Summary Report of 1st Symposium on Prevention of Medical Facilities

June 21-22, 2004

Earthquake Disaster Mitigation Research Center

National Research Institute for Earth Science and Disaster Prevention

Summary Report of 1st Symposium on Prevention of Medical Facilities

June 21-22, 2004

Tsukuba, Japan

Organized by Earthquake Disaster Mitigation Research Center, National Research Institute for Earth Science and Disaster Prevention

EDITORS:
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CONTENTS

EXECUTIVE SUMMARY

Hiromichi Higashihara

1. Why EDM/NIED, why now?

Earthquake Disaster Mitigation Research Center (EDM) of National Research Institute for Earthquake Science and Disaster Prevention (NIED) is launching a research plan toward utmost safe medical facilities. We owe this initiative exclusively to Dr. Heki Shibata and Dr. Tsuneo Katayama, President of NIED. They started their studies in the context of utilization of the world's latest and largest shaking table (E-defense) and then EDM took over several months ago. Participation of EDM inevitably modified the character of the project.

EDM was founded in 1997, on a basis of a recommendation to the Minister of Science and Technology of Japanese Government from a governmental committee set up just in the midst of the aftermath of the 1995 Kobe disaster. It is Japanese habitude to respond to disastrous earthquakes with initiation of brand-new academic researches toward earthquake disaster mitigation: 1891 Nohbi Earthquake, 1923, Kanto Earthquake and this time.

This recommendation gave fundamental orientation as follows:

"Safety of nation is public goods; market mechanism fails in allocating sufficient investment to safety of people, handicapped people above all. Allocation of public investment is judged through political mechanism and response to new danger s always comes behind the time. EDM/NIED need proactively raise questions, find risks critical to the safety of people, analyze them and offer solutions.

Enhancement of economic power shifts the social consensus toward higher spending for safety. Similarly, visible threats encourage it (September 11 for the USA, Kobe or North Korea for Japan). We are currently in such a season; safety of people is being one of the distinguished subjects of science and technology policy of Japanese government. Local governments are prioritizing it, too."

Baseline idea of EDM approach followed:

"Past experiences in Japan of disaster medicine have so far revealed inadequacy of integration and coordination. (Poor management/logistics of Japanese society through its history has long been pointed out. This comes back to socio-cultural issues.)

The front line of medicine is facing intense risks in daily work. Specifically, advanced medicine using sophisticated equipments and demanding close team cooperation, poses intensive and dense tension. Japanese society tends to blame the persons that triggered the accidents; risk of individual medical staffs is extremely high. It is therefore desirable to take the initiative from engineering (in a wide sense following the institutional code of EDM/NIED) and, based on the risk management technique, identify and analyze critical needs/risk, and devise solutions.

2. Toward next time

By the time of our next meeting, to be held February or March 2005 in Kobe, EDM will propose an agenda. At the end of the first day meeting, I showed my personal summary as follows, which I hope could provide a clue:

(1) HOW TO DRAW UNIVERSAL INFORMATION FROM EXPERIENCES.
FRAMEWORK NEEDED?

(2) FLEXIBILITY AND REDUNDANCY NEEDED.

(3) CONSENSUS MATTER: MOTIVATION AND ENCOURAGEMENT
INTERGOVERNMENTAL COORDINATION
INVESTMENT, COMPENSATION FROM SUSTAINABILITY PERSPECTIVE
MOBILIZATION OF LOCAL COMMUNITY;
CAPACITY BUILDING OF LOCAL GOVERNMENT
PARTNERSHIP BEING SOUGHT
(4) INNOVATIVE SOLUTIONS DESIRABLE
MOBILE ARCHITECTURE; SMART STRUCTURES
SAFETY OF MEDICAL OPERATIONS
EFFECT VERIFIABLE OR VISIBLE?
(5) NONSTRUCTURAL COMPONENTS AND LIFELINES;
INFRASTRUCTURES IN A WIDE SENSE

Our research is under a preparatory phase; it will be in full activity as a component of NIED's next five-year mid-term research plan starting 2006 fiscal year. The plan for **Protection of Medical Facilities** has been widely discussed and elaborated. Its base will consist of structural engineering, socio-political and information technology. It is truly multi-disciplinary because the field we are facing a triangle of interfaces between man, machine and building; by no means separable. Organization of productive collaboration across the disciplines and countries is really imperative. EDM urges you to join us.

MAINTENANCE OF MEDICAL SERVICE
SHIFT FROM LOCAL FUNCTIONS TO WHOLE SYSTEM

Heki Shibata

On June 21 and 22, 2004, the first Symposium of Protection of Medical Facilities was held at National Research Institute for Earth Science and Disaster Reduction. I discuss about it from the holistic point of view below. Afterwards, I refer the comments mentioning about functions as a system with regard to the connection of nodes and links.

At the symposium, Dr. Myrtle of University of South California discussed about the regional and comprehensive medical system at the emergency of earthquake. The symposium was yielded from the discussion with Prof. Masri of University of South California about the possibility of experiments to examine the effects of seismic isolation of large-scale operating rooms.

The main purpose of protection of medical facilities at and after the earthquake is the possibility and security of continuation of operation. However, it contains seismic resistance issues involving dynamics, thus, here I decided to discuss about it in another occasion and focus to consider how to develop the comprehensive system.

Large-scale system consists of the following steps. First important aspects are seismic resistance of local parts and independency. That is, it is important that medical services, such as surgery can be continued at and after the earthquake and all functions of hospital is maintained as much as possible. In order for that, the following matters have to be maintained.

i) Utility (electricity, communication, gas, water, drainage, particular gas for medicine, etc.)
ii) Security of lives of medical staffs
iii) Security of lives of patients
iv) Security of lives of outpatients
v) Security of medical information and availability of information
vi) Continuation of treatments
vii) Security of living of patients

Fundamentally, seismic resistance of hospitals, maintenance of lifeline, avoidance of damages by disaster from outside are affected conditions at and after the earthquake. Seismic resistance of hospitals can be achieved by adopting seismic isolation system to the buildings. By doing so, seismic resistance of utility supply facilities for emergency can be improved, however, there still remains the security of water and fuel gas whose supply depends on external services.

Several hours after the earthquake, main issues with regard to medical services are as follows:

i) Continuation of treatments
ii) Security of living of patients
iii) Continuation of treatments for outpatients

These are the extension of ordinary functions.

iv) Emergency treatment for patients injured by earthquake
v) Treatment of patients who suffer by psychological damage
vi) Treatment of patients in neighbor who receive ordinary medical services

These are some issues under the emergency.

The following six issues need to be considered, planned and prepared as research topics of this theme. First, transportation methods need to be considered to make a decision either

i) treat at the hospital,
ii) transport a patient to the near hospital that has capacity for treatment. or
iii) transport a patient outside damaged area.

Second, transportation method of medicines, water and foods to maintain functions of hospitals needs to be considered. Third, planning for work shift to give the rest to medical staffs and preparation for substitutes, and their transportation method need to be considered. Fourth, food supply for patients needs to be secured. Fifth, the transportation method of all the patients or patients with slight illness needs to be considered. Finally, medical disposal needs to be treated.

It is desirable that hospitals function independently with regard to the various matters mentioned above. However, there are many problems for implementation.
In order to solve these problems, understanding of communication system between related institutes including hospitals and transportation agencies, and direction from the center are important.

Nonetheless, the maintenance of soundness of communication method is serious problem. Dr. Myrtle, who has involved in works related to FEMA mentioned about the local communication network in Los Angels area. The communication network is considered that it was developed spontaneously and has a lot of redundancy. The consideration of robustness of the communication network toward ground motion distribution is a serious topic. In Japan, how to maintain the robustness of various kinds of networks in local areas at the occurrence of earthquake has been studied in many fields, and the theories and practices have been developed under the name of lifeline since TECLEE of ASCE. Especially, practices in gas network have been developed remarkably. However, the situation of Kobe was not satisfactory. On the other hand, in the field of communication a legitimate network theory has been developed remarkably. Recently, there is an article in the journal of IEEE (American Institute of Electrical Engineers). In summary, connecting points randomly distributed with communication line, small groups become one large group. There are two groups if all points are connected. One is road or railroad network that adjacent nodes are connected but very few cases that two far apart nodes are connected. It is called network type for the convenience. The other type has the points function as hubs like runways, they are stretched radiating to connect distant nodes. It is called Hub type.
With the view of the case of Los Angels, it is spontaneously developed and quite dense network different from those two types.

I mentioned that there is an article that explains about the general network theory. I discuss about it in the relation to disaster.

Network theory is a part of communication theory and it consists of nodes and links. Connecting nodes with links, first several isolated small worlds are formulated, and finally all the nodes are connected as a whole. These links are disconnected at the occurrence of disaster. If many links are disconnected, some parts are isolated. In theory, links are disconnected randomly. And, it is analyzed that nodes are randomly damaged.

If damage ratio is low at the occurrence of earthquake, this random damage model can be applied. However, random theory is not effective if there is an area whose seismic intensity is assessed large.

With regard to link, communication lines attached on the ground like optical fiber yield more serious damages in such an area. Wireless lines or radio yield less damage, but they are very few. In any ways, random theory cannot be applied here.

With regard to nodes, the model would be determinant theory as it depends on if nodes are collapsed or not. The discussion of robustness of communication lines is general in the model of random damages, but in the case of earthquake general theory is not applied, and simulation is effective. However, robust network is relatively robust under other conditions (even not random damage). When the network is constructed in a big city like Tokyo, it is constructed based on the existing network,

thus, these problems should be considered.
Generally speaking, it is better to construct detour lines with wireless lines connecting distant points, avoiding to locate hubs in certain area. Also, hub type requires efforts to avoid congestion of nodes.

Network lines to connect between hospitals and related facilities are considered. Both general theory and simulation should be combined to design. The following two problems need to be studied separately afterwards.

i) Hospital ship is a new concept for the city that has harbor facilities. Large ferry can be converted to the hospital, and prepared for it.
ii) Heliport needs to be prepared in bases, hospitals or frontage. It should be examined that heliport on high-rise buildings can be used at the occurrence of earthquake.

In the first week of August, the 13th World Conference of Earthquake Engineering was held in Vancouver. Visit to Vancouver General Hospital (Operated by Univ. of British Columbia) was planned to see secondary seismic isolation of computer rooms and emergency power generation. The former mechanism is to support machines or device including connection of communication lines with ball seismic isolation instruments. Electricity instruments are fixed using shear stress support made of rubber as well, and among four power generators (6KV、2000KVA), two were equipped with transformed vibration absorption system.

Reference
(1) Wang, X.F. and Chen, G.: Complex Networks: Small-World, Scale-Free and Beyond, *IEEE Circuits and Systems Magazine*, First Quarter 2003, p.6~p.20.

(Original language was Japanese and translated by EDM staff)

PROGRAM

Day 1 Experts Workshop

10:00-17:00 Presentation and Discussion

• SHIBATA, Heki	NIED
• MASRI, Sami F.	Earthquake Engineering, U. of South California
• HENMI, Hiroshi	National Disaster Medical Center
• FERNANDEZ Jeanette	EDM, NIED
• MYRTLE, Robert C.	Medical Administration, U. of South California
• OKUDERA, Takashi	Emergency and Disaster Medicine, School of Medicine, Toyama Medical and Pharmaceutical University
• WAKASUGI, Masahiro	Emergency and Disaster Medicine, School of Medicine, Toyama Medical and Pharmaceutical University
• ALLISON, David J.	Architecture, Clemson University
• NAKAYAMA, Shinichi	
• BANBA, Michiko	EDM, NIED
• ARAI, Hiroshi	EDM, NIED
• NAGASAWA, Yasushi	Architecture, Tokyo University
• MAKI, Norio	EDM, NIED
• HOTTA, Kayoko	
• KATSURAGI, Satoko	Kobe Pharmaceutical Association
• HIGASHIHARA, Hiromichi	EDM, NIED

Day 2 Symposium

10:00-12:00

1. Policy and Planning Issues in the Regulation of Hospital Performance Under Earthquake Conditions

   Dr. Robert Myrtle, Health Administration, University of South California

2. Issues and Challenge of Emergency and Disaster Medicine of Japan

   Dr. Takashi Okudera, Emergency and Disaster Medicine, School of Medicine, Toyama Medical and Pharmaceutical University

12:00-13:30 Lunch Break

13:30-16:00 Panel Discussion

Coordinator *Dr. Tsuneo Katayama, Director-General, NIED*

Experts Workshop

Symposium on

Strengthen of Medical Function in the Society

医療施設の対地震防護

-emphasized on Medical Function

National Research Institute

for Earth Science and Disaster Prevention, NIED

Prof. Dr. Heki SHIBATA

柴田 碧

450

4500

45000

The Talk with Prof. Masri in Taxi in Dec. 2003

話の発端

Base Isolation Test of Medical Operation Room

by E-Defense

How to keep Function of Utilities in Hospital

under Seismic Condition

Prof. Masri introduced me the activities of FEMA

and State of California

451

San Fernando Earthquake-1971

Survey Mission of Metropolitan Tokyo

Olieve-View Hospital

Van-norman Dam

Information Transmission

Ambulance

Hyogoken-Nanbu, -Kobe-, Earthquake-1995

Sumiyoshi Hospital (住吉病院): dialysis (透析)

452

非常ヂーゼル
発電機

San Fernando
Eq.-1971

453

San Fernando Eq.-1971

Miyagiken-oki Eq.-1978

Continuation of Surgical Operation

under and after a Destructive Earthquake

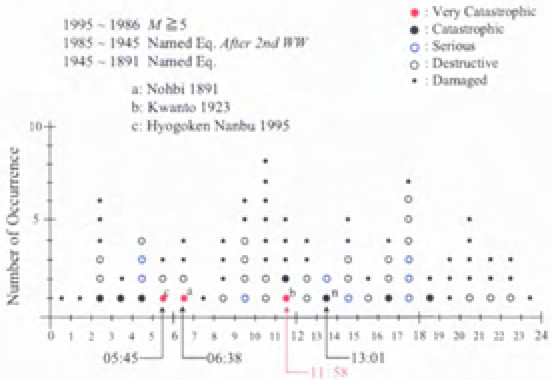
Very Few Example of Such Cases

Time of Occurrence Destructive Earthquake in a Day

-Record for Last 100 years-

Less in Business hours

破壊的地震の発生時刻



Time Distribution of Starting of Destructive Eqs. in 20 C

Medical Equipment 医療機器の特徴

- Heavy or Handy or Fragile
- Materials ~ Sometimes, Aluminum Alloy etc.
- Utility Requirement (電力、水廻り、真空 等)
- Special Gas Use

Surgical Operation under a Destructive Earthquake
手術中の地震発生

How many minutes is necessary for emergency ending?
必要処理時間

How low acceleration, velocity and displacement of earthquake motions should be for continuing the practice of operation safety?
手術が可能な地震動

The floor motions in the operation room should be lowered to this level.

Safe-level of Seismic Motions in the Operation Room

手術室の地震動の許容レベル

Full Function of Utilities may be necessary

手術室機能の100%維持

4S10

Equipment, Furniture, Bed and Secondary Building Structure should be safely installed inside or outside of the operation room in a Hospital, for patient, medical staffs especially.

病院建屋の免制震

What is the Required Function of Hospital

病院が必要とする機能は？

4S11

病院の対地震性能

Additional requirements:

During earthquakes and post-earthquakes should be discussed.

地震中のみならず地震後に必要な機能

However, the mentioned above at the moment of event has not been discussed much by now.

地震の瞬間の問題は議論されて来ていなかった。

4S12

The Great Alaska Earthquake of 1964

HUMAN ECOLOGY

2004 Symposium for

Protection of Medical Facilities

National Research Institute for Earth Science and Disaster Prevention

Tsukuba, Japan

22 June 2004

Presentation on

Seismic Protection and Keeping the Function of Medical Facilities

by

Sami F Masri
Professor
Department of Civil Engineering
University of Southern California
Los Angeles, California 90089, USA
Email: *masri@usc.edu*

NONSTRUCTURAL MITIGATION IN HOSPITALS: THE FEMA-USC PROJECT

S. Masri, J. Caffrey, R. Myrtle, R. Nigbor, M. Agbabian, E. Johnson, W. Petak, M. Shinozuka, R. Tranquada, L. Wellford

University of Southern California

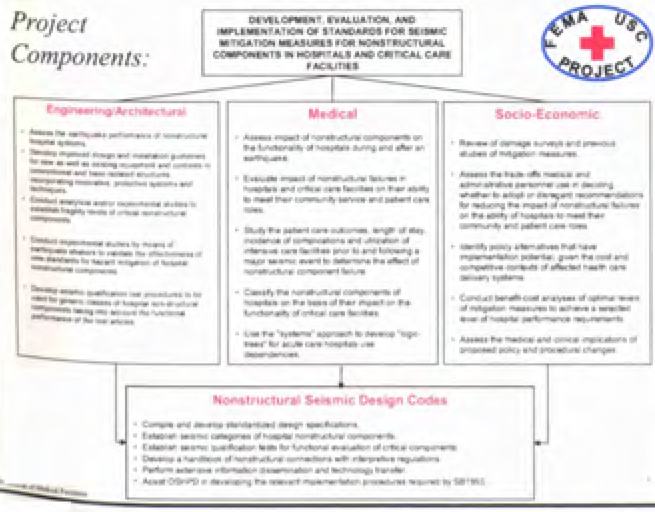
Project Goal

Development, evaluation, and implementation of seismic mitigation measures for nonstructural components in hospitals and critical care facilities

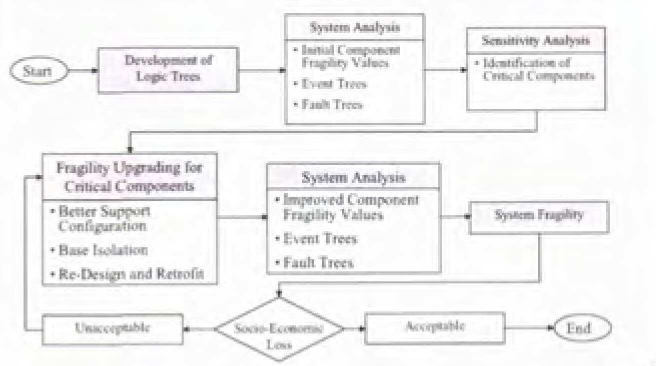
Project Features

- Sponsored by FEMA
- Collaboration between academia, industry, and government
- Multi-disciplinary: engineering, medical, and socio-economic
- Investigators from several USC Schools: Engineering, Medicine, Policy, and Nursing
- Use a "systems" approach

Project Components:



Action Flow Chart

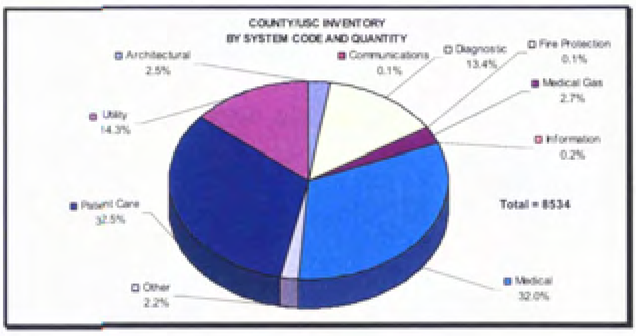


Hospital Damage Survey Reports

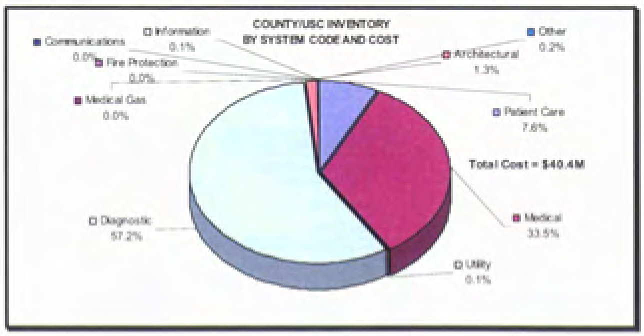
Hospital Equipment Survey

Los Angeles County-USC Hospital

Contents By System Code And Quantity



Contents By System Code And Cost



Critical Nonstructural Components

Hospital Identification

Group Description	Representative Systems
Architectural systems	Nonstructural walls, ceilings, doors, windows, storage
Communications systems	Telephone, HEAR radio, microwave, intercom
Diagnostic systems	Imaging, clinical pathology
Fire protection systems	Alarm, sprinkler
Medical gas systems	Oxygen, nitrogen, etc.
HVAC systems	Heating, ventilation, air-conditioning
Information systems	Computers, computer networks, patient records (paper and digital)
Medical systems	ER, ICU, surgery, dialysis
Other systems	Sterilization, oxygen supplies
Patient care systems	Rooms, beds, monitoring, food
Transportation systems (internal)	Elevator, dumbwaiter, stairwells
Utility systems	Electricity, water, sewer, garbage

Most Critical Systems

- Piping systems: water, medical gases, suction, steam
- Electrical
- Communications
- Medical monitors, ventilators, defibrillators
- HVAC
- Suspended ceilings & fire sprinklers

Seismic Tests on Specific Hospital Systems

Seismic Tests on Specific Systems

- Medical Equipment
- Pipe Components
- Equipment Snubbers
- Suspended Ceilings

Shake Table Tests of Medical Equipment

- 23 specimens obtained from hospitals/clinics
- Computers, monitors, stands, electronics
- Test waveforms: earthquake, sine, random, Telcordia/Belcore
- PGA to 4g

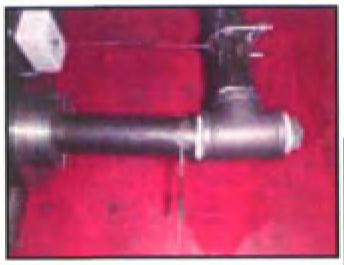
Pulse Oximeter test

Pipe Component Testing

- Address UBC/IBC code language:
  - What is "deformability" of pipe components?
  - Is the definition of "deformability" appropriate?
  - Are the Rp values appropriate
  - How do UBC/IBC and ASME code values compare?
- Custom test bed created for static, slow-cyclic (ATC-24), and ASME fatigue testing
- Testing measures "functional failure" or leakage as well as structural failure

Test Setup, 4"

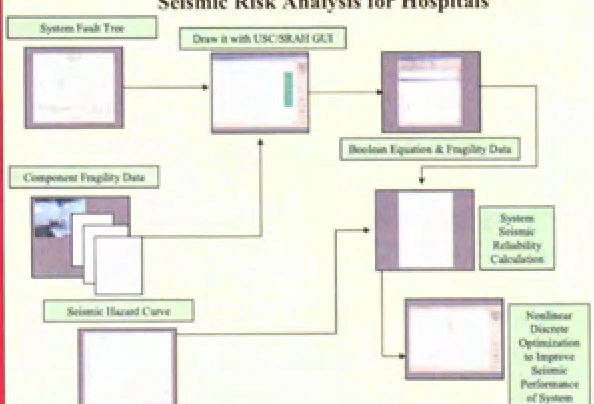
Structural Failure



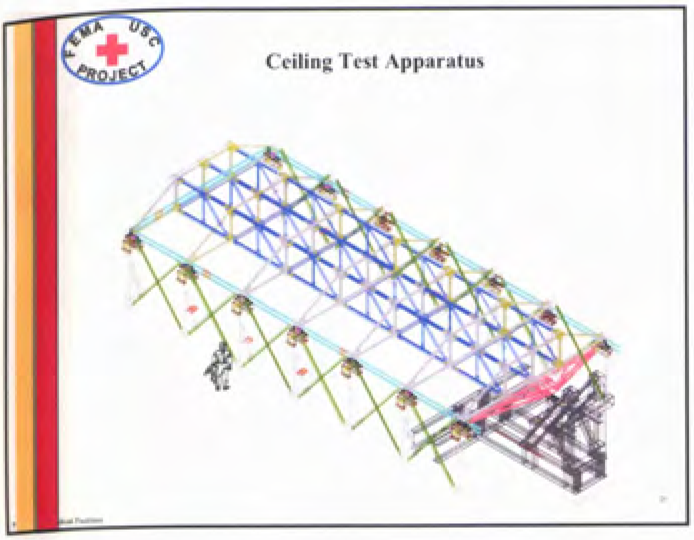
Operational Failure (Leakage)

Seismic Risk Analysis for Hospitals

Seismic Risk Analysis for Hospitals



Construction of Ceiling Test Apparatus

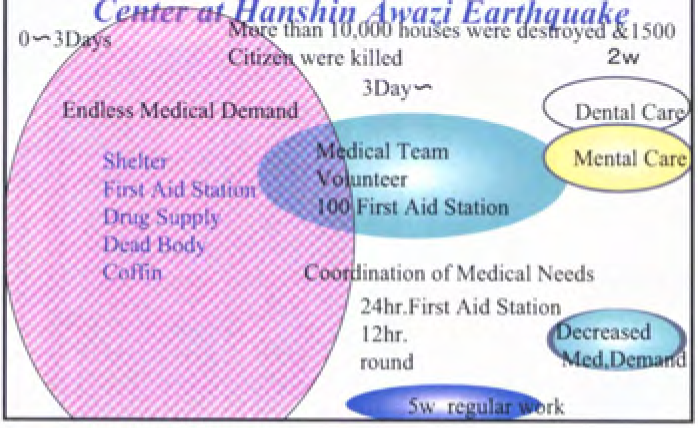

Ceiling Test Apparatus

災害に対する拠点病院の対応
Correspondence of Hospital for Disaster Medicine

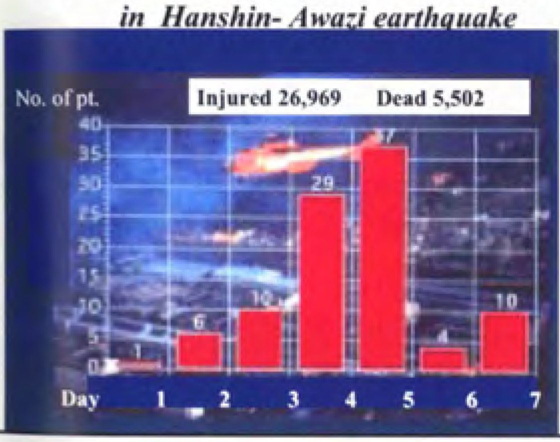
国立病院機構　災害医療センター
辺見　弘

National Hospital Organization Disaster Medical Hospital
Director Hiroshi Henmi

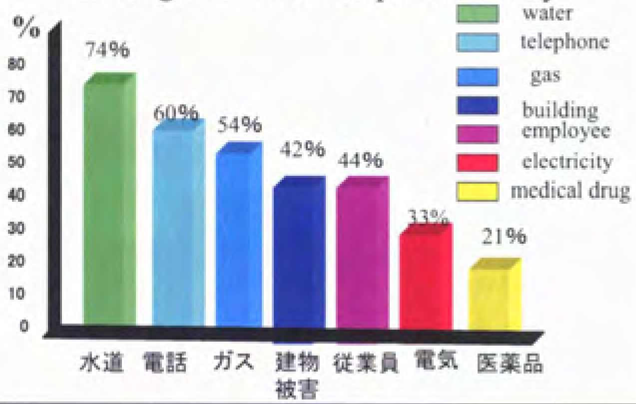
東灘保健所の活躍
Activity of Higasinada Public Health Center at Hanshin Awazi Earthquake



No.of transported pt. by helicopter shows lacks in systemic emergency medical system in Hanshin- Awazi earthquake



診療機能低下の原因
Losing Cause on Hospital Activity



Fail to preparedness for disaster is preparedness for disaster

備えあれば憂いなし

阪神淡路大震災の医療としての最大の反省点は初期救急医療体制の欠如

厚生省研究班

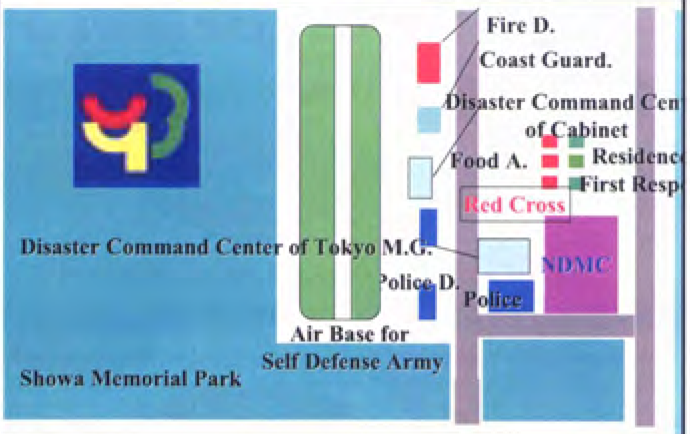
災害拠点病院
Hospital for Disaster Medicine

530(Dec.2002)→542(Aug.2004)

Hard
- 備蓄庫　48% stockyard
- 耐震化　68% earthquake proof
- 自家発電　33% generator
- 受水槽　17% water tank
- ヘリポート85% helipad

Soft
- 防災マニュアル65% manual for
- 院内防災訓練　64% hospital drill for disaster
- 地域防災訓練　54% local area drill for disaster

Tachikawa Disaster Base



平時の災害医療センターの役割
*Roles of NDMC *at ordinary time .*

The first level of trauma and emergency center ,as well as the general hospital.

Drills ,education ,clinical research for disaster

*NDMC:National Disaster Medical Center

災害医療センターの備蓄
Preparedness of NDMC

Foods :5 days for 900 patients

Medical Drugs and Materials: 5 days for 900 patients

Medical Gases :for 7 days

Fuel :for 4 days

ライフライン強化
Reinforcement of NDMC for life line

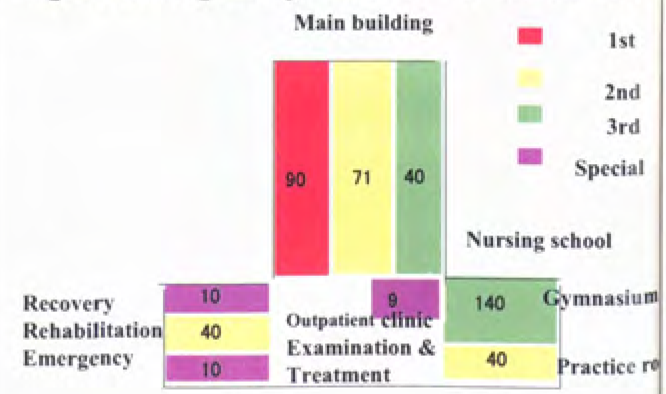
Water:**1200t pool＋400t/day by well**
Communication: **connected 2 ways of telephone station 3 ways of wireless system &terminal of DIS**
Electricity:**non-stop installation & 2000kv generator**
City gas:**exchangeable to LP gas or kerosene**
900t.Sewage tank

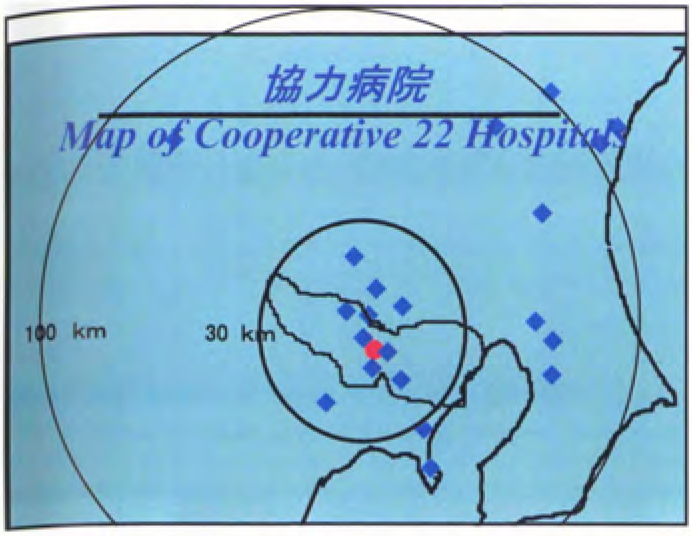
*DIS:Disaster Information System;Super computer of cabinet which estimate the number of casualties

災害時の役目
Role of NDMC for Disaster

455 beds extend to 900 beds
and accept mainly severely injured patient.
(multiple trauma , burn ,crush syndrome)
Decontamination for N.B.C
Dispatch the Disaster Medical Assistance Team

増床計画
Expansion plan from 455 to 900beds





重症患者対応能力

Maximum Capacity of NDMC for Severely Injured Patients.at the same time

Triage 2 person 3min. First Aid 4person 30min.
Emergency Major Surgery 6 person 300min

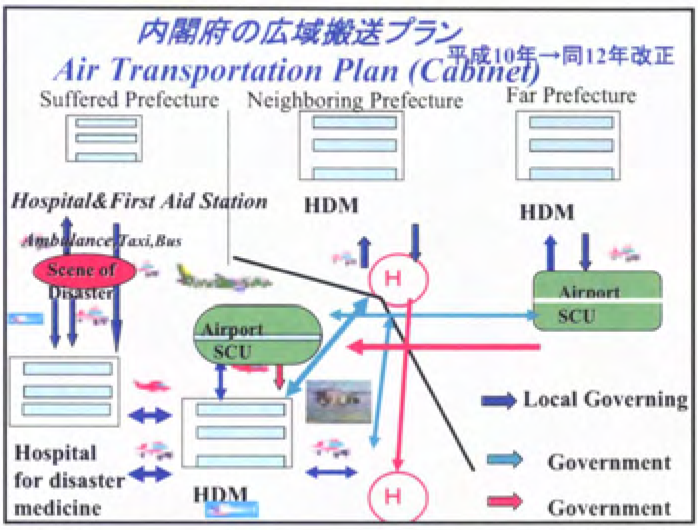
Major Surgery	8
ICU	10
Interventional Radiology	3
Hemo-dialyze	6

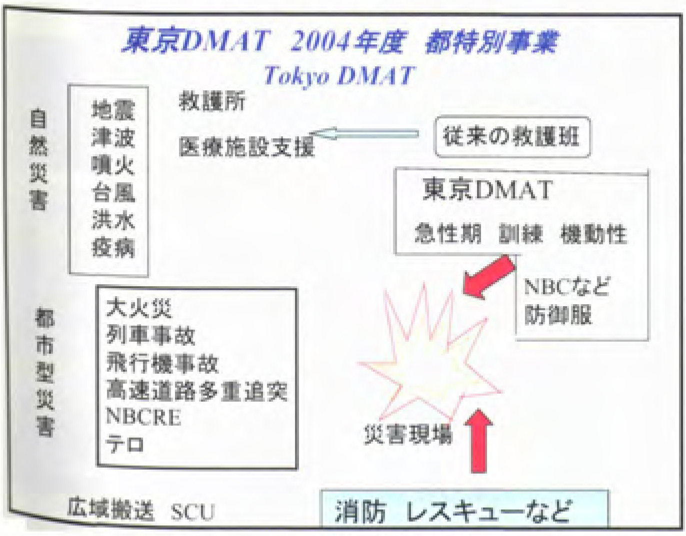
Above Number of Pts have a chance to survive by transfererd to unaffected area

重症患者を非被災地に航空機による搬送

Air Transportation of Severely Injured Pts.

Criteria for air transportation
Method & Control for air transportation
Staging Care Unit
Patient care in aircraft
Tracking
Ability of the Hospital (affected area and unaffected area)





地下鉄サリン事件

Terrorism in Tokyo Sarin attack in subway

20th Mar. 1995 *5 lines*

5500 suffered

1000 admitted

12 dead

150 first responder &
132 emergency staff secondary contaminated

Decontamination on site

21

Japanese Disaster Relief Team and Medical Team in Algeria Earthquake on Sep.2003

アルゼリア地震

予防できる死の回避

To avoid preventable death at disaster

To brush-up of ordinary emergency medicine is important to raise the level of disaster medicine.

Corporation with 550 hospital for disaster medicine is necessary.

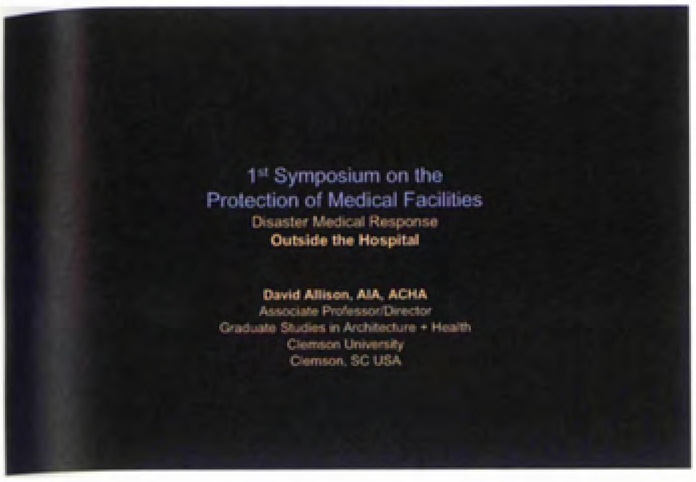
Early set-up of emergency medical system in wide area is important.
Transportation of severely injured patient to unaffected wide area.

The most important role of NDMC is coordination

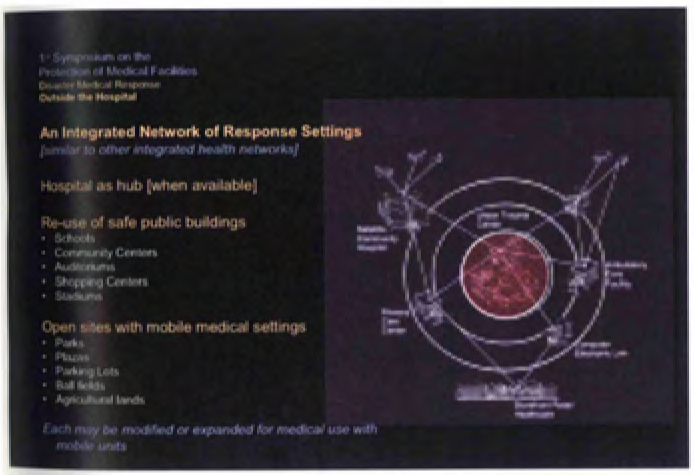
Thank you for your kind attention

Disaster Medical Center

Question


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
David Allison, AIA, ACHA
Associate Professor/Director
Graduate Studies in Architecture + Health
Clemson University
Clemson, SC USA


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Questions:
• What range of disaster scenarios and locations should be considered for planning?
• Is the hospital the only place that should be considered for disaster medical response?
• How can finite financial, physical, and human resources be best employed to respond quickly and effectively to disasters?
• Can hospitals alone adequately and quickly provide appropriate care to large numbers of people?
• Can large numbers of people needing medical care always get to a hospital for care after a disaster?
• What other settings can flexibly provide primary and urgent care services to large numbers of people for a wide range of event conditions?


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
An Integrated Network of Response Settings
[similar to other integrated health networks]
Hospital as hub [when available]
Re-use of safe public buildings
• Schools
• Community Centers
• Auditoriums
• Shopping Centers
• Stadiums
Open sites with mobile medical settings
• Parks
• Plazas
• Parking Lots
• Ball fields
• Agricultural lands
Each may be modified or expanded for medical use with mobile units


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Disaster Relief Mobile Architecture must respond to:
Multiple Methods of Transportation:
road, rail, air, sea
A Range of Disaster Scenarios:
earthquake, flood, famine, hurricane/typhoon, refuge crisis
A Range of Climatic Conditions:
hot/humid, hot/dry, cold/wet, temperate, etc.
A Range of Geographic and Physical Conditions:
coastal, plain, hilly, mountainous, urban, rural, etc
A Range of Cultural Contexts:
EARTHQUAKE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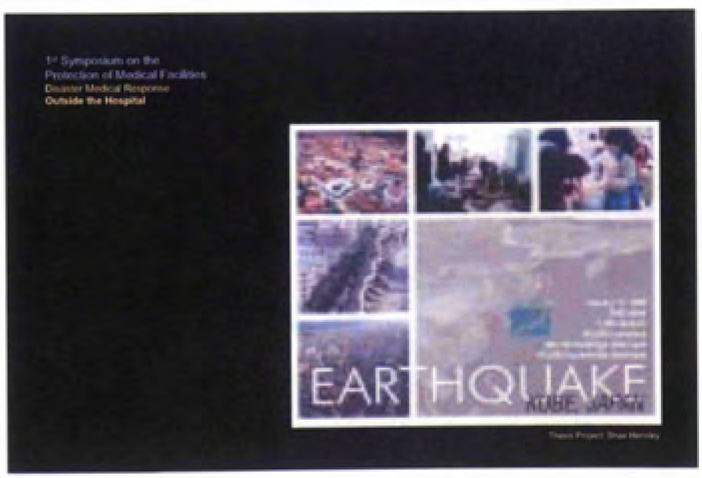
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital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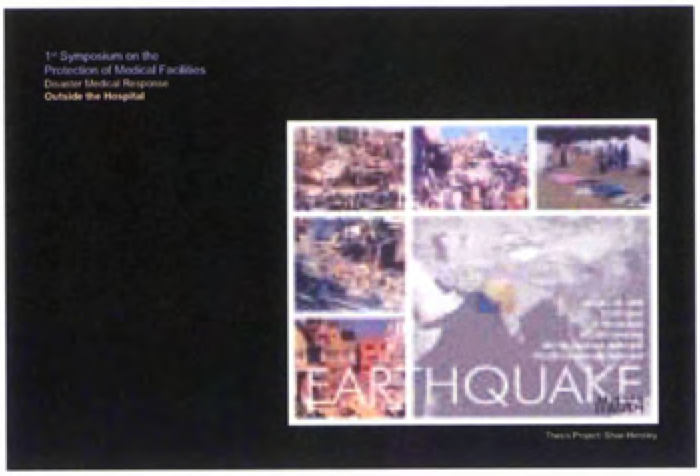
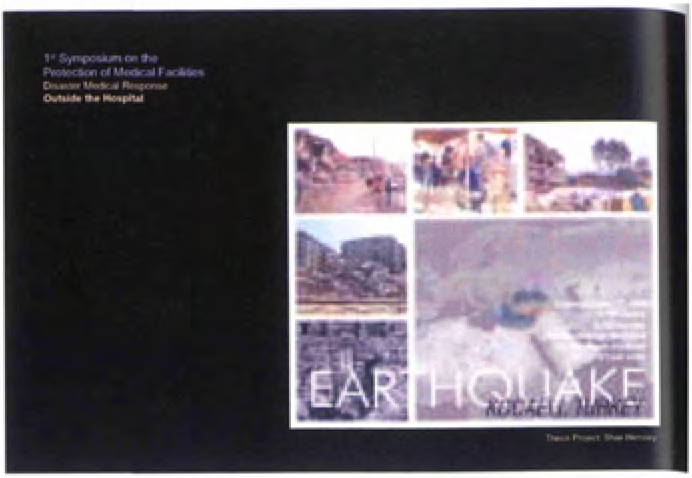
Disaster Medical Response
Outside the Hospital
EARTHQUAKE
KOBE, JAPAN


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
EARTHQUAKE
INDIA
Thesis Project: Shae Hensley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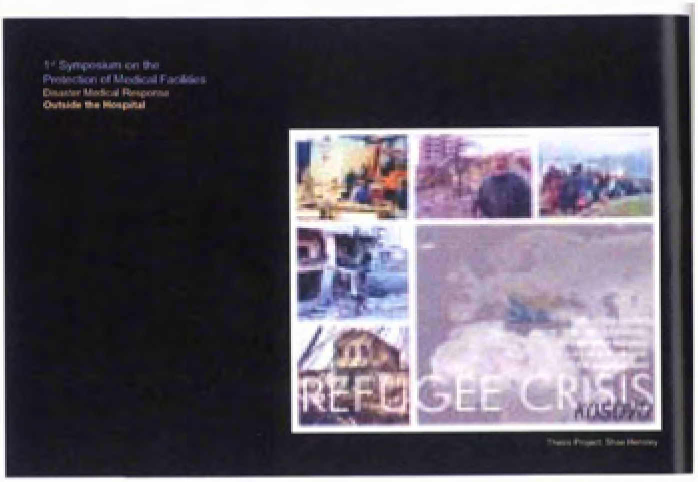
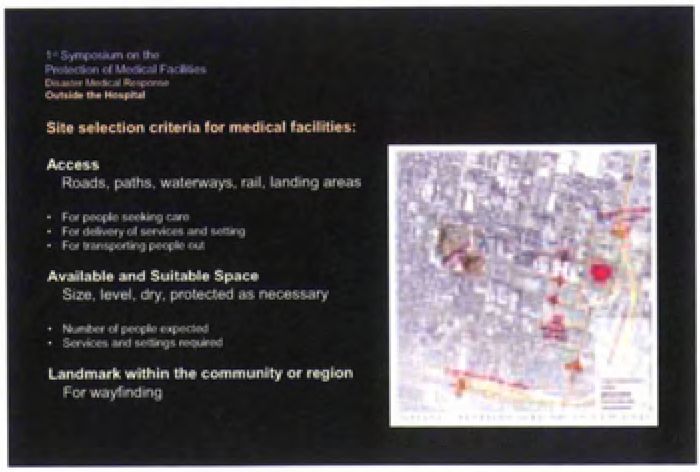
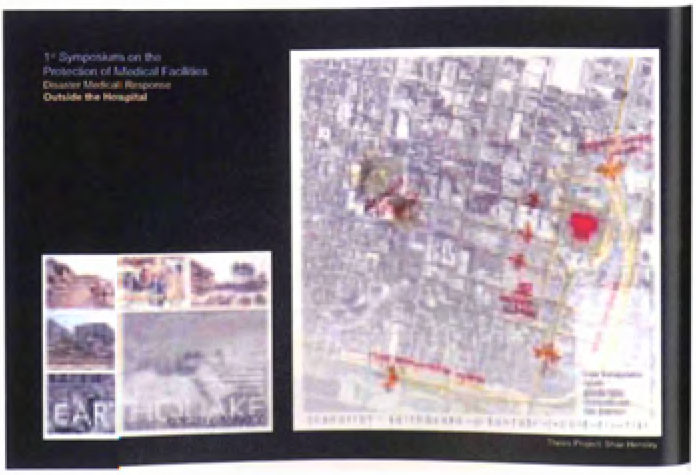
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
EARTHQUAKE
KOCAELI, TURKEY
Thesis Project: Shae Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
HURRICANE
CENTRAL AMERICA
Thesis Project: Shae Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
REFUGEE CRISIS
KOSOVO
Thesis Project: Shae Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Site selection criteria for medical facilities:
Access
Roads, paths, waterways, rail, landing areas
• For people seeking care
• For delivery of services and setting
• For transporting people out
Available and Suitable Space
Size, level, dry, protected as necessary
• Number of people expected
• Services and settings required
Landmark within the community or region
For wayfinding


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
EARTHQUAKE
Thesis Project: Shae Hensley


1st Symposium on the
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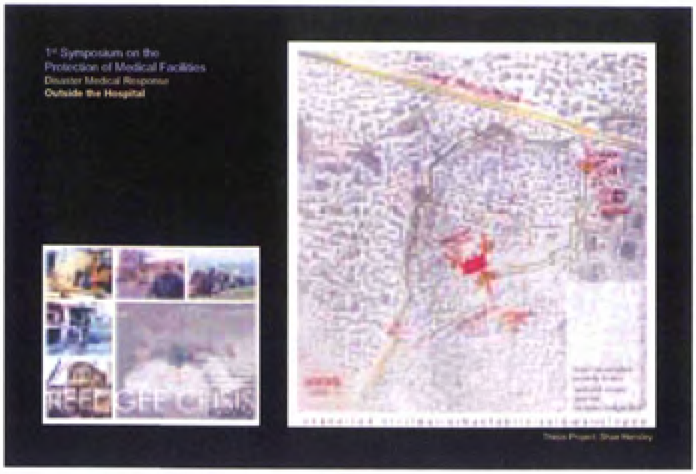
Disaster Medical Response
Outside the Hospital
HURRICANE
Thesis Project: Shaw Hensley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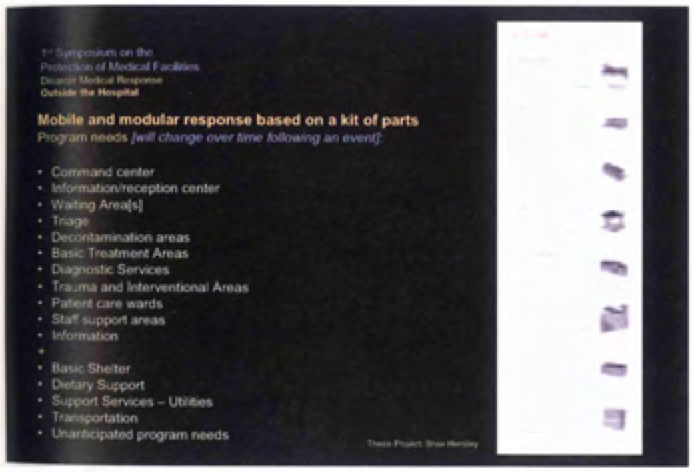
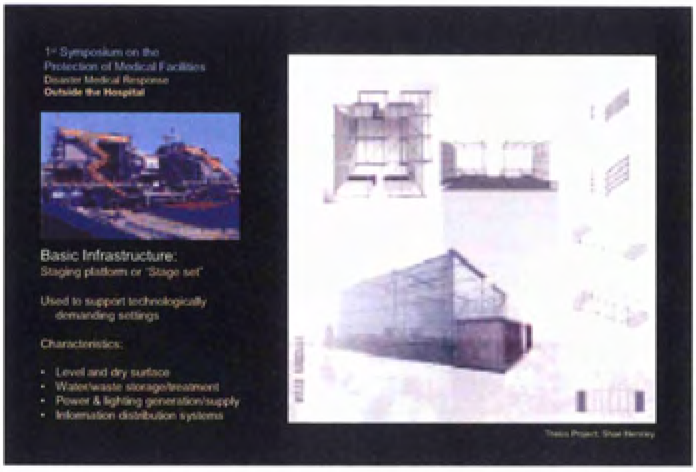
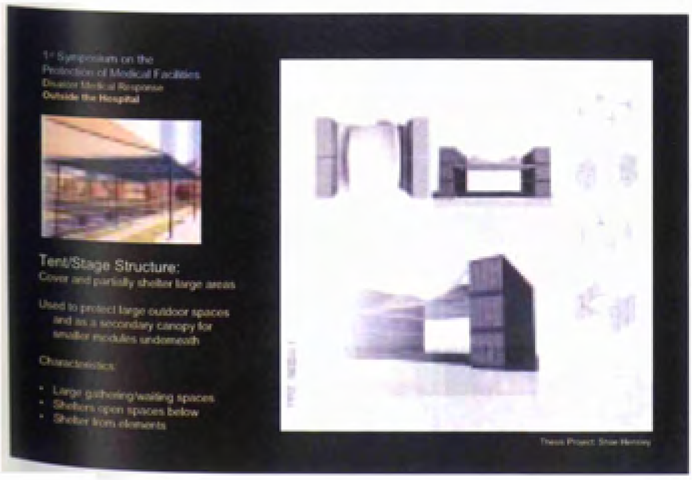
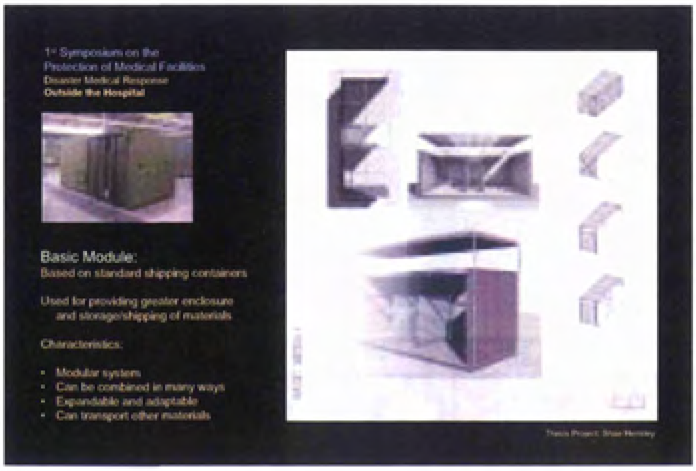
Disaster Medical Response
Outside the Hospital
Thesis Project: Shaw Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Mobile and modular response based on a kit of parts
Program needs [will change over time following an event]:
Command center
Information/reception center
Waiting Area[s]
Triage
Decontamination areas
Basic Treatment Areas
Diagnostic Services
Trauma and Interventional Areas
Patient care wards
Staff support areas
Information
Basic Shelter
Dietary Support
Support Services – Utilities
Transportation
Unanticipated program needs
Thesis Project: Shaw Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Basic Infrastructure:
Staging platform or "Stage set"
Used to support technologically demanding settings
Characteristics:
Level and dry surface
Water/waste storage/treatment
Power & lighting generation/supply
Information distribution systems
Thesis Project: Shaw Hensley


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Tent/Stage Structure:
Cover and partially shelter large areas
Used to protect large outdoor spaces and as a secondary canopy for smaller modules underneath
Characteristics:
Large gathering/waiting spaces
Shelters open spaces below
Shelter from elements
Thesis Project: Shaw Hensley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Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Basic Module:
Based on standard shipping containers
Used for providing greater enclosure and storage/shipping of materials
Characteristics:
Modular system
Can be combined in many ways
Expandable and adaptable
Can transport other materials
Thesis Project: Shaw Hensley

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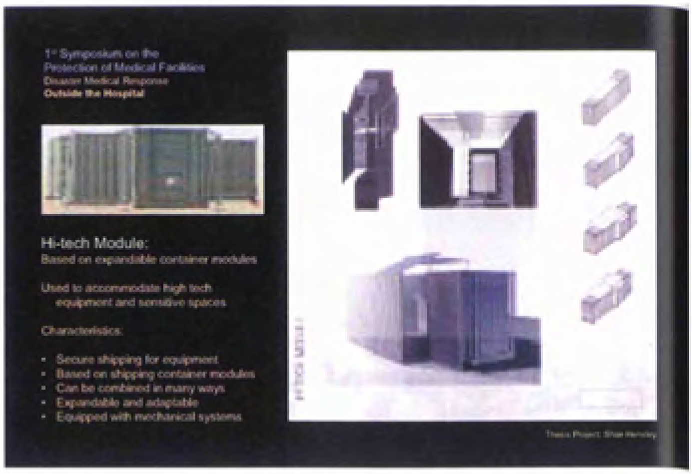
Disaster Medical Response
Outside the Hospital
Hybrid Module:
Adaptable shipping container
Used for providing expanded canopy area over uses needing less enclosure
Characteristics:
• Shelter from sun and rain
• Modular and expandable
• Can be modified for many uses



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Disaster Medical Response
Outside the Hospital
Hi-tech Module:
Based on expandable container modules
Used to accommodate high tech equipment and sensitive spaces
Characteristics:
• Secure shipping for equipment
• Based on shipping container modules
• Can be combined in many ways
• Expandable and adaptable
• Equipped with mechanical systems

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Disaster Medical Response
Outside the Hospital

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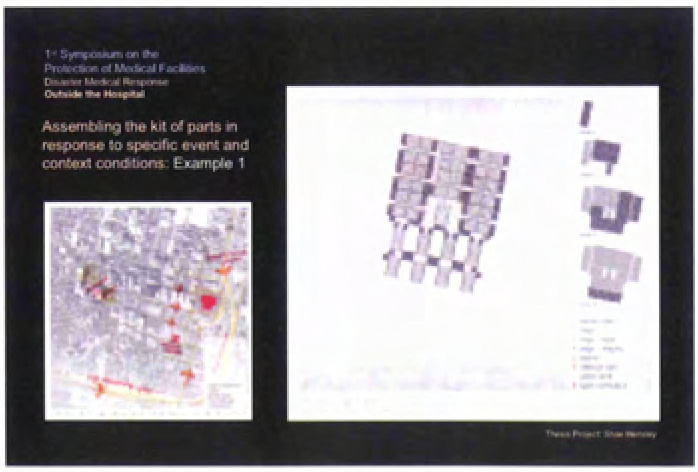
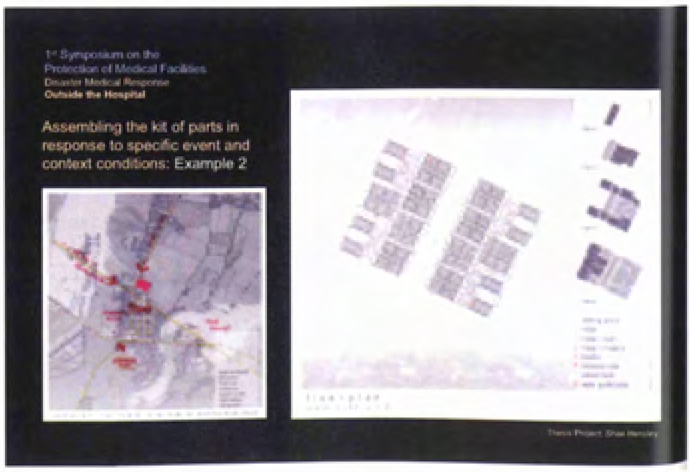
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Pre-Fabricated Module:
The tent or hut
Provides greater enclosure in spaces that larger than shipping containers
Characteristics:
• Quick site assembly/erection
• Can be combined in many ways
• Can be expandable and adaptable
• Can be modified for many uses



1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Assembling the kit of parts in response to specific event and context conditions: Example 1



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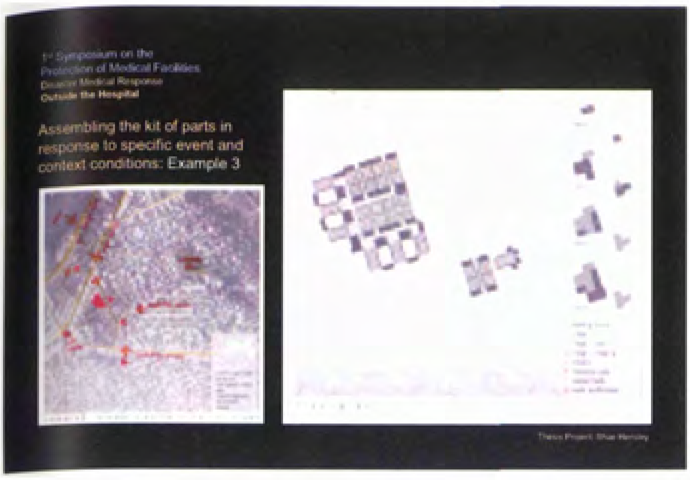
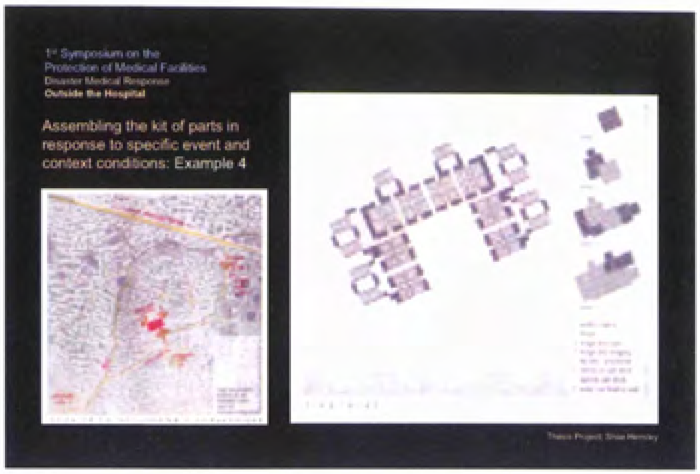
Disaster Medical Response
Outside the Hospital
Assembling the kit of parts in response to specific event and context conditions: Example 2


1st Symposium on the
Protection of Medical Facilities
Disaster Medical Response
Outside the Hospital
Assembling the kit of parts in response to specific event and context conditions: Example 3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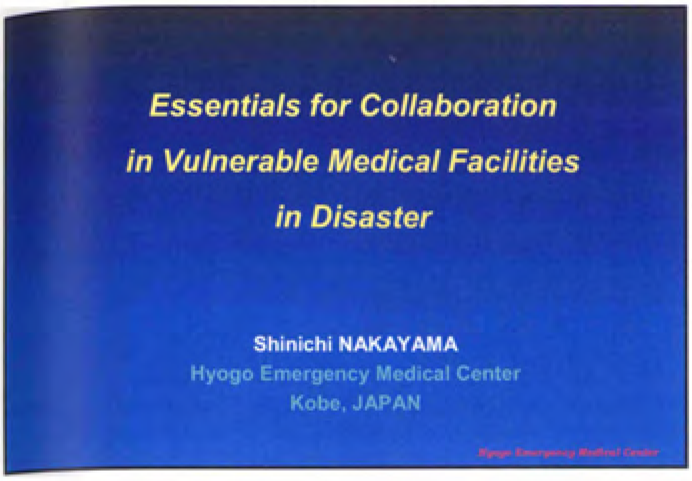
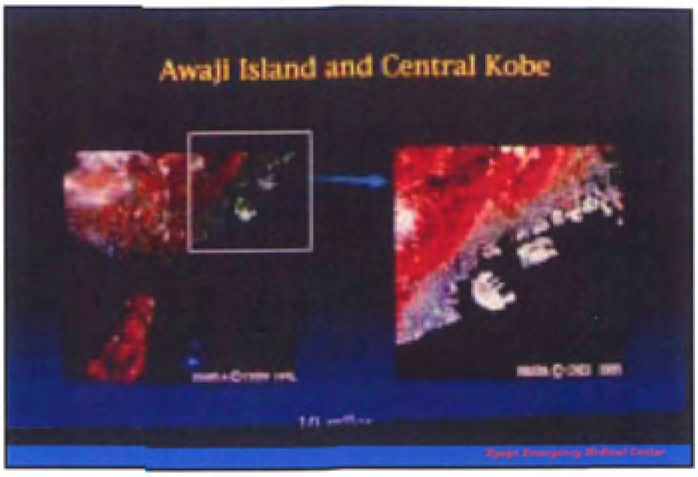
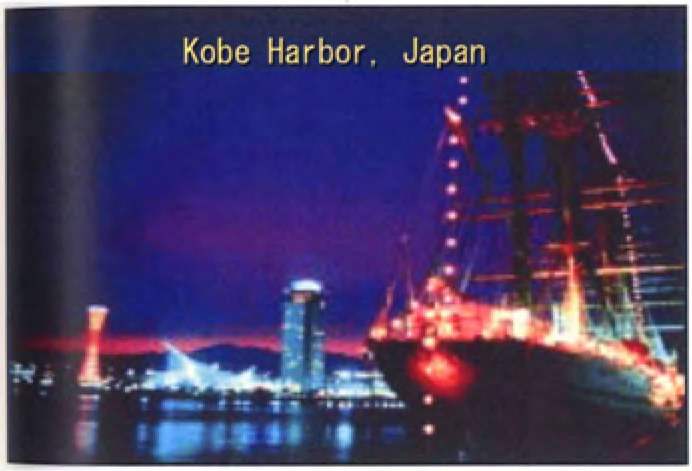
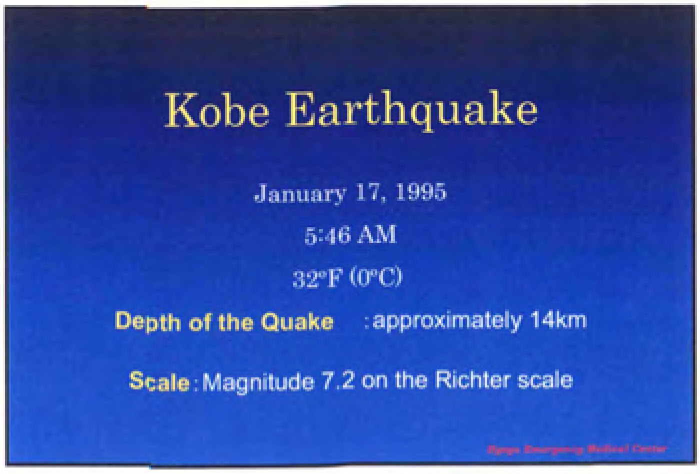
Disaster Medical Response
Outside the Hospital
Assembling the kit of parts in response to specific event and context conditions: Example 4


Essentials for Collaboration
in Vulnerable Medical Facilities
in Disaster
Shinichi NAKAYAMA
Hyogo Emergency Medical Center
Kobe, JAPAN


Awaji Island and Central Kobe


Kobe Harbor, Japan


Kobe Earthquake
January 17, 1995
5:46 AM
32°F (0°C)
Depth of the Quake :approximately 14km
Scale : Magnitude 7.2 on the Richter scale

Kobe Earthquake
Casualties

6,425	Deaths
43,772	Injured
4,849	Buildings damaged
>480,000	Houses collapsed or damaged

Vulnerability of Medical Facilities

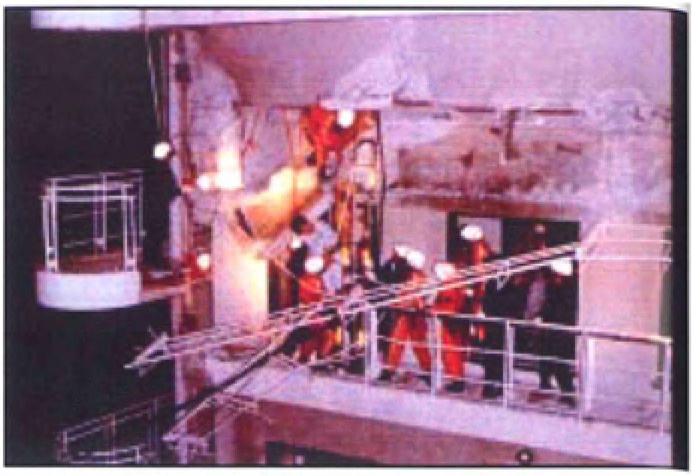
Dark Hospital Lobby after Fire at Mid-day

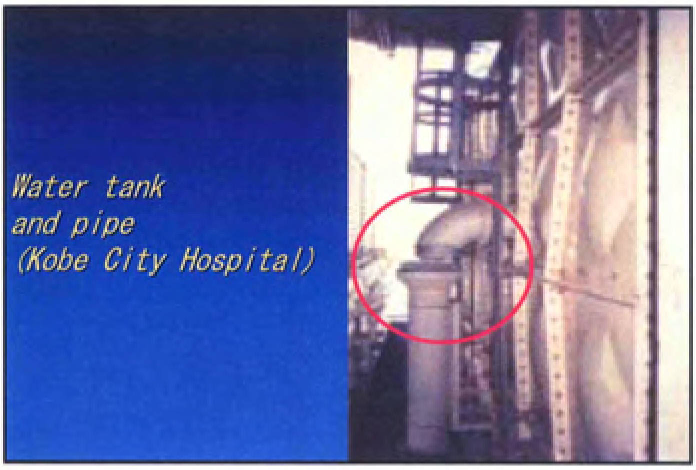
Damages of Medical Facilities in Kobe

	Before	After	
Hospitals	112	100	(-11%)
Clinics	1363	1104	(-19%)

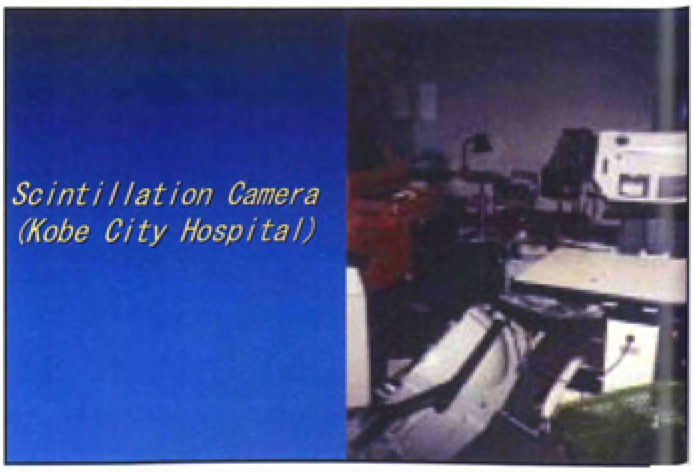
12 out of 112 (11%) hospitals
259 out of 1,363 (19%) clinics
collapsed completely or partially.

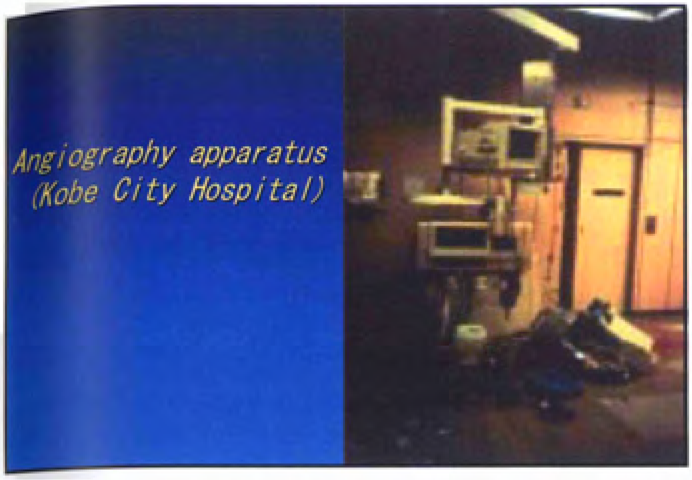
Pan-cake crash (Kobe City West Hospital)

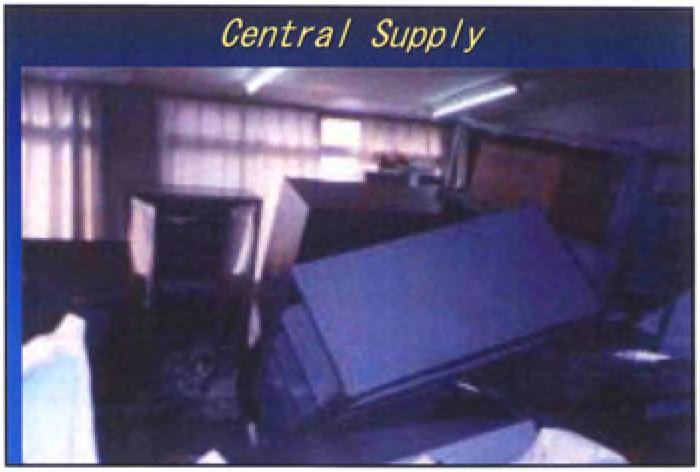


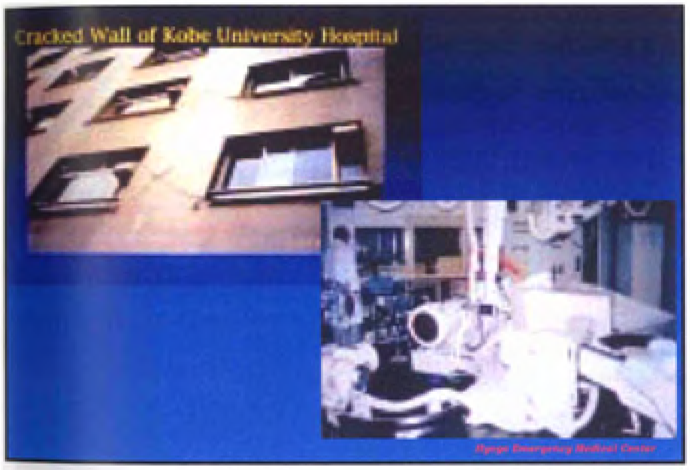

Water tank
and pipe
(Kobe City Hospital)


Resuscitation Room


Scintillation Camera
(Kobe City Hospital)







Kobe Earthquake

- Water
- Food
- Energy Source (Electricity and Gas)
- Transportation
- Communication
- Medical Manpower

Kobe Earthquake
Water

- Drinking
- Washing
- Sanitation

Kobe Earthquake
Water

In Kobe University Hospital,

- water tank exhausted in the evening.
- water supply resumed 6 days after the quake.

Kobe Earthquake

Chronic renal failure patients who required hemodialysis were transferred to other institutions outside of the destroyed area.

Kobe Earthquake

Acute renal failure patients with the crush syndrome were treated by hemo-filtration and transferred to other institutions outside of the destroyed area.

Kobe Earthquake

Food

Kobe Earthquake
Energy Source

- Electricity
- Gas

Kobe Earthquake
Electricity

In Kobe University Hospital,

- electricity supply instantly shut down and hospital power plant started.
- public supply resumed shortly after the quake.

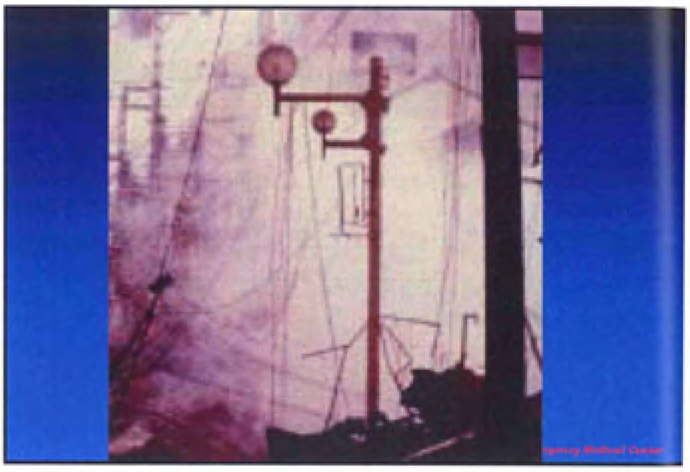
Kobe Earthquake
Gas

In Kobe University Hospital,

- Gas supply instantly shut down.
- Gas supply resumed 25 days after the quake.

Kobe Earthquake
Transportation

- Railway
- Subway
- Marine
- Highway (overpass)
- Street

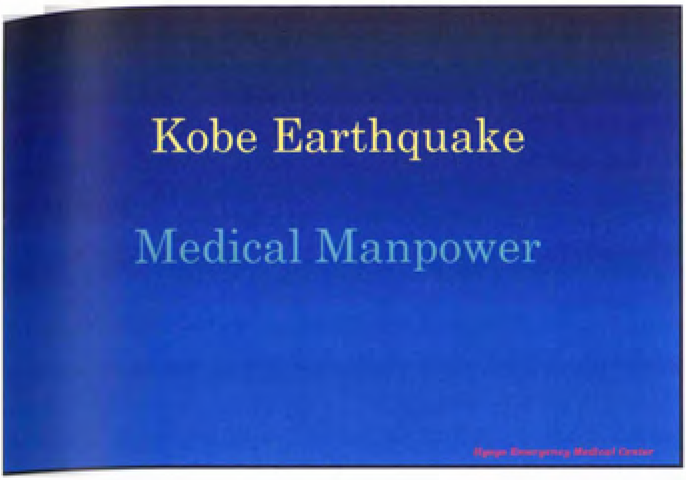


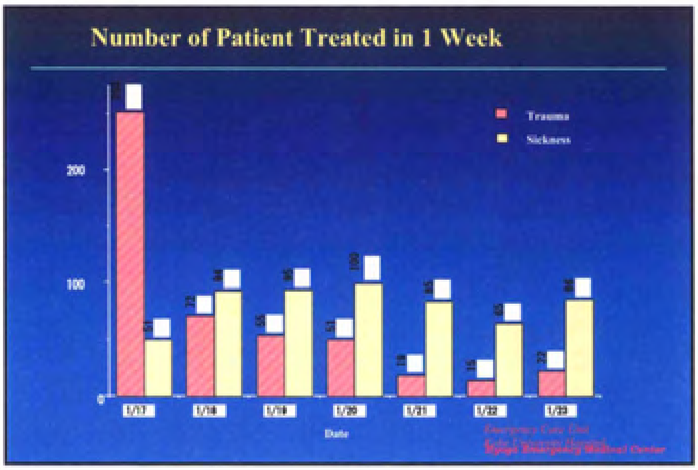
Kobe Earthquake
Communication

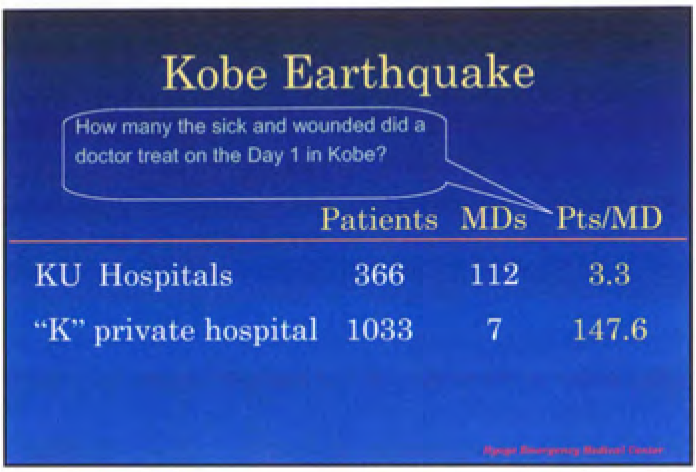
- •Telephone
- •Cellular phone
- •Internet
- •Wireless radio
- •Bulletin board
- •Messenger

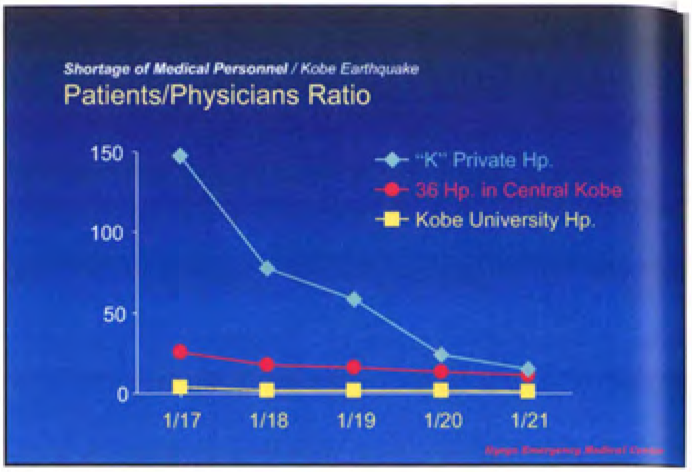
Kobe Earthquake
Telephone

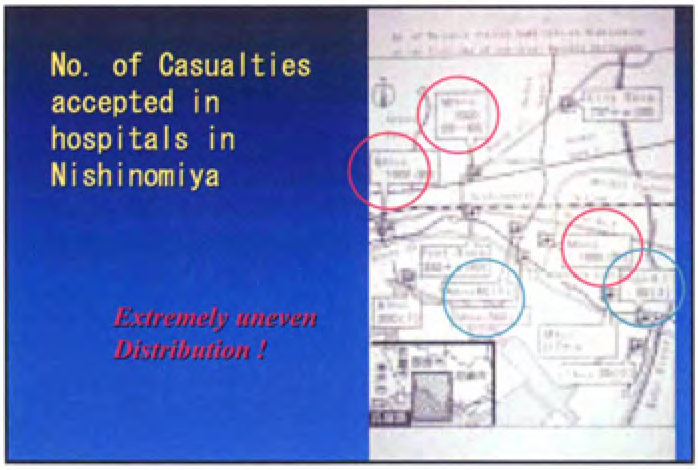
•Telephone line was alive for 2-3 hours after the quake, and then was unusable.
•It resumed 5 days after the quake.
•The bulletin board and messengers were the only way of communication.

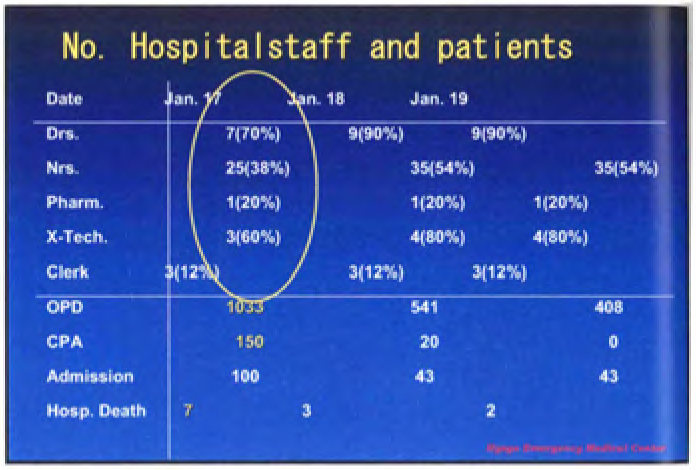

Kobe Earthquake
Medical Manpower
Hyogo Emergency Medical Center


Number of Patient Treated in 1 Week
Trauma
Sickness
200
100
0
1/17
1/18
1/19
1/20
1/21
1/22
1/23
Date
Hyogo Emergency Medical Center



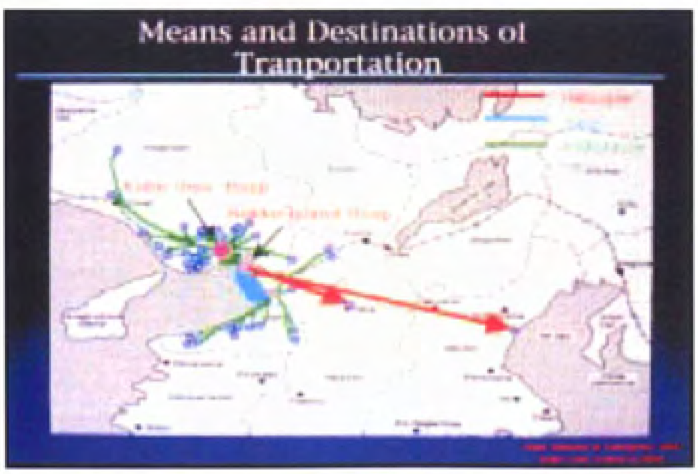


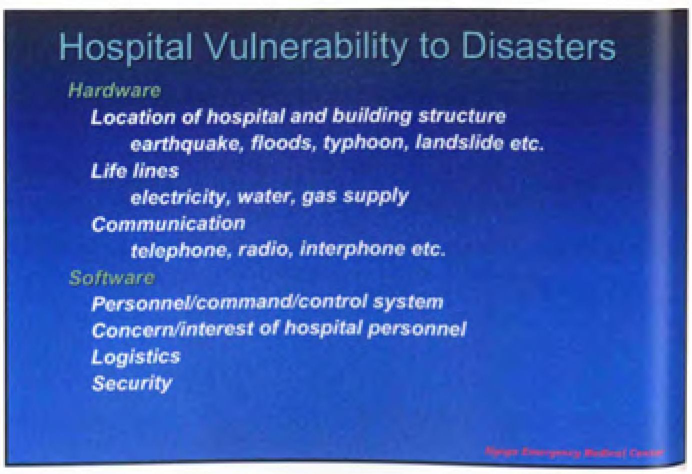




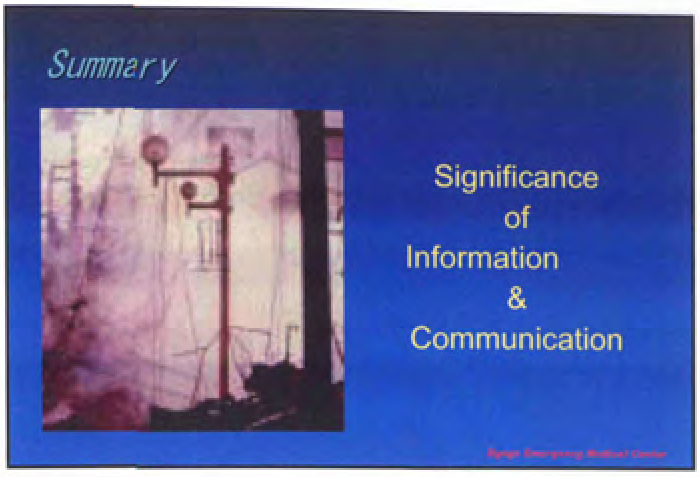
No. Hospitalstaff and patients

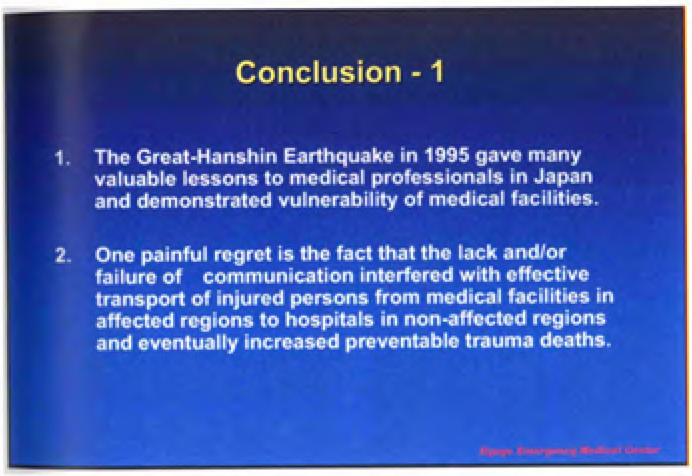
Date	Jan. 17	Jan. 18	Jan. 19
Drs.	7(70%)	9(90%)	9(90%)
Nrs.	25(38%)	35(54%)	35(54%)
Pharm.	1(20%)	1(20%)	1(20%)
X-Tech.	3(60%)	4(80%)	4(80%)
Clerk	3(12%)	3(12%)	3(12%)
OPD	1033	541	408
CPA	150	20	0
Admission	100	43	43
Hosp. Death	7	3	2






Summary
* Huge communication gap often exists between in affected region and in unaffected region!
Medical resources
Imbalance in
affected region
Trauma & Sickness
patients
It is too late if medical relief teams wait to be requested to come and help!


Summary
Significance
of
Information
&
Communication


Conclusion - 1
1. The Great-Hanshin Earthquake in 1995 gave many valuable lessons to medical professionals in Japan and demonstrated vulnerability of medical facilities.
2. One painful regret is the fact that the lack and/or failure of communication interfered with effective transport of injured persons from medical facilities in affected regions to hospitals in non-affected regions and eventually increased preventable trauma deaths.

Lessons Learned from Kobe Earthquake

by the Committee on Disaster Medicine to learn from Experiences of the Great Hanshin-Awaji Earthquake (May 29, 1995)

- Interruption and Confusion of Information
- Delay of EMS Dispatch
- Deterioration of Hospital Functions
- Difficulty and Delay of Transportation
- Lack of Disaster Preparedness
- Inadequate Disaster Training

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Kobe University School of Medicine

The Priority in terms of Urgency

by the Committee on Disaster Medicine to learn from Experiences of the Great Hanshin-Awaji Earthquake (May 29, 1995)

- The Establishment of Medical Information System
- The Implementation of Disaster Medicine Operation Units
- Augmentation of Disaster Preparedness in Communities
- Enhancemant of Disaster Capabilities of Hospitals
- Distribution of Pharmaceuticals and Medical Supplies
- The Establishment of Patients Transport System both Inside and Outside the Disaster Areas
- The Comprehensive Research into Disaster
- Training and Disaster Exercises of Medical Professionals and Optimization of Volunteer Activities
- The Public Health Education on Emergency Health Care

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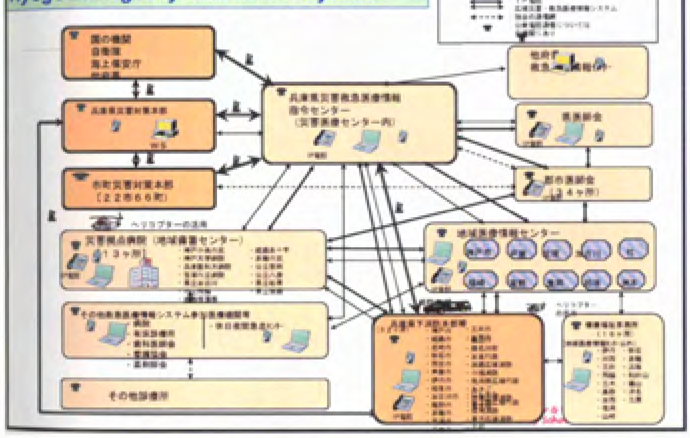
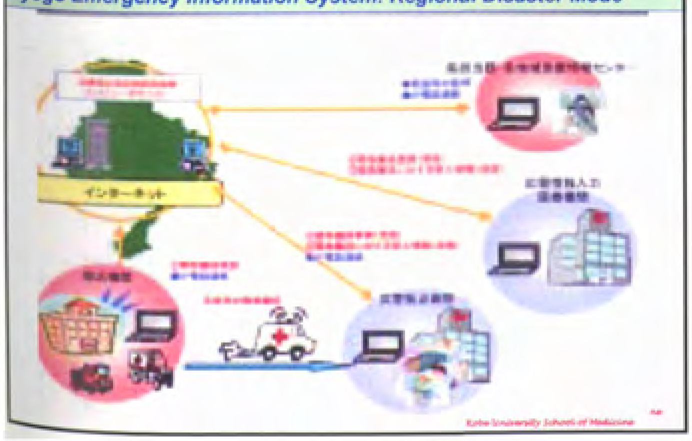
Hyogo Emergency Information System



Hyogo Emergency Information System: Major Disaster Mode

Hyogo Emergency Information System: Regional Disaster Mode



Disaster Medicine Operation Units

- M.H.W.J. has been trying to promote the establishment of Disaster Medicine Operation Units (DMOU) to provide DEMS to cope with disasters.
- Tasks
  - Recieveing patients
  - Immediate dispatch of emergency medical care teams
  - Training EMS crew and stock of EMS supplies (main key-hospital or disaster medicine center)

Requirements

- Earthquake-proof and equipped with all the EMS resources (shelters, heliport, water reservoirs, dynamometers, extra stock of pharmaceuticals, medical supplies, food etc).

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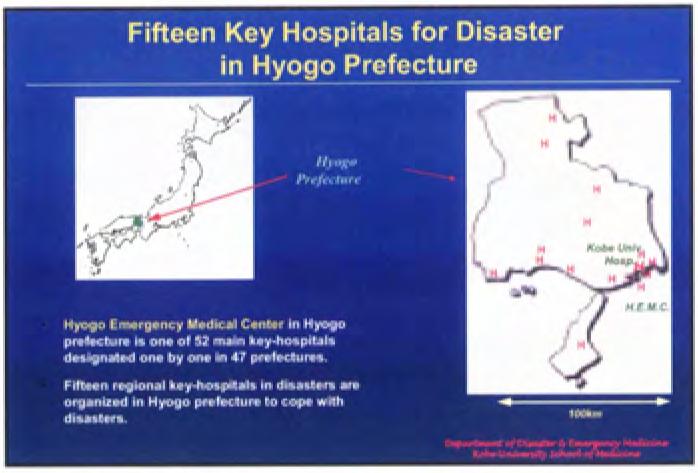
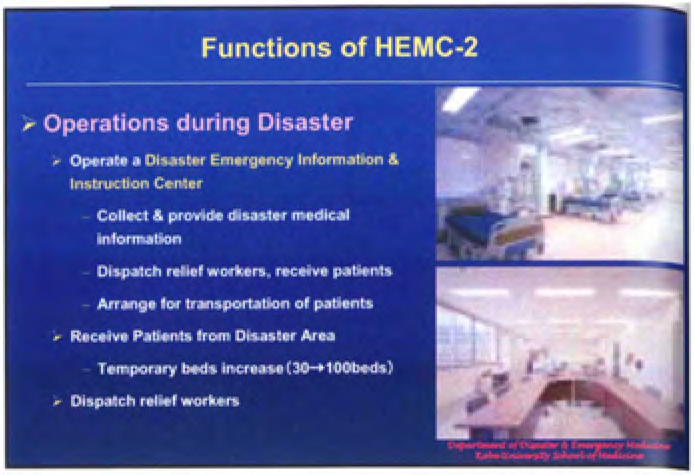

Fifteen Key Hospitals for Disaster
in Hyogo Prefecture
Hyogo
Prefecture
Kobe Univ.
Hosp.
H.E.M.C.
100km
Hyogo Emergency Medical Center in Hyogo prefecture is one of 52 main key-hospitals designated one by one in 47 prefectures.
Fifteen regional key-hospitals in disasters are organized in Hyogo prefecture to cope with disasters.


Functions of HEMC-2
Operations during Disaster
Operate a Disaster Emergency Information & Instruction Center
Collect & provide disaster medical information
Dispatch relief workers, receive patients
Arrange for transportation of patients
Receive Patients from Disaster Area
Temporary beds increase (30→100beds)
Dispatch relief workers


Topics of the Training Sessions (Lecture)
General aspects of disaster medicine
Disaster and emergency medical system in Hyogo prefecture
The role of disaster medical coordinator
Keys in DEMS such as triage, treatment and transport
Emergency transport by helicopter
Information in disasters
FEMA in the USA
Management of Nuclear Disaster etc.

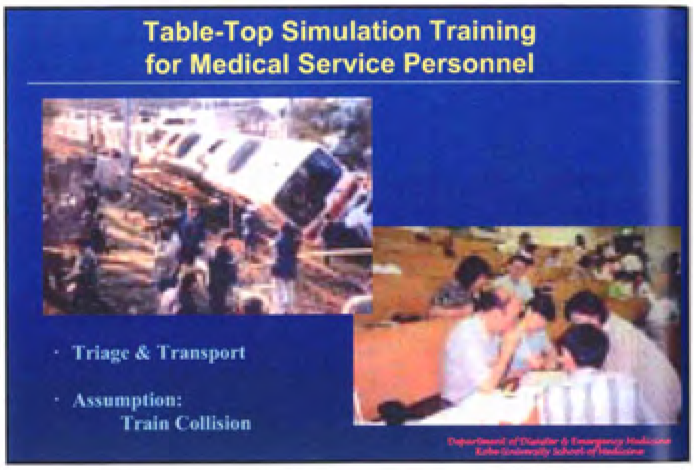


Table-Top Simulation Training
for Medical Service Personnel
Triage & Transport
Assumption:
Train Collision


Simulation Triage Training
for Medical Service Personnel

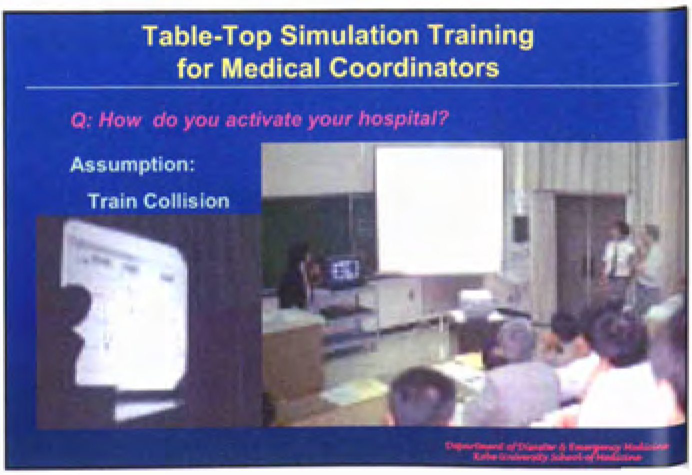
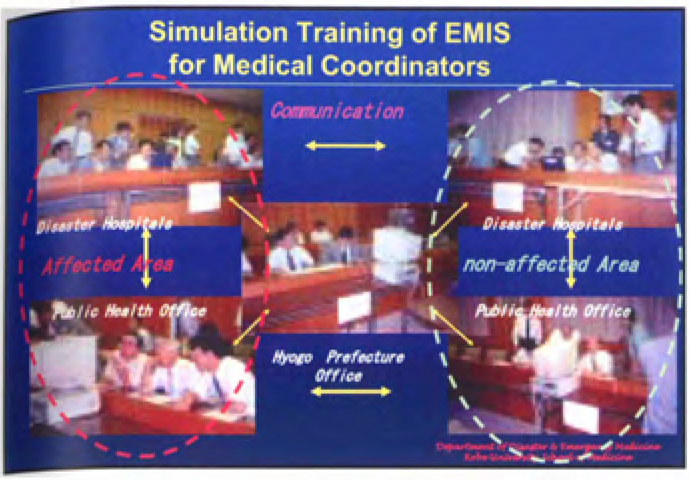
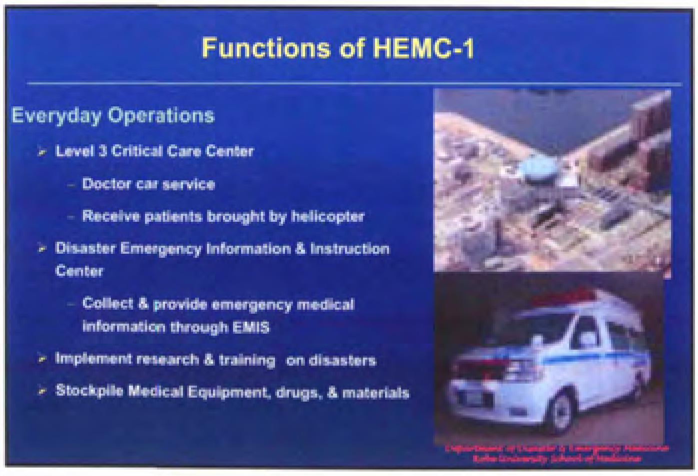
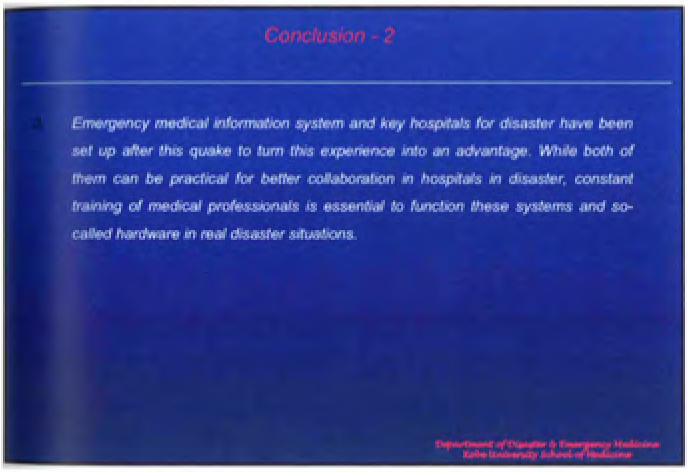


Table-Top Simulation Training
for Medical Coordinators
Q: How do you activate your hospital?
Assumption:
Train Collision


Simulation Training of EMIS
for Medical Coordinators
Communication
Disaster Hospitals
Affected Area
Public Health Office
Disaster Hospitals
non-affected Area
Public Health Office
Hyogo Prefecture
Office
Department of Disaster & Emergency Medicine
Kobe University School of Medicine


Functions of HEMC-1
Everyday Operations
Level 3 Critical Care Center
Doctor car service
Receive patients brought by helicopter
Disaster Emergency Information & Instruction Center
Collect & provide emergency medical information through EMIS
Implement research & training on disasters
Stockpile Medical Equipment, drugs, & materials
Department of Disaster & Emergency Medicine
Kobe University School of Medicine


Conclusion - 2
Emergency medical information system and key hospitals for disaster have been set up after this quake to turn this experience into an advantage. While both of them can be practical for better collaboration in hospitals in disaster, constant training of medical professionals is essential to function these systems and so-called hardware in real disaster situations.
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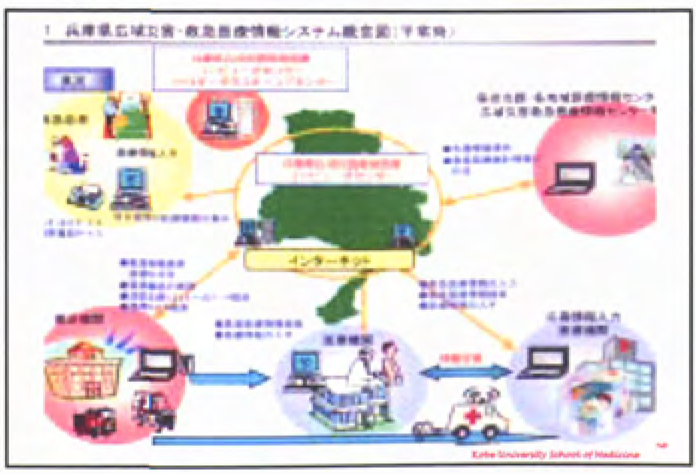
Kobe luminarie™
since 1996
2nd & 3rd week in December
more than Five Million visitors
Enjoy your trip in Japan!
ありがとう
Gracias!
Takk!
カムハサムニダ！
Thank you
for your attention!
Department of Disaster & Emergency Medicine
Kobe University School of Medicine


QuickTime PICT
QuickTime PICT
Department of Disaster & Emergency Medicine
Kobe University School of Medicine


インターネット
Kobe University School of Medicine

Prevention Medical Facilities from Urban Planning Perspective

Earthquake Disaster Mitigation
Research Center
Michiko Banba

Prevention of Medical Facilities from Urban Planning Perspective

1. Optimal location of facilities
   - Distance
   - Demand

   → Economic and social issues

2. Location of facilities to avoid risk

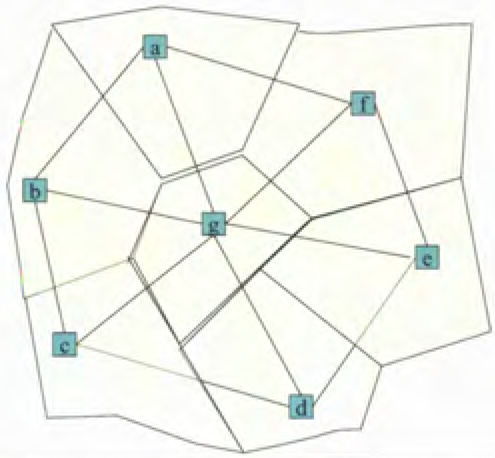
   - Natural hazard (earthquake, flood, landslide, etc.)
   - Nuclear power station or chemical factories

   → Risk management issues

Prevention of Medical Facilities from Urban Planning Perspective

3. Lifeline Network to support hospital functions

   - Security of lifeline (electricity, gas, water) to maintain medical services
   -



Key issues for location of medical facilities

- Efficiency & effectiveness
- Equity
- Risk management

Problems in disaster risk management

- Damage to the facilities
- Damage to infrastructure and lifelines

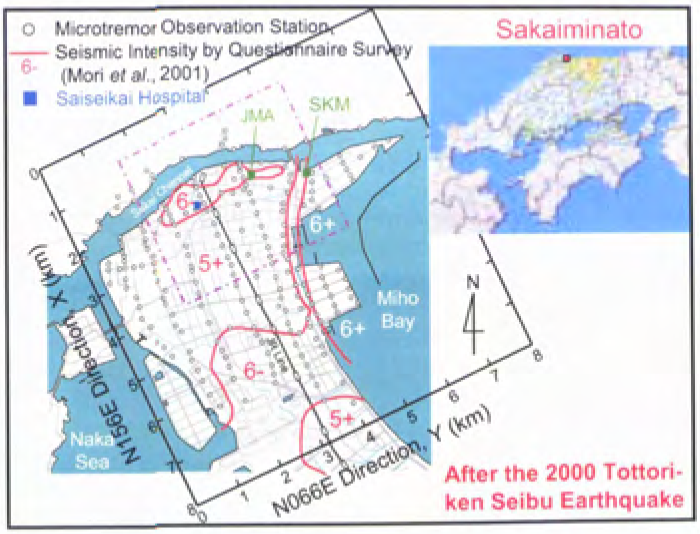
Possible solutions from urban planning perspective

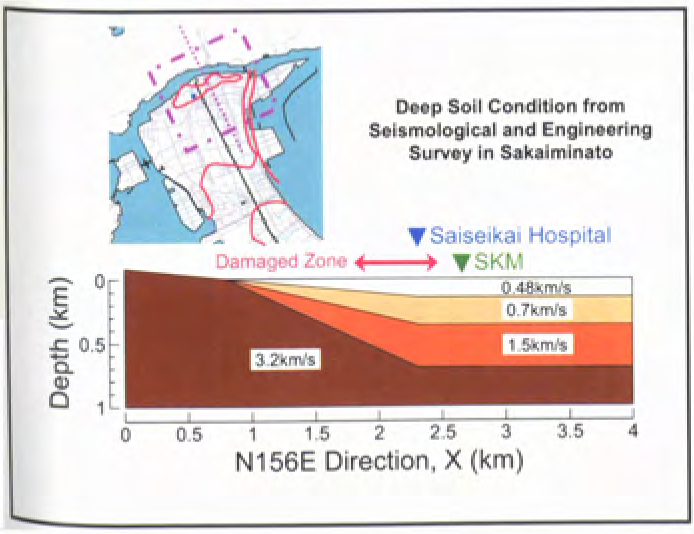
- Avoid hazard area (Location)
- Strengthen infrastructure and lifelines

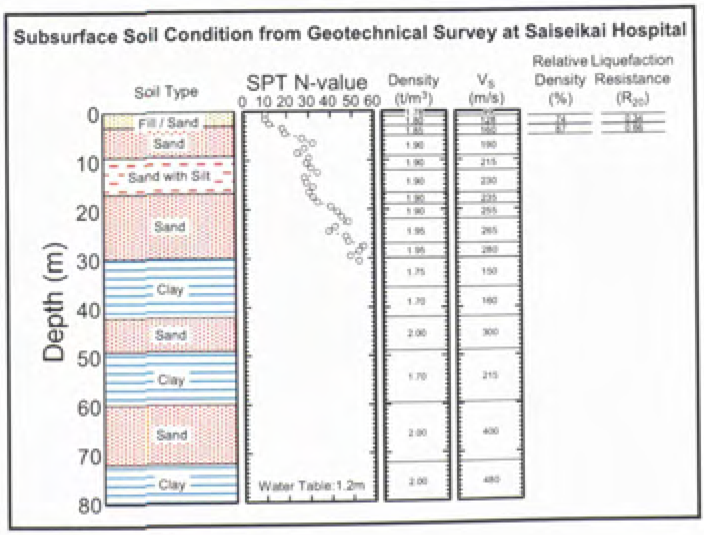
A Case Study of Strong Ground Motion Estimation at Hospital Site

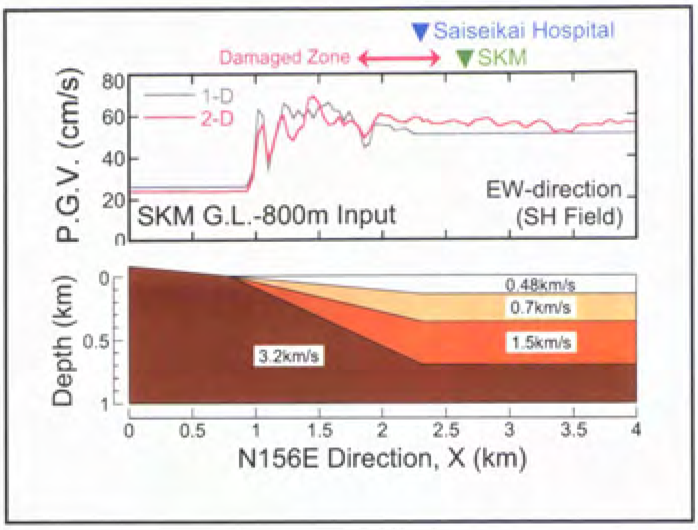
An Example of Contribution from Engineering Seismology and Geotechnical Earthquake Engineering

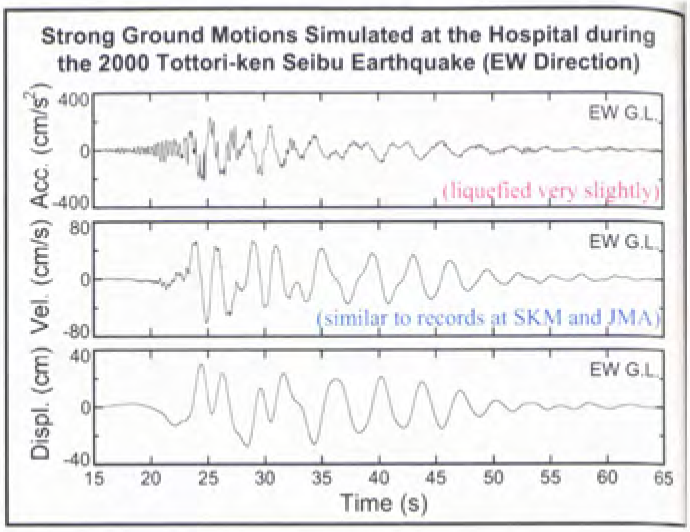
Hiroshi ARAI, Dr. Eng.
Earthquake Disaster Mitigation Research Center,
National Research Institute for Earth Science and Disaster Prevention









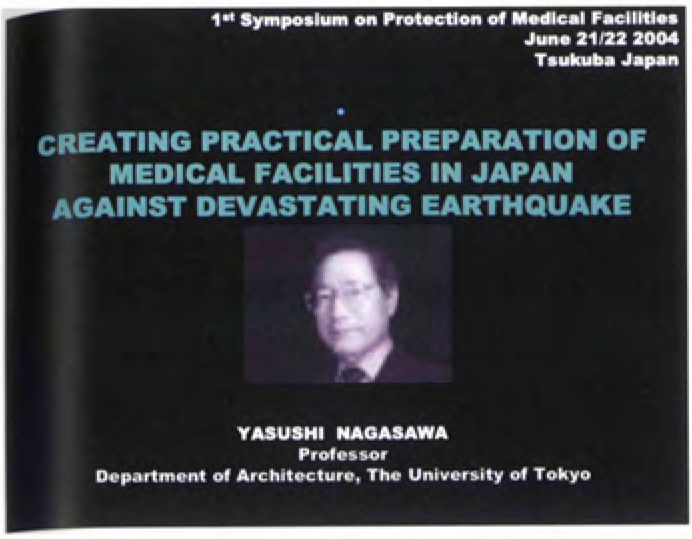


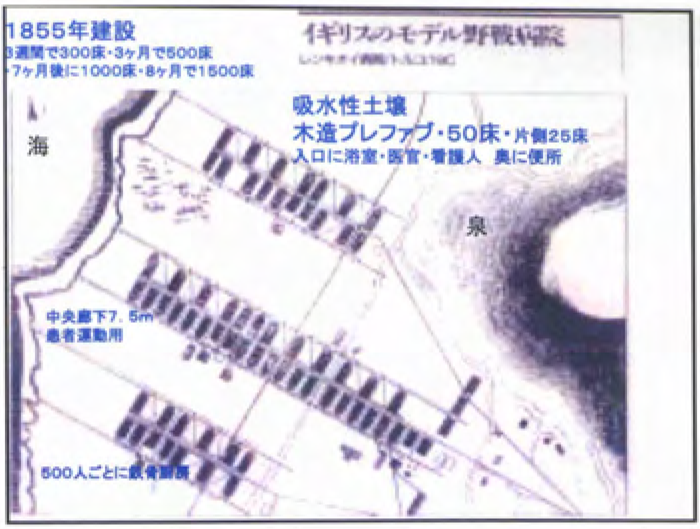
Strong ground motions at the northern area in Sakaiminato during the 2000 Tottori-ken Seibu earthquake could be simulated reasonably.

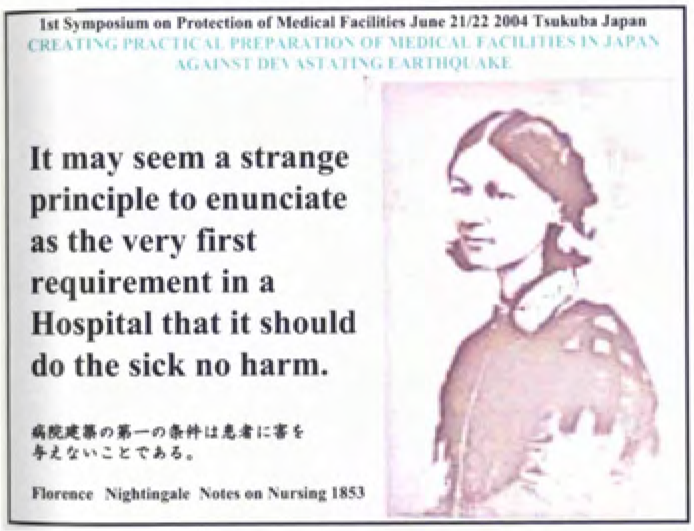
Analytical models of the Saiseikai hospital for simulating seismic responses may be assumed based on architectural drawings and on-site investigations of the building.

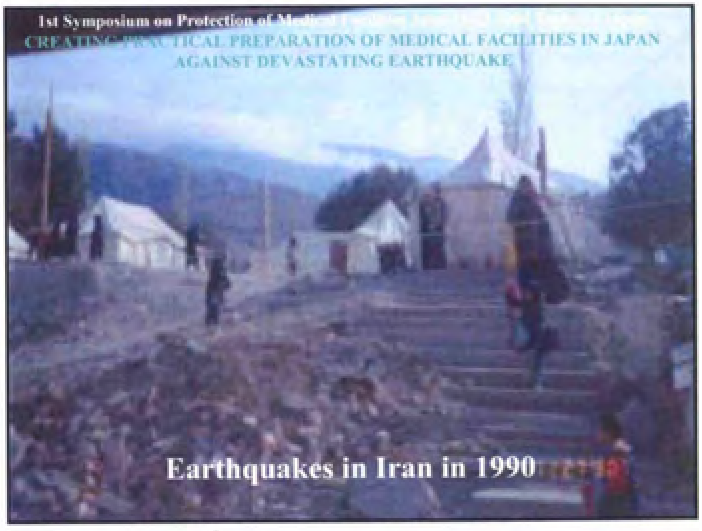
Dynamic Response Analysis
Considering Soil-Structure Interaction

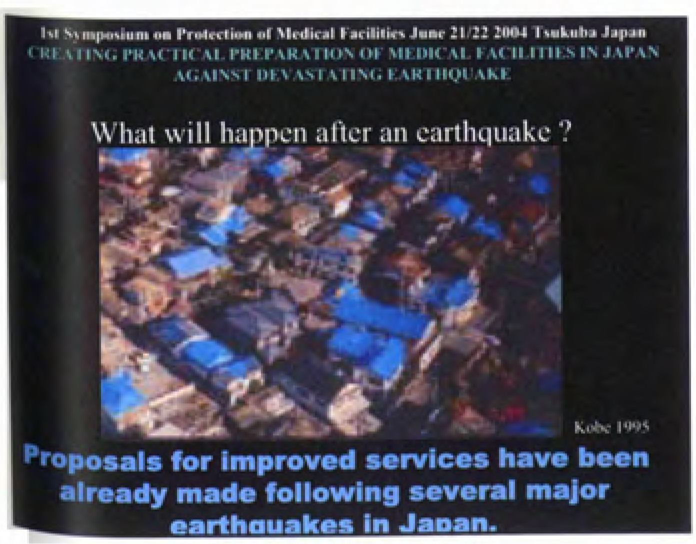
Evaluation of structural performance, the cause of damage to the building, and how to prevent the damage during the earthquake.

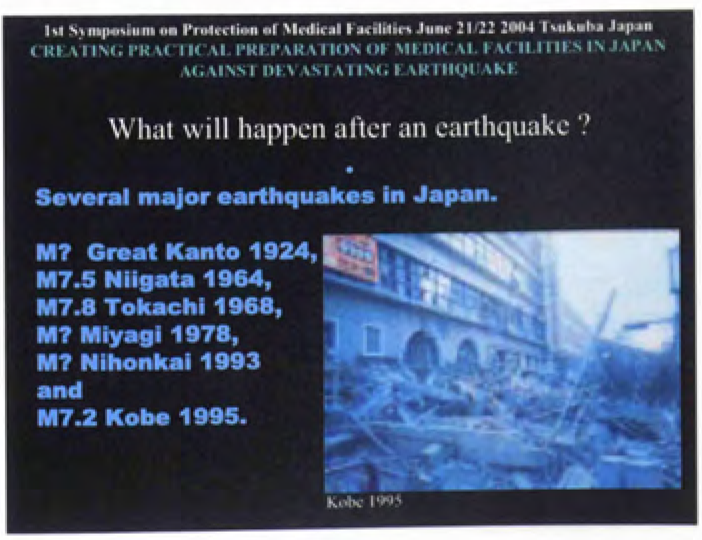

1st Symposium on Protection of Medical Facilities
June 21/22 2004
Tsukuba Japan
CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE
YASUSHI NAGASAWA
Professor
Department of Architecture, The University of Tokyo


1855年建設
3週間で300床・3ヶ月で500床
・7ヶ月後に1000床・8ヶ月で1500床
イギリスのモデル野戦病院
吸水性土壌
木造プレファブ・50床・片側25床
入口に浴室・医官・看護人 奥に便所
海
泉
中央廊下7．5m
患者運動用


1st Symposium on Protection of Medical Facilities June 21/22 2004 Tsukuba Japan
CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE
It may seem a strange principle to enunciate as the very first requirement in a Hospital that it should do the sick no harm.
病院建築の第一の条件は患者に害を与えないことである。
Florence Nightingale Notes on Nursing 1853


CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE
Earthquakes in Iran in 1990


1st Symposium on Protection of Medical Facilities June 21/22 2004 Tsukuba Japan
CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE
What will happen after an earthquake ?
Kobe 1995
Proposals for improved services have been already made following several major earthquakes in Japan.


1st Symposium on Protection of Medical Facilities June 21/22 2004 Tsukuba Japan
CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE
What will happen after an earthquake ?
Several major earthquakes in Japan.
M? Great Kanto 1924,
M7.5 Niigata 1964,
M7.8 Tokachi 1968,
M? Miyagi 1978,
M? Nihonkai 1993
and
M7.2 Kobe 1995.
Kobe 1995

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN
AGAINST DEVASTATING EARTHQUAKE

CURRENT ROLES OF HOSPITALS IN EARTHQUAKE AFFECTED AREAS

TASK No.1

PROVISION OF MEDICAL SERVICES FOR INJURED PEOPLE IN A COMMUNITY

地域的対策傷病者の保護(?)

TASK No.2

CONTINUOUS CARE FOR PATIENTS IN A HOSPITAL AND PROTECTION OF STAFF

院内対策患者職員の生命保護 診療の継続(?)

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN
AGAINST DEVASTATING EARTHQUAKE

TASK No.1

NUMBER OF INJURED PEOPLE

Slightly injured
1~10% OF SUFFERED INHABITANTS
負傷者数 被災者の 1－10%

Severely injured
0. 3~1% OF SUFFERED INHABITANTS
重傷者数 被災者の 0. 3－1%

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN
AGAINST DEVASTATING EARTHQUAKE

TASK No.1

IF SUFFERED POPULATION WERE ONE MILLION, HOSPITALS IN THE AREA SHOULD ACCEPT 10,000 SEVERELY INJURED PEOPLE.

IS IT PRACTICAL ENOUGH ?

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN
AGAINST DEVASTATING EARTHQUAKE

TASK No.2

DIFFERENCE IN PROTECTING OBJECTIVES IN PHASES

1st Phase - Half a day after the incidence
- Protection of patients and staff
- Accepting injured people from outside community

第一時期(発生後半日)発生期・避難期・大火期
患者・職員生命身体保護 地域からの傷病者受け入れ・応急処置

2nd Phase - After a half day
- Daily life in a suffered area

第二時期 (発生後半日以降)避難生活期・流失残留期
患者・傷病者・職員の生活維持 二次傷病者受け入れ・応急処置 災害医療拠点機能

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN
AGAINST DEVASTATING EARTHQUAKE

TASK No.2

IN KOBE THE RESPONSE TIME WAS UNACCEPTABLY LONG AND BASIC SERVICES WERE UNAVAILABLE. WATER, ELECTRICITY AND EMERGENCY TRANSPORTATION WERE OFTEN LACKING.

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE

TASK No.2

MAINTAINING HOSPITAL FUNCTION

病院の機能維持

PREVENTION OF 2ND DISASTERS

二次災害防止

STRUCTURE : ANTI-SEISMIC AND BASE ISOLATION

構造：耐震・免震

ENGINEERING: WATER AND ELECTRIC POWER

設備：水と電気確保

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TASK No.2

What will happen after an earthquake ?

Non structural damages make a hospital function paralyzed.

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE

TASK No.2

WHAT IS IT INSIDE A HOSPITAL?

MOVING ABILITY OF PATIENTS

4300 cases

IN AN EMERGENCY SITUATION - BASIC ABILITY

非常時移動能力 -患者個人の基礎的な能力
水平避難能力(5段階) ひとりで・移動用具・介助者・移動用具と介助者・できない

IN AN ORDINARY SITUATION - MEDICAL, NURSING AND ADMINISTRATIVE ABILITY

日常時生活自由度 -治療・療養・管理上の能力
水平行動範囲(4段階)寝たまま・ベッド上・病室内・自由

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE

TASK No.2

WHAT IS IT INSIDE A HOSPITAL?

MOVING ABILITY IN AN EMERGENCY SITUATION

非常時移動能力

GREAT DIFFERENCES IN EACH NURSING UNIT

病棟ごとに違いが大きい

50% OF PATIENTS ON AVERAGE CAN MOVE

10~5% OF PATIENTS CAN NOT MOVE

平均すると半分は逃げられるが 5−10%は逃げられない

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CREATING PRACTICAL PREPARATION OF MEDICAL FACILITIES IN JAPAN AGAINST DEVASTATING EARTHQUAKE

TASK No.2

WHAT IS IT INSIDE A HOSPITAL?

COMPLICATED CORRIDOR SYSTEM

COPING WITH VARIOUS MOVEMENT OF PATIENTS, STAFF AND VISITORS.

HIGH-TECH TRANSPORTATION SYSTEM

COPING WITH COMPLICATED LOGISTICS OF MEDICAL, NURSING AND OTHER MATERIALS AND EQUIPMENT.

EXTENSIVE USE OF COMPUTER NETWORKING SYSTEM

COPING WITH VARIOUS KIND OF DATA/INFORMATION.

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TASK No.2

HARDWARE AND SOFTWARE COUNTERMEASURES

NONSTRUCTURAL PROTECTION

ハード 仕上げ機器落下防止
・配管破損防止・機器家具転倒防止

FAIL SAFE AND FOOL PROOF

ソフト フェイルセーフ：既存システムと
臨時システム 準備と維持管理 (花見！)
広報：危機意識
二重・三重の対策停電に備えての

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KOBE EARTHQUAKE

5:46am January 17, 1995,
N34'36" E135'3", 14km depth, M 7.2, 30km with seismic intensity 7
5500 dead (4830 crushed, 550 burnt), 415,00 injured
100,000 total collapse, 107,000 partial collapse wooden buildings
<National Land Agency, White Paper on Disaster Prevention 1995>

DAMEGED

including slightly damaged
3,883 Schools,
467 Cultural Facilities,
173 Cultural Assets,
191 Hospitals out of 222
2,479 Clinics out of 4,578
<Nagasawa Y., Earthquake Damage to Hospitals and Clinics in Kobe , Japan, IPHS>

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A MODEL USING EXISTING & TEMPORARY BAÇKUP-HOSPITALS In Densely populated urban areas and fragile infrastructure

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A MODEL USING EXISTING & TEMPORARY BACKUP-HOSPITALS
In Densely populated urban areas and fragile infrastructure

This model assumes that no hospital is immune to damage from a high-magnitude earthquake. Accordingly, the focus is on architectural and transportation software during the first 72 hours following the quake, special emphasis is given to decisions and tasks during the first 12 hours.

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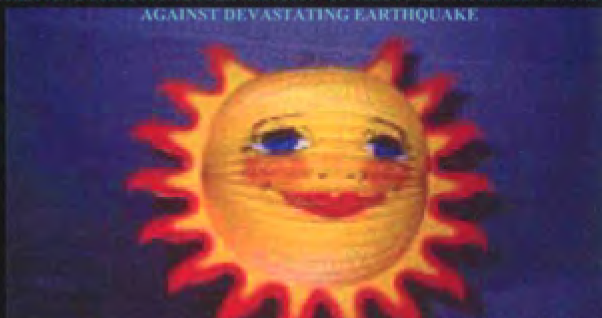
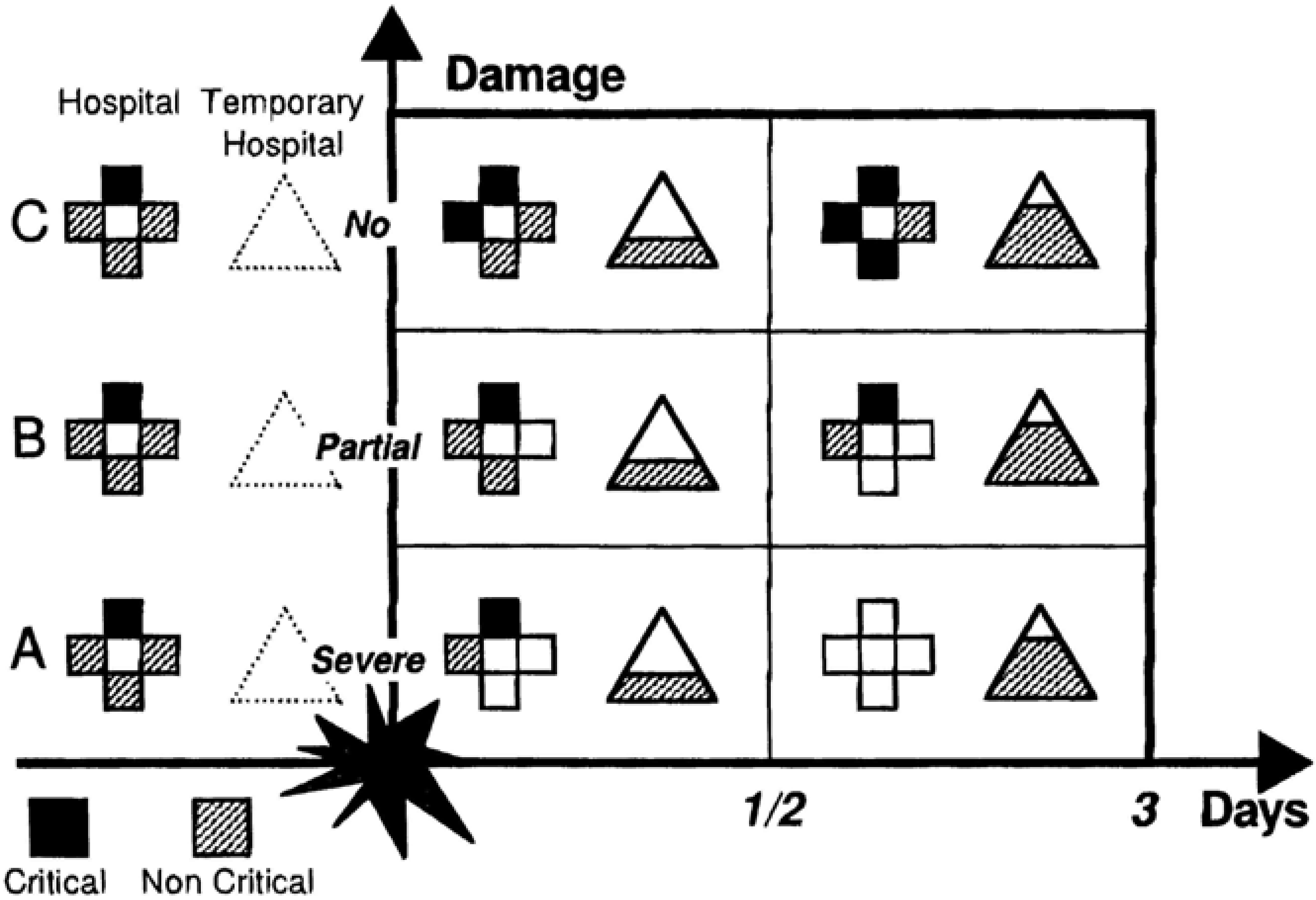
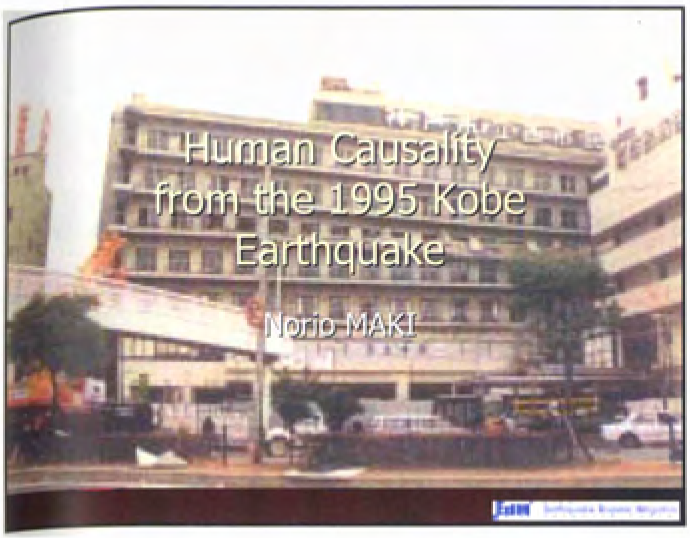
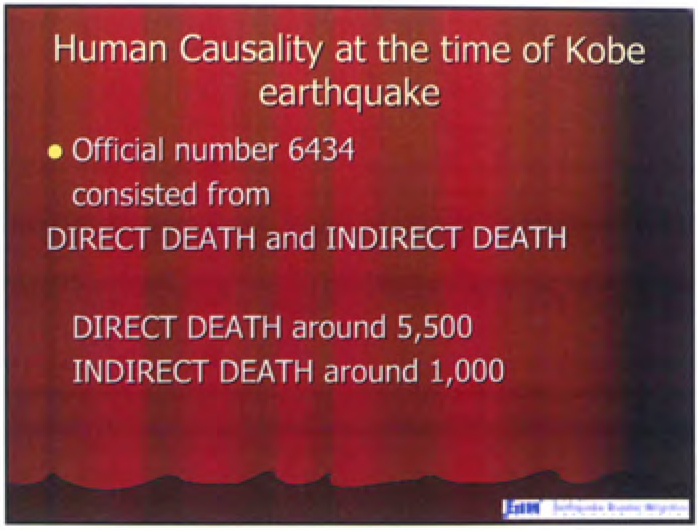


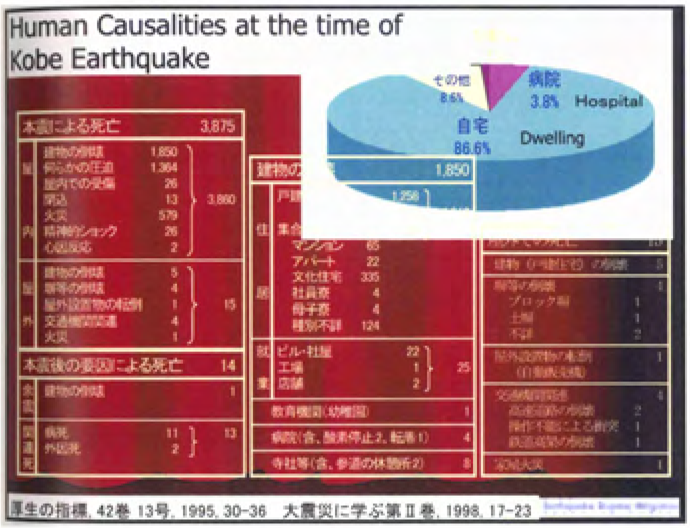
I will show the model with a handout.
Thank you for your attention
ありがとうございました。



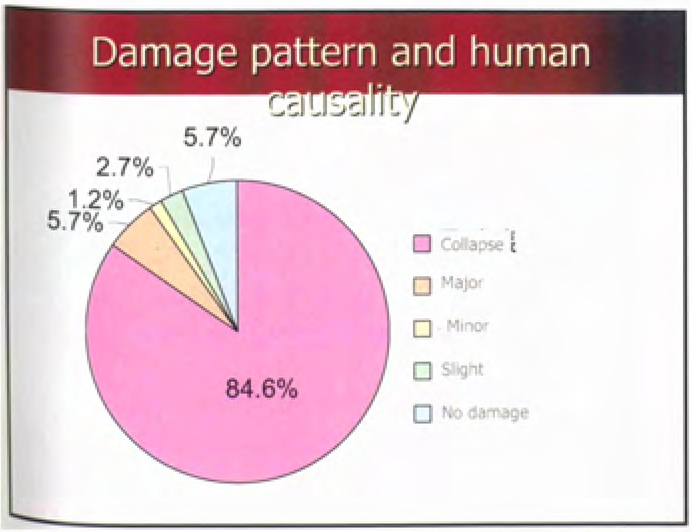
Earthquake Hospital Model

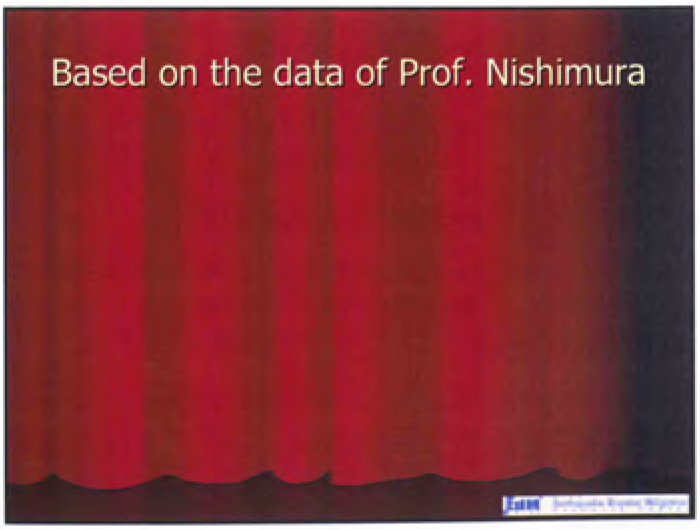

Human Causality
from the 1995 Kobe
Earthquake
Norio MAKI


Human Causality at the time of Kobe earthquake
Official number 6434
consisted from
DIRECT DEATH and INDIRECT DEATH
DIRECT DEATH around 5,500
INDIRECT DEATH around 1,000


Human Causalities at the time of
Kobe Earthquake
その他
8.6%
病院
3.8%
Hospital
自宅
86.6%
Dwelling
本震による死亡 3,875
3,860
マンション 65
アパート 22
文化住宅 335
社員寮 4
母子寮 4
種別不詳 124
ビル・社屋 22
工場 1
店舗 2
25
本震後の要因による死亡 14
厚生の指標, 42巻 13号, 1995, 30-36 大震災に学ぶ第Ⅱ巻, 1998, 17-23


層破壊建物

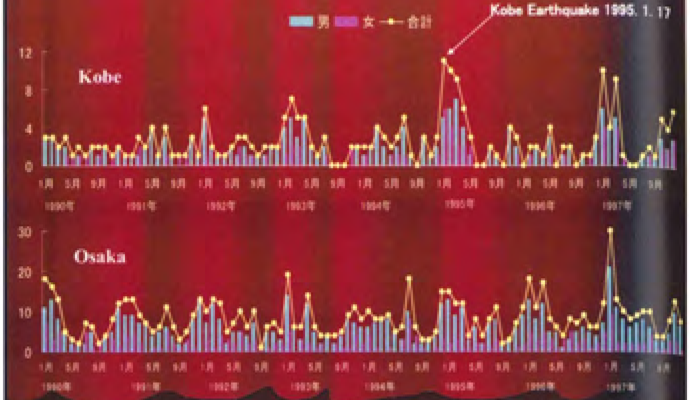

Damage pattern and human causality
5.7%
2.7%
1.2%
5.7%
84.6%
Collapse
Major
Minor
Slight
No damage


Based on the data of Prof. Nishimura

Death Number inspected by a corner —blood circulation relating diseases—

日本生理人類学会誌, 4巻 1号 1999, 3-6

Death Number inspected by a corner — Pneumonia —



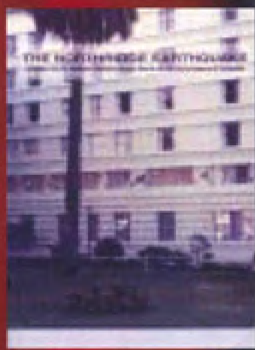
日本生理人類学会誌, 4巻 1号 1999, 3-6

1971 San Fernando Earthquake

Damage at the Olive View Community Hospital (Source: http://www.scecdc.scec.org/sanfer.html)

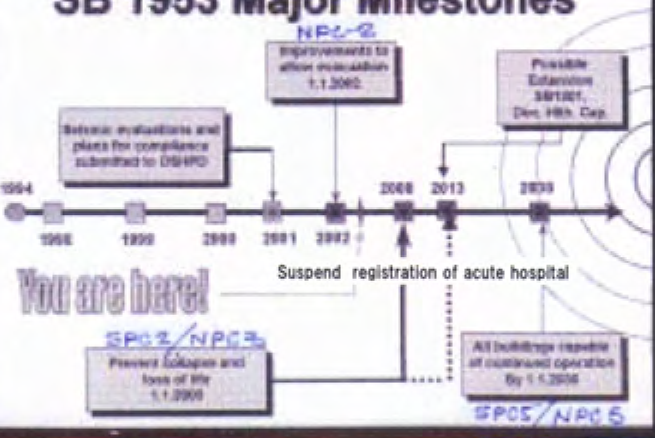
1972 Hospital Seismic Safety Act of 1972
(SB 519, Chapter 1130)（病院のための耐震基準の制定）
1982 Hospital Inspection (SB 961)（設備の固定の図面審査・検査）
1993 Hospital Seismic Safety Act of 1983（州機関による図面審査・検査）
1990 Anchorage of medical equipment at hospital (SB 2453)
（既存施設についても設備の固定）

Damage Degre	棟数(%) 耐震法以前	耐震法以降
	Before 1972	After 1973
Strctural Damage		
Red Tag	12(24%)	0(0%)
Yellow Tag	17(33%)	1(3%)
Green Tag	22(43%)	30(97%)
Non Structural Damage		
Mojor	31(81%)	7(23%)
Minor	20(39%)	24(77%)
Total	51	31



ノースリッジ地震による病院の被害
(出典 OSHPAD, The Northridge Earthquake: A Report to the Hospital Building safety Board on the Performance of Hospitals)

SB 1953 Major Milestones



(出典: Chris Tokas, SB1953 - Moving Toward Compliance)

- How we can reduce the number of BOTH direct death and INDIRECT death.
- How we can implement lessons from the 1995 Kobe Earthquake into disaster management of hospitals, structural and non-structural element design.
  - Policies
    - Compliance and Enforcement
    - Incentives

Disaster Reduction Activities as a Pharmacist

Satoko Katsuragi
Kobe City Pharmaceutical Organization

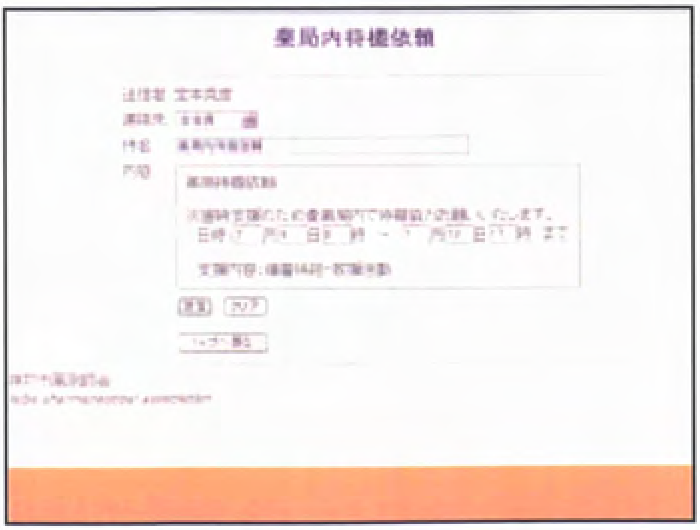
◆震災から始まった防災対策

被災した中で行った支援活動を通じて分かった事

- ・個人で出来る事には、限界がある
- ・如何に組織で動くか
- ・如何に組織を動かすか
- ・如何に連係プレーを構築するか

◆災害時の救援活動と平時の災害対策

§ 1.　災害発生時　薬剤師会に出来ること



＜連絡媒体及び情報伝達媒体＞…詳しくは災害システムマニュアル参照

①独自構築メーリングリスト（PHS、無線、携帯及びPC使用）
a. 全会員用メーリングリスト
b. 災害対策本部担当者用メーリングリスト（Kユニット長及び地区長）
c. 各担当ブロック用メーリングリスト（地区長及びグループ長）
d. 派遣チーム用メーリングリスト
e. その他用メーリングリスト
②メール送受信が不可能な場合、電話・:FAXを使用
③①②が不可能な場合、担当地区内の連絡網を利用
④災害連絡用ホームページにて必須事項を表示
⑤～⑨
有線が切れた場合は、必要に応じて、他機関に協力要請し、
通信手段を確保
サーバーも市内と他府県の二カ所に設置

本部システム・サブシステム

2）医薬品の供給について

…活動可能な薬局に対して

現在の備蓄制度の問題

1. 保管場所の問題
2. 有効期限切れによる廃棄処分の問題
3. 備蓄内容の硬直（見直しがされにくい）
4. 備蓄センターが被災する事を想定していない
5. 備蓄拠点数の増加が困難
6. 災害発生時における備蓄配送の距離的な問題

3）専門家としての活動

・地域避難所や学校での活動
・地域公衆衛生管理としての活動
・薬剤師不在の医療機関への派遣
・救援物資集積センターでの活動
・災害派遣チームの発動

＜災害派遣チーム＞

派遣員は、神戸市薬剤師会の100％のバックアップを受け、
薬剤師としての責任と人としての倫理に則り、
災害救援活動をより理想の形で実現できるよう、
職能やあらゆる技能の研鑽を積み、
その技術を十分に発揮できるよう、
日々研修努力を惜しまないものとする。
この内容を十分に理解し参加を希望するものを募り、登録をする。

Ⅱ. 他所における災害に関して

1）当該薬剤師会や関係機関との連携をはかる
災害規模の把握と相手のニーズを確認する

2）物資の供給及び人の派遣を行う
必要なものを必要な所へ

Ⅲ. 薬剤師として出来る事

・薬のトリアージ

・公衆衛生

・その他

§2. 平時の災害対策

Protection of Medical Facilities

Why EDM/NIED, why now?

Earthquake Disaster Mitigation Frontier Research Center
National Research Institute for Earthquake and Disaster Prevention

Safety of nation is public goods; market mechanism fails in allocating sufficient investment to safety of people, handicapped people above all. Allocation of public investment is judged through political mechanism and response to new dangers always comes behind the time.
EDM/NIED need proactively raise questions, find risks critical to the safety of people, analyze them and offer solutions.

Enhancement of economic power shifts the social consensus toward higher spending for safety. Similarly, visible threats encourage it. (exa. September 11 for the US, Kobe or North Korea for Japan)
We are currently in such a season; safety of people is being one of the distinguished subjects of science and technology policy of Japanese Government. Local governments are prioritizing it, too.

Entrance to the problem

A complex emergency like large earthquakes requires comprehensive treatment. Safety problems cannot allow blind spots.
(exa. NSC's overlooking approach and NRC's pervasive oversight)

Past experiences in Japan of disaster medicine have so far revealed inadequacy of integration and coordination.
(Poor management/logistics of Japanese society through its history has long been pointed out. This comes back to socio-cultural issues.)

The front line of medicine is facing intense risks in daily work. Specifically, advanced medicine, using sophisticated equipments and demanding close team cooperation, poses intensive and dense tension.
Japanese society tends to blame the persons that triggered the accidents; risk of individual medical staffs is extremely high.
It is therefore desirable to take the initiative from engineering (in a wide sense following the institutional code of EDM/NIED) and, based on the risk management technique, identify and analyze critical needs/risks, and devise solutions.

Protection of Medical Facilities / Higashihara

Impact of E-defense

Implication of E-defense

What happens if a medical operation site is hit ?
This can be simulated in full detail.
Performance of smart shock moderators can be examined in full size.

Protection of Medical Facilities / Higashihara

Risk Adaptive GIS of *NIED*

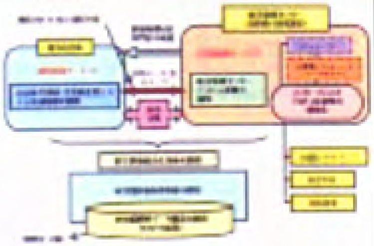
時空間地域管理によるリスク対応技術に基づく防災情報システムの特徴

○自治体の平常業務において使われる情報システムとシームレスに連動し、災害に関わる多数の現象や活動のモデルを総合的に取り込んで、平常時のみならず緊急時においても、高信頼・高性能、わかりやすいインターフェイスで稼動する。

○災害時、必ず機能する防災システムを実現するため、被災地外からの情報支援と情報収集のための専門家の派遣を行い、自治体の災害活動を支援する。

○災害現場と連携する先端的な情報技術を活用する。

Pinpoint tracing of time history of individual persons or real estates enables outreach to households including aged persons or children from local governments



Protection of Medical Facilities / Higashihara

Deployment of *NIED*-GIS

Protection of Medical Facilities / Higashihara

Impact of control technology

CCV= control configurated vehicle
Intentional elimination of intrinsic stability →high maneuverability

Conventionally, structural and aerodynamic design of bodies first; next, operation and control system, and fire system

Instrumental sophistication forces the change of design philosophy.

6DOF direct control

Mathematics of counter-disaster behaviors

Any human adaptive behavior is an optimal control.

Distinguish two optimizations: post-disaster (or emergency) and post-disaster (or long-term).
If we call the policy parameters indicating the long-term as infrastructure, emergency management is an optimal control subject to the given infrastructure.
Let λ =infrastructure and ι =emergency operation, and damage=D(λ, ι)
If the post-disaster action is optimized,
damage(λ)=$\min_{\iota}$ D(λ, ι)
Long-term planning optimizes in terms of λ:
damage=$\min_{\lambda} \min_{\iota}$ D(λ, ι)

Can we cope with risks?

A series of scandals of Japanese corporations: nuclear power, meat, pharmacy, bank

The Science and Technology Agency is proving itself incapable of adequately regulating the safety of nuclear power....However, there is little public pressure in a society where respect for authority, despite its failings, remains high.
(*nature* Oct.1999 just after the criticality accident)

2002 EqTAP/Bangkok

Military incapability

2003 NSC/HLW

Short Life of Japanese Carrier Force

Pearl Harbor→Indian Ocean→Coral Sea →Midway
1941.12 1942.6

While having invincible strike forces, always received pre-emptive surprise attack;

could not amend the weak points: cipher broken and neglected reconnaissance

failed in settling second stage operations: orientation of air force, guard of sea lane

One revolution ongoing

Enactment of
the law of freedom of information based on the accountability of national government affords
a revolution rather than an evolution
to Japanese administration since Meiji era.
(Prof. Shiono, 1998)

2000 Japan Soc. Atomic Energy

Decentralization to local administration are going on.

DISCUSSION REPORT OF EXPERTS WORKSHOP
June 21, 2004

Jeannette Fernandez

This one day preparatory meeting was held at NIED with the participation of 15 delegates belonging to different Japanese organizations associated to the National and local Health Care System and research activities in fields of engineering, architecture and disaster mitigation, among others. In addition, two delegates from the University of Southern California in the USA, with recognized experience on mechanical engineering and health care management and regulatory issues. A complete list of the participants to this first preparatory meeting is attached.

Dr. Hiromichi Higashihara, Director of EdM, starts the session by welcoming all the participants and requesting for an informal but very informative meeting as to find out best ways to start a sustained program on medical facilities protection, understanding the current situation in Japan and learning how the north American Health System is organized and what kind of actions are being developed to protect them.

Professor Sami Masri from USC and Dr. Heki Shibata from NIED are asked to conduct the session, which starts with short presentations of both professionals. While Dr. Shibata refers to the systematic observation of damage in lifeline facilities of the hospitals like water, gas and electric installations that put at risk not only other components or equipment, but also the life of patients who are under surgery interventions, for example, or the shut down of other important services of the hospital which are supposed to be operative to adequately respond to the emergency. So the question we should be answering and agreeing upon is: What is the required function of a hospital during and after a severe earthquake? Providing surgery rooms with base isolation systems could be one alternative to protect life of patients, further research is required and the new installations at the E-Defense complex could be used with this regard.

Dr. Masri introduced one of the major research programs that USC has undertaken with the support of FEMA, a million USD dollars during the last 7 years have been already invested. What is unique from this project is its multidisciplinary and multisectoral approach, it includes researchers from different fields of expertise like engineers, architects, government and regulatory officials. The main purpose of this program is to develop a framework or methodology that can be used to enable individual hospitals' response, seen as an individual systems, while moving upwards looking into its relationship with other hospitals on what could be a system of hospitals and then liking this with other complementary systems like transportation, for example.

USC operates the Los Angeles County-USC Hospital that represents all the generic areas that a usual hospital includes. It has been used to better understand the needs and real function of such an infrastructure, using it as a prototype and doing inventory of every single equipment and critical non-structural components. This has been complemented through direct and systematic observation of hospital behavior in every recent earthquake.

Since most critical systems relate to piping systems, water, medical gases, suction, steam, which are by far the most vulnerable, and through additional consultation with world leaders in this field, additional testing and observation of the response of these so called non structural elements and equipment in actual earthquakes has been suggested.

New challenge relates to the construction and testing of a real scale hospital ceiling that can reproduce the medical equipment and pipes usually provided in this kind of structures, based on actual designs from local professionals. Future USA-Japan cooperation program could include a similar initiative using Japanese standards and E-Defense big shaking facility.

This presentation was complemented by Dr. Robert Myrtle, who referred to the complex management and governance issues of the emergency management in the USA. He referred to the institutional arrangement where FEMA is the responsible at the federal level, while the Office of the Emergency Services (OES) is the state authority for emergency, recovery and mitigation, finally, at the local level, each county has its own office for emergency management.

The management and governance process turns complicated if we see it from the megacity perspective, for example, Los Angeles County is integrated by some 88 small cities having populations of around 1 million, that have to work in an integrated manner. So, in addition of looking at the hospital as a system it self, we will have to deal with a system of hospitals and then a whole system of cities, turning it in a very complex process.

Despite available plans to retrofit and strengthen the whole system in the State of Los Angeles, it has been very difficult to accomplish since estimated budged is big and tends to increase on the light of additional needs observed. Nevertheless, improving the functionality of hospitals following seismic events is a challenge that has to be undertaken by deciding where is better to allocate scarce resource to get the best cost-benefit.

Japanese experts coming from the medical field showed the vast experience they have obtained in the last years being exposed to severe natural and manmade hazards like the Matsumoto terrorist attack of 1995 in the Subway of Tokyo, or the 1997 Awaji Earthquake that severely affected the city of Kobe.

Dr. Hiroshi Okudera and his colleague Masahiro Wakasugi from Toyama Medical and Pharmaceutical University, made emphasis on the need of considering the possibility of chemical contamination of the hospitals after a severe earthquake. They suggested that special thought should be given to provide mechanisms to reduce this possibility.
(http://www.toyama-mpu.ac.jp/hp/ope/topics/96bousai/01bousai.html)

The developments of procedures for rapid assessment of the scale of a disaster regarding hospital response capacity as well as complementary procedures for a quick evaluation of the hospital damage were highlighted. A code that the hospital director could follow to make informed decisions about keeping the hospital opened or deciding otherwise to shut it down are very useful in case of an emergency and the organization of the emergency response through the health care system.

The Hanshin Awaji Earthquake that caused 6425 deaths, 43 772 injured and approximately 5000 houses damaged, was by far the most demanding incident that the Japanese organizations working on the fields of disaster management, response and recovery had to face in the recent years, both at the national an local levels. Lessons learned from these experiences were vividly introduced by Dr. Henmi Hiroshi from the National Disaster Medical Center and Dr. Shinichi Nagasawa, from the Hygo Emergency Medical Center.

At that time, the high vulnerability in the medical facilities was evident, most of them suffered minor damages, but 11% of the hospitals and the 20% of the clinics suffered severe damage. Cause of progressive loss of activity in the hospitals relates to the lack of water, almost 74% of the health care structures had this problem. Endless medical needs were shown in the first 3 days, while the food provision problem was solved after some 24 hours. Fail to preparedness for disaster was evident during this event.

In full agreement to what their colleagues for USC have mentioned, piping failures were very common, water, electricity and gas, were most severely damaged, but other problems seen from the system perspective were transportation, communication and medical manpower availability.

In other related actions, the can recommend additional training on triage process at the hospital as well as clear protocols for air transportation of patients inside the prefecture, to neighboring prefectures or other places of the country, needs to be brushed up. So, procedures to organize a real corporation or system of hospitals that can perform appropriately in case of huge emergencies would be interesting to look at.

As an example the case of the Kobe University Hospital was used, water was out in 12 hours, chronic renal failure patients who required hemo-dialysis treatment were not able to get it due to lack of water. City gas took more than 20 days to be reestablished because it was very dangerous due to existing fires. Transportation was a severe problem, electricity was shut down but reestablished shortly. Telephones were available 2-3 hours later, but cellular phones worked relatively well despite huge congestion of phone calls.

Additional statistics can be very useful when planning emergency response procedures at hospitals, this can help to properly plan human and other resources allocation. As an example, trauma patients demand tend to decrease day by day, the first 3 days are critical for this specific patients, meanwhile, other sickness will tend to increase with time.

Huge communication gap happens in a disaster, interruption and confusion of information; delays emergency response, which leads to misallocation of resources, for example in some places, one doctor had to attend some 1000 patients whereas on others, they saw only 60. So an interesting proposal for integrated delivery of a network of 500 hospitals is at present being discussed, in addition some hospitals are linked to an information system to communicate in daily basis and major disaster mode to integrate the information in the city and in the region.

Training and capacity building in disaster management is still required, but still a lot has to be done to reduce the vulnerability of both the structure but also of sophisticated equipment that has been installed inside these buildings. At present, in Japan, some hospitals have base isolation systems, or at least some important sections of the hospital, for example the surgery room have now a days base isolation protections. Also, flexible piping connections have been provided in some hospitals, but there are still so many such facilities that need to be upgraded or retrofitted.

From the architectural perspective, Professor David Allison from Clemson University and Professor Yasushi Nagasawa from Tokyo University presented some interesting alternatives for health response during exceptional conditions like those produced a cause of natural or manmade hazards. Depending on the type of emergency we are responding to, different arrangements can be set.

Dr. David Allison suggested that the hospital is not the only place where health car services can delivered, the concept of delivering the care service to the site of the event has been a concept extensively used by the military. Making use of multiple modes of transportation available, non permanent settings can be easily and quickly set up to allow quick delivery of even sophisticated medical treatments. Similar concept is also used for the installation of sophisticated rock concert facilities with remarkably reduced time of installation.

With this purpose, available places that can be used in case of emergency should be identified and inform to the community. Schools, parks, stadiums are some of the places that can be easily adapted in case it is required, but it would be interested to have then identified in advance.

Ms. Hotta and Katsuragi argued about problems and suggested the system from their experiences and pharmacist point of view. Ms Hotta introduced about the current water supply system using well at Sumiyoshi Hospital now, learning from the experience that Self Defense Army carried water at the earthquake. She also discussed about the usage of water transportation. At the Kobe earthquake, Rokko Hospital and Konan Hospital used ships to transport patients. Ms Katsuragi introduced the network system to contact pharmacists for emergency.

Researchers from EdM were also asked to make short presentations related to their main interest in the subjects that have been discussed along this first day. So Norio Maki, Hiroshi Arai, Michiko Bamba and Jeannette Fernandez briefly introduce some of their motivations to actively participate on this project, among others, they can be summarize as follows.

For Dr. Maki, an important fact of discussion should be how to reduce number of killed persons by an earthquake, not only those that die due to the direct action of the earthquake like falling roofs, walls or others, but also the so called indirect deaths, for example due to heart attacks or just like in the case of Kobe earthquake were several died due to pneumonia or cardio vascular illness. Dr. Maki considers that there might room for further discussion, around this concept of direct and indirect death.

Dr. Arai showed the capacity of EdM to perform state of the art studies related to engineering development to understand the response and behavior of any kind of structures when subjected to earthquakes, in particular the soil-structure interaction model applied to a hospital structure.

Dr. Bamba suggested the importance of urban planning when deciding where to locate a new health care facility that should be functional after an earthquake for example. She suggested the importance of using available information of microzonation, earthquake scenarios or others to avoid placing these critical structures on already risky places in order not to increase vulnerability.

Ms Jeannette Fernandez referred to the increased complexities posed to growing number of megacities around the world with regards to management and governance issues. Referred to the current research project that team 4 at EdM is currently working with, which aims to produce disaster risk management master plans for megacities around the world with emphasis in the Asian Region. The proposed methodology will look not only on current arrangements for DRM, what is the legal and institutional arrangement, how is the inter institutional coordination done, but also at the sound practices that can be shared with other complex environments and can be adopted or adapted taking into account local and specific conditions. One of the key areas of DRM has to do with the response during emergencies where health care facilities play a key role, with this regard a project like the one that EdM is carrying out related to megacities can significantly benefit if it is linked to this Health Care Facilities Safety Program that EdM would be leaded in the future.

Finally, Dr. Higashihara, Director of EdM was asked to make a final statement. He started by saying that safety of the nation should be seen as a public good. Market mechanisms have failed to allocate enough investment for the safety of people.

According to his perspective, past experience in Japan related to disaster medicine has showed inadequacy of integration and coordination. Poor management and logistics of Japanese society through its history has long been pointed out. This aspect should be linked to socio-cultural issues.

Dr. Allison commented on Dr. Higashihara saying that one innovative solution Dr. Higashihara brought up is important to not only reinforce a capability but also strategies.

Dr. Myrtle commented and asked a question, "Dr. Higashihara mentioned about consensus, building inter-governmental coordination or mobilization. To what extent positions, policy makers, elected officials and research agenda need to engage? Who owns the problems, and should be engaging more broadly our research agenda?"

Towards next time meeting – next February or March on this fiscal year was suggested, some of the most important issues to be raised could be the following:

- How to draw universal information from experiences. Framework needed?
- Flexibility, redundancy needed. Too many regulations, unanticipated incidents
- Consensus matter: motivation and encouragement. Intergovernmental coordination (Japanese police, fire department are very exclusive), investment, compensation from sustainability perspective.
- Mobilization of local community and capacity building of local government and partnership being sought
- Innovative solution, mobile architecture, smart structures, safety of medical operations, effect verifiable or visible?
- Nonstructural components: lifelines; infrastructures in a wide sense

CONCLUSIONS AND RECOMMENDATIONS

- It is most important for the Japanese group of researchers to fully understand the organizational framework of the Health Care System
- A learning approach should be taken to start with relatively basic actions that can be improved on the light of progressive acquired knowledge
- Stake holders should be clearly identified as to gain a support base for the actions that can be implemented in the future
- Hospitals should be seen as a whole system where the interaction of patients, medical staff, their families working in a structure that can be highly vulnerable from the non structural elements perspective, with an increased demand in case of a severe emergency.
- Inter organizational perspective needs to be included as a favorable approach to improve management procedures
- Disaster relief mobile architecture could be an interesting alternative for health emergency delivery by transferring some of the health services to be delivered under a pre established and well planned emergency arrangement, that the community can be well informed in advance.
- In addition, legal and institutional arrangements regarding emergency management have to be fully understood in reference with the health care system.
- EdM would be in charge of the full research program and workshops organization in the future
- February of March 2005 are suggested as possible dates for a follow up meeting, the venue would be EdM at the city of Kobe

(Edited by Michiko Banba)

Symposium

Development of Rapid Assessment Scale for Hospital Disaster

- from the view point of personal experiences

1st Symposium on the Protection of Medical Facilities, Expert Workshop, NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

Hiroshi Okudera, M.D., Ph.D.
Professor and Chairman
Department of Emergency and Disaster Medicine
Toyama Medical and Pharmaceutical University
Toyama, Japan

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my personal experiences in Shinshu University

1944 Matsumoto Nerve Gas Terrorism
treatment and follow-up committee
of victims

in 2 of 6 hospital, emergency rooms were affected by nerve gas due to lack of knowledge on concept of decontamination, and equipment

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

G7＋化学災害危機管理ワークショップ(2002.11.7-8)

G7+ Global Health Security Action Group
Workshop "Plans on preparedness and response to chemical events"
November 7-8, 2002

1994 Matsumoto Sarin Case in Japan

Hiroshi Okudera, M.D., Ph.D.
Associate Professor
Department of Intensive and Critical Care Medicine
Shinshu University School of Medicine

Organized by Tokyo Disaster Medical Center and
Ministry of Health, Labour and Welfare, Japan

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

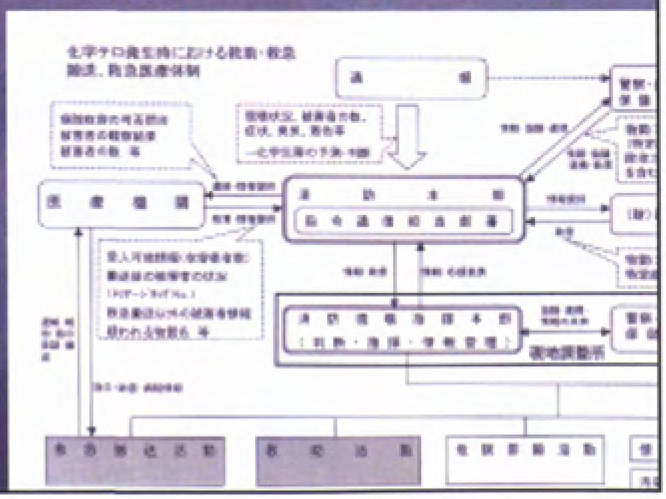
G7+会議において提唱した
急性サリン中毒の重症度の目安

重症度(%ChE)と瞳孔径

	症例数	初診時の瞳孔径mm (平均値)
正 常(%ChE>100)	140	2.2
中等症 (100>%ChE>50)	30	1.3
重 症 (50>%ChE)	17	0.9

%ChE=当該患者のChEの最低値／病院の正常値(中間値)x100

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004



In large earthquake,
contamination of hospital by chemical
medical substances should be considered.

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

my personal experiences in Shinshu University,

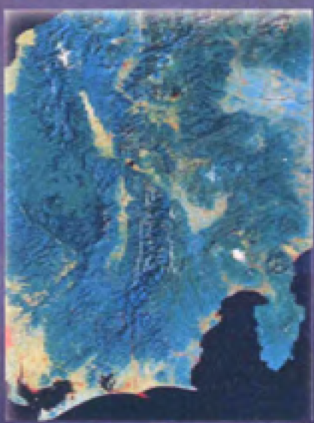
1996-1998 Medical Director of Nagano Winter Olympic Games

in 1996, visiting staff if Atlanta Olympic Games
discussion with FEMA staff

1998 Planning and management of Nagano Olympic Medical System consisting of 12 General Hospitals in Nagano prefecture

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

本州中央部
一地震により容易に地域が
孤立する可能性



Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

At earthquake, hospital, on site, should cover the damaged area.

Rapid evaluation of the hospital damage is the key factor to control the situation.

Due to the level of hospital damage, following procedure may change.

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

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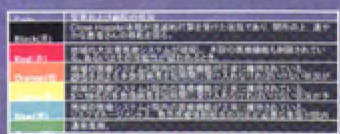
1st Symposium on the Protection of Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

Development of Color Coding System on Hospital Damage



Hiroshi Okudera, M.D., Ph.D. Chairman and Professor
Masahiro Wakasugi, M.D., Ph.D. Assistant Professor
Department of Emergency and Disaster Medicine
Toyama Medical and Pharmaceutical University

Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
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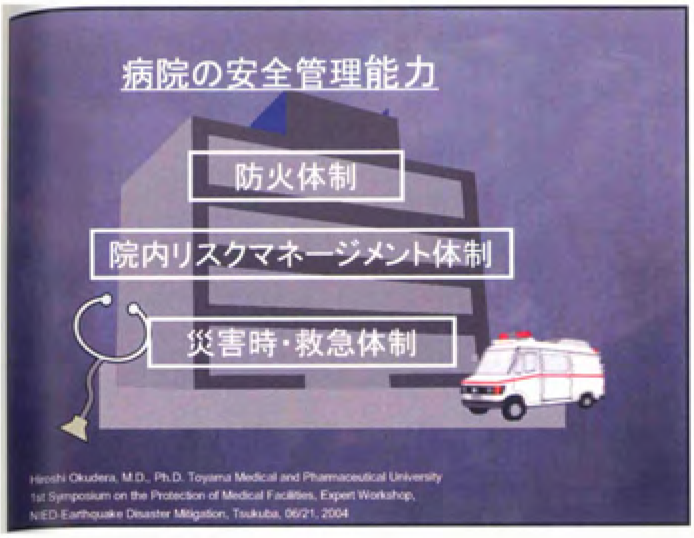
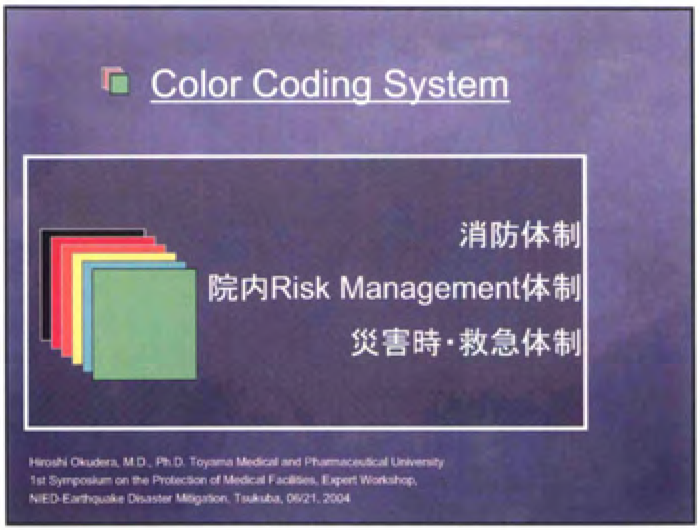
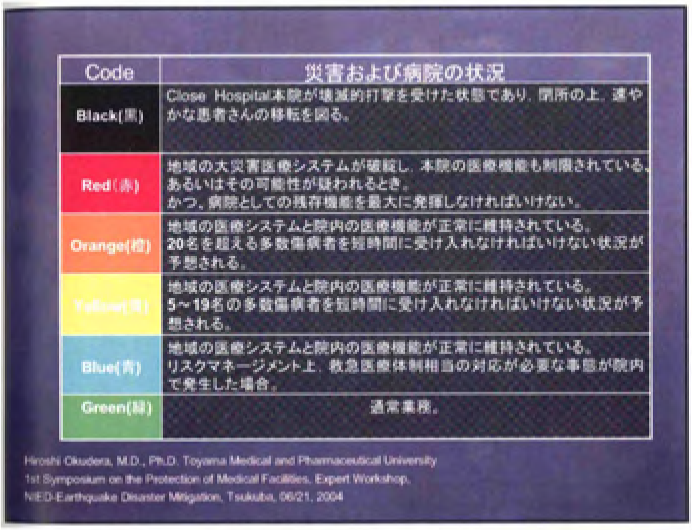
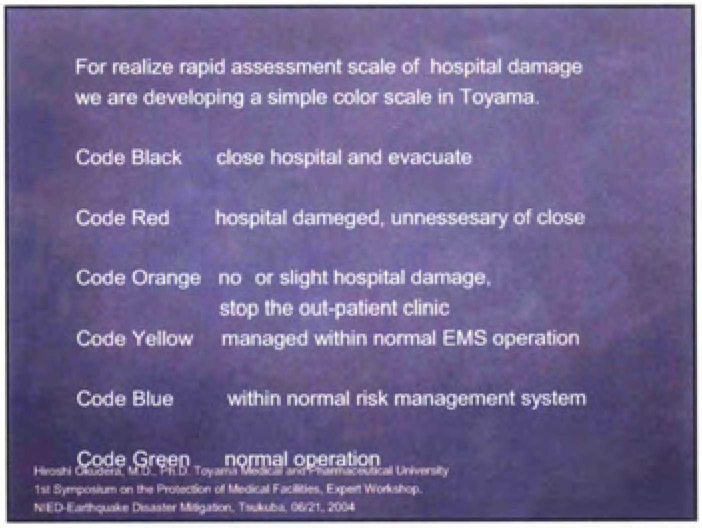
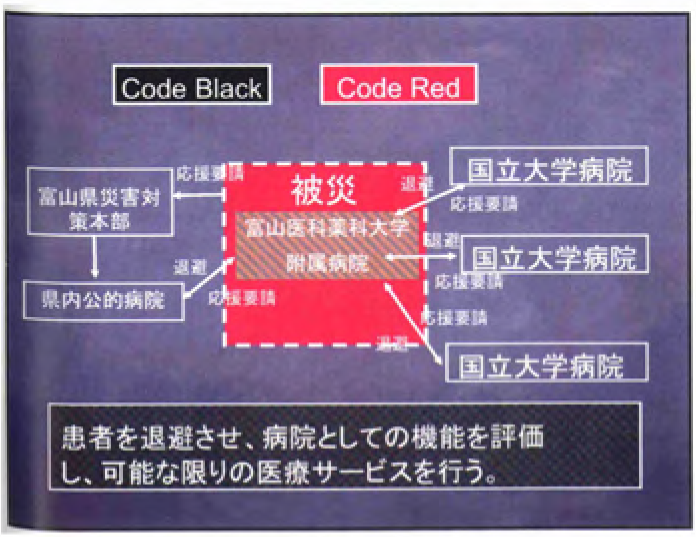


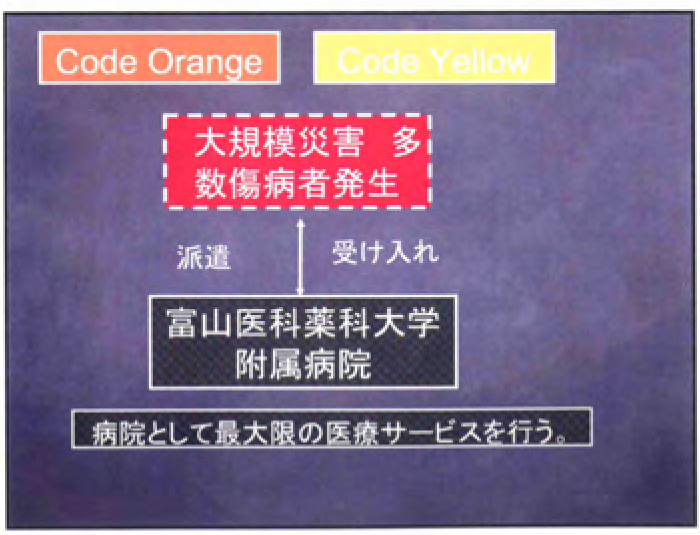




Code	災害および病院の状況
Black(黒)	Close Hospital本院が壊滅的打撃を受けた状態であり，閉所の上，速やかな患者さんの移転を図る。
Red(赤)	地域の大災害医療システムが破綻し，本院の医療機能も制限されている。あるいはその可能性が疑われるとき。かつ，病院としての残存機能を最大に発揮しなければいけない。
Orange(橙)	地域の医療システムと院内の医療機能が正常に維持されている。20名を超える多数傷病者を短時間に受け入れなければいけない状況が予想される。
Yellow(黄)	地域の医療システムと院内の医療機能が正常に維持されている。5～19名の多数傷病者を短時間に受け入れなければいけない状況が予想される。
Blue(青)	地域の医療システムと院内の医療機能が正常に維持されている。リスクマネージメント上，救急医療体制相当の対応が必要な事態が院内で発生した場合。
Green(緑)	通常業務。

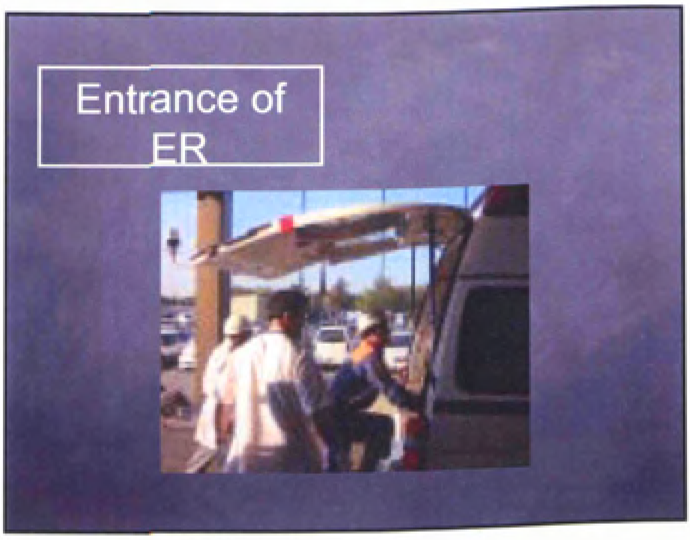


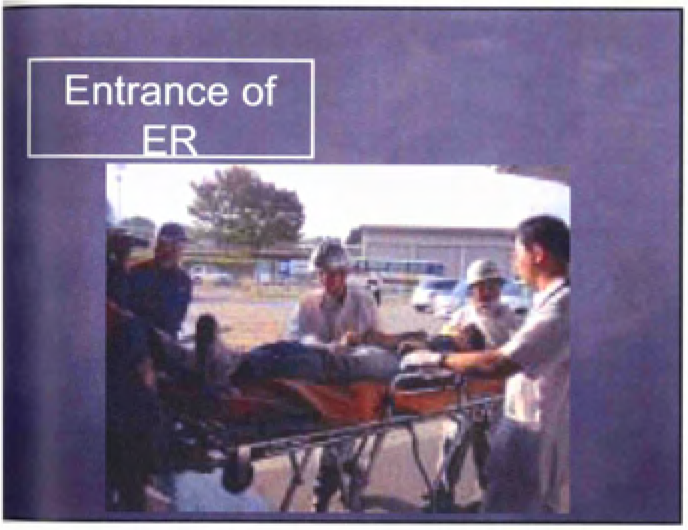


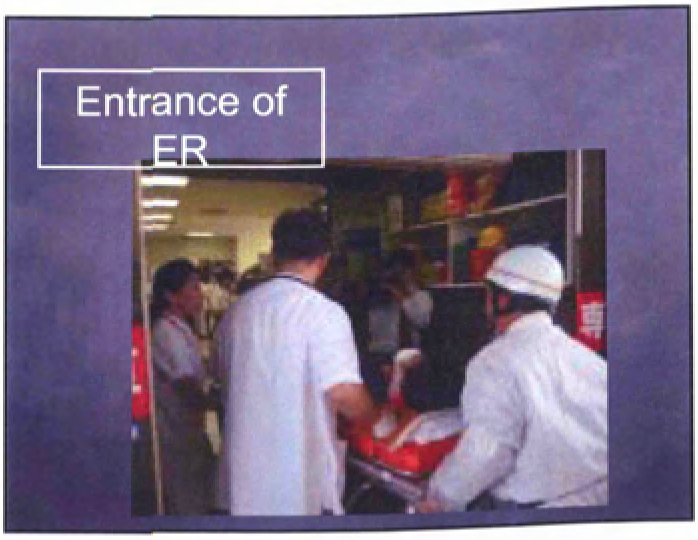


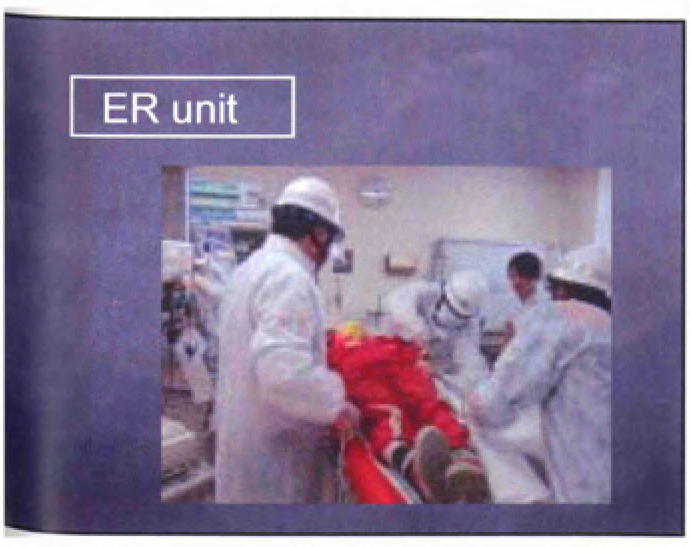
Code Orange

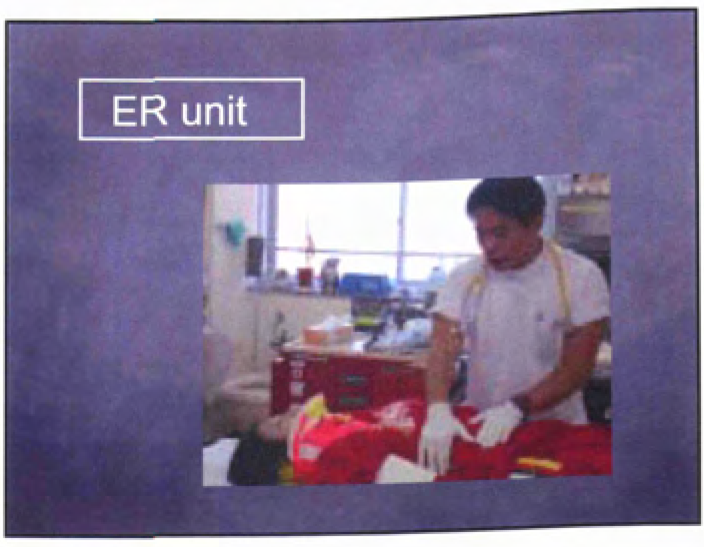
1. 病院長を本部長とする対策本部の設置（救護班、患者受付班、情報連絡班、ボランティア班の設置を含む）
2. トリアージ医2名の設置
3. 全診療科、全中央診療部門、看護部5名の招集
4. 連絡網を使用した全診療科医師、夜勤体制時の人員の確保

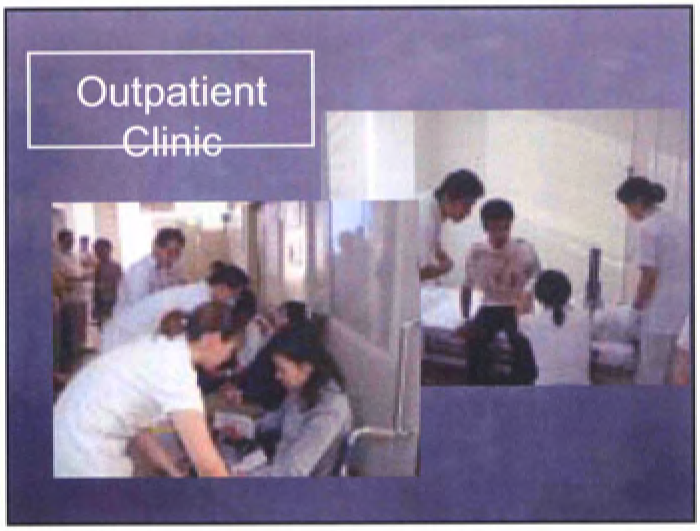

Entrance of ER

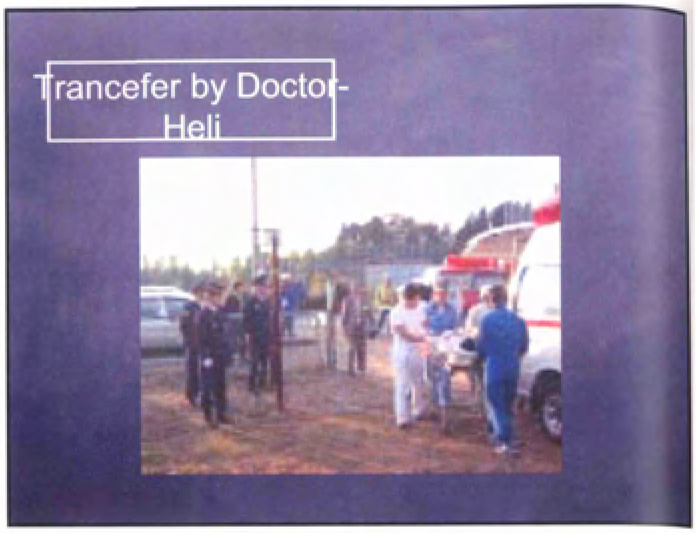

Entrance of ER

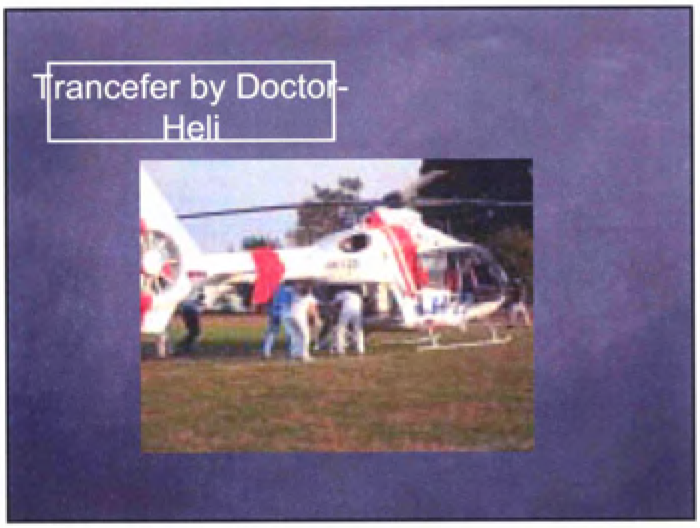

Entrance of ER

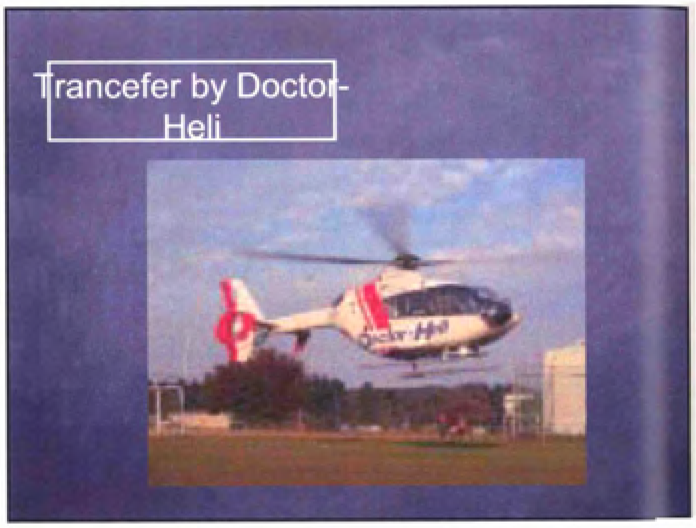

ER unit

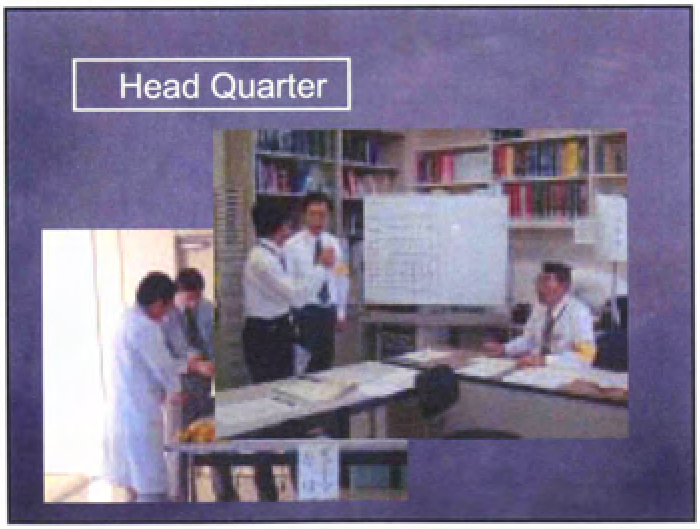

ER unit

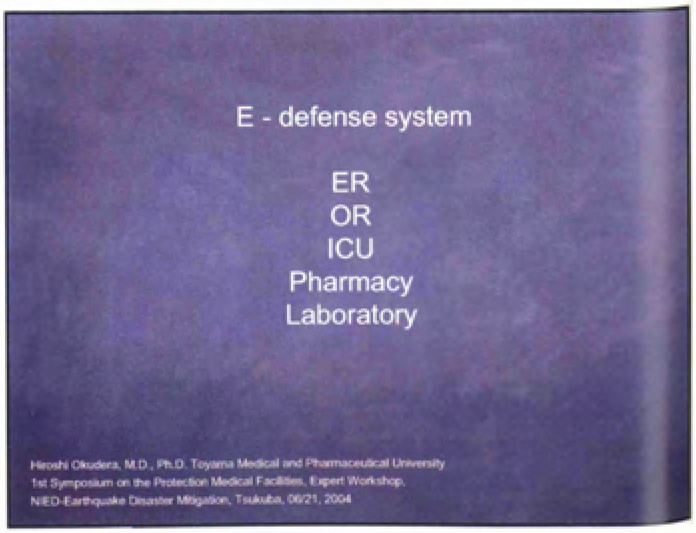

Outpatient Clinic


Trancefer by Doctor-Heli


Trancefer by Doctor-Heli


Trancefer by Doctor-Heli


Head Quarter


E - defense system
ER
OR
ICU
Pharmacy
Laboratory
Hiroshi Okudera, M.D., Ph.D. Toyama Medical and Pharmaceutical University
1st Symposium on the Protection Medical Facilities, Expert Workshop,
NIED-Earthquake Disaster Mitigation, Tsukuba, 06/21, 2004

Policy and Planning Issues in the Regulation of Hospital Performance Under Earthquake Conditions

Professor Robert C. Myrtle
Health Services Administration
School of Policy, Planning and Development
University of Southern California

Policy and Planning Issues in the Regulation of Hospital Performance Under Earthquake Conditions

Overview of the presentation

- Introductory Remarks
- The Emergency Response System in the United States
- California Policies Addressing Seismic Safety Concerns of Hospitals and Other Critical Care Units
- Characteristics of Hospitals and Health Systems in the United States and California
- Experience of California Hospitals During Recent Earthquakes
- The FEMA+USC Project
- Future Steps and Actions

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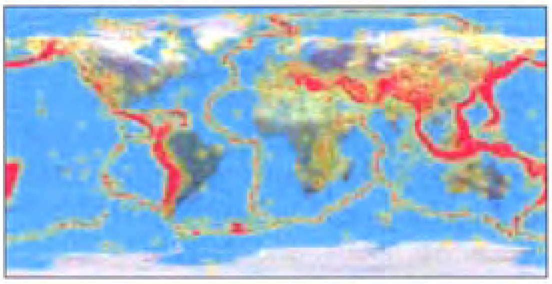
School of Policy, Planning, and Development

Earthquakes: A World-Wide Problem

The red spots indicate earthquakes of 4.5 or greater between 1980 and today.



Source: Seismic Shock Control

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The Costs of a Major Earthquake Can be Staggering

- **Death and injuries**
- **Property damage**
- **Infrastructure loss**
- **Business disruption**
- **Crime & looting**
- **Disease & hunger**

Source: Seismic Shock Control

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School of Policy, Planning, and Development

Although We Cannot Prevent Earthquakes We can Prevent Much of the Damage

Source: Seismic Shock Control

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When Earthquake Happen Hospitals Matter

- Many of the World's population lives in seismically active zones
- Casualties arrive at hospitals with a short period of time after the disaster
- Nearly all of the victims self-transport themselves—most arriving within an hour or so of the incident
- The closest the hospital is to the center of the event, the more patients it will receive
- Regional and national responses take time—up to 72 hours after the event

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When Earthquakes Happen Hospitals Matter

The public expects:

- Hospitals will be capable of remaining functional during and following most earthquakes
- Hospitals will be able to provide services for a reasonable period of time following an earthquake.

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Disaster Management in the United States: An Intergovernmental Responsibility

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School of Policy, Planning, and Development

FEMA THE FEDERAL EMERGENCY MANAGEMENT AGENCY

- Federal Emergency Management Agency (FEMA) was initially created in 1979 as an independent agency of the Executive Branch.
- FEMA is currently part of the Department of Homeland Security

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School of Policy, Planning, and Development
Source: FEMA, 2002

FEMA

- FEMA is tasked with developing an effective civil government response to national security and/or catastrophic events. These events include either man-made ones, such as the release of hazardous materials or wastes, or natural catastrophes, such as earthquakes, hurricanes, floods, and tornadoes.

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Source: FEMA, 2002

FEMA

- The goal of FEMA is to:
  - improve mobilization of government resources
  - assure availability of government resources
  - develop "Presidential Emergency Action Documents"
  - manage a 24-hour National Response Center (actually manned by the Coast Guard)
  - provide both fixed and mobile communications

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Source: FEMA, 2002

FEMA

- **State and Local Programs**
  - Whether the catastrophe is natural, technological (man-made), or attack-related, the role of FEMA is to administer support programs to state and local governments. These programs are designed to improve:
    - emergency planning
    - preparedness (all contingencies)
    - mitigation
    - response
    - recovery capabilities at the state and local level

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Source: FEMA, 2002

FEMA

- **Financial Assistance**
  - FEMA is responsible for the following programs and responsibilities:
  - administering the president's "Disaster Relief Program"
  - assisting in recovering from disaster or catastrophe
  - mitigating or preventing losses after disastrous events or emergencies
  - assuring the maximization of population survival
  - protecting vital resources in the event of national security emergencies
  - providing training through FEMA's Emergency Management Institute located in Emmittsburg, Maryland

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Source: FEMA, 2002

OES History and California Disasters

- *1950*: Master Mutual Aid Agreement signed
- *1956:* The California Disaster Office
- *1970*: Office of Civil Defense becomes the Office of Emergency Services

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Source: Adam Sutkus, OES, 2002

OES' Authority in Emergencies

Under the authority of the Emergency Services Act and other legislation, OES mitigates, plans and prepares for, responds to, and aids in recovery from the effects of emergencies that threaten lives, property, and the environment.

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Source: Adam Sutkus, OES, 2002

Cornerstones of California Response

Standardized Emergency Management System (SEMS)

RIMS

Response Information Management System (RIMS)

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Source: Adam Sutkus, OES, 2002

OES Programs

- Recovery and Mitigation Coordination
- Law Enforcement Coordination
- Fire & Rescue Coordination
- Emergency Management Planning & Tech Assist.
- Preparedness Campaigns
- Communication Resources
- State Agency Coordination/Mission Tasking
- Multi-Discipline Mutual Aid Programs
- Urban Search and Rescue
- Emergency Management Training

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Source: Adam Sutkus, OES, 2002

OES Emergency Organization

- Warning Center
- Regional Emergency Operations Centers (REOCs)
- State Operations Center (SOC)
- Disaster Field Office (DFO)

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Source: Adam Sutkus, OES, 2002

OES Coordination with Medical and Health

- Works closely with the Department of Health Services and the Emergency Management Services Agency on medical/health issues in emergency management
- Cooperative efforts take place in
  - Planning and Preparedness
  - Training
  - Response
  - Recovery

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Source: Adam Sutkus, OES, 2002

OES Coordination with Medical and Health Care Agencies

- Planning for medical/health issues in all hazards involves cooperative efforts
  - Hospital Disaster Interest Group
  - Shelter Medical Specialist Committee
  - Regional Disaster Medical Health Specialist meetings
  - Statewide Medical/Health Disaster Conferences
  - State Medical and Health Disaster Exercise

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Source: Adam Sutkus, OES, 2002

THE LOS ANGELES COUNTY OFFICE OF EMERGENCY MANAGEMENT

Established by County ordinance to:

- Coordinate planning, training, exercises, and response activities for the Operational Area
- Direct development & approval of emergency plans for all County departments
- Promote community awareness & self sufficiency
- Foster, participate in, and conduct emergency training programs
- Interact cooperatively with State and federal agencies
- Manage the Operational Area Emergency Management Information System (EMIS) in the County Emergency Operations Center (EOC)
- With Sheriff, ensure 24-hour operability of the County EOC

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Source: Constance Perett, Los Angeles County Office of Emergency Management, 2003

LOS ANGELES COUNTY DATA

- Size - 4,083 square miles
- Population – 9.8 million
- 88 cities with 8.8 mil pop
- 137 named unincorporated areas – 1 mil pop
- 95,000+ County govt. workforce
- $16.5 billion County budget

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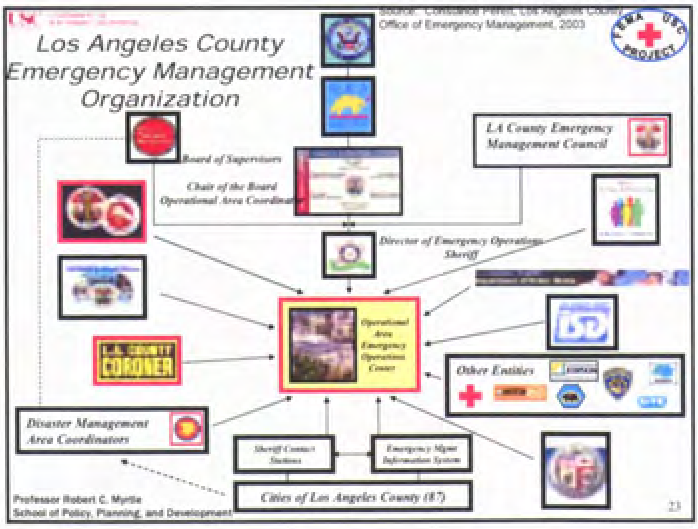
Source: Constance Perett, Los Angeles County Office of Emergency Management, 2003

Los Angeles County Emergency Management Organization

Source: Constance Perett, Los Angeles County Office of Emergency Management, 2003



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23

California Policies Addressing Seismic Safety Concerns

- 1927 Uniform Building Code provided the first comprehensive earthquake requirements for buildings in the state
  - April 18, 1906 San Francisco Earthquake
  - 700 or more deaths
- 1933 Field Act for Schools
  - March 10, 1933, Long Beach
  - 115 killed
- 1973 Hospital Facilities Seismic Safety Act
  - February 9, 1971 San Fernando/Sylmar
  - 65 deaths (50 V.A. and Olive View)
- the Hospital Seismic Safety Act of 1994 (SB 1953, Alquist)
  - 8/91 acute care hospitals required evacuation (2500 beds lost)
  - 4 hospitals condemned
  - Greater than 1,500 injured
  - Fatalities – 57

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Source: Performance of Hospital Nonstructural Components During Recent Earthquakes, USC 2000.

OSHPD
Major Functions and Divisions

Mission Statement:

The Mission of OSHPD is to promote healthcare accessibility through leadership in analyzing California's healthcare infrastructure, promoting a diverse and competent healthcare workforce, providing information about healthcare outcomes, assuring the safety of buildings used in providing healthcare, insuring loans to encourage the development of healthcare facilities, and facilitating development of sustained capacity for communities to address local healthcare issues.

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Source: OSHPD 2004

OSHPD
Major Functions and Divisions

Major Divisions:

Facilities Development Division primary goal in this regard is to ensure that patients in these facilities are safe in the event of an earthquake or other disaster, and to ensure that the facilities remain functional after such an event in order to meet the needs of the community affected by the disaster

Cal-Mortgage Insurance Division provides loan insurance to not-for-profit health facilities, especially those providing healthcare in underserved communities, to help them develop or expand access to needed services. Without such a guarantee, many of these facilities simply could not arrange the financing required to serve their communities

Healthcare Workforce and Community Development Division supports the training of health professionals, especially doctors and nurses who provide primary care services and are willing to practice their profession in underserved communities

Healthcare Information Division collects, analyzes, and disseminates information about hospitals, nursing homes, clinics, and home health agencies licensed in California. The information includes financial reports, data on the use of services, and measures of the quality of care provided.

Healthcare Quality and Analysis Division health services research and development activities

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Source: OSHPD 2004

Characteristics of Hospitals and Health Systems in the United States and California

Total Number of All U.S. Hospitals	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total Staffed Beds in All U.S. Hospitals	[illegible]
[illegible]	[illegible]
Number of Rural Community Hospitals	[illegible]
Number of Urban Community Hospitals	[illegible]
Number of Community Hospitals in a System***	[illegible]
Number of Community Hospitals in a Network****	[illegible]

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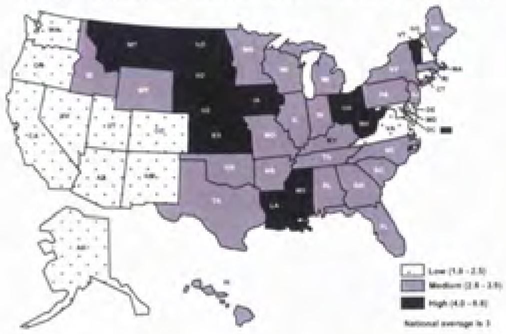
Source: 2000 AHA Annual Survey, Kaiser Family Foundation State Health Facts Online

Table 2.3
Number of Hospital Beds per 1,000 Persons by State, 2000



Note: Per 1,000 population

Source: 2000 AHA Annual Survey, Kaiser Family Foundation State Health Facts Online

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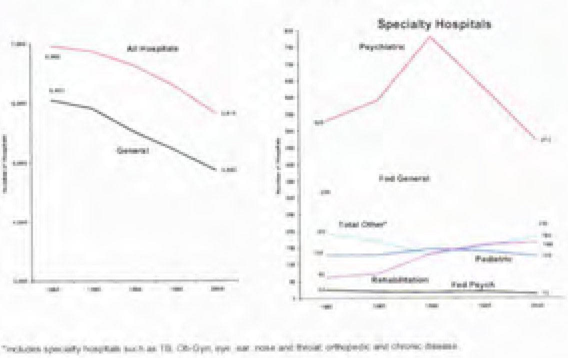
Table 2.1
Number of Hospitals by Type, 1980-2000



*Includes specialty hospitals such as TB, Ob-Gyn, eye, ear, nose and throat, orthopedic and chronic disease

Source: American Hospital Association

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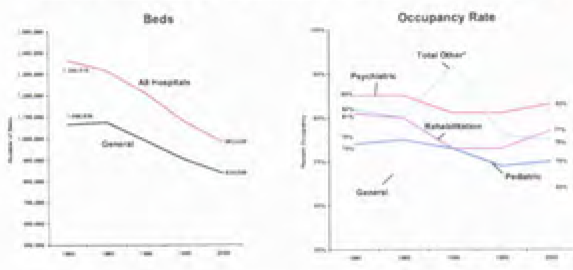
Table 2.2
Number of Hospital Beds and Occupancy Rates by Hospital Type, 1980-2000

Decline in the total number of hospital beds has not kept up with declines in occupancy



*Includes specialty hospitals such as TB, Ob-Gyn, eye, ear, nose and throat, orthopedic and chronic disease

Source: American Hospital Association

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Experience of California Hospitals During Recent Earthquakes

- The Coalinga Earthquake (6.7) damaged X-ray equipment, computers, laboratory analyzers, emergency radio equipment and emergency elevators in the only hospital in the area. Little structural damage was observed (Tierney, 1983).

Experience of California Hospitals During Recent Earthquakes

- Loma Prieta (7.1) caused little structural damage to hospitals but damaged elevators, communication systems, laboratory and patient support equipment (California Seismic Safety Commission, 1991).
- Northridge (6.7) led to the evacuation of over 900 patients because of nonstructural problems including damage to sprinklers, domestic water and chiller lines (California Seismic Safety Commission, 1994).

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The FEMA+USC Project

- An interdisciplinary team from
  - USC Schools:
    - Engineering
    - Medicine
    - Policy, Planning, and Development
  - Government Agencies
    - OSHPD
  - Profession Engineering Organizations
- Purpose of the study:
  - evaluate the performance of structural and nonstructural hospital components
  - assess the impact of structural and nonstructural systems on critical hospital functions
  - prepare prioritized recommendations where cost-effective seismic mitigation measures might be employed

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Improving the Functionality of Hospitals Following Seismic Events

- Recent earthquakes in the United States has indicated that building code changes and code enforcement has reduced the likelihood of catastrophic structural failures.
- Today the functionality of hospitals is increasingly dependent on the performance of their nonstructural components.

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Improving the Functionality of Hospitals Following Seismic Events

- A major factor limiting the improvement of nonstructural systems is a lack of consensus on which items are essential to functioning of hospitals (FEMA 1989).
- The Veterans Administration identified 9 areas that were high hazard or high priority functional concerns (Stone, Marraccini and Patterson, 1976).

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High Priority Systems Identified by US Veterans Administration

- Anesthesia equipment
- Automated clinical analyzer
- Blood bank refrigerators
- Essential diagnostic tools
- Film developer
- Fixed and portable x-ray equipment
- Hemodialysis machines
- Monitors
- Portable oxygen and other medical gases
- Respirators and suction machines
- Surgery lights and other equipment

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High Priority Systems Identified by McGavin and Associates

- Sixty-six items were identified as being required for the operation of the facility. Fourteen of these were defined as critical life support equipment.

•Anesthesia Machine
•Emergency Cart
•Hyper-Hypothermia Unit
•Infusion Pump
•Kidney Dialysis Unit
•Suction Machines
•Surgical Table
•Defibrillator
•External Pacemaker
•Heart-Lung Machine
•Infant Care Unit
•Infant Isolation Incubator
•Oxygen Cylinders
•Surgical Instruments
•Ventilator/Respirator

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Identifying High Priority Systems Surveys of Doctors, Nurses and Administrative Personnel

Previous studies emphasized:

- A single facility to identify critical systems (Veterans Administration)
- Limited sample of facilities and informants (McGavin and Associates)
- Critical Nonstructural Life Line Systems (Chew, 1998)
- Information obtained from engineering professionals (Hospital Building Safety Committee)

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Identifying High Priority Systems Surveys of Doctors, Nurses and Administrative Personnel

Methods:

- Structured interviews with administrative, medical, nursing, technical and support personnel working in hospitals during the Chi-Chi, Nisquali and Northridge earthquakes
- Surveys of administrative, medical, nursing, technical and support personnel working in hospitals during the Chi-Chi, Duzce, and Ismet earthquakes

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Identifying High Priority Systems Surveys of Doctors, Nurses and Administrative Personnel

Methods:

- Development and administration of a 5 part questionnaire seeking information about:
  - Part I: The extent to which the earthquake impacted nonstructural systems, equipment and the availability of staff and supplies. Respondents were also asked about the impact on patient care, change in service base and change in admissions.
  - Part II: The impact of the damage to these systems on the functionality of the hospital.
  - Part III: The importance of Medical, Diagnostic, Patient Support Units and Overhead Units during and following the earthquake

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Identifying High Priority Systems Surveys of Doctors, Nurses and Administrative Personnel

Methods (continued):

- Part IV: An assessment by individual department heads about the earthquake's impact on nonstructural systems, equipment and the availability of staff and supplies.
- Part V: The assessment by individual department heads of the importance of different nonstructural systems, departments and medical equipment on the functionality of the hospital over the life cycle of an earthquake

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Identifying High Priority Systems Surveys of Doctors, Nurses and Administrative Personnel

Participants in In-depth Interviews

Type of Facility	Physicians	Nurses	Other Medical	Administration	Engineering	Other Non-Medical
Academic Medical Centers	17	15	4	3	5	10
Major Medical Centers	13	29	23	10	21	15
Community Hospitals	5	13	12	4	9	7
Total	35	57	39	17	35	32

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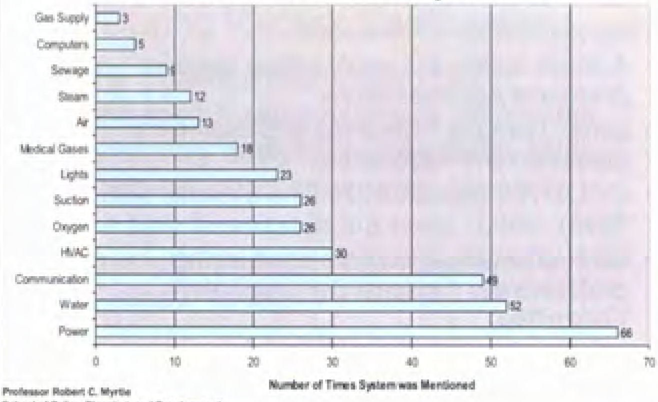
Findings: Critical Life Line Systems



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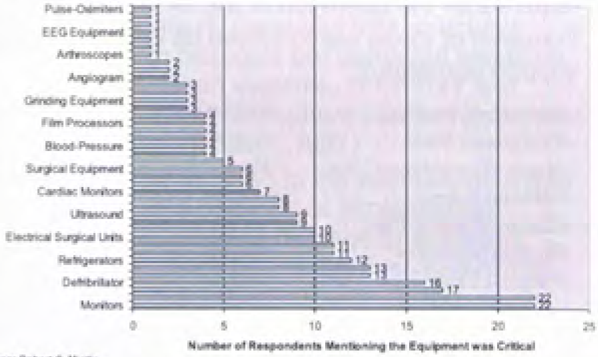
Findings: Critical Life Support Equipment



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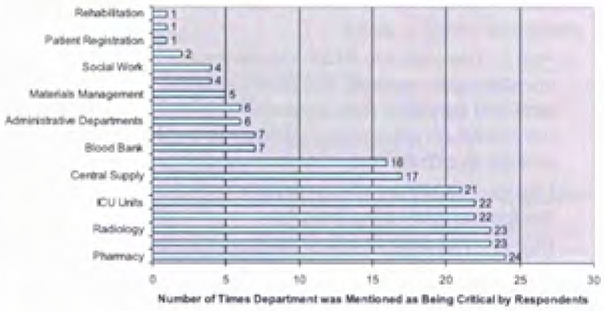
Findings: Critical Hospital Departments



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The Importance of Different Hospital Departments at Different Points of Time Following an Earthquake

Systems	Immediately Following the Earthquake	During Stabilization	During Recovery & Cleanup	Transition to Normal Operation
Medical Systems				
Emergency Room	1.10	1.00	1.10	1.10
Operating Room	1.11	1.11	1.11	1.11
Recovery Room	1.33	1.33	1.33	1.22
ICU/CCU	1.00	1.14	1.25	1.14
NICU	1.40	1.50	1.43	1.33
Blood Bank	1.00	1.22	1.44	1.33
Diagnostic Systems				
Laboratory	1.40	1.50	1.30	1.20
Radiology	1.60	1.50	1.70	1.10
Imaging (MRI/CT Scan)	1.67	1.56	1.56	1.44
Patient Support Systems				
Nursing Care	1.00	1.33	1.00	1.00
Central Supply	1.20	1.10	1.10	1.10
Pharmacy	1.00	1.00	1.00	1.00
Housekeeping	2.00	1.60	1.30	1.30
Medical Records	1.50	1.30	1.10	1.10
Laundry	2.38	2.11	1.67	1.44
Dietary	1.75	1.78	1.56	1.33
Overhead Services				
Data Processing	1.78	1.67	1.44	1.22
Maintenance	1.67	1.44	1.33	1.44
Purchasing	1.38	1.56	1.22	1.11
Business Office	1.56	1.44	1.33	1.33
Security	1.33	1.44	1.44	1.44
Biomedical Engineering	1.75	1.75	1.75	1.75
Communication Systems	1.00	1.11	1.11	1.11

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Challenges facing Policy Makers, Researchers and Managers

- Interruptions of water, sewage, electrical and telephone services to the hospital were a major factor limiting hospitals' functioning
- Structural and nonstructural damage often hindered the operation of back up systems
- The failure of supply systems rather than damage to a particular piece of equipment were found to limit functionality
- Interruptions in the communications and transportation systems as well as the damage to the cities' infrastructure limited hospitals' access to staff, information, supplies, and services
- The lack of information about the extent of the damage in the area; questions about the structural integrity of the building; and, uncertainties over the state of critical systems hindered the functionality of the hospitals
- Uncertainty and information isolation hindered the functionality of the hospitals. Especially during the early hours of the catastrophe, TVs and mobile phones, when they were not jammed, had a pivotal role in overcoming the uncertainty and information isolation

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Challenges facing Policy Makers, Researchers and Managers

The functionality of hospitals is influenced by a number of different factors:

- the severity, proximity and duration of seismic forces
- the seismic standards governing the construction of the facilities and their enforcement
- the age and type of construction of the facilities

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California's Policy Response For Improving the Functionality of Hospitals—SB 1953

- Hospital Buildings Should:
  - Protect life and property
  - Provide for the treatment of injured
  - Protect investment
  - Reduce demand on post-earthquake resources

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Source: David Carlisle, OSHPD, 2004

Policy Responses For Improving the Functionality of Hospitals—SB 1953

- Health Facilities Seismic Safety Act is law
- Life/Safety issue
- Entire Infrastructure Affected
- Major earthquake predicted prior to 2030

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Source: California Healthcare Association, 2002

SB 1953 Deadlines

Deadline	Required Action
January 1, 2002	Basic emergency and power systems must be braced
January 1, 2008	Collapse hazard buildings must be closed or retrofitted
January 1, 2030	All hospitals should be capable of operating following a large earthquake

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Source: Estimating the Compliance Cost for California SB 1953
California Healthcare Foundation, 2002

Basic SB 1953 Requirements

- 2001 Building Evaluations
- 2002 Compliance Plan Deadline
- 2002 Bracing of Key Systems
- 2008 Life/Safety
- 2030 Substantial Compliance

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Source: California Healthcare Association, 2002

Cost of SB 1953

- 1990 Estimated Cost $14 Billion
- CHA 1999 Estimated $24 Billion
  - 2008 $10 Billion
  - 2030 $14 Billion
- Rand 2002 Estimate As High As $40 Billion Plus

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Source: California Healthcare Association, 2002

Financial Status of California Hospitals

- Approximately 67% losing on operations
- Approximately 33% losing from all sources
- 474- hospitals under SB 1953
- 436- met evaluation deadline

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Source: Shattuck Hammond Partners, LLC, 2002

SB 1953
All News is Not Bad

While SB 1953 is expensive it:

- Eliminates the practice of retrofitting buildings that are 30 or more years old
- Encourages construction programs that consider the safety of the patients, staff and the public
- Stimulates realistic long-term planning

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Source: David Carlisle, OSHPD, 2004

SB 1953
All News is Not Bad

While SB 1953 is expensive it:

- Will improve efficiency because current technology does not "fit" in older buildings
- Buildings likely to be replaced by 2030 will be 60 or more years old
- In the mid-1900's, who could have envisioned the technological and electronic transformations today's hospitals are expected to function with

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Source: David Carlisle, OSHPD, 2004

Improving the Functionality of Hospitals Following Seismic Events Concluding Thoughts

- Earthquake mitigation and preparedness requires consideration of both internal and external elements of a health system influenced by the earthquake
- Functionality of hospitals will depend on the performance of structural as well as nonstructural components of the hospitals

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Improving the Functionality of Hospitals Following Seismic Events Some Concluding Thoughts

Our research reveals that these systems matters most to hospitals in ensuring their functionality

Life Line Systems:

- Power
- Water
- Communication

Critical Medical Systems:

- Monitors
- Ventilators
- X-Ray Machines
- Anesthesia Machines

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Source: Performance of Hospital Nonstructural Components During Recent Earthquakes, USC 2000.

Improving the Functionality of Hospitals Following Seismic Events Some Concluding Thoughts

Our research reveals that these departments matters most to hospitals in ensuring their functionality

- Pharmacy
- Nursing Care Units
- Central Supply
- Operating Room
- ICU/CCU
- Emergency Room

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Source: Performance of Hospital Nonstructural Components During Recent Earthquakes, USC 2000.

Improving the Functionality of Hospitals Following Seismic Events Some Concluding Thoughts

Future Research:

- Identify sources of piping vulnerability
- Examine interactions between nonstructural elements
- Evaluate sensitivity of life support, treatment and diagnostic equipment to seismic forces

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Improving the Functionality of Hospitals Following Seismic Events

Questions?

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Improving the Functionality of Hospitals Following Seismic Events

Thank You

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School of Policy, Planning, and Development

Discussion Report of Symposium
June 22, 2004

Hiroshi Arai

10:00-12:00 Lectures

1. Lecture of Dr. Okudera
(Please refer to ppt)

Discussion:
The question was raised about the network to transport medical doctors (Dr. Katayama), and it was answered that fire department is in charge, and Self Defense Forces is not easy to be used as command of governor or mayor is required.

Dr. Fujino of Tokyo University asked if instruments and facilities are investigated individually how much they can be damaged by disaster. Dr. Okudera answered that there is no standard for it, and only seismic resistance is considered. He insisted that it is necessary to disseminate the experiences of Kobe to other regions.

It is asked that if color codes and evaluation criteria are already established including various factors, such as the number of patients or facilities to be functioned under the emergency. For example, Fujisawa citizen hospital is expected to accept 5000 victims under the emergency; however, it is not capable. Dr. Okudera asked that there are many factors, and now, color codes and criteria are under development, and participation is welcomed. He also stated that over triage is principle, it can be flexible.

Dr. Nakayama discussed that it is important to construct one reliable hospital as a base hospital. At ChiChi Earthquake, people helped themselves. They did not go to hospitals unless injuries were severe.

Dr. Okudera insisted that local governments make a decision in consideration of seismic resistance of hospitals, but in many cases, medical doctors are not involved in the process. Their voices should be reflected.

Ms. Hotta asked about the capability of fire department, and Dr. Okudera answered that triage can be treated by all emergency units.

Dr. Nagasawa suggested that color code system needs to be disseminated, and Dr. Okudera answered that he will consult with Ministry of Internal Affairs and Communication.

2. Lecture by Dr. Myrtle
(Please refer to ppt)

13:30-16:00 Panel Discussion

Presentation of Dr. Shibata, Dr. Masri, Dr. Nagasawa, Dr. Myrtle, Dr. Allison, Dr. Nakayama, Ms katsuragi, and Dr. Higashihara. (Please refer to ppt)

Dr. Fujino asked whether the advance of medical technology is not contradicted with emergency medicine. Dr. Nakayama argued that emergency medicine is important for disaster medicine.

Dr. Fujino asked what the problems are if not treated by control technology or base isolation. Dr. Higashihara answered that base isolation will be the main stream. Hospital should be a building specific to maintain functions for medicine.

Dr. Katayama asked Dr. Myrtle what is the serious barrier in Japanese disaster medicine. Dr. Myrtle answered it is the lack of inter-organization coordination between public agencies, non-public agencies, local agencies and so on. Dr. Nakayama agreed that bureaucracy is the problem. For example, the command chief is a mayor. It might delay the establishment of emergency system.

Dr. Katayama asked that the situation is not satisfactory even though after Kobe earthquake, base hospitals and their networks were improved. Dr. Nakayama answered that Hyogo has bad experiences before, so the situation is better. However, in many places, there are not enough interests and knowledge. At this moment, people confide too much in base isolation. Dr. Katayama stated that he does not believe network and instruments function at the moment of emergency even though even though they are prepared for it.

Dr. Fujino asked how hospitals are contacted each other if network is collapsed in the United States. Dr. Myrtle answered that US emergency medicine is based on day to day system based on cooperative relationship using standardized frequency system. The system is used for trauma care providing real time information system. It is similar to pharmacist system Ms Katsuragi mentioned. Informal communication system in local area can be used to establish the system that can be utilized in emergency.

Dr. Katayama asked that US emergency medical system is based on military system. It is derived from the concept how to provide medical cares to soldiers not to send soldier to hospital. Dr. Allison emphasized again that US emergency medicine system is more active in day to day basis, and there is a market for it.

Dr. Nakayama stated that it is not good that communication lines are maintained in one place. If one cable is disconnected everything is over. Dr. Shibata stated that in nuclear power plant, spare cables and secondary parts are prepared manually. The technology is not transferred to medical services.

Ms Katsuragi stated that after the Kobe Earthquake, she worked 24 hours for three months with hardly sleeping. She drove to Blood Center by motorbike. Now, only electric scale is allowed by the Ministry of Welfare, but what is going to happen if the power goes out.

Dr. Nakayama argued that heliport is a problem as stairs have to be used to transport patients. If it is a slope, the situation is much better.

Dr. Katayama asked how many patients Dr. Nakayama thinks were saved if the ordinary medical services were available. Dr. Nakayama answered that basically, medical doctors do not pass patients to other doctors. However, more doctors have changed the idea. He assumed that several hundreds people could have saved.

Dr. Katayama stated that we found that there are many issues from resources, personnel and system. Also, we might need to look at our nationality and history. Ms. Katsuragi, pharmacist, introduced us the grass-roots efforts. Study of "Prevention of Medical Facilities", we believe, is a suitable research topic for NIED. We would like to continue this research, and invite more audience to show our achievement.

Dr. Arai's comments:
I have heard that structure of school architecture is used for that of hospital buildings. If it is true, I wonder that hospital buildings have seismic resistance as much as schools.

In Kobe, seismic intensity right under the fault was not so strong. Rather, 1 to 2 km from fault to the ocean, ocean side land was not so severe. It was edge effect. However, it was investigated because of the earthquake, and before the earthquake nobody investigated and knew the underground structure.

(Edited by Michiko Banba)

Appedix A Participants List

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APPENDIX B

Experts Workshop on June 21, 2004

Symposium on June 22, 2004

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