



CLINICAL REPORT

Medical Conditions Affecting Sports Participation

Guidance for the Clinician in Rendering
Pediatric Care

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ABSTRACT

Children and adolescents with medical conditions present special issues with respect to participation in athletic activities. The pediatrician can play an important role in determining whether a child with a health condition should participate in certain sports by assessing the child's health status, suggesting appropriate equipment or modifications of sports to decrease the risk of injury, and educating the athlete, parent(s) or guardian, and coach regarding the risks of injury as they relate to the child's condition. This report updates a previous policy statement and provides information for pediatricians on sports participation for children and adolescents with medical conditions.

In 2001, the American Academy of Pediatrics published an analysis of medical conditions affecting sports participation.¹ This updated report replaces the 2001 policy statement and provides additions and changes to increase the accuracy and completeness of the information.

Health care professionals must determine whether a child with a health condition should participate in a particular sport. One way of determining this is by estimating the relative risk of an acute injury to the athlete by categorizing sports as contact, limited-contact, or noncontact sports (Table 1). This categorization may subdivide contact sports into collision and contact sports; although there may be no clear dividing line between the 2, collision implies greater injury risk. In collision sports (eg, boxing, ice hockey, football, lacrosse, and rodeo), athletes purposely hit or collide with each other or with inanimate objects (including the ground) with great force. In contact sports (eg, basketball and soccer), athletes routinely make contact with each other or with inanimate objects but usually with less force than in collision sports. In limited-contact sports (eg, softball and squash), contact with other athletes or with inanimate objects is infrequent or inadvertent. However, some limited-contact sports (eg, skateboarding) can be as dangerous as collision or contact sports. Even in noncontact sports (eg, power lifting), in which contact is rare and unexpected, serious injuries can occur.

Overuse injuries are related not to contact or collision but to repetitive microtrauma; furthermore, overuse injuries generally are not acute. For these reasons, the categorization of sports in Table 1 insufficiently reflects the relative risks of injury. However, the categorization indicates the comparative likelihood that participation in different sports will result in acute traumatic injuries from blows to the body.

For most chronic health conditions, current evidence supports and encourages the participation of children and adolescents in most athletic activities. However, the medical conditions listed in Table 2 have been assessed to determine whether participation would create an increased risk of injury or affect the child's medical condition adversely. These guidelines can be valuable when a physician examines an athlete who has one of the listed problems. Decisions about sports participation are often complex, and the usefulness of Table 2 is limited by the frequency with which it recommends individual assessment when a "qualified yes" or a "qualified no" appears.

The physician's clinical judgment is essential in the application of these recommendations to a specific patient. This judgment is enhanced by consideration of the available published information on the risks of participation, the risk of acquiring a disease as a result of participation in the sport, and the severity of that disease. Other variables to consider include (1) the advice of knowledgeable experts, (2) the current health status of the athlete, (3) the sport in which the athlete participates, (4) the position played, (5) the level of competition, (6) the maturity of the competitor, (7) the relative size of the athlete (for collision/contact sports), (8) the availability of effective protective equipment that is acceptable to the athlete and/or sport governing body, (9) the availability and efficacy of treatment, (10) whether treatment (eg, rehabilitation of an injury) has been completed, (11) whether the sport can be modified to allow safer participation, and (12) the ability of the athlete's parent(s) or guardian and coach to understand and

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words

youth, athletes, risk of injury, contact and collision sports, prevention management, strenuousness, safety

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TABLE 1 Classification of Sports According to Contact

Contact	Limited-Contact	Noncontact
Basketball	Adventure racing ^a	Badminton
Boxing ^b	Baseball	Bodybuilding ^c
Cheerleading	Bicycling	Bowling
Diving	Canoeing or kayaking (white water)	Canoeing or kayaking (flat water)
Extreme sports ^d	Fencing	Crew or rowing
Field hockey	Field events	Curling
Football, tackle	High jump	Dance
Gymnastics	Pole vault	Field events
Ice hockey ^e	Floor hockey	Discus
Lacrosse	Football, flag or touch	Javelin
Martial arts ^f	Handball	Shot-put
Rodeo	Horseback riding	Golf
Rugby	Martial arts ^f	Orienteering ^g
Skiing, downhill	Racquetball	Power lifting ^c
Ski jumping	Skating	Race walking
Snowboarding	Ice	Riflery
Soccer	In-line	Rope jumping
Team handball	Roller	Running
Ultimate Frisbee	Skiing	Sailing
Water polo	Cross-country	Scuba diving
Wrestling	Water	Swimming
	Skateboarding	Table tennis
	Softball	Tennis
	Squash	Track
	Volleyball	
	Weight lifting	
	Windsurfing or surfing	

^a Adventure racing has been added since the previous statement was published and is defined as a combination of 2 or more disciplines, including orienteering and navigation, cross-country running, mountain biking, paddling, and climbing and rope skills.¹

^b The American Academy of Pediatrics opposes participation in boxing for children, adolescents, and young adults.²

^c The American Academy of Pediatrics recommends limiting bodybuilding and power lifting until the adolescent achieves sexual maturity rating 5 (Tanner stage V).

^d Extreme sports has been added since the previous statement was published.

^e The American Academy of Pediatrics recommends limiting the amount of body checking allowed for hockey players 15 years and younger, to reduce injuries.

^f Martial arts can be subclassified as judo, jujitsu, karate, kung fu, and tae kwon do; some forms are contact sports and others are limited-contact sports.

^g Orienteering is a race (contest) in which competitors use a map and a compass to find their way through unfamiliar territory.

to accept the risks involved in participation. Potential dangers of associated training activities that lead to repetitive and/or excessive overload also should be considered.

Unfortunately, adequate data on the risks of a particular sport for athletes with medical problems often are limited or lacking, and an estimate of risk becomes a necessary part of the decision-making process. If primary care physicians are uncertain or uncomfortable with the evaluation and/or the decision-making process, they should seek the counsel of a sports medicine specialist or a specialist in the specific area of medical concern. If the physician thinks that restriction from a sport is necessary for a particular patient, then he or she should counsel the athlete and family about safe alternative activities.

Physicians making decisions about sports participation for athletes with cardiovascular disease (Table 2) are strongly encouraged to consider consulting a cardiologist

and to review carefully recommendations from the 36th Bethesda Conference.¹² The complexities and nuances of cardiovascular disease make it difficult to provide important detailed information in a single table.

An athlete's underlying cardiac pathologic condition and the stress that a sport places on that condition are the 2 primary factors determining the risk of participating in that sport. A strenuous sport can place dynamic (volume) and static (pressure) demands on the cardiovascular system. These demands vary not only with activities of the sport but also with factors such as the associated training activities and the environment, as well as the level of emotional arousal and fitness of the competitors. Figure 1 lists sports according to their dynamic and static demands, as classified by cardiopulmonary experts of the 36th Bethesda Conference.¹²

New recommendations on sports participation for athletes with hypertension (Table 2) are available.^{10,12} The latest blood pressure tables provide the 50th, 90th, 95th, and 99th percentiles based on age, gender, and height.¹⁰ The blood pressure reading must be at least 5 mm Hg above the 99th percentile before any exclusion from sports is indicated.¹⁰ Periodic monitoring of resting (preexercise) blood pressure levels is preferred for readings above the 90th percentile. A more-complete evaluation is performed for sustained blood pressure readings above the 95th percentile.^{10,12}

In earlier legal decisions, athletes have been permitted to participate in sports despite known medical risks and against medical advice, usually in cases involving missing or nonfunctioning paired organs. In recent years, however, courts have been reluctant to permit athletes to participate in competitive athletics contrary to the team physician's medical recommendation. When an athlete's family seeks to disregard such medical advice against participation, the physician should ask all parents or guardians to sign a written informed consent statement indicating that they have been advised of the potential dangers of participation and that they understand these dangers. The physician should document, with the athlete's signature, that the child or adolescent athlete also understands the risks of participation. To ensure that parents or guardians truly understand the risks and dangers of participation against medical advice, it is recommended that these adults write the statement in their own words and handwriting.⁵⁹⁻⁶²

Additional information on the effects of medical problems on the risk of injury during sports participation is available in *Care of the Young Athlete* by the American Academy of Orthopaedic Surgeons and the American Academy of Pediatrics⁶³ and *Preparticipation Physical Evaluation, Third Edition*, by the American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine.⁷ In addition, other American Academy of Pediatrics policy statements include relevant material.⁶⁴⁻⁶⁷

TABLE 2 Medical Conditions and Sports Participation

Condition	May Participate
Atlantoaxial instability (instability of the joint between cervical vertebrae 1 and 2) Explanation: Athlete (particularly if he or she has Down syndrome or juvenile rheumatoid arthritis with cervical involvement) needs evaluation to assess the risk of spinal cord injury during sports participation, especially when using a trampoline. ⁴⁻⁷	Qualified yes
Bleeding disorder Explanation: Athlete needs evaluation. ^{8,9}	Qualified yes
Cardiovascular disease	
Carditis (inflammation of the heart) Explanation: Carditis may result in sudden death with exertion.	No
Hypertension (high blood pressure) Explanation: Those with hypertension >5 mm Hg above the 99th percentile for age, gender, and height should avoid heavy weightlifting and power lifting, bodybuilding, and high-static component sports (Fig 1). Those with sustained hypertension (>95th percentile for age, gender, and height) need evaluation. ¹⁰⁻¹² The National High Blood Pressure Education Program Working Group report defined prehypertension and stage 1 and stage 2 hypertension in children and adolescents younger than 18 years of age. ¹⁰	Qualified yes
Congenital heart disease (structural heart defects present at birth) Explanation: Consultation with a cardiologist is recommended. Those who have mild forms may participate fully in most cases; those who have moderate or severe forms or who have undergone surgery need evaluation. The 36th Bethesda Conference ¹² defined mild, moderate, and severe disease for common cardiac lesions.	Qualified yes
Dysrhythmia (irregular heart rhythm)	Qualified yes
Long-QT syndrome	
Malignant ventricular arrhythmias	
Symptomatic Wolff-Parkinson-White syndrome	
Advanced heart block	
Family history of sudden death or previous sudden cardiac event	
Implantation of a cardioverter-defibrillator Explanation: Consultation with a cardiologist is advised. Those with symptoms (chest pain, syncope, near-syncope, dizziness, shortness of breath, or other symptoms of possible dysrhythmia) or evidence of mitral regurgitation on physical examination need evaluation. All others may participate fully. ¹³⁻¹⁵	
Heart murmur Explanation: If the murmur is innocent (does not indicate heart disease), full participation is permitted. Otherwise, athlete needs evaluation (see structural heart disease, especially hypertrophic cardiomyopathy and mitral valve prolapse).	Qualified yes
Structural/acquired heart disease	
Hypertrophic cardiomyopathy	Qualified no
Coronary artery anomalies	Qualified no
Arrhythmogenic right ventricular cardiomyopathy	Qualified no
Acute rheumatic fever with carditis	Qualified no
Ehlers-Danlos syndrome, vascular form	Qualified no
Marfan syndrome	Qualified yes
Mitral valve prolapse	Qualified yes
Anthracycline use Explanation: Consultation with a cardiologist is recommended. The 36th Bethesda Conference provided detailed recommendations. ^{12,13,15-18} Most of these conditions carry a significant risk of sudden cardiac death associated with intense physical exercise. Hypertrophic cardiomyopathy requires thorough and repeated evaluations, because disease may change manifestations during later adolescence. ^{12,13,17} Marfan syndrome with an aortic aneurysm also can cause sudden death during intense physical exercise. ¹⁸ Athlete who has ever received chemotherapy with anthracyclines may be at increased risk of cardiac problems because of the cardiotoxic effects of the medications, and resistance training in this population should be approached with caution; strength training that avoids isometric contractions may be permitted. ^{19,20} Athlete needs evaluation.	Qualified yes
Vasculitis/vascular disease	Qualified yes
Kawasaki disease (coronary artery vasculitis)	
Pulmonary hypertension Explanation: Consultation with a cardiologist is recommended. Athlete needs individual evaluation to assess risk on the basis of disease activity, pathologic changes, and medical regimen. ²¹	
Cerebral palsy Explanation: Athlete needs evaluation to assess functional capacity to perform sports-specific activity.	Qualified yes
Diabetes mellitus Explanation: All sports can be played with proper attention and appropriate adjustments to diet (particularly carbohydrate intake), blood glucose concentrations, hydration, and insulin therapy. Blood glucose concentrations should be monitored before exercise, every 30 min during continuous exercise, 15 min after completion of exercise, and at bedtime.	Yes
Diarrhea, infectious Explanation: Unless symptoms are mild and athlete is fully hydrated, no participation is permitted, because diarrhea may increase risk of dehydration and heat illness (see fever).	Qualified no
Eating disorders Explanation: Athlete with an eating disorder needs medical and psychiatric assessment before participation.	Qualified yes
Eyes	Qualified yes
Functionally 1-eyed athlete	
Loss of an eye	
Detached retina or family history of retinal detachment at young age	
High myopia	
Connective tissue disorder, such as Marfan or Stickler syndrome	
Previous intraocular eye surgery or serious eye injury	

TABLE 2 Continued

	Condition	May Participate
	<p>Explanation: A functionally 1-eyed athlete is defined as having best-corrected visual acuity worse than 20/40 in the poorer-seeing eye. Such an athlete would suffer significant disability if the better eye were seriously injured, as would an athlete with loss of an eye. Specifically, boxing and full-contact martial arts are not recommended for functionally 1-eyed athletes, because eye protection is impractical and/or not permitted. Some athletes who previously underwent intraocular eye surgery or had a serious eye injury may have increased risk of injury because of weakened eye tissue. Availability of eye guards approved by the American Society for Testing and Materials and other protective equipment may allow participation in most sports, but this must be judged on an individual basis.^{22,23}</p>	
Conjunctivitis, infectious	<p>Explanation: Athlete with active infectious conjunctivitis should be excluded from swimming.</p>	Qualified no
Fever	<p>Explanation: Elevated core temperature may be indicative of a pathologic medical condition (infection or disease) that is often manifest by increased resting metabolism and heart rate. Accordingly, during athlete's usual exercise regimen, the presence of fever can result in greater heat storage, decreased heat tolerance, increased risk of heat illness, increased cardiopulmonary effort, reduced maximal exercise capacity, and increased risk of hypotension because of altered vascular tone and dehydration. On rare occasions, fever may accompany myocarditis or other conditions that may make usual exercise dangerous.</p>	No
Gastrointestinal	<p>Malabsorption syndromes (celiac disease or cystic fibrosis) Explanation: Athlete needs individual assessment for general malnutrition or specific deficits resulting in coagulation or other defects; with appropriate treatment, these deficits can be treated adequately to permit normal activities. Short-bowel syndrome or other disorders requiring specialized nutritional support, including parenteral or enteral nutrition Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports. Presence of central or peripheral, indwelling, venous catheter may require special considerations for activities and emergency preparedness for unexpected trauma to the device(s).</p>	Qualified yes
Heat illness, history of	<p>Explanation: Because of the likelihood of recurrence, athlete needs individual assessment to determine the presence of predisposing conditions and behaviors and to develop a prevention strategy that includes sufficient acclimatization (to the environment and to exercise intensity and duration), conditioning, hydration, and salt intake, as well as other effective measures to improve heat tolerance and to reduce heat injury risk (such as protective equipment and uniform configurations).^{24,25}</p>	Qualified yes
Hepatitis, infectious (primarily hepatitis C)	<p>Explanation: All athletes should receive hepatitis B vaccination before participation. Because of the apparent minimal risk to others, all sports may be played as athlete's state of health allows. For all athletes, skin lesions should be covered properly, and athletic personnel should use universal precautions when handling blood or body fluids with visible blood.²⁶</p>	Yes
HIV infection	<p>Explanation: Because of the apparent minimal risk to others, all sports may be played as athlete's state of health allows (especially if viral load is undetectable or very low). For all athletes, skin lesions should be covered properly, and athletic personnel should use universal precautions when handling blood or body fluids with visible blood.²⁶ However, certain sports (such as wrestling and boxing) may create a situation that favors viral transmission (likely bleeding plus skin breaks). If viral load is detectable, then athletes should be advised to avoid such high-contact sports.</p>	Yes
Kidney, absence of one	<p>Explanation: Athlete needs individual assessment for contact, collision, and limited-contact sports. Protective equipment may reduce risk of injury to the remaining kidney sufficiently to allow participation in most sports, providing such equipment remains in place during activity.²²</p>	Qualified yes
Liver, enlarged	<p>Explanation: If the liver is acutely enlarged, then participation should be avoided because of risk of rupture. If the liver is chronically enlarged, then individual assessment is needed before collision, contact, or limited-contact sports are played. Patients with chronic liver disease may have changes in liver function that affect stamina, mental status, coagulation, or nutritional status.</p>	Qualified yes
Malignant neoplasm	<p>Explanation: Athlete needs individual assessment.²⁷</p>	Qualified yes
Musculoskeletal disorders	<p>Explanation: Athlete needs individual assessment.</p>	Qualified yes
Neurologic disorders	<p>History of serious head or spine trauma or abnormality, including craniotomy, epidural bleeding, subdural hematoma, intracerebral hemorrhage, second-impact syndrome, vascular malformation, and neck fracture.^{4,5,28-30} Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports.</p>	Qualified yes
	<p>History of simple concussion (mild traumatic brain injury), multiple simple concussions, and/or complex concussion Explanation: Athlete needs individual assessment. Research supports a conservative approach to concussion management, including no athletic participation while symptomatic or when deficits in judgment or cognition are detected, followed by graduated return to full activity.²⁸⁻³²</p>	Qualified yes
Myopathies	<p>Explanation: Athlete needs individual assessment.</p>	Qualified yes
Recurrent headaches	<p>Explanation: Athlete needs individual assessment.³³</p>	Yes
Recurrent plexopathy (burner or stinger) and cervical cord neuropraxia with persistent defects	<p>Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports; regaining normal strength is important benchmark for return to play.^{34,35}</p>	Qualified yes
Seizure disorder, well controlled	<p>Explanation: Risk of seizure during participation is minimal.³⁶</p>	Yes
Seizure disorder, poorly controlled	<p>Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports. The following noncontact sports should be avoided: archery, riflery, swimming, weightlifting, power lifting, strength training, and sports involving heights. In these sports, occurrence of a seizure during activity may pose a risk to self or others.³⁶</p>	Qualified yes

TABLE 2 Continued

Condition	May Participate
Obesity Explanation: Because of the increased risk of heat illness and cardiovascular strain, obese athlete particularly needs careful acclimatization (to the environment and to exercise intensity and duration), sufficient hydration, and potential activity and recovery modifications during competition and training. ³⁷	Yes
Organ transplant recipient (and those taking immunosuppressive medications) Explanation: Athlete needs individual assessment for contact, collision, and limited-contact sports. In addition to potential risk of infections, some medications (eg, prednisone) may increase tendency for bruising.	Qualified yes
Ovary, absence of one Explanation: Risk of severe injury to remaining ovary is minimal.	Yes
Pregnancy/postpartum Explanation: Athlete needs individual assessment. As pregnancy progresses, modifications to usual exercise routines will become necessary. Activities with high risk of falling or abdominal trauma should be avoided. Scuba diving and activities posing risk of altitude sickness should also be avoided during pregnancy. After the birth, physiological and morphologic changes of pregnancy take 4 to 6 weeks to return to baseline. ^{38,39}	Qualified yes
Respiratory conditions Pulmonary compromise, including cystic fibrosis Explanation: Athlete needs individual assessment but, generally, all sports may be played if oxygenation remains satisfactory during graded exercise test. Athletes with cystic fibrosis need acclimatization and good hydration to reduce risk of heat illness.	Qualified yes
Asthma Explanation: With proper medication and education, only athletes with severe asthma need to modify their participation. For those using inhalers, recommend having a written action plan and using a peak flowmeter daily. ⁴⁰⁻⁴³ Athletes with asthma may encounter risks when scuba diving.	Yes
Acute upper respiratory infection Explanation: Upper respiratory obstruction may affect pulmonary function. Athlete needs individual assessment for all except mild disease (see fever).	Qualified yes
Rheumatologic diseases Juvenile rheumatoid arthritis Explanation: Athletes with systemic or polyarticular juvenile rheumatoid arthritis and history of cervical spine involvement need radiographs of vertebrae C1 and C2 to assess risk of spinal cord injury. Athletes with systemic or HLA-B27-associated arthritis require cardiovascular assessment for possible cardiac complications during exercise. For those with micrognathia (open bite and exposed teeth), mouth guards are helpful. If uveitis is present, risk of eye damage from trauma is increased; ophthalmologic assessment is recommended. If visually impaired, guidelines for functionally 1-eyed athletes should be followed. ⁴⁴	Qualified yes
Juvenile dermatomyositis, idiopathic myositis Systemic lupus erythematosus Raynaud phenomenon Explanation: Athlete with juvenile dermatomyositis or systemic lupus erythematosus with cardiac involvement requires cardiology assessment before participation. Athletes receiving systemic corticosteroid therapy are at higher risk of osteoporotic fractures and avascular necrosis, which should be assessed before clearance; those receiving immunosuppressive medications are at higher risk of serious infection. Sports activities should be avoided when myositis is active. Rhabdomyolysis during intensive exercise may cause renal injury in athletes with idiopathic myositis and other myopathies. Because of photosensitivity with juvenile dermatomyositis and systemic lupus erythematosus, sun protection is necessary during outdoor activities. With Raynaud phenomenon, exposure to the cold presents risk to hands and feet. ⁴⁵⁻⁴⁸	Qualified yes
Sickle cell disease Explanation: Athlete needs individual assessment. In general, if illness status permits, all sports may be played; however, any sport or activity that entails overexertion, overheating, dehydration, or chilling should be avoided. Participation at high altitude, especially when not acclimatized, also poses risk of sickle cell crisis.	Qualified yes
Sickle cell trait Explanation: Athletes with sickle cell trait generally do not have increased risk of sudden death or other medical problems during athletic participation under normal environmental conditions. However, when high exertional activity is performed under extreme conditions of heat and humidity or increased altitude, such catastrophic complications have occurred rarely. ^{8,49-52} Athletes with sickle cell trait, like all athletes, should be progressively acclimatized to the environment and to the intensity and duration of activities and should be sufficiently hydrated to reduce the risk of exertional heat illness and/or rhabdomyolysis. ²⁵ According to National Institutes of Health management guidelines, sickle cell trait is not a contraindication to participation in competitive athletics, and there is no requirement for screening before participation. ⁵³ More research is needed to assess fully potential risks and benefits of screening athletes for sickle cell trait.	Yes
Skin infections, including herpes simplex, molluscum contagiosum, verrucae (warts), staphylococcal and streptococcal infections (furuncles [boils], carbuncles, impetigo, methicillin-resistant <i>Staphylococcus aureus</i> [cellulitis and/or abscesses]), scabies, and tinea Explanation: During contagious periods, participation in gymnastics or cheerleading with mats, martial arts, wrestling, or other collision, contact, or limited-contact sports is not allowed. ⁵⁴⁻⁵⁷	Qualified yes
Spleen, enlarged Explanation: If the spleen is acutely enlarged, then participation should be avoided because of risk of rupture. If the spleen is chronically enlarged, then individual assessment is needed before collision, contact, or limited-contact sports are played.	Qualified yes
Testicle, undescended or absence of one Explanation: Certain sports may require a protective cup. ²²	Yes

This table is designed for use by medical and nonmedical personnel. "Needs evaluation" means that a physician with appropriate knowledge and experience should assess the safety of a given sport for an athlete with the listed medical condition. Unless otherwise noted, this need for special consideration is because of variability in the severity of the disease, the risk of injury for the specific sports listed in Table 1, or both.

FIGURE 1

Classification of sports according to cardiovascular demands (based on combined static and dynamic components).¹² This classification is based on peak static and dynamic components achieved during competition. It should be noted, however, that the higher values may be reached during training. The increasing dynamic component is defined in terms of the estimated percentage of maximal oxygen uptake (Max O₂) achieved and results in increasing cardiac output. The increasing static component is related to the estimated percentage of maximal voluntary contraction (MVC) reached and results in increasing blood pressure load. Activities with the lowest total cardiovascular demands (cardiac output and blood pressure) are shown in box III C. Boxes IIA and IB depict activities with low/moderate total cardiovascular demands, boxes IIIA, IIB, and IC depict activities with moderate total cardiovascular demands, and boxes IIIB and IIC depict high/moderate total cardiovascular demands. These categories progress diagonally across the graph from lower left to upper right. ^a Danger of bodily collision. ^b Increased risk if syncope occurs. ^c Participation is not recommended by the American Academy of Pediatrics.² ^d The American Academy of Pediatrics classifies cricket in the IB box (low static component and moderate dynamic component).⁵⁸ (Reproduced with permission from Mitchell JH, Haskell W, Snell P, Van Camp SP. 36th Bethesda Conference. Task force 8: classification of sports. *J Am Coll Cardiol*. 2005;45(8):1364–1367.)

		INCREASING DYNAMIC COMPONENT →		
		A. Low (< 40% Max O ₂)	B. Moderate (40-70% Max O ₂)	C. High (> 70% Max O ₂)
↑ INCREASING STATIC COMPONENT	III. High (>50% MVC)	IIIA (Moderate) Bobsledding/luge ^{a,b} Field events (throwing) Gymnastics ^{a,b} Martial arts ^a Sailing Sport climbing Water skiing ^{a,b} Weight lifting ^{a,b} Windsurfing ^{a,b}	IIIB (High Moderate) Body building ^{a,b} Downhill skiing ^{a,b} Skateboarding ^{a,b} Snowboarding ^{a,b} Wrestling ^a	IIIC (High) Boxing ^{a,c} Canoeing/kayaking Cycling ^{a,b} Decathlon Rowing Speed-skating ^{a,b} Triathlon ^{a,b}
	II. Moderate (20-50% MVC)	IIA (Low Moderate) Archery Auto racing ^{a,b} Diving ^{a,b} Equestrian ^{a,b} Motorcycling ^{a,b}	IIB (Moderate) American football ^a Field events (jumping) Figure skating ^a Rodeoing ^{a,b} Rugby ^a Running (sprint) Surfing ^{a,b} Synchronized swimming ^b	IIC (High Moderate) Basketball ^a Ice hockey ^a Cross-country skiing (skating technique) Lacrosse ^a Running (middle distance) Swimming Team handball
	I. Low (< 20% MVC)	IA (Low) Billiards Bowling Cricket ^d Curling Golf Rifery	IB (Low Moderate) Baseball/softball ^a Fencing Table tennis Volleyball	IC (Moderate) Badminton Cross-country skiing (classic technique) Field hockey ^a Orienteering Race walking Racquetball/squash Running (long distance) Soccer ^a Tennis

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REFERENCES

1. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Medical conditions affecting sports participation. *Pediatrics*. 2001;107(5):1205–1209
2. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Participation in boxing by children, adolescents, and young adults. *Pediatrics*. 1997;99(1):134–135
3. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Safety in youth ice hockey: the effects of body checking. *Pediatrics*. 2000;105(3):657–658
4. American Academy of Pediatrics, Committee on Injury and Poison Prevention, Committee on Sports Medicine and Fitness.

- Trampolines at home, school, and recreational centers. *Pediatrics*. 1999;103(5):1053–1056
5. Maranich AM, Hamele M, Fairchok MP. Atlanto-axial subluxation: a newly reported trampolining injury. *Clin Pediatr (Phila)*. 2006;45(5):468–470
 6. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Atlanto-axial instability in Down syndrome: subject review. *Pediatrics*. 1995;96(1):151–154
 7. American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, American Osteopathic Academy of Sports Medicine. *Preparticipation Physical Evaluation*. 3rd ed. New York, NY: McGraw-Hill; 2004
 8. Mercer KW, Densmore JJ. Hematologic disorders in the athlete. *Clin Sports Med*. 2005;24(3):599–621
 9. National Hemophilia Foundation. *Playing It Safe: Bleeding Disorders, Sports and Exercise*. New York, NY: National Hemophilia Foundation; 2005
 10. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics*. 2004;114(2 suppl):555–576
 11. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Athletic participation by children and adolescents who have systemic hypertension. *Pediatrics*. 1997;99(4):637–638
 12. American College of Cardiology Foundation. 36th Bethesda Conference: eligibility recommendations for competitive athletes with cardiovascular abnormalities. *J Am Coll Cardiol*. 2005;45(8):1313–1375
 13. Maron BJ, Thompson PD, Ackerman MJ, et al. Recommendations and considerations related to preparticipation screening for cardiovascular abnormalities in competitive athletes: 2007 update: a scientific statement from the American Heart Association Council on Nutrition, Physical Activity and Metabolism: endorsed by the American College of Cardiology Foundation. *Circulation*. 2007;115(12):1643–1655
 14. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Cardiac dysrhythmias and sports. *Pediatrics*. 1995;95(5):786–788
 15. Freed LA, Levy D, Levine RA, et al. Prevalence and clinical outcome of mitral-valve prolapse. *N Engl J Med*. 1999;341(1):1–7
 16. Maron BJ. Sudden death in young athletes. *N Engl J Med*. 2003;349(11):1064–1075
 17. Maron BJ. Hypertrophic cardiomyopathy: a systematic review. *JAMA*. 2002;287(10):1308–1320
 18. Pyeritz RE. The Marfan syndrome. *Annu Rev Med*. 2000;51:481–510
 19. American Academy of Pediatrics, Council on Sports Medicine and Fitness. Strength training by children and adolescents. *Pediatrics*. 2008;121(4):835–840
 20. Steinherz L, Steinherz P, Tan C, et al. Cardiac toxicity 4 to 20 years after completing anthracycline therapy. *JAMA*. 1991;266(12):1672–1677
 21. Newburger JW, Takahashi M, Gerber MA, et al. Diagnosis, treatment, and long-term management of Kawasaki disease: a statement for health professionals from the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease, Council on Cardiovascular Disease in the Young, American Heart Association. *Pediatrics*. 2004;114(6):1708–1733
 22. Gomez JE. Paired organ loss. In: Delee JC, Drez D Jr, Miller MD, eds. *Delee and Drez's Orthopaedic Sports Medicine: Principles and Practice*. 2nd ed. Philadelphia, PA: Saunders; 2003:264–271
 23. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Protective eyewear for young athletes. *Pediatrics*. 2004;113(3):619–622
 24. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Climatic heat stress and the exercising child and adolescent. *Pediatrics*. 2000;106(1):158–159
 25. Bergeron MF, McKeag DB, Casa DJ, et al. Youth football: heat stress and injury risk. *Med Sci Sports Exerc*. 2005;37(8):1421–1430
 26. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Human immunodeficiency virus and other blood-borne viral pathogens in the athletic setting. *Pediatrics*. 1999;104(6):1400–1403
 27. Dickerman JD. The late effects of childhood cancer therapy. *Pediatrics*. 2007;119(3):554–568
 28. Wojtys EM, Hovda D, Landry G, et al. Current concepts: concussion in sports. *Am J Sports Med*. 1999;27(5):676–687
 29. McCrory P, Johnston K, Meeuwisse W, et al. Summary and agreement statement of the 2nd International Conference on Concussion in Sport, Prague 2004. *Clin J Sport Med*. 2005;15(2):48–55
 30. Aubry M, Cantu R, Dvorak J, et al. Summary and agreement statement of the 1st International Symposium on Concussion in Sport, Vienna 2001. *Clin J Sport Med*. 2002;12(1):6–11
 31. Herring SA, Bergfeld JA, Boland A, et al. Concussion (mild traumatic brain injury) and the team physician: a consensus statement. *Med Sci Sports Exerc*. 2006;38(2):395–399
 32. Guskiewicz KM, Bruce SL, Cantu RC, et al. National Athletic Trainers' Association position statement: management of sport-related concussion. *J Athl Train*. 2004;39(3):280–297
 33. Lewis DW, Ashwal S, Dahl G, et al. Practice parameter: evaluation of children and adolescents with recurrent headaches: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. *Neurology*. 2002;59(4):490–498
 34. Castro FP Jr. Stingers, cervical cord neuropraxia, and stenosis. *Clin Sports Med*. 2003;22(3):483–492
 35. Weinberg J, Rokito S, Silber JS. Etiology, treatment, and prevention of athletic "stingers." *Clin Sports Med*. 2003;22(3):493–500, viii
 36. Hirtz D, Berg A, Bettis D, et al. Practice parameter: treatment of the child with a first unprovoked seizure: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. *Neurology*. 2003;60(2):166–175
 37. American Academy of Pediatrics, Council on Sports Medicine and Fitness and Council on School Health. Active healthy living: prevention of childhood obesity through increased physical activity. *Pediatrics*. 2006;117(5):1834–1842
 38. American College of Obstetricians and Gynecologists, Committee on Obstetric Practice. ACOG committee opinion: exercise during pregnancy and the postpartum period. *Obstet Gynecol*. 2002;99(1):171–173
 39. Morales M, Dumps P, Extermann P. Pregnancy and scuba diving: what precautions? [in French]. *J Gynecol Obstet Biol Reprod (Paris)*. 1999;28(2):118–123
 40. National Heart, Lung, and Blood Institute. *National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma: Full Report*. Bethesda, MD: National Institutes of Health; 2007. Available at: www.nhlbi.nih.gov/guidelines/asthma/asthupdt.htm. Accessed October 2, 2007
 41. American College of Allergy, Asthma, and Immunology. *Asthma Disease Management Resource Manual*. Arlington Heights, IL: American College of Allergy, Asthma, and Immunology. Available at: www.aaaai.org/Member/Practice_Resources/manual.htm. Accessed November 17, 2006
 42. Storms WW. Review of exercise-induced asthma. *Med Sci Sports Exerc*. 2003;35(9):1464–1470

43. Holzer K, Brukner P. Screening of athletes for exercise-induced bronchospasm. *Clin J Sport Med*. 2004;14(3):134–138
44. Giannini MJ, Protas EJ. Exercise response in children with and without juvenile rheumatoid arthritis: a case-comparison study. *Phys Ther*. 1992;72(5):365–372
45. Tench C, Bentley D, Vleck V, McCurdie I, White P, D’Cruz D. Aerobic fitness, fatigue, and physical disability in systemic lupus erythematosus. *J Rheumatol*. 2002;29(3):474–481
46. Carvalho MR, Sato EI, Tebexreni AS, Heidecher RT, Schenckman S, Neto TL. Effects of supervised cardiovascular training program on exercise tolerance, aerobic capacity, and quality of life in patients with systemic lupus erythematosus. *Arthritis Rheum*. 2005;53(6):838–844
47. Hicks JE, Drinkard B, Summers RM, Rider LG. Decreased aerobic capacity in children with juvenile dermatomyositis. *Arthritis Rheum*. 2002;47(2):118–123
48. Clarkson PM, Kearns AK, Rouzier P, Rubin R, Thompson PD. Serum creatine kinase levels and renal function measures in exertional muscle damage. *Med Sci Sports Exerc*. 2006;38(4):623–627
49. Pretzlaff RK. Death of an adolescent athlete with sickle cell trait caused by exertional heat stroke. *Pediatr Crit Care Med*. 2002;3(3):308–310
50. Kark J. *Sickle Cell Trait*. Washington, DC: Howard University School of Medicine; 2000. Available at: http://sickle.bwh.harvard.edu/sickle_trait.html. Accessed November 17, 2006
51. Kerle KK, Nishimura KD. Exertional collapse and sudden death associated with sickle cell trait. *Am Fam Physician*. 1996;54(1):237–240
52. Bergeron MF, Cannon JG, Hall EL, Kutlar A. Erythrocyte sickling during exercise and thermal stress. *Clin J Sport Med*. 2004;14(6):354–356
53. National Heart, Lung, and Blood Institute. *The Management of Sickle Cell Disease*. 4th ed. Bethesda, MD: National Institutes of Health; 2002:15–18. NIH publication 02-2117
54. Mast EE, Goodman RA. Prevention of infectious disease transmission in sports. *Sports Med*. 1997;24(1):1–7
55. Sevier TL. Infectious disease in athletes. *Med Clin North Am*. 1994;78(2):389–412
56. Centers for Disease Control and Prevention. Methicillin-resistant *Staphylococcus aureus* infections among competitive sports participants: Colorado, Indiana, Pennsylvania, and Los Angeles County, 2000–2003. *MMWR Morb Mortal Wkly Rep*. 2003;52(33):793–795. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5233a4.htm. Accessed November 17, 2006
57. Centers for Disease Control and Prevention. Community-associated MRSA information for clinicians. Available at: www.cdc.gov/ncidod/dhqp/ar_mrsa_ca_clinicians.html. Accessed November 17, 2006
58. American Academy of Pediatrics. General physical activities defined by level of intensity. Available at: www.aap.org/sections/seniormembers/docs/Fit-ActvsIntensity.pdf. Accessed October 2, 2007
59. Baxter JS. Legal aspects of sports medicine. In: Garrick JG, ed. *Orthopaedic Knowledge Update: Sports Medicine 3*. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2004:397–402
60. Mitten MJ. When is disqualification from sports justified? Medical judgment vs patients’ rights. *Phys Sports Med*. 1996;24(10):75–78
61. Mitten MJ. Emerging legal issues in sports medicine: a synthesis, summary, and analysis. *St John’s Law Rev*. 2002;76(1):5–86
62. Mitten MJ. Legal issues affecting medical clearance to resume play after mild brain injury. *Clin J Sport Med*. 2001;11(3):199–202
63. Sullivan JA, Anderson SJ, eds. *Care of the Young Athlete*. Elk Grove Village, IL: American Academy of Pediatrics; 2000
64. Washington RL, Bernhardt DT, Gomez J, et al. Organized sports for children and preadolescents. *Pediatrics*. 2001;107(6):1459–1462
65. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Risk of injury from baseball and softball in children. *Pediatrics*. 2001;107(4):782–784
66. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Intensive training and sports specialization in young athletes. *Pediatrics*. 2000;106(1):154–157
67. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Promotion of healthy weight-control practices in young athletes. *Pediatrics*. 2005;116(6):1557–1564

ADDITIONAL RESOURCE

Brenner JS, American Academy of Pediatrics, Council on Sports Medicine and Fitness. Overuse injuries, overtraining, and burnout in athletes. *Pediatrics*. 2007;119(6):1232–1241

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