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## Original Research

# The dynamics of prehospital/hospital care and modes of transport during civil conflict and terrorist incidents



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## ABSTRACT

**Objective:** Prehospital and hospital care during incidents of mass violence and civil conflict involve a number of aspects that distinguish it from care during times of peace. We aimed to analyze the dynamics and outcomes of prehospital and hospital care during ongoing conflicts.

**Study design:** Multicentric prospective observational study.

**Method:** Patients enrolled in the study, which was conducted in Turkey, were all injured in armed conflict and taken to level 1 trauma centers. On admittance, patients were requested to complete a semistructured questionnaire containing questions on patient demographics, transport type, weapons used, injury severity score (ISS), and other incident-related factors. We analyzed patient outcomes (mortality, morbidity, complications, and length of hospital stay) and transfers of patients between hospitals. The present study evaluated the cases of 390 victims enrolled over a 9-month period and followed up for 6 months.

**Results:** The majority of patients were transported by ambulances ( $n = 334$ , 85.6%); other transport modes were helicopters ( $n = 32$ , 8.2%) and private vehicles ( $n = 24$ , 6.2%). Nearly half of patients (48.7%) did not benefit by changing hospitals. During transport to hospitals, 4.1% of the vehicles in the study were involved in accidents. Using multiple regression analysis, only ISS (odds ratio [OR]: 1.098, 95% confidence interval [CI]: 1.044–1.156) and the Glasgow Coma Scale (OR: 0.744, 95% CI: 0.639–0.866) were found to affect mortality. In Receiver-operator characteristic analysis, a cutoff value of 22.5 for ISS had a sensitivity of 100% and a specificity of 89.6% for mortality.

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*Conclusions:* Despite lower ISS values, patient outcomes were worse in terror incidents/civil conflicts. Transport modes did not significantly affect outcomes, whereas hospital transport was found to be inefficiently used.

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## Introduction

The very nature of war has changed in recent years. Armed conflicts are no longer fought only on the battlefield; now, they are also fought in cities and civilian areas, as terror attacks and bombings frequently target civilians. Thus, modern warfare affects civilians more than traditional warfare. In terror attacks (such as the Charlie Hebdo massacre in Paris, various suicide bombings in Turkey, and so forth), often large numbers of people are injured simultaneously, and many victims are need to be transported to suitable trauma care centers while others require urgent medical intervention.

There is disagreement in the literature and in practice regarding prehospital trauma care systems, modes of transport, and emergency services. Debate on these issues is not limited to practices occurring during times of conflict but extends to peacetime as well.<sup>1,2</sup> The present study aims to correct this gap in the literature by examining prehospital care during terror attacks and civil conflicts.

In Turkey, there are three types of patient transport: helicopters, Emergency Medical Services vehicles (EMSs), primarily ground ambulances, and private vehicles. Incidents requiring the transport of patients to healthcare facilities occur in both rural and urban areas.

In the present study, we intend to compare modes of transport in terms of patient mortality and morbidity during times of conflict, in contrast to previous studies which have been conducted in times of peace. We provide a summary of the characteristics of the injuries, the weapons used to inflict said injuries, and the outcomes of the wounded. Finally, we evaluate the dynamics of Turkish health services in the face of ongoing conflicts.

## Methods

### Design/setting

Two university hospitals, one research and training hospital and one military academic hospital participated in this cohort, multicentric study. These four care centers meet the criteria for level 1 trauma centers as described by the American College of Surgeons.<sup>3</sup> The study focused on the eastern and southeastern regions of Turkey.

This prospective study was defined as an observation and recording of the characteristics of injuries caused by high kinetic energy weapons (HKEW). The definition of injury was based on International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10 CM) external causes of morbidity and mortality in operations of war.<sup>6</sup> The present

study was also designed to evaluate the relation between transport mode and outcome (mortality/morbidity, length of hospital stay [LOS], and complications). To that end, the HKEW study group developed a standard questionnaire that includes questions on incident type and time, weapon types, transport mode, Injury Severity score (ISS), the Glasgow Coma Scale (GCS), vital signs, and transfusions performed during transport, and patient demographics. Data were collected between August 15, 2015 and May 1, 2016, and follow-up for surviving patients was completed after six months.

To avoid recall bias and obtain more accurate information from EMS personnel, data collection took place immediately upon arrival to emergency departments for hemodynamically stable patients. For hemodynamically unstable patients ( $n = 83$ ), data were collected postoperatively or following stabilization. To minimize another potential source of bias, interviewing doctors were blind concerning patient outcomes, whereas doctors who gathered data on outcomes were blind regarding exposure (weapon types, transport type, victim profiles, transport times, and so forth).

### Patients' eligibility

All patients (civilians, security, and military personnel) injured in terror attacks (bombings, mass shootings, explosions, and so forth) or during armed conflicts were enrolled in the study (Fig. 1). Patients of all age groups and both sexes were included in the study.

Patients who were dead on arrival or had died at the scene were excluded from the study. Patients whose information (transport mode, characteristics of incident, weapon type, and so forth) was not consistent when cross-checked were also excluded.

### Measurement of variables

There were two types of admissions to level 1 trauma centers: some patients arrived directly from the scene of the event, while others were transferred from a second or third level trauma center to a level 1 trauma care center (Fig. 2). Injuries caused by weapons such as long barrel guns, pump-action rifles, and handguns were categorized as Gunshot Wounds (GSW), whereas those caused by mine explosions, shrapnel, artillery, or other improvised explosive devices were classified as explosion wounds. In cases where the type of weapon was indeterminate, the cause was listed as undetermined. The trauma region was divided into five anatomical regions: head-neck-face-spinal cord, thorax, extremity, abdomen, and skin-soft tissue. If a patient had trauma in two anatomical regions, the injury was classified as two regions, and if more than two regions were involved, the classification was 3 or more regions.

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