of hospital

Enter in an emergency (information just after a disaster occurs).  
Enter information about the medical institution just after a disaster occurs (whether or not it functions as a medical institution, whether it needs support).

1. Collapse  
Choose "Yes" if it is difficult to accept patients because hospital wards may have collapsed or may collapse.

2. Lifelines  
Choose "None" or "Insufficient" if medical care cannot be performed due to lack of or insufficient lifelines (electricity, water, medical gas, medical supplies, sanitary products, equipment).

3. Patient capacity  
Choose "Yes" if it is difficult to accept more patients due to overcapacity.

4. Staff  
Choose "shortage" if treatment cannot be provided due to lack of staff.

5. Others  
If you need assistance for reasons other than 1 to 4, freely enter the reason in the "Others" field.

6. Date and time of information  
Enter the date and time when you grasped the situations of 1 to 5.

7. Emergency contact  
Enter emergency contact details.

If any of the items on the left side of the choice is checked, it means the following:

- The institution cannot provide medical care during normal time.
- The institution needs help.

Hospital can send SOS for emergency input

## Form for describing the situation of a medical institution – Detailed information fields ① –

### List of emergency inputs (upper part of screen)

Detailed entry (information about medical institution)  
Enter these fields when some information of the medical institution becomes available. Enter the situation of the medical institution and its actual experience in the field of disaster medical care.

1. If any facility collapsed or may collapse  
Choose whether any facility of the medical institution has collapsed or may collapse. Also, enter the collapse situation of other facilities.

2. Lifelines  
Choose the current situation of each lifeline. In the field for insufficient medical products, enter the name of the medical product which is lacking.

3. Functions of the medical institution  
Choose the situation of each function currently available in the medical institution.

4. Number of patients currently admitted  
In the field "Number of patients admitted after disaster," enter the cumulative number of patients admitted since the disaster occurred.  
In the field "Number of hospitalized patients," enter the total number of patients currently in the hospital, including hospitalized patients.

Repeatedly report more details on  
the emergency situation!

– Detailed information fields ② –

今後、記入が必要な票数 **3** 年 月 日 曜日 時 分 現在日時検索

費正定外票数部 **票正(票)** **中票正(票)**

人工所 **人** 旅費 **人** 通費 **人** 旅費 **人**

今後、受け入れ可能な票数 **2** 年 月 日 曜日 時 分 現在日時検索

災害時の対応能力(災害時の発生直後票数) **2** 人 **3**

費正定外票数部 **票正(票)** **中票正(票)**

人工所 **人** 旅費 **人** 通費 **人** 旅費 **人**

非常時対応力、および非常時対応時間 **年 月 日 曜日 時 分 現在日時検索**

非常時対応状況 **貸付可** **非貸付可** **下記の通り貸付**

時数第1 **分 ~ 分**

時数第2 **分 ~ 分**

時数第3 **分 ~ 分**

職員数 **3** 年 月 日 曜日 時 分 現在日時検索

登録人数 **114** 人 **DAGAT** 登録数 **4** 人 **DAGAT** 登録部 **5** 人 **所属登録部** **2** 人

出動職員数 **出動職員数** **人** **内、DAGAT職員** **人**

**出動有線職員** **人** **内、DAGAT職員** **人**

**その他出動人数** **人** **内、DAGAT職員** **人**

その他 **年 月 日 曜日 時 分 現在日時検索**

その他、**30分以内の登録、1時間未満を記入してください。(200文字以内)**

Enter the number of patients who need to be transferred among those in the hospital, including inpatients. Describe the types of patients to be transferred by entering the number of patients requiring artificial respiration/oxygen, and the number of carriers/escorts.

Describe the types of patients that can be admitted by entering the number of patients requiring artificial respiration/oxygen, and the number of carriers/escorts.

Enter the situation concerning outpatient reception.

Enter the number of staff who are currently in the medical institution.

Freely enter special notes not covered by 1 to 8 (e.g. access condition around the medical institution).

Enter more details about the situation of the hospital..

**Basic function of EMIS:** Monitoring the situation of medical institutions

すべて

医療機関

避難所

救護所

その他

チーム表示切替

要手配/未入力のみ表示する

支所  
支所

医療  
機関  
支所  
支所

名称

更新  
日時  
▼▲

医師  
出勤  
状況  
▼▲

IV編入力

施設の利用・利用の恐れ

更新  
日時  
▼▲

医療所  
有無

所属医療

EXCEL出力

2018/07/27 00:00:00現在の入力箇所です。

さいたま市地区 要手配:1 未入力:22

0%2322000

要

手配済

秋葉病院

緊

詳

支援

07/29  
21:20

0%

◆

◆

◆

◆

07/29  
21:18

07/29  
21:20

埼玉県 大宮中央総合病院

要

要手配

緊

詳

支援

07/29  
21:21

0%

◆

未

07/29  
21:21

埼玉県 大宮中央総合病院

要

手配済

荏穂市病院

緊

詳

支援

07/27  
15:39

0%

-

-

-

-

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埼玉県 大宮中央総合病院

要

支所中

緊

詳

支援

07/27  
15:40

0%

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埼玉県 大宮中央総合病院

要

手配済

太富中央総合病院

緊

詳

支援

07/29  
21:20

0%

◆

◆

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◆

未

07/29  
21:20

埼玉県 大宮中央総合病院

未

未入力

緊

支援

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埼玉県 大宮中央総合病院

Though a request for support is entered, no support team is available.

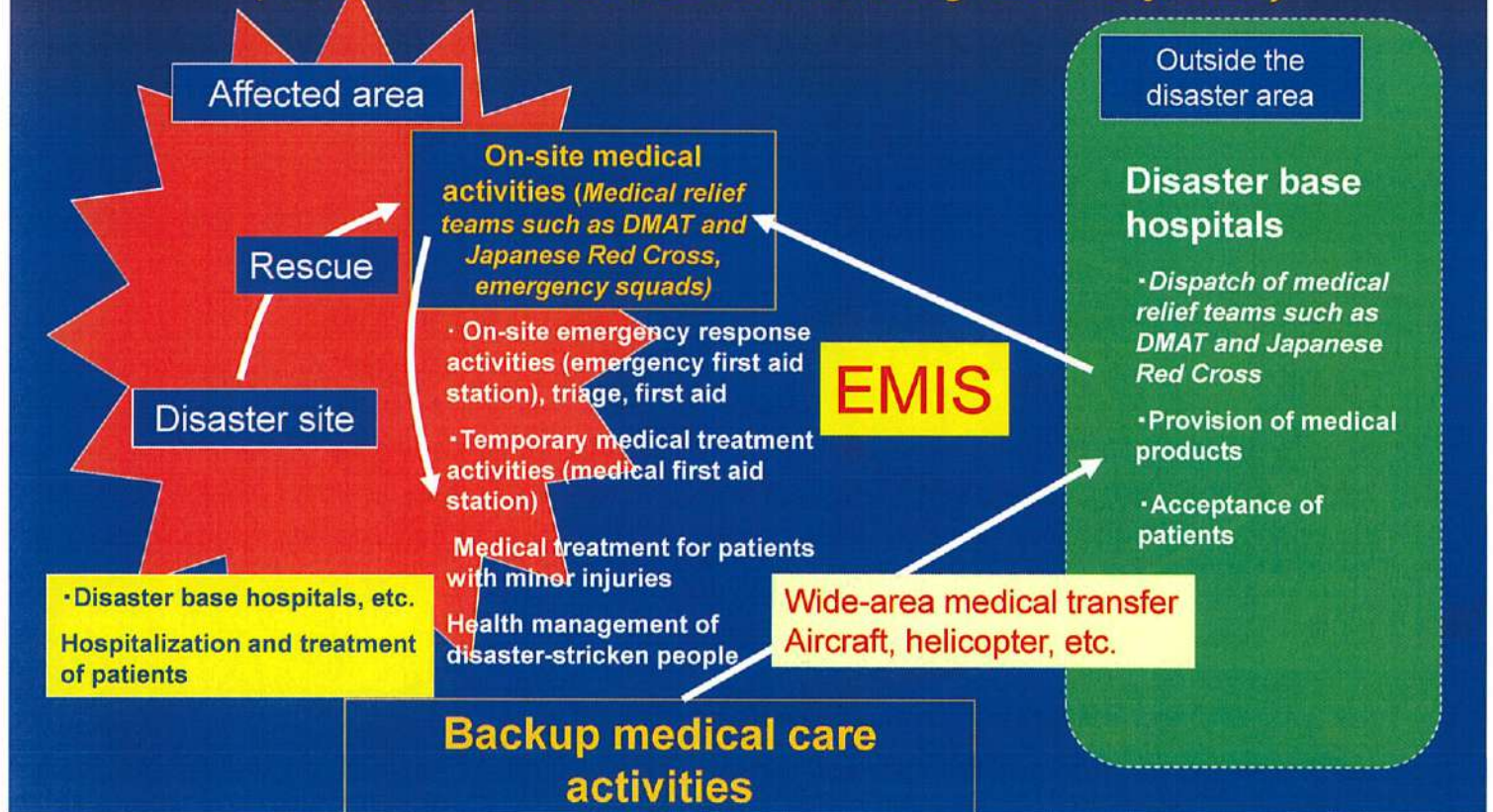
No emergency medical information has been entered.

Dispatch of support team has been arranged, but the team has not arrived at the site yet.

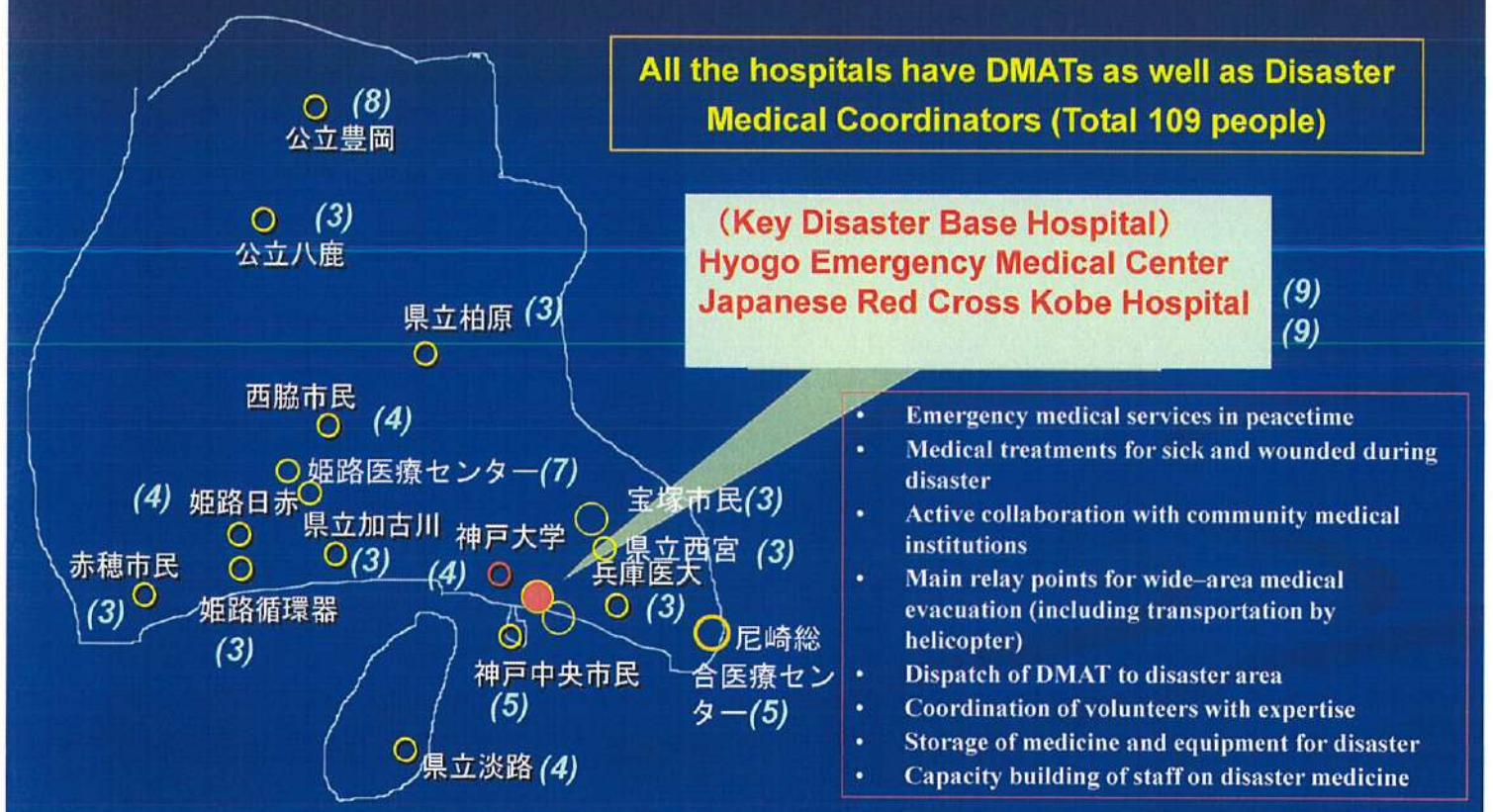
Support team is now in action at the site.

Monitor this information so that stakeholders can use it effectively for disaster response.

# Disaster Medical Care System in Japan (after the Great Hanshin-Awaji Earthquake)









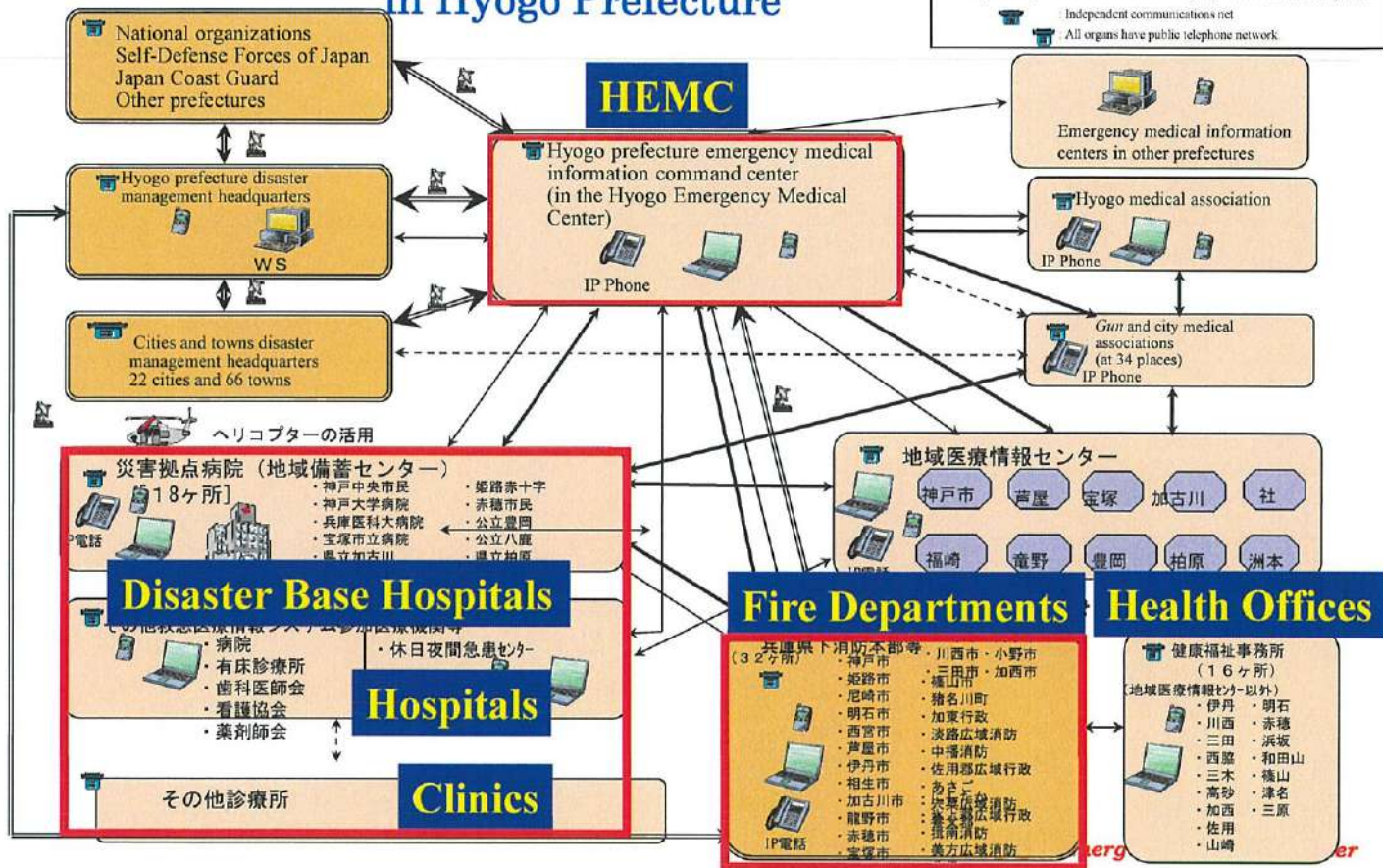
## Disaster Base Hospitals in Hyogo Prefecture (18 hospitals : September, 2018)



# Emergency Medical Information System (EMIS) in Hyogo Prefecture

Legend

-  Maintenance organs for satellite communications facilities
-  Satellite communications
-  IP Phone
-  Wide-area disaster emergency medical information system
-  Independent communications net
-  All organs have public telephone network



## the Great East Japan Earthquake : Main activities of 383 DMATs (1800 persons)



Iwate

- Duration : 11 Mar. ~ 19 Mar. (9 days)
- DMAT Main Headquarter : In the prefecture office
- SCU : **Hanamaki airport**, Prefectural school of fire fighting
- Hospital support : 8 hospitals

Miyagi

- Duration : 11 Mar. ~ 16 Mar. (6 days)
- DMAT Main Headquarter : In the prefecture office
- DMAT Second Headquarter : Sendai National Medical Center
- SCU : Kasminome base, Ishinomaki Field Park
- Hospital support : 6 hospitals

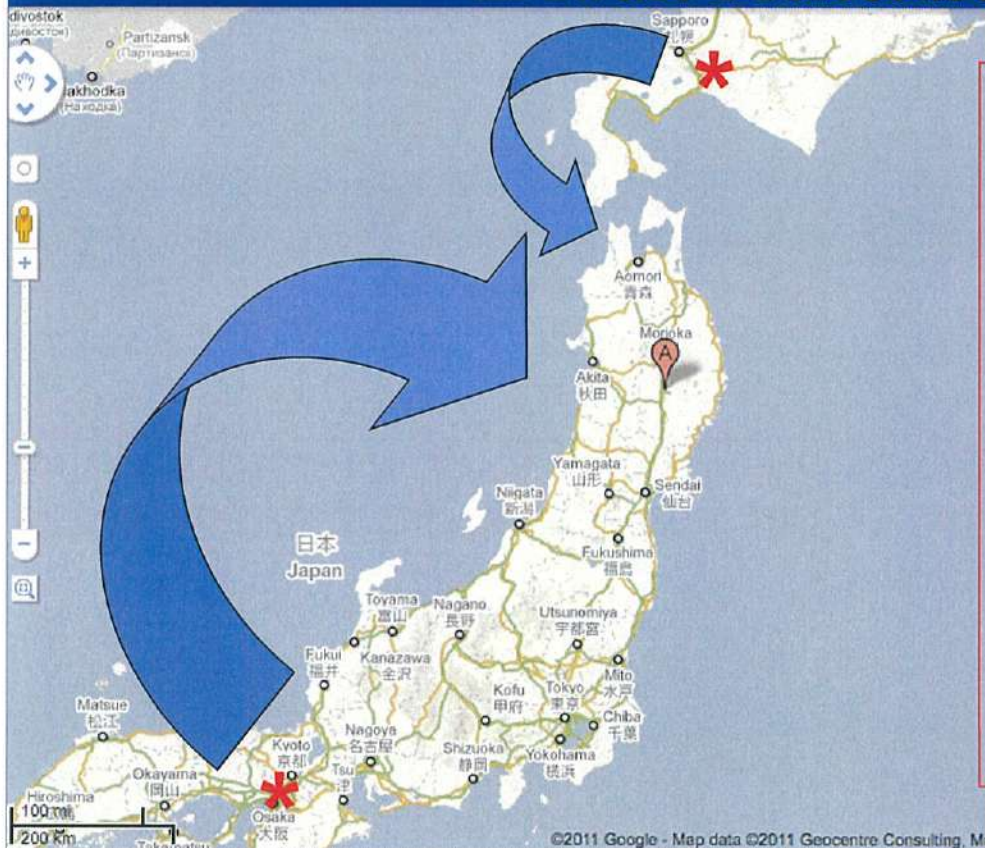
Fukushima

- Duration : 11 Mar. ~ 15 Mar. (5 days) , 17 Mar. ~ 22 Mar. (6 days)
- DMAT Main Headquarter : In the prefecture office
- DMAT Second Headquarter : Fukushima Prefectural Medical Collage
- SCU : Fukushima airport, Iwaki Koyo High school, Satellite Kashima
- Hospital support : 3 hospitals

Ibaragi

- Duration : 11 Mar. ~ 18 Mar. (8 days)
- DMAT Main Headquarter : In the prefecture office
- DMAT Second Headquarter : Tsukuba Medical Center
- Hospital support : 3 hospitals

# DMATs Assembly in Hanamaki AP in Iwate Prefecture



## ✧ By Air (SDF)

- from Itami AP, Osaka
- From Chitose AP, Hokkaido

## ✧ By Surface

- from nearby places

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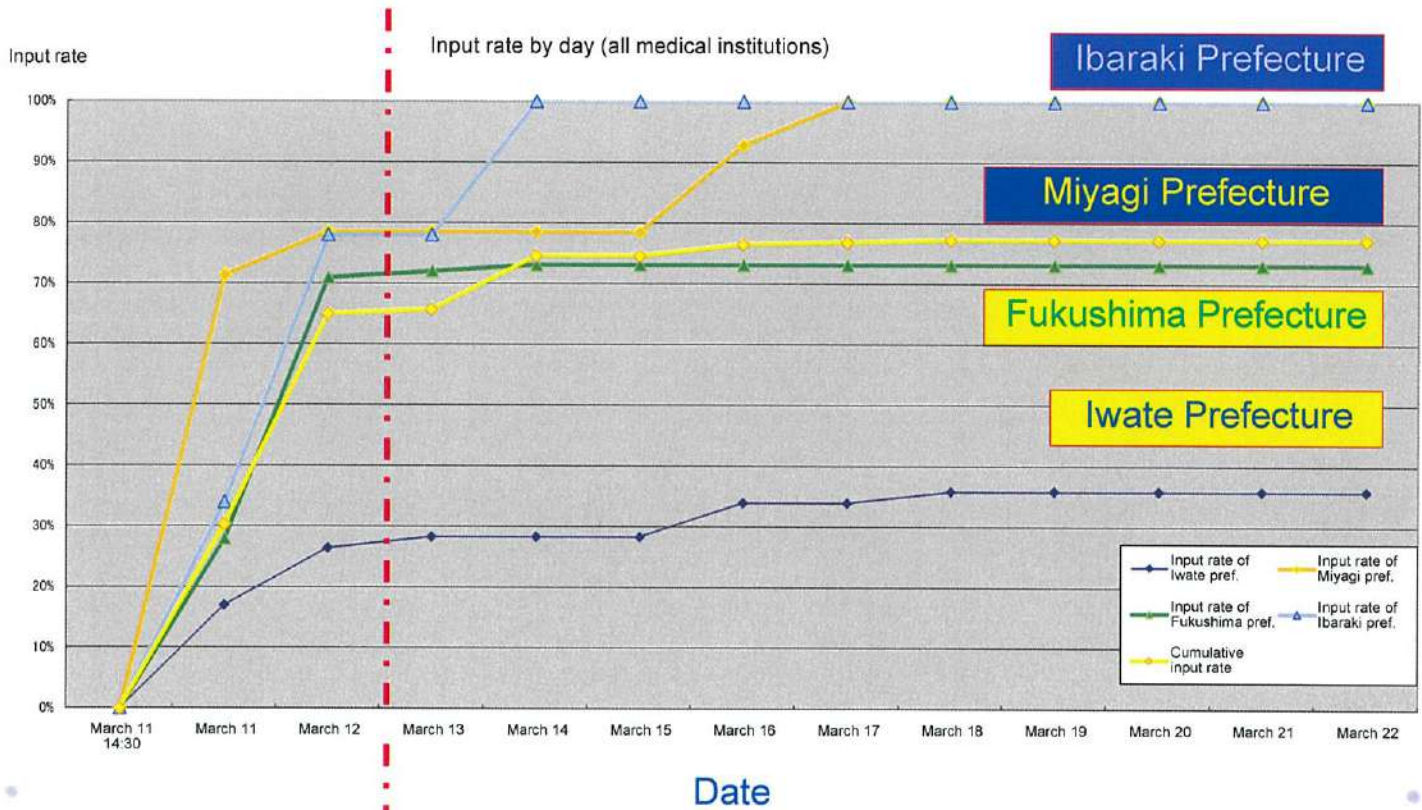
# Iwate Hanamaki Airport SCU Resource (Members)

	Total	March 12	13	14	15	16
DMAT gathered (No. of teams)	74	64	63	34	14	4

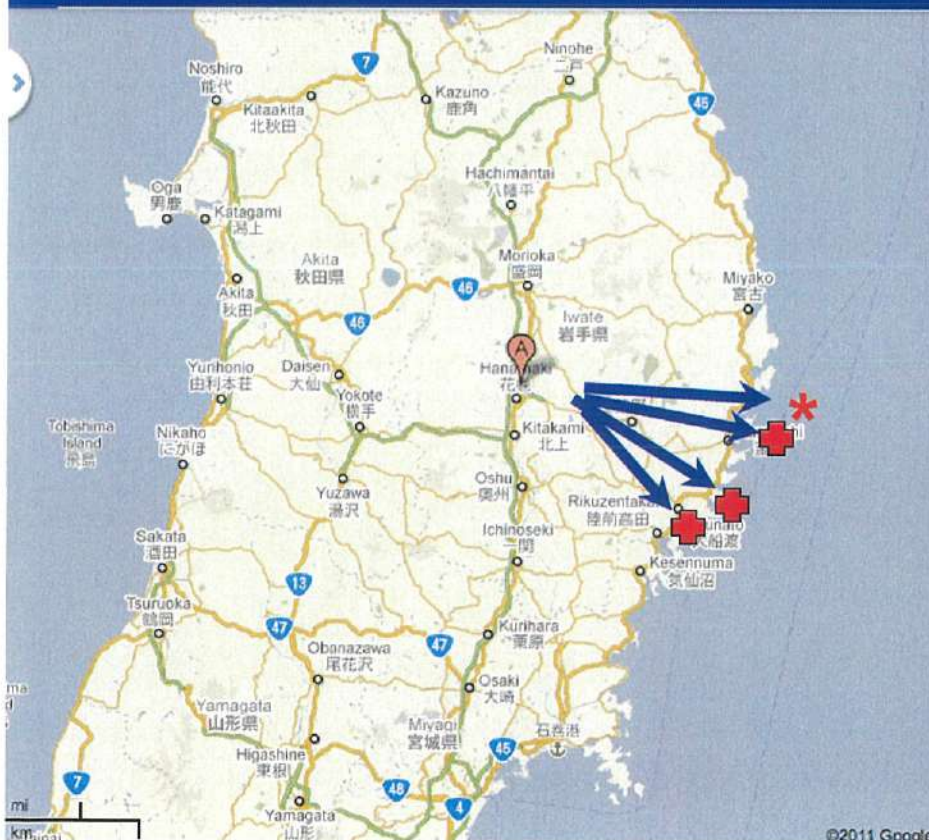


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# Percentage of Hospitals which Sent their Urgent Situation with EMIS in the 2011 Japan Earthquake



## Activities of Hanamaki SCU-1



\* In 4 days, a total of 21 DMATs was dispatched to the affected areas by helicopter.

(Tasks)

- 1: To collect information
- 2: To provide assistance to hospitals
- 3: To attend on medical transport

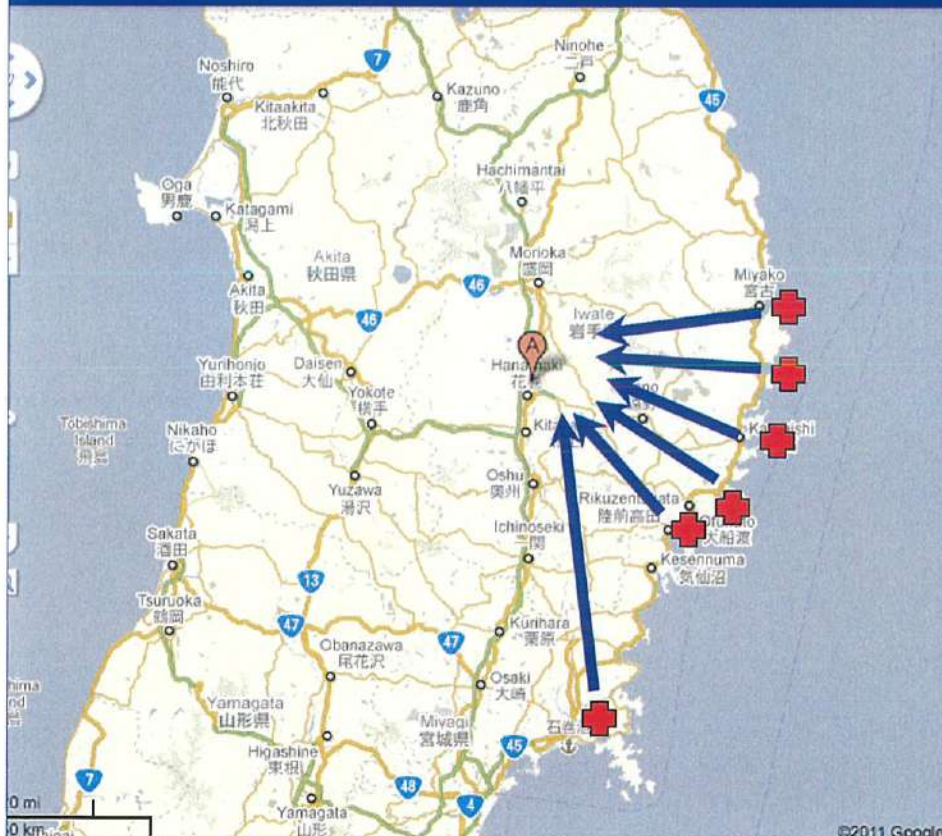
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## Hanamaki SCU → Iwate Prefectural Kamaishi Hospital (Examples of activities of DMAT of Hyogo Emergency Medical Center on Mar. 12 & 13)



ter

## Activities of Hanamaki SCU-2



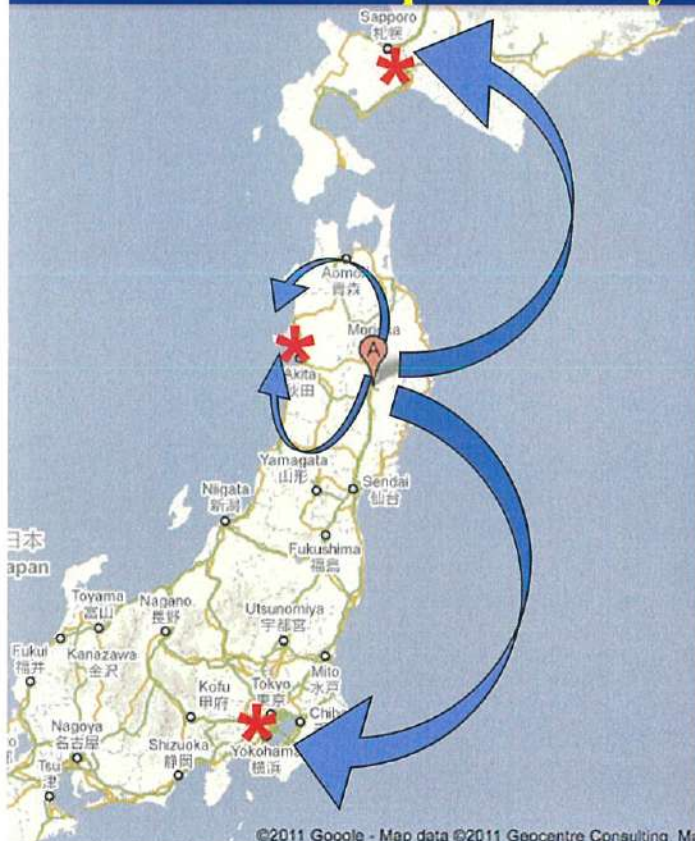
In 4 days, 136 patients were transported to Hanamaki SCU.

- Mainly from Hospitals in affected area not in Iwate but in Miyagi prefecture.
- Mostly by various helicopters
- Some by ambulance

# The Great East Japan Earthquake: Activities at Hanamaki Airport SCU



## the large-scale Air Transport for 16 patients by SDF C-1 Aircrafts



- ◇ 3/12 : 4 Pts. → Shin-Chitose AP  
→ Hospitals in Hokkaido
- ◇ 3/13 : 6 Pts. → Haneda AP  
→ Hospitals in Tokyo
- ◇ 3/14 : 3 Pts. → Akita AP  
→ Hospitals in Akita
- ◇ 3/15 : Pts. → Akita AP  
→ Hospitals in Akita

## 4<sup>th</sup> aircraft carrying out wide-area medical transfer (Hanamaki→Akita Airport)



al Center

Does the current system make our disaster medical response perfect?

# Vulnerability of disaster medical care system in Japan

## ❖ Medical institutions including disaster base hospitals

- Vulnerability of hardware including lifelines
- Busy with daily work → Poor awareness of disaster medical treatment, lack of training of staff

## ❖ Disaster and Emergency Medical Information System (EMIS)

- Network connectivity troubles in a disaster
- Not all medical institutions are covered (also nursing facilities, etc.)
- Poor awareness of transmitting information after a disaster: Ignorance & incuriosity

## ❖ Disaster medical care coordinators

- Not a dedicated position
- There is no main coordinator

## ❖ DMAT

- Handing over of tasks to the post-acute phase

## ❖ Wide-area medical transfer

- Insufficient development of SCU (Staging Care Unit)

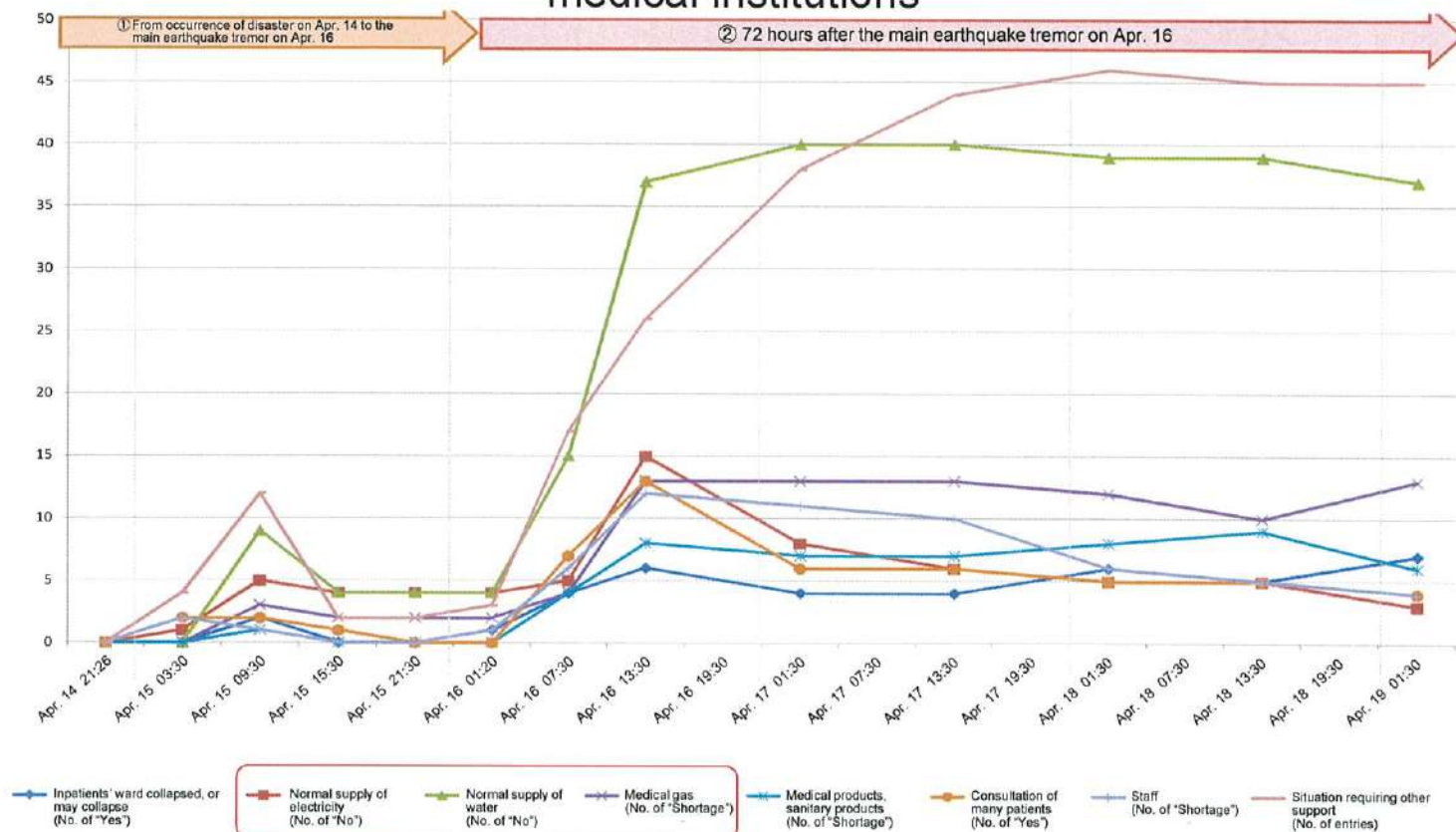
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## Vulnerability of medical institutions (Hardware and infrastructure side)

- ✓ Buildings: Structures, siting conditions
- ✓ Lifelines: Electricity, water, gas, etc.
  - Advanced medical equipment including CT, MRI, artificial respirators, operating rooms
  - Electronic health charts
  - Air conditioning
  - Insufficient emergency generators, fuel stocks
- ✓ Communication equipment
  - Telephone/fax
  - Internet

# Kumamoto Earthquake in 2016:

## No. of cases by input field in terms of emergency information entered by medical institutions



## Hospitals which evacuated after the Kumamoto Earthquake in 2016

### Medical institutions which evacuated all inpatients

Health and medical care area	Name of institution	Specialized field	Date of evacuation	Situation of lifelines				No. of evacuated patients	Reason for evacuation
				Building has collapsed or may collapse	Electricity unavailable	Water unavailable	Medical gas unavailable		
Kamimashiki	Kibougakoka Hospital	Psychiatry	Apr. 15			◆		177	Danger of water leakage and short circuit in several sections in the hospital
Kamimashiki	Mashiki Hospital	Psychiatry	Apr. 15		◆	◆		200	Cutoff of lifeline
Kumamoto	Kumamoto City Hospital	General hospital	Apr. 16	◆		◆	◆	300	Danger of collapse of building, water leakage
Kikuchi	Kumamoto Central Hospital	General hospital	Apr. 16			◆		190	Possibility of water leakage and short circuit in several sections in the hospital due to bursting of sprinklers and water pipes
Aso	Aso Tateno Hospital	General hospital	Apr. 16	◆		◆		65	Danger of collapse Risk of secondary disaster by landslide of mountain behind the hospital
Kamimashiki	Higashi Kumamoto Hospital	General hospital	Apr. 16	◆	◆	◆	◆	50	Danger of collapse of building
Kumamoto	Aoba Hospital	Psychiatry	Apr. 17	◆		◆	◆	150	Severe collapse of walls. The entire building tilted. The second and third floors were dangerous. Sprinklers broke. Sections of the parking area suffered liquefaction.
Kumamoto	Kumamoto Shinto General Hospital	Psychiatry	Apr. 17	◆		◆		96	Water leak in the hospital ward due to damaged pipes of the elevated tank. Several cracks on the walls
Kumamoto	Koyanagi Hospital	Psychiatry	Apr. 18	◆		◆		192	Building was in danger of collapse. Water leakage.
Kamimashiki	Arase Hospital	Care facility	Apr. 19	◆		◆		39	Building was in danger of collapse. No water supply.

Total: 1,459 patients

### Medical institutions which evacuated some of their inpatients

10 institutions evacuated all of their inpatients  
Total: 1,535 patients evacuated

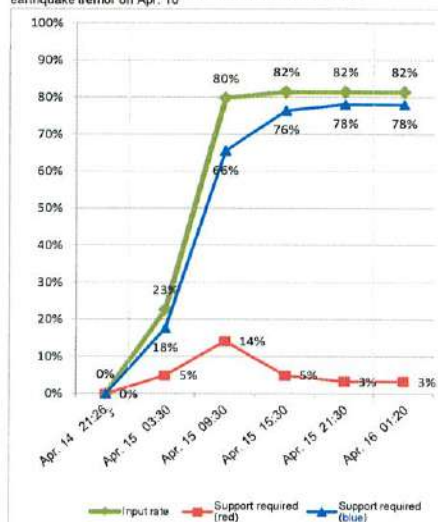
Cracks in the main columns and walls. Most of the ground around the hospital subsided. Though the hospital continued to accommodate inpatients on the third and fourth floors, those on the fifth and upper floors were evacuated.

Total: 76 patients

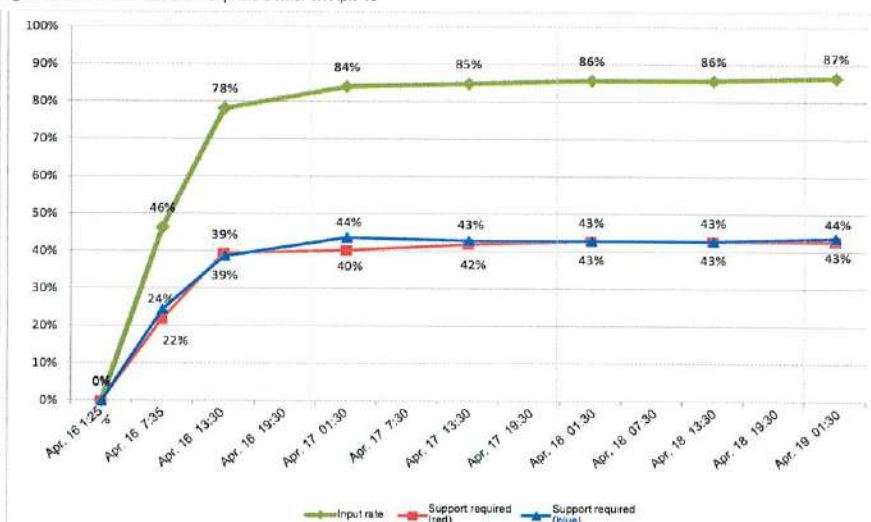
# Kumamoto Earthquake in 2016: Input rate of medical institutions in EMIS system at the time of emergency

Kumamoto Earthquake: Input rate of medical institutions at the time of emergency  
(With breakdown of those requiring support (red), not requiring support (blue))

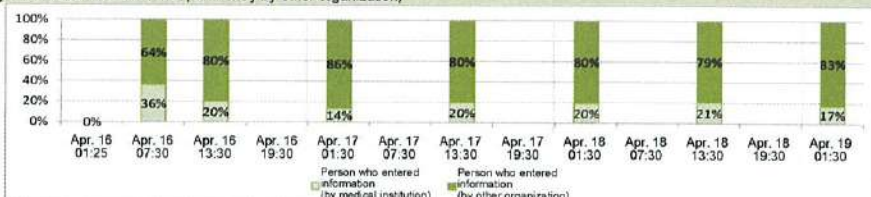
① From occurrence of the earthquake on Apr. 14 to the main earthquake tremor on Apr. 16



② 72 hours after the main earthquake tremor on Apr. 16



※Person who filled in the form after the emergency (rate of entry by the medical institution itself, and entry by other organization)



## 2018 Osaka Earthquake National Cerebral Cardiovascular Center

### Damages in the National Cerebral Cardiovascular Center

**Electricity: Outage.** Electronic health records became unusable.

□ **Response:** Used an uninterruptible power supply. Requested to borrow a power generator. Requested Kansai Electric Power to repair; power was restored around 23:00.

**Water: Water outage** due to rupture in the water tank on the roof.

□ **Response:** Requested repair of the pipe. Requested the SDF and neighboring cities to dispatch water trucks.

Gas/medical gas: No problem

Human injury: None

(Provided by Mr. Yuji Shiozaki, Himeji Medical Center)

Hyogo Emergency Medical Center

## 2018 Osaka Earthquake

### Patients transferred from the National Cerebral and Cardiovascular Center to other hospitals (62 persons)

- Transferred with assistance of DMAT 22 patients
  - Ambulances of the fire department of Suita City 7 patients
  - Air ambulance of Osaka Pref. 2 patients
  - Air ambulance of Hyogo Pref. 1 patient
  - DMAT, doctor cars 12 patients
- Destinations and patients to be transferred by DMAT were decided by the DMAT activity base headquarters in the Toyono Medical area (in Osaka University Hospital).
- Transferred by National Cerebral and Cardiovascular Center 40 patients
  - DC transfer via perinatal and neonatal liaison medical service ☐ Could not be grasped by DMAT

(Provided by Mr. Yuji Shiozaki, Himeji Medical Center)

*Hyogo Emergency Medical Center*

## 2018 Japan Floods (Mabi Memorial Hospital)



Hospital evacuation  
due to flooding  
(transfer of all  
inpatients)



# 2018 Japan Floods (Mabi Memorial Hospital)



- The substation was on the first floor.
- Due to the characteristics of the hospital substation, restoration took a long time.

**Typhoon No. 21** 瀬戸川の西側の沿岸部の地域

1 地上D 011-

**Hyogo**

台風 神戸付近に再  
災害の危険性 極め

神戸 中

中継



# EMIS: Disaster on Sept. 4, 2018 caused by Typhoon No. 21

[illegible]

Japanese Red Cross Kobe Hospital/Hyogo Emergency Medical Center





# What will happen in the Nankai Trough earthquake?

- Extensive areas will suffer damage
  - Disaster medical care system cannot provide support to all of the affected areas



**What will happen to the medical institutions including the disaster base hospitals in the disaster-stricken areas?**



**Is the only way to survive to shut ourselves up inside the institution?**



**It is critical to make medical institutions resilient!**

## Conclusions

- Based on the lessons learned from the Great Hanshin-Awaji Earthquake, the disaster medical care system in Japan has evolved, centered around five axes: “disaster base hospitals,” “DMAT,” “Wide-Area Disaster Emergency Medical Information System,” “wide-area medical transfer” and “disaster medical care coordinators.”
- However, **contrary to expectations, the vulnerability** of medical institutions **has increased**. We must immediately start taking **actions to increase their resilience** from diverse angles so that they can accomplish their responsibilities in the event of disaster.