



# Policy Statement—Athletic Participation by Children and Adolescents Who Have Systemic Hypertension

COUNCIL ON SPORTS MEDICINE AND FITNESS

## KEY WORDS

sports, blood pressure, cardiovascular disease, athlete, heart disease, LVH

## ABBREVIATION

LVH—left ventricular hypertrophy

This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through a process approved by the Board of Directors. The American Academy of Pediatrics has neither solicited nor accepted any commercial involvement in the development of the content of this publication.

[www.pediatrics.org/cgi/doi/10.1542/peds.2010-0658](http://www.pediatrics.org/cgi/doi/10.1542/peds.2010-0658)

doi:10.1542/peds.2010-0658

All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2010 by the American Academy of Pediatrics

## abstract

FREE

Children and adolescents who have hypertension may be at risk for complications when exercise causes their blood pressure to rise even higher. The purpose of this statement is to update recommendations concerning the athletic participation of individuals with hypertension, including special populations such as those with spinal cord injuries or obesity, by using the guidelines from “The 36th Bethesda Conference: Eligibility Recommendations for Competitive Athletes with Cardiovascular Abnormalities”; “The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents”; and “The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.” *Pediatrics* 2010;125:1287–1294

Hypertension is the most common cardiovascular condition seen in people who engage in competitive athletics.<sup>1</sup> In 2005, the 36th Bethesda Conference guidelines, which contained new recommendations concerning the participation of athletes who have heart disease, was released.<sup>1</sup> The “The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents” (hereafter referred to as the Fourth Report), published in 2004, briefly addressed exercise for youths with hypertension.<sup>2</sup> The 2003 “Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure” (hereafter referred to as the JNC 7 report)<sup>3</sup> established new adult hypertension guidelines. This policy statement summarizes the updated recommendations of these 3 groups of experts and makes these guidelines more available to the general pediatrician.

## UPDATED GUIDELINES

The Fourth Report updated hypertension guidelines to be consistent with the modified adult hypertension classifications proposed in the JNC 7 report and new pediatric blood pressure data.<sup>2,3</sup> The JNC 7 authors created a prehypertension classification based on recent data reporting lifetime risk of developing hypertension in those who are normotensive, indicating a need for increased surveillance at lower blood pressure levels.<sup>3</sup> For these adult guidelines, the importance of lifestyle changes (weight reduction, balanced eating, reduction of dietary sodium, increased physical activity, and limited alcohol consumption) for management of hypertension was also recognized.<sup>3</sup> New pediatric blood pressure data, obtained from the 1999–2000 National

**TABLE 1** Blood Pressure Levels for Boys According to Age and Height Percentile

Age, y	BP Percentile	SBP, mm Hg							DBP, mm Hg						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
2	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
3	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
4	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79
5	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
6	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
7	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
8	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
9	50th	95	96	99	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89
10	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90
11	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
12	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
13	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
14	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92
15	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93

**TABLE 1** Continued

Age, y	BP Percentile	SBP, mm Hg							DBP, mm Hg						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
16	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
17	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

BP indicates blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure.

(Reproduced with Permission from National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *Pediatrics*. 2004;114[2 suppl 4th report]:558.)

Health and Nutrition Examination Survey (NHANES), and new height-percentile data for blood pressure/height comparison, made available by the Centers for Disease Control and Prevention ([www.cdc.gov/growthcharts](http://www.cdc.gov/growthcharts)), were also included in the Fourth Report guidelines.<sup>2</sup> The 99th percentile for hypertension was added to facilitate clinical decision-making and delineate the severity of hypertension.<sup>2</sup>

The new adult and pediatric guidelines for hypertension include 3 categories: prehypertension; stage 1 hypertension; and stage 2 hypertension. Tables 1 and 2 provide the latest pediatric blood pressure tables ([www.nhlbi.nih.gov/guidelines/hypertension/child\\_ttbl.pdf](http://www.nhlbi.nih.gov/guidelines/hypertension/child_ttbl.pdf)).<sup>2</sup> The Fourth Report defines childhood hypertension as measurements at or above the 95th percentile for gender, age, and height on 3 or more occasions.<sup>2</sup> In children and adolescents younger than 18 years, prehypertension is defined as blood pressure measurements of  $\geq 90$ th percentile but  $< 95$ th percentile.<sup>2</sup> In this age group, prehypertension is also defined as blood pressure measurements of  $\geq 120/80$  but  $< 95$ th percentile.<sup>2</sup> Stage 1 hypertension is defined as blood pressure measurements from the 95th percentile to 5 mm Hg above the 99th percentile.<sup>2</sup> Stage 2 hypertension is defined as blood pressure measurements  $> 5$  mm Hg above the 99th

percentile.<sup>2</sup> For those who are 18 years or older, prehypertension is defined as blood pressure measurements of 120 to 139 systolic and/or 80 to 89 diastolic; stage 1 hypertension is defined as 140 to 159 systolic and/or 90 to 99 diastolic; and stage 2 hypertension is defined as  $\geq 160$  systolic and/or  $\geq 100$  diastolic, as defined in the 36th Bethesda Conference guidelines and the JNC 7 report.<sup>1,3</sup> All values given apply to patients who are not taking antihypertensive drugs and who are not acutely ill. When the systolic and diastolic pressures fall into different categories, the higher category should be selected to classify the patient's blood pressure status.

When hypertension and other cardiovascular diseases coexist, eligibility for participation in competitive athletics is usually based on the type and severity of the other cardiovascular disease.<sup>1</sup> The heart can become enlarged nonpathologically as a result of adaptations during high levels of training in some athletes—usually males; this condition is commonly referred to as “athlete's heart.”<sup>4</sup> Left ventricular hypertrophy (LVH) beyond that seen with athlete's heart should limit participation until blood pressure is normalized with drug therapy.<sup>1</sup> Child and adolescent athletes with LVH and/or athlete's heart should be followed and

managed by pediatric medical subspecialists (cardiologists).

## EVALUATION

Care must be taken to obtain reliable blood pressure recordings.<sup>1,2</sup> The athlete should be seated and resting quietly for 5 minutes with the arm supported at the level of the heart. A right arm reading is suggested for consistency and for evaluation for a coarctation (the left arm may give falsely low readings with a coarctation). Appropriately sized cuffs should be used, because cuffs that are too small may overestimate blood pressure readings. Some athletes have exceedingly large biceps or triceps, have long extremities, or are obese; hence, they may require measurements taken by using an adult or thigh cuff. The width of the blood pressure bladder must be adequate to cover at least 80% of the individual's upper arm (measured between the top of the shoulder and the olecranon), and the bladder length should encircle the arm completely.<sup>2</sup> A measurement of  $> 90$ th percentile obtained by oscillometric devices should be repeated by manual auscultation.<sup>1</sup> Only after several elevated readings (3 readings recommended in the Fourth Report and 2 readings recommended in the 36th Bethesda Conference guidelines) have been obtained on separate occasions should the diagnosis of

**TABLE 2** Blood Pressure Levels for Girls According to Age and Height Percentile

Age, y	BP Percentile	SBP, mm Hg							DBP, mm Hg						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88
11	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
12	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
13	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
14	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92
15	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93

**TABLE 2** Continued

Age, y	BP Percentile	SBP, mm Hg							DBP, mm Hg						
		Percentile of Height							Percentile of Height						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
16	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
17	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

BP indicates blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure.

(Reproduced with Permission from National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *Pediatrics*. 2004;114[2 suppl 4th report]:559.)

hypertension be made. Out-of-office blood pressure measurements may be taken to delineate true high blood pressure if the diagnosis is in question.<sup>1</sup> Further details concerning the measurement of blood pressure are available.<sup>1,2</sup>

Once the diagnosis of hypertension is confirmed, an evaluation that includes a history, a thorough physical examination, and appropriate laboratory testing should be performed, as outlined in the Fourth Report. Updated recommendations from the Fourth Report for evaluation of values >95th percentile include an echocardiogram, retinal examination, and consideration of a workup for sleep disorders.<sup>2</sup> Sleep apnea, especially in overweight children, may be associated with cardiovascular disease and an increased risk of hypertension.<sup>2</sup>

### PHYSICAL ACTIVITY AND BLOOD PRESSURE

Children and adolescents should be encouraged to participate in regular, non-competitive physical activity, because exercise has been shown to help reduce both systolic and diastolic pressures in those with hypertension.<sup>1-3</sup>

Reports of cerebrovascular accidents during maximal exercise have raised concerns that the increase in blood pressure accompanying strenuous activity may cause harm.<sup>1</sup> The following

guidelines recommend temporary restriction for those athletes who have stage 2 hypertension until normal blood pressure is achieved. However, available data do not indicate that strenuous dynamic exercise places these athletes at risk of acute complications of hypertension during exercise or of worsening of their baseline blood pressure values.<sup>1</sup>

In dynamic exercise (exerting muscles through joint movement), intramuscular force is not greatly increased as muscles lengthen and contract and joints move through their range of motion. There is a sizable increase in systolic blood pressure, a moderate increase in mean arterial pressure, and a decrease in diastolic pressure and total peripheral resistance. In static exercise (exerting muscles without joint movement), relatively large intramuscular forces develop without much change in muscle length or joint motion. Systolic, mean arterial, and diastolic pressures increase significantly, and total peripheral resistance remains essentially unchanged. It is the acute increase in diastolic pressure that particularly concerns the experts, as well as the possible increases in muscle mass that may elevate resting blood pressure. Although the limited evidence shows no greater risk with highly static exercise<sup>1</sup> (Fig 1), experts are more cautious

about allowing athletes with stage 2 hypertension to participate in this type of activity. Most physical activities and sports have both static and dynamic components. Guidelines for restricting participation should be based on the cardiovascular demands of the activity and the demands of the practice, training, and/or preparation for that activity.

### SUBSTANCES THAT INCREASE BLOOD PRESSURE

Medications, alcohol, tobacco, drugs of abuse, stimulants, and caffeine may affect blood pressure (Table 3). The young athlete with hypertension, regardless of severity, should be strongly encouraged to adopt healthy behaviors, including the avoidance of exogenous androgens, growth hormone, illicit drugs (especially cocaine), alcohol, use of tobacco (all forms), nonprescribed stimulants, certain over-the-counter supplements (especially those that contain ephedra or other stimulants), and excessive consumption of energy drinks and caffeinated beverages.<sup>1,3,5</sup> Because certain medications (Table 3) may increase blood pressure, medications should be monitored and reviewed during the evaluation and treatment of patients with hypertension. Blood pressure should be remeasured after

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

**FIGURE 1**

Classification of sports according to cardiovascular demands (based on combined static and dynamic components). 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 percent of maximal oxygen uptake (MaxO<sub>2</sub>) achieved and results in an increasing cardiac output. The increasing static component is related to the estimated percent of maximal voluntary contraction (MVC) reached and results in an increasing blood pressure load. The lowest total cardiovascular demands (cardiac output and blood pressure) are shown in Box IA and the highest are shown in Box IIIC. Boxes IIA, IB, IIIA, IIB, IC, IIIB and IIC depict low-moderate, moderate, and high-moderate total cardiovascular demands. These categories progress diagonally across the table from lower left to upper right. \*Danger of bodily collision. †Increased risk if syncope occurs. ‡Participation not recommended by the American Academy of Pediatrics. +The American Academy of Pediatrics classifies cricket in the IB box (low static, moderate dynamic). (Reprinted from Rice SG; American Academy of Pediatrics, Council on Sports Medicine and Fitness. Medical conditions affecting sports participation. *Pediatrics*. 2008;121(4):841–848 (originally adapted from Mitchell JH, Haskell W, Snell P, Van Camp SP. 38th Bethesda Conference. *J Am Coll Cardiol*. 2005;45(8):1364–1367, with permission from Elsevier).

the offending substance has been removed from the athlete's system.

Sodium balance can affect blood pressure, and restricting sodium intake is typically recommended for those with hypertension. Current sodium recommendations for youth are 1.2 g/day for

children 4 to 8 years of age,<sup>2</sup> 1.5 g/day for older children,<sup>2</sup> and 2.4 g/day for adults.<sup>3</sup> For some youth athletes, however, a significant total-body sodium deficit can develop as a result of extensive sweating during extended or repeated bouts of exercise, practice, or

**TABLE 3** Medications and Substances That May Increase Blood Pressure

Acetaminophen
Alcohol
Antidepressants
Caffeine
Decongestants
Herbal supplements
Illicit drugs
Immunosuppressants
Nonsteroidal anti-inflammatory drugs
Oral contraceptives
Stimulants
Tobacco

competition.<sup>5,6</sup> Accordingly, rehydration often requires deliberate concomitant intake of additional salt-containing fluids and foods to ensure greater body-water retention and distribution to all fluid compartments.<sup>7–10</sup>

Athletes should be advised that the use of diuretic medications and  $\beta$  blockers, which are commonly used to treat hypertension, have been prohibited by some athletic governing bodies. These drugs can also decrease athletic performance in certain individuals. In these instances, other types of medications may need to be considered to control hypertension. All medications should be registered with the appropriate sport governing body to request a therapeutic exemption when appropriate.

## SPECIAL POPULATIONS

Obese athletes are at greater risk of hypertension than their nonobese counterparts. In certain sports and team positions, bulk and body mass are valued, expected, and promoted. This practice should not be encouraged because of the health risks associated with obesity, including but not limited to hypertension, cardiovascular disease, diabetes, dyslipidemia, and arthritis.

Athletes with spinal cord injuries may have difficulties regulating blood pressure. In these athletes, hypertension may be a sign of autonomic dysreflexia (uncontrolled systemic sympathetic



response) as a result of pain, illness, infection, or bowel or bladder distension.<sup>11</sup> These athletes should be evaluated and managed accordingly. Some athletes with spinal cord injuries above the T6 level may participate in a practice called “boosting,” in which they induce blood pressure elevations via voluntary bladder distension in hopes of enhancing athletic performance.<sup>11</sup> This intentional autonomic dysreflexia is banned by the International Paralympic Committee ([www.paralympic.org](http://www.paralympic.org)) and should be discouraged because serious health problems may occur as a result.

## RECOMMENDATIONS

The American Academy of Pediatrics makes the following recommendations.

1. Lifestyle modifications, including daily physical activity and a well-balanced diet, should be discussed and encouraged at all well-child visits regardless of whether the patient has hypertension or normal blood pressure.
2. The presence of prehypertension should not limit a person's eligibility for competitive athletics. Lifestyle modifications, including weight management, daily physical activity, and a well-balanced diet, should be discussed and encouraged. Patients with prehypertension should have their blood pressure measured every 6 months.
3. Stage 1 hypertension in the absence of end organ damage, including LVH or concomitant heart disease, should not limit a person's eligibility for competitive athletics. These athletes should have their blood pressure rechecked in 1 to 2 weeks to confirm the hypertension or sooner if they are symptomatic. Appropriate referrals to qualified pediatric medical subspecialists need to be made if patients are symptomatic, have LVH or concomitant heart disease, or have persistently elevated blood pressure on 2 additional occasions. Lifestyle modifications should be discussed and encouraged.
4. Youth with stage 2 hypertension in the absence of end organ damage, including LVH or concomitant heart disease, should be restricted from high-static sports (classes IIIA to IIIC in Fig 1) until their blood pressure is in the normal range after lifestyle modification and/or drug therapy. These athletes should be promptly referred and evaluated by a qualified pediatric medical subspecialist within 1 week if they are asymptomatic or immediately if they are symptomatic. Lifestyle modifications should be discussed and encouraged.
5. When hypertension and other cardiovascular diseases coexist, eligibility for participation in competitive athletics should usually be based on the type and severity of the other cardiovascular disease.
6. Medication, caffeine, drug, tobacco, and stimulant use should be reviewed with any athlete with hypertension because of the effects these substances may have on blood pressure.
7. Although restricting sodium intake is typically recommended for those with hypertension, for some young athletes rehydration often requires deliberate concomitant intake of additional salt-containing fluids and foods to ensure greater body-water retention and distribution to all fluid compartments.
8. Care should be taken to appropriately diagnose and monitor athletes who are at higher risk for hypertension, such as obese athletes and athletes with spinal cord injuries.

## COUNCIL ON SPORTS MEDICINE AND FITNESS EXECUTIVE COMMITTEE, 2008–2009

Teri M. McCambridge, MD, Chairperson  
 Holly J. Benjamin, MD  
 Joel S. Brenner, MD, MPH  
 Charles T. Cappetta, MD  
 Rebecca A. Demorest, MD  
 Andrew J. M. Gregory, MD  
 Mark Halstead, MD  
 Chris G. Koutures, MD  
 Cynthia R. LaBella, MD  
 Stephanie Martin, MD  
 Stephen G. Rice, MD, PhD, MPH

## LEAD AUTHORS

Rebecca A. Demorest, MD  
 Reginald L. Washington, MD, Past Chairperson

## LIAISONS

Claire M. A. LeBlanc, MD – *Canadian Paediatric Society*  
 James Raynor, MS, ATC – *National Athletic Trainers Association*

## CONSULTANTS

Michael F. Bergeron, PhD, FACSM

## STAFF

Anjie Emanuel, MPH

## REFERENCES

1. Maron BJ, Zipes DP, eds. 36th Bethesda Conference. Eligibility recommendations for competitive athletes with cardiovascular abnormalities. *J Am Coll Cardiol*. 2005; 45(8):1318–1321
2. 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 4th report):555–576
3. Chobanian AV, Bakris GL, Black HR, et al; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High

Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report [published correction appears in *JAMA*. 2003;290(2):197]. *JAMA*. 2003;289(19):2560–2572

4. Huston TP, Puffer JC, Rodney WM. The athletic heart syndrome. *N Engl J Med.* 1985; 313(1):24–32
5. Bergeron MF. Heat cramps: fluid and electrolyte challenges during tennis in the heat. *J Sci Med Sport.* 2003;6(1):19–27
6. Bergeron MF. Muscle cramps during exercise: is it fatigue or electrolyte deficit? *Curr Sports Med Rep.* 2008;7(4): S50–S55
7. Maughan RJ, Leiper JB. Sodium intake and post-exercise rehydration in man. *Eur J Appl Physiol Occup Physiol.* 1995;71(4): 311–319
8. Maughan RJ, Leiper JB, Shirreffs SM. Restoration of fluid balance after exercise-induced dehydration: effects of food and fluid intake. *Eur J Appl Physiol Occup Physiol.* 1996;73(3–4):317–325
9. Sanders B, Noakes TD, Dennis SC. Water and electrolyte shifts with partial fluid replacement during exercise. *Eur J Appl Physiol Occup Physiol.* 1999;80(4):318–323
10. Sanders B, Noakes TD, Dennis SC. Sodium replacement and fluid shifts during prolonged exercise in humans. *Eur J Appl Physiol.* 2001;84(5):419–425
11. Patel DR, Greydanus DE. The pediatric athlete with disabilities. *Pediatr Clin North Am.* 2002;49(4):803–827