



**An Assessment of the Residential Environment of Casualties of  
the 1995 Hyogo-ken Nambu Earthquake:  
Based on Medical Records of Patients Transported to other Hospitals  
after Treatment at Kobe City Medical Center General Hospital**

Tomoko SHIGAKI<sup>1</sup>, Michio MIYANO<sup>2</sup>

**ABSTRACT**

This paper aims to understand and evaluate the reality of earthquake victims' health by comprehensively and sequentially considering each patient's pre-hospitalization and post-discharge health status and living environment. Among the 1,128 medical records of Hyogo-ken Nambu Earthquake-related emergency inpatient registries (January 17 to March 31, 1995) at Kobe City Central Hospital (now known as Kobe City Medical Center General Hospital), it focuses in particular on 84 patients who were transferred post-treatment to other medical institutions. There were twelve transfers to obtain emergency medical care. Others were transferred for reasons including "Disaster casualties has no residence due to the earthquake", "Individual is physically disabled and therefore emergency shelters or temporary housing are not suitable", and "Relatives are unable to accommodate them", etc. These patients were unable to be rapidly discharged and, despite desiring to return to their own homes, were transferred reluctantly to hospitals (55 cases) or adult assisted-living facilities (5 cases) away from the disaster area and relatively nearer to family member's or relative's residences.

**INTRODUCTION**

It is necessary to understand the situation of diversifying human casualties on disaster earthquake that to consider the each patient's pre-hospitalization and post-discharge health status and living environment with subject of research on earthquake engineering and disaster medical care.

This paper aims to understand and evaluate the reality of earthquake victims' health by comprehensively and sequentially considering each patient's pre-hospitalization and post-discharge health status and living environment. Among the 1,128 medical records of Hyogo-

<sup>1</sup> Institute of Elderly Housing Sciences, Osaka, Japan, d06hf001@gmail.com

<sup>2</sup> Osaka City University, Osaka, Japan, miyano@ado.osaka-cu.ac.jp

ken Nambu Earthquake-related emergency inpatient registries (January 17 to March 31, 1995) at Kobe City Central Hospital (now known as Kobe City Medical Center General Hospital), it focuses in particular on 84 patients who were transferred post-treatment to other medical institutions.

## METHODOLOGY

In this study, in accord with the damages on this hospital, it is compared and investigated the time series approach of Hyogo-ken Nambu Earthquake-related emergency inpatient registries based on 13356 medical records of inpatient registries in 1994, 11191 in 1995, and 12845 in 1996. Secondly, it is extracted 1.128 medical records of Hyogo-ken Nambu Earthquake-related emergency inpatient registries after browsing all the inpatients of 1723 medical records (January 17 to March 31, 1995). And then, it focus in particular on 84 patients who were transferred post-treatment to other medical institutions, it is aimed to understand and evaluate the reality of earthquake victims' health by comprehensively and sequentially considering each patient's pre-hospitalization and post-discharge health status and living environment.

## RESULTS AND DISCUSSION

### 3.1 Trend of inpatient on during the earthquake at Kobe City Central Hospital

#### 3.1.1 Time series by month

All the inpatients in January 1995 were 916 because it was difficult to be continued therapy of severe patient because of restricted traffic damaged port train after the quake.

A look at a way of admission to a hospital, however, each percentage of emergency outpatients (red) and introduced another hospital and transported by ambulance (yellow) it was increased January (emergency out patients 356, introduced another hospital and transported by ambulance 101), February (emergency out patients 253, introduced another hospital and transported by ambulance 49) in 1995 compared with before and after January and February in 1994 and 1996

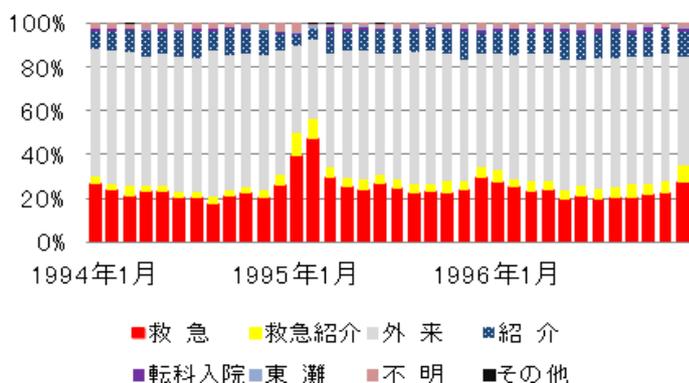


Fig.1 Time series by month

### 3.1.2 Number of emergency outpatients by date

It was transported 31 inpatients from Kobe City Medical Center West Hospital (relatives) because it was damaged soon after the quake. Outpatients from outside the island were largely decreased because access shut off for Port liner (marine transportation) damaged by the quake. Figure 2 shows it has 2 peak of outpatients, almost injuries on the day of the quake and exacerbation of illness from emergency evacuation area on January 24<sup>th</sup>, 1 week after the quake.

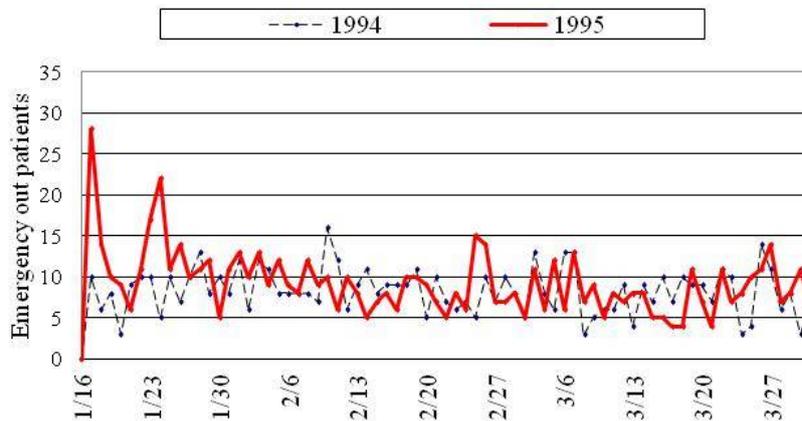


Fig.2 Time series variation of emergency out patients in 1994 and 1995 (January 16=0)

### 3.1.3 Breakdown of discharge after treatment

There are 9 categories of discharge after treatment, dead, changing hospital, continued therapy, treated as an outpatient, cure, discharge for other reasons, change department, discontinuation of treatment, and unclear. In this paper, it coordinates discharge for other reasons, change department, discontinuation of treatment unclear for others.

Figure 3 shows differences (chi-square  $p < .01$ ) each percentage of total for discharge after treatment victims of quake compared with those who were in 1994 and in 1995. It gives reason inpatients of outside island could not access because they could not visit hospital physical burden.

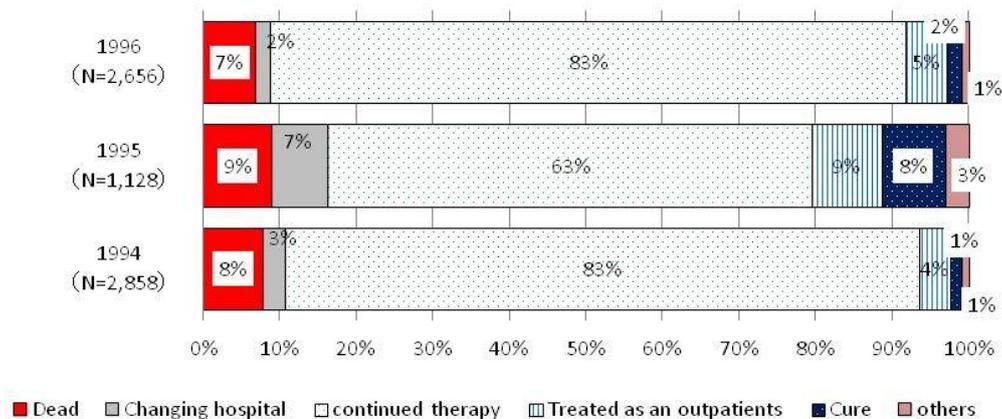


Fig.3 Breakdown of discharge inpatients in 1994, 1995 and 1996

Details inpatients of cure mainly accounted for children who consulted pediatric service. duration of hospital stays tended to be shorter than that of 1994 and 1996. The reason is that it is a tough way to make a living for their parents lost the works. They desired early discharge from the hospital independently.

Compared with 1994 and 1996, total inpatients decreased but each percentage of total inpatients, discharge, treated as an outpatient, cure relatively high

### 3.2 Residential Environment of 84 patients who were transferred post-treatment to other medical institutions (January 17 to March 31, 1995)

Among the 1,128 medical records of Hyogo-ken Nambu Earthquake-related emergency inpatient registries (January 17 to March 31, 1995) at Kobe City Central Hospital, it focuses in particular on 84 patients who were transferred post-treatment to other medical institutions.

#### 3.2.1 human characteristic (by sex, age, family and occupation)

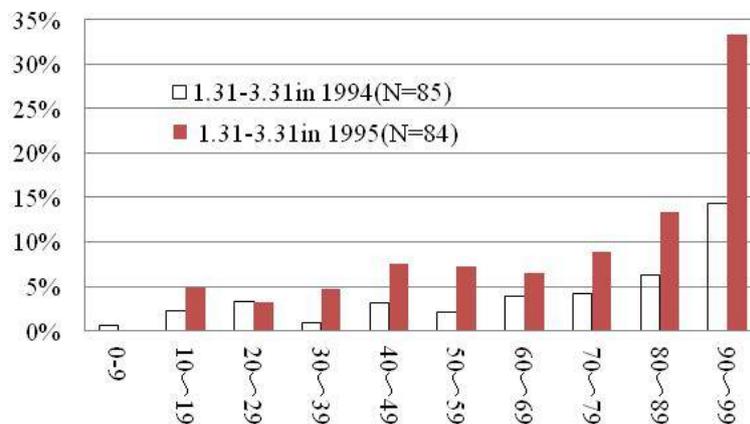


Fig.4 Percentage of number of patients who are transferred post-treatment to other medical institutions by age and sex (per applicable age in 1994 and 1995)

Patients who are transferred post-treatment to other medical institutions, men for 47 women for 37 in 1995, account for 11 patients for men and 12 women aged 70 and older, men for 10 patients and women for 7 aged 60 and over, men for 7 and women for 7 aged 50 and over, men for 6 and women for 7 aged 80 and over, men for 7 and women for 1 aged 40 and over, men for 2 and women for 1 aged 90 and over, men for 2 aged 10 and over, women for 2 aged 20 and over, men for 2 aged 30 and over.

It indicates significant differences for each age group by square test between patients who are transferred post-treatment to other medical institutions' proportion of all the inpatients in 1994 and 1995 on same duration ( $p < 0.1$ ). It becomes older, it shows the rate of transferred is higher in 1994 and 1995. Family composition, aged 60 and over (5 cases) and aged 70 and over (6 cases) accounted more single than other age group, couples and nuclear family. Occupation, taxi, day worker, pension, family on relief, particularly nuclear family, old parents depend on their children but imbalanced income.

#### 3.2.2 Damage degree and place to live

Damage degree of patients who were transferred post-treatment to other medical institutions account for collapsed 43% (all the inpatient 32%), half collapsed 10% (15%), partially collapsed 2% (8.5%). It appeared differences between total inpatients and patients who were

transferred post-treatment to other medical institutions by square test ( $p < 0.5$ ). It is clear that degree of damaged for patients who were transferred post-treatment to other medical institutions relatively severed.

Detailed number: home 29, emergency evacuation area 26, hospital 9, work place 6 and relatives 6, streets and others 4 unclear 4. It is characterized refuge life in homes because of unfamiliar surroundings, emergency evacuation area whose houses half collapsed. After earthquake, patients led to exacerbation of previous diseases worsen fatigue keeping in the move on relatives and stress experiences in relationships at new address.

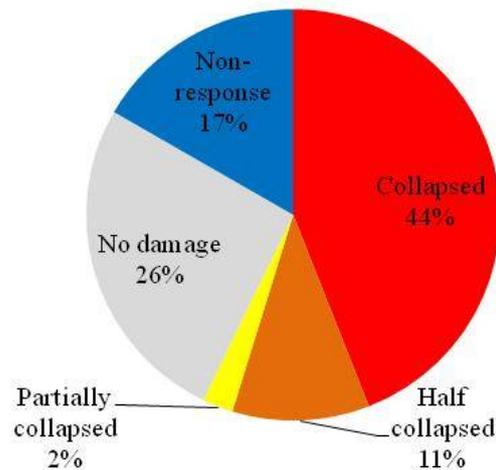


Fig.5 Damaged level of patients who are transferred post-treatment to other medical institutions

### 3.2.3 Treatment department and time series approach date of admission by diseases

Rate of almost forty-percent (33 cases) of patients who were transferred post-treatment to other medical institutions accounts injuries and details are 16 cases of orthopedics (25 cases) were collapsed and their routes to hospital were hoses (10 cases), emergency evacuation area (5 cases), street (1 case) (show chart 1). Those numbers of orthopedics (25 cases) account for femur, clavicle and costa broken by crushed collapsed houses and furniture tipping, followed by lumbar area, crushed, buttocks, crushed wound. End of the January, by recovery work, industrial injuries, and previous diseases led to exacerbation of gangrenous and amputated. Trauma (4 cases) transported from emergency evacuation area and 2 cases of them were physical handicapped (disable to walk and bedridden).

One case of neurosurgery, head banging on recovery work, another case of that was slipped behind the sea by headache on disaster dispatched from Ohita to Kobe port.

Illness accounted for sixty percent of total (50 case), endoneurium (13 cases) accounted for the highest number, followed by brain infarct (7 cases), encephalorrhagia (3 cases), CO intoxication by briquette coal burned (1 case), exciccation (1 case), other (1 case).

Places before transported of cardiovascular (13 cases) accounted for emergency evacuation area (6 cases), home (5 cases), relatives' homes (1 case), and hospital (1 case). It was increased steadily in the beginning of the February. Patient who was admitted to hospital on January 24<sup>th</sup>, dilatative cardiomyopathy (DCM), on ambulant by hypothyroidism heart pacer attached after two years later (home was collapsed and evacuation life). And old myocardial infarction (OMI) transported from Higashi hospital located in Higashinada ward on January 26<sup>th</sup>, right upper extremity and lower extremity palsied and under restricted environment, not getting balanced food service, was diagnosed unstable angina pectoris (UAP) (home was no damage).

After the earthquake, exertion like carrying water led to upper respiratory symptom on 26th, and breathing difficulty, orthopnea, in a cold sweat on 29<sup>th</sup>, then, admitted to hospital by annuloaortic ectasia (home was partially collapsed and evacuation life). Gynecology (1 case) was transferred from Kobe City Medical Center West Hospital in Nagata ward on January 19<sup>th</sup>.

As stated above, almost of illnesses had previous diseases and reluctantly evacuation life constrained, their daily self-cares were not sufficient and worsen, then, admitted to hospital.

Chart.1 Breakdown of treatment department of patients who were transferred post-treatment to other medical institutions

3.2.4 Date of admission

Kobe City Medical Center West Hospital were collapsed under the extension or reconstruction of building, hospital function stopped. And home generation of electricity broken, medical devices were unavailable.

On the day of earthquake, 12cases included 3cases whose who were transferred post-treatment to other medical institutions transported from Kobe City Medical Center West Hospital, accounted for residents of Nagata and Hyogo wards. Even after the earthquake increasing number of injuries admitted to hospital, after this initial stage, however, increasing number of those admitted were suffering from illness instead of injuries (see Fig.7).

“Projection and Planning Group Research Report of Initial Emergency Care on the Great Hanshin-Awaji Earthquake” (Sugimoto, 1996), reported the situation of human casualties in the disaster area from a medical perspective. Osaka University Medical School Department of Emergency Medicine staff analyzed and categorized 6,107 inpatient medical records, especially seriously injured and seriously ill patients, which dated from within two weeks of the January 17th, 1995 Hyogo Prefecture Nambu Earthquake. This survey covered 10 cities and 10 towns around the afflicted area where the Disaster Relief Act was in effect. The medical records are sourced from 95 major area hospitals with more than 100 beds, located both within the disaster area and in surrounding areas.

Until the third day following the quake, almost 75% of those admitted to hospital was external injury. Subsequently, the number of people admitted steadily increased Focusing on the cumulative number of injuries and illnesses, illnesses exceed injuries on January 26<sup>th</sup>, it continued steadily to increase.

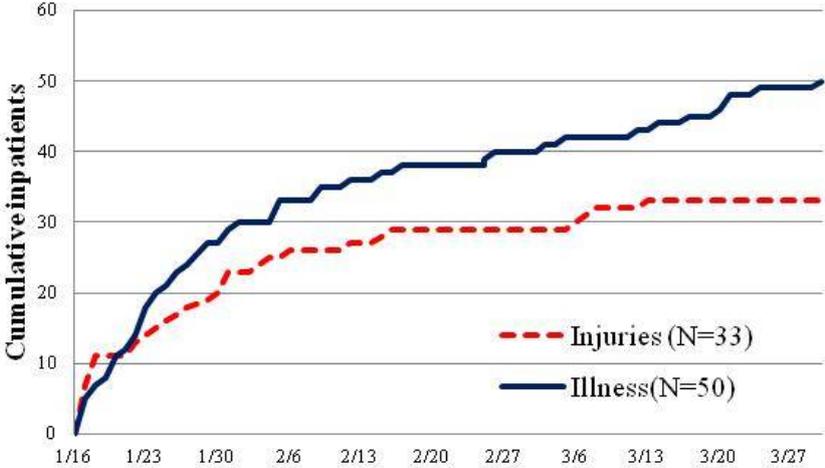


Fig.6 Cumulative inpatients of the two primary disease types (January 16, 1995=0)

As for this hospital, however, a look at a cumulative inpatients of the two primary diseases types, following the quake, injuries admitted to hospital beginning of the February, steadily fallen. Line illness crosses line injuries at January 22th, and then it indicates to continue this trend because of increasing.

### 3.2.5 Reasons and places after discharge

One of the significant factors on the elderly life is continuity and cumulateness of life. In this section, it is clear the reasons and places after discharge. In particular, it assemble 3 points among houses, families and activity of daily living on the ground of difficulty cases of discharge.

10 patients of total 72(hospital 9cases, nursing home 1case) were transferred post –treatment to other medical institution, like rehabilitation, housing-related for other reason, it includes no residence due to the earthquake (3 cases), uneven and narrow space (3cases), relatives are unable to accommodate them (4 cases) .

Total 62cases of other reasons (hospital 55cases, care facility 2case, healthcare facility1 case, nursing home 2 cases, unclear 2cases), 55 cases live Kobe City but 30cases visit hospitals outside Kobe City. For the reason that no residence due to the earthquake: 23 cases, Individual is physically disabled and therefore emergency shelters or temporary housing are not suitable, uneven, narrow and TATAMI : 9 cases, distance from home:5 cases, unable to reconstruct architectural regulation:2 cases, blocking lifeline and then reestablish a life :2 cases. Family-related reasons are no relatives (5 cases), disable to care because relatives live for distance (6 cases), and no corporations of relatives (12 cases) .

Relatives selected transferred place despite desiring to return to their own homes, were transferred reluctantly to hospitals. Activities of daily living be confined to bed dementia dysarthria sensorial impairment mental instability extremities paresis. There were led to exacerbation of illness after the quake. For other reason, 26 inpatients (31%) of total 62, they moved outside of afflicted area.

## CONCLUSION AND FUTURE WORK

This paper aims to understand and evaluate the reality of earthquake victims' health by comprehensively and sequentially considering each patient's pre-hospitalization and post-discharge health status and living environment. Among the 1,128 medical records of Hyogo-ken Nambu Earthquake-related emergency inpatient registries (January 17 to March 31, 1995) at Kobe City Central Hospital (now known as Kobe City Medical Center General Hospital).

This paper indicates that it is more continued to increase injuries soon after the earthquake and then, was steadily increasing illness until last March.

Regional disaster prevention plan shows prediction of human casualties intended the dead and injuries but it indicates partial because it is increased inpatients of exacerbation illness even after two months apart from the serious afflicted area by the earthquake.

Considering the situation of diversifying human casualties on disaster earthquake, Detailed study should be made on interdisciplinary or integrated research like earthquake engineering disaster medicine and life science to explain earthquake-related diseases.

Under hospitals damaged, patients needed emergency and clinical care (12 cases), rehabilitation (10 cases), "Individual is physically disabled and therefore emergency shelters or temporary housing are not suitable", and "Relatives are unable to accommodate them", etc. These patients were unable to be rapidly discharged and, despite desiring to return to their own homes, were transferred reluctantly to hospitals (55 cases) or adult assisted-living

facilities (5 cases) away from the disaster area and relatively nearer to family member's or relative's residences. It is significant to continue their lives keeping relationship established in a familiar environment and to give the security for residents when their move-out and move-in.

It extracted the potential problems about dwellings on daily life to assess of the Residential Environment of Casualties after 1995 Hyogo-ken Nambu Earthquake. Urgent need public support for dwellings and development of legal systems for houses to able to live human.

## ACKNOWLEDGEMENT

This research was supported in part by a grant from Sasagawa Science Foundation of The Japan Science Society in 2011. I wish to express my gratitude to Kobe City Medical Center General Hospital for providing us with the materials and critical comments

## REFERENCES

- Lu HENGJIAN, Michio MIYANO (1992)  
“A Study on Human Casualties due to the Earthquake based on damage investigation reports”, *Journal of Social Safety Service, ISSS*, May, 127-135
- Eisuke IKUTA, Michio MIYANO, Eiichi ITOIGAWA et al (2005)  
“Analysis on the Mechanism of Human Casualties due to the 1995 HYOGOKEN-NANBU Earthquake based on the Comprehensive Database”, *J Archit. Plan., AIJ*, No.590, Apr., 117-123
- Keiko OGAWA(1999)  
“Trend on Casualties with Acute Myocardial Infraction in the 1995 HYOGOKEN-NANBU Earthquake”  
*Journal of Health and Welfare Statistics*,46(8), 16-19
- Tomoko SHIGAKI, Michio MIYANO (2009)  
“Fundamental Investigation Assessing Trends in the Hyogo-ken Nambu Earthquake-related Diseases using Osaka City Emergency Ambulance Service Records ” *Journal of PHYSIOLOGICAL ANTHROPOLOGY*, 14(4), 179-186
- Kouzou UEDA(1996)  
“Analysis on the Mechanism of the Hyogo-ken Nambu Earthquake-related Diseases and the Provision”,  
*Japan Medical Journal*, 3776, 40-44
- Testuya MATSUOKA, Atsushi IWAI, Tsuyoshi SHIGAMOTO(1997)  
“A Study on Pediatric Emergency Care due to Hanshin Awaji Earthquake” *The Journal of the Japan Medical Association*, 118(13), 1901-1909
- Yutaka OHTA, Atsutake NOZOE and Manami SAKAKIBARA(2008) “Bibliometric Study on Earthquake-Related Diseases (1) –Retrieval of Articles from the Established Medical DBs and Trend Analysis on Research Activities -” *Tries*, Seq.No22,271-286
- Yutaka OHTA, Atsutake NOZOE and Manami SAKAKIBARA(2008) “Bibliometric Study on Earthquake-Related Diseases (2) –Investigation into interdisciplinary of Human Aspects by Means of Text Mining for Articles from Japan's Most known medical DB-” *Tries*, Seq.No22, 287-320
- Yutaka OHTA, Atsutake NOZOE and Manami SAKAKIBARA(2008) “Bibliometric Study on Earthquake-Related Diseases (3) –Overview of Research Activities by Means of Text Mining of Retrieved Articles from World's Most known Medical DB -” *Tries*, Seq.No22, 321-393
- Kazuo HAYAKAWA(1991) “JUUTAKUJINKENNOSHISOU” , *GAKUYOU SHOBOU*,1-339, Japan
- IGAKUSHOIN(2009) “IGAKUDAIJITEN”