Focusing the Preparticipation Sports Examination

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Athletic preparticipation evaluations are among the most common routine health screening tools, yet no standardized approach to these evaluations has been adopted. This paper presents a focused preparticipation examination form developed by the authors with the assistance of the North Carolina Academy of Family Physicians' Task Force on Sports Medicine. After reviewing the major studies of preparticipation examinations, 11 basic questions that identify specific risks for sports participation were selected. Three specific components form the core of the physical examination: blood pressure measurement, a comprehensive orthopedic examination, and cardiovascular auscultation. Other portions of the physical examination may be included because of sport-specific risks or problems identified in the history, but are not routine. The rationale for this form and guidelines for the physician to make recommendations for sports participation and timing of reevaluation are discussed. J

A thletic participation in all sports increased dramatically during the 1980s. Subsequently, 7 million high school students and an equal number of middle school students may need preparticipation examinations on a yearly basis. In spite of the large number of athletes being screened, no national standards dictate who can safely participate in sports, and the goals, content, and objectives of preparticipation examinations remain unclear.

In 1988 the American Academy of Pediatrics developed an updated preparticipation examination form and has published modified recommendations for participation in competitive sports to replace the last American Medical Association guidelines, which were developed in 1976.⁴ Currently, the American Academy of Family Physicians Task Force on Sports Medicine is also reworking the preparticipation examination form that they last published in 1984.⁵ The current efforts of both of these national academies represent the acceptance of positions that were first outlined a decade ago.

In an editorial in the November 1980 issue of *Pediatrics*, Garrick and Smith⁶ made several points that are now emerging as consensus. They noted that it would be inap-

propriate to look at the mandatory preparticipation examination as the total health care of adolescent athletes. Second, they emphasized that a review of relatively few findings in the medical history and physical examination would allow safe participation in sports. Specifically, they suggested using not more than a half-dozen historical questions and a brief screening physical examination. These same sentiments have been expressed by others including Dyment,7 Runyan,8 and Thompson et al.9 In addition. Garrick and Smith⁶ observed that the laboratory screening, traditionally part of these examinations, has not helped detect athletes who merit disqualification. While comprehensive physical examinations, multistation examinations, and laboratory tests do discover a number of abnormalities, the vast majority of these abnormalities prove to be false-positive findings. Consequently, in the healthy population of young athletes, the disqualification rates in multiple studies have averaged only 0.3% to 1.3% of all the students screened.7,10-13

This paper describes a focused preparticipation examination form that was developed by the author with the assistance of the North Carolina Academy of Family Physicians' Task Force on Sports Medicine. By incorporating recommendations from the preparticipation sports literature, a limited history and physical examination that would be oriented toward participation, not general health maintenance, was defined (Appendixes 1 and 2). A discussion of each component of this preparticipation examination form and its rationale follows.

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HISTORY

Most studies confirm the history as more important than other aspects of the examination. In a study of 701 athletes by Goldberg et al, ¹⁰ seven of the nine athletes disqualified had problems detected during the history. Although the history is of primary importance, most researchers have noted that a limited number of questions would be adequate. Dyment⁷ listed six questions he felt were essential to the examination. Thompson and coworkers⁹ devised a form that included four general questions. Runyan⁸ noted that questions covering nine items were of special concern. The common theme that runs through the attempts to focus the historical part of the preparticipation examination is that critical areas need to be included and can be covered with a few simple questions.

Consensus does exists that certain basic areas must be reviewed in the preparticipation examination. These health areas include cardiovascular risks, previous musculoskeletal injury, and previous neurological injury. Recent papers also emphasize the importance of exercise-induced bronchospasm and heat injury. The other broad area of concern is general health, and questions should cover missing organs, allergies, chronic diseases, medication use, and harmful habits.

Cardiovascular Risks

Cardiovascular risks, the first of the critical screening areas, can probably be screened with two questions:

- 1. Has anyone in the athlete's family (grandmother, mother, father, brother, sister, aunt, uncle) died suddenly before the age of 50 years?
- 2. Has the athlete ever passed out during exercise or stopped exercising because of dizziness?

Question 1 probes for a family history that might suggest hypertrophic cardiomyopathy, an autosomal dominant condition noted by Maron and others^{14,15} to be the most common cause of sudden death in athletes under the age of 35 years. Question 2, regarding syncope or dizziness during exercise, not only screens for hypertrophic cardiomyopathy but also for athletes who have a variety of other conditions including congenital anomalies of the coronary arteries or arrhythmias. ¹⁶ No prospective studies are likely to identify whether these questions are useful screening tools, since the incidence of sudden cardiac death in young athletes has been estimated at 1 in 200,000. ¹⁷ Retrospective review of the history of athletes who have died suddenly, however, suggests that the in-

clusion of these questions might identify the rare individual at risk.

Exercise-Induced Asthma

Exercise-induced bronchospasm correlates closely with specific symptoms and a history of atopy. The following is a good question to screen for this disorder:

3. Does the athlete have asthma (wheezing), hay fever, or coughing spells after exercise?

In a 1984 screening of Olympic athletes at the Colorado Springs Olympic Training Center, 11% were found to have exercise-induced bronchospasm.¹⁸ Even in these successful athletes, over one half had not been recognized as having exercise-induced bronchospasm before that screening. This finding underscores the subtle nature of symptoms such as cough following exercise that may be indicators of exercise-induced bronchospasm. Athletes who have other allergic problems, specifically allergic rhinitis, have an increased risk of exercise-induced bronchospasm that may approach 40%. 19 The purpose of this question is not disqualification from competition but initiation of additional screening tests, such as simple peak flow measurements, before and after vigorous exercise. Exercise-induced bronchospasm responds well to treatment, and the preparticipation examination can identify a treatable health concern that will enable the athlete to function more effectively.

Musculoskeletal Injury

The history of musculoskeletal injury covers the most common problem area in preparticipation examinations. A simple question is recommended:

4. Has the athlete ever broken a bone, had to wear a cast, or had an injury to any joint?

A positive answer to this question places the athlete in a special risk group that suffers from more recurrent injuries. In particular, knee and ankle injuries often recur, and most commonly new injuries actually are a reinjury of a previously damaged joint.^{8,20} A study by Robey et al²¹ noted a 71% injury rate of football players injured in the previous season compared with a 43% injury rate in players without a previous injury. A positive response to this question also directs the examiner to ask the athlete what rehabilitation he or she has undergone. The reinjury risk of a rehabilitated joint is negligible compared with risk of reinjuring a joint that has persistent weakness or instability.²²

Other questions may be in order to elicit a history of persistent pain or weakness. A history of wearing a cast suggests a significant injury even if the athlete did not regard it as such. A positive history also helps direct the orthopedic examination to test carefully any previously injured joint.

Neurological Injury

A history of traumatic neurological injury is of major importance in contact and collision sports. The following question screens for neurological injury:

5. Does the athlete have a history of concussion (getting knocked out)?

Gerberich,²³ using data from 3063 secondary school football players in Minnesota, emphasizes that athletes with a previous concussion have a fourfold greater risk of intracerebral hemorrhage. Football players often do not regard the transient "bell ringer" or brief loss of consciousness as abnormal. A positive response to this question certainly indicates a need for a more in-depth history. It also mandates a neurological examination as part of the routine screening. The athlete with a history of recurrent concussions falls into a special category in which clearance for participation requires a thorough evaluation beyond the preparticipation assessment.

Heat-Related Illness

Heat-related illness poses a particular risk for athletes exercising in hot, humid conditions. 18 Susceptibility can be identified by a history of previous problems and can be screened with the following question:

6. Has the athlete ever suffered a heat-related illness (heat stroke)?

Considerable research indicates that individuals who have suffered one bout of heat illness have an increased risk of recurrent problems.²⁴ Whether this susceptibility relates to some intrinsic defect in their physiological ability to dissipate heat or to poor aerobic conditioning is not always clear. A positive response to a question about heat illness should prompt further questions about general fitness. Dyment⁷ recommends asking whether athletes can run two laps around a track without difficulties. Athletes who give a positive response to a history of heat illness or to questions that indicate a lack of good aerobic conditioning should be monitored on the field during adverse practice conditions to see whether they are showing an abnormal temperature response. Publicity regarding

deaths of athletes with cardiovascular problems often overshadows the fact that many states record heat illness as the primary cause for athletic deaths. Heat stroke is a medical emergency with high mortality unless prompt recognition and therapy are instituted.

Harmful Health Habits

Issues surrounding harmful health habits may change how many physicians conduct preparticipation evaluations. The following question identifies a group of athletes with special concerns:

7. Does the athlete have anything he or she wants to discuss with the physician?

The National Collegiate Athletic Association (NCAA) drug survey of 1981 revealed that 62% of athletes used alcohol, 22% used marijuana, 7% used cocaine, and small percentages used amphetamines, narcotics, and hallucinogenics. ²⁵ Buckley et al²⁶ reported that 6% of high school athletes use anabolic steroids. Pope et al²⁷ noted the incidence of anabolic steroid use in high-risk areas approaches 20% of male high school students. A positive response to question 7 may identify an athlete with one of these serious habits.

Unfortunately, a majority of high school athletes still report that the preparticipation sports examination is their only health care contact. This knowledge may tempt the physician to try to provide counseling regarding health risks. The brief nature of this type of examination, however, suggests that the physician can more effectively use preparticipation physical examinations to identify problem athletes and gain rapport. Examinations conducted through a multistation format or in a gymnasium rarely provide adequate privacy or enough personal contact to accomplish these goals. In this regard, relying on the patient's primary care physician to provide this examination or using an individual examiner seems more appropriate to screen for the health risks seen today. Longitudinal involvement as a personal or team physician develops the type of trust between physician and athlete that allows effective counseling to take place.

General Health Screening

General health screening looks at acute and chronic illnesses, allergies, and regular medications:

- 8. Does the athlete have any chronic illness or see a physician regularly for any particular problem?
 - 9. Does the athlete take any medicine?

10. Is the athlete allergic to any medications or to bee stings?

11. Does the athlete have only one of any paired organ (eyes, ears, kidneys, testicles, ovaries, etc)?

A positive response may alert the examiner to specific restrictions that the athlete should follow in terms of safe participation. Allergies take on importance, not only because of bee stings and other environmental allergens, but also because the student may be sensitive to aspirin or nonsteroidal anti-inflammatory medications that may be used in training rooms. Restriction of participation based on absence of paired organs and other medical illness is clarified in the physicians' statement by the American Academy of Pediatrics on recommendations for participation in competitive sports.⁴

PHYSICAL EXAMINATION

While the history identifies most significant problems, three areas of the physical examination contribute the greatest diagnostic utility. The critical parts of the examination include blood pressure measurement, musculoskeletal evaluation, and cardiovascular auscultation. A brief examination is more appropriate because complete examinations often reveal false-positive findings rather than true abnormalities. A positive answer to one of the questions on the history or considerations for specific sports, however, may necessitate additional examination or evaluation of other factors such as aerobic capacity, maturity, or strength.

Unrecognized hypertension has been noted in most studies of adolescent athletes. Goldberg et al¹⁰ detected 10 of 701 adolescents with undiagnosed hypertension. Edward Shahady and Karl Fields found that 31 of 515 athletes were hypertensive, one half of whom had previously undetected disease (personal communication, March 1, 1989). Moderate or severe elevations of blood pressure limit safe participation, whereas the athlete who has good levels of control or mild elevation can play without restriction.⁴ While athletes with hypertension have not been shown to have an increased incidence of sudden cardiac death,²⁰ hypertension is the most significant risk factor for developing cardiovascular disease.²⁸ Early treatment of hypertension modifies long-term risks and lessens end organ damage.

The hypertensive athlete with left ventricular hypertrophy on electrocardiogram must be carefully assessed to determine whether the cardiac changes reflect "athlete's heart" or true pathological hypertrophy.²⁹ The physiologic changes in athlete's heart represent training adaptations and are not prognostic of disease. Pathological left

ventricular hypertrophy lessens ventricular compliance, however, and the demands of vigorous exercise increase stress on a damaged heart. Hypertension has also been suspected of playing a role in concentric left ventricular hypertrophy and possibly other hypertrophic cardiomyopathies,³⁰ although this has not been substantiated.

Musculoskeletal Evaluation

Musculoskeletal evaluation consistently yields the greatest number of abnormal findings during preparticipation examinations. In a group of 2670 young athletes reported by Thompson et al,9 11% had identifiable risk factors for participation, and two thirds of these problems were musculoskeletal. Clearly the knee joint leads to more disqualifications than any other orthopedic injury. In the study by Goldberg et al¹⁰ five of the nine athletes ultimately disqualified had significant knee instability. Another 21 of his 701-member study group had to have additional knee evaluation and ongoing rehabilitation in order to participate. The percentages noted in Edward Shahady and Karl Fields' unpublished study were similar in that 3 of the 5 disqualifications of 515 athletes were due to unstable knees. In addition, there were a total of 31 athletes with knee problems requiring further assessment (personal communication, March 1, 1989). In the late 1960s Abbott and Kress²² at the US Military Academy showed that identifying and rehabilitating weaker muscle strength around the knee reduced the subsequent rate of knee injuries. Considering recent advances in rehabilitation and in arthroscopic surgery, a good knee examination allows the physician to direct the athlete to therapy that can reduce subsequent risk of reinjury.

Ankle injuries are the most common sports injury and are the second most common orthopedic cause to limit participation. 20,31 While disagreement exists about the value of ankle rehabilitation, most sports physicians and professional teams have adopted graded programs of ankle strengthening, functional exercises, and proprioceptive training. These functional tests help the athletic trainer and team physician to identify the player who is ready to resume competition. Demonstrating laxity of ankle ligaments on the preparticipation examination also allows the examining physician to recommend taping or other ankle supports for a specific period. Since most ankles are unstable to inversion, the examining physician can use a quick screening check by asking athletes to walk on the lateral aspects of their feet. The athlete with unstable ankles will not attempt this maneuver for fear of developing a new sprain.

Muscular strength and physical maturity are not core components of the physical examination, but become essential for specific youth sports activities. Contact and collision sports, such as football, wrestling, ice hockey, or even soccer, pose greater risks when immature or weaker athletes are matched against more physically developed peers. ^{32,33} A physician's estimate of maturity using the Tanner classification and an estimate of strength can lead to objective measurement before clearance for full contact. Kreipe and Gewanter³⁴ suggest using a simplified measure of grip strength, which has been shown to correlate well with Tanner classification. This type of test allows widespread screening for maturity without the more embarrassing and cumbersome process of having all athletes completely disrobe.

Musculoskeletal alignment becomes an important consideration in certain activities. For example, scoliosis is a significant risk factor for gymnasts who, during a dismount, land with considerable impact and place tremendous pressure on the vertebral spine. Similarly, long-distance runners with increased Q angles are more prone to patellofemoral tracking disorders. A simple patellar compression test and a quick visual assessment to estimate Q angles during the preparticipation examination allow the physician to suggest modifications of training and quadriceps-strengthening exercises.

Cardiovascular Examinations

Cardiovascular examinations are primarily useful in identifying murmurs. Strong and Steed¹⁶ report that a majority of athletes have a murmur noted on examination at some time. The simple presence of a murmur is common, so the focus of the examination is to identify the murmurs likely to indicate disease. 14-16 Hypertrophic cardiomyopathy is the leading cause of sudden death in young athletes, and physicians should be aware of the characteristics of the murmur found with this condition. This systolic ejection murmur typically is heard best at the left sternal border and begins shortly after the first heart sound. It is accentuated by maneuvers which reduce the volume of blood flow that returns to the left side of the heart. For example, when going from a lying position to a standing position, blood will pool in the lower extremities, and the murmur will become louder.35 Rarely, systolic or diastolic murmurs of valvular heart disease, sounds of mitral valve prolapse, or a fixed split second heart sound suggestive of atrial septal defect are detected on screening examinations. All of these findings need further assessment but usually have been identified prior to the time the athlete presents for his or her first preparticipation physical examination.

Sports-Specific Risks

For most preparticipation examinations the core essentials of blood pressure, orthopedic, and cardiovascular

evaluation are adequate. Some sports-specific risks, however, merit inclusion of a specific component of the physical evaluation. For example, swimming poses increased risks for otitis externa or to the athlete with tympanic membrane perforations. An ear examination in a swimmer thus yields more useful information than the same process in a basketball player. Wrestlers face a risk of infectious skin conditions such as herpes gladiatorum, so in this group of athletes examining the skin has a specific screening purpose.

The examination may also be expanded to include a risk area identified by the history. Screening for exercise induced bronchospasm in the athlete with a history of atopic problems is an example. The physical examination of these athletes would be more likely to reveal stigmata of allergy or wheezing on chest auscultation than in a random population. The examining physician may suggest further screening measurements such as peak air flows before and after exercise to document whether a clinical problem exists. Another example would be the athlete with a prior history of heat-related problems. In the unpublished study by Edward Shahady and Karl Fields, a 12-minute run (Cooper test) was included in the preparticipation examinations since the risk of heat injury is higher in deconditioned athletes (personal communication, March 1, 1989). While certain examiners may recommend this test for all athletes, certainly the rationale in this special risk group is clear.

Laboratory Testing

Most preparticipation examination forms require laboratory testing, which usually includes a urinalysis and hemoglobin. Neither of these tests, however, have been found to identify athletes who warranted disqualification. 1, 6, 10, 32 The athlete who has a history of anemia or who complains of fatigue is in a different risk group, and the hemoglobin reading may give helpful information. Similarly an abnormal urinalysis usually showing proteinuria is extremely common in athletes. In the Goldberg et al 10 study, 40 athletes had proteinuria, but subsequent workup revealed that none of them had significant genitourinary or kidney disease. The 701 urinalyses done in their study detected no serious diseases, disqualified no athletes, and required 40 athletes to undergo more extensive evaluation of false-positive results.

Rather than general laboratory assessment, the examiner may occasionally order directed tests. For example, an athlete felt to have Marfan's syndrome on examination may need consultation and an echocardigram. The athlete with a history of a family member with sudden death before the age of 50 years merits an electrocardigram (ECG), since 90% of the time ECG readings will be abnormal in hypertrophic cardiomyopathy. 16,30 This type of

testing goes beyond simple screening, however, and should be ordered only if the physician will provide follow-up beyond the preparticipation screening.

RECOMMENDATIONS FOR PARTICIPATION

Following completion of the focused history and physical examination, the physician is asked to assess the athlete's risk for participation. Guidelines entitled "Recommendations for Participation in Competitive Sports" were developed in 1988 by the American Academy of Pediatrics.4 This publication classifies sports into the major categories of contact versus noncontact. These major categories are subdivided into contact and collision and limited contact and impact, and for noncontact sports into strenuous, moderately strenuous, and nonstrenuous. Following the classification of sports, conditions that limit athletic participation are listed along with the recommended restriction from some or all classes of sports. Certainly the vast majority of athletes screened will have no limitations placed upon their participation since studies usually yield disqualification rates of less than 1%. For the athlete who does have an identified problem, however, these guidelines allow the physician to limit restrictions to specific sports rather than disqualify the athlete from all participation.

RECOMMENDATIONS FOR REEXAMINATION

At the completion of the examination the physician is asked to recommend reexamination. While the National Collegiate Athletic Association stopped the routine yearly requirement for preparticipation examinations in 1978, uniform requirements do not exist for high schools.³⁷ Most states require yearly examinations, but some require examinations before each sport. A majority of states still do not require reexamination after serious injury.3 Some states and a number of sports medicine experts recommend cyclical examinations. For example, the athlete has a comprehensive assessment at the entry into either middle school or high school. Subsequent yearly evaluations would update changes in the history and would include a reexamination of any area that had been injured in the previous year. This type of system holds merit for reducing expenditures and time involved in preparticipation examinations without compromising the quality of the process. Currently physicians must follow guidelines from individual states. Nevertheless, requiring reexamination after serious injury should be documented on the form if it is not a state requirement. Even in states that do not require yearly evaluation, the physician can recommend

the annual or more frequent return of an athlete who needs periodic follow-up.

COMMENT

Eleven basic questions and three specific components of the physical examination comprise the core elements for an athletic preparticipation examination. While blood pressure measurement, a comprehensive orthopedic examination, and cardiovascular auscultation are essential, other portions of the physical examination may be included because of sport-specific risks or problems identified in the history. At the conclusion of this focused examination, the physician is asked to make a recommendation for participation following guidelines published in 1988 by the American Academy of Pediatrics.⁴ Timing for reexamination may be mandated by state requirements, but the importance of recommending reexamination of athletes following serious injury is strongly emphasized.

The questions athletes have about sexually transmitted diseases, anabolic steroids, smoking, and drugs diminish the utility of multistation examinations for preparticipation examinations. Rather, the examination should be in a private setting, preferably in the family physician's office, so that the physician will have an atmosphere conducive to gaining rapport with the athlete. Since a great number of adolescents have no other contact with the medical establishment, this brief chance to gain rapport may be a factor in encouraging athletes to return to ask important medical advice.

Finally, physicians should rarely be in a situation in which they will disqualify an athlete. Certainly, for the small percentage of athletes that are disqualified, additional consultation and assessment is generally warranted. Even for serious medical problems, physicians can carefully define limitations that will allow virtually all athletes to participate in some sport.

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			APPENDIX 1 Sports Preparticipation History Form		
Patient's Name:			Age:		
Athlete's l		Please rev	iew all questions with your parent or guardian and answer them to the best of your		
Physician' positive an	s Direction	s: We reco	mmend repeating the 11 questions listed below and carefully reviewing details of any		
Yes	No	Don't Know			
			1. Has anyone in the athlete's family (grandmother, mother, father, brother, sister, aunt, uncle) died suddenly before the age of 50 years?		
			2. Has the athlete ever passed out during exercise or stopped exercising because of dizziness?		
			3. Does the athlete have asthma (wheezing), hay fever, or coughing spells after exercise?		
			4. Has the athlete ever broken a bone, had to wear a cast, or had an injury to any joint?		
			5. Does the athlete have a history of a concussion (getting knocked out)?		
			6. Has the athlete ever suffered a heat-related illness (heat stroke)?		
		1	7. Does the athlete have anything he or she wants to discuss with the physician?		
			8. Does the athlete have a chronic illness or see a physician regularly for any particular problem?		
			9. Does the athlete take any medicine?		
	Mary and		10. Is the athlete allergic to any medications or to bee stings?		
			11. Does the athlete have only one of any paired organ? (eyes, ears, kidneys, testicles, ovaries, etc)		
Elaborate	on any po	sitive answ	vers:		
I have ans	swered and	l reviewed	the questions above and give permission for my child to participate in sports.		
Signature	of Parent	or Guardia	Date Phone		

APPENDIX	. 2				
PHYSICAL EXAMINATION					
1. BP Wt (Minimal Wt) H	It Vision (R) (L)				
2. Musculoskeletal examination					
(Record laxity, weakness, instability, decreased ROM—if abnormal)					
Normal Abnormal A. Knee B. Ankle C. Shoulder D. Other joints E. Alignment problems (eg, leg length, Q angle) F. Scoliosis G. Feet H. Estimate of strength I. Estimate of flexibility 3. Cardiovascular examination 4. Other examination (if indicated by history)	Description of Abnormal Findings				
ASSESSMENT 5. A. No problems identified B. Other					
RECOMMENDATIONS					
6. A. Unlimited B. Limited to specific sports: C. Deferred until: (eg, rehabilitation, recheck, consultation, laboratory tests, etc)					
REEXAMINE					
7. A. Yearly and after any injury that limits participation for longer than 1 week B. Other:					
Physician Signature Date					
Physician Name	Physician Phone				