

Use and Analysis of Field Triage Criteria for Mass Gatherings

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Abbreviations:

ALS = Advanced Life Support
ED = Emergency Department
EMS = Emergency Medical Services

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Abstract

Introduction: Mass gatherings may result in an acute increase in the number of people seeking medical care potentially causing undue stress to local emergency medical services (EMS) and hospitals. Often, temporary medical facilities are established within the mass gathering venue. Emergency Medical Services providers encountering patients in the field should be equipped with effective protocols to determine transport destination (venue facility vs. hospital).

Hypothesis: Paramedics are capable of appropriately using triage criteria written specifically for a particular mass gathering. The use of triage criteria, when applied correctly, decreases over-triage to the venue facility and under-triage to the hospital.

Methods: Paramedics triaged patients at a mass gathering to a temporary venue facility or to a single emergency department using criteria specific for the event. Cases were reviewed to determine if the patients transported went to an appropriate facility and if the triage criteria were applied appropriately.

Results: Transport destination was consistent with that dictated by the criteria for 78% of cases. Analysis of these cases shows that the criteria had a sensitivity of 100% (95% CI = 58–100%) and a specificity of 90% (95% CI = 73–98%) for predicting which patients needed hospital services and which could be cared for safely in the temporary clinic setting.

Conclusions: Triage by paramedics at the point of patient contact may reduce transporting of patients to hospitals unnecessarily. Patients in need of hospital services were identified. Point-of-contact triage should be applied in mass gatherings.

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Introduction

Mass gatherings (events with >1,000 participants) often have on-site medical facilities.^{1,2} These have been shown to be safe and effective in the treatment of patients and in reducing the number of patients presented to an emergency department (ED).³ Protecting emergency departments from unusual increases in patient volume may be beneficial given current issues with emergency department overcrowding.⁴

Organization of the medical response to a mass gathering will be affected by the characteristics of the event. Events, particularly amateur athletic events, may encompass a wide geographic area encompassing difficult terrain away from ready access to established medical care.^{5–9}

Emergency Medical Services (EMS) personnel often are employed in the initial evaluation of patients at events that encompass a

A. Injuries

1. Extremities

Hospital Transport

Penetrating injury proximal to the knees or elbows, open fractures, fractures with any significant deformity, threat to skin integrity, vascular compromise including pulse abnormality, changes in color or capillary refill or any other signs of vascular compromise. Any knee injury with significant effusion or concern for dislocation. Any suspected dislocation in any extremity. Any injury appearing to require significant analgesia.

Clinic Transport

Simple sprains and abrasions.

2. Head

Hospital Transport

Loss of consciousness, amnesia, vomiting or change in mental status.

3. Neck, chest, abdomen

Hospital transport for any blunt or penetrating injury.

B. Lacerations*Hospital Transport*

Laceration with suspected arterial involvement, bleeding that is not readily controlled, associated with any loss of function in the extremity, associated with any loss of sensation or if any vascular, muscular, tendinous, nervous or bony structure involved.

Clinic Transport

Simple skin lacerations

C. Burns*Hospital transport*

Partial thickness or deeper burn greater than 5% total body surface area, or involving hands, face, feet, or perineum or across a major joint.

D. Bites and Stings*Hospital transport*

Any envenomation that has findings other than local reaction.

E. Environmental Emergencies*Hospital transport*

1. Heat

Any patient with any change in mental status, decreased sweating, syncope in the setting of heat exposure should be transported to the hospital.

2. Cold

Any patient less than 34°C who does not respond rapidly to passive external rewarming should be transported to the hospital.

F. Asthma*Hospital transport*

Patient who experiences signs or symptoms of asthma exacerbation and continues to have an abnormal pulmonary exam or continues to be tachypnic after using their own medications should be transported to the hospital.

G. Patients with chest pain, dyspnea or hypoxia, altered mental status, vomiting greater than one time, vomiting billious or feculent material, or abdominal pain that is severe, associated with decreased bowel sounds, significant abdominal tenderness, guarding or other physical findings should be transported to the hospital.

As always, the paramedic in charge may opt for hospital transport based on clinical judgment

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Figure 1—Document provided to paramedics stating the criteria to determine transport destination for patients encountered at event venues

wide geographical area, as it typically is impractical to have physicians dispersed over such an area. Most of these mass gatherings will have a medical facility to receive patients.⁶⁻⁹ Many temporary medical facilities set up to serve mass gatherings have been described, and guidelines for setting up such facilities have been published.^{1,2,10} Generally, these facilities are not intended to manage complex or critically ill or injured patients, as such patients require transportation to a hospital. Consequently, the question arises regarding which patients should go directly to the hospital from the field, i.e., triaged by the paramedics who are charged with the initial evaluation versus

being transported to a medical facility at the venue for further evaluation. This question is not well addressed in the literature. Several studies address the issue of paramedic's ability to triage patients who do not need transportation to an ED.¹¹⁻¹⁴ Most found under-triage rates of 9-20%, which were deemed unacceptable. However, these studies were performed during the usual EMS operations, not in the setting of a mass gathering.

This study used transport criteria written specifically for use by paramedics. The criteria were designed to triage patients directly from the field, either to the hospital emergency department, bypassing a presumably unnecessary

<p>Services</p> <p>Hospital Admission Parenteral medication administration Chemistry, hematology, microbiology, or other laboratory services Electrocardiogram Radiographic studies</p> <p>Procedures</p> <p>Supplemental oxygen Use of airway device Assisted ventilation (bag-valve-mask, intubation, bipap) Circulatory supportive measures (intravenous fluid, blood, mechanical devices)</p>

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Table 1—Services or procedures occurring in transport or in the emergency department deemed to require hospital transport

and potentially harmful transport to a field clinic located at the main venue of a geographically dispersed mass gathering, or to the field clinic, preventing unnecessary emergency department visits. The performance of the written triage criteria was evaluated, as well as the performance of the paramedics in applying the criteria.

Description of Event

The event was an athletic competition involving approximately 1,500 amateur athletes from five countries. Two-hundred, and forty of the athletes were from the host city. The games took place over a four-day period at 22 geographically separate venues, with a local community center as the main venue. The majority of the venues were within an 11-mile (18.3 km) radius of the main venue, with two being between 25 (41 km) and 35 (58 km) miles away respectively. The largest distance between concurrent competitions was approximately 50 miles (83 km). Competition was held between the hours of 08:30 to 16:30 hours each day. Multiple events were held simultaneously.

Athletes ranged in ages from 13 to 16 years and both males and females competed. The sports and activities were as follows: art competition, baseball, basketball, bowling, cross-country running, dance, golf, gymnastics, in-line hockey, karate (non-contact), racquetball, soccer, softball, swimming, table tennis, tennis, track and field, and volleyball.

A temporary clinic staffed with volunteer nurse practitioners, internists, and family practice physicians was located at the main venue. Clinic facilities included examination rooms, basic splinting and suturing equipment, and oral pharmaceuticals that commonly are available in the clinic setting. The clinic was not equipped to resuscitate critically sick or injured patients, perform procedures that were not minimally invasive, or perform any radiographic studies.

Paramedics attended every event and independently evaluated patients who were presented to the EMS system in the field. Paramedics were stationed at each venue and were supported with ambulances equipped with advanced life support (ALS) capabilities. Other than ambulances, there were no temporary facilities (tents, trailers, etc.). Patients in the field were transported either to the regional, tertiary-care facility emergency department or the field

clinic facility, or were released from care, according to regional protocols.

Methods

A set of triage criteria for use by paramedics staffing the various venues was developed prior to the start of the event (Figure 1). The criteria were designed to identify patients who should be transported directly to the hospital, bypassing the medical facility at the main venue. The physician medical director and the senior ALS staff of the single proprietary ambulance service hired to staff the event developed the criteria. Pre-event briefings by incident commanders included instruction to choose hospital transport for any patient meeting existing regional criteria for ALS-level transport.

Paramedics used standard report forms in the usual fashion for transport records. Caregivers at the clinic used a chart similar to that used in the regional, tertiary-referral center, emergency department. Documentation in the emergency department was in the usual fashion.

A log of all patient encounters was kept by the transporting agency. This log was used to identify patients who were transported from the field and their destination (clinic versus hospital).

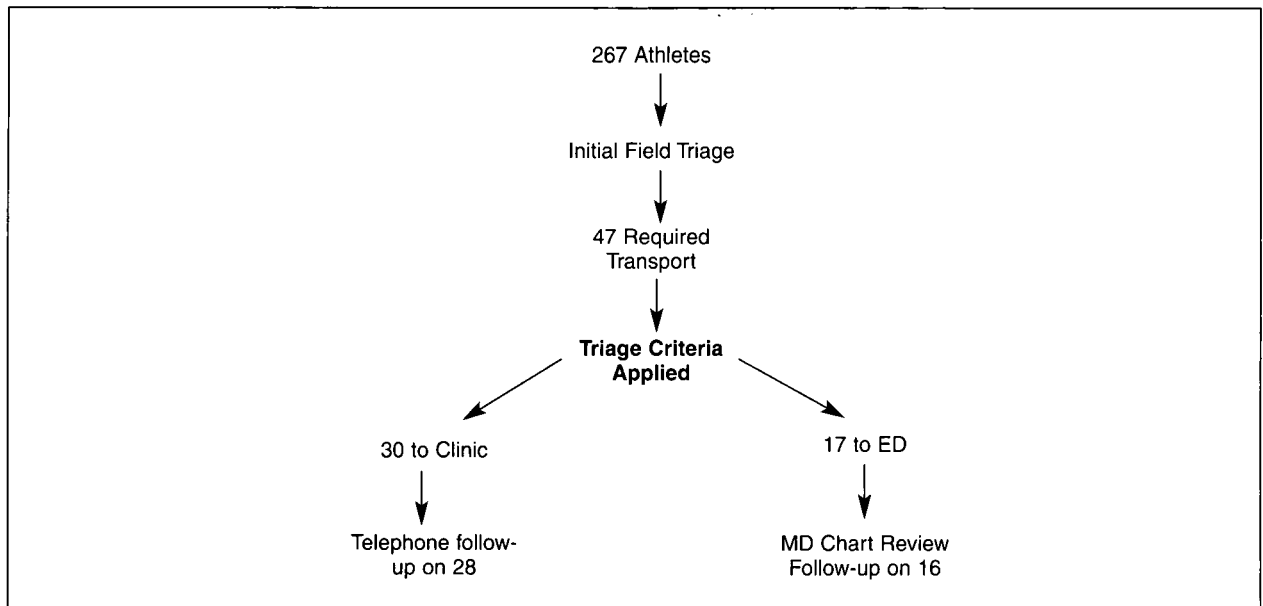
The records of each of the transported subjects underwent case review to determine if the patient was triaged appropriately. This review was considered the gold standard against which the performance of the triage protocol was compared. Review for patients transported to the clinic and those transported to the ED differed as follows.

Hospital and prehospital records of those patients transported to the ED were abstracted by a board-certified emergency physician blinded to the objective of the study using a review instrument designed to identify the need for services or procedures not available at the event facility (Table 1). Patients who fulfilled these requirements were determined to have a need for emergency department evaluation.

Approximately 120 days after the event, patients transported to the clinic were contacted by telephone by a quality-assurance representative of the ambulance service. The quality-assurance representative identified any repeat ED visits or non-elective hospital admission for the same injury or illness sustained during the event. Negative responses were indicative of a successfully diverted, non-emergent, ED visit. Written consent to respond to the quality-assurance representative was not required by the institutional review board.

A study proposal was reviewed and approved by the institutional review board of the university medical center to which the patients were transported. This also is the institution with which the authors were affiliated during the study period.

The accuracy of the triage criteria was determined using the aforementioned retrospective, case-review instrument as a gold standard for deciding whether the patient was triaged to the appropriate location. The triage location dictated by the triage protocol was compared against this gold standard for a measure of protocol sensitivity, specificity, positive predictive value, and negative predictive value (using 95% confidence intervals). The proportion of triage errors due to the



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Figure 2—Disposition and follow-up of patients encountered at event venues. (ED = emergency department; MD = physician)

triage protocol was compared to the proportion of actual triage errors using the chi-square test. Statistical significance was set a priori as $p < 0.05$. All analyses were performed using Statistical Analysis Systems software, Version 8 (Chicago, IL USA).

Results

During this event, EMS personnel evaluated a total of 267 athletes. This represents approximately 18% of all of the participating athletes. Two hundred and twenty patients (82.4%) were released to the care of parents or adult members of the host families. The majority of these patients sought supplies to self-administer care (adhesive bandages, over-the-counter analgesics, fluids for oral rehydration). These patients were not included, as they did not specifically seek medical evaluation or treatment. The triage criteria were applied to 47 patients (approximately 3% of all athletes) who were presented for medical evaluation and were transported (Figure 2).

Of the 47 patients, 37 were transported according to the facility advised by the triage criteria; 10 were not. This translates to a rate of 78% of consistency between destination and criteria (Figure 3).

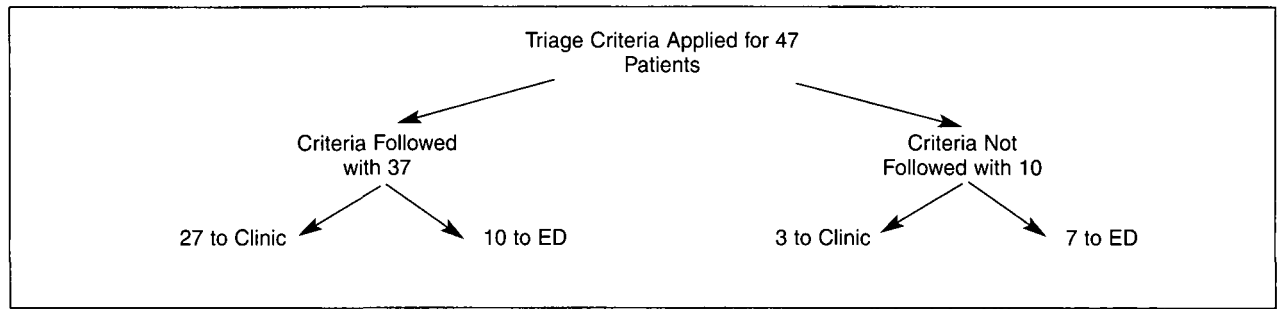
Of the 47 patients, 30 (63.8%) were transported to the clinic and subsequently followed-up by telephone interview. Two people from this group were lost to follow-up. Seventeen (36.2%) of the 47 patients requiring transport were brought to the ED. Sixteen of these patients underwent physician review of their ED chart. One patient from this group was lost to the follow-up analysis.

Of the 37 for whom the triage criteria were followed, 27 (73%) were taken to the clinic and 10 (27%) to the ED. Upon follow-up, none of the patients taken to the clinic required the ED, however two of the patients taken to the

ED could have been treated in the clinic. Of the 10 for whom the triage criteria were not followed, three (30%) were taken to the clinic and seven (70%) to the ED. On follow-up, none of the patients taken to the clinic required the ED. However, one of the seven sent to the ED could have been treated in the clinic. If one assumes that the three patients lost to follow-up were incorrectly triaged than these results translate to an error rate of 8.1% when the triage criteria were followed and 30% when the triage criteria were not followed. The difference between these groups is not statistically significant ($p = 0.07$).

The accuracy of these triage criteria for correctly predicting the need for the ED or the clinic was examined in the 37 patients for whom the triage criteria were followed. Using follow-up information as the gold-standard to whether the patient was triaged to the appropriate location, these triage criteria were determined to have a sensitivity of 100% (95% CI = 0.58, 1.0), a specificity of 90% (95% CI = 0.73, 0.98), a positive predictive value of 70% (95% CI = 0.34, 0.93), and a negative predictive value of 100% (95% CI = 0.87, 1.0).

None of the patients required hospital admission, emergent operation, sedation, or anesthesia for procedures, and there were no fatalities. Final diagnoses for the patients transported to the clinic were: sprained ankle (11 patients), bruise to lower extremity (6 patients), knee sprain (2 patients), shoulder sprain (2 patients), head contusion (2 patients), eye injury (1 patient), allergic reaction (1 patient), sprained wrist (1 patient), and epistaxis (1 patient). Final diagnoses for the patients transported to the ED were: neck muscle sprain (4 patients), ankle sprain (3 patients), chest wall contusion (1 patient), knee laceration (1 patient), concussion (1 patient), medial collateral ligament injury (1 patient), knee sprain (1 patient), wrist sprain



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Figure 3—Disposition of patients subject to event specific triage criteria for transport destination. (ED = emergency department)

(1 patient), nasal fracture (1 patient), ligament injury to dominant thumb (1 patient), corneal abrasion (1 patient), and records lost (1 patient).

Discussion

These data support the hypothesis that paramedics can be provided with written triage criteria and effectively apply them in the setting of a mass gathering. When applied correctly, these criteria proved highly sensitive and specific. Low-risk patients who otherwise likely would have been unnecessarily transported to an acute-care facility were safely excluded, resulting in the effective and safe reduction in the number of patients seeking emergency services during this hospital's emergency department historically busiest hours.

There are several limitations to this study. The indicators of need for hospital emergency services purposefully were broad, and, as such, some of these services may be performed safely in the outpatient setting. For example, intravenous fluid resuscitation, often is performed for endurance athletes in the field, and these patients are discharged without being transported to a hospital.⁹ Also, the easy availability of resources in the ED may have led to the overuse of hospital services. Several patients who ultimately were diagnosed with ankle sprains underwent x-rays in the ED, many of whom did not meet the Ottawa ankle criteria for radiographic evaluation, suggesting that they could have been managed without this service. Consequently, use of these triage protocols may result in over-triage to a greater extent than is indicated by these data.

The study is weakened by the lack of a control group, as many of these patients may have been transported to appropriate facilities based on the judgment of the prehospital care provider alone. It may be beneficial for future studies to test the prehospital care provider's judgment against those or some similar criteria. However, the data derived from those patients that were not triaged according to the triage protocol (i.e., based presumably on prehospital care provider's judgment) showed a greater error rate in terms of appropriateness of the facility to which they were transported, supporting the use of a decision rule in this setting. A change in the format of the decision rule to an algorithm may be helpful in increasing the use of the rule. The study also is weakened by the small numbers of patients, and also by the relatively minor injuries encountered.

Conclusions

Transport destination was consistent with that dictated by the event-specific criteria in the majority of cases, supporting the hypothesis that paramedics can apply event-specific criteria appropriately. When event-specific criteria were met with regard to transport destination, patients were triaged to the facility with the appropriate level of resource availability. These preliminary data support the concept of triage at the point of initial patient contact regarding transport destination as a standard to be applied at mass gatherings.

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