**Chapter 27   
Medical management of mass gatherings**

**John F. Brown, Joshua G. Smith, and Katie Tataris**

**Defining mass gatherings and special events**

Mass gatherings present unique challenges to EMS as they put pressure on the surrounding emergency response systems. History demonstrates that they can produce, or are vulnerable to, escalating events such as crowd disturbance, fire, structural collapse, natural disaster, disease outbreak, or terrorist attack. Mass gatherings are not isolated events. Despite best efforts to manage and contain events within normal operations, they often strain peripheral resources, including EMS, hospitals, transportation, and law enforcement. As a result, when a mass casualty incident (MCI) occurs during a mass gathering, emergency services are often already saturated and the response is compromised.

Traditional mass gathering planning has concentrated on normal operations using historic patient presentation rates from comparable events [1]. As a result, when an escalating event does occur, conventional planning tools and available resources are generally not prepared to manage the catastrophe. However, with proper planning and tools, a mass gathering can not only be better prepared for an escalating incident during the operational period, but can also be used as a disaster response training exercise between collaborating response services.

This chapter reviews the definitions and types of mass gatherings, provides a historic perspective of MCIs that have occurred at mass gatherings, covers planning and management methodology, highlights unique EMS capabilities that are useful for response within mass gatherings, and presents MCI tools and lessons learned from case studies of prior experiences.

The goal of this chapter is to go beyond the traditional role of preparing for normal operations at mass gatherings by integrating MCI planning and tools to address historical vulnerabilities and emerging threats. The vulnerabilities that mass gatherings expose can be converted into an opportunity by using these events as repeatable training exercises for MCI response. These exercises incorporate many of the actors required to respond, which forges interagency relationships and facilitates application of the procedures and protocols. Mass gathering planning that includes preassignment of MCI leadership roles, predesignation of disaster communications channels, coordination with regional hospitals, integration of unique EMS tools and capabilities, staging of disaster supplies, recognition and mitigation of historic vulnerabilities, and preservation rather than saturation of regional resources with physician-based treatment centers will better prepare for normal operations as well as for a MCI.

**Types of mass gatherings and definitions**

There is a broad variety of mass gatherings that vary in scale, location, and nature of event. Large athletic events, rock concerts, religious celebrations, and street fairs will each present a different set of challenges to planners. A mobile and open event, such as a marathon, that is spread across a city will differ significantly from an enclosed, ticketed event at a stadium. The nature of the attendee will also influence the challenges faced. For example, a rock concert may have a higher potential for substance abuse and violence while a religious celebration might have a higher number of elderly or infirm participants [2]. The scale of planning will differ greatly for a local parade, when compared to a large-scale event such as the Olympic Games, which requires planning and coordination at the federal and international level.

Mass gatherings have varied definitions as well as terms to describe them. Some authors define mass gatherings as over 1,000 persons [3], but most published data are for events with greater than 25,000 persons in attendance [4]. The United States Federal Emergency Management Administration (FEMA) uses the term “special events.” The operational definition that FEMA uses for the *Special Events Contingency Planning Job Aids Manual* is:

…a non-routine activity within a community that brings together a large number of people. Emphasis is not placed on the total number of people attending but rather the impact on the community’s ability to respond to a large-scale emergency or disaster or the exceptional demands that the activity places on response services. A community’s special event requires additional planning, preparedness, and mitigation efforts of local emergency response and public safety agencies [5].

The World Health Organization similarly defines a mass gathering as “…any occasion, either organized or spontaneous, that attracts sufficient numbers of people to strain the planning and response resources of the community, city or nation hosting the event” [6]. The definitions do not focus on the number of attendees; rather, they recognize that mass gatherings will strain surrounding resources. Therefore, mass gathering planning must recognize that these events are not isolated and must account for the surrounding system pressures that are generated by the event.

**History of disasters and mass casualty incidents at mass gatherings**

From a theater fire in Canton, China in 1845, that claimed over 1,600 lives, to a riot at a soccer game in 1964 in Lima, Peru, that had approximately 300 fatalities, to a crowd surge in Mecca, Saudi Arabia, in 1990 with over 1,600 deaths, history demonstrates that disasters and MCIs occur at, or are caused by, mass gatherings [2,7]. Every year at mass gatherings held across the globe, attendees fall victim to the consequences of poor planning, inadequate preparation, or violence. Soomaroo and Murray found that there are several common causes of these disasters as well as areas of mitigation in planning that can help prevent loss of life [8]. The five general areas of risk management and planning mitigation that were identified were overcrowding and crowd control, event access points, fire safety measures, medical preparedness, and emergency response.

*Overcrowding and inadequate crowd management and control* are a recurrent cause of MCIs at mass gatherings. Crowd densities and pedestrian traffic flow patterns create predictable patterns of behavior and bottlenecks. In dense crowds, people are often unable to see what is happening only a few feet ahead and this can exacerbate a crowd crush with pushing behaviors. Stairways, tunnels, turns, equipment, and stages can all create obstacles that will impede traffic flows. In addition, stimuli such as weather changes, event cancellation, crowd violence, rumor of danger, intoxicated individuals, or structural collapse can create a sudden surge in the crowd that may cause individuals to fall and be crushed regardless of strength or size. Some of these risks can be avoided with a properly designed venue that is appropriate for the event.

*Ticketed and controlled event access points* can help control the number of attendees and provide additional security screening. Access points that are used for both entrance and exit will have greatly reduced traffic flows. An adequate number of clearly marked emergency exits that are not blocked in an emergency can help prevent loss of life in the event of a catastrophe.

*Robust fire safety, prevention, and response measures* can prevent loss of life. Examples include using approved site construction materials and strict enforcement of fire safety codes, such as set numbers of extinguishers in each temporary structure present.

*Medical preparedness and emergency response planning* can help manage an event during normal operations and also prepare for an escalating event. Traditional planning has focused on suggesting the number and type of medical personnel based on historic patient presentation rates at similar events under normal circumstances. However, there often is a disconnect and lack of recognition that events commonly saturate emergency services on one hand, yet the expectation remains that these stretched services will be able to effectively respond to an escalating event. Practical budget constraints coupled with the improbability of a major disaster will generally not allow for the number of medical personnel on scene that would be required to manage a MCI. However, planning, staging, and education can help prepare event providers with the necessary tools to better manage the early, critical stages of an MCI. Mass gathering medical operations share many characteristics of MCI management and as a result can be used as an opportunity for repeatable training exercises for all levels of community response [9].

*Emergency response* must be preplanned. Emergency access corridors must be protected and maintained for responders. Proper communications are necessary for both crowd management and emergency response.

**Case study 27.1 Love Parade**

July 24, 2010, Duisburg, Germany

Crowd crush at a large outdoor electronic music festival: 21 dead, over 500 casualties

Deadly consequences of poor site planning and venue review

**Lessons learned**: From the beginning, concerns were voiced about the adequacy of the site selected in a former freight station. Political pressures may have pressed the event forward despite misgivings of some planners. An improper venue selection and site set-up created predictable crowd flow problems. During the event, participants were funneled into a tunnel that turned and narrowed with obstacles creating a predictable hazard. A crowd surge pushed victims to the ground where they were killed by crush injuries and asphyxiation. High levels of substance use, inadequate communications with the crowd and between responders, difficult and delayed access to victims, and obstacles in the venue all contributed to the disaster. Medical planning had prepared with the expectation of more than a million participants; however, last minute concerns limited entry to 250,000 people. As an unintended result of this overplanning, the medical response was considered adequate for this deadly event [22,23].

**Role of the medical director**

The medical director should be knowledgeable in EMS, emergency medical conditions and treatment, and the logistical and personnel limitations inherent in mass gatherings. The goals of medical service are to establish rapid access to the injured or ill patients; provide triage, stabilization, and transport for seriously injured or acutely ill patients; and provide on-site care for minor injuries and illnesses, thereby preserving the EMS function in the surrounding community [10].

The medical director responsible for the planning and provision of medical care at a mass gathering must understand the interrelated consequences of all the planning variables. While the medical director is primarily responsible for the provision of medical care, he or she must be an active participant in many aspects of the planning phase to identify risks and operational concerns. Major system failures are often caused by an interrelated cascade of decisions and smaller failures that converge to create chaos. Although not all vulnerabilities can be foreseen, each area must be reviewed for weakness and potential failure.

**Mass gatherings event planning and management**

The key to mitigation of MCIs at mass gatherings is proper planning. The following outline can be used in the planning stages of mass gatherings to anticipate challenges and prepare for an escalating event. Preparation before a mass gathering event allows for the triage and rapid stabilization of patients as well as on-scene medical care for minor complaints. Although most medical calls during mass gatherings are minor, the ability to respond to and treat life-threatening problems should be rapid and organized.

**Timeline**

Adequate preparation time is crucial to the success of the mass gathering. An appropriate timeline can be divided into preplanning, planning, operations, and postevent review. The preplanning phase is dependent on the scale of the event and can begin up to 2 years in advance for larger events, down to a few months or weeks for smaller events. The event is defined in terms of type of event, expected attendance, dates and duration of event, agencies involved, attended demographic and transport mode, alcohol and drug policy, event history, and local site map. The planning phase involves preparation of the site, personnel, and resources. The operations phase is the duration of the event, which can range from a few hours to a few days. All mass gatherings should conclude with postevent reviews that may occur immediately following the event or a short time after. *The Provision of Emergency Medical Care for Crowds* by Calabro and colleagues delineates an event planning schedule [11].

**Resources**

Accurate resource planning depends on the number of spectators and scale of the event. The actual crowd size estimate may be difficult and can be inaccurate in the event of a street festival, but is more accurate in a stadium concert event with a ticket count. There are certain factors that indicate a higher level of resources might be needed, the most important of which is the size of the crowd. In addition, age (increased medical calls with young adult and elderly people), event type (rock concerts have been described as having more medical calls), and environment (outdoor events generally have more calls than climate-controlled events) are all important factors to consider [4]. Factors such as drugs or alcohol, crowd density, venue layout, and length of event all contribute to medical usage. Medical usage rate (MUR) is defined as the percentage of visits or patients per 10,000 (PPTT) persons in attendance [12]. Hartman and colleagues describe a stratification scoring model to predict resource use at mass gatherings using weather, number in attendance, presence of alcohol, crowd demographic, and crowd intentions [13]. Recurring events benefit from the knowledge of prior experiences in building the medical resources list. Some venues may have facilities or medical equipment available while others may need importation of resources and staff. Currently there is no widely accepted standard list of minimum medical equipment and medications needed according to provider level, but an example is provided at <http://tinyurl.com/specialeventresourcelist>. Basic food, water, sanitation facilities, and shelter are included in the resources preparation.

**Stakeholders**

Mass gathering plans should be coordinated with stakeholders who have the authority and funding to implement the plan. Groups that may have an interest include politicians (local, state, or federal, depending on the scale), hospital administrators, EMS agencies, 9-1-1 dispatchers, law enforcement, transportation operators, event sponsors, and event planners. The financial support for the medical response can be through the event sponsor, a hospital group, the local EMS agency, or volunteer organizations.

**Regulations**

Knowledge of local regulations is an important component in the legal aspects of mass gatherings management. Does the city or county require any special permits? Are there local minimum staffing regulations? The event managers should cover primary medicolegal liability but each health care provider should have active certification or licensure at the level and the region they are performing. The medical director must ensure that malpractice insurance is covered through either his or her employer or through the event sponsor.

**Medical plans**

The purpose of advanced planning for mass gatherings is to identify a medical response plan that does not place additional stress on the existing EMS system. Daily EMS operations must be able to meet dispatch requirements and not be expected to additionally cover a preplanned event. While some situations may necessitate transport by the local EMS agency, efforts should be made to keep the event medical care separate. Event medical staff should be identified prior to the date and operate within the scope of their licenses for the event. Medical plans should include staffing requirements, treatment areas, identified BLS and ALS transport options, and planning for a potential mass casualty incident. The guidelines presented apply only to normal event operations and need to be adjusted for escalating events. Most events average 0.5–2 medical calls per 1,000 spectators [3]. Smaller events may only need first aid level response while larger events may need a physician on site. Although there are many different recommendations without an evidence base, one of the most widely used references is one physician for 5,000–50,000 spectators, one nurse for 2,600–15,000 spectators, and one EMT for every 2,600–65,000 spectators [14]. Another recommendation is to place medical teams based on response interval. Saunders and colleagues suggest a BLS/first aid trained responder within 4 minutes, an ALS provider within 8 minutes, and transport to a medical facility within 30 minutes [3]. Although the predicted cardiac arrest prevalence at mass gatherings is very low [3], early access and defibrillation through BLS intervention is one of the main reasons to have medical plans for large events. Medical plans should be reviewed with event management and operations staff and approved at least 30 days prior to the date.

**Environmental factors**

Even the best planned events can be influenced by “mother nature.” Extreme cold and hot temperatures in combination with wind, rain, and other weather factors can affect both the participants and event staff. Preevent monitoring of weather predictions can indicate conditions for the event time period. Warm summer weather is a popular time to schedule outdoor events and minimal preplanning by patrons can subject them to heat illness. Maintaining plenty of water, shade, fans, and cooling centers can minimize casualties. Cold temperature events are typically held inside or patrons come dressed for the event but may need access to rewarming capability. If the venue does not already have adequate restroom facilities and water fountains, the event management should coordinate additional portable toilets and drinking water. Proper public health regulations should be followed for food preparation, storage, and waste removal. Traffic routes and parking options should be laid out prior to the event with special access routes for emergency medical vehicles. Event type can also influence the crowd disposition and atmosphere. Outdoor music events may have alcohol or drug use, sports games may have opposing team fan brawls, and rock concerts may have mosh pit-related injuries.

**Case study 27.2 Denver Papal Visit**

August 12, 1993, Denver, Colorado

Extensive heat exhaustion with acute weather change in an event with twice the anticipated attendance: many persons with heat-related illness

Environmental factors have a strong influence on medical casualties

**Lessons learned**: The predicted attendance was 250,000 for the event, but over 500,000 arrived. Daytime temperatures reached 84–89°F, causing heat exhaustion that was worsened by the altitude, high crowd density, physical exhaustion (14-mile hike before mass), and dehydration. Inadequate numbers of toilet facilities led to long lines and participants reducing water intake to not wait in line. At night the temperature dropped to 56°F with rain, which caused many of the spectators to experience hypothermia during an all-night vigil as a result of this extreme weather change [12].

**Venue review**

A complete site review is an important component of the planning stage. Venue walk-through should identify the number and accessibility of exits, hazard recognition, site mapping, and evacuation routes. Security personnel should be available to control spectator and patient flow as well as maintaining potential evacuation routes. In the event of an MCI, venue-specific plans should be in place to convert normal operations into disaster operations.

**Public health surveillance**

Disease surveillance at large-scale events can detect outbreaks or the possible deliberate use of chemical or biological agents or radioactive material and may speed response and intervention. In addition, the risk of transmission of infectious disease is potentially increased. Respiratory or droplet infectious agents, food-borne gastrointestinal illness, and skin contaminants can all be pathogenic. Coordination of knowledge between patient treatment areas to identify symptom trends can initiate an epidemiological analysis.

**Documentation**

Each patient encounter should be documented on a standardized patient care record (PCR) in paper or electronic format. Any PCR is a medical and legal record of care rendered so careful completion and review are important even though the complaint might be minor. Contracting with a local EMS agency may allow use of their company PCRs, but the medical director must create a document if none exists. Recording each patient contact is important in terms of liability, equipment restocking, future event staffing, and reimbursement.

**Communications**

Constant and accurate communication during a mass gathering is needed to relay information and prepare for any complication or escalating situation during the event. The command center should be centrally located and share the post with medical oversight or have close contact by phone and radio. There should be direct communication from medical oversight to the field providers for both status reports and online medical direction. Medical oversight should also have external contact with the local EMS agency, fire department, 9-1-1 dispatch center, and emergency departments. A communications plan with designated channels should be pre-established and distributed to the surrounding EMS systems for MCI operations with a minimum of two separate communication modalities such as cell phones and public safety radios. Some challenges include loud ambient noise, overloaded cell tower systems, and a limited number of radio channels.

Recently, social media have been incorporated into communications. For example, larger events in some systems have a blacked-out site or web page that is ready to be used in case of an emergency. There may be a benefit in following Facebook or Twitter feeds during an event to monitor crowd sentiment or to get early information regarding a situation. After-action reports frequently cite that communications can be a vulnerability if not tested in advance of the event.

**Disaster preparedness**

Even in the most prepared events, situations can expand beyond planned response configurations. Knowledge of incident command system (ICS) structure and predesignation of roles allows the transition from normal operations to disaster response to occur in a smooth manner. Mutual aid may be needed in the event of patient numbers that exceed the resources of the planned response, and discussions or contracts should be finalized ahead of the event.

**Postevent review**

After the mass gathering, a debrief session is important to address the successes and failures during the event. For recurring events, a quality improvement program is important. In addition, an after-action report or “lessons learned” session can identify areas of improvement for future events.

**Event resources**

The following specific tools can be used to manage mass gathering medical care, depending on the needs of the event and benefits of each.

**Types of response capabilities**

Medical care delivery sites can be grouped by capability, capacity, and mobility. Some mass gatherings take place in well-established venues, which enables planners to provide emergency department-like capability in specifically designed medical spaces, often labeled as first aid stations. Examples include stadiums, arenas, and exhibit halls. The capability of these fixed facilities varies according to the professional level of staffing. In many cases, large numbers of patients can be treated in these facilities at an emergency department level of care and returned to the event that they are attending [15]. Other first aid station capability is housed in more mobile spaces such as tents and mobile intensive care vans [16] and for larger events, field hospitals [17]. These facilities can provide basic to advanced level care depending on staffing, space, and equipment [11] but need provisions for security, triage, staff work space, patient treatment and staging for transport, water, electricity, restrooms, family or patient companion waiting area, signage, and climate control.

Mobile teams, whether on foot, bicycle, or small motorized transports, become valuable to access patients within desired response intervals [4]. The type of mobile platform is best determined by event footprint, congestion, and vertical as well as horizontal distance as appropriate to provide cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) access for patients in cardiac arrest within 3 minutes [18]. These include foot teams, bicycle teams, stair chairs, gurneys, and motorized vehicles similar in size to golf carts (see Video Image 27.1).

Mobile teams should consist of at least two personnel, with at least one of them being certified as an EMT or higher level field provider. For events with a significant presence on bodies of water, motorized boat access for medical teams is essential. Guidelines suggest having a minimum of one mobile team per 20,000 spectators [19].

A useful adjunct of fixed or semi-fixed treatment facilities is the ability to provide sobering services for participants at mass gatherings who become intoxicated (see Video Clip 27.1). These facilities can be staffed with health care providers familiar with alteration in mental status caused by various chemical substances and can provide safe, observational care according to strict protocols and with rapid availability of additional medical services at the ALS level.

Transportation resources will be needed for patients with complex medical problems, or issues for which the period of treatment will exceed the hours for the on-site medical facility. Taken as a whole, the rate of ambulance transports from mass gatherings does not exceed the community baseline rate [20]; however, other factors such as the use of alcohol, the physical stress of the event, the age and type of participants/spectators assembled, and the past rate of medical facility and EMS transport use must be taken into account. ALS or BLS unit selection will likely be dictated by local EMS system policy, and may be dependent on the level of care staffing of the first aid facility on site. Integration of air medical assets will be crucial if distances to hospital treatment facilities are great or if significant delay is anticipated due to crowd interference with ground transport routes. Multiple transport units are likely to be of value if the event venue is geographically large or has inaccessible areas such as water elements or off-road activities.

Staffing of both first aid facilities and mobile units is important to the success of the event medical presence. Physicians on site have been able to affect ambulance transport rates and preserve EMS and emergency department resources for surrounding communities [21]. Other capabilities that physician staffing brings to the medical mission are the expansion of on-site definitive treatment, such as advanced wound care, the ability to expand the scope of practice on site for other staff, such as enabling the use of chemical sedation for patient restraint or antidote use for certain intoxications, more efficient patient disposition in higher-risk cases, such as patients wishing to sign out against medical advice not having to call in to base hospital facilities, and potentially improved relationships with the hospitals and other medical facilities surrounding the event venue due to the physician’s day-to-day role in those environments.

Finally, MCI preparations of the medical presence must be considered. Recent events such as the Boston Marathon bombing have shown that MCIs with significant patient physical and psychological effects can happen rapidly. The well-prepared medical team will have alternative communication modalities available for their use, have an MCI plan and on-site, event-based training in the use of the plan, triage capability and equipment, and a cache of supplies to support their efforts in responding to such incidents.

**Converting into mass casualty incident operations**

Even with comprehensive, robust event planning, there is always the potential for a MCI at a mass gathering. The following section describes how the tools, preparations, and planning above can transition to MCI operations and the implementation of the ICS.

If an escalating event occurs during a mass gathering that creates a MCI, the first phase is to activate the event emergency plan. On-site communications will notify the command center of the incident. First responders on scene will need to communicate the following information: the nature of the incident (fire, crowd disturbance, structural collapse, terrorist attack), identified hazards (debris, smoke, violence), estimated potential number of patients and injury patterns (crush injury, gunshot wound, burns, chemical attack), resources needed (heavy rescue, CRBNE response, fire suppression, law enforcement), and the best route of ingress and egress for resources, taking any hazards into account.

The command center will communicate with the local 9-1-1 center to activate the local or regional MCI plan, depending on the scale of the incident. Regional mutual aid agreements may be enacted. The predesignated communications channels will be activated so incoming responders can communicate with the scene of the incident. Area hospitals that have already been notified of the mass gathering as part of the planning phase will be notified of the MCI and will be able to implement surge capacity and recall procedures.

Each medical provider will transition to the predesignated mass casualty officer role as trained in the ICS, don the appropriate vest, and deploy the appropriate equipment and management aids (protective gear, ICS documentation aids and job action sheets, triage tags, etc.). For example, the medical director may become the medical group supervisor or treatment officer. Roles may change as incoming resources arrive. Because roles have been predesignated, each officer should be familiar with his or her roles and responsibilities as well as the specific job aids for each position. Because MCIs create chaos and confusion, and because of the infrequency of large-scale MCI drills, it is challenging for responders to implement the infrequently used skill set and officer roles required for successful MCI management. Predesignation of roles of personnel on scene allows for immediate implementation of the command structure, opportunity to review roles and materials before the chaos, and perhaps even as ongoing training even if an escalating incident does not occur.

Mobile teams will likely perform the initial triage of patients and organize potential transport of non-ambulatory patients to the treatment center. Meanwhile, the treatment center will also transition to prepare for patients. The staged MCI supplies (cots, blankets, bandaging) will be deployed to receive patients and organized to receive the different classifications of patients (red/immediate, yellow/delayed, green/minor, and potentially black/deceased) (see Video Clip 27.2). The initial planning and organization of the treatment centers should mimic the classification of patients. For example, a sobering center can become the treatment area for the green patients, a rehydration center can handle the yellow patients as it has IV supplies and is staffed with advanced personnel, and the most acute patients, red, can be sent to the advanced clinic prepared for immediate transport.

The clinic intake area will become a secondary triage area and documentation point that will direct incoming patients to the appropriate level of care. The different levels of care should be clearly separate yet adjacent to one another, so that patients may be moved from one to another if their conditions change. In addition to protected ground unit access, a helicopter landing zone with preidentified longitude and latitude coordinates may be useful in a large-scale incident. In the case of potential terrorism, site security is imperative to maintain the safety of responders by preventing a secondary attack that targets the treatment centers and medical personnel. In these types of events, deceased patients may need to be left in place to preserve the crime scene. Otherwise, an area should be reserved to serve as a temporary morgue. Larger events should dictate the mobilization of system-wide coordination and management teams, such as city emergency operations centers (see Video Clip 27.3).

**After a mass casualty incident**

In the aftermath of a mass casualty incident, responders and attendees will likely suffer the effects of stress. Every effort should be made to provide psychological support to all who were involved in management of the incident as well as the victims. Medical directors can be instrumental in putting a critical incident stress management process in motion.

A postevent operational debriefing can be helpful to identify areas for improvement and to assist in planning for future events and disaster management. The medical director can set the tone for a non-judgmental, objective, and constructive environment to review successes and challenges faced. A candid after-action report can be a helpful document for future planning and training for all levels of responders. Even with the best training and preparation, mistakes and errors will occur in MCIs. Some individuals and agencies may resist, but the need to apply lessons learned to future events is paramount.

**Case study 27.3 Ramstein Airshow Disaster**

August 28, 1988, Ramstein Air Force Base, Ramstein, Germany

Plane crash at airshow into spectator crowd: 73 dead, over 500 casualties

Even with best training and planning, weaknesses will be found

**Lessons learned**: The Ramstein “Flugtag” was an annual airshow that benefited from many advantages of mass gathering planning: it was a long-running event with predictable, ticketed attendance, it had strict security as it took place on a military base, there were large numbers of highly trained medical staff on site, planners had revised and practiced the event emergency plan twice in the prior year, and regional hospitals and ambulances were on standby for an escalating event. Despite robust planning, there were challenges, problems, and proof of “Murphy’s Law”: a show plane crashed into the crowd, and the resulting explosion destroyed both the emergency public address system and the emergency medical evacuation helicopter. The radios that connected the command post to the field were dropped and broken in the first moments of the emergency. The rapid evacuation of patients overwhelmed hospitals and patients arrived with little or no treatment. As a result, the disaster was shifted to the hospitals, care was delayed, and patient tracking problems left some patients unidentified until days later [24].

**Potential complications and considerations**

Each event will present unique challenges. The axiom “we prepare for the last disaster, not the next one” is a potential weakness for emergency planners. Nonetheless, implementing the planning principles, plan flexibility, and preparing for the worst will benefit the management of a potential escalating incident. Planners may encounter resistance due to budgetary restrictions or organizational inertia; however, it is the ethical responsibility of municipalities, event organizers, and service providers to mitigate the risks inherent in mass gatherings.

**Conclusion**

Mass gatherings can present challenges to planners and emergency response services at every level. These challenges can be addressed with proper planning that includes EMS response capabilities geared to meet event-specific predicted needs plus preassignment of MCI leadership roles, predesignation of disaster communications channels, coordination with regional hospitals, integration of unique EMS tools and capabilities, staging on-site disaster supplies, recognition and mitigation of historic vulnerabilities, and preservation rather than saturation of regional resources with physician-based treatment centers. A mass gathering can be converted from an event that creates potential risk for a community to a superior, ongoing training tool for MCI preparedness while preserving system standards of care. The error is not in the inability to foresee a specific calamity; rather, it is in the lack of coordination, preparation, and planning of actors on all levels to be trained to work together to prevent the foreseeable, train for the exceptional, and prepare for the unthinkable.

**References**

1. 1 Grant WD, Nacca NE, Prince LA, et al. Mass-gathering medical care: retrospective analysis of patient presentations over five years at a multi-day mass gathering. *Prehosp Disaster Med* 2010;25(2):183–7.
2. 2 Tsouros AD, Efstathiou PA. *Mass Gatherings and Public Health: The Experience of the Athens 2004 Olympic Games*. Geneva: World Health Organization, 2007, pp.6–21.
3. 3 Sanders AM, Criss E, Steckl P, Meislin HW, Raife J, Allen D. An analysis of medical care at mass gatherings. *Ann Emerg Med* 1986;15(5):515–19.
4. 4 DeLorenzo RA. Mass gathering medicine: a review. *Prehosp Disaster Med* 1997;12(1):68–72.
5. 5 Federal Emergency Management Agency. *Special Events Contingency Planning Job Aids Manual*. Washington, DC: Federal Emergency Management Agency, 2005.
6. 6 World Health Organization. Communicable disease alert and response for mass gatherings. Technical workshop. Geneva: World Health Organization, 2008, p.4.
7. 7 Emergency Management Australia. *Safe and Healthy Mass Gatherings: A Health, Medical and Safety Planning Manual for Public Events*. Canberra: Emergency Management Australia, 1999, p.63.
8. 8 Soomaroo L, Murray V. Disasters at mass gatherings: lessons from history. PLOS Currents. Available at: [www.ncbi.nlm.nih.gov/pmc/articles/PMC3271949/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3271949/)
9. 9 Lund A, Gutman SJ, Turris SA. Mass gathering medicine: a practical means of enhancing disaster preparedness in Canada. *Can J Emerg Med*2011;13(4):231–6.
10. 10 Arbon P. Mass-gathering medicine: a review of the evidence and future directions for research. *Prehosp Disaster Med* 2007;22:131–5.
11. 11 Calabro JJ, Rivera-Rivera EJ, Reich JJ, Krohmer JR, Balcombe DJ. Provision of emergency medical care for crowds. Irving, TX: American College of Emergency Physicians EMS Committee, 1995–6.
12. 12 Milsten AM, Maguire, BJ, Bissell RA, Seaman KG. Mass-gathering medical care: a review of the literature. *Prehosp Disaster Med* 2002;17(3):151–62.
13. 13 Hartman B, Williamson A, Sojka B, et al. Predicting resource use at mass gatherings using a simplified stratified scoring model. *Am J Emerg Med*2007;27:337–43.
14. 14 Franaszek J. Medical care at mass gatherings. *Ann Emerg Med* 1986;15:600–1.
15. 15 Varon J, Fromm RE, Chanin K, et al. Critical illness at mass gatherings is uncommon. *J Emerg Med* 2003;25:409–13.
16. 16 Friedman LJ, Rodi SW, Krueger MA, Votey SR. Medical care at the California AIDS Ride 3: experiences in event medicine. *Ann Emerg Med*1998;13:219–23.
17. 17 Binder LS, Willoughby PJ, Matkaitis L. Development of a unique decentralized rapid-response capability and contingency mass-casualty field hospital for the 1996 Democratic National Convention. *Prehosp Emerg Care* 1997;4:238–45.
18. 18 Crocco TJ, Sayre MR, Liu T, et al. Mathematical determination of external defibrillators needed at mass gatherings. *Prehosp Emerg Care* 2004;8:292–7.
19. 19 Wetterhall SF, Coulombier DM, Herndon JM, et al. Medical care delivery at the 1996 Olympic Games. *JAMA* 1998;18:1463–8.
20. 20 Meites E, Brown JF. Ambulance need at mass gatherings. *Prehosp Disaster Med* 2010;25:511–14.
21. 21 Grange JF, Baumann GW, Vaezazizi R. On-site physicians reduce ambulance transports at mass gatherings. *Prehosp Emerg Care* 2003;7:322–6.
22. 22 Helbing D, Mukerji P. Crowd disasters as systemic failures: analysis of the Love Parade disaster. EPJ Data Science 2012;1:7. Available at: <http://www.epjdatascience.com/content/1/1/7>
23. 23 Ackerman O, Lahm A, Pfohl M, et al. Patient care at the 2010 Love Parade in Duisburg. *Deutsch Ärzteblatt Int* 2011;108:483–9.
24. 24 Martin TE. The Ramstein Air Show disaster. *J R Army Med Corps* 1990;136:19–26.