

according to predefined eligibility criteria. Included items were read and results were compiled and summarized.

**Results:** In a total of 64 included items, 34 were published between 2013–2016. The most studied events were Germany's Love Parade stampede in 2010 ( $n=6$ ) and the UK Hillsborough stadium stampede in 1989 ( $n=4$ ). The literature retrieved was from a wide range of different disciplines. Conflicting definitions of human stampedes were found. The common belief that they result from an irrational and panicking crowd has progressively been replaced by studies suggesting that successive systemic failures are the main underlying causes. Stampedes are not reported in global disaster databases, making unusual sources like news reports often the only information available. Prevention measures are to date mainly related to crowd management and venue design, but their effectiveness has not been studied. Best practices for preparedness and response are not consensual.

**Conclusion:** Stampedes are a complex phenomenon that remains incompletely understood, hampering formulation of evidence-based strategies for their management. Many of the findings come from high-profile events and are difficult to extrapolate to other settings. More research from different disciplines is warranted to address these gaps in the knowledge in order to prevent and mitigate future events. A start would be to agree on a commonly accepted definition of stampedes.

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### Common Injuries of Marathon Runners in Nigeria,

#### Epidemiology and Preparedness

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**Study/Objective:** To identify the epidemiological spread of athletes, the injuries and medical conditions they present with, to assess the level of preparedness and organization of the medical care at the event, and how the medical preparedness coped with the surge at the medical tent.

**Background:** Marathons and ultra-marathons have become increasingly popular in Nigeria and other developing countries. Participants are more dedicated, investing time and effort to prepare and compete. As the field increases, so do the types of injuries and medical conditions that present to the medical tent on event day. As a result, a lot more goes into preparation and medical capacity for these events.

**Methods:** A mass gathering matrix will be applied to the event demographics to assess the projected need for the event. Actual preparedness on the ground will be assessed and studied. All athletes entering the medical tent, picked up along the route, or taken directly to hospital will be triaged and a questionnaire applied to them.

**Results:** Musculoskeletal injuries, dermatological, respiratory problems, collapse and hypotension have been shown to be common problems in marathon runners. The result should clarify, if this is so in marathons in Nigeria. Organization of medical coverage of these events needs to be well coordinated

and staffed to be effective. The matrix will help organizers have a baseline or template for proper preparation.

**Conclusion:** The epidemiology of marathon injuries may follow conventional events, but a proper understanding of this will aid proper preparation for the event and organization of medical coverage. Though nothing is definite, a mass gathering matrix can give an effective guide or template for Medical organizations for marathon events.

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### Can the Patient Influx at Mass Gatherings be Predicted?

#### A First Attempt to Crunch the Numbers

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**Study/Objective:** To determine whether there are certain patterns that emerge at mass gatherings, in order to create a model for future predictions concerning the pace of patient influx at mass gatherings. Patient influx is an important parameter to determine the capacity of the first aid post.

**Background:** The Belgian Red Cross staffs first aid posts at more than 50 events with an attendance of more than 10,000 people every year. Since 2006, every patient encounter gets logged in a database called MedTRIS. The MedTRIS database contains more than 150,000 unique patient encounters.

**Methods:** The time of entry gets logged in the MedTRIS database for every patient. A chart is made showing the evolution of the number of patients that enter the first aid post every 30 minutes. To compare data over different editions (years), these data are 'normalized' by dividing these numbers by the total amount of patients that entered the first aid post that day. By doing this, abstraction is made of the total amount of attendees or other parameters.

**Results:** For all events where the number of patients is more than 300 per day in a particular first aid post, it is clear that the patient influx always follows a similar, event specific trend. Calculating the correlation between the different normalized graphs over the different years for a same first aid post on the same event, renders high rates in the range between 0.6 and 0.8.

**Conclusion:** For a given mass gathering, there seems to be a constant patient influx trend over the years. Further exploration is needed, and may lead to the start of creating a predictive model to determine the capacity of the first aid post.

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### What Skills does a Physician Need at Mass Gatherings? An Analysis of more than 16,000 Patient Encounters that Required Medical Attention

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**Study/Objective:** To determine the most common type of injuries that need medical attention, to better prepare physicians at mass gatherings.

**Background:** The Belgian Red Cross provides first aid at 50 events with an attendance of more than 10,000 people every year. Since 2006, every patient encounter gets logged in a database called MedTRIS. The MedTRIS database contains more than 150,000 patient encounters.

**Methods:** The triage category of a patient is recorded upon entering the first aid post. Four categories are used: without treatment, first aid, medical condition and medical emergency. A “medical emergency” requires immediate attention of a physician, a “medical condition/case” can wait. Other patient’s characteristics, such as type of injury and type of event, are also recorded. All recorded information was coded for analysis in SPSS©.

**Results:** 162,611 patient encounters are recorded in the MedTRIS database. 16,989 (10,5%) patients needed medical attention. 1080 (0,8% of total patient encounters) of these patients presented as a medical emergency. In the “medical condition/case” triage category the most prevalent type of injury was of the miscellaneous kind. This category represents -among others- urological and gynecological problems, eye abrasions and patients with chronic conditions. It is worth noting that some of the patients in the miscellaneous category probably belong in one of the other, more specific categories. Other types of injuries such as skin lesions, traumas and intoxications were roughly equally represented. However, in the “medical emergency” category, intoxications were more than three times as common as other type of injuries.

**Conclusion:** True medical emergencies remain infrequent. An on-site physician needs to be capable to treat a multitude of different conditions. However, it is important to note that a medical emergency often concerns an intoxicated patient. Therefore, extra training in this specific type of injury is advisable.

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### The Most Prevalent Injuries at Different Types of Mass Gathering Events: An Analysis of More Than 150,000 Patient Encounters

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**Study/Objective:** To determine the most prevalent injuries at different types of mass gatherings, to optimize the resources available on site.

**Background:** The Belgian Red Cross provides first aid at 50 events with an attendance of more than 10,000 people every year. Since 2006, every patient encounter gets logged in a database called MedTRIS. The MedTRIS database contains more than 150,000 patient encounters.

**Methods:** Upon entering the first aid post at a mass gathering, every patient receives a unique identifier. This identifier can be used to log patient data in a database called MedTRIS. Among the data recorded are the type of event (outdoor music festival, indoor music festival, outdoor Electronic Dance Music (EDM) festival, indoor EDM festival, city festival and sport event) and the type of injury (skin lesions, intoxications, traumas, neurological events, gastrointestinal complaints, cardiac and respiratory

problems and a miscellaneous group). All the recorded information was coded for analysis in SPSS©.

**Results:** There were 162,611 patient encounters recorded in the MedTRIS database. Overall, the most prevalent type of injury are skin lesions (44,6%). The second most prevalent injury is trauma (15,5%). In third place comes neurological symptoms (12,7%), mainly because headaches are represented in this group. Intoxications only represent 3,5% of patient encounters. However, at (indoor) EDM events intoxications are more common and can represent up to 20% of patient encounters.

**Conclusion:** Skin lesions are by far the most prevalent injuries at mass gatherings. As such, the caregivers in the first aid post must be adequately trained in treating this type of injury. However, special considerations must be given to the type of event, especially at indoor EDM festivals where intoxication is more common.

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### Mobile Response by Medical First Responders at a Music Festival

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**Study/Objective:** Music festivals are a subset of mass gatherings prone to high-risk illnesses and injuries requiring dedicated on site medical services. Implementation of a mobile medical response to rapidly reach, stabilize, and transport patients is a major component of safety planning.

**Background:** The delivery of tailored mobile medical care at these types of events has the potential to improve outcomes by enhancing the speed and appropriateness of care to patients.

**Methods:** Mobile first response records were reviewed for a multi-day electronic dance music event. Information reviewed included demographics, call and transport times, chief complaint, acuity, location, and all interventions delivered on scene. Audio recordings of communications and mobile GPS data were also reviewed.

**Results:** 174 mobile responses were catalogued over the 120 hour period. 62 licensed prehospital volunteers served 15,000 attendees over a five-day period. 10% of calls were high acuity, 40% intermediate and 50% low. Peak call volume occurred in an eight hour period from 20h to 04h, with the three busiest hours from 21h to midnight (68% and 41% of all calls respectively). Altered mental status was the most common chief complaint. 79% of patients required transport to medical services and 7% were transported to harm reduction services. The average high acuity patient was reached in 4 minutes, with 8 minutes spent on scene performing targeted interventions. Basic airway manoeuvres and oxygen were the most common interventions required.

**Conclusion:** Response to medical emergencies at a multi-day music festival is aided by a well-prepared and organized mobile first responder program. The goal is to deliver rapid targeted care to the scene as part of the chain of survival. Suitable preparation for first response calls is likely to maximize benefits