A Multidisciplinary Field Hospital as a Substitute For Medical Hospital Care in the Aftermath of an Earthquake: The Experience of the Israeli Defense Forces Field Hospital in Duzce, Turkey, 1999

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IDF = Israeli Defense Forces
OR = operating room

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Abstract

The damage created by an earthquake can overwhelm local health services, and damage to clinics and hospitals can render them useless. After an earthquake, even undamaged medical facilities cannot be used for a period of time if there is a risk of aftershocks and collapse.

In such a situation, there may be calls for international health teams – but what constitutes the optimal medical aid a few days after the event? Does a military field hospital fill the "gap" in the local healthcare system?

On 12 November 1999, a 7.2 magnitude earthquake struck Duzce, Turkey. All of the medical activities of the responding Israeli Defense Forces (IDF) mission team field hospital in Duzce, Turkey were recorded and evaluated. A total of 2,230 patient contacts occurred at the field hospital during the nine days it operated. Most of the patients who presented (90%) had non-traumatic medical, pediatric, or gynecological problems unrelated to the earthquake.

The IDF hospital offered medical care provided by specialists, hospitalization, and surgical abilities, which Duzce's hospitals could not offer until two weeks after the earthquake. These results strengthen the importance of a multidisciplinary, versatile, field hospital as an aid to an earthquake-affected population during the first few weeks after an earthquake.

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Introduction

The damage caused by an earthquake poses a challenge to healthcare systems in the affected region. On one hand, the system may be overwhelmed with a high number of casualties. On the other hand, hospitals and other healthcare facilities generally may be compromised heavily: buildings may be damaged, and the supply of water, electricity, medical gasses, etc. may be limited. The transportation infrastructure may be severely damaged, creating problems for both people and equipment arriving at the hospital.[1,2]

In this aspect, the critical time is within the first two weeks after the earthquake, since the risk of secondary earthquakes, or aftershocks, prevents the use of many indoor medical facilities in the earthquake zone, even if they were not grossly damaged by the precipitating event.

The optimal deployment of medical assistance for this critical, post-earthquake period is controversial.[3,4] Field hospitals, mainly of foreign med-

Field	Operation	Number of operations in Duzce
General surgery	Appendectomy	4
	Abdominal exploration	1
	Incarcerated hernia	1
	Omentopexy	0
	Total general surgery	**6**
Orthopedic surgery	Nerve exloration	3
	Tendon repair	6
	Amputations	2
	Fracture fixation	1
	Total orthopedic surgery	**12**
Obstretics/ Gynecology	Cesarian section	4
	D & C	5
	Labors	2
	Total Obstretrics/ Gynecology	**11**
Soft tissue and plastic surgery	Debreadment	0
	Abscess drainage	5
	Reconstructions	3
	Skin grafts/flaps	2
	Laceration repair	0
	Total soft tissue	**10**
Total operating room activity		**39**

Table 1—Operating room activity in Duzce field hospital (D & C = dilation and curettage)

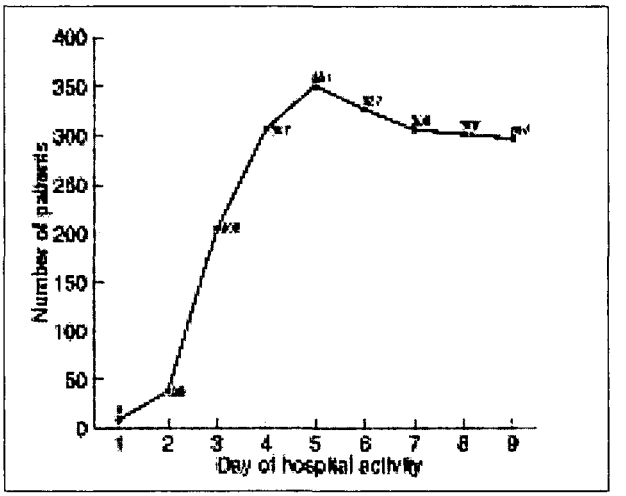

Figure 1—Number of patients seen in the field hospital per day

ical mission teams, frequently are operated in earthquake zones, but their exact role in substituting medical services until local healthcare systems regain control, is not well-established. Some of the international medical relief at disasters happens to be disorganized, ineffective, and, at times, irrelevant.[5–8]

The medical activities of a military field hospital, operated by Israeli Defense Forces Medical Corps at Duzce, Turkey, were documented in order to examine its role in the help effort.

Methods

Pre-event medical system

The pre-disaster medical service in Duzce consisted mainly of three fully equipped, general hospitals: (1) the social security hospital; (2) the state hospital; and (3) the University hospital. Small district health institutes provided primary outpatient care services.

Event

On 12 November 1999 at 22:00 hours, an earthquake of 7.2 magnitude (Richter scale) struck Turkey. It was a recurring earthquake, since Turkey suffered a similar event in a nearby region only three months before. Turkey had suffered 705 fatalities, and approximately 3,500 people were injured in the November earthquake. The epicenter was 200 km (120 miles) southeast of Istanbul, and resulted in destruction in the cities of Kynashlee and Duzce. The earthquake was localized to that area, and other cities in Turkey sustained only slight damage. However, the damage to Duzce's infrastructure was significant—electricity and water supplies were shut down in most city areas, 70% of the buildings were damaged (750 buildings overall) and 90% of the citizens were forced to live in tents in the cold, rainy weather.

The earthquake significantly damaged Duzce's healthcare system. Damage to the northern wing of one of Duzce's hospitals subsequently led to the complete collapse of the building. Hospitals also were damaged in nearby cities (e.g., Kaynasli and Boludagi). The main problem occurred during the first two weeks after the earthquake, when the occurrence of small aftershocks prevented indoor crowding, including the routine use of hospitals and clinics.[9] Surgical capabilities and operations which must be conducted in a closed, clean, and dust-free space, were the most severely damaged services.

Turkan recently has described his experience with Turkey's 1999 earthquakes, stating the lack of "patient services for the post-disaster [event] period."[9]

The local health services gradually regained their capabilities—partial ambulatory care services started on the second day, but hospitalization capabilities, although partial, were regained only one week after the earthquake. Surgical abilities were severely compromised for the first two weeks following the earthquake.

Post-event Response—Israeli Defense Forces Field Hospital

The IDF Hospital is a uniformed hospital consisting of both active service and medical corps reservists, some of whom have been experienced in prior missions to earthquake-damaged zones.[10–13]

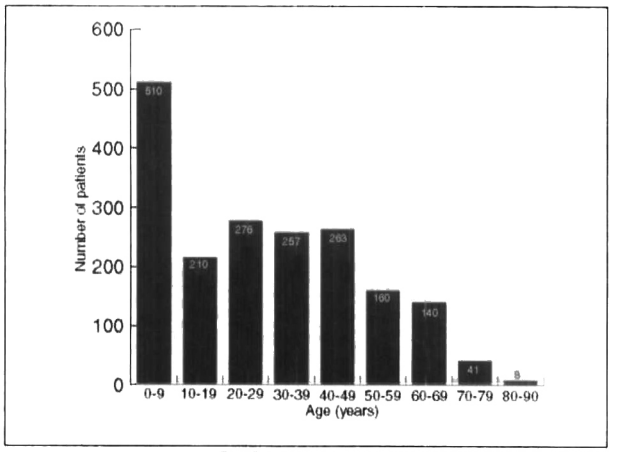

Figure 2—Age distribution of patients seen by the Israeli Defense Forces field hospital in Duzce

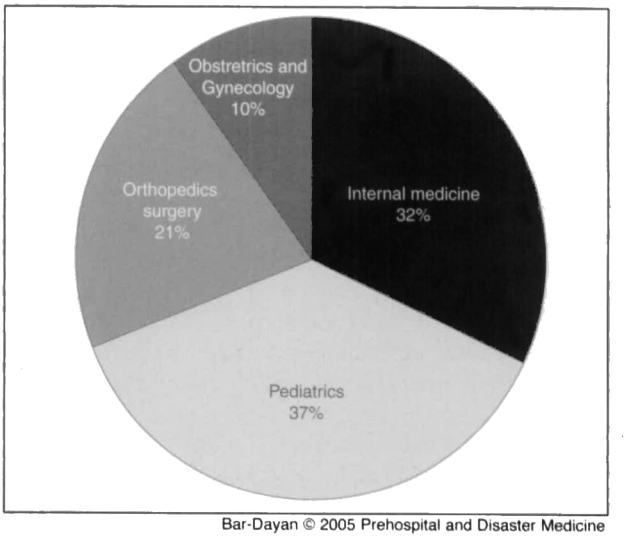

Figure 3—Frequency distribution of patients treated in the field hospital

The IDF field hospital was set up in Duzce on 15 November, three days after the earthquake, after the request of the Turkish authorities, and after consultation with the IDF Surgeon General. The primary, intended mandate of the mission team field hospital was to provide primary and secondary medical care, including intensive care and surgical facilities for the population of Duzce. The Israeli team was organized beforehand, in order to send the most relevant healthcare personnel. The team consisted of 100 medical personnel, including 21 physicians, 13 nurses, two paramedics, 17 medics, support personnel, technicians, and logistic and communication personnel. The hospital included seven clinical sections: (1) emergency room (including triage); (2) general surgery and operating room (OR); (3) surgical intensive care unit; (4) internal medicine; (5) orthopedics; (6) pediatrics; and (7) obstetrics and gynecology. These sections were located in tents near the state hospital, and began to admit patients 63 hours after the earthquake.

All medical activities were documented and later were analyzed.

Results

In its nine days of activity, a total of 2,230 patients were assessed at the hospital in Duzce. The number of patients rose to a peak level of 300 patients per day on the fourth day after beginning the operation, and similar numbers of patients were evaluated and treated on Days 5–9 (Figure 1). The field hospital served as a secondary referral center: patients were referred from the primary care clinics in Duzce, from several international medical teams, and from the three partially functioning hospitals in Duzce. An outpatient clinic, using local medical volunteers, functioned at the field hospital from Day 5 of the operation.

The ages of the patients were highly variable, ranging from newborn to 89 years. The majority of patients were either <10 years old or 20–50 years old (Figure 2).

Interestingly, 90% of patients had non-traumatic illnesses, and only 10% were due to trauma or the earthquake. The low number of trauma victims was constant from the very beginning (third day post-event) and throughout the team's stay.

Non-traumatic problems were: pediatric (37%); general (adult) medicine (32%); 21% were non-trauma surgical consultations (general, orthopedic, and plastic surgery); and 10% were obstetrics and gynecology (Figure 3).

A total of 84 patients (3.8%) were hospitalized in the field hospital for >24 hours (up to one week). Hospitalizations were distributed as follows: 37% internal medicine, 30% pediatrics, 18% surgery and orthopedics, and 15% obstetrics and gynecology (Figure 4).

A total of 39 patients were surgically operated on in the field hospital's OR. Of these, 15% (5 patients) received general surgery, 18% (6 patients) received orthopedic surgery, 38% (15 patients) received surgery related to obstetrics and gynecology, and 29% (11 patients) received soft tissue and plastic surgery (Table 1).

Discussion

The November 1999 earthquake at Duzce presented a complicated combination of a mass-casualty event with a temporary, but significant, shutdown of indoor medical capabilities, especially surgical operations and hospital admissions.

Although exact data regarding local medical systems and population health status pre-event are lacking, it is clear that this population benefited from the full services of three large hospitals, of which only a minor section continued to function after the earthquake. Most departments (including the ORs) were abandoned because of the risk of aftershocks occurring and buildings collapsing.

The data show that a well-constructed, multidisciplinary, field hospital oriented for an array of different medical problems fills the "gap" in the medical system created by the damage to the medical infrastructure, giving the population a good response to urgent or semi-urgent medical problems or surgical procedures. The field hospital that

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arrived 2–3 days after the earthquake was not intended to treat injured or earthquake-related patients. It was prepared, however, to assess and treat secondary medical problems typical of an earthquake zone relevant to the crowded, tent-living, evacuated population, such as: (1) the spread of infections; (2) the exacerbation of chronic diseases; (3) the lack of medicine supply; and (4) a variety of stress-related, post-traumatic manifestations.[14–15]

A foreign, military, field hospital is temporal, acting, as the one described here, during the first two weeks after the precipitating event. After these two weeks, at least partial construction and rehabilitation of healthcare facilities generally has been accomplished, and the risk of aftershocks is decreasing.

In conclusion, a field hospital is an important aid for the provision of secondary and tertiary care following an earthquake. It should be constructed beforehand (in the land of origin) according to local data, but still must be versatile and adaptive to the needs of the affected population. Most of its medical activity is the non-urgent treatment of the affected population (including children and pregnant women), with only minimal aid in treatment of earthquake-related traumatically injured victims. It should have operational capabilities of all types of patients.

The field hospital provides the hospitals in the affected area that are already filled with casualties, a good back-up for overwhelmed or damaged services, prevents massive self-referral to the hospitals, and assists the health system to gradually regain its capabilities.

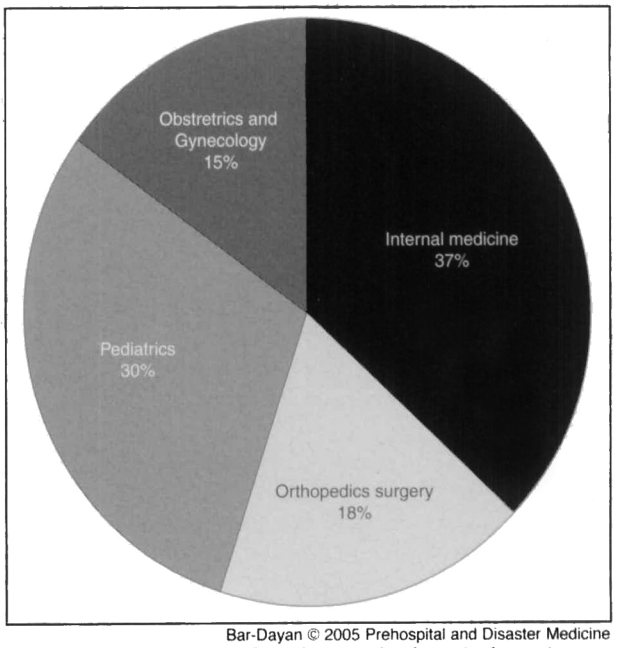

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Figure 4—Frequency distribution by hospital service

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