

Earthquakes & Blood Transfusion A challenge

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Magen David Adom – National Blood Services
Israel

Definition of a “Disaster”

- ▣ Any domestic disaster or act or terrorism that:
 - Suddenly increases the demand for blood
 - Restricts or eliminates ability to collect, test, process or distribute blood
 - Prevents the local population from donating blood
 - Restricts or prevents the use of the available inventory of blood products
 - Requires immediate replacement or re-supply of the region's blood inventory from another region
 - Creates a sudden massive influx of donors

Strategies to emergency planning

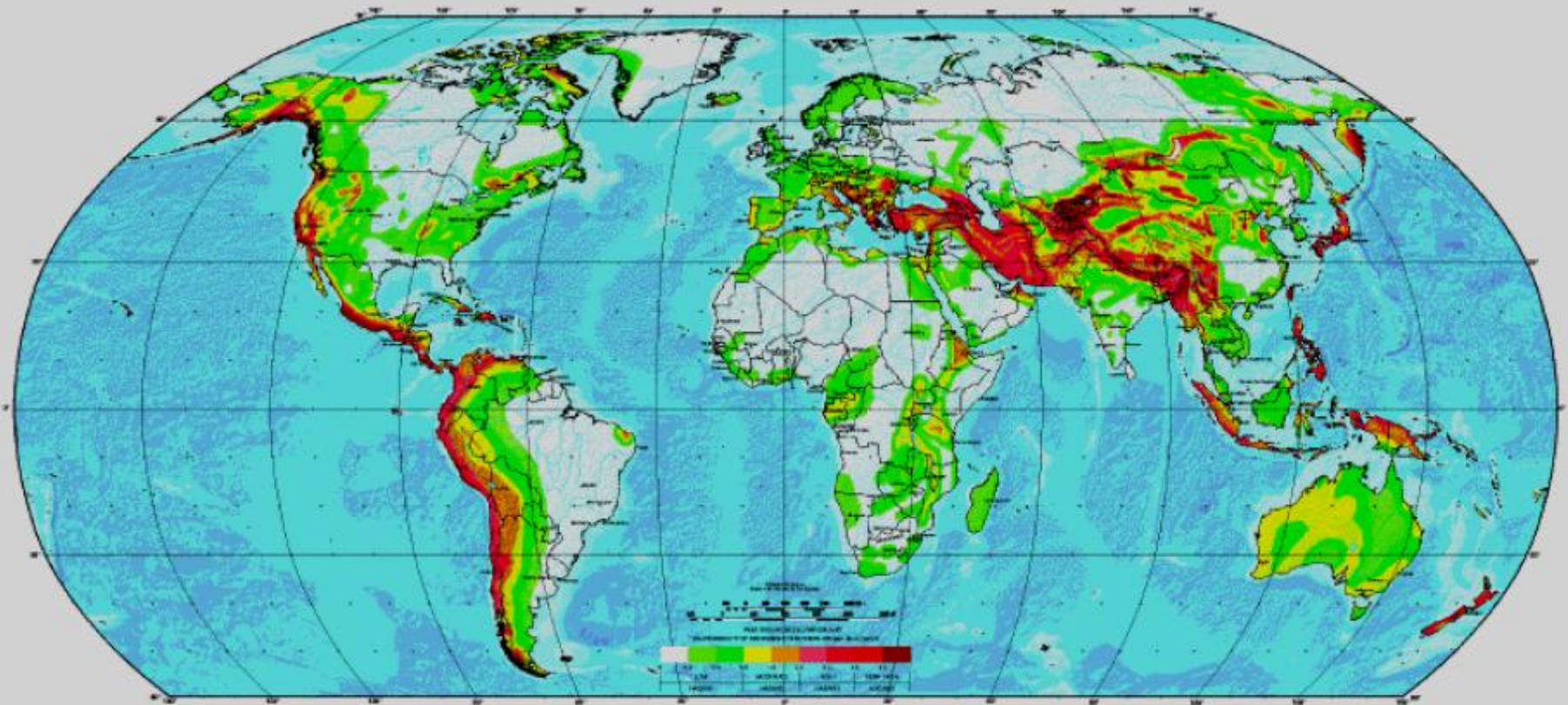


- Disaster Reduction & risk mitigation
- Organizing disaster response teams
- Assess vulnerability
- Identify areas in need of improvement
- Take preventive measures
- Exercising and drilling

- * Respond according to response plans
- * Check damage to facilities
- * Assess the operational capacity

- Disaster-recovery
- Timely & cost-effective recovery

GLOBAL SEISMIC HAZARD MAP



EARTHQUAKES: A WORLDWIDE PROBLEM



Marmara – Turkey - 1999



Pakistan Earthquake - Oct 2005

A Snapshot of Scale and Magnitude

- 7.6 on the Richter Scale
- 30,000 sq Km
- 73,338 Dead & 128,304 Severely Injured
- 3 million Rendered Homeless, 600,000 Houses Destroyed
- 6,300 Education Facilities Destroyed
- 800 Health Facilities Destroyed
- 949 Govt Buildings Damaged
- 6,440 Kms Roads Damaged
- Miscellaneous: Damages to environment, Telecom, Power, Livelihood and -- Vulnerable Population
- 4,020 Watsan schemes Destroyed
- **Colossal Economic loss Leaving Behind a reconstruction bill of Over US\$ 5 billion**

Lt. General Nadeem Ahmed
Former Deputy Chairman
Earthquake Reconstruction and Rehabilitation

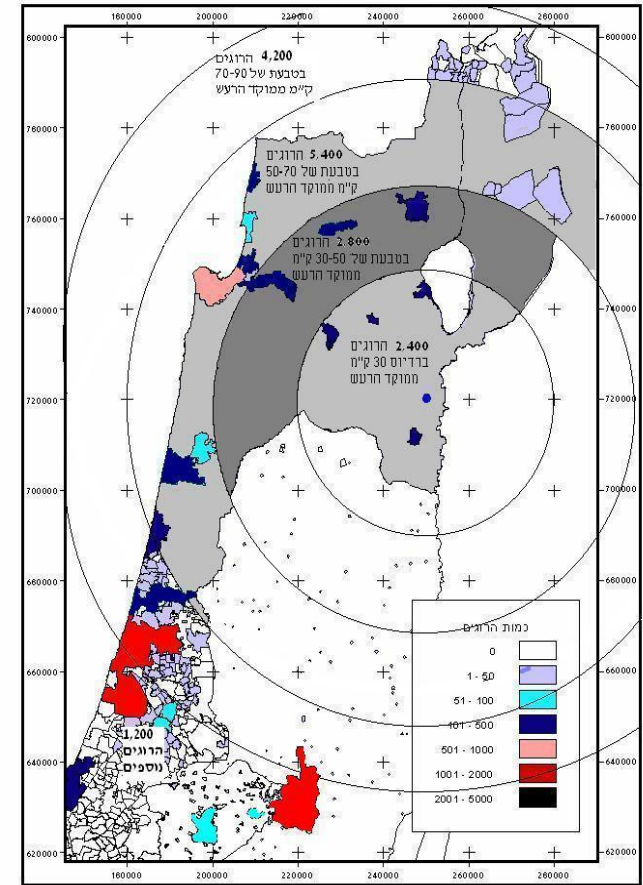
CHAOS

Unpredictable in time & magnitude

Our mission is to BE PREPARED

PREPARE

- Knowledge of vulnerable areas
- Modes of construction
- Density & type of population
- Contingency plan
- SOP's
- Simulation/ drills



רעידת אדמה בבית שאן 7.5

סה"כ כ-16,000 הרוגים

PREPARE

- Infrastructure of Hospitals, Blood banks & Blood centers
 - Need for reinforcement of non constructive elements
 - Power supply
 - Water supply
 - Testing equipment – Reinforcement, Back up systems & procedures, Trained personnel back up
 - IT & Back up system

PREPARE – Coordination & Alternative Communication

- Blood services & Hospitals
- Different blood center sites
- Employees
- Donors
- Volunteers in the country & abroad
- Government & other organizations (EMS, Military, NGO's) in the country & abroad
- **Media** - Local, Nation, International

PREPARE - Alternative Transportation

- Walking
- Bicycles/motorcycles
- 4X4
- Boats
- Helicopters
- Planes

Critical issues – Cold chain

> 24 hours – Plt agitation

Components safety & integrity

PREPARE - Supplies

- Blood donations (blood bags, Hgb Cu vets etc.)
 - Minimum inventory
 - Emergency supplies & Suppliers lists
 - Replenishing supplies plan
- Testing Reagents & laboratory consumables
 - As above &
 - Alternative tests
 - No testing (Ethical issues)
- Food & water
 - Employees
 - “Bystanders”

PREPARE - Personnel

- Blood donations
 - Phlebotomists
 - Interviewers
 - Order & safety
- Laboratories
 - Typists
 - Mainly - Trained personnel
- Dispatch
- Administration & Logistics



Destruction wrought by the earthquake Kobe – Japan 1995

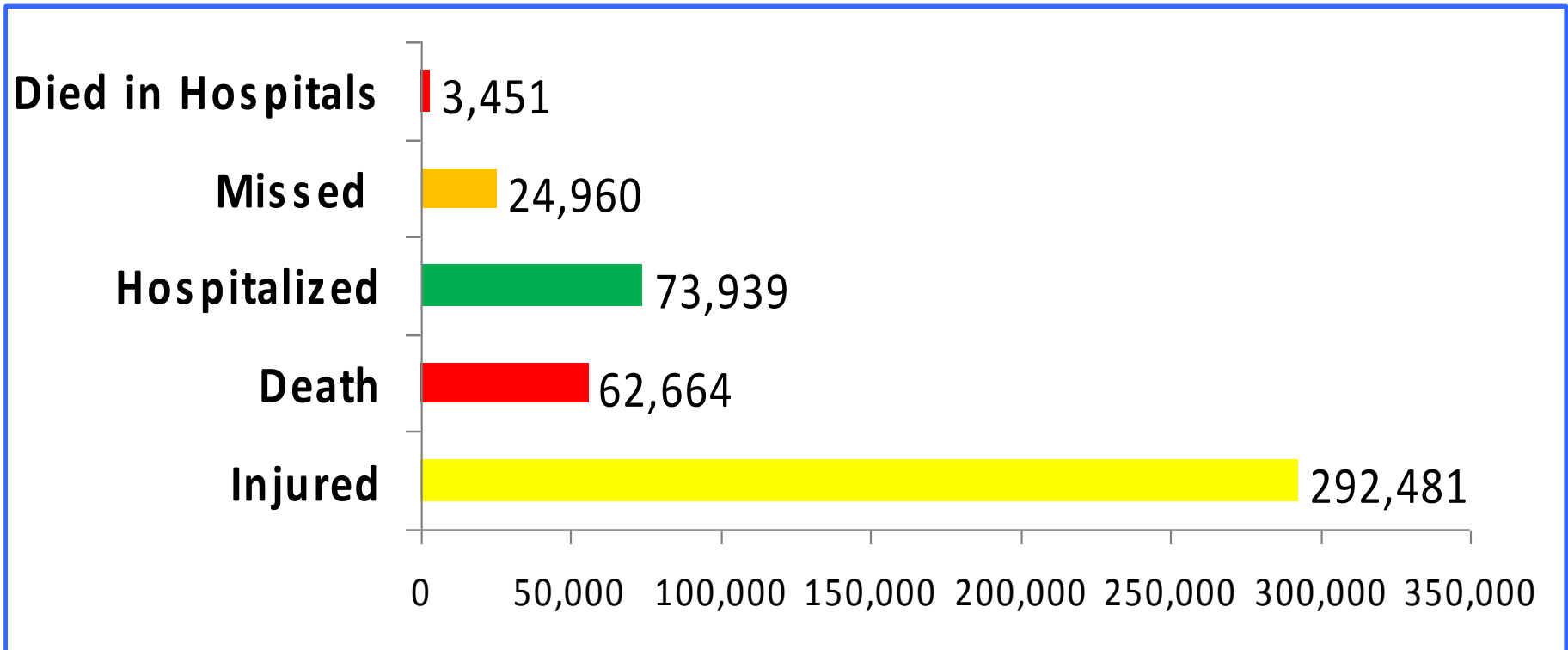


Yoshiaki Numata
Japanese Red cross

RESPOND

Death Tolls & Casualties (as of 23rd May 2008)

Affected population: 10.59 Millions and 5.2 Millions left homeless
CHINA



Source: OCHA reports

Respond - Local rescue efforts

- Workers & families
- Volunteers & families
- Hospitals
- Blood centers



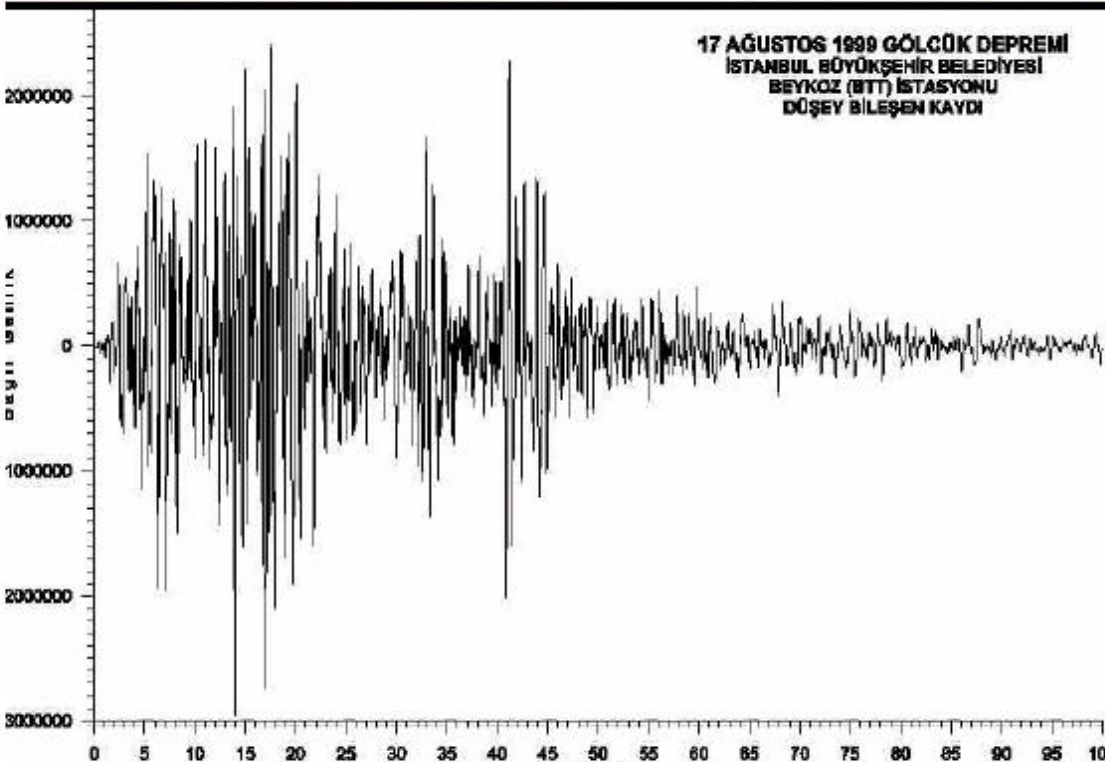
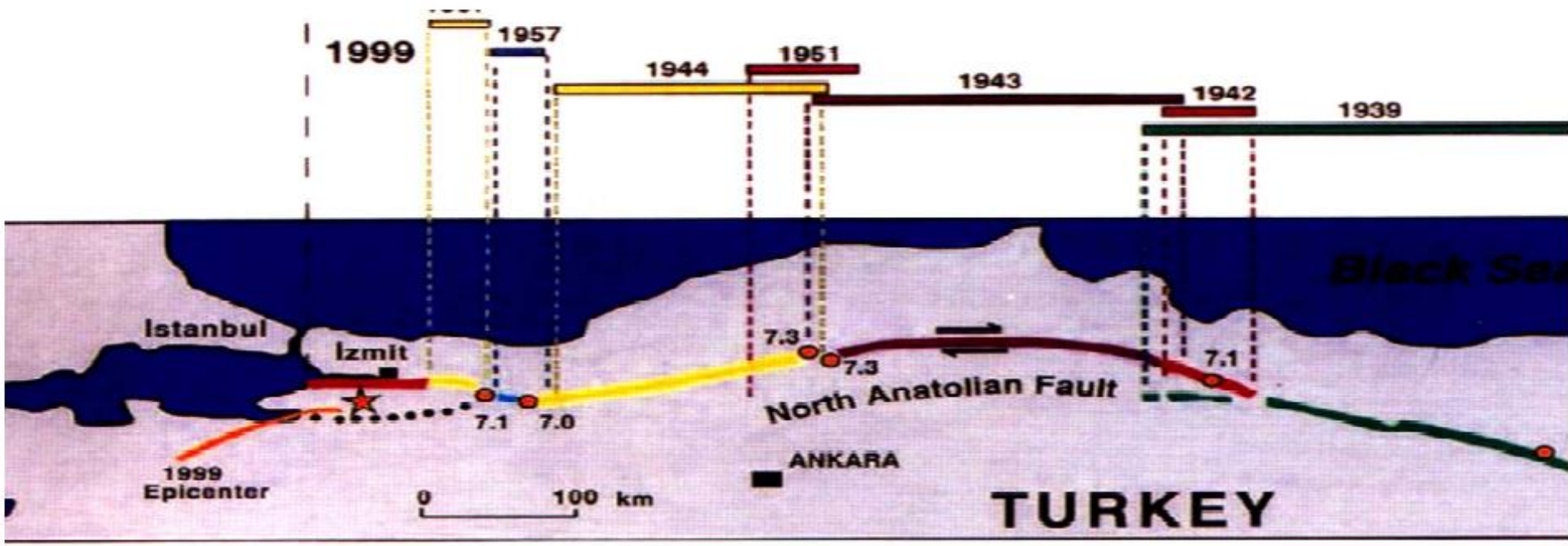
Evacuation & Relocation

- Evacuation plans
- Relocation sites
SOP's
Different standard of
care (ethical issues)
- Simulation/ Drills



QIN Li, TAN Bin, HUANG Chunyan, XIONG Hui
Dept. of Laboratory Medicine
West China Hospital Sichuan University, China

Sino-German Red Cross Field Hospital of Dujiangyan



17 AĞUSTOS 1999 GÖLCÜK DEPREMİ
İSTANBUL BÜYÜKŞEHİR BELEDİYESİ
BEYKOZ (BTT) İSTASYONU
DÜŞEY BİLEŞEN KAYDI

- 17 August, 1999
- 7.4 (Richter scale)
- 45 sec
- Deaths: 17,480
- Injured: 43,953

SEVERITY ASSESSMENT - I

- Following major earthquakes:

Deaths / Injured: $\approx 1 / 3$

- The Marmara Earthquake: $\approx 1 / 2.5$
(17,480 / 43,953)

- Crush syndrome in the injured: 2 - 5%

- The Marmara Earthquake: $\approx 1.5\%$
(639 / 43,953)

2 - 3% of all casualties ~ crush syndrome

SEVERITY ASSESSMENT - II

**Many
factors
effective!**

- Intensity of the disaster
- Population density of the region
- Structural characteristics of buildings
- Timing (moment) of disaster
- Efficacy of rescue activities

Noji et al., 1990; Nadjafi et al., 1997



Gujarat Earthquake:
Death: 19,727, Cr.:35



Bam Earthquake:
Death: 26,000; Cr.: 124



September 11 terrorism
Death: >3,000; Cr.: 1



- 80% die instantly
- 10% minor injuries
- 10% major injuries

Crush syndrome



**2nd most frequent cause of deaths
(following direct effect of trauma)**

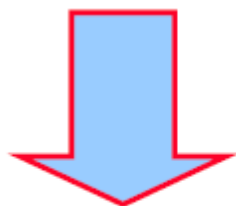
“RENAL DISASTER”

BLOOD and BLOOD PRODUCT TRANSFUSIONS

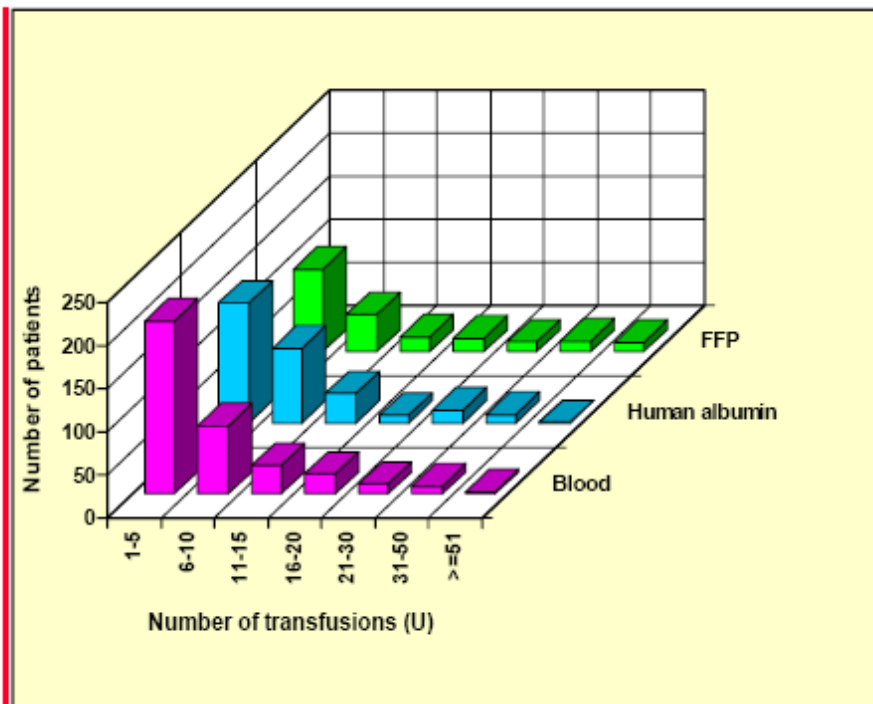
(The Marmara earthquake experience)

Blood: 2981 u.
FFP: 2837 u.
H. alb.: 2594 u.

4u.



8500 units



- Medical concerns
- Logistic concerns

Anticipating Blood needs

Table 3. Requirements for Dialysis and Blood and Blood-Product Transfusions in 639 Patients with the Crush Syndrome after the Marmara Earthquake.*

Variable	Value
Dialysis	
No. of patients undergoing dialysis	477
No. of hemodialysis sessions	5137
No. of hemodialysis sessions per patient undergoing hemodialysis	11.2±8.0
No. of hemodialysis sessions per patient†	8.2±8.4
Transfusion	
No. of blood transfusions	2981
No. of fresh-frozen plasma transfusions	2837
No. of human albumin transfusions	2594
No. of blood transfusions per patient receiving transfusions	8.3±10.7
No. of blood transfusions per patient‡	4.6±9.0
No. of fresh-frozen plasma transfusions per patient receiving transfusions	13.6±19.8
No. of fresh-frozen plasma transfusions per patient‡	4.4±12.9
No. of human albumin transfusions per patient receiving transfusions	8.8±9.1
No. of human albumin transfusions per patient‡	4.0±7.5

Victims sent to West China hospital

■ May 12-June 25

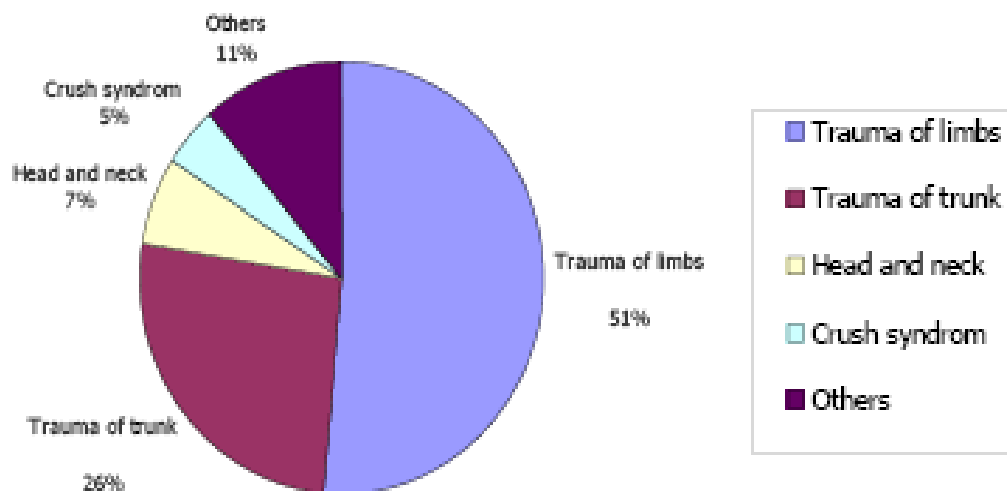
- Total No. of victims treated: 2,712
- Total No. of victims hospitalized: 1,840
- Total No. of severely wounded: 1,153
- Operations: 1,404
- Total No. of death: 23
- No. of patients transfused: 528

1:5 wounded reached Hospital Tx
1:2 severely wounded Tx

? Volume RBC's & FFP

	pts No	Average RBC(U)	Average Plasma(U)
Total	528	7.425	13.39
RBC Only	111(21%)		
Plasma Only	29(5%)		
RBC+Plasma	388(73%)		
plt	19		
cryo	11		

Classification of trauma victims



Diagnosis	No. of pts	Average RBC (U)	Average plasma (U)
Trauma of limbs	271	7.4	9.4
Trauma of trunk	138	5.6	8.6
Head and neck	35	3.5	7
Crush syndrom	24	17.5	31.1

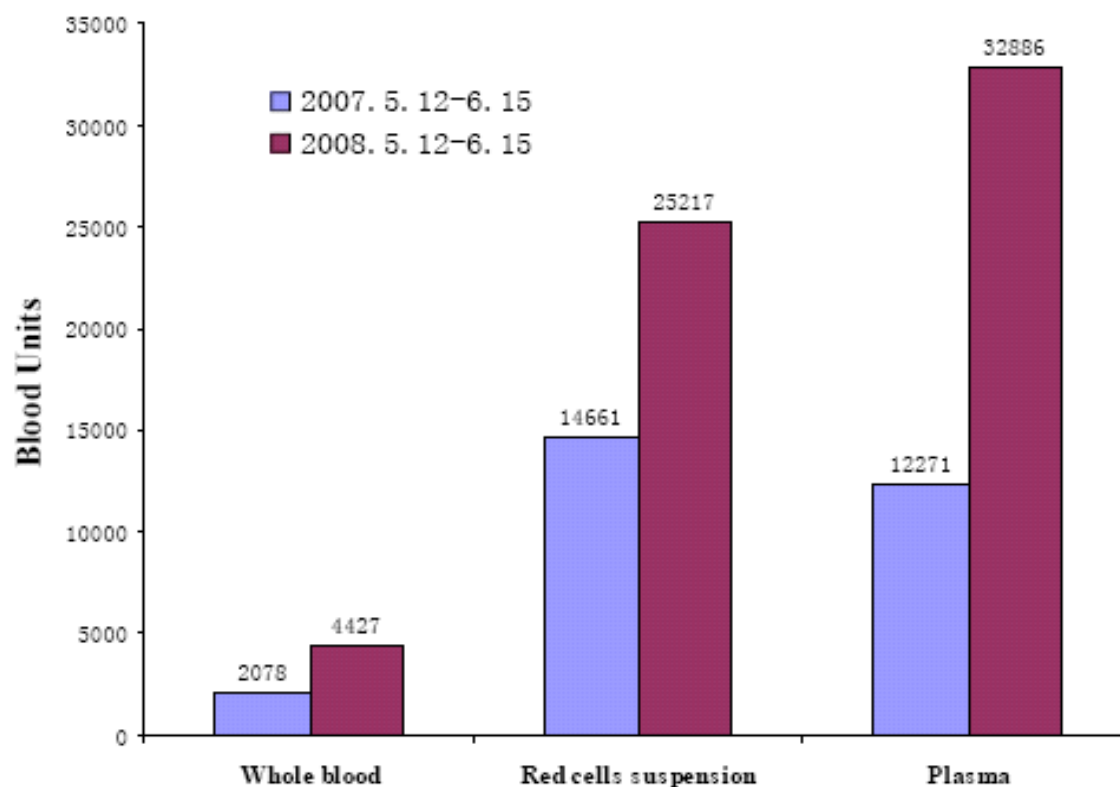


Fig 2 Statistic analyses of blood usage after the Earthquake (2008.5.12-6.15) compared to the same period last year in Chengdu area

When is blood needed ?

- **1st stage: the 1st day after the earthquake**
 - **Victims from the junction area between Chengdu plain and mountainous area**
 - **Slight contamination of the wound**
 - **Most managed by debridement**
 - **Very few blood transfusion needed**

- **2nd stage: days 2-14 after the earthquake**
 - Large numbers of patients started to come 48h after earthquake
 - Transported by helicopters from mountainous areas or referred by local hospitals after simple treatment
 - 76% fractures, 9% head injury
 - Many had contaminated open wounds
 - Treatment focused on wound management, infection prevention and treatment, life support for the severely injured, secondary orthopedic surgeries
 - Large amount of blood transfusion

- **3rd stage: days 14-21**
 - **Patients came in decreased numbers**
 - **Most referred from first line or second line hospitals, severely ill, life support needed**
 - **Treatment focused on prevention of iatrogenic infections, management of complications, continued life support**
 - **Large amount of blood transfusion**

Correct & uniform public information



- No need for blood donations
Need for specific blood types
Increased need
- Radio, TV, Newspapers
Community, National, International
- Internet, E-mail
- Discrepancies:
MOH
Local needs
Public enthusiasm





Jinjiang Blood Donation Room, Chengdu
(Evening, May 12, 2008 after the Earthquake)

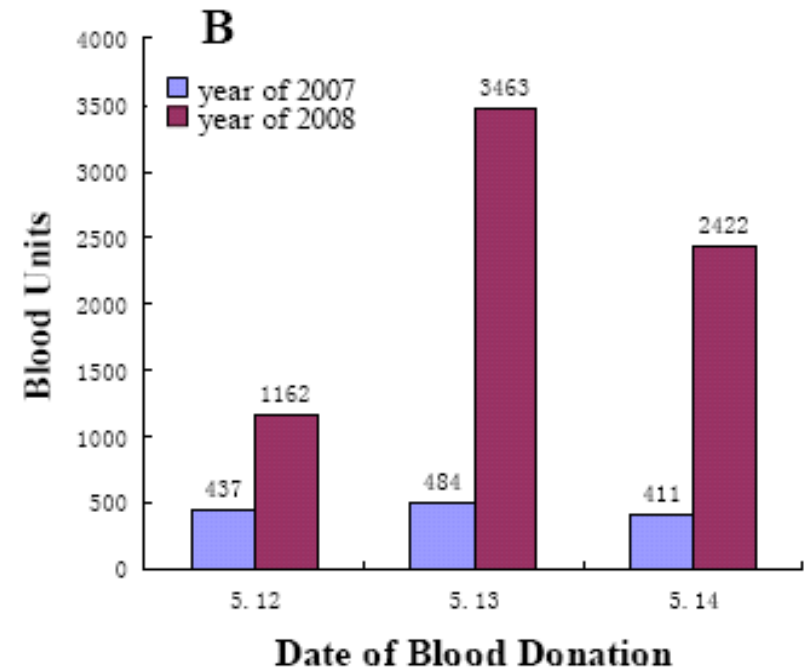
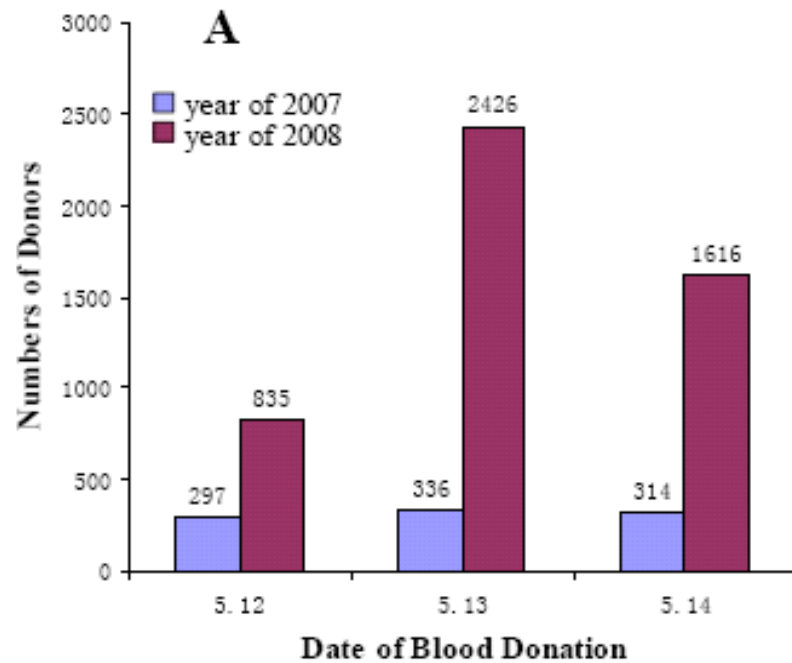


Fig 1 Statistic analyses of Blood Donation after the Earthquake (2008.5.12-5.14) compared to the same period last year in Chengdu area

Blood donor management

Emergency donor cards

成都市应急献血队员卡

姓名:罗晓英 年龄:38 性别:女 血型:A

感谢你成为成都市应急无偿献血队伍中的一员。当遇到突发事件或紧急情况时,我们将以如下方式与你联系:

- 1、电话通知;
- 2、新闻媒体发布紧急通知。

衷心感谢你,你的爱心和奉献让你肩负起挽救生命的神圣职责。

无偿献血 无尚光荣

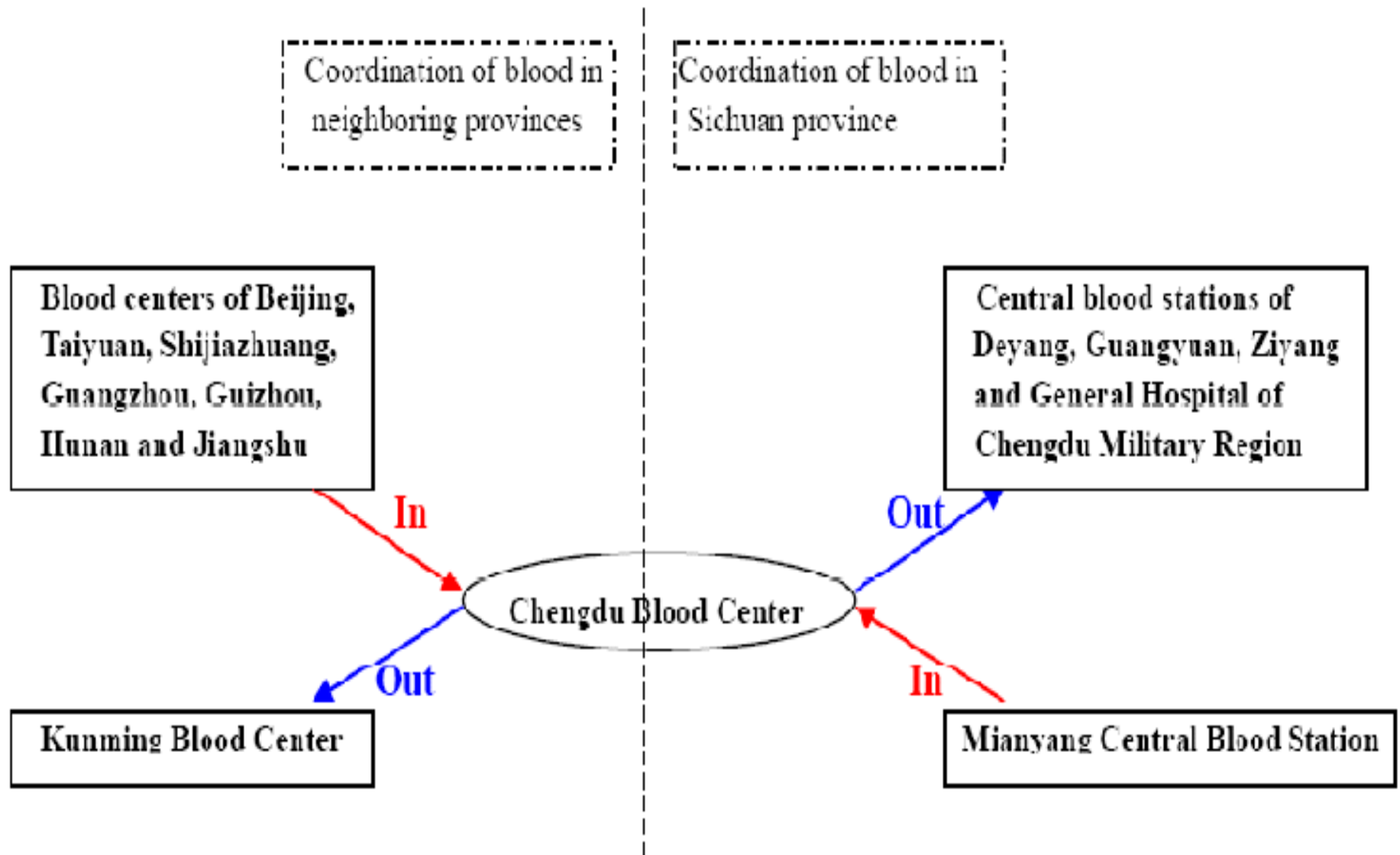
Donor lists

无偿献血登记表									
姓名	性别	年龄	血型	身份证号	联系电话	工作单位	居住地址	备注	签名
罗晓英	女	38	A	510101196401010001	13980073711	中国华西工程建筑设计院	成都市高新区		
王明	男	45	B	510101196901010002	17800000000	四川华西工程建筑设计院	成都市高新区		
李华	男	35	O	510101197401010003	17800000000	四川华西工程建筑设计院	成都市高新区		
张强	男	25	A	510101199901010004	17800000000	四川华西工程建筑设计院	成都市高新区		
赵伟	男	30	B	510101197901010005	17800000000	四川华西工程建筑设计院	成都市高新区		
孙丽	女	28	O	510101199701010006	17800000000	四川华西工程建筑设计院	成都市高新区		
周涛	男	32	A	510101198201010007	17800000000	四川华西工程建筑设计院	成都市高新区		
吴昊	男	22	B	510101199501010008	17800000000	四川华西工程建筑设计院	成都市高新区		
郑宇	男	27	O	510101199201010009	17800000000	四川华西工程建筑设计院	成都市高新区		
陈静	女	31	A	510101198801010010	17800000000	四川华西工程建筑设计院	成都市高新区		
林峰	男	29	B	510101199001010011	17800000000	四川华西工程建筑设计院	成都市高新区		
黄磊	男	24	O	510101199401010012	17800000000	四川华西工程建筑设计院	成都市高新区		
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周璇	女	23	O	510101199601010015	17800000000	四川华西工程建筑设计院	成都市高新区		
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郑宇	男	25	B	510101199201010017	17800000000	四川华西工程建筑设计院	成都市高新区		
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郑宇	男	25	O	510101199201010081	17800000000	四川华西工程建筑设计院	成都市高新区		
陈静	女	28	A	510101199101010082	17800000000	四川华西工程建筑设计院	成都市高新区		
林峰	男	30	B	510101198901010083	17800000000	四川华西工程建筑设计院	成都市高新区		
黄磊	男	27	O	510101199001010084	17800000000	四川华西工程建筑设计院	成都市高新区		
徐敏	女	24	A	510101199401010085	17800000000	四川华西工程建筑设计院	成都市高新区		
高翔	男	26	B	510101199101010086	17800000000	四川华西工程建筑设计院	成都市高新区		
周璇	女	29	O	510101198801010087	17800000000	四川华西工程建筑设计院	成都市高新区		
吴昊	男	22	A	510101199501010088	17800000000	四川华西工程建筑设计院	成都市高新区		
郑宇	男	25	B	510101199201010089	17800000000	四川华西工程建筑设计院	成都市高新区		
陈静	女	28	O	510101199101010090	17800000000	四川华西工程建筑设计院	成都市高新区		
林峰	男	30	A	510101198901010091	17800000000	四川华西工程建筑设计院	成都市高新区		
黄磊	男	27	B	510101199001010092	17800000000	四川华西工程建筑设计院	成都市高新区		
徐敏	女	24	O	510101199401010093	17800000000	四川华西工程建筑设计院	成都市高新区		
高翔	男	26	A	510101199101010094	17800000000	四川华西工程建筑设计院	成都市高新区		
周璇	女	29	B	510101198801010095	17800000000	四川华西工程建筑设计院	成都市高新区		
吴昊	男	22	O	510101199501010096	17800000000	四川华西工程建筑设计院	成都市高新区		
郑宇	男	25	A	510101199201010097	17800000000	四川华西工程建筑设计院	成都市高新区		
陈静	女	28	B	510101199101010098	17800000000	四川华西工程建筑设计院	成都市高新区		
林峰	男	30	O	510101198901010099	17800000000	四川华西工程建筑设计院	成都市高新区		
黄磊	男	27	A	510101199001010100	17800000000	四川华西工程建筑设计院	成都市高新区		

Increasing donor data base
Donor acknowledgement



Blood Coordination & transportation

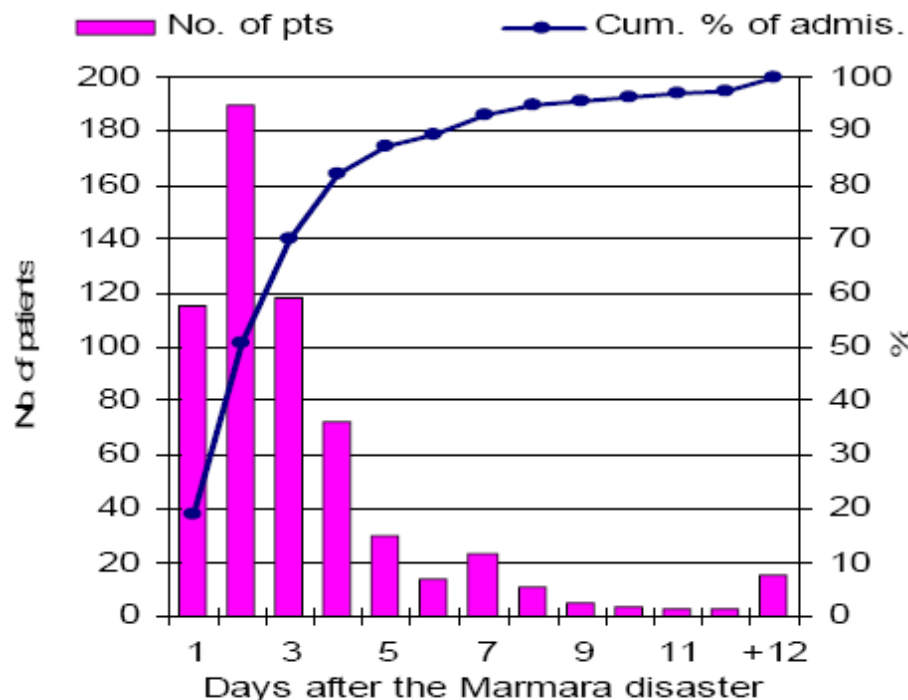


LOGISTIC PLANNING in HOSPITALS - I

(Timing of hospital admissions)

In disasters most admissions occur within 3 days

Noji, 1990



Mildly injured victims:



- Arrive shortly after disaster
- Occupy positions of more seriously wounded cases, who often arrive later.
- Can be followed as outpatients

LOGISTIC PLANNING in HOSPITALS - II

(Status of health care personnel)

- Personal harm to themselves or family members
- Work overload
- Panic and depression

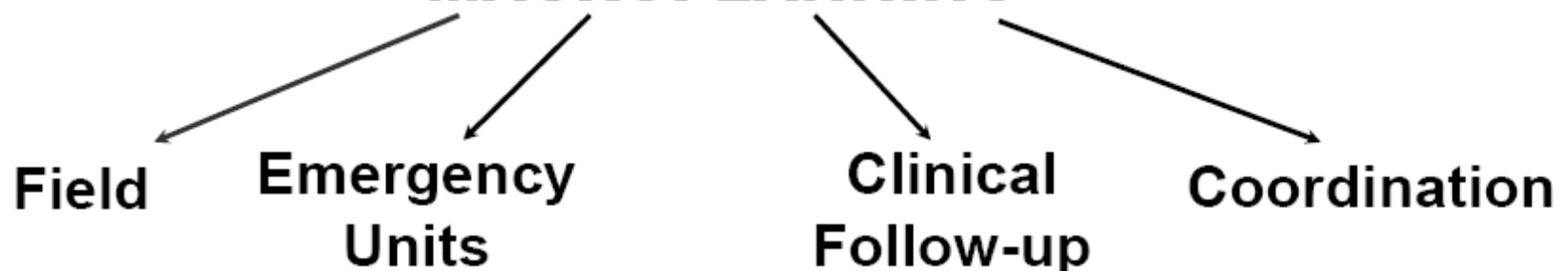
Ukai, 1997; Waeckerle, 1991



INEFFECTIVE WORK

- Experienced personnel \Rightarrow first days
- Avoid “burn-out” syndrome
- Clear guidelines may minimize risk of malpractice

MACROPLANNING



Disaster Prediction Modeling

- Introduction
 - Why an emergency plan and prediction modeling was needed at YNHH
 - How a frozen blood inventory was initiated
- Methods
 - How we designed and use the prediction model
- Results
 - A frozen-blood reserve does extend self-sufficiency
- Conclusions
 - Key findings
 - Changes made to the YNHH Emergency Blood Management Plan

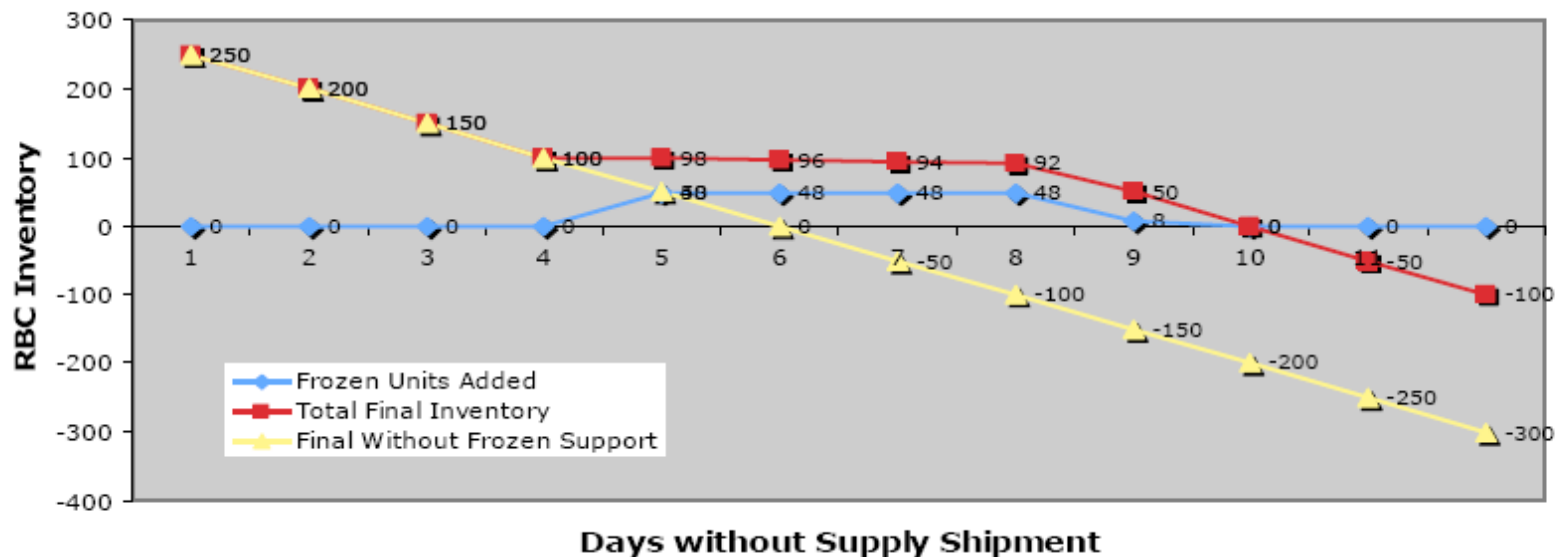
Michelle Erickson, M.D., M.B.A
Yale University
School of Medicine

Disaster Prediction Model

Input Data	
Frozen RBC units	200
Closed system cell processors	1
Open system cell processors	2
Hours to thaw each unit	1.5
Demand per day	50
Liquid inventory in BB	300
Trigger inventory to start thawing	50

Enter variables into the Input Data fields at left to view the resulting Disaster Prediction Projected Inventory Levels.

Projected Inventory Levels



Frozen Red Blood Supply for Various-Sized Hospital Blood Banks

<i>Hospital Size</i>	<i>Daily Demand</i>	<i>Liquid Inventory</i>	<i>No. Cell Washers</i>	<i>Recommended Frozen Inventory</i>	<i>Additional Time until Blood Bank Inventory is Depleted</i>
Small	25 Units	100 Units	1	75 Units	3 Days
Medium	50 Units	200 Units	2	125 Units	2.5 Days
Large	75 Units	300 Units	3	200 Units	3 Days
Very Large	150 Units	400 Units	5	350 Units	3 Days

Frozen Red Blood Supply for Various-Sized Blood Centers

<i>Blood Center Size</i>	<i>Daily Demand</i>	<i>Liquid Inventory</i>	<i>No. Cell Washers</i>	<i>Frozen Inventory</i>	<i>Additional Time Until Inventory is Depleted</i>
Small	200 Units	600 Units	1	400 Units	0 Days
Small	200 Units	600 Units	5	400 Units	0.5 Days
Medium	300 Units	1000 Units	2	500 Units	0 Days
Medium	300 Units	1000 Units	7	500 Units	1 Day
Large	500 Units	1500 Units	3	1000 Units	0 Days
Large	500 Units	1500 Units	10	1000 Units	0.5 Days
Very Large	700 Units	2000 Units	5	1500 Units	0 Days
Very Large	700 Units	2000 Units	15	1500 Units	0.5 Days



30 years continuous evolution in the practice of Crisis or Disaster Management

- Civil defense
- Emergency assistance
- Disaster response and relief
- Humanitarian assistance
- Emergency management
- Civil protection
- Disaster mitigation and prevention
- Disaster Risk Management**

**Strategic shift
from managing
a disastrous
event to more
preventive and
proactive
approaches!!**



Gaps

- Precise causes of injury & deaths
- Prediction models
 - Need for blood & components
 - Re assessing hospital frozen blood inventories
- Alternative communication modes
- Variable transportation modes
 - Efficient cold chain > 24 shipment

Conclusions

- Disasters are local and need to be planned locally – yet learning from international experience **is a must**
- Blood is a key element of the critical health care infrastructure
 - ? How many Pt require Tx
 - 8 RBC/** Transfused Pt
 - 13.5 FFP/** Transfused Pt
- Be Prepared
 - Prepare**
 - Hopefully we won't need to **Respond**
 - Recover**

Our Disaster Recovery Plan Goes Something Like This...

