

Original Articles

Descriptive epidemiology of orthopedic injury and illness during the Special Olympics of Pennsylvania Summer Games from 2008 to 2017

James D. Galdieri¹, Alka Sood², Amber N. Edinoff³, Elyse M. Cornett⁴ ^a, Alan D. Kaye⁴, Peter H. Seidenberg⁵

¹ East Stroudsburg University, ² Department of Family and Community Medicine, University of Toronto, ³ Department of Psychiatry, Louisiana State University Health Sciences Center, School of Medicine, ⁴ Department of Anesthesiology, Louisiana State University Health Sciences Center, School of Medicine, ⁵ Department of Family Medicine, Louisiana State University Health Sciences Center, School of Medicine

Keywords: intellectual disability, Special Olympics, musculoskeletal injury, predisposition to injury, orthopedic injury

<https://doi.org/10.52965/001c.35276>

Orthopedic Reviews

Vol. 14, Issue 3, 2022

Background

The Special Olympics Pennsylvania Summer Games attract over 2000 athletes each year. Volunteer medical staff ensures their safety throughout this period. However, few studies have examined the incidence of orthopedic injury and sickness in this group, especially with a large sample.

Objective

Identify the incidence of orthopedic injury and illness at the Special Olympics Pennsylvania Summer Games based on demographic criteria and identify the incidence of transports required for advanced care.

Methods

Data was collected from logs provided by Special Olympics Pennsylvania. The data were analyzed and stratified by gender, age, sport, and type of encounter. We summarized the data and compared it to data from other years and the average.

Results

An average of 1971 athletes competed annually. On average, 10% (N=144) of competitors required medical care. Males comprised 58.2% (N = 837) of encounters, females 33.6% (N = 483), and in 8.1% (N = 117) of encounters gender was not identified/recorded. The mean age of participants was 29 years of age (range from 10 to 83). 56.6% (N= 813) of encounters required first aid management only. Injuries made up 31.7% (N = 455) of total encounters, and 11.8% (N=169) of encounters were classified as illnesses. Basketball was the sport with the most injuries, 49.5% (N = 711). An average of 9.8 transports was required annually.

Conclusions

Special Olympics athletes suffer the same injuries as regular athletes, but they are also prone to various medical disorders that regular athletes are not.

INTRODUCTION

Special Olympics is a non-profit, international program that has provided individuals with intellectual disabilities

in 150 countries to compete in numerous sports since its foundation in the early 1960s.¹⁻³ The Games are organized and operated at local, regional, state, national, and world-wide levels. Special Olympics Pennsylvania (SOPA) is the state chapter for Pennsylvania and was founded in 1970.

^a Corresponding author:

Elyse M. Cornett, PhD, Assistant Professor, Department of Anesthesiology, LSU Health Shreveport, 1501 Kings Highway, Shreveport LA 71103, elyse.bradley@lsuhs.edu
248-515-9211

SOPA hosts its Summer Games annually, with approximately two-thousand athletes from across the Commonwealth participating each year.¹ The Summer Games typically run from the first Thursday through Saturday in June in State College, Pennsylvania, hosted by Pennsylvania State University.¹ In addition to the competitors, officials, coaches, volunteers, family members, and fans are also present for the duration of the Games. To ensure the safety of the competitors and any other individuals present, many healthcare professionals and support staff volunteer their services for the time of the Summer Games. This study analyzed the data for competitors only.

The SOPA Summer Games offer nine sports for the athletes to compete in. The majority of these events take place on the campus of the Pennsylvania State University in State College, Pennsylvania. The seven on-campus sporting events include aquatics, athletics (track and field), basketball, equestrian, gymnastics, softball, and tennis. In addition, bowling and golf hold their competitions off-campus and can be reached via personal vehicle or Special Olympics-provided shuttle bus.

While some sports have a single venue, aquatics uses two swimming pools. In addition, basketball can utilize as many as six courts in two separate facilities, tennis operates seven courts, and softball competes in five different fields. This creates 24 sites where competitions can be held.

One central command center, known as Special Olympics Security (SOS), housed all radio operations, Summer Games security, and medical staff services. Golf carts are also provided, allowing quick access to all on-campus competition sites. Each sports venue has two-way radio access with SOS, and all coordinators have immediate radio access regardless of where they are on campus. The healthcare staff comprises certified athletic trainers (ATs), primary care sports medicine physicians, primary care sports medicine fellows, athletic training students, and emergency medical technicians (EMTs). During the years of this study, SOPA required that each sports venue has, at minimum, one security volunteer, one EMT, and one AT. Additional athletic trainers and athletic training students may be utilized at venues based on the number of medical staff volunteers, competitors, and the probability of orthopedic injury. The sports medicine attending physicians and fellows circulate to each platform and are within radio contact so they can quickly arrive at an injured athlete. The ATs and physicians can provide advanced care to competitors and, when necessary, refer them to appropriate outpatient clinics, urgent care facilities, or the local emergency department.

POPULATION

Individuals who compete in Special Olympics events often have pre-existing or specific medical conditions requiring different care plans than traditional athletes. The orthopedic injury patterns identified for other individuals with disabilities, such as athletes with spinal cord injuries, cerebral palsy, and amputations, are distinct from those in the Special Olympic cohort.⁴ Many Special Olympics participants have underlying vision, hearing, and motor impair-

ments.⁴⁻⁷ Vision impairment has been found in 25-50% of all individuals with intellectual disabilities while hearing deficits are present in one-third.^{3,7} Motor deficits produce difficulties with coordination, endurance, and biomechanical stability in up to 30% of athletes.⁷ Additionally, individuals with intellectual disabilities have been shown to exhibit decreased levels of cardiovascular fitness and increased rates of obesity.^{2,6} Previous data from Special Olympics research has demonstrated that many athletes also have behavioral disorders and medical conditions such as asthma, diabetes, seizures, congenital cardiac anomalies, and ligamentous laxity. Additionally, if an underlying syndrome has caused an intellectual disability (such as Down syndrome), syndrome-specific associated disorders need to be considered.^{3,4,7}

METHODOLOGY

ETHICAL CONSIDERATIONS

This study received an exemption from the Institutional Review Board (IRB) at Penn State Hershey University College of Medicine, STUDY00004857. No consent was necessary from patients since this was a retrospective review. Data were protected in several ways. All data were kept on a password-protected computer on campus, in a locked office, in a university hospital that requires badge/key card access to non-public areas.

When aid was required for an orthopedic injury or illness to a competitor, SOPA Summer Games medical staff members completed an incident report. Each report documented the athlete's vitals, demographic information, orthopedic injury/illness, etiology, and care. In addition, incident reports recorded the type of injuries and medical conditions encountered throughout the SOPA Summer Games. After receiving the determination of exempt status from the Institutional Review Board (IRB) for this retrospective, descriptive study, all incident reports and orthopedic injury logs from 2008 through 2017 were collected from the Special Olympics of Pennsylvania office in Norristown, Pennsylvania. The following data was then obtained: gender, age, sports participation, incident classification, type of treatment provided, and whether the participant's orthopedic injury warranted transportation for higher-level medical care.

The following terms are defined to organize the reports correctly:

- Orthopedic injury was defined as any acute trauma that occurred during the Games, most often musculoskeletal, and included dental injury, lacerations, or an eye injury. An orthopedic injury often required the athlete to stop, limit, or modify participation following the incident.⁸
- Illness pertained to any condition that arose during the games (such as heat illness) or related to a pre-existing condition exasperated by participation (e.g., diabetic complications or seizures).
- First aid was defined as a quick intervention requiring minimal evaluation and management involving a 'convenience' item such as providing a bandage, bag

Table 1. Study Demographics

Length of Study (years)	10
Total # of Special Olympic athletes	19708
Mean # of athletes annually	1971
Range of athlete ages logged	10 to 83
Mean age of athletes	29.1
Total incidents reports	1437
Total incidents by gender	
Male	837
Female	483
Undisclosed	117
Total incidents by type	
Illnesses	455
Injuries	169
First Aid	813

of ice, cleaning sunscreen from eyes, taping, and basic wound care (such as dealing with abrasions, but not lacerations).

- Transport involved a referral of the athlete to a higher level of medical care than could be provided on the sidelines or in the SOS medical suite. This transpired in either a specialty clinic, urgent care center, or local emergency department. The mode of transport entailed either emergency medical services (EMS) or private vehicles.

The data was analyzed to determine the frequency and nature of injuries, and medical conditions evaluated and determine which athletic events were associated with the highest frequencies during competition. Additionally, the medical interventions administered were utilized to form a list of recommended resources when providing medical coverage for future Special Olympics Summer Games and all Special Olympics events worldwide.

RESULTS

The cumulative number of athletes competing in the SOPA Summer games during this 10-year study was 19,708, with a mean of 1971 athletes per year. The age of athletes treated by medical staff members ranged from 10 to 83 years of age, with a mean age of 29. The total number of incidents reported over the ten years was 1437, with a mean of 144 incident reports annually, approximately 10%. In almost all incidents, gender was recorded. Males comprised 58.2% (N = 837) and females 33.6% (N = 483), with gender not having been identified/recorded in 8.1% (N = 117) of incidents. Most encounters, 56.6% (N= 813), required first aid management only. Injuries made up 31.7% (N = 455) of total incidents, and the remaining 11.8% (N=169) were classified as illnesses. These demographic data are summarized in [Table 1](#).

Consistent with Conn's findings,⁹ basketball was the sport with the most injuries, comprising just under half the total at 49.5% (N = 711), and softball had the second most injuries with 18.1% (N = 260). Basketball and softball combined comprised over two-thirds of the complete incident reports. Athletics (Track and Field) had the third most, with 11.2% (N = 161) of injuries, while golf at 0.3% (N = 5) and equestrian at 0.2% (N = 4) had the least number of injuries. ([Table 2](#)).

Of the 1437 total encounters, 56.6% of incidents were classified as first aid (N = 813). The most common first aid administered was ice (34.8%, N = 283), followed by tapings and wrappings (34.2%, N = 278), and then wound care (26.7%, N = 215). ([Table 3](#)).

The most common musculoskeletal orthopedic injury was a lower leg sprain (ankle, foot, toe), which accounted for 22% of total injuries, followed by thigh (hip, knee, thigh) contusion (8.8%), strain in lower body musculature (quadriceps, hamstrings, glutes, hip flexors) (6.4%), contusions to the head, face, eyes, or nose (7.9%), and sprains to the fingers, thumb, wrist, or elbow (6.2%). In addition, there were 14 concussions diagnosed throughout this study, accounting for 3.1% of all injuries. ([Table 3](#)).

The minor proportion of incidents was classified as illnesses. The most-reported illness was heat exhaustion, which accounted for 29.6% of illnesses treated and 3.5% of all encounters. Other illnesses commonly reported were seizures (16.0%), upset stomach (11.2%), and chest pain (7.7%). ([Table 3](#)).

Over the 10-year study, 98 athletes required EMS transport to a local hospital for further evaluation and treatment. Most of these incidents were managed on-site; however, a mean of 9.8 carriers as needed annually. More than half of the transports resulted from an illness (57%) compared to orthopedic injury (43%). The most common diseases requiring transport were chest pain (14%), heat illness (9%), seizures (7%), and dehydration (4%). The most

Table 2. Number and Type of Incidents Per Year

Total Incidents by Sport				
	10 Year Total	Overall % of total incidents	Incidents % of total avg annual SO participants	
Aquatics	73	5.1%	3.7%	
Athletics	161	11.2%	8.2%	
Basketball	711	49.5%	36.1%	
Bowling	16	1.1%	0.8%	
Equestrian	4	0.3%	0.2%	
Golf	5	0.3%	0.3%	
Gymnastics	34	2.4%	1.7%	
Softball	260	18.1%	13.2%	
Tennis	49	3.4%	2.5%	
SOS	103	7.2%	5.2%	
No Sport Listed	21	1.5%	1.1%	
Total	1437	100%	73%	
Total Incidents by Type				
Illnesses	455	31.70%		
Injuries	169	11.80%		
First Aid	813	56.60%		
Total	1437	100%		
Total Incidents Requiring Transports				
	98			

common injuries requiring transport were head injuries, including concussions (15%). (**Table 4 & 4a**).

The year 2008 was the busiest for medical staff members in several aspects. While the average number of annual encounters is 144, in 2008, the highest number of incidents were logged with 224 meetings. That same year experienced the most illnesses with 29, compared to an annual mean of 17. There was also twice the average number of transports with 20. In 2015, the most injuries were recorded (N=72), an increase from 46, while 2017 represented the first aid encounters with 163, compared to a mean of 81. (**Table 5**).

DISCUSSION

There is limited sports medicine research longitudinally evaluating injuries or illnesses in individuals with disabilities in general and intellectual disabilities in particular.¹⁰⁻¹² Presently, few studies document the number and types of injuries to athletes with disabilities and compare them to other athletic populations.^{5,9,10,13,14} Prior orthopedic injury and illness surveillance studies during other states' Special Olympics summer games revealed that orthopedic trauma (40-60%), including abrasions, strains, sprains, lacerations, and fractures, occurred more often than other medical conditions combined.¹² The knee was the most frequently injured joint, followed by the ankle, back, and shoulder.^{11,15} Basketball, track and field, and

softball seem to be the most significant culprits, similar to this study.^{14,15} Birrer's two-year study involving Special Olympics New Jersey found a 2.8% overall incidence of medical encounters, with an increased tendency of visits due to orthopedic injury (66%) rather than medical illness. They, too, found most incidents to be related to abrasions, contusions, and sunburn.¹⁰ McCormick et al. reported a 3.5% incident frequency during a three-day Special Olympics Texas event. In contrast to our study, track and field produced the most injuries and recorded more medical visits for illness than orthopedic injury.¹³ Robson reported the most significant orthopedic injury rate (13%) among 1512 athletes competing in 14 events during the five-day United Kingdom Special Olympics games but did not differentiate acute injuries from prior medical conditions.¹⁴ Of the other documented medical conditions, sunburn, heat exhaustion and abdominal pain were the most frequent, while others included seizures, diabetes, asthma, epistaxis, dermatitis, and bee stings.^{11,12,15}

The orthopedic injury patterns of the Special Olympics athlete are challenging to compare to physically disabled athletes or athletes without intellectual disability. However, Dehaven & Lintner's study of disabled athletes without intellectual disability found that 80.3% of all injuries occurred in male participants.¹⁶ Knee and ankle sprains or strains were the most common etiology for both sexes. Conn et al. similarly noted that in traditional athletes, males were involved in greater than two times (68%) the

Table 3. Type of Injury, Illness, and First Aid

Injury	Total #	% of Injuries	% of all Incidents
Pain, Strains, and Sprains	202	43.1%	14.1%
Contusions	142	30.3%	9.9%
Lacerations	31	6.6%	2.2%
Fractures/Avulsion	19	4.1%	1.3%
Ligament/Tendon	14	3.0%	1.0%
Concussions	14	3.0%	1.0%
Ligament/Tendon	14	3.0%	1.0%
Unspecified Injury	10	2.1%	0.7%
Other	9	1.9%	0.6%
Neurological	5	1.1%	0.3%
Dislocations/Subluxations	5	1.1%	0.3%
Infections	2	0.4%	0.1%
Swelling	2	0.4%	0.1%
Illness/System Affected	Total #	% of Injuries	% of all Incidents
Heat/Hydration	59	34.9%	4.1%
Neurological	31	18.3%	2.2%
Gastrointestinal	22	13.0%	1.5%
Cardiovascular	20	11.8%	1.4%
Respiratory	14	8.3%	1.0%
Allergies/Infections	8	4.7%	0.6%
Endocrine	7	4.1%	0.5%
Integumentary	4	2.4%	0.3%
Psychiatric	4	2.4%	0.3%
First Aid	Total #	% of Injuries	% of all Incidents
Ice	283	34.8%	19.7%
tapings/wrappings	278	34.2%	19.3%
Wound care	215	26.7%	15.1%
Sunscreen in eyes	22	2.7%	1.5%
Insect sting	11	1.4%	0.8%
Foreign body in eye	2	0.2%	0.1%

number of injuries than females.⁹ They found that the highest orthopedic injury frequency was seen in basketball (14.4%), and strains and sprains accounted for 31% of total injuries, consistent with this study.⁹ Thus, it would be fair to infer that the injuries noted in this study are typical of an average sports event among the traditional athletic population. The implications of this are that though each group of athletes participates in sports with unique differences in competitive ability, the medical demands of Special Olympics athletes during competition can be compared with those of physically disabled and athletes without intellectual disability. Ferrara deduces that based on current epidemiological studies, disabled athletes have similar orthopedic injury rates and patterns as athletes without this barrier.¹⁷ Batts notes that although the injuries of the Special Olympics athletes are fewer in number and less severe than those of non-disabled athletes, the sports-specific injuries are similar to each group of competitors.⁵

When the Special Olympics athletes are treated by on-site athletic trainers, sports medicine physicians, and emergency medical technicians, they are in most cases treated and released to the care of their coach, parent, or guardian. Only 9.8% of all encounters resulted in transport for further evaluation during the years studied. This number would undoubtedly be higher without medical professionals working on the sidelines with these athletes. This concurs with findings by Williamson et al., who found that providers could address 93% of consultations on-site at the Summer Olympics Great Britain in Leicester.¹⁸ Most injuries and illnesses would be referred for further evaluation in an emergency department at the cost of time and money to both SOPA and the athletes. Physicians and ATCs have the skills and training to evaluate and treat many injuries and illnesses. To further this point, the majority of encounters during the period analyzed were injuries (31.7%) in nature or required first aid (56.6%) when compared to ill-

Table 4. Transports by Sport and by Type of Incidents

Sport	Total #	% of all Transports
Aquatics	14	14.3%
Athletics	11	11.2%
Basketball	34	34.7%
Bowling	5	5.1%
Equestrian	2	2.0%
Golf	1	1.0%
Gymnastics	0	0.0%
Softball	21	21.4%
Tennis	0	0.0%
SOS/no sport listed	10	10.2%
Total	98	100%
Incidents	Total #	% of All Transports
Injuries	42	42.9%
Head/face/eye/mouth injury	10	10.2%
Upper extremity injury	10	10.2%
Lower extremity injury	10	10.2%
Concussion	5	5.1%
Neck injury	4	4.1%
Laceration	2	2.0%
Miscellaneous injury	1	1.0%
Illnesses	56	57.1%
Chest pain	14	14.3%
Heat exhaustion	9	9.2%
Seizure	7	7.1%
Dehydration	4	4.1%
Abdominal pain	2	2.0%
Asthma attack	2	2.0%
Migraine	2	2.0%
Syncope	1	1.0%
Shortness of breath, dizzy	2	2.0%
Mental health emergency	2	2.0%
Anaphylaxis	1	1.0%
Bilateral lower leg edema	1	1.0%
Diabetic emergency	2	2.0%
Dizzy, worsening signs and symptoms	1	1.0%
High blood pressure	1	1.0%
Sick, upset stomach	1	1.0%
Dental	1	1.0%
Insect bite	2	2.0%
Infection/cellulitis	1	1.0%
Total	98	100%

nesses (11.8%). These same healthcare professionals also recognize when referral for higher-level care is necessary for the athlete's safety. However, despite the relatively low

number of illnesses, most transports to a hospital or specialty clinic were categorized as illnesses (57% vs. 43% respectively). This statistic is a testament to the skills pos-

Table 4a. Frequency of Injuries by Location

Location	Total #	% of total injuries (455)	% of total incidents (1437)
Lower Extremity	245	53.9%	17.1%
Hip/thigh/knee	94	38.4%	
Lower Leg/Foot/Ankle	150	61.2%	
Upper Extremity	88	19.3%	6.1%
Shoulder/Upper Arm	17	19.3%	
Elbow/wrist/hand/fingers	70	79.6%	
Head/Face	84	18.5%	5.9%
Neck/Back	18	4.0%	1.3%
Chest/Abdomen	11	2.4%	0.8%
Miscellaneous	9	2.0%	0.6%

Table 5. Necessary Resources at Special Olympics Games/Events

Set-up Equipment	Standard Medical Equipment	First Aid Kit	Urgent/Emergency Response Kit
• Examination tables	• Stethoscopes	• Ice	• Epinephrine 1:1000 in auto injector
• Partitioning devices (ex. pipe/drape, rail/curtain or other)	• Thermometers	• Oral fluid replacement	• Short-acting beta agonist inhaler
• Hand sanitizer	• Blood pressure cuffs with small, regular, and extra-large sized cuffs	• Gauze	• Glucose tabs/gel
• Sharps box and red bag	• Pulse oximeters	• Band-Aids	• Rectal diazepam
• Paper, pens, clipboards	• Oscopes with speculum covers	• Bandages/ ACE wrap	• Crutches/ slings/ splints
• Plastic bags	• Tongue depressors	• Bandage scissors	• I.V. fluids (ex. NSS, D50%W) and administration set
• Blanket	• Non-latex gloves	• Forceps	• Scalpel
• Smart phone or tablet with a medication reference application	• Alcohol swabs	• Wound irrigation materials (ex. sterile normal saline, 10- to 50-cc syringe)	• Tourniquet
	• Flexible measuring tape	• Disinfectant/ iodine swabs	• Skin staple applicator
	• Lea vision eye chart	• Local anesthetic/ syringes/ needles	• Mouth-to-mouth mask
	• Reflex hammer	• Suture set/steri-strips	• Semi rigid cervical collar
	• Flashlight	• Nail clippers	• Spine board and attachments
	• Pin/sharp object for sensory testing	• Nasal packing material	• Advanced Cardiac Life Support (ACLS) drugs and equipment
	• Prescription pad	• Topical antibiotics	• Automated external defibrillator

sessed by the sports medicine professionals who specialize in musculoskeletal injuries. They were able to evaluate and treat most of the injuries seen, but they also have the skills to know when a referral is prudent. This again lowers the cost of healthcare for SOPA and lessens the burden on local hospitals and clinics that would receive these patients.

The authors recognize several limitations in the present study. First, some of the incident reports lacked complete demographic data. Second, in 2012, original incident logs could not be located. As such, data was instead obtained from SOPA's insurance company. Both limitations were due to the study's retrospective nature but were not felt to significantly alter the results.

Additionally, this analysis aimed to describe the pattern of sports injuries in Special Olympics athletes. Unfortunately, the data available for comment did not allow for calculating orthopedic injury-exposure ratios. The number of participants per sport, number of games played, number of sports played, length of time per event, and orthopedic injury mechanism were not recorded. Therefore, although basketball had the highest number of injuries, we cannot conclude that basketball is a higher risk activity. The sport may have had more participants, athletes who played for more extended periods, or athletes who played in more games than individuals in other sports. The authors were also unable to determine the etiology of injuries, such as a wet basketball court causing falls. Finally, this study focused on Special Olympic of Pennsylvania athletes, and, though generalizations can be postulated, applicability may vary for other populations. Future prospective research is needed to obtain orthopedic injury exposure ratios. Afterward, prevention efforts can be studied to lessen the risk to Special Olympics competitors.

Yet, this study highlights a need for more trained medical professionals to act as healthcare staff for Special Olympics athletes. These athletes push themselves in the exact nature as traditional athletes and are no less immune to the injuries and illnesses associated with the high-level competition.¹⁹ Armed with prior knowledge of the orthopedic injury and illness patterns experienced by the Special Olympics athletes during the competition will improve the medical planning and coverage for future Summer Games and Special Olympics events worldwide. By increasing awareness and understanding of the common injuries and illnesses of the Special Olympics athletes, medical personnel who were once reluctant to volunteer their services may feel confident of the scope of medical coverage required to meet the healthcare demands of this athletic population.

The participation of individuals with disabilities in SOPA promotes inclusion, reduces deconditioning by improving physical functioning, and enhances overall well-being.^{6,7} It is a common misconception that those with disabilities are susceptible to trauma and should thus avoid rigorous activities that may typically be associated with orthopedic injury.^{6,19} Although incidents occur, their frequency is low, and their presentation is similar to that of the traditional athletic population.¹⁵ However, differently-abled athletes do face many challenges throughout training and competition. As the number of disabled athletes grows, sports medicine professionals must encourage and work with this population.⁴ There may be a reluctance to provide medical coverage because healthcare providers may believe these athletes are predisposed to more frequent injuries requiring complex medical interventions.¹⁵ Though it is imperative that healthcare volunteers understand the comorbidities and medical conditions that affect Special Olympic athletes, as noted in this study, essential evaluation and intervention can go a long way in preventing unnecessary healthcare expenditures. As with all injuries or medical incidents, the healthcare team needs to react quickly and efficiently to provide proper care for these athletes.³ [Table 5](#) comprises a list of resources adapted from Seidenberg et al.

and the Consensus statement of multiple organizations for sideline preparedness that would provide professional care in similar Special Olympics events.^{7,20}

CONCLUSION

The Special Olympics Pennsylvania Summer Games allow approximately two thousand individuals with intellectual disabilities to enjoy three days of competition and camaraderie each year. And as with any athletic event, participation is not without risk, as approximately 10% of participants require medical attention. Thus, for Special Olympics athletes to compete at their highest level in the safest way possible, the SOPA Summer Games and similar Special Olympics mass participation events must be adequately staffed with healthcare providers, particularly ATCs and physicians. These volunteers must continue to work closely with SOPA staff and local hospitals and emergency medical services to ensure the safety of the competitors for years to come.

RECOMMENDATIONS BY AUTHORS

To ensure the safety of all participants, coaches, spectators, and volunteers, several considerations should be addressed by organizers of a mass participation event of this magnitude:

1. Begin planning early. SOPA begins planning for each year's Summer Games shortly after the previous year's Games.
2. Create an 'Emergency Action Plan' for each venue being used. Review and update annually.
3. Create a 'Policy and Procedure' manual for the event. Review and update annually.
4. Hold and maintain a list of contact information for all emergency services (EMS, police, and fire), mental health services, urgent care centers, pharmacies, hospitals, and emergency departments used during the event.
5. Given the complexity of some athletes' pre-existing medical conditions, medical records (athlete pre-participation physical evaluation forms) should be readily available at SOS.⁵ A copy of this should travel with any athlete transported to a higher level of care.
6. An emergency transport vehicle should be available on site.¹⁵
7. An automated external defibrillator should be available at each venue.
8. Plan accordingly for realistic weather conditions, including severe weather evacuation procedures.
9. Review participants' pre-participation physicals. Create a list of participants with significant medical issues or 'red flags'. An identification badge with coding for quick reference might be helpful.^{3,15}
10. Designing sports-specific policies may be beneficial. For example¹⁵
 - a. Eye protection in projectile-type sports, particularly for monocular athletes.

- b. Restricting athletes with symptomatic atlantoaxial instability from participation.⁷
 - c. Seizure precautions in all activities where there might be a risk of severe orthopedic injury if a convulsion occurs.
11. Prevention initiatives should reduce injuries by targeting higher-risk activities and places of frequent

occurrence. Additionally, the use of sport-appropriate protective equipment should be considered.⁹

Submitted: November 19, 2021 EDT, Accepted: January 12, 2022 EDT

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