

Medical Support for Children's Mass Gatherings

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Abbreviations:

AED = automatic external defibrillators
ALS = advanced life support
BLS = basic life support
CEP = chief emergency physician
EMT-D = emergency technicians
licensed to use a defibrillator
EMS = emergency medical systems
EP = emergency physicians
MCI = mass casualty incident
MG = mass gathering
MGMC = mass gathering medical care

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Abstract

Introduction: Medical care must be well-planned for mass gatherings. Events such as fairs, concerts, parades, and rallies cause many people to gather in one place, increasing the chance of injuries and for the development of a disaster. In this study, the level and quality of medical care were evaluated at a mass gathering of approximately 100,000 children. The event was a television-sponsored fun fair.

Methods: Every patient contact was documented on printed forms, including data such as the number of patients treated, gender of the patients, presence or absence of a parental escort, time distribution of patient contacts, the diagnoses for the patient contacts, specific therapies applied, duration of the treatment, and patient discharge information. All data were coded after the event and transferred into a computer database. These data were analyzed using descriptive statistics.

Results: Of the 100,000 spectators, 192 patients (81 male [42.2%] and 111 female [57.8%]) were treated during the nine-hour period, from 09:00 hours (h) until 18:00 h. Twenty percent of all the children up to the age of 10 years needing medical assistance were not accompanied by an adult. Seventy-five percent of all patient contacts were made during the afternoon. Of those treated, 164 patients (85.4%) suffered only minor injuries and were seen for <10 minutes. The most common type of complaint was minor trauma (103 patients, 53.6%); followed by minor medical problems such as headaches or light allergic reactions (21 patients, 10.9%); insect bites (20 patients, 10.4%); and serious medical problems or trauma such as severe arterial hypertension or long bone fractures (19 patients, 9.9%). Treatment included, but was not limited to, dressings (100 patients; 52.1%), local therapy (68 patient, 35.4%), and analgesic therapy (10 patients, 5.2%). Four patients (2%) were transferred to local hospitals.

Conclusion: Most of the medical needs in the patients attending the children's fun fair were minor. Nevertheless, for similar events in the future, the medical team should be qualified for all serious medical emergencies, as well as major trauma; and should be prepared to meet the requirements of the specific group of spectators.

The overall usage rate in the children's fun fair described was 19.2 patient encounters per 10,000 spectators. Half of all of the patients were children below the age of 14 years. Medical services should consider that this study shows that up to 33% of children seeking medical assistance may not be accompanied by adults.

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Contact	Surname:	Time	
	First Name:	Place:	
	Female: () Male: ()		
	Date of birth	Postal code:	
	Accomp.pers.: None () Group: ()	Parents: ()	
Treatment on-site	Pediatricians: () NIBP:	Time:	
	Nurse: () HR:	Situation:	
	EP (Anesth.): ()		
	Paramedic: ()		
	Trauma: () Illness: () Others: ()		
Treatment in tent	Pediatricians: () NIBP:	Time:	
	Nurse: () HR:	Symptoms:	
	EP (Anesth.): ()		
	Paramedic: ()		
	Diagnose:		
	Therapy: No: () Transport: ()		
	Therapy:		
Therapy:			
Discharge		Time:	
	Comments (back side) ()		

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Figure 1—Patient contact questionnaire

Introduction

A mass gathering (MG) is not clearly defined in the literature. Some authors describe a MG as a group of more than 1,000 spectators,^{1,2} while others define the term as a group of up to 25,000 people.³

Organized mass-gathering medical care (MGMC) has existed in Europe and the United States for more than 30 years.^{1,4-6} On-site medical coverage is essential to minimize the workload of the local health services and Emergency Medical Systems (EMS) during such events.^{7,8} Planning and providing emergency and primary care for a large, possibly transient, population of visitors can be problematic. Therefore, in addition to the personal experience of the planning staff, other methods of preparation should be considered.⁹

Software tools may help to estimate the medical requirements (e.g., personnel, equipment, supplies, organizational prerequisites, communication, and transportation), but there is little evidence to support any standard of care or uniformity in its delivery.¹⁰ Often the crowd size has been selected as the most important factor in determining the potential patient load.¹¹ A linear relationship between the numbers of spectators and the numbers of treated patients would be the simplest parameter for the planning of MGMC, but this often does not meet the specific requirements of the population. Also, the preparation of MGMC must account for the type of event, its duration, and the type of visitors. Other uncontrollable factors, such as weather conditions, must be considered as well.

Little information has been published on MG involving children.^{12,13} Therefore, the organizers of these events

must plan according to their best estimation or use data gained from MG of adults.

Mass gathering medical care (MGMC) for children's events rarely has been organized. Furthermore, data collection may be more difficult in this specific population due to the rate of unaccompanied minors (which can result in missing information) and the number of parents with language difficulties (due to immigrants' accompanying their children).

Methods

Medical support for a children's fun fair had to be planned and implemented. The event took place outdoors in a park in the center of a city with about 180,000 inhabitants. The site measured about three square kilometers. During the nine-hour period from 09:00 h to 18:00 h, 100,000 visitors were counted by the police. The maximum temperature rose to 29°C (84.2°F) at noon, with a relative humidity of 63%. This is equivalent to a heat index of about 91°F, which is considered extreme. This level of heat index may cause sunstroke, heat cramps, or heat exhaustion.

Every patient contact was documented using a questionnaire designed exclusively for the event (Figure 1). Data such as patient age, gender, and time of contact were gathered, as well as the place of the first patient contact and the accompanying persons.

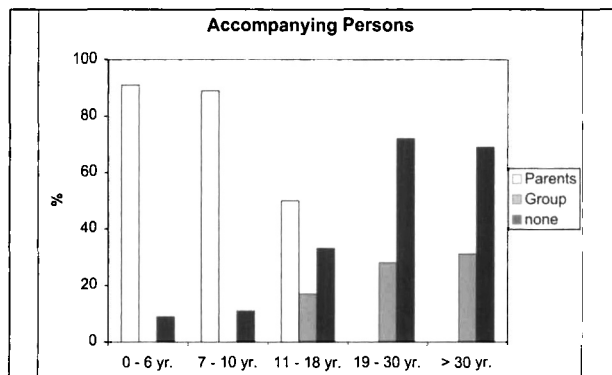
To predict medical needs of this population, variables such as crowd size exceeding 100,000 in an outdoor event and hot weather conditions were taken into account. An estimated rate of 25-35/10,000 attendees was calculated.

The medical team consisted of physicians (one anesthesiologist as chief emergency physician, two anesthesiolo-

Author	Event	Usage Rate /10,000	Range
Baker, 1986	Summer Olympics	16	6.8 to 68
Ounanian, 1986	Rock Festival	62	50 to 105
Spaite, 1988	5 Stadiums	3.3	1.2 to 5.2
Weaver, 1989	World's Expo	39.3	19.4 to 68
Thompson, 1991	Winter Olympics	15.2	
Bock, 1992	Indianapolis 500	3.5	
Suy, 1999	Rave Party	135	

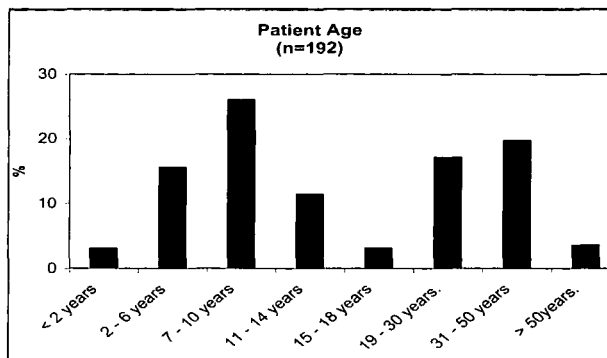
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Table 1—Usage of typical mass gatherings



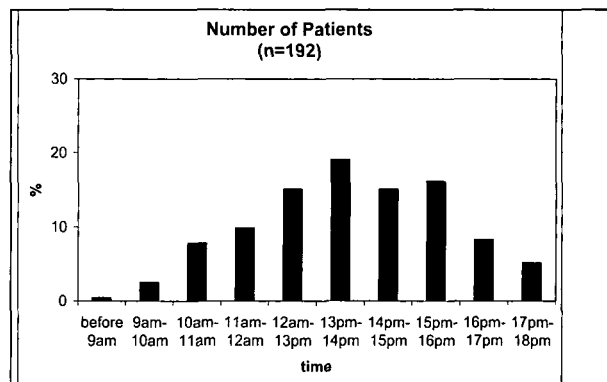
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Figure 3—Accompanying person of individual patient



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Figure 2—Age distribution of patients



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Figure 4—Patient encounters stratified by time

gists as emergency physicians, and four pediatricians) and four pediatric nurses from the local university hospital. A chief emergency physician (CEP) is trained to lead within a local command structure in order to manage all medical aspects of mass casualty incidents and disasters including man-made (e.g., traffic or industrial accidents, terrorist attacks) and natural (e.g., earthquakes, floods, fires) incidents.¹⁴ Chief Emergency Physicians (CEPs) are experienced in defining medical priorities and analyzing and organizing key problems, such as triage of victims, medical care and its limitations, in-field treatment, and means of transportation of victims requiring conveyance to a hospital at mass casualties incidents (MCI) and disasters. Furthermore, CEPs are responsible for all aspects of planning and preparing the medical response of a MCI as well as for mass gatherings. The CEP was responsible for the entire medical organization of this event.

Paramedics, emergency medical technicians licensed to defibrillate (EMT-D), and first-aid providers from rescue organizations also were included. Four tents serving as first aid and advanced life support (ALS) hosts were located strategically at the site. One pediatrician, one pediatric nurse, and EMS personnel were present in each tent. The anesthesiologists were available on-site and could be deployed via radio.

Eight mobile teams consisting of EMT-Ds and first-aid providers were distributed over the area to provide emergency treatment. The primary objective of these teams was to render first aid, basic life support (BLS), and early defibrillation by the use of automatic external defibrillators

(AED). Ambulances were accessible for transports in the area or to other medical facilities. Three fully equipped mobile intensive care units and four patient transport ambulances were positioned at strategic locations in the park.

The communication structure consisted of portable radios, mobile phones, and fixed-line communication to the local EMS dispatch center and hospitals.

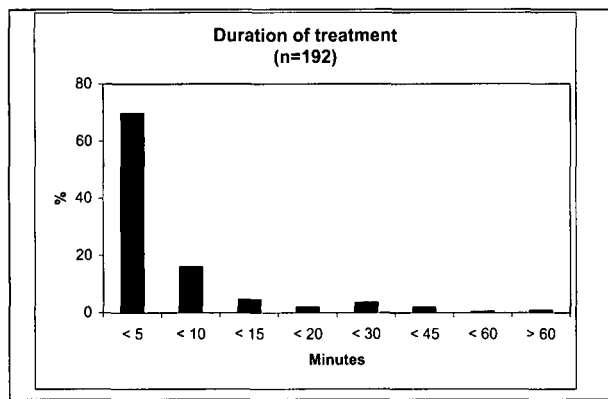
Data were stored in an Excel 2002 database (Microsoft, Redmond, Washington, USA). Patients with partially missing data, such as age or type of complaint, were not included in the database. Descriptive statistics were used to analyze the data.

Results

During the nine-hour event, 192 patient contacts were documented. The overall usage rate (patients per 10,000 spectators was 19.2). Medical assistance was requested by 81 males and 111 females. Half of all patients encountered (50.5 %) were children below the age of 14 years (Figure 1).

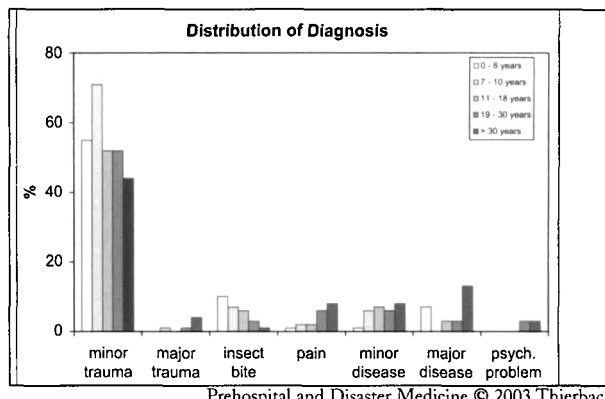
Ten percent of children up to the age of 10 years and another 33% of children from ages 11 to 18 years seeking medical assistance were not accompanied by an adult (Figure 3). The majority of patient encounters occurred during the afternoon (Figure 4).

In 164 of the patients (85.4%), medical problems and injuries were minor and assessment and treatment required <10 minutes (Figure 5). The most common diagnosis was



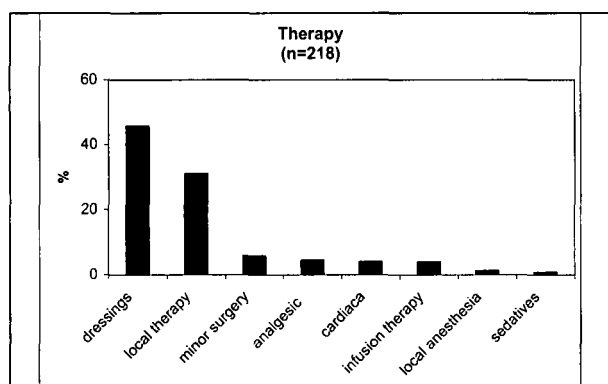
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Figure 5—Duration of medical treatment for individual patient



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Figure 6—Diagnosis stratified by age groups



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Figure 7—Therapy provided to patients

minor trauma (including grazes, cuts, and bruises), followed by minor diseases (including light allergic reactions, rashes, fever, headaches, and psychological problems), and insect bites (Figure 6). Twelve of 19 patients with serious medical problems (including cardio-circulatory problems and severe arterial hypertension) occurred in adults. Major trauma, such as long bone fractures, occurred in four adults and one minor. There was no significant difference in gender and age groups among traumatized and non-traumatized patients.

Seventy-eight percent of the medical treatment of individual patients took place inside the tents, while 20% occurred at the patient's location, and 2% of the care was provided inside the ambulances.

Most on-site patient contacts were made by EMTs or paramedics, and interventions by a physician were necessary in only 14% of these. Inside the tents, medical support by a pediatrician was necessary in 35% of patients; and 3% of patients were treated by the emergency physicians.

Treatment measures included primarily local wound therapy and dressings, and the administration of analgesics (Figure 7). No life-threatening conditions were treated.

Some children were monitored following medical treatment at a specific playground and meeting point managed by a local kindergarten.

Four patients were admitted to local hospitals, mainly for diagnostic procedures, such as radiographs or blood tests. Ten patients underwent private transportation to

their family practitioner for further ambulatory treatment or the administration of specific drugs.

Discussion

The primary goal of MGMC is the delivery of rapid and qualified medical care, which must be adapted to the specific patient population.¹¹ Another responsibility is to minimize the impact of the event on the EMS and local hospitals by having qualified medical resources available. Large numbers of patients with minor injuries or diseased patients may overwhelm local medical resources. Therefore, an independent medical structure must be developed and established on scene in connection with the medical infrastructure of the specific region.

Reports on medical assistance during mass gatherings have been published previously,^{1,3,15,16} but little data are available for events coping with large crowds of children.¹²

Every mass gathering is unique in characteristics such as venue, number of spectators, local weather conditions, and medical infrastructure of the specific region. However, it is feasible to incorporate experiences gained from other mass gatherings into the planning process. Reliable predictions of medical resources that may be required facilitate planning and estimation of the number of medical staff and equipment necessary.

Several studies have shown that the number of treated patients varies considerably with type and category of event,⁹ as well as with the number of people attending the event.⁷ Higher usage rates have been described for larger crowds.¹⁷

Also, it has been determined that there are higher usage rates during outdoor mass gatherings compared with indoor events.¹⁸ Another factor to consider is whether the people are seated or are allowed to move around or participate in the event. Ambulatory crowds are associated with higher usage rates.

Other classifications divide events into bounded and unbounded areas. The higher usage rate for bounded gatherings, such as football or soccer games, is related to the instant availability of medical services on scene,¹¹ and the fact that bounded crowds may show mass panic reactions resulting in large numbers of casualties.

A higher rate of patient encounters is associated with hot weather conditions.^{9,19} A relationship between the relative humidity of the air and the number of treated persons

has been identified by several authors.^{11,18} Therefore, it is essential to include forecasted weather conditions into the planning. In this case, the heat index exceeded 90°F (32°C), but no heat-related problems were documented.

Classification systems^{19-22,28} and software tools¹⁰ that complete the necessary medical resources have been published previously, but none of these have been validated.⁹ These systems are based on the integration of all risk factors into a scoring system.

Although the visitors at the children's fun fair described in this publication were only seated during specific top acts and had the opportunity to take in games and other competitions actively, the medical usage rate (19.2) was less than estimated (25–35 per 10,000). These data support the findings^{9,17} that estimating the usage rate and medical resources for a specific event should include more variables, often resulting from common sense and personal experience, than provided by software modules or classification systems.

Michael showed in a meta-analysis reviewing 25 years of MG events, that the mean medical usage rate per 10,000 spectators was 32 ± 32.0, and the hospital transport rate was 0.8 ± 0.02 per 10,000 spectators.⁹ With 19.2 patient encounters per 10,000 spectators, the usage rate is well within the described range, and is similar to that of the Olympic Games or at a World's Exposition.^{18,23-24}

The hospital transport rate of 0.4 per 10,000 in this specific event is lower than the rate found at sport contests or rock concerts.^{18,25-26}

Surprisingly, many children needing medical assistance were not accompanied by an adult. One would assume that the parents are the first ones involved if a child presents medical problems or is injured. The unexpected frequency of unattended minors resulted from two conditions: (1) small children became separated from their parents due to crowd size; and (2) older children attended the event without direct supervision from adults. The higher usage rate during the afternoon correlated well with the number of visitors, as had been estimated by the police.

For 85% of the patients contacted, only minor trauma (e.g., grazes, insect bites, and minor medical problems) had to be treated. Although advanced life support was not necessary at this MG, ALS equipment was readily available. The benefit of the use of AEDs²⁷⁻²⁸ and ALS measures at public events had been well-documented previously.²⁹

Statistically, some spectators of mass gatherings, at rock concerts as well as papal masses, will suffer from chronic diseases.²⁶ Asthma has been the most common complaint of patients with acute symptoms seeking treatment at mass gatherings.¹¹ Typical lung diseases and metabolic problems such as asthma or diabetes may be present in minors also. As a general rule, the number of chronically ill people in a population attending a MG is lower compared with the general public.³⁰

At children's mass gatherings, medical teams even may be confronted with typical geriatric problems from parents or grandparents, such as hypertension or symptoms related to acute coronary syndromes. These often are related to physical exhaustion, heat, or the lack of continuity in taking essential prescriptions.¹⁶

At MG, the consumption of alcohol increases the casualty rate remarkably.^{16-17,31} This problem could be neglected during the preparation for this children's mass gatherings, because the consumption of alcohol was not allowed at the venue. Usually, during events such as rock concerts or rave parties, alcohol and other drugs, such as Ecstasy, pose major problems.¹⁵

Minor first-aid problems during mass gatherings arranged for adults include headaches, insect bites, and blisters. These complaints account for up to 75% of the entire patient encounters.^{1,18,32} Consequently, the overwhelming majority of patients can be treated effectively by non-physician personnel, such as nurses and paramedics.^{2,7,16} However, there is little question that the presence of physicians, who carry the highest medical responsibility and are qualified for extended medical and surgical treatment on-site, are necessary for providing quality care.^{18,33} Studies have proven that physicians on-site are capable of reducing the impact of the MG on EMS and local hospitals.^{1,7}

Physicians involved must be appropriately qualified for the specific medical needs of the spectators. Especially for a MG involving children, the inclusion of pediatricians beside emergency physicians (EPs) or traumatologists into medical teams must be discussed. Pediatricians are highly qualified to cope with typical diseases of infants or children. On the other hand, EPs usually are represented in central European countries by anesthesiologists, are most appropriate for handling any medical or traumatic emergency, and are most familiar with the EMS. Some authors believe that EPs are the most qualified to staff MG.¹⁸ Surgeons may play a role in further reducing impact on local hospitals by providing the possibility of treating minor trauma, such as lacerations, on-site.

The equipment needed for MGMC should be adapted to the estimated amount and type of diseases and injuries. In contrast to the equipment used by the EMS, equipment for acute emergencies must be available as well as that needed to treat minor complaints.³

Especially for children's mass gatherings, the standard of ambulances is not sufficient. Special equipment for basic and emergency care of this young population must be readily available.

Event organizers usually request cost-effective medical care; but even costs for extended medical care do not exceed one dollar [U.S.] per visitor.

The organization of MGMC must include notifications of local hospitals well in advance of the event. Although all preparations should be taken to reduce the potential impact of the event on local hospitals, nevertheless, a significant flow of patients may result.

Contingency planning for medical response in the unlikely possibility of a full-scale mass casualty incident, cases of violence or terrorism, or exposure to toxic substances also must be anticipated and coordinated with local authorities.

Conclusion

Proactive attention to comprehensive contingency planning for personnel, equipment, supplies, and organizational prerequisites is essential to meet medical needs during

the children's mass gathering. The medical team must be qualified to cope with all serious medical emergencies, as well as major trauma, and should be specially selected for the specific group of spectators.

The overall usage rate in the children's fun fair described was 19.2 patient encounters per 10,000 spectators. Half of all patients were children below the age of 14 years. Medical

services should be aware that up to 33% of children seeking medical assistance are not accompanied by adults.

Most of the medical needs in a population attending a children's fun fair are minor. Therefore, medication and supplies needed are different from the ones used in emergency medicine. The rate of patients admitted to hospitals can be kept low to reduce the impact of the event on local medical resources.

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