

# Disaster Plan of Hospital and Emergency Service in the Van Earthquake

## Van Depreminde Hastane Afet Planı ve Acil Servis

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### Abstract

**Objective:** One of the most important occupation field of emergency medicine specialists is disaster medicine. Health services within disaster medicine are quite different from individual health services. Although triage practice is a great problem for hospitals in such kind of incidents; it enables all the medical interventions. In this study, we have aimed to present hospital emergency plan and our triage practice in emergency unit in Van earthquake.

**Material and Methods:** Color coding system was used in triage practice ay Van Region Education and Research Hospital in Van earthquake. All the units, duties of personnel and the places of duty were determined. Emergency unit and recucitation room was marked with red area, intervention tents were marked with yellow area, hospital garden was marked with green area, morgue was marked with black area. There was a trauma team and an emergency medicine spacialist at the entrance of hospital and every corner determined. Patients were evaluated again and again periodically.

**Results:** One thousand ninety patients registered in three earthquakes in total. There were 68 casualties. Total triage duration was 1350 minutes and average triage duration is 1.23 min.

**Conclusion:** Every hospital should have their own disaster plan and emergency medicine specialists must be available in the preparation and conduction of disaster plans. Demonstrations should be carried out within disaster plan; demonstrations should be expanded in a way that it would include all the hospitals and other institutions in the city. (*JAEM 2012; 11: 86-92*)

**Key words:** Earthquake, emergency medicine, disaster plan

### Özet

**Amaç:** Acil Tıp Uzmanlarının en önemli uğraş alanlarından birisi de afet tıbbıdır. Afet tıbbındaki sağlık hizmetleri bireysel sağlık hizmetlerinden çok farklıdır. Bu tür olaylarda triaj uygulaması hastaneler için büyük bir problem olsa da tüm tıbbi müdahaleleri kolaylaştırmaktadır. Bu çalışmada, hastane afet planı ve Van depreminde acil servisteki triaj uygulamamızı sunmayı amaçladık.

**Gereç ve Yöntemler:** Van depreminde, Van Bölge Eğitim ve Araştırma Hastanesi'nde triaj uygulamasında renk kodlama sistemi kullanıldı. Hastane-deki tüm bölümler ve personelin görevi görev yeri belirlendi. Acil servis ve resüsitasyon odası kırmızı alan, müdahale çadırları sarı alan, hastane bahçesi yeşil alan, morg siyah alan olarak belirlendi Hastane girişinde ve belirlenen her alanda travma ekibi ve bir acil tıp uzmanı bulunduruldu. Hastalar belirli aralıklarla tekrar değerlendirildi.

**Bulgular:** Meydana gelen 3 depremde 1090 yaralı başvurdu. Atmış sekiz olgu kaybedildi. toplam triaj süresi 1350 dk olup ortalama triaj süresi 1.23 dk'dır.

**Sonuç:** Her hastanenin kendine ait bir afet planı olmalı ve afet planı hazırlanmasında, yürütülmesinde acil tıp uzmanları bulunmalıdır. Afet planı içinde tatbikatlar yapılmalı ve tatbikatlar genişletilip il genelindeki bütün hastaneler ve diğer kurumları da kapsamalıdır. (*JAEM 2012; 11: 86-92*)

**Anahtar kelimeler:** Deprem, acil servis, afet planı

### Introduction

The total population of Van is 1.022.310 according to the 2009 data-base of the address based population registration system. 51.60% (527.525) of this population live in the city, 48.40% (494.785) live in villages. The surface area is 21.334 km<sup>2</sup> and there are 48 people

per km<sup>2</sup> province-wide. There are 11 towns and 575 villages connected to Van.

An earthquake is a natural disaster which causes the most casualties and injuries both in our country and throughout the world (1, 2). A large part of our country is in the 1. degree seismic zone. In the last century, 100.000 citizens lost their lives due to earthquakes (2, 3). However, although periodic earthquakes are experienced in many

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seismic zones, especially on the active fault-line, the rate of casualties and injuries do not change, moreover conurbations and earthquake non-resistant buildings increase more and more due to inadequate first responders (4, 5).

Hospitals and health staff who are prepared for these incidents would decrease possible losses. One of the main terms of a modern society are relief programmes and healing the wounds of those who are injured in the disaster. A hospital should have a written, applicable disaster plan in order to be successful in the diagnosis and treatment of patients during disasters and minimize the problems as much as possible (6).

## Material and Method

The HDP was prepared with the support of experts from the Prime Ministry Disaster and Emergency Management Presidency (AFAD), Ministry of Health, General Directorate of Primary Health Services, Health Directorate and Directorate of Civil Defense. New assignments were made in the location of those who were injured or had injured family members. Hospital stations were established by the National Medical Rescue Team (NMRT) and Civil Defense organizations from our city and from the cities in the vicinity. The HDP which was applied was also the disaster plan for Van. The practice was not a kind of drill or a retrospective study but the disaster itself and it was an actual event. Hospital registers of the Van Education and Research Hospital were compared with data of the Disaster Coordination centre.

## Results

The Van Education and Research Hospital began providing service in May, 2011. The hospital provides services to 4000-4500 (1000-1500 being referrals to emergency polyclinic) with 120 specialist physicians, 510 beds (can be increased up to 710 beds in the event of a disaster), 18 operating rooms and an intensive care unit for 40 people. There is a hospital disaster plan available whose practice has not been put into practice yet. There were more than 3000 after shocks (Richter Range 3-6 Mw) two of them being large earthquakes in the Van city centre and districts between 23 October and 30 November.

### In the first earthquake

An Earthquake epicentered in Tabanlı Village and measuring 7.2 on the Richter scale struck the Van Province, at 13:41 on 23 October 2011. According to official figures, there were 604 casualties in total, with 61 casualties in the city centre, 66 in the villages connected to city centre, 477 in Ercis, and approximately 3500 injured people were referred to hospitals. In addition to this, various buildings were damaged. Many hospitals, primarily the university hospital, were also damaged. The Van Education and Research Hospital gave service immediately after the earthquake primarily with its emergency service and operating rooms, services and then hospital stations as well. The hospital accepted nearly 1500 injured people in a week; 60 of them lost their lives. The triage system lasted for nearly 10 hours. Approximately 750 patients were discharged after simple interventions, while around 250 patients were kept under medical observation in emergency or observation tents. While 150 patients were transferred to other centers, 200 patients were hospitalized and 130 were operated on (Figure 1).

### The second earthquake

An Earthquake epicentered in Edremit Town and measuring 5.6 on the Richter scale struck the Van Province, at 21:23 on 9 November 2011. According to official figures, 22 buildings collapsed, 39 people died and 300 injuries occurred, since all the hospitals in the Van city centre were damaged, our hospital carried out its functions in the hospital station founded in the garden for two days. The triage system operated actively for 12 hours. Around 200 patients were given simple interventions in emergency tents and 50 patients were kept under observation after they had been attended to in hospital stations. Nearly 50 patients were transferred to hospitals in the vicinity (Figure 2).

### The third earthquake

An Earthquake epicentered in Kurubaş Village and measuring 5.0 on the Richter scale struck the Van Province, at 02:47 on 30 November 2011. While there was no major casualty in this aftershock, 24 injured people were referred to our hospitals. No one has been hospitalized due to aftershocks. Treatment was given in the hospital station in the hospital garden. The triage operation lasted half an hour. While 16 of the patients had extremity injuries, 8 had soft tissue trauma. All the interventions were given in the emergency unit (Figure 3).



Figure 1. The situation after the earthquake (23 October 2011)



Figure 2. Rescue work from the ruins of a hotel after the earthquake (9 November 2011)

The number of patients who referred to hospital during triage and average duration of care are given in Table 1.

Average triage duration (time spent for each patient): and triage duration/number of patients are given in Table 2.

The accuracy rate is 55-78% in the drill carried out in foreign countries, and the accuracy rate in Turkey is 100%. Triage duration in Van Education and Research Hospital was calculated with the observation of patients' registrations after an actual earthquake. Therefore the accuracy rate is 100%.

### Our Hospital Disaster Plan

**SCOPE:** Since Van and its district is an active seismic zone, it is a border town which allows immigrants, and has plants and studies which may release chemical, biological, nuclear and radioactive substances can also cause disasters; the aims are to

1. Build a secure and functional health facility for patients, relatives of patients, visitors and workers,
2. Decrease danger and risks in any event of disaster and all the staff should take their position as soon as possible in the event of disaster,
3. Build a secure and functional health facility for victims of disaster, patients, relatives of patients, visitors and workers,
4. Create an efficient management system to decrease and control danger and risks and to provide security,
5. Sustain the establishment,
6. Provide the most effective first and immediate aid and operational assistance as the main purpose;



**Figure 3.** Some of the hospital stations built in the hospital garden

7. Protect life security in the event of disaster, prevent loss of goods and information, provide security and medical opportunities for patients and their relatives, determine precautions against disasters such as earthquake, fire, epidemic illness etc.

**SCOPE:** The plan was prepared according to international standards, in accordance with the commands and directives of the Head Physician. As is seen in the example of many countries, it is possible to avoid severe injuries in a disaster with well-prepared planning. For this, it is essential to be prepared for the disaster and have good planning, and all the staff should know "what" to do and perform their tasks in the drills, and everybody should feel the responsibility of duty with the consciousness of their task. The plan is comprised of the principles of tasks to be performed by emergency services and other facilities, their coordination and association principles, materials and equipment and assignments.

Disaster commander: Head doctor of hospital

Operation chief: Emergency doctor

Coordination chief among institutions: Hospital manager

Field managers of the disaster: Emergency medicine specialist

Organization of hospital disaster is seen on Figure 4.

### Stages of Hospital Disaster Plan

**Damage Reduction:** They can be collected under various titles such as decrease of structural and non-structural epidemic, chemical, biological, radioactive and nuclear dangers. Our building, being new, gives us advantages in this sense. Precautions to be taken within a settlement can be actualized rapidly and the stages are immediately carried into action. In this sense, fire exit signs are located at suitable places in the hospital. There was no obstacle in front of fire exit doors, thereby the access was clear. Fire Extinguishers are accessible, their controls are done periodically and necessary education is given to the whole staff on this issue.

**Vehicle Traffic:** Fulfillment of transportation needs of service-givers by making arrangements in the hospital area. Parking lots were arranged according to the current suitable features of the hospital, parking lot attendants were assigned. The traffic route was arranged and unconventional traffic and parking problem were solved.

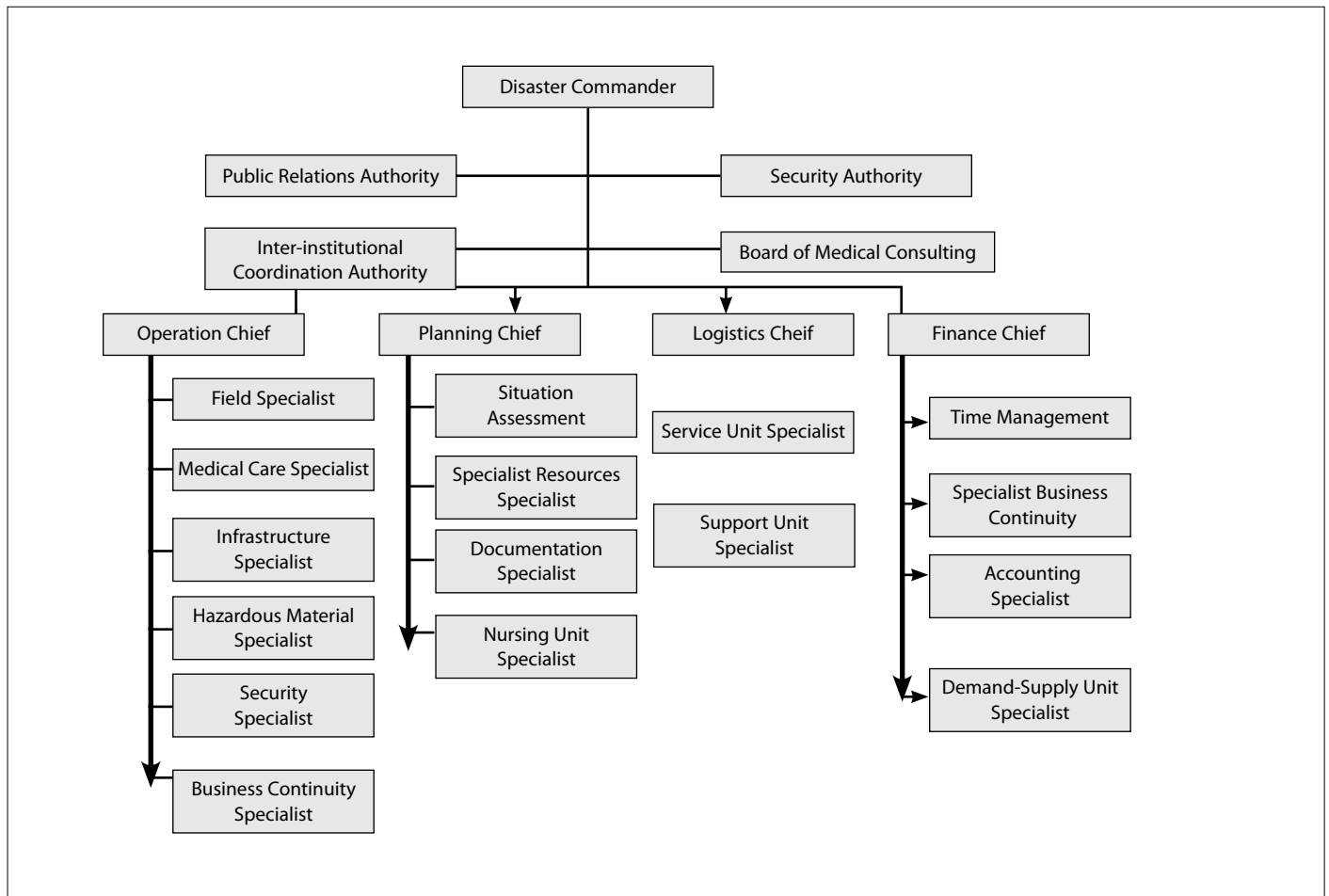
**Security:** Necessary arrangements were made to operate security services efficiently both in the current situation and in unexpected conditions, forensic cases and the like; A Private Security

**Table 1.** Number of patients referred to hospital during triage and average duration of care

	1. earthquake	2. earthquake	3. earthquake	Injured people in total
Number of patients	816	250	24	1090
Triage duration (minute)	600	720	30	1350
Number of casualties	60	28	0	68
Average triage duration (minute)	0.73	2.88	1.25	1.23

**Table 2.** Average triage duration in some centers

	Number of patients	Triage duration (minutes)	Average triage duration (minutes)
New York	130	60	0.46
Hong Kong	19	45	2.36
Ankara (Hacettepe Univ.)	19	8	0.42
Van (VEAH)	1090	1350	1.23



**Figure 4.** Disaster organization scheme

Agency was founded with the method of contracting services. Necessary instructions and plans were prepared. Trainings were done by Civil Defense Expertise within a program.

**Electric Network:** There are 3 generators to compensate our needs when the electricity is cut in the city. A sufficient number of technical personnel was assigned for maintenance and repair; these technical personnel conduct periodical maintenance as well.

**Elevators:** There are elevators for patients, their relatives, visitors and staff in every department of the hospital. There are elevators to carry food and waste material also. Therefore they are constantly in operation. Contracts for Maintenance and repair were made; thereby they function smoothly within the contract. Elevators are under constant observation and control by technical staff of the hospital.

**Environmental Cleaning:** General cleaning of the hospital is carried out with the method of contracting service. Relevant firm acts according to the commands and instructions of an authorized person of our institution. All the cleaning is carried out by the cleaning staff 24 hours and 7 days.

**Compressed Gas Storages:** They are used in operating rooms, intensive care and services as compressed in liquid tank in order to use fresh-air respiratory equipments. Necessary precautions are taken and they are protected in wire mesh.

**Medical Gases:** They are used in operating rooms and emergency polyclinic in little portable tubes. They are always in stock; controlled and followed-up by personnel.

**Palatable Water systems:** The water we currently is the city water supply. Our hospital has a water capacity of 185 tons; one of them has a capacity of 90 tons in "Fire Extinguish Systems" with 50 tons being available, the second tank, which is fed with city water supply, has a capacity of 45 tons and the main distribution tank has a capacity of 90 tons. They are left to mature after storage in carbon and sand refinement tanks for chemical and biological particles. Chlorination and softening systems are available among tanks. Distribution is done with a hydrophore system. Weekly and monthly water analysis of the city water is done and the water is disinfected according to its location if necessary. Water is used securely since it is continuously under control by our technical personnel.

**Waste water systems:** There is no facility for waste water system within our hospital. Water disposal is carried out through the city sewer system. Manhole maintenance, cleaning and control are carried out weekly and monthly by our technical personnel.

**Fire Extinguisher equipments:** Our building is equipped with Fire Extinguisher systems which were prepared according to laws and regulations on Fire Protection of Constructions; fire cabinets including fire hose and one fire extinguisher. They are mounted on walls within the reach of a person. They can be monitored with visually since they have a pressure indicator. These controls are done weekly, semi-annually and annually. Necessary controls of fire cabinets are made. Moreover, there are extra Fire Extinguishers to be used in the event of any disaster or in personnel training. We carry out planning for some other department which pose a danger.



### A. Critical Zones

**Crisis center:** The crisis center is determined by the Head of Hospital Disaster. This place is determined before the disaster. This place was determined as the Head Physician meeting hall.

**First aid center:** The place of the emergency unit.

**Meeting center:** The place to be determined by the crisis center.

**Equipment centers:** The storages where extra medical equipment, search and rescue equipments, fire extinguishers are kept.

**Door Keys of Institution:** It is the place where various door keys of the hospital are kept in a closed key cabinet in the room of the on duty officer.

**Evacuation:** Evacuation is carried out following secure exit routes in the event of evacuation from hospital when the region for mobile hospital is determined by the crisis center.

#### Events For Disaster Declaration in The Hospital:

1. Natural disasters,
2. Industrial accidents,
3. Fire,
4. Flood, Submersion,
5. Terrorist attacks,
6. Mass poisoning,
7. Pandemic,
8. Traffic Accidents,
9. Mass drills, social events, injuries after sports competitions and concerts,
10. Disaster management starts without waiting for registration of injured people or patients after meeting injures.
11. When there is any incident that may result in fights and injures during sportive competitions in the City Stadium, Sports Hall and other sport complexes; disaster management begins immediately.

#### Emergency Organization in Disasters

Immediately following a disaster declaration, the head of HDP puts the "Hospital Disaster Plan" into action if necessary. However, if s/he is not at the hospital and cannot be reached, the person who is responsible for this duty is the Assistant Head Physician who is on duty at that time and represents him. If the disaster happens out of working hours, the person who is responsible for the duty is the on-call consultant or on-call emergency physician.

Lists of addresses and phone numbers which are prepared to reach Emergency personnel at the hospital are always kept up-to-date by the Emergency Supervisor Nurse. However, if the telephone connection is cut during the disaster, attempts to reach emergency

personnel are made by mobile telephone, satellite telephone, radio-telephone, messenger, means or through media.

For the Disaster Plan to operate actively and perfectly, all necessary personal information such as their home address and telephone numbers concerning doctors at Emergency Units and other personnel, have to be known.

#### Area to be Established in Front of the Emergency Area in the Event of Disaster:

- a. The area where ambulance and helicopters would bring patients,
- b. Triage area,
- c. Patient admissions area,
- d. Intervention area of patients whose general conditions are stable and can be treated as outpatients (GREEN AREA), The open area in hospital garden
- e. YELLOW AREA for the injured who have no life-threatening injuries and can wait for medical intervention and care. Emergency Unit
- f. (RED AREA), for those who have life-threatening injures and need emergency intervention, resuscitation rooms, emergency operating rooms, first interventions rooms of emergency units.
- g. (BLACK AREA) for those who are brought dead or are about to die. Morgue

**TRIAGE:** In cases when there are a great number of patients and injured people after a disaster, triage application will be conducted at the scene and health-care organizations for rapid choice and coding process in order to determine the people who need primary treatment and transport.

- a) Triage application will be conducted at the entrance of the Emergency Unit. No patients shall be allowed in unless the confirmation of the triage supervisor is obtained.
- b) The security of the triage area will be ensured by the Security Manager, head of hospital security.
- c) Triage application shall be conducted by the attending doctor of Emergency. If s/he is not at the hospital or cannot be reached at that time, triage will be performed by the on-call emergency doctor.

Since we had not prepared the triage cards that we had planned, we directed patients to the. Evacuation area of the hospital (Figure 5).

#### Triage Preparation

It is used in the event of emergency or unexpected conditions that can affect the hospital. At least, the Executive Board of Hospital Disaster Planning should meet up in order to carry out a situation assessment, planning and take decisions.

Emergency coding system is observed in Table 3.

**Table 3.** Emergency coding system

Event	Color of Code	
1 Natural disasters	Used as a warning in the event of earthquake, flood or hurricane	GREEN
2 Fire Danger	Used in the event of fire in hospital	RED
3 Security	Used when the security of hospital is under threat due to incidents, such as bombing terrorist attack etc	GREY
4 KBRN Decontamination	Used when contaminant materials cause danger for the hospital	ORANGE
5 Mass accidents	Used for the events when a great number of trauma incidents will be experienced as a result of mass accidents. In this incident, all the units – primarily emergency and then all the polyclinics responsible for traumatic patients, services and operating rooms should make their preparations as soon as possible	YELLOW
6 War	Used in the event of war	BLACK

**TRIAGE:** This warning indicates that the hospital is, or is going to be profoundly influenced by the disaster. All the units and the whole staff should take their place in the Hospital Disaster Plan. Red area (emergency unit and resuscitation room), yellow area (intervention tents), green area (hospital garden), black area (morgue) were determined by Emergency Medicine Attendants and Trauma staff at the entrance of hospital. One emergency medicine attendant was left available in each unit. Patients were evaluated periodically.

Hospital stations with 50 beds were built next to the hospital (Figure 6).

## Discussion

HDP is a disaster intervention system. This system is activated immediately in the event of a disaster and approaches the case in a specific system. Personnel who are staff have been well-planned and identified in advance. It enables regular registration. A common language shall be used between units. It is a kind of discipline that can be understood and applied by the whole staff (6, 7).

Disaster experts and staff should not be expected outside the hospital. Instead, hospital staff should undertake the care of these people and start service according to the disaster plan. Therefore, all the staff should know the plan in advance and be prepared for it.

In order to be successful in the diagnosis and treatment of patients and injured people at the hospital in a disaster and to minimize the problems, every hospital should have a written disaster plan. With the increase in the possibility of a real disaster and expectations of the public about necessary and prompt intervention of hospitals after a disaster, detailed and complete disaster planning has become compulsory. On the other hand, earlier expectations at disasters show that documentation and registrations have not been conducted well in the disasters. This situation results in incorrect reporting, analysis and evaluation after disasters.

Therefore, this forces institutions to prepare a plan which has a registration system and easy reporting channels. All personnel at this unit should be determined in advance. The plan should be learned by the personnel very well and should be tested periodically in order to not to encounter problems during disasters (7, 8).

A plan shall be prepared for all these issues mentioned above in a disciplined and standard manner, and the plan should be reviewed by the hospitals and transferred and taught to whole staff before the disaster. After HDP is prepared, it shall be rehearsed at least twice a year and twice at a meeting with the participation of the whole staff (6, 8). After the September 11 attacks, disaster programs were renewed and improved in many hospitals in the USA and other countries. Sensitivity towards disasters has increased in our country after the 1999 earthquake.

In the disaster drills of the plan Shenker et al completed, their triage involved for 130 injured people in 1 hour (9); Lau et al. completed their triage for 19 injured people in 45 minutes (10). In a drill carried out in our country, the triage for 19 injured people was completed in 8 minutes (11). In the triage carried out in our hospital, although it was not a drill and there was an excessive number of injured people; it was a great success to finish triage in 10 hours in the first earthquake, in 12 hours in the second earthquake and in half an hour in the third earthquake (Table 1). The reason for this is primarily the emergency medicine specialists who have been educated primarily in disaster and triage.

Due to chaotic working conditions; emergency medicine specialists are the doctors who can serve most efficiently in any event of disaster. Due to the fact that first admissions in disaster are made at emergency units, it is quite important that emergency units are ready for the disasters, emergency medicine specialists serve in hospital disaster planning and disaster preparation (12).

ACEP (American College Emergency Physicians) Emergency medicine specialists have important roles in disaster cases. One of the most important of these is about the operation of multidisciplinary institutions in disaster (13). Some of the drills in the department of emergency medicine taking inter-institutional operation as a model and conducting drills with the cooperation of fire civil defense are considered as steps taken in parallel with these suggestions. Moreover, emergency medicine specialists and institutions serving in disasters should prepare for disasters and also prepare disaster plans for their own; and take important roles in triage and resource management (14).

One of the most important points is that triage should be conducted on the scene and the most suitable transfer should be conducted after the first intervention. The NMRT (National Medical Rescue Team) has proved itself after the Marmara earthquake. The important role played by the UMKE (NMRT) in the intervention and



Figure 5. Evacuation area of the hospital



Figure 6. Hospital stations with 50 beds built next to the hospital

triage, the effective management of the head physician coordinating personnel and managing hospital disaster plan, in addition to these doctors coming from the vicinity and from all over Turkey, have contributed to our examination in the Van Earthquake.

## Conclusion

Every hospital should have its own disaster plan and conduct regular drills. Emergency medicine specialists should be available in the preparation and operation of disaster plans. Drills should be expanded and include every hospital and other institutions within the province

## Conflict of Interest

No conflict of interest was declared by the authors.

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