

SECOND EDITION

Sports & Medicine & Rehabilitation

A Sport-Specific Approach

Ralph Buschbacher

Nathan Prahlow

Shashank J. Dave



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Sports Medicine *and* Rehabilitation

A Sport-Specific Approach

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Sports Medicine *and* Rehabilitation

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Second Edition

Ralph M. Buschbacher, MD
To Lois, Michael, Peter, John, and Walter

Nathan D. Prahlow, MD
To Julie, Jonathan, Caleb, and Joshua

Shashank J. Dave, DO
This book is dedicated to my residents
and medical students, whose brightness
and curiosity reminds me every day
why I went into medicine

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P R E F A C E

Sports Medicine is an exciting field. However, the usual approach to a sports medicine text—concentrating on anatomic regions, such as shoulder, elbow, hand, etc., can be a bit dry. Working with athletes who are passionate about their sports, is anything but dry. The purpose of this book is to acquaint or reacquaint the reader with a basic background of individual sports along with the diagnosis and treatment of the most common conditions encountered in those sports. It is our hope that this makes the chapters more interesting and readable. We also hope that it will allow the clinician to speak on the athletes' terms, regarding their sport and their special needs, requirements, and training modifications.

Athletes can be a demanding group. They are dedicated to their sport. They and their coaches often

do not wish to change their techniques, cutback in their training schedule, or make any modifications. It is up to the clinician to be able to explain the need for various treatments and interventions, as well as to help the athletes make modifications that will still allow them to maximize their fitness and skill level.

We have assembled an outstanding group of authors for this book; many of them have extensive athletic backgrounds, which has helped them to approach the topic with the athletes' perspective. We hope that readers enjoy this book as much as we have enjoyed putting it together.

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Nathan D. Prahlow, MD

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Sports Medicine **Rehabilitation**

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CONTENTS

Contributors vii

Preface ix

SECTION I

- 1** Preparticipation Physical Evaluation 3
John L. Turner
- 2** Sport Psychology: Psychological Concepts and Interventions 11
Chris Carr
- 3** Tissue Injury and Healing 17
Sara Christensen Holz and Matthew Smuck
- 4** The Sports Medicine Approach to Musculoskeletal Medicine 23
Anthony Margherita
- 5** Stretching and Injury Prevention 31
Vicki L. Voils and Nathan D. Prahlow
- 6** Performance-Enhancing Sports Supplements 39
Jeff Fields and John L. Turner

SECTION II

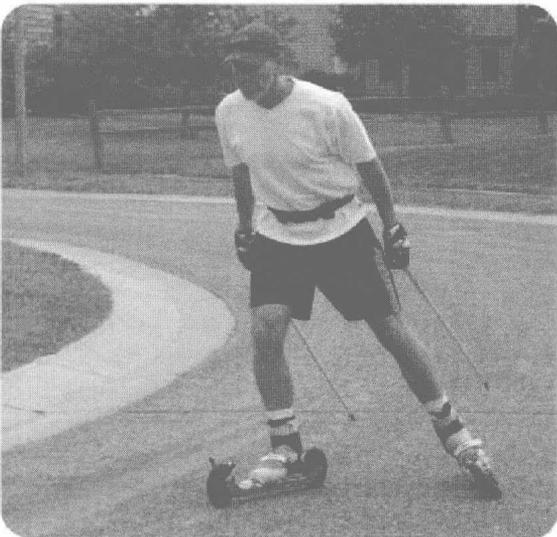
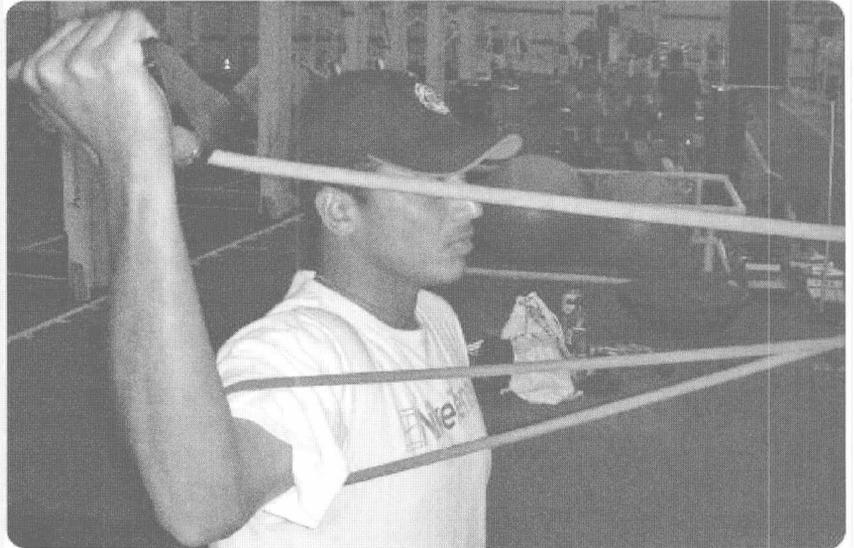
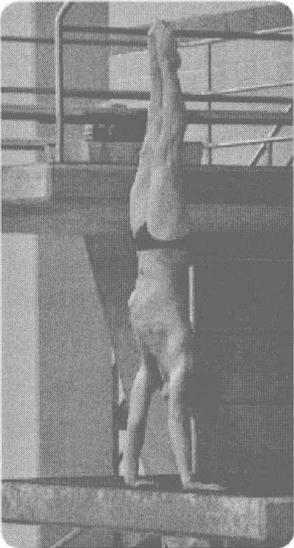
- 7** Baseball Injuries 53
Lance A. Rettig and Mark Ritter
- 8** Racket Sports Injuries 69
Neeru Jayanthi and Jay V. Subbarao
- 9** Golf Injuries 83
Andrea L. Agesen and Shashank J. Dave
- 10** Swimming and Diving Injuries 93
Kevin M. Marberry and Dawn Schisler
- 11** Road Cycling Injuries 109
Julia J. Walker and Shashank J. Dave

12	Mountain Biking Injuries	119
	Matthew Smuck	
13	Football Injuries	129
	Gerard A. Malanga, Jason Peter, and Dennis A. Bandemer, Jr.	
14	Soccer Injuries	147
	Elizabeth A. Grossart and Johnny G. Owens	
15	Running Injuries	159
	Michael Khazzam and Kevin M. Marberry	
16	Skiing and Snowboarding Injuries	175
	Peter W. Bailey, Andrea J. Boon, and Eric J. Watson	
17	Gymnastics Injuries	191
	Grant Lloyd Jones, Todd C. Miller, and Donald C. LeMay	
18	Basketball Injuries	205
	Meenakshi Garg, Peter I. Sallay, and Patti Hunker	
19	Volleyball Injuries	219
	Nathan D. Prahlow	
20	Weight-Training Injuries	227
	Jess D. Salinas, Jr.	

SECTION III

21	Women's Musculoskeletal Issues	243
	Gary P. Chimes	
22	Musculoskeletal Issues in the Elderly	255
	Nabiha N. Gill	
23	Health Benefits of Exercise	263
	Angela T. Carbone and Albert Gunjan Singh	

SECTION I



Preparticipation Physical Evaluation

The preparticipation physical evaluation (PPE) is a well-known but poorly understood intervention with great psychological impact but often limited ability to accomplish its intended goals. Recent work has begun to codify and standardize the PPE to a greater extent, but there is still debate about the most appropriate content and application of athletic screening principles. In general, preparticipation screening is defined as the “systematic practice of medically evaluating large, general populations of athletes before participation in sports for the purpose of identifying (or raising suspicion of) abnormalities that could provoke disease progression or sudden death.”¹ Despite general medical and lay support, the PPE is in transition both in its application and the evidence to support its use.

For many years athletes have undergone annual examination for clearance to compete in sports with three *primary goals*:

1. To identify life-threatening or disabling diseases and conditions.
2. To identify diseases or conditions that may put that athlete at increased risk for injury.
3. To ensure the participant, physician, and organization meet institutional, association, or governmental requirements.

Recently, the PPE has been recognized for its potential to improve the health of athletes by meeting other *secondary goals*:

1. To determine the general health of athletes.
2. To serve as an entry point for adolescents into the health care system.
3. To provide opportunity for discussion on health and lifestyle.²

New evidence and understanding about the real risk of athletic participation, combined with a refined

understanding of how to truly identify those at risk, will hopefully lead to the most appropriate screening of our athletes. Ideally, the PPE should serve as a timely and effective method to minimize the dangers of sports while enhancing the overall health of the athletic population.

PREPARTICIPATION PHYSICAL EVALUATION PROCESS

The majority of PPEs are performed on competitive athletes. A competitive athlete is defined as “one who participates in an organized team or individual sport that requires systematic training and regular competition against others.”¹ However, with a more active, aging population and recent focus on exercise as a lifestyle, there are growing numbers of participants who need evaluation but are not engaged in any formal competitive sport. Most PPEs are accomplished through one of two scenarios: (i) mass examination of athlete cohorts by physicians (often) associated with supervising organizations, or (ii) examination by the athlete’s personal physician with provision of appropriate documentation to the necessary organization. There is debate over the needed qualifications for providers of the PPE, and guidelines often vary significantly by state. Since 1997, there has been a 64% increase in the states that allow nonphysicians to perform athletic screening. Eighteen states currently permit chiropractors or naturopathic practitioners to evaluate athletes.¹ The third PPE monograph² recommends a licensed medical doctor (MD) or doctor of osteopathy (DO) because this allows the provider to manage the broad range of problems potentially encountered during the PPE. Whichever practitioner performs the PPE, it is critical that all three primary objectives be met and needed follow-up testing or treatment be coordinated.

The various testing scenarios each have benefits and drawbacks. Often, mass PPE events or coordinated teams of examiners provide efficient and systematic screening to large numbers of athletes. Ideally, these events are organized to allow for involvement of specialists for particular evaluation components. Unfortunately, the impersonal approach can prevent athletes from disclosing delicate information, or may lead to disconnected evaluations unless communication is robust. When utilizing mass screening there must be a final review of all gathered information by a trained physician.

Younger athletes often have no contact with the health care system outside of an annual PPE, which places much importance on this interaction. Ideally, each person is seen by a personal physician who knows the athlete and can place new symptoms or findings into the context of existing problems. Established trust with a physician promotes honest conversations about delicate issues including drug and alcohol use, birth control, and sexual habits. When problems do arise, the primary physician is more likely to have the necessary medical records and may be in a position to communicate more effectively with parents or guardians. Ethical concerns over whose needs are being served first by the physician (institutional, organization, or team needs versus the individual athlete's needs) are minimized through the use of established physician relationships.

There are no universally accepted standards or practices for screening athletes at the high school or collegiate level. Clearance routinely consists of a medical history, family history, and physical examination, but the content of each component varies greatly. A review of state guidelines found that 81% of states have adequate questionnaires, up from 60% in 1997.¹ High schools rely heavily on individual physicians who complete clearance forms, as well as mass screenings delivered by volunteer practitioners with variable comfort and competence with the required evaluations. Most PPEs at this level occur just before the sport season and often do not leave time for further testing or management of identified problems before competition begins. Due to the large cohort of high school athletes (estimated at 5 to 6 million), logistic impediments are considerable.

The National Collegiate Athletic Association (NCAA) mandates preparticipation evaluation for all Division I, II, and III athletes before the first practice or competition. These athletes are routinely cleared through an organized examination led by a team

physician (often formally associated with the institution) with the support of athletic trainers and on-campus health centers. Collegiate evaluations occur with more lead time and typically afford the opportunity to address any concerns. A review of collegiate evaluation forms found that 75% adequately address national recommendations.³

History and Physical Examination

Although there is some data on cardiac clearance, there is little evidence that particular components of the remainder of the PPE have the sensitivity or specificity to identify athletes at risk for significant injury or death. With those limitations in mind, the PPE in its entirety is still thought to be the best screening tool available, and its overall effectiveness depends upon systematic questioning and a focused physical examination. The third PPE monograph recommends a number of questions for the historical portion of the examination.⁶ This PPE is designed to be applicable for many settings and competitive levels, while providing efficient and practical recommendations that are likely to identify athletes at risk.

Where possible, the history questions have been drawn from the Youth Risk Behavior Surveillance System, which has been validated in similar applications.⁴ The minimalist will limit the scope of a PPE to a cardiovascular and musculoskeletal evaluation; however, the use of the PPE in a broader context of systematic health care for youth and young adults is becoming more widespread. Medical history-taking focuses on known health problems, medications and supplements, allergies, and surgical history. Review of personal history for heat illness, neurologic symptoms, cardiovascular symptoms, musculoskeletal symptoms, and symptoms of asthma is also included. Questions about menstrual patterns and nutrition are becoming more important, especially in those female athletes at risk for female athletic triad (impaired eating, dysmenorrhea, osteoporosis). Immunization history is critical in light of the more common contagious diseases seen in young populations such as meningococcus and hepatitis. Sexual history is important, but truthful answers are not anticipated on most written questionnaires or mass screening encounters.

The components of the physical exam may vary by application and athletic group being screened, but the third PPE monograph guidelines establish a standard that serves to direct most practitioners. Table 1-1

TABLE 1-1 Components of the Preparticipation Physical Examination

Physical characteristics: Height, weight, % body fat
 Vital signs: Heart rate, blood pressure (may include multiple readings)
 General appearance
 Eyes: Visual acuity, differences in pupil size
 Ears: Hearing
 Nose
 Throat/oral cavity
 Lungs
 Cardiovascular system: Cardiac auscultation, radial and femoral pulses
 Abdomen: Masses, tenderness, organomegaly
 Genitalia (males only)
 Skin: Rashes, lesions
 Musculoskeletal system: Often low-yield, but can include range of motion, strength, stability, and symmetry of the neck, shoulder, arm, elbow, forearm, wrist, hand, fingers, back, hip, thigh, knee, leg, ankle, foot, and toes

Adapted from Preparticipation Physical Evaluation Task Force. *Preparticipation Physical Evaluation*. 3rd ed. Minneapolis: McGraw-Hill/The Physician and Sports Medicine; 2005.

lists the recommended examination. A comprehensive examination such as this does not have outcome data to support its use; nevertheless, there is generally wide acceptance of this more-than-minimal physical examination.

Height, weight, and calculation of body mass index (BMI) will help determine those in need of nutritional counseling or adaptation. Obesity is a growing concern among youth in the United States and a predictor of many chronic diseases that impact our population. Early identification allows for diet and exercise modification and incorporation of healthier habits. Obesity is a particularly ominous predictor of future health, as obese white males between the ages of 20 and 30 years live on average 13 fewer years, and obese black males lose around 20 years of life expectancy. Obese white females on average live 8 years less while obese black females lose 5 years of life expectancy.⁵

Blood pressure readings are crucial for identification of prehypertensive and hypertensive states. Both the short-term risks of participation and the long-term health outcomes are impacted by elevated blood pressure. Care should be taken to identify hypertension based on established norms in children and

adolescents; these values are now based on gender, age, and height.⁶ HEENT (head, eyes, ears, nose, and throat) examination is for the general health of these areas, with particular attention paid to visual acuity and pupil reactivity and size, so that testing after any injury is comparable to a known baseline.

The cardiovascular examination includes auscultation for murmurs that may reflect underlying pathology that increases risk for sudden death or that may limit the exercise capacity of an athlete (Table 1-2). Detection of murmurs is most critical, and care should be taken to provide a quiet environment for auscultation. Often the clinician must distinguish between innocent flow murmurs and murmurs that require further testing.

The yield of any type of musculoskeletal examination is low in asymptomatic athletes with no history of injury. In fact, the history alone has been shown to detect 92% of significant musculoskeletal injuries.⁷ Despite the poor evidence of disease detection, it is still standard to perform a thorough musculoskeletal examination on athletes before clearance for competition. Brief, repeat examination for returning players can suffice if an updated history suggests no interval injury.

The PPE: Practical Application

Taking the scientific evidence and combining it with traditional practices that are now informed by established guidelines, one is still left with room for significant disagreement on what constitutes the best PPE. Screening recommendations must take into account not only the scientific evidence to support each evaluation strategy, but the practical consideration of adopting expensive or resource-intensive methods. Many athletes and organizations cannot sustain more than is included in the current recommendations. Even with recent advances in the science and use of PPEs, a 2003 review of published articles on the PPE concluded that “the PPE for athletes does not satisfy the basic requirements for medical screening.”⁸

A Closer Look: Can the PPE Reduce Cardiac Risk?

The sudden death of an athlete is one of the most devastating and publicized events in sports. Athletes are held in high regard and represent the healthiest and fittest of our population, and as such, the death of an athlete is not an expected event. However,

TABLE 1-2 American Heart Association Recommendations for Participation Cardiovascular Screening of Competitive Athletes

Medical history*

Personal history

1. Exertional chest pain/discomfort
2. Unexplained syncope/near-syncope[†]
3. Excessive exertional and unexplained dyspnea/fatigue, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure

Family history

6. Premature death (sudden and unexpected, or otherwise) before age 50 years due to heart disease, in ≥ 1 relative
7. Disability from heart disease in a close relative < 50 years of age
8. Specific knowledge of certain cardiac conditions in family members: hypertrophic or dilated cardiomyopathy, long-QT syndrome or other ion channelopathies, Marfan syndrome, or clinically important arrhythmias

Physical examination

9. Heart murmur[‡]
10. Femoral pulses to exclude aortic coarctation
11. Physical stigmata of Marfan syndrome
12. Brachial artery blood pressure (sitting position)[§]

*Parental verification is recommended for high school and middle school athletes.

[†]Judged not to be neurocardiogenic (vasovagal); of particular concern when related to exertion.

[‡]Auscultation should be performed in both supine and standing positions (or with Valsalva maneuver), specifically to identify murmurs of dynamic left ventricular outflow tract obstruction.

[§]Preferably taken in both arms.³⁷

From Maron BJ, Thompson PD, Ackerman MJ, et al. Recommendations and considerations related to preparticipation screening for cardiovascular abnormalities in competitive athletes: 2007 update. *Circulation*. 2007;115:1646.

underlying cardiac diseases are often silent and may be difficult to detect, yet the public often believes that such detection is always possible. Despite the judicious use of modern technology, there will always be sudden cardiac death among athletes, because certain predisposing conditions are not detectable. The role of the physician, therefore, is to minimize that risk while staying within the constraints of a health care system with limited resources.

Sudden death is rare and occurs between 1 in 100,000 to 1 in 300,000 high school athletes, with only 20% of lesions being detectable before death.^{9,10} In competitors 35 years and younger in the United States, fatal arrhythmias resulting from underlying structural abnormalities account for 95% of all sudden deaths; 36% of deaths are also associated with hypertrophic cardiomyopathy, and 13% with anomalous coronary arteries.^{11,12} Italian screening programs have found approximately 25% of athletic sudden death is attributable to arrhythmogenic right

ventricular cardiomyopathy.^{13,14} Figure 1-1 reviews the common causes of sudden cardiac death. In athletes over the age of 40, undetected atherosclerotic disease is the leading cause of sudden death.^{15,16}

Medical evaluations aim to detect these structural or functional abnormalities and make appropriate clinical decisions on clearance for competition. The most commonly used testing methods include a thorough history and physical examination, 12-lead electrocardiogram, and screening echocardiogram. Application of each method varies significantly by age of athlete, level of competition (recreational, school related, elite travel team, professional, etc.), organizational level (community youth sports, high school, NCAA divisions, professional, etc.), and the available resources. Many professional sports use a comprehensive testing program including cardiac stress testing, echocardiography, and a panel of blood tests to detect any possible abnormality. To apply that type of full testing would be cost-prohibitive in the