Triage During Mass Gatherings

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Abbreviations:
CTAS: Canadian Triage Acuity Scale
DAS: discharge acuity score
DRISS: Drug-Rock Injury Severity Score
EMS: Emergency Medical Services
MCI: mass-casualty incident
MGM: mass-gathering medicine
PPR: patient presentation rate
START: simple triage and rapid treatment
TAS: triage acuity score

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Abstract

Triage is a complex process and is one means for determining which patients most need access to limited resources. Triage has been studied extensively, particularly in relation to triage in overcrowded emergency departments, where individuals presenting for treatment often are competing for the available stretchers. Research also has been done in relation to the use of prehospital and field triage during mass-casualty incidents and disasters.

In contrast, scant research has been done to develop and test an effective triage approach for use in mass-gathering and mass-participation events, although there is a growing body of knowledge regarding the health needs of persons attending large events. Existing triage and acuity scoring systems are suboptimal for this unique population, as these events can involve high patient presentation rates (PPR) and, occasionally, critically ill patients. Mass-gathering events are dangerous; a higher incidence of injury occurs than would be expected from general population statistics.

The need for an effective triage and acuity scoring system for use during mass gatherings is clear, as these events not only create multiple patient encounters, but also have the potential to become mass-casualty incidents. Furthermore, triage during a large-scale disaster or mass-casualty incident requires that multiple, local agencies work together, necessitating a common language for triage and acuity scoring.

In reviewing existing literature with regard to triage systems that might be employed for this population, it is noted that existing systems are biased toward traumatic injuries, usually ignoring mitigating factors such as alcohol and drug use and environmental exposures. Moreover, there is a substantial amount of over-triage that occurs with existing prehospital triage systems, which may lead to misallocation of limited resources. This manuscript presents a review of the available literature and proposes a triage system for use during mass gatherings that also may be used in the setting of mass-casualty incidents or disaster responses.

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Introduction

All communities experience occasions during which large numbers of people assemble in public or private spaces for the purpose of celebrating or participating in musical, sporting, cultural, religious, political, or other events. Collectively, these events are referred to as "mass gatherings." From a medical perspective, a mass gathering is defined as an event involving the gathering of individuals or crowds during which emergency responses may be delayed due to limited access.[1-5]

Large crowds require dedicated first aid, medical, and other health-related services at a presentation rate that is higher than that for the surrounding, local population.[4] There is great variability within and between mass gatherings. The crowd size, weather, event duration, crowd members' age and behaviour, topography, event-specific hazards, use of alcohol or drugs, and whether attendees are participants or spectators will vary substantially between events.[1,5,6] At any mass gathering, this complex interplay of factors affects the patient presentation rate (PPR), the acuity, and the case mix.

Triage is a complex process and is one means of determining which patients most need access to limited resources. The process of triage takes many forms, depending on the context. It may be divided into triage systems used in prehospital settings (ie, at the side of a road, in a field of combat) and those used in a fixed location (ie, emergency department, military field hospital). For example, during a mass-casualty incident (MCI) in which health care needs (ie, number of seriously ill or injured patients) exceed available resources to provide the health care required (ie, personnel or bed-spaces to provide care), triage is the process of sorting patients with the goal of identifying life-threats and saving the maximum

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number of people.[7] Similarly, in a hospital setting triage is used to determine the right location for the right patient at the right time[8] as opposed to using a "first-come, first-served" approach that ignores time-critical clinical presentations.[9] Emergency departments function on a "worst-come, first-served" principle.

Mass Gatherings as Unique Populations

Mass gatherings present a unique set of challenges for health care professionals. Mass gathering settings differ in several important ways from other prehospital settings. First, there currently is limited knowledge and understanding with regard to the factors that shape PPRs during mass-gathering events.[2] Systematically collected data regarding acuity and the range of clinical presentations have the potential to shape planning for medical services.[10] Second, there is great variability in the on-site medical capacity between events in relation to both available equipment and medical team expertise and composition (eg, availability of automatic external defibrillators, basic vs. advanced life support, first aid only vs. full medical team).[11] Third, PPRs—the number of people who present with an illness or injury per 1,000 attendees or participants—vary between events. No reliable, validated model currently exists to predict PPR for an event prospectively.[3,12] Accordingly, at any given event there may be hundreds of patients presenting in a very short period of time (e.g., at the finish line of a marathon); some will require resuscitation, but the majority simply will need to be streamlined to the appropriate service or level of care.[13]

Fourth, mass gatherings may involve high PPRs, and critically ill patients may be encountered.[14] Mass-gathering events generate an increased injury and illness burden. A higher incidence of injury occurs at mass gatherings than is expected from general population statistics.[1] Fifth, at many mass gatherings there is overuse of drugs and/or alcohol.[15] However, existing prehospital (field) triage systems focus primarily on ensuring that individuals with traumatic injuries receive timely, appropriate care,[7,13,16-18] making these systems imperfect instruments for use in the mass gathering context. Sixth, the literature regarding mass gatherings often has been written from the perspective of care providers who are employed in acute care settings. Health promotion and illness prevention, as well as other central tenets of public health theory, may not be the focus.

Finally, by their very nature, mass-gathering events have the potential to become mass-casualty incidents (MCIs)[14] that require multiple, local and regional agencies to work together. This makes a common language of paramount importance.[13] Thus, any triage system used in this context must be effective and efficient in both a mass-gathering medicine (MGM) tent/clinic setting and in a field/disaster setting. Together, these challenges make mass gatherings different from other prehospital settings. Existing triage tools may fail to address the needs of individuals who are injured or become ill while attending mass-gathering events.

Triage—State of the Art

The quality of evidence regarding the effectiveness of triage systems varies substantially. Because of the difficulties in doing field research during a disaster, only a small amount of research has been performed in relation to the use of prehospital triage systems in this setting. In contrast, much research has been done in relation to the use and efficacy of triage in emergency departments, where individuals presenting for treatment often are competing for limited resources. Canadian researchers have made substantial contributions to the literature with regard to emergency department triage systems.[8,19-23] However, virtually no research has been done to develop, test, and prospectively validate an effective triage approach for use during mass gatherings.

The authors of this article are members of the Mass Gathering Medicine Interest Group (MGMIG), within the Department of Emergency Medicine at the University of British Columbia. Faculty, learners, and other volunteers are involved in the provision of medical support for mass gatherings. After more than two decades of experience providing care at mass-gathering events, the authors are seeking a triage and acuity scoring system appropriate for both mass gatherings and MCIs. Unfortunately, existing triage systems (particularly prehospital triage systems) are biased toward traumatic injuries, and usually fail to incorporate mitigating factors such as alcohol and drug use and environmental exposures, which are important factors at mass gatherings. Moreover, a substantial amount of over-triage occurs when using existing prehospital systems, which at times leads to the misallocation of limited resources.

Mass-gathering medical care providers also deliver services that include health promotion, injury prevention, and customer service at the events; these activities are not captured by any of the currently described triage or acuity scoring systems. No existing triage tool meets the needs for a mass gathering. Hence, a review of the available literature with regard to currently used triage systems, in general, is provided. A triage system is proposed for use during mass gatherings and also, if required, in a mass-casualty or disaster scenario, should such an event occur in these settings.

Methods

A review of the literature on mass gatherings and triage systems, both prehospital and in-hospital, was conducted. Three databases were utilized: (1) EBSCO (EBSCO Publishing, Ipswich, Massachusetts USA, www.ebsco.com); (2) OVID (Ovid Technologies, Inc., New York, New York USA, www.ovid.com); and (3) PubMed (National Center for Biotechnology Information, US National Library of Medicine, Bethesda, Maryland USA, www.pubmed.com). The search terms "triage," "prehospital triage," "field triage," "acuity scoring," "acuity scales," "mass gatherings," "mass-casualty incidents," and "disaster triage" were used. Abstracts were reviewed by two team members, and relevant articles were obtained and reviewed by the team. Articles selected for in-depth review had to be: written in English; published in a peer-reviewed journal; focused on the development and testing of a triage scale or scales for use in the context of humans; and tested in the field (in vivo).

This synthesis underpins a larger project that includes a central registry for mass-gathering events. The registry supports collection of a wide variety of data such as patient presentations rates, event characteristics, and a host of other variables that, in turn, facilitate longitudinal data collection. The intention of this registry is to facilitate comparisons between events from year to year and between different types of events that encompass different risk factors. Acuity is one important data element of patient presentations that must be captured and quantified for the purposes of measurement and comparison. Further information about the Mass Gathering Medicine Online Registry Project may be found at http://www.ubcmgm.ca/registry.

Based on the findings of the present analysis of currently available triage systems and the needs for an additional system for

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Theme	Issue
Quality of evidence	• Triage systems are not evidence based.[7,17,27] • There is no agreement regarding which system should be used because there is little evidence to support one approach over another.[7] • There is no agreement about who should perform triage.[15,19]
Populations studied	• There has been limited research evaluating the efficacy of various triage approaches in the mass-casualty setting[7] and only one study was identified in the mass gathering literature.[24] • Emergency Medical Services patients are the most commonly studied prehospital group, which biases findings on the subset of patients already identified for transport. • In general, children are excluded from the testing of triage systems. • There virtually is no research on the use of triage in developing countries.[28] • Disaster and prehospital systems tend to focus on trauma and ignore illness. This is a legacy of the warfare roots of modern triage systems.[29]
Efficiency and effectiveness	• Over-triage is a common feature of all prehospital and disaster triage models, a sacrifice of specificity for sensitivity.[27,30] • A lack of standardization leads to a plethora of triage systems that do not mesh together creating communication difficulties.[29,31-33] • There are differences in the approach to triaging mass casualties and typical triage (eg, parallel versus serial triage is required).[31] • Current triage systems provide a "snap shot" and accordingly do not identify the evolution of the clinical presentation of an individual patient, or the evolution of a queue (ie, new arrivals to the waiting room) in a serial triage setting.[29] • Triage is a cognitive process involving expertise, experience, nonverbal cues, and subjective judgments; these factors are difficult to capture in protocol-based approaches.[1,25,34]

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Table 1. General Limitations of Existing Triage Systems

use during mass-gathering events and MCIs, suggestions for a new system were developed.

Results

A medical research librarian was consulted regarding search strategies. The search terms described above, for the years 1985-2010, yielded thousands of references. To narrow the search, key words were systematically deleted from the overall search when a review of the abstracts revealed articles not directly relevant to the research question. For example, the search term "acuity scoring" yielded abstracts about tools used to measure acuity (often in an intensive care setting) and to predict mortality and morbidity in the context of a given disease or disorder (eg, stroke). The search term "mass-casualty incident" yielded >1,100 citations, only a small portion of which dealt with triage systems. In the end, approximately 40 articles were reviewed in depth and the results are summarized below.

Overview of Triage Systems

During the past two decades, triage systems have been standardized in a number of countries and both prehospital (also known as "primary" or "field" triage) and hospital/emergency department (ED) (also known as "secondary") triage systems are in widespread use.[24] The former systems focus on sorting the sickest patients from among mass casualties using parallel triage (ie, groups of patients are the unit of analysis), whereas the latter focus on sorting the sickest using serial triage (ie, one patient at a time).

Although originally used to sort the injured according to the severity of injuries, during the present decade triage systems have evolved to serve multiple purposes related to acuity determination, human resource planning, resource allocation, and quality assurance. Formally, triage systems provide data regarding acuity for a certain population (eg, patients presenting to the emergency department). These systems also provide a mechanism for prioritizing patients in a situation where the demand for health care resources exceeds the availability of required resources at a moment in time. Triage systems may be used as a way to quantify workload (although this was not an intended use), predict resource consumption,[22,25] measure quality of care (eg, waiting times),[26] and/or to support funding requests for additional staff.[27,28] Informally, triage systems serve as a common language for health care professionals to abbreviate descriptions of acuity for communication among team members.

Triage System Limitations

Despite decades of common usage and the ongoing efforts of researchers to develop and refine triage tools, there are a number of persistent limitations discussed in the literature (Table 1). Limitations may be grouped into three main themes. First, given the challenges of research in the field, there is a relative dearth of high-level evidence with regard to prehospital triage. Second, the evidence that is available only infrequently addresses unique populations (eg, children) or nontraditional settings (eg, mass gatherings in developing nations), although this slowly is changing. Third, prehospital triage scales may be inefficient and ineffective due to the variety of reasons listed in Table 1, including the current lack of both standardization and the ability to capture changes in patient status over time.

Triage and Acuity Scoring System for Mass Gatherings

Creating effective triage approaches for high-consequence events has been identified as an important focus of research.[29] A triage system for mass gatherings must be: (1) *Versatile*—the system must be useful across the full spectrum of patient presentations ranging

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from mass-casualty incidents (parallel triage) to "business as usual" (serial triage). In particular, such a system must capture all of the work done on-scene in relation to medical support during which transport is averted, as well as capturing services such as prevention, over-the-counter medication requests, and the myriad of other non-urgent care requests that constitute (at least anecdotally) the majority of the work of the medical team during events that are well-planned and executed; (2) *Simple*—the system must be quick to learn and easy to apply, by individuals from a wide variety of health care backgrounds; (3) *Evolving*—the system takes into account acuity at the initial call and again upon discharge. Of necessity, there must be a way to differentiate between the initial "call out" (ie, security calls for medical assessment for a "collapse/unconscious patient" who is assigned a high acuity score), from actual acuity when assessed by members of the medical team and discharged (ie, when the diagnosis is known, the case turns out to be a minor intoxication and is assigned a correspondingly low acuity score). Conversely, a patient initially may be triaged as a simple medication request (eg, "do you carry any Benadryl [diphenhydramine]?") and given a low triage acuity score (TAS), but then progresses to anaphylaxis, with a high discharge acuity score (DAS). Capturing one or the other, in isolation, will provide a biased view of the population serviced by the medical team. The change between TAS and DAS represents an important area of research regarding the impact of the medical team on individual cases; (4) *Supportive of Communication*—the system must be supportive of communication between providers on-site ***and*** between levels of care (eg, mass casualty incident/disaster, prehospital, hospital);[30] and (5) *Practical*—the triage system considers business implications. The volume of service provided at an event might have an impact on the budget for similar or subsequent events, as well as for equipment and staff. The system used must enable staff to quantify acuity so that event planners and medical team members have accurate information upon which to base current and future decisions about resource allocation and budget.

Only one article was identified that described the use of a scale-based scoring system specifically designed for use during a mass-gathering event. The authors developed and retrospectively applied the Drug-Rock Injury Severity Score (DRISS) to the patient encounters during five rock music concerts involving 250,000 spectators.[15] The triage system used a combination of anatomical and physiological indicators as well as features of the patient history—specifically drug and alcohol use—that were applied retrospectively. Interestingly, additional points were assigned for treatment required (eg, restraints, cardiac monitor). The higher the score, the more acute was the presentation. The DRISS never was prospectively applied and validated. Essentially, the DRISS functioned as a discharge acuity score that was useful in terms of measuring acuity retrospectively, but it is unknown whether the tool had the ability to capture the complexity of the initial patient presentations. In a slightly different take on triage during mass gatherings, Salhanick and colleagues,[31] created an algorithm for use by paramedics to make decisions about whether or not to transport a patient to the hospital. The system involved a list of categories of common illnesses/injuries such as "burns," "lacerations," and "asthma." Each category included clear criteria for transfer. The strengths of this approach include a sensitivity of 100% for detecting cases that require transport and a specificity of 90%. The weaknesses of this approach include the resulting over-triage and the fact that the content of the algorithm was necessarily brief, and therefore, not inclusive of the full range of injuries and illness with which individuals might present.

Other than in the articles discussed above, few authors have written about triage systems for use during mass gatherings. With regard to mass gatherings that turn into mass-casualty incidents, the literature is sparse and consists primarily of opinion.[14]

Proposed Solution

Acknowledging that there is no need to add to the proliferation of triage systems that differ in important ways, confuse providers, and make communication between levels of care more difficult, there exists an opportunity to build on the strengths of existing systems, and to make adaptations for triage during mass gatherings.

In developing a triage system for use at mass gatherings, disruptions of physiology alone will not identify every critically ill individual[32] and may result in a medical bias because victims of trauma may have normal vital signs and subsequently evolve into an unstable condition.[33] Similarly, anatomical changes alone will not identify every critically ill individual. The weakness of a mechanism-of-injury-based system is that this approach results in considerable over-triage.[33]

Additionally, no current triage system takes into account the unique features of a population attending mass gatherings, specifically the use (or overuse) of recreational drugs and/or alcohol and/or environmental exposures. Importantly, the triage and acuity scoring system must acknowledge that the majority of patients seen at mass-gathering events are not critically ill; ideally they should provide some opportunity for capturing the type of intervention required (eg, minor wound care, blister management, sunscreen, bug spray, ear plugs, or over-the-counter medication requests). There is a substantial gap in the literature for describing and classifying the service and care provided to individuals in the minor spectrum of presentation. Not capturing the lowest acuity services provided on-site due to absent or inadequate charting represents a lost opportunity to fully document and understand the role of the medical team at a mass gathering.

Triage ought to be, at minimum, a two-stage process due to the fact that an individual's status can change over time, evolving into a more serious (or less serious) clinical presentation[33] that also must capture the nature of the work for event planners. Finally, any system used must be effective for both serial triage and parallel triage.

This project currently is in the second of three phases. The first phase included the literature review and creation of the University of British Columbia Mass Gathering Medical (UBC MGM) Triage Acuity Scale/Discharge Acuity Scale (TAS/DAS); the second phase involves retrospective application of the tool in the context of a series of clinical cases that occurred during events held during the previous event season; and, the third phase will involve prospective testing.

The TAS/DAS is based on the most widely used disaster triage system, simple triage and rapid treatment (START)[34] that employs a common, color-based system, and the Canadian Triage Acuity Scale (CTAS)[8,19] that employs several clinical modifiers. Development, modification, and simplification are ongoing. The START disaster triage system is physiology-based and uses four color categories: black (deceased or expectant); red (emergent, resuscitation); yellow (urgent); and green (minor). Addition of a fifth color, white (dispensary), captures any patient

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interaction for services, such as any request that a patient normally would take care of independently at home (eg, band aids, sunscreen, contact lens removal, simple over-the-counter medications) and that does not require medical assessment or intervention.

Recognizing that a physiology-based system has limitations, indicators were extracted from the CTAS; then, two modifiers that captured the strengths of other triage systems were added and applied specifically to the mass-gathering situation. Thus, "mechanism of injury" and the "use of recreational drugs and/or alcohol" were chosen as modifiers.

The last phase of testing will include validation of the scale and determination of inter-observer reliability using retrospective data collected through the UBC MGM Online Registry Project.[35] Finally, prospective validation, evaluation, and dissemination of the results are planned for 2012 and 2013.

Summary and Conclusions

In the practice context of mass gatherings, a triage scale that is reliable, valid, and easy to use by a wide variety of providers is essential. No existing system meets the needs of those providing medical support for mass gatherings. The MGM TAS/DAS is proposed as an approach to triage and discharge acuity categorization during mass gatherings, during which large numbers of patients may present in surges, for assessment and treatment.

The adaptation of a familiar and widely used triage acuity system for the unique environment of a mass gathering represents an opportunity to streamline care for those attending mass gatherings. Use of a rigorously tested triage system in this context may improve data collection for researchers and event planners between and across different types of events. Such an adaptation could increase the consistency of nomenclature thereby improving communication between health care professionals. Looking into the future, use of a common triage system for mass gatherings has the potential to allow comparisons between municipal, provincial, and national populations and between data sets from different MGM patient registries.

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