

Mass Participation and Tournament Event Management for the Team Physician: A Consensus Statement (2022 Update)

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ABSTRACT

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This document is an update of the “Mass Participation Event Management for the Team Physician: A Consensus Statement (2004).” The focus of the initial document included administrative components, medical staffing, equipment, and environmental considerations for an event such as a marathon or other endurance event. Providing medical care in this setting has evolved with a greater understanding for the

importance of developing and practicing an emergency action plan (EAP), with components including identifying key stakeholders, chain of command, emergency facilities, equipment needs, and other environmental or sport-specific considerations.

Since the 2004 statement:

- Team physicians are increasingly involved as event physicians providing administrative support and medical care for tournaments that use the essential components of planning and medical care for mass participation events.
- Events are more prevalent, the number of participants has increased, and there is a wider variety of sports.
- Experience has highlighted the importance of developing a detailed, event-specific EAP considering preevent, event, and postevent management in all aspects of the event, including a plan for acute and life-threatening injuries and illnesses and a first aid plan for nonemergency injuries and illnesses.

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- Environmental and security issues are more prominent at mass participation events.

This article will discuss team physician considerations for both 1-d and multiple-day endurance sporting events, (e.g., marathons, ultramarathons and triathlons, Nordic skiing), and multiple day/multiple sporting events (e.g., American football, soccer, tennis, baseball tournaments or camps). These events have both common and distinct issues involving medical care and management. This article will aid the organization, implementation and evaluation of the resources available in assisting the team physician and athletic care network during mass participation events. The team physician acts as part of the event operations team and often as the medical director. Although the focus of the Team Physician Consensus Conference (TPCC) Statement series is on the team physician, this document is applicable to and recognizes the value of the multidisciplinary team covering events.

KEY POINTS

1. Mass participation event medical management needs and requirements have changed over time.
2. Environmental and security issues are more prominent at mass participation events. EAP may be proprietary and confidential for security.

Sport-specific considerations and policy developments for some mass participation events and tournament settings have been better defined.

METHODOLOGY

The TPCC has been led by the American College of Sports Medicine (ACSM) Clinical Sports Medicine Leadership committee for more than two decades. The TPCC was formed to create relevant, timely, and condensed resources specifically for the team physician working with athletes at every level of competition. An executive committee of medical and orthopedic team physicians from the Clinical Sports Medicine Leadership selects topics, creates an outline based on their collective experience of the topic, then leads a delegation composed of one to two representatives from each of six major professional medical organizations including the American Academy of Family Physicians, American Academy of Orthopedic Surgeons, ACSM, American Medical Society for Sports Medicine, American Orthopedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine. Representatives are chosen by their organization based on their experience as team physicians with expertise in the topic area. The executive committee assigns select topics from the outline for the representatives who perform an evidence-based review of the existing literature. The outline is reviewed and modified by the executive committee and expert panel members, and they then formulate statements that are supported by the literature and best practices into a format of

“essential” and “desirable” information that the team physician is responsible for understanding. “Essential” statements are information that every and any team physician must be responsible for understanding, whereas “desirable” statements are those that are ideal in the setting where every resource is available.

TPCC articles are intended to provide general recommendations but are not meant to be prescriptive. The executive committee along with select expert consultant(s) collate and review the document over the course of 12–14 months, culminating in an in-person 2-d meeting of the executive committee and consultant(s) to finish compiling the article into a rough draft. That meeting is followed by a 2-d meeting with all of the representatives during which the final article is completed. This is a facilitated process where all topics of the article are reviewed and exact wording is determined and agreed upon. Consensus in this TPCC was reached by unanimous agreement. The final documents are then reviewed and approved by the board of directors of all six participating organizations.

GOAL

The goal is to assist the team/event physician in providing medical care during mass participation events. The physician’s role is to organize or participate as part of the medical team that facilitates event safety, provides medical care, makes return-to-participation decisions, and acts as the event medical spokesperson. To accomplish this goal, the team physician acts as part of the event operations team and often as the medical director.

ADMINISTRATION

Medical care and administrative planning should include preevent, event, and postevent strategies. The medical team is a component of the full event team and develops an agreement of the scope of medical care with key event administrators. The team/event physician should participate in decision-making with event administrators related to all aspects of event planning that would affect health and safety, including those that would delay or cancel the event (1,2).

The team/event physician should participate in developing or reviewing the EAP and medical protocols for the event. The team/event physician often acts as the medical director, is part of the event operations team, and assembles the on-site medical team. The medical protocols should be event specific and address life-threatening and common illnesses and injuries. The medical director is responsible for disseminating medical protocols and education of the on-site team (see “Staffing for Medical Areas” hereinafter) (1–3).

Emergency Action Plan

An EAP is integral to planning and administration of medical care at a mass participant event. Templates are available to assist in EAP development. It should include the following:

- Personnel and responsibilities (e.g., chain of command, first responders).

- Contact information for emergency medical services (EMS) and other key emergency personnel.
- Identification of medical facilities preferred for a given type of emergency (e.g., trauma, cardiovascular events).
- Emergency communication plan (e.g., devices, numbers).
- Equipment (location, maintenance).
- Emergency medical transportation (e.g., accessibility, estimated response time).
- Venue-specific directions with a map (e.g., including ingress and egress, location of automated external defibrillator (AED), lightning shelter).
- Strategies for nonmedical emergencies (e.g., severe weather, terrorism).
- Policies for support staff emergency care.
- Policies for individuals not covered under the EAP (e.g., spectators).
- Requirements for documentation.

The EAP should be reviewed, updated, and practiced as part of preevent planning (i.e., the team physician along with other event administrators review and update the EAP and the on-site medical team will review and practice the EAP). The EAP should be made available to all event medical personnel, EMS, and key administrators and posted in visible locations at each venue. Plans may be proprietary and confidential for security.

Medical team members should be trained and certified in cardiopulmonary resuscitation (CPR), including the use of an AED, and recognize emergency situations and factors that increase the risk of catastrophic injury or sudden death. First aid and CPR training are encouraged for coaches, officials, parents, and athletes (4).

Preevent

A preevent medical and administrative plan is key to optimizing safety and reducing risks for participants involved in mass participation events (1,2).

Mass participation planning should begin in advance (6–12 months) to optimize on-site medical care. Consideration should be given to the availability of local medical resources, including EMS and local emergency departments (ED). Planning should include confirmation of medical liability coverage.

Preevent planning delineates medical team services at the event for the care of participants. For some events, the medical staff may be responsible for nonparticipants. If the plan does not cover nonparticipants, a policy is needed to manage emergencies. Medical care planning should confirm duties of various members of the medical team, taking into consideration the following:

- Total number and profile of medical personnel required (e.g., MD, RN, PT, ATC/ATL), including backup coverage.
- Event history (e.g., prior illness/injury of participants, public attendance).
- Environmental conditions.
- Field or surface conditions.
- Security considerations.
- Medical personnel that make participant return-to-play or participation (RTP) decisions.

- Logistical support needed to provide medical care (e.g., location/size of medical stations, number of on-site ambulances, general medical equipment and supplies).

All mass participation events should have access to early defibrillation (e.g., AED). Other considerations should include the following:

- Event type (e.g., marathon, Nordic skiing, tennis tournament).
- Participant factors (e.g., age range, skill level).
- Medical staffing.
- Course layout.
- Equipment type (e.g., cervical spine collar, spine board, cold-water immersion tub, immediate electrolyte and glucose measurement), location, accessibility, condition and maintenance.
- Environment and safety.

It is essential the team/event physician

- Understand and be prepared to implement the EAP and medical protocols.
- Understand the scope (size, number of participants, location) of the event.
- Maintain CPR certification.
- If serving as the medical director, additional responsibilities may be present, including the following:
- Develop and/or review and disseminate the EAP and medical protocols.
- Determine the coordination requirements with local EMS and first responders.
- Participate in decision-making with event administrators related to logistical support and medical conditions that would delay or cancel the event.

It is desirable the team/event physician

- Participate in the development of the EAP.
- Participate in the development of medical protocols in advance (6–12 months) to optimize on-site medical care.
- Review event history (e.g., prior illness/injury of participants, public attendance).
- Work with event administrators to schedule the event and start time for when historical environmental conditions are most favorable.
- Confirm fields and surfaces have been inspected.

During Event

Before the start of the event, a “medical time-out” (5) should be conducted with medical personnel and event administrators to review the EAP and medical protocols. For events at multiple venues and/or multiple days, this should take place on a daily basis at each site. The EAP should be activated quickly and at the first sign of a medical or environmental emergency.

During the event, evaluate, triage, and manage injuries and illnesses, including RTP decisions, and monitor environmental conditions. For events over multiple days, a daily postevent review should take place.

All medical personnel should document medical encounters for each treated injury and illness using the predetermined reporting system.

It is essential the team/event physician

- Participate in the “medical time-out.”
- Review the EAP and medical protocols for conditions related to event delay or cancellation.
- Enact emergency medical protocols directing acute on-site care, determining emergency transportation, and limits to participation or RTP.
- Maintain medical and event records while adhering to the principles of patient privacy and confidentiality.
- If serving as the medical director, additional responsibilities may include leading the “medical time-out,” having a plan to monitor environmental and public health conditions, conducting a daily postevent review for events with multiple days, and planning for personal protective equipment provision for medical staff.

It is desirable the team/event physician

- Provide all-area access to the medical team.
- Include food, shelter, and sanitation facilities for the medical team.
- Include parking/venue passes and locations for the medical team and support staff.

Postevent

All medical personnel and key event administrators should be debriefed and given the opportunity to provide feedback on event experience and recommendations for future events.

Medical encounters and documentation should be reviewed to evaluate opportunities for quality improvement, which may include the following:

- EAP and medical protocol modifications and improvements.
- Location/size of venue medical stations.
- Equipment and medication considerations.
- Adjustments to the number or profile of available medical personnel.

It is essential the team/event physician

- Complete documentation of illnesses and injuries for medical encounters.
- Provide feedback to the medical director regarding areas for concern in the EAP and medical protocols.
- If serving as the medical director, additional responsibilities may include the following:
 - Conduct a postevent review of the medical care and administrative plan.
 - Review and analyze event injury, illness, and environmental data.
 - Prepare a summary report of what was seen and supplies used to facilitate planning for the next year.
 - Summarize the medical encounters that are seen throughout the course of the event, for record-keeping purposes and to be used for the planning of future events.

It is desirable the team/event physician

- Participate in a postevent review of the medical care and administrative plan.
- Participate in the postevent meeting of medical and event administrative leaders to determine what things worked well and opportunities to improve.

EQUIPMENT AND MEDICAL SUPPLIES

The team/event physician when acting in the role of medical director should collaborate with medical providers and event administrators to determine what equipment and medical supplies are necessary for the mass participation event. All mass participation events should have access to early defibrillation (e.g., AED). Equipment and supplies should be determined and distributed based on a variety of factors, including the number of participants, medical personnel, type and volume of injury and illness, environmental factors, and other event-specific needs (e.g., course distance and layout, location of hydration fluids, and medical tent(s)). For contact/collision sports where helmets and shoulder pads are present, devices required to remove helmets, shoulder pads, and other protective equipment should be accessible (6). Examples of additional equipment and medical supplies are provided in Table 1.

It is essential the team/event physician understand

- All mass participation events should have access to early defibrillation (e.g., AED).
- Equipment and supplies are determined and distributed based on the number of competitors, type and volume of injury and illness, environmental factors, and other event-specific needs.
- The importance of collaborating with event administrators in determining equipment and medical supply needs.

It is desirable the team/event physician

- Collaborate with event administrators in determining equipment and medical supply needs.
- Be involved in decision-making in the selection and distribution of equipment and medical supplies.

MEDICAL SERVICES

Medical services at mass participation events should be delivered in accordance with predetermined policies and protocols. The development of these protocols begins with collaboration among stakeholders, including the medical director/medical team, event administrators and staff, and first responders/EMS (1,2). The protocols direct on-site care, determine emergency transport criteria, identify health care facilities (e.g., ED, clinic, urgent care, pharmacies), outline processes for RTP, and plan for follow-up care.

Protocols should address new onset or exacerbation of an existing illness or injury (e.g., asthma, diabetes, hamstring strain, shoulder instability). Protocols should also anticipate sport/venue/environment-specific emergencies. Medical services at sporting events with athletes with disabilities (e.g., para or adaptive sports, Special Olympics) should reflect knowledge and understanding

TABLE 1. Examples of equipment and medical supplies (listed alphabetically).

Medical Equipment/Supplies	Medications	Musculoskeletal and Skin Supplies	Personal Protective Equipment	Other Supplies
Biohazardous waste disposal	Acetaminophen	Athletic tape	Eye protection	Blankets
Blood pressure cuff	Albuterol	Blister care products	Gloves	Chairs
Emergency airway management equipment	Antihistamines	Crutches	Gowns	Cots
Eye solution/wash	Calcium chloride	Elastic bandages	Hand sanitizer and/or sink and soap	Eye care kit
First aid (bandages, tape, wound care)	Diazepam	Ice and plastic bags	Masks	Fans
Glucose monitor		Immobilization devices (e.g., splints, slings)		Fluids and food
Equipment for rapid cooling	Epinephrine	Skin lubricant		Generator or electricity source
Intravenous fluid kit(s)	EpiPen	Sunscreen		Heating or cooling equipment
On-site laboratories	Glucagon	Wheelchair(s)		Insect repellent
	Intravenous fluids (e.g., normal saline, hypertonic saline, dextrose in water)			Lighting
	Magnesium sulfate			Privacy drapes
	Nonsteroidal anti-inflammatory drugs			Sharps container
	Potassium			Tables
				Tent for shade
				Toilet
				Towels
				Tubs/ice
				Water

of the medical and neuromusculoskeletal conditions influencing participation and the adaptive equipment used by these athletes.

Medical services at mass participation events include the following:

- Staffing for medical areas.
- Medical care delivery.
- Limits to event participation.
- RTP.

Staffing for Medical Areas

Staffing for mass participation events should be based on the number of anticipated medical encounters, location at/on the venue/course, expected types of injury and illness, the level of on-site medical care (first aid vs full field care), and access to advanced medical care. Decisions are made in advance through a review of historical event data, if available, local health care resources, and the requirements of the sanctioning authority (e.g., local/state/regional activities association(s), national/international governing bodies).

Medical director. A physician serving as the medical director should have experience in medical administration and management of illness and injury associated with mass participation events.

The medical director is responsible for administrative planning, including the following:

- Reviewing or developing the EAP and medical protocols.
- Identification of equipment and supply needs.
- Confirming the availability of fluid and nutrition replacement.
- Reviewing or developing event-day safety protocols (e.g., environment, security).

The medical director oversees medical care delivery, including assembling the following:

- Medical operations team.
- On-site medical team.

Medical operations team. The medical operations team provides medical oversight to the event and collaborates with event administration and emergency service providers to address planning, logistics, and staffing. Members of the medical operations team may include leaders from EMS, physicians, athletic trainers, nurses, physical therapists, and event administrators.

On-site medical team. The on-site medical team has the responsibility for the direct provision of medical care. The medical team for a mass event should be interdisciplinary, including medical personnel capable of treating illness and injury, including emergencies. Members of this team may need to have specific skills (e.g., skiing or swimming) based on the event. Nonmedical volunteers can assist with tent maintenance, supply management, documentation, and other functions that do not require medical training.

Medical Care Delivery

Medical care at mass participation events should be guided by predetermined policies and protocols. These policies and protocols direct on-site care and emergency transport criteria. Medical policies and protocols should be developed by the medical operations team and reviewed with the on-site medical team members before the event.

Although some events require preparticipation screening (e.g., Special Olympics), and it may be helpful, in most situations, it is not practical, available, or cost-effective. There are many factors that may affect participation, including conditioning, acute or chronic medical or musculoskeletal conditions, medications, and environmental conditions. Interscholastic events frequently require preparticipation evaluation. In some events, athletes may provide medical history during registration. However, it should be anticipated that health care information may be incomplete or not available.

Medical tent/shelter. The size of the event and the environment will determine the specific shelter/tent needs (e.g.,

single or multiple sites) for delivering medical care. Common medical issues can be managed with basic resources in the on-site medical tent.

On-site communication. A well-designed communication plan is required for medical management of mass participation events, including a backup system(s) should the primary system fail.

- Mobile phones and text messaging may work well for the medical team with attention to battery life and local network capabilities.
- Phone systems may be shut down intentionally by public safety officials or unintentionally by the sheer volume of calls.
- A dedicated radio network can be used for general communication or as a backup to mobile phones. Handheld radio and amateur radio (“ham radio”) systems are not as secure as mobile phones for transmitting confidential medical information.
- An increasingly common medical communication tool involves the use of “apps” for mobile phones and tablets, including interpretation/translation services.

Event Limitations or Cancellation

In certain situations (e.g., severe/extreme weather, air quality, infectious disease outbreak), the medical director may decide event modification, cancellation, or postponement. In certain security situations, the medical operations team should integrate with the community disaster or crisis management plan. When acts of terrorism or other incidents threaten a community, an emergency operations center or jurisdictional agency director assumes leadership.

EAP and limitations or cancellation policies need to consider environmental challenges (e.g., severe/extreme weather, unusual heat, humidity and cold, air quality).

- The risk of requiring medical attention and not finishing rises considerably when the wet bulb globe temperature (WBGT) is $>15^{\circ}\text{C}$ (60°F). Marathons in northern latitudes ($>40^{\circ}$) held in “unexpectedly” hot conditions when the participants are not acclimatized and the start WBGT is $>21^{\circ}\text{C}$ often end in either race cancellation or a mass casualty incident (MCI).
- Cold injury is an important environmental consideration (7). When the ambient temperature is above -15°C (5°F), the risk of frostbite on bare skin is less than 5%, but when the wind chill tolerance falls below -27°C (-17°F), increased surveillance is warranted, as frostbite can occur in 30 min or less (8). There is an increased risk when the skin is wet as it cools more rapidly (9). Exercise can increase skin perfusion and thus reduce skin cooling and cold injury risk (9,10).

Each event should identify and communicate its unique do not start policy for heat, cold, air quality, or infectious disease (11–15).

Participant Limitations, Removal, and Return to Play

Event-specific policies and procedures should exist for the medical director or designee to assess, clear, restrict, remove, and determine RTP. Policies for RTP in the same mass participation event should be based on established criteria (16).

It Is Essential in Medical Services for Mass Participation Events

- Medical care for mass participation events is guided by predetermined policies and protocols.
- A communication plan is used for medical management.
- The medical operations team assesses environmental conditions.
- Understand options available to the team/event physician to determine RTP for participants.
- If the team/event physician serves as the medical director, they should be a member of the event management team;
- assemble and lead the medical operations team;
- understand what options are available for modification, cancellation, or postponement;
- are responsible for assembling and educating the on-site medical team.

It Is Desirable in Medical Services for Mass Participation Events

- The medical director has the authority to cancel or postpone the event because of medical situations.
- The team/event physician determines RTP for participants.
- Environmental conditions are monitored throughout the event to determine modified play or cancellation.
- Criteria for limits to participation or RTP are published or posted.

ENVIRONMENTAL AND SECURITY CONDITIONS

Environmental and security conditions (e.g., thermal conditions, altitude, pollution, surfaces, thunder/lightning, natural disaster/terrorism) pose a risk to mass participation events. Although the primary responsibility of the medical team is to participants, environmental hazards and security threats can additionally impact support staff and spectators and rapidly create an MCI. Event preparation needs to include an EAP that addresses common and unexpected environmental hazards and security threats.

Thermal conditions. Thermal conditions ideally should be assessed before and during an event to determine the safety of activities performed in the heat and cold. Continuation, modification, or cancellation should be considered based on these readings.

Heat risk is optimally assessed with the use of WBGT. WBGT measurements are best done 1.2 m above the playing surface (17,18). WBGT measurements should be taken longitudinally to account for changing environmental conditions and adjusting heat safety strategies. There may be regional activity modifications based on variable climate conditions. These would alter heat acclimatization by region as well (19,20).

Cold risk is assessed using the temperature in combination with wind speed to estimate cold injury risk.

In the absence of a predetermined do not start policy, Figures 1 and 2 may assist with event modification using the WBGT or the ambient temperature and wind speed to assess the risk of heat and cold injury, respectively, to modify activity.

Altitude. Altitude illness can be life threatening; risk factors include increasing altitude, previous history of altitude sickness, ascent rate, sleeping at high altitude, living at low altitude, and intense exercise at high altitude (21). It is caused by partial pressure of oxygen decreasing with increased altitude secondary to decreased barometric pressure. At 10,000 ft, 42% of individuals get altitude sickness (22).

Altitude illness is a primarily neurologic continuum encompassing high-altitude headache, acute mountain sickness (headache with gastrointestinal irritation, dizziness, fatigue and sleep disturbances) and high-altitude cerebral edema (20). High-altitude pulmonary edema is a separate condition associated with pulmonary hypertension. High-altitude cerebral edema and high-altitude pulmonary edema are the most common cause of altitude-related deaths. Team/event physicians should be aware of participants with previous problems with altitude.

Acclimatization is critical for reducing risk of altitude illness, and simple interventions include descent, oxygen, and select medications (21).

Altitude is a risk factor for exertional sickling, rhabdomyolysis, splenic infarction, and exercise-related sudden death in participants with sickle cell trait (23,24). Team/event physicians should be aware of participants with sickle cell trait that may be susceptible to conditions associated with altitude, as early recognition (e.g., cramping) and treatment is recommended (25).

Pollution. Air quality may impact the mass participation event, affecting both participants and spectators (26). Medical personnel and event administrators should be aware of local air quality levels and warnings during the course of the event.

See Figure 3 for interpretation of air quality and guidance with activity recommendations.

Surfaces. Medical personnel should be aware of the impact of surfaces and the potential impact on participant illness and/or injury. Surfaces include all weather tracks, tennis courts, artificial turf, synthetic turf grass, sand, clay, natural grass, snow, or water. Variations in surface may impact ambient temperature, including shading and heat reflection (e.g., presence/absence of trees), open field versus closed field (e.g., stadium), and obstacles that may obstruct or promote wind (e.g., buildings may affect wind, humidity, and radiation). The presence or absence of moisture (e.g., rain, ice, snow) may affect traction and the playing characteristics. Even on the same surface, there may be variations in conditions (e.g., potholes) (27).

Lightning. Lightning is a direct threat to participants and nonparticipants. It is most prevalent in the afternoon to early evening in late spring to early fall often coinciding with hours of sports activity.

The medical operations team should monitor for lightning. Options include listening for thunder, monitoring local forecasts, monitoring programmed weather radios or lightning detection services, and using real-time notification services (phone apps). Handheld lightning detectors are available as an adjunct, but their reliability has not been proven. An individual may be designated to monitor the weather.

The mass participation plan should include a lightning-specific EAP (28). Establish criteria to suspend and resume play. Recommendations are to clear the area after hearing thunder and resuming the event after not hearing thunder for 30 min, or when the lightning is at least 10 mi (16 km) away on a tracking device.

Natural disaster/terrorism. MCI includes natural disasters, transportation accidents, active shooter(s), and terrorism. Before the mass participation event, the local operations plan should be identified and shared with all stakeholders. The

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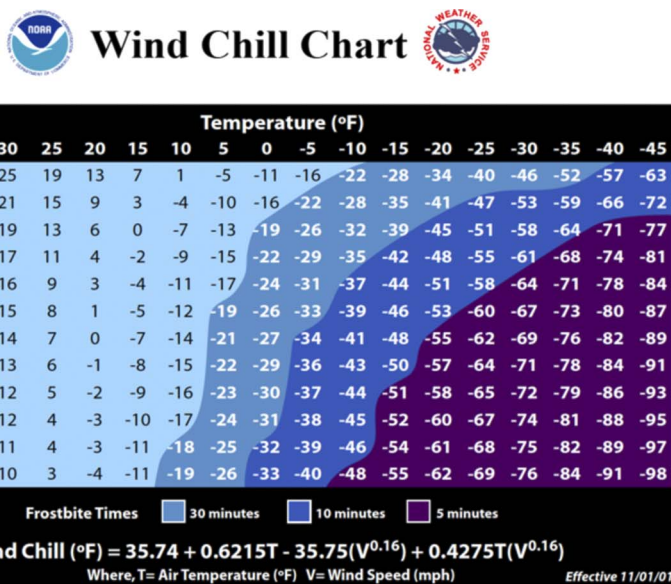


FIGURE 1—Wind chill chart (<https://www.weather.gov/safety/cold-wind-chill-chart>).

WBGT ^b		Continuous activity & competition for highly fit & fully acclimatized to high heat conditions ^{b,c}	Training & noncontinuous activity	
°F	°C		Non-acclimatized, unfit, high-risk individuals ^c	Acclimatized, fit, low-risk individuals ^{c,d}
≤50.0	≤10.0	Generally safe; EHS can occur associated with individual factors	Normal activity	Normal activity
50.1 – 65.0	10.1 – 18.3	Generally safe; EHS can occur in individuals who are not acclimatized or have risk factors	Normal activity	Normal activity
65.1– 72.0	18.4 – 22.2	Risk of EHS and other heat illness begins to rise; high-risk individuals should be monitored or not compete	Increased risk. Increase the rest:work ratio. Monitor fluid intake.	Normal activity
72.1– 78.0	22.3 – 25.6	Risk for all competitors is increased	Moderate risk. Increase the rest:work ratio and decrease total duration of activity. Football: Players restricted to helmet, shoulder pads, and shorts	Normal activity. Monitor fluid intake. Football: Players restricted to helmet, shoulder pads, and shorts
78.1–82.0	25.7–27.8	Risk for unfit, non-acclimatized individuals is high	Moderate-high risk. Increase the rest:work ratio; decrease intensity and total duration of activity. Football: No protective equipment during practice and no conditioning activities.	Normal activity. Increase rest breaks. Monitor fluid intake. Football: Players restricted to helmet, shoulder pads, and shorts
			Very high risk. ^e	Increase the rest:work ratio
82.1–86.0	27.9–30.0	Cancel level for EHS risk	Increase the rest:work ratio to 1:1, decrease intensity and total duration of activity. Limit intense exercise. Watch at-risk individuals carefully	and decrease total duration of activity. plan intense or prolonged exercise with discretion ^f ; watch at-risk individuals carefully. Football: No protective equipment during practice and no conditioning activities.
86.1 – 90.0	30.1 – 32.2		Very High-risk ^e Cancel or stop practice and competition.	Limit intense exercise ^f and total daily exposure to heat and humidity; watch for early signs and symptoms
≥ 90.1	> 32.3		Extremely high risk. ^e Cancel exercise.	Extremely high risk. ^e Cancel exercise ^{f,g}

FIGURE 2—WBGT levels for modification or cancellation of workouts or athletic competition for healthy adults and adolescents. Reproduced with permission from ACSM expert consensus statement on exertional heat illness: recognition, management, and return to activity. *Curr Sports Med Rep.* September 2021;20(9):470–484. doi: 10.1249/JSR.0000000000000878.

most commonly used incident command structure is the National Incident Management System. This plan should be reviewed before the event (1).

It is essential the medical operations team

- Include environmental hazards and security threat planning into mass participation event medical preparation planning.

Air Quality Index (AQI) Basics

[Versión en Español](#)

What is the U.S. Air Quality Index (AQI)?

The U.S. AQI is EPA's index for reporting air quality.

How does the AQI work?

Think of the AQI as a yardstick that runs from 0 to 500. The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 or below represents good air quality, while an AQI value over 300 represents hazardous air quality.

For each pollutant an AQI value of 100 generally corresponds to an ambient air concentration that equals the level of the short-term national ambient air quality standard for protection of public health. AQI values at or below 100 are generally thought of as satisfactory. When AQI values are above 100, air quality is unhealthy; at first for certain sensitive groups of people, then for everyone as AQI values get higher.

The AQI is divided into six categories. Each category corresponds to a different level of health concern. Each category also has a specific color. The color makes it easy for people to quickly determine whether air quality is reaching unhealthy levels in their communities.

AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

See the [Activity Guides](#) to learn ways to protect your health when the AQI reaches unhealthy levels.

Five major pollutants

EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health:

- ground-level ozone
- particle pollution (also known as particulate matter, including PM2.5 and PM10)
- carbon monoxide
- sulfur dioxide
- nitrogen dioxide

[Using the Air Quality Index](#)

Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI)

FIGURE 3—Air quality guide for activity (https://www.airnow.gov/sites/default/files/2021-03/air-quality-guide_pm_2015_0.pdf).

- Understand the importance of coordinating plans with local emergency medical and disaster management services.
- Understand a modification or cancellation policy for the event when hazardous environmental or security threat conditions exist.

It is desirable the medical operations team

- Publish or post hazardous condition protocols and policies in advance.
- Develop and coordinate the environmental hazard and security threat planning in conjunction with local emergency medical and disaster management services.
- Develop a modification or cancellation policy for the event when environmental hazardous and security threat conditions exist.
- Assess environmental conditions at the start and throughout the event to cancel or modify consistent with policy.
- Include medical staff with disaster management experience on the planning and medical care teams.

HYDRATION AND ENERGY REPLACEMENT

Participants need fluids (water and carbohydrate–electrolyte solutions) and nutrition for replacement and recovery. When

provided, fluids and nutrition should be easily accessible and strategically placed adjacent to practice fields, event areas, start and finish lines, aid stations, and medical areas to maximize availability to participating athletes (29,30).

For longer duration events (>1 h), approximately 6 to 12 oz (180–360 mL) of fluid should be available for every 15–20 min of continuous activity. Excessive fluid intake may result in hyponatremia, which can be life threatening. Symptoms include dizziness, fatigue, headache, decreased urine output, and mental confusion.

Fluid replacement strategies may be optimized for palatability and absorption if fluids are cooled to 59°F–72°F (15°C–22°C). Provide fluid choices containing carbohydrate and sodium as detailed in Table 2.

There is variability in individual fluid replacement needs (29). Recreational athletes should not consume extra fluids before activity but are encouraged to drink to thirst (29). Fluid replacement should be encouraged to avoid >2% of total body weight during activity.

It is essential the team/event physician

- Understand the role and availability of fluids and energy replacement.

- Recognize signs and symptoms of hyponatremia.
- Understand fluid and energy replacement needs should be individualized.

It is desirable the team/event physician

- Be involved in determining the types and location of fluid and fuel replacement.
- Encourage organizers to publish the fluid types and locations (i.e., aid station locations) before the event or practice.
- Understand fluid temperature and composition of fluids for optimal palatability.
- Confirm the accessibility of carbohydrate and salt solutions for during and postevent.
- Educate athletes and support staff about excessive fluid intake and how to calculate and monitor individual sweat losses to reduce the risk of hyponatremia.
- Encourage participants to replace sweat losses during activity and replace weight loss postevent.

RECOVERY

Recovery is the period and process during which the body responds to load (31–33), and for multiday events or tournaments, it refers to the time between competitions. Recovery is an essential part of athletic activity during multiday or multievent mass participation. Major processes, defined hereafter, involved in recovery include the following:

- Hydration and nutrition replacement.
- Sleep and rest.
- Mental rest and recovery.
- Active and passive recovery strategies.

The goal of rehydration and nutrition during recovery is to replenish fluid and energy and facilitate muscle repair. Strategies to meet this goal include (34–36) the following:

TABLE 2. Guidelines for fuel intake during activity.

Situation	Carbohydrate (CHO) Targets	Comments on Type and Timing of CHO Intake
DAILY NEEDS FOR FUEL AND RECOVERY		
1. The following targets are intended to provide high CHO availability (i.e., to meet the CHO needs of the muscle and central nervous system (CNS)) for different exercise loads for scenarios where it is important to exercise with high quality and/or at high intensity. These general recommendations should be fine-tuned with individual consideration of total energy needs, specific training needs, and feedback from training performance. 2. On other occasions, when exercise quality or intensity is less important, it may be less important to achieve these CHO targets or to arrange CHO intake over the day to optimize availability for specific sessions. In these cases, CHO intake may be chosen to suit energy goals, food preferences, or food availability. 3. In some scenarios, when the focus is on enhancing the training stimulus or adaptive response, low CHO availability may be deliberately achieved by reducing total CHO intake, or by manipulation of CHO intake related to training sessions (e.g., training in a fasted state, undertaking a second session of exercise without adequate opportunity for refueling after the first session).		
Light	• Low-intensity or skill-based activities 3–5 g·kg ⁻¹ of athlete's body weight/day	• Timing of intake of CHO over the day may be manipulated to promote high CHO availability for a specific session by consuming CHO before or during the session, or in recovery from a previous session
Moderate	• Moderate exercise program (e.g., ~1 h·d ⁻¹) 5–7 g·kg ⁻¹ ·d ⁻¹	
High	• Endurance program (e.g., 1–3 h·d ⁻¹ , moderate- to high-intensity exercise) 6–10 g·kg ⁻¹ ·d ⁻¹	• Otherwise, as long as total fuel needs are provided, the pattern of intake may simply be guided by convenience and individual choice
Very high	• Extreme commitment (e.g., >4–5 h·d ⁻¹ , moderate- to high-intensity exercise) 8–12 g·kg ⁻¹ ·d ⁻¹	• Athletes should choose nutrient-rich CHO sources to allow overall nutrient needs to be met
ACUTE FUELING STRATEGIES —these guidelines promote high CHO availability to promote optimal performance in competition or key training sessions		
General fueling up CHO loading	• Preparation for events <90 min exercise 7–12 g·kg ⁻¹ per 24 h as for daily fuel needs • Preparation for events >90 min sustained/intermittent exercise 36–48 h of 10–12 g·kg ⁻¹ body weight per 24 h	• Athletes may choose CHO-rich sources that are low in fiber/residue and easily consumed to ensure that fuel targets are met and to meet goals for gut comfort or lighter “racing weight.”
Speedy refueling	• <8 h of recovery between two fuel-demanding sessions 1–1.2 g·kg ⁻¹ ·h ⁻¹ for the first 4 h then resume daily fuel needs	• There may be benefits to consuming small regular snacks • CHO-rich foods and drink may help to ensure that fuel needs are met
Preevent fueling	• Before exercise >60 min 1–4 g·kg ⁻¹ consumed 1–4 h before exercise	• Timing, amount, and type of CHO foods and drink should be chosen to suit the practical needs of the event and individual preferences/experiences • Choices of high in fat/protein/fiber may need to be avoided to reduce risk of GI issues during the event
During brief exercise	• <45 min Not needed	
During sustained high-intensity exercise	• 45–75 min Small amounts including mouth rinse	• A range of drinks and sports products can provide easily consumed CHO • The frequent contact of CHO with the mouth and oral cavity can stimulate parts of the brain and CNS to enhance perceptions of well-being and increase self-chosen work outputs
During endurance exercise including “stop and start” sports	• 1–2.5 h 30–60 g·h ⁻¹	• CHO intake provides a source of fuel for the muscle to supplement endogenous stores • Opportunities to consume foods and drinks vary according to the rules and nature of each sport • A range of everyday dietary choices and specialized sports products ranging in form from liquid to solid may be useful • The athlete should practice to find a refueling plan that suits their individual goals including hydration needs and gut comfort
During ultra-endurance exercise	• >2.5–3 h Up to 90 g·h ⁻¹	• As mentioned • Higher intakes of CHO are associated with better performance • Products providing multiple transportable CHOs (glucose–fructose mixtures) achieve high rates of oxidation of CHO consumed during exercise

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- Replacing 150% of fluid losses over 6 h.
- Consuming 1.2 g of carbohydrate per kilogram body weight each hour for 6 h.
- Consuming 10 to 20 g of protein during the first hour.

An individual athlete’s fluid and nutritional requirements vary depending upon the sport, intensity of training, age, and other factors.

Overlap exists between recovery from the last event and preparing for the next one. This is especially true for tournaments when the time between events is limited.

Strategies should be considered to optimize sleep. Insufficient sleep impairs athletic performance and increases injury risk (33,37,38). A sport-specific tool for assessing sleep may be helpful (39).

Mental rest and recovery include strategies addressing mental health status, psychological readiness, event-specific considerations, and strategies to process event outcomes and prepare for the subsequent activities (33,37,40). Optimal performance is more likely if the balance between recovery and stress state is reestablished (41).

Recovery may be facilitated by active and passive recovery methods. Active recovery includes short-duration low-intensity exercise. Passive recovery, with variable levels of evidence for efficacy, may include compression garments, cold-water immersion, massage, pneumatic compression devices, and neuromuscular electrical stimulation (42).

Existing research of psychological and physical recovery between individual events may be used to develop strategies for recovery within a multiday event (43). A disturbed balance between psychological and physical recovery has been associated with illness (44–47)

It is essential that the team/event physician understand

- The importance of recovery in decreasing injury and improving performance

It is desirable that the team/event physician

- Understand the components of recovery include hydration and nutrition replacement, sleep and rest, mental rest and recovery, and active and passive recovery strategies.
- Incorporate strategies of recovery into planning for events.
- Educate members of the medical operations team.

SPORT-SPECIFIC CONSIDERATIONS

Sport-specific considerations unique to mass participation events include factors such as distance covered, pitch counts, innings played, and duration of matches or tournaments. For the purposes of this document, mass participation events are grouped into three categories. Sports within each category were selected to represent broader applicability to other events and activities with similar demands.

- Endurance sports (e.g., marathon, 10K, triathlon)
- Collision/contact sports (e.g., American football, soccer, basketball, lacrosse)
- Repetitive motion sports (e.g., baseball, softball, tennis, swimming)

Endurance sports. Because of the nature of the events and the number of participants at various states of training and preparation, endurance competitions are the most likely to have participants with medical issues, in addition to the common musculoskeletal and trauma issues associated with sports (48).

TABLE 3. Guidelines for youth tennis.

Scheduling Guidelines for Junior Divisions: Maximum No. Matches Per Day		
Match Format	12s Divisions	14s, 16s, and 18s Divisions
All Matches: Best of three tiebreak sets	2 singles 1 singles + 2 doubles 3 doubles	2 singles +1 doubles 1 singles +2 doubles 3 doubles
All Matches: Tiebreak in lieu of third set or short sets	3 singles 2 singles +1 doubles 3 doubles	3 singles +1 doubles 2 singles +2 doubles 1 singles +3 doubles 4 doubles
Main Draw Singles: Best of three tiebreak sets	2 main draw singles	2 main draw singles + 2 doubles and/or consolation singles
Doubles and/or Consolation Singles: eight-game pro sets	1 main draw singles + 3 doubles and/or consolation singles 4 doubles and/or consolation singles	1 main draw singles + 3 doubles and/or consolation singles 4 doubles and/or consolation singles
Main Draw Singles: Tiebreak in lieu of third set or short sets	3 main draw singles	3 main draw singles + 2 doubles and/or consolation singles
Doubles and/or Consolation Singles: eight-game pro sets	2 main draw singles + 2 doubles and/or consolation singles 1 main draw singles + 3 doubles and/or consolation singles	2 main draw singles + 3 doubles and/or consolation singles 1 main draw singles + 4 doubles and/or consolation singles
Combinations of singles, doubles, and consolation singles not shown above. ^a	4 doubles and/or consolation singles 117 games, no more than 88 of which should be singles	5 doubles and/or consolation singles 117 games, no more than 115 of which should be singles

Reproduced with permission from Friend at Court 2022. *Handbook of Rules and Regulations*, USTA (<https://www.usta.com/content/dam/usta/2022-pdfs/2022%20Friend%20at%20Court.pdf>). If a player enters more than one division, these guidelines apply separately to each division.

Completion of suspended matches. When a match is carried over from a preceding day, it is counted as a match for these scheduling guidelines if the player so elects and if 16 or more games of singles or 20 or more games of doubles are required to finish the match.

^aCalculate the maximum number of games for specific combinations of formats not shown in the chart. The maximum number of games for a best of three sets match is 39; the maximum number for a match with a tiebreak in lieu of the third set is 27; and the maximum number for an eight-game pro set is 17.

TABLE 4. Guidelines for adult and wheelchair tennis.

Scheduling Guidelines for Adult, Family, and Wheelchair Divisions: Maximum No. Matches Per Day						
Divisions	All Matches Best of Three Tiebreak Sets	All Matches Best of Three Tiebreak Sets When Tiebreak Played in Lieu of Third Set	All Matches Short Sets	All Matches Short Sets When Tiebreak Played in Lieu of Third Set and Pro Sets played to 7, 8, 9, or 10 Games	All Matches Pro Sets Played to Six or Fewer Games	Red, Orange, and Green Ball Tennis; When More Than One Format Is Used; All Other Formats
Adult open Adult divisions through 55 Family divisions Group A NTRP 55 and over and younger divisions	3 matches, no more than 2 of which should be singles	4 matches, no more than 3 of which should be singles	4 matches, no more than 3 of which should be singles	4 matches, no more than 3 of which should be singles	6 matches, no more than 4 of which should be singles	108 games, no more than 81 of which should be singles
Adult divisions 60–80; family divisions group B	2 matches	3 matches, no more than 2 of which should be singles	3 matches, no more than 2 of which should be singles	3 matches	4 matches	81 games, no more than 54 of which should be singles
Adult divisions 85 and over and older	2 matches, only 1 of which should be singles	2 matches, only 1 of which should be singles	2 matches, only 1 of which should be singles	2 matches	3 matches	78 games, no more than 39 of which should be singles
Wheelchair divisions	3 matches, no more than 2 of which should be singles	4 matches, no more than 3 of which should be singles	4 matches, no more than 3 of which should be singles	4 matches, no more than 3 of which should be singles	6 matches, no more than 4 of which should be singles	108 games, no more than 81 of which should be singles
All other divisions	No more than 2 singles; no guideline for doubles	No more than 3 singles; no guideline for doubles	No more than 3 singles; no guideline for doubles	No more than 3 singles; no guideline for doubles	6 matches, no more than 4 of which should be singles	85 games, no more than 63 of which should be singles

Reproduced with permission from Friend at Court 2022. *Handbook of Rules and Regulations*, USTA (<https://www.usta.com/content/dam/usta/2022-pdfs/2022%20Friend%20at%20Court.pdf>). Family divisions group A: father–son, father (60 and over)–son, father–daughter, father (60 and over)–daughter, mother–son, mother (60 and over)–son, mother–daughter, mother (60 and over)–daughter, husband–wife, husband–wife (combined ages 100 yr), husband–wife (combined ages 120 yr), grandfather–grandson, same gender male couples doubles, same gender male couples doubles (combined ages 80 yr), same gender male couples doubles (combined ages 100 yr), same gender male couples doubles (combined ages 120 yr), same gender female couples doubles, same gender female couples doubles (combined ages 80 yr), same gender female couples doubles (combined ages 100 yr), same gender female couples doubles (combined ages 120 yr). Family divisions group B: father (70 and over)–son, father (80 and over)–son, father (70 and over)–daughter, father (80 and over)–daughter, mother (70 and over)–son, mother (70 and over)–daughter, husband–wife (combined ages 140 yr), same gender males couples doubles (combined ages 140 yr), same gender female couples doubles (combined ages 140 yr). If a player enters more than one division, these guidelines apply separately to each division. *Completion of suspended matches.* When a match is carried over from a preceding day, it is counted as a match for these scheduling guidelines if the player so elects and if 16 or more games of singles or 20 or more games of doubles are required to finish the match.

Endurance sports may involve one or multiple sport activities, generally at a fixed distance, which varies by event type, and where participants begin and end the event at a common location.

Resources are available to assist the team/event physician in determining the number of medical personnel and equipment necessary for medical care delivery during endurance sports (48–50).

The number of participants requiring medical attention increases as the race progresses, with the most participants requiring attention later in the race (20,50).

Endurance events are more likely to have varied participant populations in terms of age, preexisting medical condition, and fitness than other mass events (51).

The length, duration, number of participants, type of event, environment, proximity to emergency transport, and/or nearest hospital will dictate the type and amount of equipment for the medical aid station. Medical considerations include the following:

- Life-threatening collapse (e.g., heat stroke, cardiovascular, hyponatremia).
- Exercise-associated collapse (exercise associated postural hypotension).
- Fluid and fuel replacement.
- Rhabdomyolysis.
- Environmental conditions (e.g., heat illness, cold injury, altitude illness, sun exposure, envenomations, animal bites).

- Pulmonary conditions (e.g., exercise-induced asthma, exercise-induced laryngeal obstruction, swimming-induced pulmonary edema).
- Musculoskeletal overuse/overload injury.

Trauma is less likely in endurance sports, with the exception of high-speed events (e.g., cycling, Nordic skiing) and downhill trail running. The team/event physician covering high-speed events should be prepared to immobilize fractures or address other traumatic musculoskeletal or organ injuries and concussion.

Collision/contact sports. In contact and collision mass participation events, the incidence of trauma is high and requires planning for injuries, including fractures, ligament sprains, muscle strains, dislocations, cervical spine injury, and head injury including concussion. Equipment should be

TABLE 5. Guidelines for softball.

Monitoring Pitch Count Chart:			
Age	Pitches/Game	Pitches/Day, Days 1 and 2	Pitches/Day, Day 3
8–10	50	80	0
10–12	65	95	0
13–14	80	115	80
15 and over	100	140	100

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TABLE 6. Guidelines for baseball.

Age	Daily Max (Pitches in Game)	0 Days Rest	1 Days Rest	2 Days Rest	3 Days Rest	4 Days Rest	5 Days Rest
7–8	50	1–20	21–35	36–50	N/A	N/A	N/A
9–10	75	1–20	21–35	36–50	51–65	66+	N/A
11–12	85	1–20	21–35	36–50	51–65	66+	N/A
13–14	95	1–20	21–35	36–50	51–65	66+	N/A
15–16	95	1–30	31–45	46–60	61–75	76+	N/A
17–18	105	1–30	31–45	46–60	61–80	81+	N/A
19–22	120	1–30	31–45	46–60	61–80	81–105	106+

Reproduced with permission from MLB/Pitch Smart Guidelines. *Guidelines for Youth and Adolescent Pitchers* (<https://www.mlb.com/pitch-smart/pitching-guidelines>).

Pitch count limits and required rest recommendations.

It is important for each league to set workload limits for their pitchers to limit the likelihood of pitching with fatigue. Research has shown that pitch counts are the most accurate and effective means of doing so. See required rest recommendations hereafter.

readily available and strategically placed to help manage these injuries, in accordance with the EAP.

Devices required to remove helmets, shoulder pads, and other protective equipment should be accessible (6).

Recommendations for contact/collision tournament play (e.g., lacrosse, soccer, rugby, ice hockey) include the following:

- All-day tournaments should limit the total number of hours of individual participant play, including overtime, per day (consider 3 h).
- Time off between tournament games (consider 2–3 h) to allow participant recovery (19,28,52). More time may be necessary for high-risk thermal conditions.
- Consider heat, cold, and other environmental conditions, including lightning.
- Hydration breaks every 10–15 min during tournament play in high-risk thermal conditions (52).

For sports that include projectiles (e.g., lacrosse, baseball, ice hockey), confirm the presence, proper function, and accessibility of AED for treatment of commotio cordis (53,54).

Repetitive motion sports. Medical management of repetitive overhead motion sports should include strategies to prevent chronic overuse injuries, including regulation of pitch counts, limitations in match participation, and rest and recovery. The medical operations team should be aware of local/state/national/international governing body rules and regulations. Certain organizations have created resources with varying levels of evidence related to activity; examples include the following:

- Tennis—United States Tennis Association (USTA) outlines daily match limitations by match type, age group, and singles versus doubles. It stipulates a mandatory 12-h rest between completion of the last match of the day and the first match of the following day, with start times no later than 8 PM for 12 and 14 divisions and 10 PM for the 16 and 18 divisions (55) (Tables 3 and 4).
- Softball—Although pitch counts in softball are not universally adopted, several recommendations have been published. Recommendations include pitching no more than 7 innings per game and 12 innings per day, and pitching no more than two consecutive days for players under 13 yr of age. Players over the age of 13 should not pitch more than three consecutive days. Pitchers should have 2 d of rest after each pitching exposure (56) (Table 5).

- Baseball—Pitch Smart, a collaboration from USA Baseball and Major League Baseball, publishes age-based daily pitch maximums and minimum days rest guidelines (57) (Table 6).
- Swimming—According to USA Swimming, meets should be conducted within a maximum timeframe of 8 h of competition. In preliminary and finals meets, a swimmer may not compete in more than three individual events per day, and in a timed finals meet, a swimmer may not compete in more than six individual events per day. For combined preliminary and finals and timed finals, no more than three individual events per day are allowed (58).

It is essential the team/event physician understand

- Events have different types and frequency of injury and illness.
- Sport-specific policies and protocols may help reduce injury and illness and improve performance.
- Access to early defibrillation is important for events where there is a risk for sudden cardiac arrest and commotio cordis.

It is desirable the team/event physician understand

- Sport-specific rules, regulations, and recommendations for activity including pitch counts, match limitations, or specific requirements for rest and recovery.
- How to recognize and manage both the highest risk and more common illnesses and injuries in specific events.
- Protective sport-specific equipment may help to reduce the risk of injury (e.g., helmets, chest protectors, and mouth guards).
- How to remove helmets, shoulder pads, and other protective equipment.

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