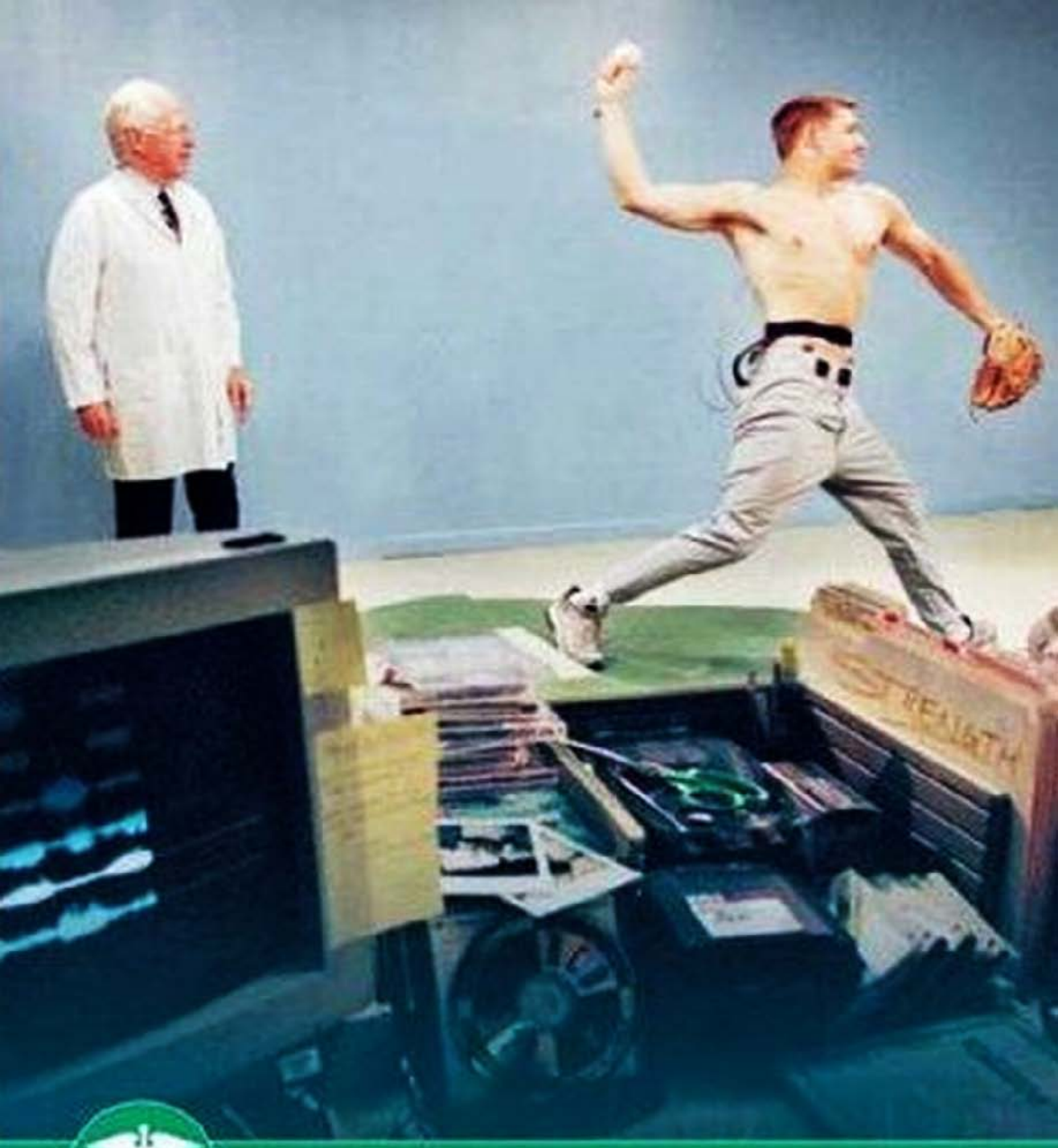

HEALTH & MEDICAL ISSUES TODAY

SPORTS MEDICINE

JENNIFER L. MINIGH

Sports Medicine

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SPORTS MEDICINE

Jennifer L. Minigh

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CONTENTS

SERIES FOREWORD

Every day, the public is bombarded with information on developments in medicine and health care. Whether it is on the latest techniques in treatments or research, or on concerns over public health threats, this information directly impacts the lives of people more than almost any other issue. Although there are many sources for understanding these topics—from Web sites and blogs to newspapers and magazines—students and ordinary citizens often need one resource that makes sense of the complex health and medical issues affecting their daily lives.

The *Health and Medical Issues Today* series provides just such a one-stop resource for obtaining a solid overview of the most controversial areas of healthcare today. Each volume addresses one topic and provides a balanced summary of what is known. These volumes provide an excellent first step for students and lay people interested in understanding how healthcare works in our society today.

Each volume is broken into several sections to provide readers and researchers with easy access to the information they need:

- Section I provides overview chapters on background information—including chapters on such areas as the historical, scientific, medical, social, and legal issues involved—that a citizen needs to intelligently understand the topic.
- Section II provides capsule examinations of the most heated contemporary issues and debates, and analyzes in a balanced manner the viewpoints held by various advocates in the debates.

- Section III provides a selection of reference material, including annotated primary source documents, a timeline of important events, and an annotated bibliography of useful print and electronic resources that serve as the best next step in learning about the topic at hand.

The *Health and Medical Issues Today* series strives to provide readers with all the information needed to begin making sense of some of the most important debates going on in the world today. The series will include volumes on such topics as stem-cell research, obesity, gene therapy, alternative medicine, organ transplantation, mental health, and more.

PREFACE

This title describes the turmoil seen in sports medicine when balancing scientific, legal, and ethical issues.

In this book, sports medicine is defined not only by the customary definition, but also by the issues surrounding the industry. Readers will gain a true appreciation for the complexity and intricacies of these issues that weave the tangled web of sports medicine. In the end, readers will understand the background and history of sports medicine, possess both sides of related scientific, legal, and ethical issues, and have a new respect for everyone involved in the field.

Developed according to the guidelines of the Greenwood Press *Health and Medical Issues Today* series, this book was written as a reference for students and others who want to know more about sports medicine. As such, this book is different from other books on sports medicine in that it seeks to present both the science and the issues surrounding this field. Because a position is not taken on the issues, the information is balanced and thus ideal for those individuals who want an unbiased account.

Section One (Chapters 1–6) lays the groundwork for sports medicine and the science, legality, and ethics involved. Section Two (Chapters 7–15) explains the various issues in sports medicine. Section Three lists the references and resources for further information.

Chapter 1, "The Field of Sports Medicine," defines sports medicine and details the careers, responsibilities, and working environment of a sports medicine professional.

Chapter 2, "History of Sports Medicine," describes the historical evolution of the sports medicine field, including the emergence of related scientific, legal, and ethical issues.

Chapter 3, "Common Sports Injuries," describes many of the most frequently occuring sports injuries and the sports in which these injuries occur. In addition, the often overlooked issue of injuries to disabled athletes is covered.

Chapter 4, "The Impact of a Sports Injury—Who Does It Hurt?," emphasizes the shock wave following the injury, not only for the injured athlete but also for the athlete's family, team, and competitors. Issues involving insurance, medical care and care providers, the news media, and sports equipment are also considered in the light of sports injuries.

Chapter 5, "Doping," looks at the history and issues surrounding the use of performance enhancing substances. The chapter also provides an overview of doping strategies.

Chapter 6, "The Future of Sports Science," takes a look at what we will see in this field in the years ahead. Among the areas explored are injury prevention, gene therapy, new drugs, the frontiers of bionics, and the impact of science on sports medicine law.

Chapter 7 tackles the issues of informed consent as it applies to sports medicine. Informed consent for injured athletes is an area where often conflicting interests are involved in decisions. This chapter reviews this complex aspect of athletics.

Chapter 8 describes the issues involved with the right to play sports. It asks the question, "Who has the right to play?" Among the issues covered are physical fitness, the return to play following injury, and the many impacts of barring athletes from play.

Chapter 9 asks, "Are sports too aggressive and violent?" The issues of aggression and violence are covered along with related topics as body chemistry, medications and drugs, and fan involvement.

Chapter 10 covers the battles over performance enhance in sports. The topics covered include not only the widely known performance enhancing drugs, but also such topics as gene doping, blood doping, and the role of drug companies in this area.

Chapter 11 asks, "Who is liable?" For sports medicine professionals, the complex issue of medical liability and potential malpractice suits can be daunting and expensive. This chapter looks at the issues and the difficult choices facing sports medicine professionals as they seek to provide the standard of care needed in this field.

Chapter 12 asks, "Who has the right to know and to tell?" The issues revolve around confidentiality and privacy rights. The discussion ranges

from the problems injured athletes may have in marketing their skills to problems involving insurance, defamation, and premature public release of drug testing results.

Chapter 13 covers the matter of advertising by sports medicine professionals. At a time when medical advertising is increasing dramatically, this chapter looks at how sports medicine professionals can and should act in promoting their professional services.

Chapter 14 explores the controversy over nutrition in sports medicine. The questions are numerous, including what to eat and when. This chapter explores the facts.

Chapter 15 introduces the field of neuropsychology and addresses various issues of excess in sports medicine, including controversial Return-To-Play decisions and what happens to children who are pushed to perform beyond their normal limits. The chapter also explores the issue of parental achievement-by-proxy.

Overall, this book illustrates battles in courts of another kind—courts of law.

Acknowledgments

First and foremost, I wish to thank the Lord for instilling in me the capacity to accomplish such fantastic feats and for providing me with the loving support of my family.

Second only to the Lord, my loving husband David and my beautiful daughter Julia have given me reason to pursue my dreams, as well as reason to live each day with a joyous heart. Thank you.

Finally, I would like to bestow a special thanks to Kevin Downing and April Reynolds for their gracious help in the preparation of this book. In addition, I would like to thank Drs. Gary Rankin and Monica Valentovic for their unending support and encouragement. Last but not least, I would like to thank my parents for their love and prayers.

Section One

Overview

CHAPTER 1

The Field of Sports Medicine

The field of sports is not unlike a soap opera. It is full of dramatic details, such as who was traded for whom, who is out for the season, and who is on the juice (see Jose Conseco's book). Do we watch sports to altruistically cheer on our team, or do we have some morbid preoccupation with violence and injury? Is the most interesting part of the game watching the slow-motion replay of a gruesome injury? Which gets more airtime, a game-saving interception, a nearly impossible hole in one, or a leg-breaking slide into home base?

During a 1997 game against the New York Jets, Reggie Brown of the Detroit Lions rammed his helmet into another player's body, crushing his own neck. He lay motionless on the turf, stopped breathing, and turned purple and blue. After he was given mouth-to-mouth resuscitation, he remained unconscious for seventeen minutes. Had it not been for the sports medicine professionals and their quick and decisive action, Brown might have remained motionless indefinitely. Instead, he is on the road to making a miraculous recovery.

Sports medicine deals with injuries or illnesses resulting from participation in sports and athletic activities. It is concerned with proper functioning of the human body and with the prevention and treatment of athletic injuries. This field continues to evolve for many reasons. Growing numbers of people seek to improve or maintain their fitness level by engaging in a wider variety of sports activities than ever before. Parallel to the greater number of sporting participants, there is an increase in the number of high-risk types of sports. As a result, more people (who generally are less trained) participate in more dangerous athletic activities.

Like the recreational athlete, professional athletes witness the evolution and growth of sports medicine. This advancement likely results from the increased financial reward for professional competition, which has increased the dedication to sport success, often at the cost of physical safety. Furthermore, formerly seasonal athletes now choose to undergo year-round training to gain an edge over their competition, leaving the kinder, gentler era of seasonal practice in the dust. With this explosive growth in the popularity of sports, there has been an increased interest among members of the healthcare professions to pursue careers in this dynamic field. To combat the rise in sports-related injuries, coaches, trainers, and physicians have united to develop sporting facilities, which often house state-of-the-art diagnostic and therapeutic equipment. Due to the growing importance of elite and recreational sports, the demand for accurate diagnosis and management of sporting injuries is mounting. In response, new subspecialties of sports medicine are evolving.

To get a better understanding of the definition of sports medicine, I asked various individuals (from both on and off the field) to define the term *sports medicine.* Following is a list of the responses I received. Notice the wide variety of language.

- Chief umpire (seven- to fifteen-year-old leagues): "anything dealing with sports-related activities—mainly joints, bones, and muscles"
- Chiropractor: "treatment of athletes, both on and off the field"
- Father and coach of three kids who play sports: "rehabilitation and maintenance of sports injuries"
- Six-year-old girl: "a medicine for if you're hurting after you do sports"

Careers in Sports Medicine

Today, sports medicine involves a comprehensive team of healthcare professionals trained in a variety of backgrounds. Sports medicine is not a single profession, but rather an umbrella under which there are diverse professions and many available employment opportunities. Following is a depiction, in alphabetical order, of the most common careers.

Athlete

Being an athlete involves more than competing in a competition every now and then. Today's athletes spend many hours every day practicing skills and developing teamwork. They watch videotapes to analyze their own performances and to learn strategies for competing against their opponents.

Because many athletes push their bodies to the limit during both practice and competition, career-ending injuries always lurk on the horizon. Even minor injuries may put a player at risk of being fazed out and replaced by someone younger and fitter. Competition is extremely intense, and job security is always uncertain. Athletes cannot afford downtime from the sport at the professional level. The life of an athlete can be demanding, both physically and mentally.

Athletic Trainer (Sports Therapist)

Athletic trainers work with team physicians, coaches, and other sports professionals to prevent and treat illness and injuries related to sports and exercise. As of 2004, an undergraduate degree from a program accredited by the Commission on Accreditation of Allied Health Education Programs is required in order to take the National Athletic Trainer Association (NATA) certification examination. In most states, licensure is required and calls for successful completion of the NATA examination.

Athletic trainers typically work with athletes at the high school, college, or professional level. They are also employed in sports medicine clinics. This profession has been experiencing significant growth for nearly thirty years, and membership in the NATA has grown more than 520 percent since 1974.

Biomechanic/Kinesiologist

A biomechanic/kinesiologist seeks to apply the laws of physics to physical activity, exercise, and sports. Biomechanics study injury to muscles, bones, and joints under certain conditions. They analyze body mechanics and attempt to improve athletic performance. Biomechanics are typically employed in research settings and clinical sites, but future growth appears to be in industrial ergonomic settings. The minimal requirement is a master's degree.

Chiropractor

Chiropractors are specially educated in treating the joints and muscles of the body with their hands. Chiropractors treat individuals with low-back problems, sports injuries, and other health problems associated with the muscular, nervous, and skeletal systems, especially the spine. To become a chiropractor, one must obtain a doctorate of chiropractic degree and pass four national board exams. In addition, an aspiring chiropractor must obtain licensure in the state of practice. In many states, additional exams are required for this licensure.

Exercise Physiologist

Exercise physiologists study the acute and chronic physiological responses of physical activity. Their goal is to improve health, fitness, and performance. Traditionally, exercise physiologists worked only with athletes. However, today's exercise physiologists also work in commercial, clinical, and other professional settings for the general population. At a minimum, an undergraduate degree is required to be an exercise physiologist. Certification can be obtained from the American College of Sports Medicine.

Fitness Instructor/Personal Trainer

Fitness instructors, or personal trainers, typically work one-on-one with clients either in the client's home, the trainer's office, or a fitness facility. Personal trainers are generally employed as freelance contractors paid by the hour or per session. It is recommended that a personal trainer have a strong background in anatomy and kinesiology at a minimum, and preferably an undergraduate degree in a science-related area. In addition, personal trainers must obtain the American College of Sports Medicine Certified Personal Trainer certification.

Massage Therapist (Therapeutic Massage Therapist)

Massage therapists relieve muscle tension, spasms, inflammation, fluid retention, aches, stiffness, and pain by applying structured pressure, tension, motion, or vibration to the soft tissues of the body. Other benefits of massage include improved circulation (blood and lymph), general flexibility, range of motion, and increased tissue elasticity. Massage can aid in the healing of injuries by limiting scar formation. On completion of a massage therapy training program, a massage therapist can seek certification through state examinations. A national certification examination is offered by the National Certification Board for Therapeutic Massage and Body Certification. Massage therapists may work as faculty in a sports/rehabilitation medicine or fitness/spa facility. They commonly act as support for professional athletes or teams.

Nutritionist/Sport Dietitian

Dietitians study dietary patterns to prevent disease and improve health. Dietetics is the study of nutrient intake and how the body uses foods. This field of science links food and nutrition to health management.

To become a registered dietitian, one must complete an undergraduate degree in dietetics, complete a nine-month American Dietetics Association (ADA)–approved internship, and pass the ADA certification examination.

Dietitians work in hospitals, clinics, sports complexes, school systems, and public health facilities. They may also be hired by private clients or sports teams to design proper nutrition plans for weight loss, weight gain, performance, and health maintenance.

Orthopedist

Orthopedists diagnose and treat disorders of the bones and joints. Because of their knowledge of the functioning of the musculoskeletal system, orthopedists often treat sports injuries and sometimes serve as the primary physician for athletic teams. An orthopedist is required to complete a one-year internship in general surgery, four years of training in orthopedic surgery, and a year of medical practice before taking specialty board examinations.

Physical/Occupational Therapist

Physical therapists work to improve mobility, relieve pain, and prevent or limit permanent physical disabilities of patients suffering from injuries or disease. A graduate from an accredited educational program must pass a state licensure exam before being allowed to practice. Physical therapists work in hospitals, clinics, or private offices with specially equipped facilities. They may also treat patients in hospital rooms, homes, or schools.

Whereas the physical therapist helps people recover from injury or disease, the occupational therapist works more with the development of fine motor skills and dexterity. Most occupational therapy schools require two to three years of specialized education after a four-year undergraduate degree. In addition, one must pass a national examination to become a licensed physical or occupational therapist. Most employment opportunities are in hospitals and clinics.

Podiatrist

Podiatrists are devoted to the study and medical treatment of disorders of the foot, ankle, and lower extremity, which consists of a significant portion of the human skeleton. (The human foot is a complex structure containing twenty-six bones, in addition to muscles, nerves, ligaments, and blood vessels.) The fifty-two bones in the feet make up about one fourth of all the bones in the human body. Podiatrists need a state license that requires the completion of at least ninety hours of undergraduate study; the completion of a four-year program at a college of podiatric medicine; and, in most states, a postdoctoral residency program of at least one year.

Researcher in Exercise Science

Exercise science is the study of physiological, biochemical, and molecular components of movement. Most colleges and universities provide specific curriculum or academic majors in the exercise sciences. Related undergraduate college programs include biology, chemistry, biochemistry, anatomy and physiology, kinesiology, exercise physiology, and fitness programming. Graduate students typically study specific areas of exercise physiology with an emphasis on research.

Researchers conduct studies from either a basic or clinical perspective. Basic researchers usually perform studies with a focus on the cellular and molecular levels, such as how organ systems work, adapt, or respond to various factors. Clinical researchers usually carry out studies with a focus on the individual as a whole and seek to increase athletic performance or to improve health and reduce disease. Both careers require a graduate degree, such as a master's or Ph.D., which involves two to five years beyond the undergraduate level. Most researchers are employed at universities and hospitals.

Sports Lawyer

Lawyers represent clients in courts of law and in other forms of dispute resolution. Sports lawyers, in particular, handle athlete contract negotiations and drafting of details, in addition to reviewing services for a broad range of performance, endorsement, sponsorship, licensing, and media contracts. They also handle injury cases, defamation suits, and worker compensation claims following injuries. Lawyers must have law degrees to practice law in most states. Schools in the United States (and some in Canada and elsewhere) award graduating students a jurist doctorate degree. A law student must pass a bar examination (or a series of such examinations) before receiving a license to practice.

Sports Medicine Physician/Medical Doctor

Sports medicine physicians are highly trained in the diagnosis and treatment of sports-related injuries. Most professional teams employ sports medicine physicians, whereas other physicians are employed by clinics or hospitals. A physician interested in sports medicine normally seeks specialized training in sports medicine, orthopedics, cardiology, or other areas. Each field has three to five years of internship and residency training, in addition to one to two more years of fellowship training.

Sport Psychologist

Sport psychologists study the psychological factors associated with participation and performance in sports, exercise, and other types of physical

activity. Specifically, a sport psychologist helps athletes use psychological principles to achieve optimal mental health and athletic performance.

In most cases, a college undergraduate degree is the principal requirement for entry into this profession. In addition to obtaining a degree in psychology, one should acquire national certification. The Executive Committee of the Division 47 (Exercise and Sport Psychology) of the American Psychological Association recommends that an individual obtain certification from the Association for the Advancement of Applied Sport Psychology in order to practice sport psychology.

Strength and Conditioning Coach

Strength and conditioning coaches develop and monitor training plans for athletes. Their goal is to improve and enhance an athlete's power and performance. High school, college, and professional athletic teams often require the services of a strength and conditioning coach. Employment in this field usually requires a master's degree, as well as certification by the National Strength and Conditioning Association (NSCA). In addition, a strength and conditioning coach must participate in the Certified Strength and Conditioning Specialist program.

Show Me the Money

At the end of the 1996 movie *Jerry Maguire*, split-end Rod Tidwell (played by Cuba Gooding Jr.) wins a four-year contract worth $11.2 million. When considering that Tiger Woods earned $87 million in 2005 (making him the world's highest paid athlete), this does not seem like much money in comparison.

A first-round NFL draft choice can expect to earn $4 million to $5 million a year, whereas a third-rounder can expect $225,000. However, this figure is relatively high in the field of sports as a whole. According to the U.S. Department of Labor, the median annual salary of a professional athlete was $48,310 in May 2004 (see Table 1.1). Surprisingly, some pros make as little as $10,000 a year, a salary below the poverty line. Multimillion dollar contracts are reserved for superstar athletes like Shaquille O'Neal and Kobe Bryant, who in addition to their high salaries, make big bucks by endorsing sneaker brands and numerous other products. Female athletes are paid significantly lower salaries compared with men. The Women's NBA (WNBA) rookie minimum is $31,800, as opposed to nearly $400,000 in the NBA. The average WNBA salary is $50,000, versus $4.5 million in the NBA. As of 2006, the highest-paid WNBA players earn about $90,000 without endorsement deals, and as much as $200,000 with them.

Table 1.1 Annual Earnings of Various Sports Medicine-Related Careers According to the U.S. Department of Labor

Occupation	Annual Salary	Outlook for 2014
Athletes	Median annual income of athletes was $48,310 in May 2004. However, the highest paid professional athletes earn much more.	Will grow faster than average. Expected to increase 18–26 percent.
Athletic trainers	Median annual income of athletic trainers was $33,940 in May 2004.	Will grow *much* faster than average. Expected to increase 27 percent or more.
Biomedical engineers (research)	With a Bachelor's degree: $48,503. With a Master's degree: $59,667.	Will grow *much* faster than average. Expected to increase 27 percent or more.
Cardiovascular technologists and technicians	Median annual salary of cardiovascular technologists and technicians was $38,690 in May 2004.	Will grow *much* faster than average. Expected to increase 27 percent or more.
Chiropractors	Median annual income of salaried chiropractors was $69,910 in May 2004. The middle 50 percent earned between $46,710 and $118,280 a year. In 2005, the mean salary for chiropractors was $104,363, according to a survey conducted by *Chiropractic Economics* magazine.	Will grow faster than average. Expected to increase 18–26 percent.
Dietitians and nutritionists	Median annual income of dietitians and nutritionists was $43,630 in May 2004. According to the American Dietetic Association, median annualized wages for registered dietitians in 2005 varied by practice area as follows: $53,800 in consultation and business; $60,000 in food and nutrition management; and $60,200 in education and research.	Will grow faster than average. Expected to increase 18–26 percent.

General psychiatrist	With less than 2 years in specialty: $173,922. More than 1 year in specialty: $180,000.	Will grow faster than average. Expected to increase 18–26 percent.
General surgeon	With less than 2 years in specialty: $228,839. More than 1 year in specialty: $282,504.	Will grow faster than average. Expected to increase 18–26 percent.
Industrial-organizational psychologists	Median annual income of wage and salary industrial-organizational psychologists in May 2004 was $71,400.	Will grow faster than average. Expected to increase 18–26 percent.
Lawyers	In May 2004, the median annual income of all lawyers was $94,930. The middle half of the percentage of those in this occupation earned between $64,620 and $143,620.	Will grow as fast, on average. Expected to increase 9–17 percent.
Massage therapists	Median hourly income, including gratuities earned, was $15.36 in May 2004. Generally, massage therapists earn 15–20 percent of their income as gratuities.	Will grow faster than average. Expected to increase 18–26 percent.
Occupational therapists	Median annual salary of occupational therapists was $54,660 in May 2004.	Will grow *much* faster than average. Expected to increase 27 percent or more.
Physical therapists	Median annual salary of physical therapists was $60,180 in May 2004.	Will grow *much* faster than average. Expected to increase 27 percent or more.
Podiatrists	Median annual income of salaried podiatrists was $94,400 in 2004. Additionally, a survey by *Podiatry Management Magazine* reported median net income of $113,000 in 2004.	Will grow as fast, on average. Expected to increase 9–17 percent.

Source: Data from Bureau of Labor Statistics, U.S. Department of Labor.

The salaries of other sports medicine professionals vary due to factors such as experience, geographic location, employment setting, and market demand. Other aspects, such as advanced degrees, professional licensure, and certification, tip the pay scales as well. Table 1.1 lists various sports medicine careers with the average 2004 reported salaries.

The outlook for careers in sports medicine is promising. According to the U.S. Department of Labor, athletes, coaches, umpires, and other sports-related workers held about 212,000 jobs in 2004. Coaches and scouts held 178,000 jobs; athletes, 17,000 jobs; and umpires, referees, and other sports officials, 16,000 jobs. Among those employed in wage- and salary-earning jobs, 30 percent were employed in private educational services. About 15 percent worked in amusement, gambling, and recreation industries, including golf and tennis clubs, gymnasiums, health clubs, and other sports and recreation facilities. Another 9 percent worked in the spectator sports industry (e.g., national ball clubs).

Employment of athletes, coaches, umpires, and other sports-related workers is expected to increase faster than the average of all occupations through the year 2014 (see Table 1.1 for the outlook for various sports medicine careers). Employment will grow as the general public continues to participate in organized sports for entertainment, recreation, and physical conditioning, and much of this growth is projected to result from growing participation of girls and women in organized sports. In addition, job growth will be driven by the increasing number of baby boomers approaching retirement, at which time they are expected to participate and require instruction in leisure activities, such as golf and tennis. The large number of children of baby boomers will also be active participants in high school and college athletics, which will create more jobs for coaches and trainers.

Office versus Field Care

Many sports medicine physicians work both on and off the playing field. As a result, they must be equipped to handle the many possible environmental factors. Thus, office physicians face less stress compared with those on the field. Office physicians are at leisure to carefully consider a diagnosis and confirm it by consulting with colleagues. In addition, they deal with more non-emergency situations.

In contrast, field physicians are faced with high-pressure situations that require them to meet the necessary standards of care under emergency situations unfolding in real time. The dynamics of the job require competence in assessing injuries and making quick diagnoses on the spot

without consulting with others. Field physicians must be cognizant of nearby medical facilities and personnel, in addition to weather and other conditions.

Event Physicians

Event physicians and team physicians are sports medicine physicians, yet they differ in their work environment and scope. Event physicians deal only with the sporting event at hand. They must be comfortable with the type of sporting event they are covering and need to know rules of game, potential hazards, problems associated with the particular type of sport, and environmental influences (weather, facilities, etc.).

Event physicians need to know what support personnel will be available for the competition. The big questions for an event physician include: Who will be under his or her care during the sporting event? Will she or he be responsible for athletes only, or will bystanders need care as well? If a basketball player leaps out of bounds to catch a pass and injures a fan in the front row, is the physician responsible for attending to the fan's injuries? Other questions for an event physician entail: Are emergency medical technicians available or close by? If other medical staff is present, who will make the final decision in an emergency situation?

The physical layout and size of the event venue comes into play too. The event physician must consider these factors, including issues such as the proximity of the athletes to one another. Clearly, reaching an injured driver on a NASCAR racetrack would take considerably longer than reaching an injured basketball player on the court.

Team Physicians

Whereas event physicians are responsible for specific events, team physicians have more continuous involvement with their teams. Team physicians deal with the ongoing care and development of players. They handle injuries both on and off the field. Not only do they provide general medical coverage during competition, but they also conduct follow-up treatment with the players.

Team physicians have certain advantages over event physicians. Team physicians work with coaches to develop return-to-play guidelines in the event of a head or other serious injury. This pregame agreement decreases confusion in the heat of battle. Team physicians have another advantage—access to preparticipation examinations. Team physicians are more familiar with the athletes they treat, so they are aware of serious predisposing conditions that could increase the chance or severity of an injury. Although

Table 1.2 Basic Equipment for Team and Event Physicians

ACE bandages	Penlight
Adhesive tape	Tongue depressors
Anaphylaxis kit	Stethoscope
Bandages	Scalpel
Blood pressure cuff	Slings
Cervical collar	Splints
Crutches	Suture kits
Gauze	Scissors
Gloves	Screwdriver or mulitool
Knife	Wound glue
Otoscope	

these preparticipation examinations lend invaluable information, their use is questionable and is addressed in Chapter 8.

Sports medicine physicians working on the field must be prepared. So what does a typical physician's black bag contain? The contents of the bag really depend on how involved the physician plans to be. The physician cannot assume that the school first aid kit is adequate. Most bags contain suture kits and scalpels, splints and wraps, and tape. The physician often carries a screwdriver or retractable knife for removing facemasks or other equipment. See Table 1.2 for a basic list of additional items.

The physician must balance preparedness with standard of care. There are also legal issues to be considered. For example, the physician must know whether spinal boards, oxygen, and defibrillators are available. In addition, physicians must know how to use this equipment. If a physician does not know how to use a defibrillator yet finds himself or herself in a situation requiring the use of one, two things can happen: The physician can choose not to use the equipment, thereby risking a negligence lawsuit, or the physician can use it—possibly incorrectly—and risk a malpractice suit. Either way, the physician is accountable.

Whether on or off the field (but especially on the field), sports medicine physicians must be educated and aware of predisposing medical conditions, such as asthma, cardiac problems, and previous injuries. The physician must have knowledge of these conditions and must be able to recognize them in unfamiliar athletes, at a moment's notice, and in relation to other injuries.

Field physicians use tips and tricks when dealing with head injuries and return-to-play situations. Because athletes may try to hide a concussion in order to continue playing, physicians need to be familiar with

signs and symptoms of serious head injuries. Physicians must work with coaches to ensure that a player does not return to play during the frenzy of a close game. If the player is inadvertently permitted to play, the physician could be liable. One old trick used by seasoned team physicians is to take away a necessary piece of the uniform, such as a helmet or shoe, without which the player is not allowed to play.

Outdoor events and weather raise other issues; in the case of lightning, referees should automatically interrupt play. However, if they do not, the physician should take charge and demand that the sporting event be cancelled or postponed until conditions improve. Obviously, this may not always agree with the coaches, participants, or spectators, and the question of game authority is raised. Exactly who has the ultimate authority in a competition?

MANAGED CARE

Sports medicine physicians face numerous challenges related to sports medicine practice economics, including coding and billing for consultations. A lack of widespread recognition of sports medicine as a valid medical specialty can be found in the realm of medical insurance. Many insurance companies refuse to recognize and adequately compensate for dual credentials in both family medicine and sports medicine.

Consultations make up a significant component of sports medicine practices because surgeons and primary care physicians often seek consultation from sports medicine physicians for preoperative clearance of patients and for the management of postoperative complications. Despite this cooperative structure, some insurance companies refuse to reimburse sports medicine physicians for such consultations because they claim sports medicine physicians are not medical specialists. To combat this discrimination, sports medicine physicians, who practice only in a primary care office, are credentialed with local insurance companies as family medicine practitioners.

Whether in the office or on the field, physicians must wrangle the bull of managed care. Managed care, as defined by J. K. Iglehart, is

> [a] system that, in varying degrees, integrates the financing and delivery of medical care through contracts with selected physicians and hospitals that provide comprehensive healthcare services to enrolled members for a predetermined monthly premium.[1]

In other words, managed care is a negotiation among insurance groups, physicians, and patients as to what prices will be paid for health services.

It is based on an effort to control escalating healthcare costs by the health insurance industry, which defines a reasonable maximum fee that healthcare providers may charge for any given service.

There are several forms of managed care, ranging from more restrictive to less restrictive, which include the following:

- Health maintenance organization (HMO): The policyholder is assigned a primary care physician who is responsible for the overall care of the member. Any specialty services or non-emergency hospital admissions require a specific referral from this physician.
- Preferred provider organization (PPO): The policyholder is free to choose a personal physician. However, policyholders will generally save money (possibly on lower deductibles, lower copayments, and higher reimbursement percentages) if they see a network physician for treatment.
- Point of service (POS): This plan resembles the previous two plans except that policyholders must choose a physician to coordinate their healthcare.

Each managed care plan has its own reimbursement schedule, physician list, and referral mechanism. Many of the plans have restrictions on the availability of physicians and coverage for services, such as physical therapy, radiology, and pharmacy. For example, it may be difficult to get an insurance company to authorize a desired diagnostic test, physical therapy service, or referral. Often, a team physician is not reimbursed for services.

Athletes typically have different insurance plans, even among members of the same team. Therefore, the type of insurance coverage for athletes varies widely. Adult recreational athletes generally have the same level and type of coverage as the rest of the population, and high school athletes generally participate in their parents' insurance programs. College athletes usually have some form of health insurance coverage, whether it be under their parents' plan or a health plan offered by their school. Unlike high schools, most colleges provide secondary insurance to cover injuries that may not be completely covered by the athlete's primary insurance. Professional athletes generally use workers' compensation programs, which place fewer restrictions on referrals and ancillary treatment services.

Reimbursement for services can be a dilemma for a physician, especially when the physician is expected to provide care to all athletes on a team without reservation. Compounding this difficulty is the reality that the medical needs of athletes, especially elite athletes, can be quite different from

the needs of most other patients. In fact, what an insurance plan considers quality care may fall short of athletes' needs.

Because every injury can affect an athlete's career, athletes, team physicians, and coaches frequently demand immediate attention. In addition, optimal care may require rapid diagnosis and aggressive treatment to minimize the impact of an injury. In the managed care arena, however, preauthorization is often required, and use of medical services is scrutinized. This creates a conflict between the athlete's needs and what the insurance company will allow. Furthermore, insurance companies typically do not recognize athletes as having needs different from those of other patients on the plan. The team physician can be caught between insurance company restrictions and the needs of the athlete.

Add to this wrestling match the role of liability. Physicians are held to the same standard of care regardless of patient coverage. Referrals to less skilled physicians, and thus fragmentation of care, pose liability issues for the primary care physician. If the physician is not permitted to provide the appropriate medical care, he or she could in turn be liable for malpractice.

When mixing sports medicine with managed care, many questions arise, such as the following:

- What is the legal responsibility of the team physician to provide care for athletes who are not in the same insurance plan?
- Is the physician obligated to provide free care and, if so, at what level?
- What is the liability of the team physician or primary care physician if she or he refers an athlete to a less skilled physician who is on a particular health plan?

These questions are certainly out-of-bound areas. Many of these and other questions will be answered only when someone shouts "foul" and the game is moved to a court of law.

NOTE

1. Iglehart, J.K. Physicians and the growth of managed care. *N Engl J Med* 1994; 331(17): 1167–1171.

CHAPTER 2

History of Sports Medicine

Sports medicine has been a recognized subspecialty by the American Board of Medical Specialties since 1989. However, the field of sports medicine truly began in the fifth century BCE.

ANCIENT HISTORY

In ancient Greece and Rome, athletic contests were the way of everyday life. Physical education and training were a necessity, and medical specialists evolved for the care of the athletes. In fact, the first use of therapeutic exercise is credited to Herodicus, a fifth-century BCE physician whose theories are considered the foundation of sports medicine and who is considered the teacher of Hippocrates, the Father of Medicine.

Other important sports medicine figures during this time include Iccus of Tarentum (about 444 BCE), who wrote the first textbook on athletic training, and Milo of Croton, who was a heroic athlete and winner of five consecutive Olympic championships. Milo encouraged athletes to gain strength by lifting a bull every day, starting from the day of the bull's birth. By doing this, the athlete would be able to lift the animal when it was full-grown. Some scholars consider this the first record of progressive resistance training.

The first documented team physician arrived much later, during the second century CE. Appointed to treat the intrepid gladiators, Galen performed copious amounts of research in anatomy and physiology. Galen's works became the dogma of the medical knowledge of the Western world.

Jump to the 1900s

The term *sports medicine* was coined at the 1928 Olympics in St. Moritz, Switzerland, when the Association International Medico-Sportive committee met to plan the First International Congress of Sports Medicine, which was being held that year during the ninth Summer Olympic Games in Amsterdam. At least 280 sports physicians from twenty countries attended.

In 1968, while attending the Summer Olympics in Mexico City, Canadian doctor J. C. Kennedy concluded that well-organized and qualified medical care should accompany competing athletic teams. He became instrumental in the founding of the Canadian Academy of Sport Medicine (CASM) in 1970. Soon after, Dr. Kennedy was appointed Chief Medical Officer of the first true medical team at the 1972 Summer Olympics in Munich, Germany.

The United States has followed the lead of other countries in the development of sports medicine. The American College of Sports Medicine (ACSM) was founded in 1954, and today it is the largest sports medicine and exercise science organization in the world, encompassing more than 20,000 international, national, and regional chapter members.

In addition, the *American Journal of Sports Medicine*, first published in 1974, is a leading peer-reviewed scientific journal of the American Orthopaedic Society for Sports Medicine (AOSSM). Interestingly, though, it was not until 1989 that the American Board of Medical Specialties recognized sports medicine as a legitimate subspecialty.

The Advent of Sports Medicine

The true advent of sports medicine in the United States arrived with the development of specialized physicians and clinics, such as Drs. Augustus Thorndike of Harvard and Edward Hitchcock of Amherst College, Drs. Robert Kerlan and Frank Jobe of the Kerlan-Jobe Orthopedics Clinic, and Dr. Jack C. Hughston of the Hughston Clinic.

Augustus Thorndike, MD, published his textbook *Athletic Injuries, Prevention, Diagnosis, and Treatment* in 1938. This book was the first general American text of sports medicine, and it still serves as the model text.

Edward Hitchcock, MD, was appointed as the first instructor of physical education and hygiene at Amherst College in 1954. Not only is he known as the father of physical education in America, but he is also regarded as the first sports medicine physician and the first team physician in America.

Robert Kerlan, MD, was the Los Angeles Dodgers' first team doctor in 1958. He was responsible for diagnosing Dodgers' pitcher, Sandy Koufax, with traumatic arthritis in her left elbow. As Kerlan's popularity grew, his personal practice flourished. He began work as an orthopedic consultant to several other professional teams in a variety of sports, including hockey, basketball, football, and horse racing. Together, Kerlan and his friend and colleague, Frank Jobe, MD, founded the Southwestern Orthopedic Medical Group in 1965. The name was changed in 1985 to the Kerlan-Jobe Orthopedic Clinic. This sports medicine clinic is regarded as one of the top centers in the nation.

Jack C. Hughston, MD, is another visionary in the field of sports medicine. He was one of the founders of the American Orthopedic Society for Sports Medicine. In 1949, he established the Hughston Sports Medicine Hospital, the first hospital of its kind, and the manifestation of his vision of a clinic that focused on the total health of an athlete. Originally, the institution was known as the Hughston Orthopedic Clinic, but after a broader range of services was introduced, the name was changed to the Hughston Clinic in acknowledgement of its wider scope.

Scientific Advancements

Without science, sports wouldn't be what it is today. Injury is inevitable, and prevention is the key. Today's scientists are redefining old sports equipment and developing new equipment to aid in the prevention of sports-related injuries. In addition, they are unveiling innovative gear designed to enable disabled athletes to safely join the ranks.

Science and technology also play a role in accurate and rapid diagnosis of a sports injury, which increases the chances of a complete recovery. New diagnostic techniques, such as various imaging modalities, permit physicians to peer into the body without breaking the skin. Injuries of bones, ligaments, and muscles are readily discernible when visualized in a digital 3-D reconstruction.

Science also breeds specialized care and new therapies. Studies are evaluating the advantages of certain therapies as compared with wait-and-watch approaches. New surgical techniques are more discriminate and less intrusive, thus promoting faster and more complete healing. Science also has opened nutritional understanding of the athlete and how diets, supplements, foods, and drinks affect athletic performance.

Sports science does not concentrate on injuries alone. In fact, most sports research targets game engineering. Scientists (and athletes) are always looking for cutting-edge equipment to enhance athletic performance. Such

innovations include lighter shoes with bigger bounce; faster and more aerodynamic skates, skis, and wheelchairs; and tougher and stronger bats and rackets.

Other research targets body engineering. Scientists search for physiological and chemical pathways in the body that can be manipulated to produce better athletes; the study of endorphins and their actions in the body is an example. They explore various doping strategies—some to formulate agents not detectable on health screens and others to look for better detection methods of such agents. Doping in sports is even taken one step further to gene doping, which is on the rise. From this process, some scientists are producing genetically modified athletes who are physically superior to their counterparts.

Onset of Sports Law

More and more competitions are being played out in the court—the courtroom, that is. Legality and sports met in the courtroom long before the O. J. Simpson trial. Since 1990, sports medicine-related litigation has increased, and the growing importance of legality in sports medicine is evident by the growing number and complexity of sports contracts and lawsuits. This increase is due in part to increasing economic benefits of playing organized sports (i.e., college scholarships or multimillion-dollar professional contracts).

The onset of sports law raises important legal issues concerning the medical care provided to athletes. Litigation and resulting compensation give many injured athletes a strong incentive to seek compensation for harm caused by negligent sports medicine care rendered by team physicians, athletic trainers, and others. With the hefty components of tort, confidentiality, and antitrust, sports law is a beast in and of itself, and an entire book could be devoted to it exclusively.

Contracts

The five-page 1919 contract that shipped Babe Ruth from Boston to the Bronx sold at auction on June 10, 2005, for a staggering $996,000. The paperwork recorded the unprecedented deal that was later blamed for dooming generations of Red Sox fans to heartbreak as victims of the "Curse of the Bambino."

The contract recorded the $100,000 sale of Ruth to the Yankees, a transaction that altered baseball history. The Red Sox had won the World Series one year before peddling Ruth, but they would not win again until 2004, when the Curse was finally broken with a World Series victory over the St. Louis Cardinals.

A standard player's contract serves as a model employment contract between a player and a team owner. The contract can be modified to accommodate the special needs and talents of individual players, but because of the increase in salaries in professional sports, most players are now represented by agents. However, in an attempt to regulate agent activities, many state legislatures now require agents to register with some type of administrative agency. This player–agent relationship is governed by a Standard Representation Contract, which defines the duties and compensation of the agent.

A standard player's contract addresses salary and signing bonuses. Because salary caps are ever-present in today's sports industry, the clubs have devised ways of creative financing. A signing bonus would likely exceed the cap of the initial year; therefore, a bonus can be divided by the number of years of the contract and paid out in equal amounts over the lifetime of the contract. This not only provides the club with acceptable means for financing the team but also provides the player with some security because it is unlikely that a club would cut a player early in his or her contract if the signing bonus would be immediately due. It would take only one or two signing bonus payouts to crush the club financially.

Money is not the only item on the negotiations agenda. Many standard player's contracts place limits on the player's off-field activities. All four major professional sports leagues have paragraphs in their standard contracts prohibiting players from engaging in off-the-field activities that could impair their ability to perform or that may cause injuries. These lists vary by team, but the New York Yankees' paragraph has some of the strictest limitations: a page-long list prohibiting everything from cosmetic surgery to shuffleboard and spelunking.

Collective Bargaining Agreement

The largest and hardest-fought issues in sports involve salary caps, free agency, salary arbitration, reallocation of revenues from more prosperous to less prosperous teams, and other ways to control cost inflation. Congress clearly upholds collective bargaining as a means to settle issues between union and management involving terms and conditions of employment.

A collective bargaining agreement occurs between the players' union and athletic league, together with the provisions of the standard player contract. A player's union negotiates on behalf of all the teams in their league, and individual teams do not negotiate with the players' union apart from these league negotiations. Although each team owner and player has input into the negotiating process, once the agreement is ratified,

the owner and player are bound by the provisions within a respective contract. Many notable collective-bargaining agreements in the United States involve the four major professional sports leagues—Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA), and the National Hockey League (NHL)—and were brought about by a history of poor relations between the players' unions and team owners of the various major leagues.

Because there are tremendous amounts of money involved in professional sports, striking a deal and working out an agreement have become increasingly difficult. An example was a total breakdown in talks between all sides that wiped out the entire 2004/2005 NHL hockey season, thus making the NHL the first major American sports league to lose an entire season to labor issues. In 2006, NFL owners agreed in a 30–2 vote to accept the National Football League Players' Association's proposal by settling a revenue-sharing controversy, an agreement that forestalled a strike over salary cap provisions.

Antitrust Issues

Trusts and monopolies are concentrations of wealth in the hands of a few. In 1890, Congress passed the Sherman Antitrust Act, which eliminates restraints on trade and commerce and reduces competition. The Sherman Act is the main source of antitrust law.

Most, if not all, states have comparable statutes prohibiting monopolistic conduct, price-fixing agreements, and other acts in restraint of trade having local influence. Antitrust issues have been particularly important to professional sports leagues.

The year 1922 was a milestone year for professional sports. In the case of the *Federal Baseball Club of Baltimore, Inc. v. National League of Professional Baseball Clubs*, the U.S. Supreme Court granted the professional baseball league immunity from antitrust challenges. The league has been able to maintain this exemption (albeit limited by the 1972 *Flood v. Kuhn* ruling) from antitrust legislation. Other professional sports have been, to some extent, able to capitalize on the baseball antitrust exemption, yet some professional sports continue to have legal problems in this area.

Exactly how does Antitrust Law Tie into Sports Medicine? Antitrust laws prevent a league of sports clubs from self-regulating. This can be explained by the example of an athlete who is caught cheating or gambling. The athlete may face discipline from the team or from the league. Perhaps the correct discipline would be a league suspension, which would have severe economic consequences for the athlete. When a league denies an

athlete the right to play, there is, in effect, a joint agreement among the member clubs to refuse any contact with the player for the period of the suspension. The athlete is prevented from selling his services and is therefore denied an important means of livelihood. All these actions produce an injury—a financial injury.

Antitrust laws prevent or limit the league's ability to act as an individual and to self-regulate (in this case, by dealing out disciplinary action). Although it is accepted that leagues have some authority to maintain a system for internal discipline, it is questionable as to how broadly a league can extend its regulatory authority. If some sort of legal control is not upheld, the league could use the disciplinary power to achieve improper economic goals or to require conformity with a certain standard of morality.

Furthermore, the concern for the public image of the sport may prompt the league to extend its disciplinary authority to the off-the-field conduct of its athletes. Many people believe that the fans' perceptions of an athlete on the field cannot be disassociated from what the athlete does off the field. Although the player is already limited by the standard player's contract in activities that could affect his or her physical prowess, without antitrust legislation the league could conceivably control the athlete's entire social life.

Just because disciplinary decisions are reviewable under the antitrust laws does not mean that sports authorities cannot control player conduct. Antitrust laws, however, call for leagues and clubs to act responsibly in defining and administering disciplinary actions. They also serve to protect players' personal freedom.

Tort

"Tort" is damage, injury, or a wrongful act done willfully, negligently, or in circumstances involving strict liability, but not involving breach of contract, for which a civil suit can be brought (*American Heritage Dictionary*). In terms of sports medicine, malpractice and negligence can qualify as a tort. Professional athletes have asserted tort claims against their teams for providing inadequate medical care or for causing the aggravation of an existing injury by requiring the athlete to play despite knowledge of the injury.

However, torts need not involve an athlete and a physician or coach. Torts can occur between players, too. Violence occurs in sports at all levels, and sometimes violent acts on the playing field result in serious injuries to participants. Anytime there is an injury on the field, a tort case may be rendered.

In the early 1970s, during an amateur soccer game between two high school teams, Julian Nabozny was seriously injured while playing the goalkeeper position. As Nabozny knelt down with the ball in the penalty area, David Barnhill (a forward for the opposing team) ran toward the ball and kicked Nabozny in the left side of the head.

The rules of soccer ban any player from making contact with a goalkeeper in possession of the ball in the penalty area. In *Nabozny v. Barnhill*, the First District Appellate Court stated, "the law should not place unreasonable burdens on the free and vigorous participation in sports by our youth," and "a reckless disregard for the safety of others cannot be tolerated." The court ruled in favor of the defendant and held that a player in an athletic contest has a duty to other players to refrain from conduct that violates rules designed to protect participants from serious injury. The court further ruled that "a player is liable for injury in a tort action if his conduct is such that it is either deliberate, willful or with a reckless disregard for the safety of the other player so as to cause injury to that player."

A similar incident occurred during a 1973 football game between the Denver Broncos and the Cincinnati Bengals. After the Broncos had intercepted a pass, Dale Hackbart, a defensive back for the Broncos, unsuccessfully tried to throw a block on Charles Clark, a running back for the Bengals. After the play, as Hackbart was resting with one knee on the ground, Clark struck the back of Hackbart's head with his forearm. Officials failed to see the blow; however, game footage clearly showed the incident. Clark later admitted that he had deliberately struck Hackbart out of frustration because the Bengals were losing. Hackbart remained in the game, and he even played two more games before the team physician discovered he had a neck fracture.

Hackbart filed a federal lawsuit against the Cincinnati Bengals (*Hackbart v. Cincinnati Bengals, Inc.*). A district court ruled in favor of the defendant and stated that play in the NFL is so violent that there is no discernible code of conduct for players, making it impossible to determine which acts are reckless. Later, the Tenth Circuit Court reversed the district court decision by stating that "[there are] no principles of law which allow a court to rule out certain tortious conduct by reason of general roughness of the game or difficulty in administering it." The court noted that the rules of football clearly prohibit players from striking other players on the head, thereby establishing some boundaries. The court held that the reckless disregard standard was appropriate, and it remanded the subject for a new trial. The dispute was eventually settled out of court.

Confidentiality and Defamation

Confidentiality

When one hears the words *confidentiality* and *medicine* in the same sentence, chances are HIPAA comes to mind. HIPAA stands for Health Insurance Portability and Accountability Act of 1996. This act sets forth regulations on the protection of individual health records. Specifically, it protects the following information:

- Information that physicians, nurses, and other healthcare providers put into medical records
- Conversations that the physician has with nurses and others about the patient's care or treatment
- Information about the patient in the health insurer's computer system
- Billing information about the patient at the physician's clinic
- Most other health information about the patient held by those who must follow this law

According to HIPAA, coaches, team owners, and team physicians cannot freely exchange medical information about an athlete. Furthermore, when a player is traded to another team, the disclosure of the player's medical records with the previous team can be revealed only at the request and consent of the athlete.

Confidentiality in sports medicine is a multifaceted topic that covers more than HIPAA regulations, though. Confidentiality is especially important among hospital and clinic staff. When a high-profile athlete requires medical services, such as imaging, the staff must keep all services confidential. Any leak of the information to the media could render the hospital, as well as the staff, susceptible to defamation lawsuits.

Confidentiality is also important among team physicians because many team physicians treat athletes for more than just sports injuries. For example, athletes may be treated for general illness, such as a cold or the flu, or maybe for a sexually transmitted disease or drug addiction. If the physician is to make a public statement concerning the health of the athlete, the physician must use the utmost care in the choice of words, even for something as simple as the flu.

Maintaining confidentiality is a big issue especially when it comes to blood-borne pathogens, such as HIV and hepatitis. Any sporting event that could result in drawn blood could potentially expose athletes to dangerous pathogens. Athletes in contact sports, such as wrestling or boxing, are especially susceptible. Even given the possible dangers, a physician is not permitted to reveal such health information to coaches to other players

because individuals with HIV or hepatitis are protected by law and do not have to reveal their illness to anyone. Confidentiality regarding HIV is a hot topic in ethics and will be discussed in Chapter 12.

Perhaps the biggest question in confidentiality is yet to come: doping and privacy of records. Currently, when an athlete tests positive for an illegal substance, the information makes it to the mainstream media in about a nanosecond. Professional sports are now starting to evaluate the legality and ethics of these types of situations.

On August 1, 2005, Rafael Palmeiro, a Major League Baseball player, was suspended for ten days after testing positive for steroids. In Palmeiro's defense, the players' union was concerned that the league, with its recently launched anti-steroids ad campaign, might have violated Palmeiro's privacy rights by leaking information to the media about Palmeiro's failed drug test.

Defamation

Defamation, when written, is called "libel." Libel occurs when something is published that is false and damaging to someone's reputation or career. For example, *Sports Illustrated* and its parent company, Time, Inc., settled a defamation suit brought by former University of Alabama football coach Mike Price (*Price v. Time, Inc.*) after details of an alleged tryst with two women in a Florida hotel room were falsely reported about Price in a 2003 *Sports Illustrated* story.

Many of the defamation lawsuits are outside the realm of sports medicine. However, more suits are cropping up involving doping claims. Athletes perform amazing physical feats that the average person can only imagine, but the public is often quick to discount the athlete's abilities and accuse him or her of taking performance-enhancing substances.

Lance Armstrong represents one such case of an athlete who has faced repeated allegations of drug use. In 2004, sports reporters Pierre Ballester and David Walsh jointly published a book alleging Armstrong had used performance-enhancing drugs (*L.A. Confidentiel—Les secrets de Lance Armstrong*). Allegations in the book were reprinted in the UK newspaper *The Sunday Times* in June 2004. Armstrong sued the newspaper for libel and settled out of court.

Armstrong later filed similar lawsuits in France. In August 2005, the French cycling newspaper *L'Equipe* reported that six of Armstrong's urine samples from 1999 came back positive for an endurance-boosting hormone after being retested in 2004. Shortly after, Armstrong was cleared of the accusations that he used performance-enhancing drugs during the 1999 Tour de France, but despite his many victories both on the

bike and in the legal courts, Armstrong continues to be haunted by accusations. Armstrong was quoted in a CBS story as saying, "Look, I am the most tested athlete in the history of sport and a review of those tests . . . has turned up *nada*."

The defense in libel or slander is that the printed statement in question is actually true. Today, the courts are not necessarily looking at whether the statement is true but at whether the false statement was made with ill intent or malice. The bottom line is that any false report of an injury, illness, or allegation of drug use will undoubtedly warrant a messy lawsuit.

Onset of Ethics

The ethics of sports medicine spans all the scientific and legal aspects previously described. Because patients with sports injuries are otherwise very healthy, they do not appear to fit the role as a sick person. This illusion can cloud the ethics of sports medicine, and therefore the moral issues remain subtle and hard to define.

Most ethical issues arise because the relationship between physician and patient is altered. The usual patient–physician relationship involves the physician acting on behalf of the patient exclusively, and both have the common goal of getting the patient well and keeping the relationship private. However, these same principles do not necessarily apply in sports medicine. For example, the physician may be employed on behalf of the team—in pursuit of the team's best interests. The goal may not be to get the patient well but instead to get the patient back on the playing field. Furthermore, coaches, teammates, agents, and team owners can infringe on the privacy of this relationship.

In terms of confidentiality, the physician has an ethical duty to clarify the nature of the relationship before an examination. When the physician works on behalf of the team with a goal to make sure the athlete is fit to compete, she or he shares information about a player's medical history and physical exams with coaches or other team officials. It is important for physicians to be proactive and explain the confidentiality issue with the athlete upfront.

The ethics of standard of care is one of the most widely discussed topics in the courts. In such cases, the goal of treatment is disputed at best. Many questions arise, such as

- Should a physician allow a patient to assume medical risks for nonmedical benefits?
- Should the physician promote or prescribe a therapy that may promote degenerative arthritis later in life to allow the patient to perform now?

Most agree that a patient's decision trumps that of a physician, and many also believe that the patient should be allowed to choose the medical approach as well. This choice ushers in the ethical issue of informed consent.

The ethics of research in sports medicine are equally troubling. Research in exercise science demands that human subjects be subjected to manipulative and sometimes invasive procedures. Although ethical implications of human experimentation were being debated as early as 1900, substantive efforts to address the issue were not made until shortly after World War II. The Nuremberg Code of 1947 emphasized the dependence of human experimentation on underlying social norms. It also showed how abuse could arise and even be defended on the grounds of the good of the community and for the sake of acquiring knowledge.

A more general ethical guidance, the Declaration of Helsinki (1964), sought to clarify and make practical the guidelines set forth in the Nuremberg Code. Despite heavy debate and several revisions of the declaration, little progress has been made in the development of concrete rules governing human experimentation. Currently, the researchers carry the burden of justifying their actions.

In 1966, the work of Henry Beecher, MD, pointed out that, although individual rights are considered sacred, abuses are continually practiced in the name of medicine. Later publications addressed the ethics of withholding treatment, introducing harmful substances to a research subject, and experimentation using children or other vulnerable subjects, such as prisoners, the elderly, and the mentally impaired.

One ongoing debate over the ethics of human experimentation concerns taking a utilitarian stance (the suffering of a few to benefit the majority) versus individual human rights (no individual should suffer). The only common ground is the idea of an informed consent form, and even the authenticity of such a form is disputed.

Bernstein and colleagues (2004) surveyed the views of practicing team physicians in the Ivy League, the NFL, and the NHL. They compared the results with responses from professional ethicists. The study was designed around six hypothetical cases. The authors concluded that team physicians and ethicists share many of the same ethical views on common ethical issues in sports medicine. However, the high degree of variance in the responses of both groups suggested that many unresolved areas exist.

CHAPTER 3

Common Sports Injuries

Football comes to mind when most people think of sports-related injuries. Swimming, badminton, and golf injuries often do not receive the same amount of attention as those from full-contact sports. However, any sport has an inherent risk for injury, even badminton. Just ask anyone who has ever received a shuttlecock in the eye.

Also, when most people think of sports-related injuries, they envision professional athletes. Assuredly, the media fosters this idea. Today's news has its own sports section that often reads like a who's who of sports injuries. It is not uncommon to hear stories about athletes forced into retirement because of health-related issues brought about by multiple and recurrent injuries.

Troy Aikman, former Dallas Cowboys quarterback, sustained as many as ten concussions over the course of his career. He announced his retirement April 2001, although he ultimately retired because of salary cap issues, not medical reasons.

Laffit Pincay Jr., a hall of fame jockey, ended his career with a record 9,530 winning mounts. He retired in 2003 after breaking his neck in a spill.

Scottie Pippen, considered among the best all-around players in NBA history, retired in October 2004. Pippen's effectiveness on the court was drastically limited by minor injuries suffered throughout his career. In a public statement, he stated: "Over the years, all the minor injuries that I've suffered, I felt like they've taken a toll on me, so maybe it's time for me to walk away from the game while I'm still able to."

Mike Richter, goaltender for the New York Rangers, was unable to recover from postconcussion syndrome, and thus retired September 2003.

Injuries in Children

Each year in the United States, approximately 30 million children and teenagers participate in organized sports. Given these numbers, one can see why sports are the leading cause of injury in adolescents. In 2001, the Centers for Disease Control and Prevention estimated that one-half of all sports injuries in children are preventable.

Epidemiology (a branch of medical science that deals with the incidence, distribution, and control of disease in a population) of children's individual sports injuries is an important area of medicine and sport science research. One notable 2006 study (by Simon et al) sought to characterize the demographics and external causes of pediatric sports injury-related visits to emergency departments and to analyze the effect of race/ethnicity and insurance status on these visits. The researchers conducted a cross-sectional survey of emergency departments in the National Hospital Ambulatory Medical Care Survey from 1997 to 2001 for patients younger than nineteen years. The study showed that sports injuries resulted in 2.5 million hospital visits annually (23 percent of emergency room injury-related visits). Caucasian boys (six to eight years old) were associated with higher admittance rates. Cycling, basketball, playground injuries, and football were tied to the largest numbers of visits. Most injuries were fractures and dislocations, sprains and strains, open wounds, and contusions. Hispanic children were associated with lower rates of injuries across all insurance types, after controlling for demographic factors and insurance.

Because most injuries in school occur during sports activities, a study[1] was conducted to explore the impact of injury in supervised school sports. Of 194 patients, ages eleven to eighteen years, 51 percent had injuries that occurred during school sports activities. Injuries occurred most commonly in rugby (43 percent) followed by physical education and other games combined (17.5 percent).

Another 2006 study (by Kurszewski et al) sought to identify the incidence, severity, and potential risk factors for sports/recreational injuries incurred by children and adults in a five-state, rural, Midwest region. Computer-assisted telephone interviews were conducted that included questions about all injuries for eligible, participating households in 1999; 16,538 people participated, including 8,488 children under twenty years of age. Of the total 2,586 injuries, 733 (28 percent) were associated with sports/recreational activities, including multiple-person sports (64 percent),

general play activities (19 percent), and single-person sports (14 percent). The overall rate was 46.4 injury events per 1,000 persons per year. Rates for children were 99.4 for boys and 64.3 for girls. For adults (age twenty years and older), rates were 11.9 for men and 4.8 for women.

Injuries in Adults

Rates of sports injury in adults are much less than those of children. Is this because children are physically more susceptible to injury or because they play harder and take more risks? The answer is most likely a mixture of both.

The elderly exhibit different characteristics of sports injuries. Exertion-related injuries are common among the elderly and are associated primarily with degenerative aging processes. Thus, an elderly athlete is likely to sustain acute injuries in sporting activities that demand high coordination, reaction time, and balance capabilities. In active elderly athletes, muscle is the most frequent acutely injured tissue, with the lower extremities being the most susceptible.

Injuries in Disabled Athletes

The *Athletes with Disabilities Injury Registry* (Ferrara and Buckley, 1996) is the only prospective study addressing injury rates of athletes with disabilities in a manner consistent with other sport epidemiological studies. In a three-year study, the authors found an injury rate of 9.30 injuries per 1000 athlete exposures. This injury rate is similar to other injury rates reported using similar recording mechanisms.

Types of injuries in disabled athletes are also similar to those of able-bodied athletes. The primary differences are due to variations in functional muscle mass and the extent of the physical impairment. Disabled athletes have injuries specifically related to their disability (e.g., more blisters and soft tissue injuries with wheelchair athletes, and leg and knee injury due to the use of outriggers in skiing). The type of disability affects location of injuries, too. Lower extremity injuries are more common in ambulatory athletes (visually impaired, amputee, cerebral palsy), whereas upper extremity injuries are more frequent in athletes who use a wheelchair.

Types of Injuries

All injuries (such as fractures, dislocations, and sprains) can be classified into two groups: acute and chronic. Acute sports-related injuries include sprained ankles, strained backs, and fractured hands, all of

which occur suddenly during activity. Signs of an acute injury include the following:

- Sudden, severe pain
- Swelling
- Inability to place weight on a lower limb
- Extreme tenderness and or weakness
- Inability to move a joint through its full range of motion
- Visible dislocation or break

Chronic injuries generally result from the overuse of one area of the body while playing a sport or exercising over a long period. The following are signs of a chronic injury:

- Pain when performing an activity
- Dull ache when at rest
- Swelling

Golf has grown in popularity among those over the age of fifty years. This leisure sport is a common source for chronic injuries, most often brought on by overuse. Golf has a large number of senior participants who already have structural and functional alterations in the body brought on by illness and aging. Thus, elderly golfers are prone to overloading of the musculoskeletal system. The sport itself involves repetitive motion about the torso, which promotes overuse syndromes. In addition, carrying one's golf bag has been proved hazardous to the lower back, shoulders, and ankles.

Fractures

Fractures are a common sports injury. They are most often associated with rigorous and high-contact sports. There are several types of bone fracture:

- **Oblique:** a fracture that runs at an angle out to the axis
- **Comminuted:** a fracture of many relatively small fragments
- S**piral:** a fracture that runs around the axis of the bone
- **Compound:** a fracture that breaks the skin
- **Greenstick:** an incomplete fracture in which the bone bends
- **Transverse:** a fracture that goes across the axis of the bone
- **Simple:** a fracture that does not break the skin

Two research scientists, Hon and Kock, devised an observational study at a Malaysian hospital to establish a profile of fractures related to sporting activities. In 2001, they reported that men sustained 92 percent of all

the fractures, 62.5 percent of which occurred during football games. Overall, 65 of the 113 patients were playing football at the time of the fracture. Other fractures occurred in various sports, including fishing. According to the study, the bones in the arm and lower leg (radius, humerus, and tibia) were the most frequently fractured sites.

Stress fractures are one of the most common injuries in sports. These injuries are caused by overuse and occur when muscles become fatigued and are unable to absorb added shock. Eventually, due to repeated or prolonged force, the fatigued muscle transfers the overload of stress to the bone, thus causing a hairline crack called a stress fracture.

Stress fractures can result from increasing the amount or intensity of an activity too rapidly. They also can be caused by impact with an unfamiliar surface. For example, a tennis player who switches from a soft clay court to a hard court may sustain a stress fracture. Improper or worn equipment and increased physical stress, such as an increased playing time for a basketball player, can also contribute to this type of injury.

Most stress fractures occur in the weight-bearing bones of the extremities, with more than 50 percent occurring in the lower leg. Medical studies (see Feingold, 2006) have shown that female athletes seem to experience more stress fractures than do their male counterparts. This may be attributed to amenorrhea, osteoporosis, and a condition referred to as the female athlete triad eating disorder. This disorder is discussed in Chapter 15.

Dislocations/Joint Instability

It is not uncommon for athletes to injure joints. Not only do these injuries initiate a degenerative process in the joint, but also the lack of complete healing of an injured joint can perpetuate long-term damage. Additionally, repetitive low-grade impact from athletic events can be enough to damage the soft tissues and start the arthritic process. The main sports injuries that lead to symptomatic osteoarthritis in later years are those that occur to the ligaments, causing joint instability.

Joint instability constitutes a spectrum of disorders that includes dislocation, subluxation, and laxity (looseness). A subluxation is a partial dislocation of the joint. For example, the ball slides partially out of the socket, but never fully dislocates. Laxity is caused by structural damage to connective tissue that supports a joint. It often results in inappropriate hypermobilility of the joint. Dislocation is an extremely painful injury often resulting from a blow to a joint between bones. This differs from a broken bone in that the bone remains in one piece, but the end of the bone is moved from its normal position within the joint. This causes a temporary deformity that can sometimes cause immobilization

of the joint. Dislocation can occur in the larger joints, such as shoulders, elbows, or knees, as well as in the smaller joints, such as fingers and toes.

Muscular/Ligament Injuries

Injuries to muscle are common, accounting for up to 30 percent of all sports injuries. Examples of muscle and ligament injuries include ACL tear, rotator cuff, patellar, and Achilles tear. The terms *strain* and *sprain* are often used interchangeably to describe these types of injuries; however, strains and sprains are very different. A sprain is a stretch or tear of a ligament, and a strain is an injury to either a muscle or a tendon.

Within these types of injuries there is much similarity. Some injuries are named *mimickers* because they resemble other injuries. For example, a rotator cuff strain is a post-traumatic mimicker of tendonitis as seen on an MRI. In addition, a kneecap dislocation can simulate a ligament injury. Fractures of the scaphoid (wrist bone) often occur from a fall onto an outstretched hand. These injuries can be incorrectly identified as sprains. Although this injury mimics the symptoms of a sprained ligament or tendon, unlike a sprain, this injury does not heal over time or with rest.

Location of Injuries

Several studies have documented which are the most common injuries related to sports. According to the National Collegiate Athletic Association injury surveillance system for 2000 to 2001, the most common injury sites were the ankle, knee, and lower leg among collegiate soccer, field hockey, basketball, and lacrosse athletes. The most common injury types were muscle strains, ligament sprains, and contusions.

There is general agreement among researchers that incidence of injury is greater during competition than in training sessions. In 1998, Seil and colleagues performed a prospective study of European handball injuries in 186 men. The results of this study indicated that injury incidence during competition was twenty-four times greater than during practice. More than half (54 percent) of all injuries occurred in the lower extremities, and the knee was the most commonly injured anatomical region. An injury was defined as any incident that resulted in absence from at least one practice or game.

In a recent study conducted by Sanchis-Gimeno et al from January 2003 to January 2005, a total of 2,701 athletes (average age of thirty-nine years) participated in a prospective study designed to identify the anatomical location of injuries suffered exclusively while training. A total number

of 781 injuries was recorded, and most occurred in the lower extremities (84.5 percent), followed by the spinal column (7.4 percent), the upper extremities (5.6 percent), the trunk (1.8 percent), and the head (0.6 percent).

In the lower extremities, injuries were most often found in the knee (35.4 percent), followed by the ankle (25.6 percent), the foot (18.8 percent), and the thigh (10.6 percent). Injuries to the spinal column were most frequent in the lower back region (51.7 percent), followed by the middle back (29.3 percent) and neck (19.0 percent). In the upper extremities, injuries were most often located in the shoulder (43.2 percent), followed by the forearm (38.6 percent), the arm (29.5 percent), and the hand (9.1 percent).

Shoulder

The anatomy and physiology of the shoulder give rise to potential sports-related injuries. The joint of the shoulder relies on the ligaments and muscles to stabilize it because it does not have the ball-in-socket anatomy like the hip. Therefore, the shoulder is the least stable joint. It has the most mobility and is difficult to assess clinically.

Shoulder injuries account for 8 percent to 20 percent of all athletic injuries. New Zealand 2004 figures indicate that there were 81,000 medical fee claims (59,000 new claims and 22,000 ongoing claims) in 2002 for shoulder injuries. The total annual cost for these injuries was around $37 million, with soft tissue injuries accounting for 74 percent, representing a considerable cost to the people of New Zealand.[2,3]

Rotator cuff injuries are the most common shoulder injury. The rotator cuff is a group of small muscles that act as the steering mechanism for the shoulder. Another common injury is shoulder dislocation, which can cause glenohumeral joint instability and acromioclavicular joint injury. This type of injury most often occurs during a fall on the point of the shoulder.

Much of the current research on the shoulder has sought to find the best ways to image and view the inside of the shoulder joint. According to the American College of Radiology, an acutely traumatized shoulder is best imaged with plain radiography (x-rays). This technique provides a quick visualization of the joint and the surrounding bony structures.

The rotator cuff and its surrounding structures can be imaged in many ways, including magnetic resonance and ultrasound. Ultrasound of the shoulder has proved to be accurate, inexpensive, and rapid. However, additional imaging is often prescribed because many orthopedists want to see more *evidence* before they operate. Imaging with shoulder arthrography

is still the gold standard insofar as full-thickness rotator cuff tears are concerned.

Knee

The knee is the most commonly injured joint of the lower body. Reportedly, there are 1.3 million annual visits to U.S. hospital emergency rooms for acute knee trauma.[4] Furthermore, it is estimated that in the United States, more than one million knee radiographs are performed annually for patients with acute knee pain. According to a 2001 study by Verma and associates, these radiographs account for over one billion dollars spent.

The most common mechanisms for knee injury are blunt trauma and twisting. Twisting injuries are responsible for three-fourths of all knee injuries; however, 86 percent of all knee *fractures* result from blunt trauma. Weber and colleagues[5] reported that the patella (kneecap) was the most common bony fracture after acute knee injury. Nearly 94 percent of patients who present with acute knee injuries have soft tissue damage rather than osseous injuries. In patients with fractures, often-associated soft tissue injuries are commonly present.

Ligament injury is the most common knee pathology. Commonly reported ligament injuries involve the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL). Other knee injuries frequently involve the meniscus, which consists of cartilage tailored to absorb shock, distribute weight, and stabilize the joint. Twisting of the knee can rip the meniscus and result in meniscal tears. Patellar tears are common, too.

Knee radiography is the most common examination performed for knee trauma. However, it has the lowest yield for diagnosing fractures. In one study, 68.6 percent of patients with knee injury had radiographs, of which 93.4 percent were negative for fracture.[6]

Magnetic resonance imaging (MRI) is the technique of choice to image internal knee derangement. MRI has been shown to demonstrate minor meniscocapsular tears when performed with proper understanding of knee anatomy. In fact, multiple studies have corroborated that unnecessary arthroscopy can be avoided given the highly predictive values of a negative MRI. In addition to MRI, single photon emission computed tomography (SPECT) has been proposed for diagnosing meniscus injuries.

Head and Spine

In May 1995, Hollywood met heartache. Christopher Reeve, America's favorite superhero, broke his neck when he was thrown from his horse during an equestrian competition.

Approximately 10,000 cervical spine fractures occur annually, comprising 2.6 percent of all trauma victims.[7] These cervical spine injuries cause an estimated 6,000 deaths and 5,000 new cases of quadriplegia each year. Sports-related activities account for another 15 percent of cervical spine injuries. Participants in sporting events, such as diving, equestrian activities, football, and gymnastics, are considered to be at a high risk for spinal trauma.

Spine injuries can be devastating injuries that may lead to partial or complete paralysis, thus they are given careful medical consideration. The American College of Radiology states that because cervical spine trauma may accompany a head injury, cervical spine radiographs are indicated for head-injured patients who have signs, symptoms, or a mechanism of injury that could result in spinal injury and in patients who are neurologically impaired.[8] Perhaps the most concerning statistic, however, is that 10 percent of all patients with spinal cord injuries arrived at the emergency room neurologically intact.

American football has seen its fair share of spinal cord injuries among players. From 1945 to 1994, there were 684 reported football-related deaths, of which 17 percent were caused by spinal cord injury.[9] This statistic has been attributed to spearing. Spearing is a tackling technique used when one player charges another player headfirst. The NCAA defines spearing as the use of the helmet (including the facemask) "to butt or ram an opponent or attempt to punish him."[10] Spearing was declared illegal in 1976, and since then, there has been a measurable decrease in football-related spinal injuries. The decrease is due to vigilant instruction and training on proper hitting techniques.

A study in 2004 examined the causes and incidence of major spinal cord injuries sustained by ice hockey players in Canada.[11] Between 1943 and 1999, 271 major spinal injuries were reported among Canadian ice hockey players, of which 49.0 percent occurred to players 16 to 20 years of age. Of the spinal cord injuries, 65.8 percent resulted from colliding with the boards, and 36.6 percent were due to players being pushed or checked. An increase in catastrophic cervical spine injuries in hockey players seems to coincide with the timing of the advent of better protective headgear allowing for more aggressive play. Prevention strategies, such as the introduction of checking-from-behind rules, have become effective in decreasing the number of severe spinal injuries. The search is still on for safer ways to play the game without interfering with the spirit of rowdy competition.

A drive through a typical suburban American neighborhood containing many children is bound to turn up several backyard trampolines.

Many funniest video episodes on television have documented hilarious incidents involving trampolines. However, trampoline accidents are not always funny. In fact, of injuries reported in the National Gymnastic Catastrophic Injury Registry from 1978 to 1982, 14 of the 20 injuries involved the use of a trampoline.[12] In 1997, the American Academy of Pediatrics recommended the elimination of trampoline use in school. Interestingly, the incidence of trampoline-related spinal injuries decreased following the recommendation. However, recent reports indicate that the incidence of injury is on the rise again with a recent resurgence of the sport.

When it comes to spinal injuries, children and adults vary because of structural differences in the cervical spine. These differences can alter injury patterns and cause distinct pathology in young children. Children have more elastic spinal ligaments and more horizontally aligned spinal joints. This anatomy predisposes them to subluxation (or dislocation) of the cervical spine without bony injury. To further compound this problem, immature neck muscles and a proportionally large head make a child's cervical spine function like a fulcrum, thus increasing the chance of injury. As a child's cervical spine matures, the fulcrum effect migrates from the upper levels to the lower ones until it reaches the fifth vertebra. Most injuries occur at the top three vertebrae levels in children younger than eight years of age.

Although head and facial injuries often occur in contact sports, they may also result from less rigorous sports, such as hunting. Tree-stand falls are a common cause of hunting-related injury. Spine and brain injuries are also associated with these falls. The most frequent sports-related head fractures are of the nose and cheekbones. Other more dangerous injuries, such as those to the underlying brain and blood supply, often accompany fractures.

Sports account for numerous eye injuries each year. In order of decreasing frequency, the sports that most commonly cause eye injuries are basketball, water sports, baseball, and racquet sports. Sports-related eye injuries are blunt, penetrating, and radiation injuries, with blunt occurring most often. The extent of ocular damage depends on the size, hardness, and velocity of the blunt object, and the force imparted directly to the eye. Examples of blunt injuries include orbital blowout fracture, orbital and lid contusions, iris injury, ruptured globe, and retinal tears/detachment. This type of injury is often cause by impact of the eye with a golf ball. Penetrating injuries are relatively uncommon but may occur even with large projectiles, including eyeglass breakage (hence the availability of polycarbonate lenses in prescription and

nonprescription forms). Fishing hooks have been known to cause penetrating globe injuries too.

Spinal and head injuries are detected with the use of various imaging techniques. The use of x-rays is the first line of diagnostic offense. However, although they may be considered adequate to rule out fracture, cervical spine radiographs have limitations. Reportedly, up to 20 percent of fractures are missed on plain radiographs. In addition, plain-film radiographic studies have reported false-negative results up to 20 percent and a false-positive rate of as high as 40 percent.[13, 14, 15]

Computer tomography (also called CT or CAT scan) is an invaluable imaging technique for visualizing bones. This technique is so useful because it eliminates the superimposition of images of structures outside the area of interest. In addition, it can differentiate between tissues that differ in physical density by less than 1 percent. Perhaps the greatest advantage of CT is that is offers the ability to observe the area of interest from multiple views or slices. Despite the many advantages CT offers, it is limited by its high cost and high risk of radiation exposure for the patient.

Other imaging modalities, such as MRI, can depict pathology not visible on a CT scan. MRI is highly sensitive for detection and characterization of subacute and chronic brain injuries. The number, size, and location of MRI abnormalities in head injuries can be used to predict the recovery outcome. Although the role of MRI in imaging of head trauma is growing, MRI has many limitations, including (1) availability in the acute trauma setting, (2) long imaging times, (3) sensitivity to patient motion, (4) incompatibility with various medical and life support devices, and (5) relative insensitivity to subarachnoid hemorrhage. Some physicians advocate MRI for imaging of neurologically stable, moderate to severe, closed-head injuries, whereas CT is currently reserved for imaging of neurologically unstable or mild head injuries. In addition, single photon emission computed tomography (SPECT), positron emission tomography (PET), and transcranial Doppler (TCD) have a complementary role in the assessment of brain injury.

Blunt Abdominal Trauma

Sports are ranked fourth in the causes of abdominal trauma. A study[16] was conducted in urban New Guinea in which all patients with abdominal trauma admitted to the local hospital were evaluated. In the study, sports-related injuries comprised 6 percent of all abdominal traumas, and spleen, liver, kidney, and intestine were the most commonly injured organs.

Blunt abdominal trauma can affect several important internal organs. The spleen remains the organ most commonly affected by blunt injury to

the abdomen in all age groups. After the spleen, the liver is the most frequently injured abdominal organ. Trauma to the urinary tract system may result in kidney or bladder injury. Although most intestinal injuries following blunt abdominal trauma are related to motor vehicle accidents, some injuries may be sports related.

Imaging abdominal trauma can be tricky. According to several authors, ultrasound is not a good modality for imaging abdominal traumas because it misses up to 25 percent of liver and spleen injuries, most renal injuries, and virtually all pancreatic and gut injuries. It also cannot detect a high proportion of bladder ruptures. Furthermore, although ultrasound is 63 percent sensitive (as compared with CT) to moderate amounts of free fluid in the abdominal cavity, 400 to 600 mL (about half a liter) is needed for ultrasound detection of fluid in the trauma setting.

Conversely, CT is an excellent modality for imaging blunt abdominal traumas. It can identify active hemorrhages, gut perforation, and injuries to the spleen and pancreas. In addition, CT can accurately predict if therapeutic surgery is urgently needed.

Other Injuries

Although most injuries fall into the previously described categories, there are other injuries worthy of discussion. These other injuries include concussions, headaches, internal injuries, avascular necrosis, and synovitis.

Concussions The most common head injury in sports is concussion, occurring in an estimated 300,000 athletes per year. A six-year study in the NFL reported a total of 887 concussions in games and practices.[17] The reported concussion rate in the NHL is more than triple that of the previous decade.[18] Bigger, faster players, new equipment, and harder boards and glass have all theoretically increased the risk of concussion in the NHL in recent years. However, an increase in the recognition and reporting may be primarily responsible for the increase in incidence since 1997.

Concussions are limited periods of unconsciousness caused by head trauma. Although generally there is no recognizable structural damage to the brain, concussions may involve subdural hematomas. Repeated concussions eventually cause symptoms suggesting brain damage. Neurologists state that once a person suffers a concussion, he or she is as much as four times more likely to sustain a second one. Moreover, after several concussions, it takes less of a blow to cause injury and requires more time to recover.

A concussion can pose a serious threat if it is accompanied by a hematoma. Subdural hematomas are a form of traumatic brain injury in

which blood collects between the layers of the brain. This bleeding usually results from tears in veins and may cause an increase in head and brain pressure, thus resulting in compression and damage to delicate brain tissue. Acute subdural hematomas have a high mortality rate and are a severe medical emergency.

The cumulative effect of repetitive head trauma and concussions is most evident in boxers. Boxer's syndrome (also called punch-drunk syndrome) is a neurological disorder that affects career boxers and others who receive multiple concussive blows to the head. The condition develops over several years, with the average time of onset being about sixteen years after the start of a career in boxing. Famous boxers who suffered Boxer's syndrome include Joe Louis, Beau Jack, and more recently, Muhammad Ali. The condition commonly manifests as dementia, declining mental ability, Parkinsonism, tremors, and lack of coordination.

Repeated mild brain injuries occurring over an extended period (i.e., months or years) can result in neurological and cognitive deficits, but repeated mild brain injuries occurring within a short period (hours, days, or weeks) can be catastrophic or fatal. The latter phenomenon, termed *second impact syndrome*, was first characterized in 1984.

Second impact syndrome can occur during any sport resulting in blows to the head. Initial head injury will set the stage for a second, more catastrophic injury. The second blow may be unremarkable and perhaps only involve a general body jolt that jerks the athlete's head only slightly. Affected athletes may appear stunned, but do not suffer loss of consciousness. They usually remain alert (yet dazed) and on their feet for fifteen seconds to approximately one minute. Often, the affected athlete will remain on the playing field or walk off without assistance. Usually within seconds to minutes of the second impact, though, the athlete will collapse to the ground and stop breathing. The death rate for second impact syndrome is nearly 50 percent.

Obviously, it is difficult for a team doctor when an athlete, professional or otherwise, has suffered a number of concussive injuries but has no residual neurological or cognitive symptoms. Second impact syndrome is shaping the ever-changing regulations and guidelines for return-to-play decisions. (See Chapter 11 for further discussion of return-to-play.) Furthermore, it is no surprise that professional athletes have health-related problems arising from concussive injuries. In fact, Troy Aikman, who sustained as many as ten concussions throughout the course of his career, claimed several health-related problems stemming from concussions and other injuries.

Headaches More than 2,000 years ago, Hippocrates noted a connection between headache and exercise: "One should be able to recognize those who have headaches from gymnastic exercises or running or walking or hunting or any other unseasonable labor."

Sports-related headaches are fairly common, especially in contact sports, such as football and boxing. They can be benign, as in primary exertion headache, or may signal a traumatic subdural hematoma. Specific headache conditions related to sports activities include the following:

- Decompression sickness headache, common in divers
- High-altitude headache, common in mountain climbers
- Goggle headache, common in swimmers

Most headaches are due to benign causes and do not require detailed investigation. However, if brain tissue injury is suspected, a proper medical work-up may include various brain scans.

Avascular Necrosis Death of a bone due to lack of blood supply is termed *avascular necrosis* (AVN). When a joint is injured, as in a fracture or dislocation, the blood vessels may be damaged. This can result in temporary or permanent loss of the blood supply to the bones. Without blood, the bone tissue dies and causes the bone to collapse. Studies suggest that this type of AVN may develop in more than 20 percent of people who dislocate their hip joint.

Although AVN can happen in any bone, it most commonly affects the end (epiphysis) of long bones, such as the femur. Other common sites include the humerus, knees, shoulders, and ankles. AVN usually affects people between thirty and fifty years of age, and about 10,000 to 20,000 people develop AVN each year.

Synovitis Synovium is the smooth, lubricated lining found in some joints, including the hip. The synovium allows the hip to move freely and prevents bone surfaces from rubbing against one other. Any hip injury that damages the synovium of the joint can lead to inflammation of the synovium, called *synovitis*. Synovitis is a common complication of a hip injury, such as a fracture. Most hip synovitis can be traced back to a specific injury, even though the athlete may not remember it.

Heat Illness Heat stroke is the third most common cause of death behind cervical spine injuries and cardiac conditions in high school athletes in the United States. The mortality rate ranges from 10 to 75 percent, and averages 25 percent. There are two types of heat stroke: classic and

exertional. Classic heat stroke occurs more in young children and the elderly and from prolonged exposure to elevated temperatures at rest. Exertional heat stroke occurs in people who are exercising under stressful environmental conditions.

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CHAPTER 4

The Impact of a Sports Injury—Who Does It Hurt?

Elena Mukhina, a young Soviet gymnast in the 1970s, was the 1978 World Champion and the person to watch for in upcoming 1980 Olympics. Following the World Championship, she suffered a broken leg, which never fully healed due to her persistent training. Because of this injury, she was unable to remaster her signature tumbling run, a Thomas salto (a one-and-three-fourths flip with a one-and-a-half twist). Two weeks before the Olympic competition, Elena was paralyzed as a result of an underrotation while practicing this exact move. Her crash-chin landing rendered her a quadriplegic.

Sam Schmidt, an Indy racecar driver, was paralyzed in a 2000 crash while practicing for the season-opening Indy Racing League event at Walt Disney World Speedway in Orlando, Florida.

Darryl Stingley was a wide-receiver for five years with the New England Patriots of the NFL. During a 1978 exhibition game against the Oakland Raiders, Darryl was the victim of a legal but vicious tackle by a Raiders player. The impact broke his neck and made him a quadriplegic for life.

ATHLETES

Most injuries hurt, especially to an athlete—at least initially. Actually, injuries to an athlete are only a small ripple of the wave that ensues, and many athletes are swept into the current due to their stake in the game. The athlete is surrounded by an entire constellation of people who have a vested interest in his or her well-being, primarily because of what they

can do for them. Jim Bouton, a former major league pitcher, once said, "Back then, if you had a sore arm, the only people concerned were you and your wife. Now it's you, your wife, your agent, your investment counselor, your stockbroker, and your publisher."[1]

Of course, the most affected person is the athlete. With every injury come two primary questions: How long will I be out? and Will I ever be 100 percent? If the injury is severe and profound, the athlete's playing quality and possibly quantity of life can be changed forevermore. The health ramifications of a bum knee do not generally rank with those of a spinal cord injury, but they can produce suffering for years to come.

Most athletes who sustain a minor cervical injury, such as a strained neck, are able to return to competitive sports once their symptoms improve. However, spinal cord injuries can lead to paralysis, a debilitating circumstance that can result in loss of various bodily functions (see Table 4.1). Although at one time the results of a spinal cord injury were considered permanent, new research is changing this perception. A cure for paralysis is rounding second base, but until it reaches home plate, any athlete who sustains a paralysis-causing injury must face many challenges beyond the physical ones.

An athlete with a long-term or permanent injury often endures certain social and financial tribulations. In situations where the injured athlete is dependent on another person for assistance with basic life skills, it becomes difficult for the athlete to fulfill the role of wife, mother, husband, or father. This difficulty manifests as both social and financial struggles. The injured athlete must overcome mental challenges, such as self-esteem issues. Not only is she or he ultimately dependent on someone else, but also she or he may fail to continue as the financial provider for the family.

With every injury, at some point the athlete undoubtedly asks the question, How will this affect my performance and, quite possibly, my career? Any leak of a serious injury to the public can alter the perception of the athlete's skills. This effect folds over onto the negotiation of future contracts. If the athlete is perceived as damaged goods, he or she may have a harder time commanding the desired contract dollars.

Sports injuries can affect the athlete's moneymaking potential in all sports. If an athlete is too injured to play in an upcoming tournament, not only does he lose the income, but he also loses his presence in the eye of the public. High-profile sports is ushering in a Hollywood effect. Athletes want to be seen on the field (and off). The more camera time they get, the more renowned they become, which translates into more promotional and endorsement opportunities—and thus, more money. For every minute the athlete misses a camera shot, untold dollars are lost.

Table 4.1 Physical Deficits and Mobility Consequences of Cervical Spinal Cord Injury

Level of Injury	Physical Deficits	Mobility Consequences
C1, C2	Paralysis of all 4 limbs	• Require a respirator or diaphragmatic pacemaker to breathe properly • Unable to eat
C3, C4	Paralysis of all 4 limbs	• May be able to breath without respirator • May be able to use power wheelchair (chin drive or sip-n-puff)
C5	Shoulder and bicep control without control of wrist or hand	• Can feed and dress self with some assistance • Can operate a power wheelchair (arm drive)
C6	Wrist control without hand function	• Can feed self with hand or splints • May have some bladder and bowel control • Can transfer to and from wheelchairs or toilets with some assistance • Can operate a power wheelchair (arm drive)
C7, T1	Dexterity problems with the hand and fingers	• Can dress independently • Can transfer independently to the bed, car, or toilet • Can use manual or power wheelchairs

Some injuries cause body parts to become immobile, whereas other injuries bring careers to a standstill. Athletes may escape an injury with their life or health intact but may be forced to choose between becoming a stagnant athlete or choosing some other suitable occupation. Others may opt for the route of retirement. Either way, career change can be eminent.

It is often said that a professional athlete dies twice. In the case of Michael Jordan, maybe three times. Retirement is a major problem for athletes who self-identify with their career. Retirement can wreak havoc on an athlete's psyche and usher in strong bouts of depression and denial. Many times, a counselor will use a technique based on the death and dying model to counsel retired athletes. One study revealed that 14 percent of the 152 retired boxers in the study had turned to alcohol or drugs to soothe the anxiety and depression of retirement.

Families

Families are the next to feel the consequences of a sports injury. In the case of a severely injured adult athlete, massive family restructuring introduces new levels of compromise and concern. If the athlete was the main provider prior to the injury, other members of the family may inherit the financial responsibilities. Add to this the prolonged hospital stays, long rehabilitation sessions, and costly medical bills.

Families with children experience additional pangs. A parent who incurs a sports injury may fall out of the family routine. The remaining parent may be left to juggle the time commitments of childcare with after-school practices and events. This added stress can invade the family dynamics and leave everyone unsettled. Furthermore, children of injured parents may be fearful and anxious about their parent's ability to care for them.

Injured children handle things differently than adults. Whereas younger children often take their cues from their parents, older children and teens are heavily influenced by input from their peers. It is important to weigh the social implications of injury in light of the child's age.

Injuries in children cause significant disruption to school and sports, and have important implications for the wider family. In one study, almost a third of parents of children with sports injuries needed to take time off from work to deal with the injured child. For parents with high-stress jobs or unwavering bosses, taking time off work can be an added worry and a financial burden.

Team and Coaches

Although the injured athlete may be in a daze for some time after the incident, family and friends are acutely aware of the gravity of the situation, especially for life-threatening injuries. The effect of the injury on a team can go two ways. Either the team will be motivated to avenge their injured teammate or impending doom will settle on their minds causing them to question how they will win in the absence of their valuable player. In their minds, they compete with anxiety as they wrestle with the question, Could it or will it happen to me?

An injury to a team member will affect the demeanor of the other members of the team in two ways. Players can become more aggressive with the opposing team, especially if the player who originally inflicted the harm is an opposing team member. Or perhaps, the anxiety of the situation will breed fear and more conservative play. The brooding emotions of the game can carry through to following games, or even into another

season. The team could be set on a winning or losing streak, depending on the reaction of the team.

Following an injury within a team, the coach must work quickly to adjust the dynamics of the team. He will regroup, alter offensive and defensive stances, and set a new plan of attack. The coach must do all of this while attempting to get the players' heads back into the game—especially if the injury was nearly or ultimately fatal.

In non-emergency injuries, the coach must decide how hard to push an injured athlete. He must plan a proper rehabilitation program and motivate the athlete to stick with it. He must work with team physicians in presenting appropriate treatment options. Last, the coach must tow the hard line and decide when to consider a trade.

INSURANCE COMPANIES

Medical insurance companies have a vested interest in athletes, especially when it comes to injuries. The bottom line is that athletic injuries are costly. Because the stakes are so high for professional athletes, they demand the best possible treatment, sometime with little or no regard for price. After all, the treatment of a high school baseball player may cost $25,000, but what is that in relation to an injured player on a full scholarship or one with the potential of a professional athletic career?

Athletics affect other types of insurance, too. Consider life insurance. Anyone who has purchased life insurance has undoubtedly answered questions about personal activities, such as the following:

- Do you participate in any dangerous activities (e.g., scuba diving, skydiving, caving, climbing, motor racing, other extreme sports)?
- Do you smoke?
- Do you exercise regularly?

Chances are, if you do not smoke and exercise regularly you will get a lower premium. But what if your exercise regime falls into the "dangerous activity" category? You will probably get stuck paying more money—that is, if you are not rejected for coverage in the first place.

Medical malpractice litigation and the defensive measures physicians take to avoid it, both combined, account for an estimated 10 percent of the cost of health insurance; 2 percent of the cost of private health insurance may be attributed directly to the cost of malpractice.[2]

Malpractice insurance is a beast in and of itself. It was reported that 2003–2005 Pennsylvania medical malpractice premiums were approximately $500,000 a year for about $1.5 million in insurance coverage.[3]

First of all, this is a large amount of money for a team physician, who may make only $15,000 a year and season tickets as compensation. Second, $1.5 million may not even completely cover a physician who treats athletes making millions of dollars a year. Several U.S. states are suffering a mass exodus of physicians because the malpractice insurance rate in their respective states is unaffordable. Furthermore, because it takes years to become an experienced team physician, the loss of just a few physicians dilutes the talent pool.

Although there is no significant increase in the number of malpractice suits filed by athletes, the headline of the $100 million wrongful death suit filed by the widow of Korey Stringer of the Minnesota Vikings grabbed the sports world's attention. Furthermore, the $1.37 million verdict in Dave Babych's suit against the Philadelphia Flyers' team physician must have turned the head of every physician who has ever set foot in a locker room.

In 2003, four Canadian team physicians resigned because the Canadian Medical Protective Association withdrew malpractice coverage for physicians who work for professional teams. The decision forced many of Canada's professional teams to purchase private liability coverage for their own team physicians for the first time.

Clubs are now finding other ways around the malpractice dilemma by restructuring their agreements with physicians, making them part-time team employees rather than independent contractors. This arrangement prevents players from filing malpractice suits against the physicians because employees generally cannot sue their employers over work-related injuries.

Insurance data can aid in the prevention, evaluation, and treatment of injuries. Actuaries crunch the numbers to see which athletes are at greater risk. Scientists then can evaluate the particular athletic group or sport for ways to improve safety and to prevent injuries. In addition, insurance data can reveal which treatments or therapies are best by determining which treatments had shorter recovery times and whether any recurring injuries were ultimately healed. Actuaries calculate the overall costs of treatment. These figures can help athletes decide which treatment is the best for their money.

Physicians and Healthcare Professionals

Physicians make decisions about injury prevention, diagnosis, and treatment options, as well as which to offer and which are appropriate. Therefore, they must stay apprised of all current treatments and research. Their

exact role, however, depends on contractual involvement. Nevertheless, physicians must maintain professionalism and various degrees of confidentiality. They help set the standard of care for athletes and for those who look to the athletes as examples.

Health professionals triage all incoming injuries to clinics and hospitals. For example, anyone who has ever made a trip to the emergency room for a bad case of stomach flu knows that nearly every other person coming in will be seen first. Now imagine that you are sitting there with a broken arm instead. Lo and behold, a famous athlete with the flu walks into the emergency room and expects immediate attention. Who do you think will be seen first?

Of course, this is a hypothetical situation that will likely never occur, but healthcare professionals deal with similar pressures from not-so-famous cases. Many times a physician is accused of giving athletes special treatment because of who they are. Interestingly, many people believe that this sort of conduct is perfectly acceptable.

Health professionals who deal with high-profile athletes have other nonmedical concerns, too. They assist in the maintenance of security for these patients, as crowd control can be an issue when the athlete is swamped with overzealous fans.

Media and Fans

Thanks to satellite and cable television, most competitions today are televised. With all these sports available to viewers, the media must devise ways to encourage viewers to watch. Injuries get attention, and the media is accused of playing (and replaying) the drama.

Any serious injury or charges of doping are rapidly picked up by the media. Everyone exercises the right of free speech, and reporters rush to be the first to break the story. However, confidentiality issues and defamation lawsuits are shaping the speed of such reporting. With every new story, news reporters must first get the facts straight and consider all parties involved. Generally, the media presents events in full discourse and oftentimes with speculation. However, on occasion, an injury-related story is postponed briefly in order to impart professional courtesy until key family members are alerted.

Different types of sports injuries and allegations are continually shaping the way the media covers sports. Many fans have a deep attachment to their favorite athlete. Unfortunately, many fans are also fickle and will seek bigger and better players when their favorite player gets down and out. So yes, sports injuries affect the fans as well. Fans must make a

decision to stay loyal or find a new favorite. This decision has great monetary implications because fans purchase game tickets and sports memorabilia.

Society as a Whole

When it comes to the effect of sports injuries on society in general, a highly debatable question is whether athletes and their injuries drive up medical costs. Professional and upper-level athletes receive public, and very expensive, medical care. Many times the media speculates or details an athlete's diagnostic testing and treatment programs. Whereas the physicians set the standard of care, the media promotes this standard to the general public, even though the standard of care for athletes deviates from the standard for the public. Because society is aware of the high standard of care for athletes, it often expects the same treatment, thus giving rise to a conflict between patient expectations and typical quality of care, sometimes leading to disenchanted patients.

In the healthcare world, there are finite medical resources. In theory, if athletes command the best physicians, equipment, and supplies, what is the rest of society left with? Is it possible that the public gets the leftovers? Some critics say yes, although others disagree and claim that there are more than enough medical resources to go around.

Many Americans lack even the most basic levels of medical attention, yet athletes often receive prompt, state-of-the-art care. Some of society believes it is okay for athletes to receive better, faster care because they can pay more for it. However, this needs to weigh fairly in the balance of subsidized healthcare. The therapy that the athlete receives is funded, implemented, and delivered at the taxpayers' expense because government funding supports medical research, physician training, and hospital construction.

Another question to consider: Are injuries in athletes responsible in part to rising insurance premiums that everyone pays? Because treatment for many athletic-related injuries is expensive, does it make it harder for the average Joe to get coverage? Furthermore, are insurance companies becoming more stringent with their coverage? Will people be rejected for coverage if they play a sport? If Dad slips off his son's skateboard while goofing around and gives this account in the emergency room, will the insurance company refuse coverage based on participation in a high-risk sport? Is it coming to that?

On the flipside, injuries in athletes benefit the rest of us. High-dollar sports drives research. Scientists search for better ways to prevent and

treat these injuries. Consider all that research in sports medicine science has to offer:

- Shoes that provide better support and stability without compromising comfort
- More comfortable fabrics such as spandex
- Kevlar protection
- Cutting-edge treatments
- New technology, such as imaging techniques used in diagnosis

NOTES

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CHAPTER 5

Doping

The demand for performance-enhancing drugs has been created by the fixation of society on winning races and on looking more physically fit. Doping has developed into a widespread problem in competitive and high-performance sports due to increasing professionalism and commercialization. Better athletes are paid more money and gain greater fame. These incentives are enough to drive athletes to misuse performance enhancers, especially ones that are undetectable by standard measures.

The doping usage rate is estimated to be 60 percent among athletes. A study of adolescents reported that 2.7 percent of boys and 0.4 percent of girls have taken doping drugs at least once in their lifetime.[1] Another study revealed that 3 percent to 5 percent of teenagers (this value increases with age) and 5 percent to 15 percent of adults use doping drugs.[2] Thirty percent of athletes, managers, and coaches and 21 percent of physicians indicate that drugs or other doping practices could enhance athletic performance.

The first Olympic athlete to test positive for doping use was Hans-Gunnar Liljenwall, a Swedish pentathlete at the 1968 Summer Olympics who lost his bronze medal for alcohol use. Today, the most common doping agent is steroids. However, even hypnosis as a form of performance enhancement is gaining popularity.

DOPING STRATEGIES

Ancient Greeks used mushrooms, ginseng root, and opium to enhance their athletic prowess. Ancient Incas of Peru chewed coca leaves for their pain-killing and other properties. Pain control and performance control—these are basically what doping is all about. Many injuries in sports are soft tissue injuries. Although painful, they often pose no immediate threat.

In these cases, athletes may choose to use a painkiller to dull the pain and allow them to continue in the competition. Other doping strategies involve more long-term treatment and goals because the use of performance enhancing agents will increase the athlete's performance over a series of competitions.

A study in Turkey was conducted to determine the rate of doping and performance-enhancing drug used by athletes.[3] The study questioned 883 volunteers (roughly half were athletes and half were not). The average age in the study was about twenty-two years. Overall, drug use rates were 8 percent. More athletes (14.5 percent) used doping agents than nonathletes (1.8 percent). The reasons given for doping included having a better body condition and solving weight problems. Of the participants, 41.3 percent reported that their friends advised them to take the drugs. Seventy-nine percent of the doping users claimed that their rivals were already taking such drugs. Interestingly, 54.5 percent of nonusers shared that same notion.

Another study in adolescent athletes reported similar findings.[4] Of 6,402 adolescents, 4.0 percent said they had been enticed into using products prohibited for athletes, and 10.3 percent said that they had received substances to improve their performance at least once from an average of two different people. The majority of the adolescents (92.9 percent) confirmed that doping was "always dangerous" for the health, and they also stated, "doping in sport is cheating" (95.8 percent). According to the athletes, 20.7 percent thought to "refuse doping means losing all chances of becoming a great champion." Many adolescents (69.7 percent) said that they trusted the person who enticed them into taking doping products, and half of them did not talk to their parents about it. In 33.2 percent of the cases, the adolescent received the product without even asking for it.

Doping Substances

The rapid growth of the pharmaceutical industry in the 1950s and 1960s led to the increased use of sophisticated chemical agents in sports. This doping was first seen with the use of amphetamines in the 1930s, followed by anabolic steroids in the 1940s. However, it was not until the 1960s that antidoping policies and testing were introduced.

Illegal drug use in sports is standardized by a prohibited list, first published in 1963 under the leadership of the International Olympic Committee (IOC). Since 2004, the World Anti-Doping Agency (WADA) has been responsible for the preparation and publication of the list. WADA classifies both doping substances and methods by categories

(eg, steroids, stimulants, gene doping). The 2007 Prohibited List is included in Section Three, *Annotated Primary Source Documents*. Additional information can be located on the WADA Web site: www.wada-ama.org.

In the *Sports Illustrated* 2002 cover report, "Steroids in Baseball: Confessions of an MVP," the 1996 National League MVP Ken Caminiti admitted to using anabolic steroids. He claimed that up to 50 percent of players use performance-enhancing drugs. Shortly before the news hit mainstream media, recently retired slugger Jose Canseco claimed to reporters around the country that as many as 85 percent of players partake in doping. A study in Turkey revealed that the most common doping agents were anabolic steroids (60.5 percent), l-carnitine (12.7 percent), erythropoietin (5.4 percent), sodium bicarbonate (11.3 percent), and creatinine (14.1 percent).[5]

NOTES

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CHAPTER 6

The Future of Sports Science

When looking back at the evolution of sports medicine, there is no doubt that the future can only manifest itself in an exponential entanglement of science, legality, and ethics. Science will move on the offence and push through with new discoveries and revelations. Progressing faster than ethics and legality, it will lay the trail for the race. Ethics and legality will run to catch up.

Breakthroughs in genetics present us with a promise and a predicament. Although we may be able to treat and prevent a host of debilitating diseases, our newfound genetic knowledge may also enable us to manipulate our own nature. We will be able to enhance our muscles, memories, and moods, and to choose the sex, height, and other genetic traits of our children.

Many believe that sports medicine will make its most significant future contributions in the area of prevention. Injury prevention is gaining ground in the study of the body's neuromuscular adaptations. For example, a study of specific preseason neuromuscular training in soccer players demonstrated a significant decrease in the incidence of anterior cruciate ligament tears.[1] In addition, Janda and colleagues reported that serious injuries in recreational softball are reduced by 98 percent when breakaway bases are used.[2]

However, because the risk of injury will never be eliminated entirely, future research will address alternative therapies as well. In an interview, sports medicine pioneer Frank Jobe was asked what he thought would be the next breakthrough in medical technology to help prevent pitching injuries, especially shoulder injuries. Jobe suggested that stem cell research

would be a key technology. He also mentioned that regrowth of cartilage in joints to treat injured knees, elbows, or shoulders could really help degenerative conditions in a way that is not well done today.[3]

TISSUE ENGINEERING

Tissue engineering is a technology based on the development of biological substitutes for the repair, reconstruction, or regeneration of tissues. Most tissue engineering has been tested and applied in bone and cartilage research. Other research involves the development of biocompatible materials that do not corrode in the body or set off an immune reaction and tissue rejection.

Scientists are devising ways to grow tissue grafts in Petri dishes to be transplanted to patients. The combination of tissue engineering and gene therapy will create more powerful muscles, stronger tendons, and more durable joints.

GENE THERAPY

Gene therapy is the insertion of genetic material into an individual's cells or tissues to treat a disease. Clinical trials indicate its potential usefulness in the treatment of metastatic skin cancer and diseases of the bone marrow system.

The birth of Dolly the cloned sheep in 1997 brought to many people terror at the prospect of cloned human beings. Cloning is now a regular attendant in news issues, especially around election season. The mere mention of cloning can immediately stir controversy. Many people want to argue the point, despite a grievous misunderstanding of the technology that not all cloning deals with human embryos. In fact, most cloning is performed with bacteria or cultured mammalian cells (e.g., mouse muscle cells).

Andrew Kilbarger (eight years old) received three injections in his right arm and became one of six boys participating in the first U.S. gene therapy trial for muscular dystrophy. Andrew, like other muscular dystrophy patients, lacks the gene that controls production of a protein called dystrophin. Other scientific progress on muscular dystrophy, coupled with the successful completion of the first gene therapy clinical trial, has led to three more clinical trials planned for the immediate future.

Gene Therapy in Sports Medicine

Alleviating muscular dystrophy and reversing the debilitating muscle loss—can this same therapy be used to improve athletic performance?

Gene therapy is important to sports medicine because it enables the transfer of desired genes into target tissues. This scientific advancement will be important for healing. Researchers have developed a synthetic gene that, when injected into the muscle cells of mice, prevents and even reverses natural muscle deterioration. The gene not only repairs wasted or injured muscles but also strengthens healthy ones. Because of the nature of gene therapy, therapeutic substances are steadily produced by local cells at the site of injury or inflammation.

Genetically enhanced athletes are easy to imagine. The widespread use of steroids and other performance-improving drugs in professional sports suggests that many athletes will be eager to avail themselves to genetic enhancement. Alas, gene therapy will likely be misused.

Genetic enhancement is possible for brains as well as brawn. In the mid-1990s, scientists managed to manipulate a fruit fly memory-linked gene, thus creating flies with photographic memories. More recently, researchers produced smart mice by inserting extra copies of a memory-related gene into mouse embryos. The altered mice learn more quickly and remember things longer than their normal counterparts. The extra gene remained active even in old age, and the improvement was passed on to the offspring. All this brain research will hopefully make athletes think about the ramifications of human use.

DESIGNER DRUGS

The arms race is on. Every athlete wants arms as long as Michael Jordan's and as muscular as Mark McGwire's. Since the 1980s, human growth hormone has been approved for children with a hormone deficiency that makes them much shorter than average. This agent is very effective at increasing the height of healthy children, too. By 1996, such off-label use accounted for 40 percent of human growth hormone prescriptions.

Seeking to expand its market, Eli Lilly & Co. recently persuaded the U.S. Food and Drug Administration to approve the company's human growth hormone for healthy children whose projected adult height is in the bottom one percentile (less than five feet, three inches for boys and four feet, eleven inches for girls). This raises a big question about the ethics of enhancement. If hormone treatments are no longer limited to those with hormone deficiencies, why should they be available only to very short children? Shouldn't all

short children be able to seek treatment? What about a child of average height who wants to be taller so he can make the basketball team?

For the physician, other concerns emerge. How can one accurately predict the adult height of a child? What happens if the child is perceived to be short, undergoes growth hormone treatment, and later hits a growth spurt raising him to an unnatural height? Is being extremely short any different from being excessively tall?

The use of steroids and other pharmaceuticals to gain a competitive edge in athletics has been a part of the sports world for a long time, and steroids are likely to remain on the forefront of sports medicine. They offer desirable traits for athletes, albeit at a high price.

The recent identification of tetrahydrogestrinone (THG), the first true designer androgen, as a sports doping agent reflects an alarmingly sophisticated, illicit manufacturing facility and an underground network of androgen abusers. Clandestine scientists are on the search for other designer drugs. Undetectable substances and substances that mask other illegal agents are the fruit of the labor. These scientists are on a tight deadline in terms of the Olympics. They have four years to develop and distribute the agent before the next competition, and chances are that by the next set of games the agent will have been exposed and the scientists will need to have a backup ready to go.

Some athletes want bigger muscles, whereas some want bigger brains. Current research in Alzheimer's disease has opened the door for other doping strategies in sports. Therapies for Alzheimer's disease and other memory disorders can enhance the thinking power of healthy people too. Having a mental edge in sports is highly desirable.

Better Testing

While one group of rogue scientists searches for new and improved agents, others are looking for better ways to detect the illicit drugs. Over the past several years, scientific advances in the detection of sports doping agents and improved collaboration between sports organizations have enhanced the monitoring of fair athletic play. Although confirming the existence of designer steroids is credited to the sports antidoping movement, antidoping agencies need to continue investing in research and depending on honest athletic participants to maintain fairness and safety in sports.

Bionics

Formed from the words *biology* and *electronic*, the word *bionics* is defined as the replacement or enhancement of organs or other body parts by mechanical versions. Bionic implants differ from mere prostheses

because they mimic the original function very closely, maybe even surpassing it.

At the 2005 annual meeting of the American Association of the Advancement of Science, Andrew Schwartz from the University of Pittsburgh described a study in which a monkey fed itself using a robotic arm, electronically linked to its brain. The monkey was able to learn to control the arm, using ninety-six electrodes—each thinner than a human hair—attached to the monkey's motor cortex, a region of the brain responsible for voluntary movement.

One day, this research may lead to permanent artificial prostheses for those who have lost a limb. Furthermore, it will increase the mobility and dexterity of those suffering from spinal cord injuries or nervous system disorders. Trials in humans are anticipated by 2009.

Monkey manipulates a robotic arm. *Photo courtesy of Andrew Schwartz from the University of Pittsburgh.*

The biggest hurdle to this research is the buildup of biological material on the electrodes. This type of corrosion causes the signal to and from the brain to degrade over time. On average, the electrodes in a monkey's brain last only six months. Future research will unveil more biologically compatible materials, as well as devices that transmit signals without wires. These new materials or devices will enable the jump to human studies.

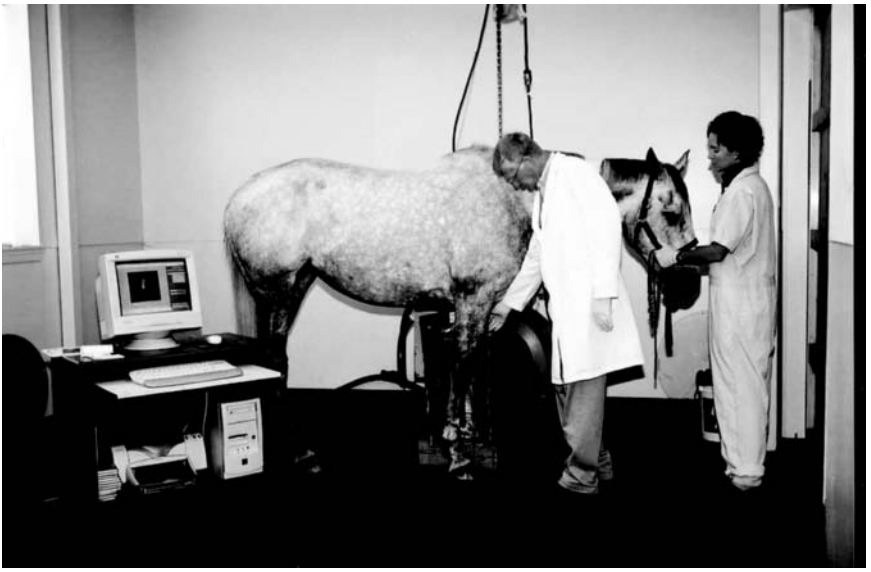
Other developments previously thought to be in the realm of sci-fi are already a reality. Such developments include the Flexfoot (a carbon-fiber prosthesis) and the knee joint that the Canadian runner, Earl Connors, is using to run the 100-meter in 12.61 seconds with an above-the-knee amputation. In addition, researchers from the University of Southern California and the Doheny Retina Institute presented data on the first six patients implanted with a retinal prosthesis, more popularly referred to as an artificial retina. After the surgery, patients were able to localize the position or count the number of high-contrast objects and to discriminate simple shapes and spatial orientation. Although the results were not perfect, they shed light on the hope for future research. Various trials are underway now.

Cochlear implants (bionic ears) are surgically implanted, electronic devices that provide a sense of sound to people who are profoundly deaf or severely hard of hearing. Unlike hearing aids, the cochlear implant does not amplify sound; instead, it works by directly stimulating auditory nerves inside the ear with electrical impulses. Cochlear implants restore the hearing of adults to a level allowing normal conversation, the use of the telephone, and even understanding with a limited amount of background noise.

As electronics continue to grow smaller, the quality of cochlear implants continues to improve. Future research will increase the number of electrodes on the array and improve the software. Tomorrow's recipients may be able to hear at levels superior to that of the general population. However, other research in deafness may render the cochlear implant obsolete if a biological cure is developed.

Most viable therapies for kidney failure are based on the use of stem cells. However, bionic kidneys are in the works. Early experiments with dogs that had kidney failure demonstrated the possible effectiveness of a bio-artificial kidney and paved the way for the first use in ten kidney patients in an intensive care unit. Recently, a phase II clinical trial evaluated the device in 58 critically ill patients on dialysis. The results were impressive, but need to be confirmed in a larger study. This next phase of research is expected to take two to four years.

The goal of future research in bionics is to prolong life and promote well-being. These are honorable goals indeed, but sports medicine professionals have to wonder about the possibility of the six-million-dollar man.



Sports medicine meets veterinary medicine. *Photograph compliments of Blue Ridge Equine Clinic, Earlysville, VA.*

These available devices, along with other devices in the pipeline, serve to provide hope.

Other Developments

Most people normally do not consider animals to be a special group in sports medicine, but they are. Although it is not addressed in detail, the legal and ethical ramifications of sports medicine in veterinary science are outstanding and growing. Horse and dog racing are big businesses. Just as other types of sports, veterinary science faces its own challenges in sports medicine, namely doping. Veterinarians are key players in the emerging field of sports medicine for animals.

What about new hybrids of electronically embedded clothing? Sports bras that count heartbeats? The Keep on Moving jacket is futuristic workout apparel that will track athletic performance using biometric sensors. The jacket will boast a digital audio player and a virtual coach to monitor training levels and create a performance log, which can then feed back into home computer devices. The future will hold swimwear that actually makes you less resistant in the water and thus swim faster. Oh wait, that already exists.

Every Harry Potter fan eagerly awaits for Quidditch game gear. Aside from computer games that simulate playing Quidditch, the only other Quidditch technology available today involves bicycles and unicycles instead of broomsticks.

Science moves faster than ethics and legality, and faster than moral understanding. Therefore, the future of ethics and legality of sports medicine is hard to discern. Bernstein and associates sought to define the ethical norms and ideals in sports medicine. They concluded that many unresolved areas remain in the field of ethics in sports medicine.[4]

Doping will continue to be questioned, as will stem cell research and cloning. What is wrong with producing designer athletes? In terms of human cloning, what is the problem with creating a child who is a genetic twin of a sports star or celebrity? These questions and others are difficult to answer, and there may be no right answer.

There are two types of athletic achievements, those through natural gifts, or those through perseverance and training. Fans appreciate players like Pete Rose, not blessed with great natural gifts but who strive with grit and determination to excel in the sport. However, fans also admire players like Joe DiMaggio, whose innate talents make the sport appear graceful and effortless.

Now, entertain an ethical supposition. Suppose we learned that both Rose and DiMaggio took performance-enhancing drugs. Would we be equally disillusioned by both players? Which player's drug use would offend us the most? Are we likely to overlook the indiscretions of one type of player, namely, the weaker one, more than another? Effort is not everything. Very few believe that a mediocre basketball player who works and trains harder than Michael Jordan deserves more airtime or a bigger contract.

Economics can further twist the ethics. Perhaps genetic enhancement becomes widely accepted. Will everyone, athlete or otherwise, be able to afford the technology? Will society spilt between those who can and those who cannot? Some worry about the danger of creating two classes of human beings, those with access to enhancement technologies and those who must make do with their natural capacities. If enhancements are passed down through generations, the two classes could conceivably become subspecies.

The law of sports medicine is a rapidly developing field, too. Sports law establishes an important body of jurisprudence, defines the legal rights and duties of all parties, and protects the health and safety of athletes. The evolution of sports law draws important distinctions between the relevant duty of care owed to athletes because of the differing legal relationships that arise out of athletic participation at different levels of competition (e.g., high school, college, professional). Society must

identify and develop these emerging legal trends. It is critical to understand the history of the law of sports medicine in order to predict its future direction and to critique its progression.

This book, designed to show the true entanglement of science, legality, and ethics as they relate to sports medicine, will end with a call for athletes, coaches, physicians, fans, and the media to unite and respect all these issues for what they truly are.

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Section Two

Controversies and Issues

CHAPTER 7

Issue: Informed Consent

Informed consent is a fundamental principle of law and medical ethics. According to American Medical Association, informed consent is a process of communication between a patient and physician that results in the patient's authorization or agreement to undergo a specific medical intervention.[1]

The evolution of informed consent made a great leap in 1949 during the Nuremberg war crime trials. The Nuremberg Code was drafted as a set of standards for judging physicians and scientists who had conducted biomedical experiments on concentration camp prisoners during World War II. The Code became the prototype of many later codes intended to assure that research involving human subjects would be carried out in an ethical manner. Other advancements in this evolution eventually followed.

The Declaration of Helsinki (1964) developed by the World Medical Association lists recommendations for guiding physicians in biomedical research involving human subjects. Like the Nuremberg Code, it made informed consent a central requirement for ethical research. In addition, it allowed for surrogate consent when the research participant was incompetent, physically or mentally incapable of giving consent, or a minor. This report has been amended multiple times and continues to be an important component of research ethics.

The Belmont Report (1979) (*Ethical Principles and Guidelines for the Protection of Human Subjects of Research by the Health and Human Services*) was created by the U.S. Department of Health and Human Services and is based on the work of the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research.

This report identified three fundamental principles for ethical human research: respect for persons, beneficence (gifts or charitable acts), and justice.

The informed consent process contains three elements: information, comprehension, and voluntariness. Informed consent must provide the patient with all pertinent information, including the following:

- Nature and purpose of proposed or possible treatments/procedures
- Risks and benefits of treatments and therapies
- Alternatives to treatment or therapy
- Risks and benefits of the alternative treatment
- Risks and benefits of not receiving or undergoing a treatment or procedure

The patient, in turn, must easily comprehend the information in the informed consent. Because the informed consent is designed to help weigh all the information and to make an informed decision, the form should be easy to read, clear, concise, and free of confusing verbiage and highly technical elements.

Any informed consent that was signed under coercion or duress will not hold up in a court of law. The entire premise of the consent must be based on voluntariness, and the implicit free will of the patient will prevail. Any language that could be construed as coercive or persuasive must be removed. In addition, any language that discusses reimbursement for participation must not outshine the risks outlined in the document.

All consents should be in writing; however, it is not required to be legally effective. Clearly, though, written consent is the finest defense against a lawsuit because it is the best proof of a patient being truly informed. Patients may waive full disclosure and informed consent, but the waiver must be voluntary and fully documented.

Informed Consent in Sports Medicine

Myth: Informed consent is designed primarily to protect the legal interests of the physician.

Reality: The purpose of the process is to protect everyone, especially the athlete. It is intended to make the athlete aware of certain rights.

Myth: The physician knows best and should advise the athlete of what to do.

Reality: Physicians are likely to be a valuable source of advice and information. However, only the athlete can make a treatment-related decision. No one, not even a medical expert, can always

predict whether a treatment, screening, or prevention will be successful.

The team physician must have an athlete's informed consent before providing any medical treatment. This requirement is based on the principle of individual autonomy, the idea that a competent adult has the legal right to determine what to do with her or his body. This means she or he can accept or refuse medical treatment at any time. Generally, parents or guardians give consent for treatment of athletes who are minors. See Section Three for an example of an informed consent.

Some argue that a blanket informed consent should be obtained at the beginning of a sports season. This arrangement would curb the discussion of risks and benefits with an injured athlete and possibly curtail the overwhelming desire to return to play despite the consequences. Furthermore, treatment could be hastened. However, others believe that each treatment deserves a separate informed consent because every injury is different. With each new injury comes a choice of treatments and a different assumption of risk. Separate informed consents would permit the injured athlete an opportunity to weigh each decision independently of the others.

Informed consents for sports medicine are not much different from general consents. Each consent should clearly warn of all short- and long-term medical risks of continued athletic participation and/or medical treatment (including any potentially life-threatening or permanently disabling consequences). It should detail the athlete's medical condition and potential consequences of playing. Courts have held that a team physician's intentional or negligent failure to provide an athlete with full disclosure of material information about playing with a medical condition or the potential consequences of proposed treatment is actionable.

Customarily, what a reasonable physician would disclose to another patient under similar circumstances has generally been the controlling legal standard. However, the recent judicial trend is to move away from this standard by requiring physicians to disclose *all* material information necessary to enable the patient to make an informed decision.

Although not a sports-related case, *Canterbury v. Spence* was a landmark case for informed consent. In this case, the court recommended to "set the standard to focus on the patient's informational needs rather than physician custom, regarding disclosure of medical information."[2] The court further stated that "[A] risk is thus material when a reasonable person, in what the physician knows or should know to be the patient's position, would be likely to attach significance to the risk or cluster of risks in deciding whether or not to forgo the proposed therapy." The same general

informed consent principles set in the *Canterbury v. Spence* apply in the sports medicine context and govern the required disclosure of information by the team physician to a competitive athlete.

Is informed consent given under stressful circumstances really consent?

The team physician must disclose medical risks and information to the athlete in plain and simple language. The courts generally do not require physicians to determine whether patients understand disclosed medical information, but team physicians should take affirmative steps to ensure patient understanding of medical information. They should be present personally to discuss risks and benefits and answer any questions. Trainers and nurses can aid in the discussion, too.

Implied Consent

Due to the lack of significant risk to the patient, consent is implied and no written informed consent is necessary for routine procedures such as physicals and blood tests. A patient's consent may also be implied from the medical circumstances. For example, if a patient offers his arm to a phlebotomist, she is in effect offering her consent to have blood drawn.

Consent may be implied under other circumstances, such as when an athlete has been rendered unconscious during play and needs emergency medical treatment. In general, the law assumes that the injured athlete would have authorized appropriate treatment had he or she been aware of his or her condition and mentally competent.

Consent in Research

Any patient who joins a clinical study would most likely want to know of any adverse procedures forthcoming: multiple and frequent biopsies and blood sampling, use of radioactive tracers, strenuous physical activities, invasive psychological procedures, etc.

The American College of Sports Medicine (1996) stated:

> By law, any experimental subject or clinical patient who is exposed to possible physical, psychological, or social injury must give informed consent prior to participating in a proposed project.[3]

According to the Experimental Subject's Bill of Rights, all individuals who elect to participate in medical research have the right to the following:

- Being informed of the nature and purpose of the experiment
- An explanation of the procedures and any drug or device to be used

- A description of any potential discomforts and risks that may be reasonably expected
- An explanation of any benefits of participation to be expected
- A disclosure of any alternative procedures, drugs, or devices that might be advantageous to the participant, and the relative risks and benefits
- Being informed of medical treatments available to the participant after the experiment or if complications should arise
- An opportunity to ask questions about the experiment or other procedures involved
- Being instructed that consent to participate may be withdrawn at any time and that the participant may discontinue in the medical experiment without prejudice
- A copy of a signed and dated written informed consent form
- The opportunity to decide consent without the intervention of force, fraud, deceit, duress, coercion, or undue influence on the participant's decision

Researchers must follow very strict legal and ethical guidelines. Before any clinical trial can begin, every participant must have signed an informed consent form. This form must provide a written outline of study; details of objectives, procedures, risks and benefits; and a statement that the participant can withdraw at any time for any reason. These informed consent forms must pass readability testing to evaluate the level of the language and ease of comprehension. The onus is on the researcher to demonstrate that every participant has enrolled voluntarily and with a complete understanding of the potential risks. It is worth noting that obtaining informed consent does not ensure that a research project is ethical. However, it establishes and guides the overall ethics of the researchers.

> Should an athlete pursue a cutting-edge yet potentially risky procedure? Because there are so many unknowns with unproven therapies, is informed consent really informed and legal?

PLAYING AGAINST MEDICAL ADVICE

On occasion, athletes will decide to play despite an injury or opposition from a physician. In such instances, physicians should make every effort to explain risks and possible consequences of playing while hurt. But in reality, because some science is subjective (e.g., evaluation of

radiographs and MRIs), can a physician ever really claim to have fully described the medical circumstance?

The team physician must fully inform an athlete of any material risks of playing a sport in light of the athlete's physical condition. Failure to do so may result in liability based on intentional tort or negligence principles. See Section Three, *Annotated Primary Source Documents* for an example of a consent form in sports.

If the player continues to disregard medical advice, the physician should have the player sign an assumption of risk waiver and a release form as a condition of being allowed to participate. An assumption of risk waiver and release form is different from a consent form. This form is designed to inform a player of risk associated with playing the sport in the player's current condition. Furthermore, it states that the team advises the player to abstain from play and requires the athlete to acknowledge that he has received and understands the information and accepts complete responsibility for playing despite the risks. The form requires the player to release coaches, trainers, and physicians from any liability or claim of any further injury that may result. See Section Three, *Annotated Primary Source Documents* for an example of a liability release form.

> Sometimes young athletes and parents are looking for a free ride through college. They may opt to pursue risky treatments in hopes of obtaining a scholarship down the road. Is this informed consent?

Caution is strongly advised when using these forms because a waiver and release form may not always hold up in a court of law, particularly if an athlete was grossly negligent, reckless, or engaged in intentional misconduct. The courts are likely to believe that the player signed away his rights, especially if the athlete signed under physical or emotional duress. These forms are not meant as a fail safe for sports medicine professionals and do not guarantee lawsuit prevention. Instead, they are more of a deterrent for lawsuits and will serve to counter a "failure to warn" type of claim.

COERCION

Knowing the pressure of family, the team, and business advisors, one must seriously question whether the athlete can possibly give informed consent. Injuries can threaten not only personal lifestyle, but also self-image. The possibility of retirement can threaten the notion of how a professional athlete views himself. High school and college students are tempted with dreams of becoming a star. Younger athletes and parents are looking for a

free ride through college. Some are willing to pursue risky treatments in hopes of obtaining a scholarship down the road. Any injury that removes income also destroys the lifestyle associated with that income. Is informed consent under these stressful circumstances really consent?

In a game situation, informed consent and explanation to the player have no real meaning. Big-game pressure, financial rewards, coaching demands, and a player's desire to return to the game often outweigh common sense. Lawyers may view these actions as coercive. In addition, to ask a player to sign a consent form is simply not practical. Some media commentators have suggested that players sign a general consent or medical release form at the start of the season.

Certain groups of people can be considered vulnerable and lacking sufficient knowledge or ability to give informed consent. Obtaining consent from these groups can also be considered coercion. Such groups include children, the elderly, the mentally impaired, the terminally ill, and prisoners. Obviously, these groups are capable of participating in sports, but their ability to give informed consent is sometimes questioned.

High school and college students tempted with dreams of becoming a star can be vulnerable in making decisions about undergoing aggressive unproved medical treatments in order to hold to the glimpse of a professional future. Can these athletes give a legitimate informed consent?

Coercion occurs in medical research, too. Many times researchers pay volunteers for their participation, particularly when intrusive procedures are involved. Researchers should be confident that payment does not constitute coercion. Payment should not affect the judgment of potential participants in terms of their of risk assessment of the study. Furthermore, information about payment should not deflect attention from information in the informed consent form.

Cases Involving Informed Consent

Failure to obtain informed consent is an invitation to legal liability. However, a signed informed consent does not always preclude lawsuits. Former Carolina Panthers receiver Patrick Jeffers claimed that his career was "destroyed" by an August 2000 knee surgery in which the orthopedist went beyond the bounds of informed consent. The lawsuit attempted to hold the Panthers accountable for the surgery, claiming that the team knew the physician had exhibited a "propensity" to exceed informed consent during surgeries on other Panthers players. Jeffers voluntarily dismissed his medical malpractice claim against the former team physician, but his attorney said he plans to refile the lawsuit.

Charlie Krueger, defensive lineman for the San Francisco Forty Niners, filed a complaint for fraudulent concealment of medical information. Krueger claimed that he was not informed by team physicians of the true nature and extent of his knee injuries, the consequences of steroid injection treatment, or the long-term dangers associated with playing professional football in his medical condition. A trial court found that Krueger failed to prove all the elements of fraudulent concealment and stated that Krueger would have continued to play football even if he had been advised of the nature and extent of his injury.

The California Court of Appeals, however, disagreed with the trial court's finding. The court indicated that the critical question was whether Krueger's medical condition was fully disclosed to him and *not* whether the team physicians withheld any information. The court held that the physician's conscious failure to make full, meaningful disclosure to Krueger was fraudulent concealment.

In other legal cases, athletes have been unable to prove that a physician violated the informed consent doctrine. In *Martin v. Casagrande*, a New York court rejected a professional hockey player's claim that a physician intentionally concealed the condition of his knee to manipulate him to continue playing hockey. Radiographs and tests performed by the physician did not indicate ligament or meniscal damage to the player's knee; therefore, the court held that there was no basis for finding the physician guilty of fraudulently withholding such information. The court observed that, at most, the player may have had a possible negligence claim against the physician for failing to properly diagnose the condition of his knee.

Hank Gathers, a Loyola Marymount University basketball player, died from an arrhythmia during a 1990 nationally televised game. The team physicians and the cardiologist knew Gathers had heart problems and prescribed him medication. Because he complained about adverse side effects, his dose was lowered to a nontherapeutic level. *Gathers v. Loyola Marymount University* was a $32.5 million lawsuit against the university sports medicine physician, the athletic director, the coach, and one of the athletic trainers. The defendants claimed that they properly explained risks of playing with a heart condition. The parties eventually settled out of court.

What does This Mean for Team Physicians?

Fraudulent concealment of medical information is based on the legality of fraud and deceit, not on negligence or medical malpractice. This is an important distinction to note because basic physician malpractice insurance

does not cover fraud; therefore, a judgment of this nature will come out of the physician's personal assets.

Ideal conception of informed consent and full disclosure becomes challenging when there are competing interests and dual obligations to the player and the team. Because the physician is typically employed by the team or franchise, he or she is under performance pressure from team management, ownership, and coaches. The physician must deal with ethical, as well as legal, dilemmas when the medical interest of the athlete/patient does not concur with the interests of the team. Although the primary responsibility of the team physician is to protect the athlete's health and well-being, the physician may feel pressured to focus only on the individual athlete's capacity to perform, while ignoring the broader implications of the physician-patient relationship.

> If a fourteen-year-old rejects a surgical procedure that is unnecessary, yet demanded by the parent, should the physician accept the parent's consent in lieu of the minor's refusal?

NOTES

1. More details are available on the American Medical Association website, http://www.ama-assn.org/ama/pub/category/print/4608.html.
2. 464 F.2d 772 (D.C. Cir. 1972).
3. American College of Sports Medicine (1996), p. 125.

CHAPTER 8

Issue: Who Has the Right to Play?

Preparticipation examinations (PPEs) are performed prior to athletic activity and are designed to help athletes and sports medicine professionals work together for the advancement of safe competition. Presumably, the advent of PPEs was not inspired by medical need. Instead, these examinations may have evolved because of media attention on athletes who had an adverse side effect while competing. Although PPEs can be a useful tool in approving athletes for sports participation, their enforcement and the idea of *who* has the right to play are hotly debated.

PREPARTICIPATION EXAMINATIONS

Generally, a PPE is a formal requirement prior to participation in high school, college, and professional sports each year. In most states, teenage athletes are mandated by law to have PPEs. However, there is some disagreement among health professionals about the frequency and timing of the examination. Most professionals agree that PPEs should be conducted six weeks prior to the beginning of the season and at the beginning of each new level of competition, unless directed differently by local laws.

The examination may be performed in an office-based or a station-based setting, depending on the number of exams to be performed, cost, and privacy needs. The qualification of the healthcare professional that performs the PPE is based on practitioner availability, clinical expertise, and individual state laws.

The objective of the PPE is not to disqualify athletes with life-threatening conditions; in fact, disqualification is a last resort. Rather, PPEs aim to

meet several other objectives. Primary objectives include the discovery of conditions that may be life threatening or disabling, in addition to identifying athletes who are at risk or predisposed to injury. Secondary objectives include determining the general health and wellness of the athlete. PPEs can reveal eating disorders, obesity, and substance abuse.

> Should PPE exams be mandatory? Do six-year-olds require electrocardiographic testing?

Preparticipation exams afford the examiner an opportunity to counsel athletes on health-related issues, including vaccinations and drug and alcohol use. The examiner can teach injury prevention and explain health risks inherent to the sport. Preparticipation exams are also an important opportunity to warn athletes about the dangers of steroid use and to detect illegal performance-enhancing substances. Examiners screen for signs and symptoms of pathological states that may lead to a traumatic or nontraumatic injury or death while participating in sports. Specifically, they consider the musculoskeletal system and the heart.

During PPEs, athletes are assessed for the fitness level of the sport. Examiners can assist athletes in safe participation. They can help patients find appropriate activities in which to participate and can educate them about their acceptable intensity of activity. Examiners can counsel athletes about limiting their participation levels.

Preparticipation exams are often the only exposure many adolescents have to a physician, and therefore offer a unique prospect for healthcare evaluation and screening. They can provide adolescents with an opportunity to talk about sports-related or development issues, such as sexual health.

Preparticipation exams generally consist of a medical history and a physical exam. The medical history should include a review of past injuries, surgeries or illnesses, medication usage, signs or symptoms of cardiac or musculoskeletal problems, and drug allergies. The physical examination should include measures of height, weight, visual acuity, and vital signs (e.g., blood pressure, pulses). Examination of the head, eyes, ears, nose and throat, lungs, abdomen, genitalia, and skin varies and may be customized depending on the sport. See Section Three, *Annotated Primary Source Documents* for an example of a PPE.

A study by Rifat and colleagues[1] determined the relative frequency of disqualifying criteria in a complete history and physical sports examination. The researchers sought to determine which factors were associated with restricted sports participation. A total of 2,574 PPEs were performed

on student athletes eleven to eighteen years old. Eighty-five percent of the student athletes passed the screening. Of those who did not, 58 percent were denied based on the medical history alone. An analysis identified seven items associated with denial overall: dizziness with exercise, history of asthma, body mass index, systolic blood pressure, visual acuity, heart murmur, and musculoskeletal examination. The authors concluded that medical history was one of the most important aspects of the PPE. Furthermore, they suggested that a directed PPE might be more efficient because it would allow more time to address specific issues.

If medical concerns are identified during a PPE, the examiner must address the following questions:

- Does the concern place the athlete at increased risk for injury?
- Is another participant at risk for injury because of the problem?
- Can the athlete safely participate with treatment (such as medication, rehabilitation, bracing, or padding)?
- Should limited participation be allowed while on treatment?
- Is clearance denied only for certain sports or sports categories? If so, in which activities can the athlete safely participate?

Any restrictions should be based on objective medical evidence and the demands of the proposed sport. The examiner must appreciate the strenuousness of the activity in relation to the physical limitations. If clearance is denied, the examiner should make recommendations for reversing or treating the medical concern. If the denial is based on an acute illness or correctable condition, the athlete should be given a chance to resolve the issue and to have a follow-up PPE.

> Should athletes be permitted to sue physicians for refusal of medical clearance to play a sport?

What are the legal rights of a high school, college, or professional athlete with a physical abnormality to participate in competitive sports? Should the athlete be permitted to play if she has a known cardiovascular condition? Spinal abnormality? Nonfunctioning or missing paired organ?

Most litigation arises from athletes who have been medically disqualified by a physician, but who nonetheless possess the necessary physical capabilities to play and who have obtained medical clearance from another physician. Athletic teams are generally able to successfully defend these suits if the athlete's participation creates a significant increased risk of substantial harm to the athlete or other players.

In *Sitomer v. Half Hollow Hills Central School District*, a junior high school student asserted that a school physician negligently evaluated his level of physiological maturity. The physician declared that the student was not sufficiently physically mature to play on the high school tennis team. Because the physician administered a state education department screening test designed to measure physical maturity to play high school sports, the court dismissed this claim. Other right-to-participate claims of athletes alleging denial of constitutional rights have generally been unsuccessful.

Pros of PPEs

The completion of a PPE offers several benefits, including legal and medical ones. Because these examinations help meet legal conditions for their respective institutions, it becomes harder to sue schools and clubs over injuries. In addition, the examination can identify conditions that might adversely affect an athlete during sports participation. The examiner and coach can work together to provide advice on nutrition, warm-up, cool-down, and proper conditioning for the compromised athlete. The examination can raise questions for the primary care physician and thus increase the effective network of healthcare for the athlete.

Preparticipation exams also open venues and relationships to discuss other nonathletic health concerns. The examiner can discuss other concerns, such as seatbelts, drinking, and high-risk behaviors such as unprotected sex. In a study performed in an urban school district, 636 students in grades 9 through 12 were tested for chlamydia and gonorrhea using specimens collected for routine urinalyses during sports physical examinations. Reportedly, the prevalence of chlamydia and gonorrhea was 2.8 percent and 0.7 percent among males, and 6.5 percent and 2.0 percent among females, respectively. Among athletes infected with either sexually transmitted disease, 93.1 percent reported no symptoms, and treatment was documented for 75.9 percent of the athletes. The authors suggested that sports physicals offer a unique opportunity to screen and treat adolescents for sexually transmitted diseases and to provide prevention counseling.

Cons of PPEs

People without primary care may depend on PPEs to fill gaps in healthcare access. Although PPEs provide medical evaluation, often the follow-up is lacking. Furthermore, some states do not require a medical license to perform the examination. Therefore, the athlete could receive subpar care.

Studies continue to cite patient history as the most important part of a medical examination, but many athletes report that history-taking procedures during PPEs are poor, and lack of recall of certain medical facts can

skew the results.[2] Because parents are usually not present during examinations, should physicians rely on a history taken from an adolescent who may be trying to get clearance to play and pursue his or her dreams?

In terms of sudden cardiac death, from 1985 to 1995, a total of 158 cases of sudden death during competition exercise were documented.[3] The Mayo Clinic reported that significant cardiac abnormalities were found in 0.39 percent of 2,739 athletes who were screened.[4] This translates to 2 in 500 children who would be disqualified from sports participation in order to find an illness with an incidence of 1 in 100,000. The result is disqualification for thousands of children who will never have a cardiac problem.

Another study at the University of Maryland in 1987 aimed to identify athletes at risk of sudden death.[5] Of 115 athletes who had a standard PPE, four (3 percent) were suspected of having cardiovascular disease. It is interesting to note that the cardiovascular abnormality responsible for sudden death was correctly identified in *only* one athlete (0.9 percent). The authors concluded that PPEs appeared to be of limited value in identifying underlying cardiovascular abnormalities.

Despite the findings from the previously mentioned study (keep in mind that this is only *one* study), many professionals agree that one of the main goals of a PPE is to examine cardiac function. This fact begs the question: if detection of conditions predisposing athletes to sudden cardiac death is so important, why do examinations not include electrocardiographic studies? Furthermore, if sudden cardiac death is so important to youth sports, why are there no defibrillators at little league ball games? Add to these questions the fact that PPEs often are performed by nonspecialized clinicians expected to detect arrhythmogenic right ventricular dysplasia (a rare heart disease and the leading cause of sudden cardiac sudden death) on the basis of an adolescent's history and a five-minute physical examination.

Athletes have conflicting ideas about the importance of PPEs. One prospective study sought to document high-level athletes' impressions of their PPE using a self-reporting questionnaire.[6] The study was performed with 150 French athletes involved in national- or international-level sports. Participants were normal, healthy, elite athletes with an average age of 22.4 years. All of the examiners were physicians trained and qualified in sports medicine. Thirty-six of the athletes reported a low-quality PPE visit. According to them, medical history taking was "poor," and physical examination was "restricted to blood pressure measurement" and/or "chest listening" and "not targeted enough on past athletic injuries." Of the athletes, 75 percent said that PPEs should especially

evaluate the cardiovascular system, 16 percent said musculoskeletal system, 8 percent said lungs, and 41 percent said the examination should involve an electrocardiogram.

> Will informed consent to participate in sports become contingent on testing for such abnormalities? In other words, if an athlete was not tested for a certain genetic risk factor and thus does not know his or her risk, can he or she truly give informed consent?

Many critics of PPEs declare the examination a waste of time and resources for athletes already receiving primary care. Risser and associates conducted a cost–benefit analysis of PPEs of 763 adolescents.[7] After initial examination, sixteen athletes (2.1 percent) were referred for further evaluation (fifteen of sixteen reported their problems on the history form), two were disqualified, and one was treated. The cost of identifying the three athletes with significant problems was $4,537 per athlete. An additional 163 athletes (21.6 percent) had significant medical problems unrelated to safe sports participation. The authors concluded that PPEs have an unfavorable cost–benefit ratio, even if costs are carefully controlled. One way to combat the costs is to require only those athletes without primary care to undergo a PPE. This possibility, though, gives rise to another ethical question: should PPEs be done only for those athletes without primary healthcare?

DISABLED/HANDICAPPED ATHLETES

The Special Olympics and Paralympics are two separate organizations recognized by the International Olympic Committee. The significant differences between the organizations lie in the disabilities of the participating athletes and levels of sports ability. The Special Olympics involves athletes who are intellectually disabled; the emphasis is on participation and fun rather than high-level competition. Each division offers a fair opportunity to compete with a chance to win. In the 2006 Special Olympics, more than 3,000 athletes from all fifty states met for six days of competition in thirteen different sports. This system is designed to encourage each athlete to do her or his best, while providing a meaningful and enjoyable experience.

The Paralympics, on the other hand, is a highly competitive organization involving athletes from various disability groups (primarily physical disabilities), including spinal cord injured patients, amputees, cerebral palsy patients, and the blind and visually impaired. The Paralympics is the

disabled version of the Olympics. These athletes compete on the *elite* sports level, and any athlete who does not meet qualifying standards may not compete. Athletes in the Paralympics are very serious and play to win.

Who defines a disabled athlete?

Disabled athletes compete in nondisabled events, too. With the onset of scientific development, participation lines are blurring. People with disabilities (e.g., physical or genetic disabilities, as in Down syndrome) continue to delve into sporting activities. With this exciting onslaught of participation, there is a greater inherent risk of injury and uncertainty. One response is to limit the activities of special athletes in the hopes of protecting them. However, special athletes are protected by the Rehabilitation Act and the Americans with Disabilities Act (ADA). Furthermore, any special treatment of athletes lends fire to the debate about the ethics of sports fairness. With this debate come right-to-play decisions and ethics in competition fairness. Both physicians and gaming regulators are facing new and ever-changing guidelines on athletes and competition.

According to the 1990 ADA, an individual is considered to have a "disability" if he or she has a physical or mental impairment that substantially limits one or more major life activities, has a record of such an impairment, or is regarded as having such an impairment. It does not say anything about athletes with prosthetic limbs being prohibited from participating in marathons or athletes in modified wheelchairs not being able to play basketball.

Should mentally disabled athletes be prohibited from participating in dangerous sports? What if they were permitted additional safety equipment—would it then be fair to the athlete? Would it be fair to other players?

In the 1977 case *Kampmeier v. Nyquist*, the Second Circuit ruled that a high school's refusal to permit one-eyed athletes to play contact sports complied with the ADA despite conflicting physician participation recommendations. However, more recently, lower federal courts have expanded the legal rights of athletes with a missing or nonfunctioning paired organ (such as an eye or kidney) to participate in interscholastic and intercollegiate contact sports.

In the case *Southeastern Community College v. Davis*, the U.S. Supreme Court held that an educational institution may require a person to possess "reasonable physical qualifications" to participate in its programs

and activities. Although "mere possession of a handicap is not a permissible ground for assuming an inability to function," a school need "not lower or substantially modify its standards to accommodate a handicapped person." The court went on to state that an individual is "otherwise qualified" if "able to meet all of a program's requirements in spite of his handicap."[8]

Special Olympics, Paralympics, and other competitions are specially designed for disabled athletes. But now, with the development of performance equipment for this group of athletes, there is a move for disabled athletes to compete in general competitions. Should these athletes be permitted to use special equipment to aid performance in competition? What about the case in which the winner gets a substantial reward? Is it fair to favor a disabled athlete? Is this a type of reverse discrimination? What are the legal ramifications of athletes using performance enhancement? Can a losing athlete sue the athletic commission?

Educational institutions must make reasonable accommodations to enable physically impaired athletes to participate in athletic programs. An impaired athlete can become "otherwise qualified" with reasonable accommodations, like medication, monitoring, or protective padding or braces that effectively reduce the risk of injury to himself or others. PPEs can reveal areas where athletes (disabled, handicapped, or otherwise) need special medical considerations.

Special Equipment and Accommodations

Ferrara and Peterson conducted a review of current sport epidemiological studies and concluded that injury patterns for the disabled athletes are similar to those for athletes without disabilities.[9] Overuse injuries remain a problem, as they recur more often than other types of injuries. Proper coaching, maintenance of equipment, proper officiating, and good health supervision can help prevent injuries. Many biomechanics are now designing competitive wheelchairs and other equipment to improve the mechanical efficiency of participants and help reduce the risk of injury. Several questions arise though: Should handicapped athletes be permitted to use special equipment to play organized sports? Does the equipment give the athlete an unfair advantage?

The ADA supports accommodations for disabled or handicapped athletes. It defines a "reasonable accommodation" as any modification or adjustment that will enable a qualified person or with a disability to perform the essential functions of the task. Examples of "reasonable accommodations" in the workplace include making existing facilities readily accessible to and usable by employees with disabilities, restructuring a job description, modifying work schedules, acquiring or modifying

equipment, and reassigning a current employee to a vacant position for which the individual is qualified.

The court case *PGA Tour, Inc. v. Martin* challenged the ADA. The PGA Tour refused to allow Casey Martin, a professional golfer with a circulatory disorder, the use of a golf cart during competition. The PGA argued that the use of a golf cart was against their rules of competition and that walking injected an element of fatigue into championship golf. This decision effectively precluded Martin from playing in PGA tournaments, although his demonstrated golf skills qualified him to participate.

The key issue was whether allowing a golf cart was a modification that would fundamentally alter the nature of the tournament. Because it was undisputed that using a golf cart was a reasonable modification necessary to enable Martin to participate, the U.S. Supreme Court held that this decision was a violation of the ADA. The court ruled that a waiver of the walking rule and an allowance of a golf cart for Martin would not fundamentally alter the nature of professional championship golf. The "essence of the game has been shot-making," according to the court, and the "walking rule . . . is not an essential attribute of the game itself." The Supreme Court recognized that "waiver of an essential rule of competition for anyone would fundamentally alter" PGA tournaments, but concluded that "the walking rule is, at best, peripheral to the nature of petitioner's athletic events, and thus it might be waived in individual cases without working a fundamental alteration." Furthermore, the court acknowledged trial testimony that "Martin easily endures greater fatigue even with a cart than his able-bodied competitors do by walking."[10]

Devices

Wheelchair basketball, rugby, and racing have changed the way wheelchairs are constructed. New prostheses have changed the lives of amputees. Together, high-tech wheelchairs and prostheses enable handicapped athletes to enter sports at every level. The first proponent of running on the Flex-Foot was Dennis Oehler, who set several records in the 100-, 200-, and 400-meter runs at the 1988 Paralympics in Seoul. The record was shortlived and surpassed by later competitors, such as South Africa's Oscar Pistorius, who clocked 21.4 seconds for the 200 meter and 47.34 seconds for the 400 meter. Pistorius' time in the 400 meter surpassed the gold medal winning time in the men's 400-meter event at the 1928 Olympics. At the current rate of improvement, leg amputees may qualify for the 2012 Olympics.

One particular study sought to determine and compare the sound limb versus the prosthetic limbs in five of the world's best unilateral amputee

sprinters.[11] Each sprinter used a different prosthesis that was best suited for his amputation. Subjects were videotaped while sprinting through a performance area. The data revealed that sound limb, hip, and knee movement in all subjects with amputation were comparable with those in able-bodied subjects. Furthermore, prosthetic limb kinematics was similar to those for the sound limb.

Tony Volpentest, an athlete born without hands and feet, was the winner of the men's 100 meters and 200 meters in the Paralympics at Barcelona (1992) and Atlanta (1996). Afterward, he was forced (because of complaints from other athletes) to reduce the height of his prostheses because they increased his stride by making him several inches taller than he would have been naturally.

Although the development of better prostheses brings droves of new athletes into competition, the real new entry is politics. The International Paralympic Committee has stated that it is not against technological developments; however, it is against the financial discrimination that ensues. Availability is an issue because not all countries or athletes can afford the latest technological advancements. In addition, the advent of better devices creates classification issues, thus making it difficult to place people in the proper disability category, which is a big concern at the Paralympics.

Wheelchair basketball. *Photograph courtesy of Ora Seidner and the Beit-Halochem Center, Tel Aviv, Israel.*

Wheelchair advancement in sports. *Photograph courtesy of Ora Seidner and the Beit-Halochem Center, Tel Aviv, Israel.*

The Deaf Olympics also faced some problems. However, the USA Deaf Sports Federation handled them by banning all cochlear implants and hearing aids during game play. In general, people who have cochlear implants are cautioned against contact sports because there is some risk that a blow to the head might damage the casing of the internal device. Manufacturers have also cautioned against scuba diving due to the pressure involved.

Athletes with Predisposition to Injury

With science traveling at the speed of light, research is revealing links between genetics and sex with a predisposition to sports injuries. A multicenter study of ACL knee injuries in women demonstrated a greater-than-expected percentage of injuries during the ovulatory phase (days 10 through 14 of the menstrual cycle) and a lower-than-expected percentage during the luteal phase (day 15 through the end of the cycle).[12] Are we

> As we gain more knowledge in genetic predisposition to diseases or injury, should we use the science to limit participation in sports?

going to start preventing woman from competing during certain times of her menstrual cycle?

Cardiovascular Problems

Most fatalities in child and adolescent athletes are caused by cardiac anomalies, such as: primary hypertrophic cardiomyopathy (36 percent), coronary artery abnormalities (19 percent), and increased heart mass (10 percent).[13] Other conditions include inflammation of the heart, valve problems, irregular heart rhythms, narrowing of arteries, and so on. Important clues to a cardiac abnormality are fainting, chest pain, and family history of sudden death. During a PPE, physicians can evaluate the patient's medical and family history. The physical examination should include resting blood pressure, palpation of radial and femoral pulses, and listening to the heart. Noninvasive testing (e.g., echocardiography and electrocardiography) can enhance the diagnostic power of the standard history and physical examination. In consideration of medical clearance, the American Academy of Pediatrics recommends addressing cardiac problems and dividing sports into contact categories based on risk of injury from collision and categories based on degree of strenuousness.[14]

In *Penny v. Sands*, Anthony Penny alleged that a cardiologist was negligent for withholding medical clearance to play college basketball. The cardiologist diagnosed Penny as having hypertrophic cardiomyopathy, a potentially life-threatening heart condition. Two other cardiologists concurred with this medical opinion. Central Connecticut State University refused to allow Penny to participate in its basketball program for two seasons; however, Penny achieved medical clearance to play competitive basketball from two other cardiologists. While playing in a 1990 professional basketball game in England, Penny collapsed and died suddenly. Penny had voluntarily dismissed his malpractice suit just prior to his death.

Apolipoprotein E4 (ApoE4) Allele

The variability in outcome after an acute head injury is only partly explained by known factors, such as the age of the patient and severity of damage. Relatively little attention has been given to the possibility that there may be genetically determined variation between individuals in both the acute response to brain injury and the capacity for repair and regeneration. A sports neurologist from New York has shown that the E4 allele of the Apolipoprotein (*ApoE4*) gene is a risk factor for chronic brain dysfunction in boxers.[15,16] Other groups have shown that *ApoE4* is also associated with poorer outcome from head injury.

More people who die from head injuries than non-head-injured controls have deposits of amyloid beta-protein in the cerebral cortex, with more deposits present in patients with the *ApoE4* allele. Teasdale and Nicoll devised a clinical study to test the hypothesis that patients with *ApoE4* have a worse clinical outcome six months after head injury than those without *ApoE4*.[17] They studied a series of eighty-nine patients admitted to a neurosurgical unit after a head injury. Of patients with *ApoE4*, 57 percent had an unfavorable outcome (death, vegetative state, or severe disability) compared with 27 percent of patients without *ApoE4*. The authors concluded that patients with *ApoE4* are more than twice as likely as those without *ApoE4* to have an unfavorable outcome six months after head injury.

The idea of screening athletes for genetic disorders or conditions prompts a series of questions:

- The risk in boxing is clear and the *ApoE4* data are robust enough to warrant valid concerns at the present time. Should we now screen our athletes for known genetic markers of adverse (and usually lethal) outcomes from brain injury?
- What does research mean for sports in which head injury is possible? If an athlete who is *ApoE4* positive suffers a concussion, should return-to-play decisions be more carefully considered and conservative?
- How will lawyers deal with information from these new tests? Will insurance companies use the results for the tests to derive risk and ratio factors for adjusting premiums?

Down Syndrome

Athletes with Down syndrome face several possible physical challenges, including spinal problems, ligament laxity, and heart trouble. Spinal problems are due in part to musculoskeletal abnormalities related to a generalized ligament laxity (looseness), thus individuals with Down syndrome are prone to a number of orthopedic problems. Approximately 1 to 7 percent of Down syndrome patients have hip instability. Athletes with Down syndrome may need to be screened for cardiac problems too. A study by Guerra and colleagues revealed that individuals with Down syndrome are prone to heart rate incompetencies.[18]

In a study by Smereczynski of 31 children with Down syndrome, radiographs of the neck revealed eight children (25 percent) with substantial abnormalities.[19] The analysis supported previous findings and indicated that screening for spine anomalies in these patients may be indicated, especially if participation in competitive sports is considered.

In 1995, the Committee on Sports Medicine and Fitness of the American Academy of Pediatrics published a position paper on neck instability in children with Down syndrome.[20] The statement included several arguments that disfavor the screening of children with Down syndrome for spinal instability. However, subsequent analysis of some of these arguments shifted the consensus. Currently, it is recommended that all athletes with Down syndrome be screened for spine abnormalities. In fact, the Special Olympics requires radiographic clearance of the spine for all athletes with Down syndrome.

Marfan Syndrome

Marfan syndrome is a heritable condition that affects the connective tissues, thus resulting in abnormalities of the musculoskeletal system, cardiovascular system, and eyes. The prevalence of Marfan syndrome is 1 in 100,000 individuals from all ethnic groups. The disorder may be inherited or not. In noninherited cases, 30 percent of individuals have a new mutation in the fibrillin gene on chromosome 15.

The primary purpose of connective tissue is to hold the body together and provide a framework for growth and development, so retinal detachment is a possible serious complication. More than half of all people with Marfan syndrome experience dislocation of one or both lenses of the eye.

Most individuals with Marfan syndrome also have problems associated with the heart and blood vessels. The valve between the chambers of the heart may be defective, thus resulting in an abnormal valve motion when the heart beats. In some cases, the valve may leak, creating a heart murmur. Small leaks may not cause any symptoms, but larger ones may result in shortness of breath, fatigue, and a fast or irregular heart rate. Because of faulty connective tissue, the wall of the aorta (the large artery that carries blood from the heart to the rest of the body) may become weakened and stretched. This increases the risk that the aorta will tear or rupture, causing serious heart problems or even sudden death.

Seventy percent of individuals with Marfan syndrome have restrictive lung disease, primarily due to chest muscle abnormalities and/or scoliosis. In addition, because the fibrillin gene is expressed in the lung and is associated with elastic recoil, spontaneous collapse of the lung and early death may be consequences of fibrillin-1 deficiency.

Flo Hyman, a female professional volleyball player, died at the age of thirty-one due to complications of Marfan syndrome. A player on the U.S. National Team, Hyman specialized in the Flying Clutchman, a fast and impacting volleyball spike that traveled at 110 mph. Hyman had many accomplishments during her career, such as winning a gold medal in the

1982 World Championship and a silver medal in the 1984 U.S. Olympics. In 1999, she was ranked sixty-ninth on *Sports Illustrated's* Greatest Woman Athletes of the Century list. Another great athlete, Chris Patton (a basketball player at the University of Maryland), died from undiagnosed Marfan syndrome.

Marfan syndrome is a common, preventable cause of sudden cardiac death in athletes. Taking into account a directed family and personal history, in addition to searching for the characteristic physical stigmata, one can optimize PPE screening for Marfan syndrome in athletes. With these evaluations, Marfan syndrome can be detected early, allowing appropriate treatment and ultimately the possible prevention of sudden death in effected athletes.

Emotional or Psychiatric Disorders

If an athlete is in perfect physical shape, should he or she be allowed to participate in sports? Yes! That is, if the athlete also passes the psychiatric evaluation.

Emotional and psychiatric disorders are becoming an important consideration in the screening of athletes. The publication *Interviewing Principles for the Psychiatrically Aware Sports Medicine Physician*[21] describes how sports medicine physicians can best approach the diagnoses of mental illness in athletes. Things to look for include excessive aggressiveness, emotional instability, personality disorders, depression, and suicidal tendencies.

Excessive aggression in athletes can lead to intentional injuries. Take Mike Tyson, for example, the boxer who bit off a chunk of Evander Holyfield's ear during a match and was subsequently disqualified. Like Tyson, some athletes have a propensity or history of doing malicious harm.

Other disorders can affect an athlete's right to play. In the dispute *Elitt v. USA Hockey*, the national governing body for amateur hockey denied the request for a youth hockey player with attention deficit disorder to have his father or one of his brothers on the ice with him during practices and scrimmages to help keep him focused on the game. In addition, he was denied his request to "play down" with a lower age group.

Neuropsychological testing of an athlete is finding its way into athlete screening. This new field of sport neuropsychology is discussed in more detail in Chapter 15.

AIDS and Hepatitis

Persons with HIV, both symptomatic and asymptomatic, have physical impairments that substantially limit one or more major life activities and therefore are protected by the ADA and the Rehabilitation Act.

In the dispute *School Board of Nassau County, Florida v. Arline*, the U.S. Supreme Court held that, in determining whether an individual is "otherwise qualified," he or she is entitled to an opportunity to have his or her condition evaluated in light of medical evidence. The exclusion of an individual from a particular program or activity must be based on "reasonable medical judgments given the state of medical knowledge." Furthermore, one should consider the nature, duration, probability, and severity of harm likely to result from the physically impaired individual's participation in an activity. The decision held that a person with a contagious disease, who poses no threat to others, is handicapped as defined by Section 504 of the Rehabilitation Act. The *Arline* decision was widely interpreted to include persons with AIDS-related illnesses as handicapped.

> Should athletes with blood-borne diseases, such as HIV and hepatitis, be permitted to play contact sports? If not, what defines a contact sport? Furthermore, who polices the disease testing and game regulations?

Much of society perceives health risks from playing contact sports with an athlete infected with HIV. Despite assurances from medical experts that the risk of HIV transmission during an athletic event is extremely low, it is feared that HIV infection may occur from exposure to an HIV-positive athlete's blood or sweat during a game. However, athletics has not been identified as a source of HIV transmission, as current knowledge indicates that participation in sports carries virtually no risk for HIV transmission. One possible mode of transmission still exists, though. With the increasing use of anabolic steroids in sports, the virus could be transmitted via the sharing of hypodermic needles.

In *Doe v. Woodford County Board of Education*, the Sixth Circuit held that a public high school district's decision to place a member of its junior varsity basketball team on "hold" status pending medical clearance from the player's physician did not violate the Rehabilitation Act. The court observed that one could be excluded from athletics if one's participation posed a direct threat to the health and safety of others. The athlete suffered from hepatitis B, and the Court found that the school district was attempting to determine whether there was a significant risk of transmission of hepatitis B to other athletes. The student's membership on the team was never terminated, and the school district ultimately allowed him to participate fully on the team with no medical restrictions.

Two amateur sports organizations, USA Boxing and USA Wrestling, prohibit HIV-positive athletes from competing. Although neither group requires athletes to take an HIV test, USA Boxing recommends yearly tests for its members. The U.S. Olympic Committee does not have any regulations regarding HIV and does not require disclosure or testing.

Trevis Smith, an HIV-positive Canadian Football League player, rekindled the debate over whether HIV-positive athletes should be barred from competition. Smith, a seven-season veteran of the Saskatchewan Roughriders, was arrested in October 2005 and charged with aggravated sexual assault. At the time of his arrest, Smith disclosed his HIV-positive status to the public. The team officials had been previously aware of Smith's status for about one year; however, privacy laws prevented them from disclosing the information to his teammates.

Earvin "Magic" Johnson won five NBA championships, was named to the NBA All-Star team twelve times, and was the league's MVP three times. In 1991, he shocked the world when he announced that he was HIV positive and would immediately retire. Magic made a second comeback to the league after concerns from several NBA players led him to end his first comeback attempt in 1992. Throughout the late 1990s, Magic continued to make appearances on the basketball court and started his own Magic Johnson Foundation, which helps inner-city communities deal with issues surrounding HIV/AIDS and raises funds for research and prevention efforts.

U.S. Olympic diver Greg Louganis, a six-time world champion and holder of forty-seven national championship titles, cut his head on the diving board during one of his dives at the 1988 Olympics. A physician tended to his injury without wearing gloves. A few years later (1995), Louganis publicly admitted in his book to being homosexual and having HIV. The announcement caused controversy because many felt that he should have declared his HIV status to physicians and those using the pool at the time of his injury.

In 1996, a few days before an upcoming fight, the heavyweight champion boxer, Tommy Morrison, had a mandatory HIV test performed by the Nevada Athletic Commission. The test was positive, and Morrison was automatically retired from boxing as a competitor. When his license was revoked in Nevada, all other states with boxing commissions upheld the indefinite suspension. Morrison is currently seeking a state that will license his proposed comeback; however, it is doubtful that any state will allow him to fight without a battle in court. Reportedly, Morrison is planning to file a lawsuit against the Nevada State Athletic Commission on the grounds of HIV discrimination for refusing to grant him a boxing license and preventing him from making a living as a boxer.

Transgendered Athletes

The debate over transgendered athletes is considered the next big equity issue in athletics. Renee Richards is a physician, professional tennis player, and one of the best-known transgendered athletes in U.S. history. In 1976, the U.S. Tennis Association denied Richards entrance into the U.S. Open. She challenged the ban, and the New York Supreme Court ruled in her favor in 1977, giving her the right to play at the U.S. Open in the women's division.

The IOC enacted new rules in May 2004, allowing transgendered athletes to compete in the Olympics for the first time. To compete, the athletes must have attained legal recognition of their chosen gender, completed genital reconstructive surgery, and undergone at least two years of hormone-replacement treatment. The two-year hormone requirement is intended to remove any size and strength advantage that, for example, a male-to-female transgendered person might have. The NCAA is considering a similar proposal.

> In which division (men or women) should transgendered athletes be permitted to compete? Should they be allowed to use hormone supplements? What if their hormone levels exceed the limit? Could this lead to doping allegations?

Mianne Bagger, an Australian golfer who placed in the top twenty at numerous professional tournaments in Sweden, is considered to be the most well-known beneficiary of the policy. Others, such as Canadian transgendered cyclists Michelle Dumaresq and Kristen Worley, made headlines when they fought to compete as women in international competitions. Michelle Dumares broke new ground for transgendered athletes by becoming the Canadian national champion in women's downhill mountain biking. Canadian cyclist and 2008 Olympic hopeful Kristen Worley hopes to compete in the Beijing Olympic Games.

Alyn Libman was constantly told she skated like a boy because of her aggressive style. Instead of changing her style, she changed her gender. Libman has taken male hormones since 2002, identifies as a male, and has received permission from U.S. Figure Skating, the sport's governing body, to compete against other men in the sport.

Opponents of the new Olympic policy on transsexuals believe that allowing some athletes to take hormones during a crackdown on performance-enhancing steroids is confusing. But Patrick Schamasch, the Olympic committee medical director, said transsexuals will be tested like everyone else for normal hormone levels.

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CHAPTER 9

Issue: Are Sports Too Aggressive and Violent?

Some would argue that without aggression there is no such thing as sports. Some believe that aggression confers a competitive edge, and aggressive behavior is inherent to life in the animal kingdom. Just ask anyone who has been called an "animal on the field."

Aggression can be defined as "the infliction of an aversive stimulus, physical, verbal, or gestural, upon one person by another. Aggression is not an attitude, but behavior and, most critically, it is committed with the *intent* to injure."[1] In another definition, aggression refers "to assertive, forceful, but constructive behavior synonymous with self-directed attempts to achieve personal or group goals."[2]

Some scholars think that aggressive people do not intentionally injure or harm themselves or others but instead attempt to control their environment and the resulting outcome. Most folks would agree that aggression and violence are not the same. Violent behavior is "conscious, usually premeditated (but at times impulsive) acts designed to injure."[3]

In 1997, the International Society of Sport Psychology (ISSP) issued a position stand on aggression and violence in sports.[4] The objective of this publication was to point out potential dangers of aggression in sports and to provide recommendations to reduce its incidence. In addition, the statement generalizes the definition of aggression to include both sports participants and spectators. Since the release of this statement, the topic has been hotly debated. Currently, there are several publications either supporting or contradicting the statement.

Rascle and associates examined the relationship of goal orientations with aggression in male adolescent handball.[5] Thirty handball games

were videotaped and observed on a monitor by means of a grid allowing the distinction between "Instrumental" (non-emotional and task oriented) and "Hostile" (an emotional response that is an end in itself) aggression. A total of 240 players also completed a questionnaire on their perception of success in sports. The authors compared differences among athletes in physical education, intercollegiate athletics, and leagues. Analyses indicated that ego–goal orientation and instrumental aggression were significantly higher in the league athletes than in the other two types. Statistically significant positive correlations between measures of ego and aggression were observed, and further analysis indicated that strongly ego–goal classified players displayed more instrumental aggression than lower ego–goal classified players did.

Violent and aggressive behaviors have become common in a large variety of sports. The antecedents and consequences of such behaviors are outlined in the position statement issued by the ISSP.[6] The ISSP recommends several actions be taken to minimize such acts in sports and encourages education of young athletes in line with fair-play ethics.

In sports, overly aggressive behavior is prohibited and penalized. But what constitutes *overly aggressive*? Although the definition of aggression is debatable, one thing remains true—aggression in sports will look different at different points in time and in different age groups.

An estimated 2.7 million nonfatal, unintentional sports and recreational injuries are treated in U.S. emergency rooms each year. However, little is known about the number of sports and recreational injuries that actually result from violent behavior. One study addressed the rates of violent injuries among U.S. children and teenagers from 2001 to 2003.[7] Data were obtained from the National Electronic Injury Surveillance System All Injury Program, a national sample of sixty-six U.S. emergency rooms. During the study period, an estimated 6,705 (8.3 per 100,000) children and teenagers had violence-related sports and recreational injuries. Violent behavior accounted for 0.25 percent of those injuries. Children age ten to fourteen years had the highest incidence rate (13.6 per 100,000). A majority of those with violence-related injuries suffered head/neck trauma, of which 24.1 percent were traumatic brain injuries. The most violent injuries resulted from being pushed or hit (65.6 percent). Furthermore, the most common sports and recreational injuries varied with age:

- For children under nine years old, the playground accounted for 65.2 percent of injuries

- For children ten to fourteen years old, bicycling accounted for 26.7 percent of injuries
- For teens fifteen to nineteen years, basketball accounted for 45.3 percent of injuries

Science of Aggression

The drive for competition and success is as much biochemical as it is psychological. During competition or fights, several biochemicals are released in the body (e.g., adrenaline) to "rev up" the body even more.

Serotonin is another player in the biochemical game of aggression. Serotonin is normally broken down in the body by the two enzymes catechol-O-methyltransferase (COMT) and monoamine oxidase (MAO). Low MAO activity has been found in subjects with aggressive and violent traits, as well as in imprisoned violent offenders. In other studies, male mice that have either the COMT or the MAO gene show more aggression.

In most species, males are more aggressive than females primarily because males have more testosterone. Testosterone is a steroid hormone secreted principally in the testes of males and somewhat in the ovaries of females (small amounts are also secreted by the adrenal glands). The amount of testosterone in the body influences the degree of aggressive behavior. One study sought to correlate testosterone levels with fighting in males participating in judo contests.[8] In this study, twenty-eight fighters were videotaped during a judo fight. The video was used to analyze any relationship to serum testosterone measured before and after the bouts. A positive relation between testosterone and offensive behaviors showed that the greater the hormone level, the greater the number of threats, fights, and attacks.

> Should science screen individuals who are more prone to violence, perhaps using MAO levels or by treating those who show excessive aggression with drugs to reverse it?

Compounds that mimic testosterone (such as anabolic steroids) can also increase aggression in individuals. It is argued that athletes who consume these compounds gain a competitive edge because of their increased aggression and not necessarily because of the increase in lean muscle mass they also experience. Athletes also partake of other aggression-inducing substances, such as caffeine, nicotine, amphetamines, ephedrine,

and other pyschostimulants. Alcohol consumption enhances aggression and is thought to play a great part in spectator aggression and violence.

Should drugs that increase violence be banned, like steroids?

In addition, predisposing health conditions can lead to overly aggressive behavior, including the following:

- **Bipolar disorder:** During manic episodes athletes may lose control of strong feelings and thus aggression can go unchecked.
- **Attention deficit disorder:** Individuals with this disorder may lack interpersonal skills or impulse control.
- **Personality disorders:** By definition, individuals with personality disorders are inclined to impulsive acts of physical aggression and violent outbursts. Narcissistic personality disorder is considered to be an occupational risk in athletes. The super-athlete lifestyle promotes an elitist outlook that can lead to athletes concealing inner insecurities and feelings of incompetence. These feelings can brew and later result in raging outbursts.

Game Aggression and Violence

Research shows that fans like aggression and violence in their sports. They like to watch the taunting and trash-talking, the overly assertive plays, and the always-popular brawls. Physically aggressive acts, such blocking in football, tackling in rugby, and body checking in ice hockey, despite being executed within the rules of the game and without intent to injure, can nonetheless be ferociously violent actions.

Players get into the aggression and violence, too. Research indicates that the amount of physical contact in competition can affect aggression. Any perception of pain can heighten aggression, and several studies have suggested that anger elicits an instigation to inflict injury. Violence begets violence. Remember the old adage: better to hit than to be hit. However, there is good evidence that noninsulting aversive events also create a desire to hurt someone.

Two experiments were designed to demonstrate that painful environmental conditions evoke aggressive inclinations to do harm even when the receiving person is not responsible for the suffering.[9] In both studies, women kept one hand in a tank of water that was either painfully cold or much warmer while they delivered rewards and punishments to another

woman. A woman with a hand in the cold water was more likely do harm to the other woman. The authors concluded that the aversive stimulation evoked an instigation to do harm.

Game frustration and the emotions of losing can drive athletes to injure opposing team members. In *Hackbart v. Cincinnati Bengals, Inc.*, Charles Clark, a running back for the Bengals, admitted that he had deliberately struck defensive back Dale Hackbart out of frustration because the Bengals were losing. Despite the injury, Hackbart remained in the game. He played two more games before the team physician discovered that he had a neck fracture.

> Should there be more stringent regulation on aggression and violence in games? And what about stricter consequences and penalties? Does sanctioning aggression in a competition actually go against the spirit of competition?

The McSorley/Brashear incident mimics the Hackbart story. Boston Bruin Marty McSorley struck Vancouver Canuck Donald Brashear in the face with a hockey stick. Brashear fell and hit the back of his head on the ice, causing a grade 3 concussion and a grand mal seizure.

The Neal Goss incident demonstrates how game aggression can escalate to violence. Goss, a fifteen-year-old hockey player, was struck from behind as he skated back to the bench after the final buzzer had sounded. Goss slid headfirst across the ice, slammed into the wooden boards, and severed his spinal cord. The perpetrator was charged with two counts of aggravated battery. Interestingly, though, if Neal had been injured by a sanctioned or legitimate act of violence within the rules of the game, his injuries may have been the same, but the player who carried out the act may have been immune from prosecution.

Aggressive behavior can be learned through modeling and reinforced by rewards and punishments. According to Terry and Jackson (1985), reinforcement for acts of violence may come from three sources:[10]

1. The athlete's immediate reference group: coaches, teammates, family, and friends
2. Structure of the game and implementation of rules by officials and governing bodies
3. Attitudes of fans, media, courts, and society

Reinforcement may take the form of rewards, such as praise, trophies, earning a starting position, and respect of friends and family.

Reinforcements can be achieved vicariously, too. These rewards arise from seeing professional players lionized and paid huge salaries, in spite of, or because of, their aggressive style of play. Conversely, players not displaying enough aggressiveness may receive negative reinforcement through criticism from parents and coaches, lack of playing time, and harassment by teammates, opponents, or spectators.

Having a sports medicine physician onsite during competition can help ensure proper treatment of sports injuries. However, does the presence of a sports medicine physician affect the amount of violence in a competition? Does the presence of a sports physician actually enable dangerous behavior? Do athletes have a false sense of security when a physician is nearby, and do they tend to play more aggressively?

Spectator Aggression

Spectator aggression is another component of sports medicine. Impassioned fans sometimes verbally abuse or throw things at the opposing team or athletes. This sort of misbehavior often leads to mob behavior. A mob of spectators on the loose can break through restraining barriers, rush the field, tear down goalposts or attack the athletes and officials. Alcohol may fuel these fires, and physical factors such as heat, noise, and crowding may fan the flames. These factors alone do not cause aggression, but rather they facilitate it.

Should the media stop showing acts of aggression during games?

Some believe that the media exploits the desire for violence. Often, overcoverage of violent plays leads to sensationalism. Many times a network promotes an upcoming sporting event by using past violent acts seen in previous competitions to encourage spectators to watch. Other proof of media involvement can be found in most sports magazines, which feature articles that glorify game violence.

Considerable research has been done on spectator violence. A central issue is whether fans incite player violence or reflect it. Although the evidence is inconclusive, researchers agree that spectators take cues from players, coaches, cheerleaders, and one another. Spectators often derive a sense of social identity and self-esteem from a team. Likewise, group solidarity with players and coaches leads spectators to view opposing teams as enemies and to foster hostility toward opposing supporters, geographical locales, ethnic groups, and perceived social classes.

Aggression Off the Field

Many athletes are unable to leave the aggression on the field. One such example is boxer Mike Tyson, who was indicted for ear biting inside the ring and was also convicted of rape outside the ring. Several hockey and football players have been in court for sexual assault, fighting, and destruction of property. Often, there is involvement of alcohol or drugs. Indeed, a survey of 200 college police departments showed that assaults by athletes were reported on the average once every eighteen days. Unfortunately, such reports create the image of athletes as belligerent drunks and drug addicts.

Cases and statistics reflecting off-field aggression seem compelling but may distort the true picture. The media tend to give greater coverage to criminal acts by people who are well known. On the other hand, the media sometimes play down the misbehavior of celebrities in order to protect them.

Rarely do the media report comparative statistics for crime rates in athletes and nonathletes. In fact, one study revealed that for male university students who participated differentially in college sports there was no significant relationship between sport involvement and either rape-supportive attitudes or aggressive sexual experiences. Although sexual aggression was predicted by competitiveness, it was not connected directly to athletic participation per se.

Roid Rage

Adverse physical effects associated with steroid abuse are well documented, but more recently, the adverse psychiatric effects of these compounds are gaining attention. Significant psychiatric symptoms include aggression and violence, mania, and less frequently psychosis and suicide. *Roid rage* is a popular term for the violence and aggression put forth by steroid users.

Research shows that users describe being significantly less in control of their aggression than the study control population.[11] Many users recount feeling good about themselves while on anabolic steroids, but report that extreme mood swings can occur and include manic-like symptoms leading to violence. Users may suffer from paranoid jealousy, extreme irritability, delusions, and impaired judgment stemming from feelings of invincibility. When the drugs are stopped, depression often becomes a problem and may contribute to dependence.

There have been numerous case studies and press reports of individuals committing acts of extreme violence after taking large doses of anabolic steroids. People with no record for violence have been known to commit

murder and other violent crimes. In an article describing homicide and near-homicide by anabolic steroid users, the authors discuss three men who lacked any psychiatric history, such as evidence of antisocial personality disorder or any history of violence.[12] These men impulsively committed violent crimes, including murder, while taking anabolic steroids. Psychiatric interviews of each man suggested that steroids played a necessary, if not primary, role in the etiology of the violent behavior. Although the men might have exaggerated their reports of the effects of steroids in the hopes of improving their legal positions, information from external sources consistently corroborated their accounts in each case.

> Does steroid use cause aggression, or are aggressive individuals attracted to steroid use?

One particular young athlete recounted his experience with steroid use. He began taking steroids at the age of thirteen, and after taking them for six months, he was so full of anger he said he could have played a seven-day football game and still would not have worked out all of his anger.[13] By the time he was a senior in high school, he had become so hostile and aggressive that he did not just want to tackle everyone, but admittedly, wanted to take their heads off.

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CHAPTER 10

Issue: Performance Enhancement

Doping—the word itself immediately stirs up controversy. In fact, this is the most debated word in the field of sports medicine. Performance enhancement issues are shrouded in questions such as: Is doping in sports within the ethics of fairness? Is doping in sports within the spirit of competition? Should doping be permitted in children or adolescents?

Performance enhancement comes in many shapes and sizes, from anabolic steroids to hypnosis. Regardless of the means, the results are questionable. Well—actually, many of the means themselves are questionable too.

ANABOLIC STEROIDS

Ancient texts reveal that Greek Olympians ate sheep testicles. Today, we recognize this act as a source of testosterone. Steroids are a class of drugs similar to testosterone. They can have anabolic (muscle-building) and androgenic (increased masculine characteristics) effects. Their use involves three administration techniques: cycling, stacking, and pyramiding. Anabolic steroids are taken typically in cycles of weeks or months, rather than continuously (referred to as cycling). In addition, users often combine several types of steroids to maximize effectiveness while minimizing negative effects (referred to as stacking). In cyclic dosage regimens, a practice called pyramiding is used. At the beginning of a cycle, a person begins with low doses of the stacked substances and gradually increases the doses for six to twelve weeks. Abusers believe that pyramiding allows the body time to adjust to the higher doses.

Steroids are legally available in the U.S. only by prescription. Anabolic steroid abusers obtain steroids through magazine ads, other athletes, gyms, and occasionally by prescription from a physician. Steroids obtained through the black market or from clandestine laboratories and foreign sources often lack quality and purity, may contain unknown or inappropriate ingredients, and are often manufactured in nonsterile facilities.

In contrast to steroidal supplements, supplements such as dehydroepiandrosterone (DHEA) and androstenedione (street name Andro) can be purchased legally without a prescription through many commercial sources, including health food and vitamin stores. However, there is little evidence to support their effectiveness.

Steroids have many known and undesirable medical risks, including liver tumors and cancer, jaundice, fluid retention, high blood pressure, increase in LDL cholesterol (bad cholesterol), and decreases in HDL (good cholesterol). Other side effects include kidney tumors, severe acne, and trembling.

One possible side effect in adolescents is premature growth halt due to premature maturation of the skeleton and accelerated puberty changes. This means that adolescents risk stunting their growth for the remainder of their lives if they take anabolic steroids before the typical adolescent growth spurt. In addition, there are some gender-specific side effects:

- For men: shrinking of the testicles, reduced sperm count, infertility, baldness, development of breasts, and increased risk for prostate cancer.
- For women: growth of facial hair, baldness, changes in or cessation of the menstrual cycle, enlargement of the clitoris, and a deepened voice.

Steroid use can result in psychological and personality changes. Researchers report that extreme mood swings can occur, including manic-like symptoms, paranoid jealousy, extreme irritability, delusions, and impaired judgment. When the drugs are stopped, depression often becomes a problem and may contribute to drug dependence.

People who share needles or use nonsterile injection techniques put themselves at risk. The black market dealers who distribute these drugs have been known to resell used needles. Use of such needles or sharing of needles increases the chances for a steroid user to contract the HIV, hepatitis B and C viruses, and bacterial infections.

Research also indicates that some users might turn to other drugs to alleviate some of the negative effects of anabolic steroids. In one study, among 227 men admitted to a private treatment center for dependence on

heroin or other opioids, 9.3 percent had abused anabolic steroids before trying any other illicit drug. Of these men, 86 percent first used opioids to counteract insomnia and irritability resulting from the anabolic steroids.

Jose Conseco, in his 2005 book *Juiced*, named several players, including Mark McGwire, as steroid users. Conseco himself mixed, matched, and experimented with steroids to such a degree that he became known throughout the league as the Chemist. He passed his knowledge on to trainers and fellow players. Before long, steroids were rampant, and baseball would never be the same.

> Are people so dubious of true athletic genius that they are too quick to accuse athletes of doping to explain performance? Are we endorsing doping scandals regardless of whether they are legitimate, or false and malicious?

Steroid use in athletes is a common problem. Baseball commissioner Bud Selig appointed former Senator George Mitchell to lead a 2006 investigation of steroid charges (mainly against Barry Bonds) brought by revelations in the BALCO (Bay Area Laboratory Co-Operative) trials. Bonds was strongly suspected of taking illegal steroids, although he denied it before a grand jury in 2003.

Steroid use has ethical considerations in the sense of competitive fairness. In one study, 185 undergraduates were asked about the fairness involved with the use of performance-enhancing drugs. They felt it was less unfair to allow the drug if it affected the bottom 10 percent than if it affected everyone, and they were more eager to have the drug banned if it affected everyone. Participants were least tolerant of drugs that affected athletic performance and most tolerant of those that affected attention.

A physician's decision to promote steroids is not an ethical question, though. It is a legal one. Many sports-governing bodies and various state legislatures have outlawed steroid use, and physicians are bound by these rulings. Steroids can be deleterious to health, and in addition to causing serious physical and mental problems, steroid use can cost anywhere from $50 to $600 a month.

Gene Doping

Yet another team of researchers is looking to use gene therapy (also known as gene doping) to enhance athletic performance. Gene therapies developed for the treatment of diseases, such as anemia, muscular dystrophy,

and peripheral vascular diseases, are potential gene doping approaches. These new biological approaches also focus on the treatment of injuries with growth factors to stimulate and hasten the healing process. Tissue engineering combined with gene therapy may potentially result in the creation of tissues or scaffolds for regeneration of tissue defects following trauma.

Blood Doping

During exercise, the body requires more oxygen than when at rest. Red blood cells carry oxygen; so many athletes increase their amount of red blood cells by training at high altitudes. The decreased levels of oxygen at higher altitudes drive the body to produce more red blood cells in order to compensate. After training under these conditions, the athlete acquires a greater capacity for carrying oxygen in the blood. When the athlete then competes at lower altitudes, he or she can have double the capacity to carry oxygen and thus less fatigue compared with competitors.

Athletes can increase their amounts of red blood cells in artificial ways, too. Blood doping is one such way and an ever-increasing problem in sports. It involves either a blood transfusion of red blood cells or administration of the drug erythropoietin, which pharmacologically increases red blood cell mass. Blood doping improves an athlete's ability to perform endurance exercise and reduces physiological strain.

One study examined the prevalence of abnormal blood profiles in elite cross-country skiers and indicated a high probability of blood doping.[1] Samples were obtained as part of routine International Ski Federation blood testing procedure from participants at the World Ski Championships. Of the skiers who were tested and who finished within the top fifty places in the competitions, 17 percent had "highly abnormal" blood profiles, 19 percent had "abnormal" values, and 64 percent were normal. Fifty percent of medal winners and 33 percent of those finishing from fourth to tenth place had highly abnormal blood profiles. In contrast, only 3 percent of skiers finishing from forty-first to fiftieth place had highly abnormal values. The authors concluded that blood doping is both prevalent and effective in cross-country ski racing, and that current testing programs for blood doping are ineffective.

The search for artificial blood has focused on two classes of substances: modified hemoglobin solutions and perfluorocarbon emulsions. Perfluorocarbons are synthetic molecules that are biologically inert, yet capable of dissolving oxygen. These agents can deliver oxygen to the

cells in the body but cannot perform the other important function of hemoglobin—the binding of carbon dioxide and removal of it from the body. Because elite athletes have a historical propensity to experiment with novel doping strategies, it is likely that the growing field of artificial oxygen carriers has already attracted attention.

Scientific data concerning the performance benefits associated with blood substitutes are virtually nonexistent; however, international sporting federations have been proactive in adding this category to the banned substance lists. Currently, there is still no accepted methodology to test for the presence of artificial oxygen carriers.

Athletes must carefully weigh the decision to experiment with blood doping. This procedure is associated with health risks amplified by dehydration and environmental stress. In addition, it is the position of the American College of Sports Medicine that any blood doping procedure used in an attempt to improve athletic performance is unethical and unfair.[2]

Growth Hormone

Growth hormone makes up about 10 percent of the dry weight of the pituitary gland and appears to affect growth of nearly every organ and tissue in the body. Athletes are turning to growth hormone because they believe that it can provide many of the benefits of anabolic steroids while being difficult to detect. They use growth hormone to increase their size and strength or height (depending on age).

No studies have proved any short-term effects of growth hormone use. In addition, because it is an injectable drug, there are added risks of HIV and hepatitis infection as a result of sharing needles and syringes. Furthermore, it is estimated that the amount of growth hormone needed for a performance-enhancing effect would cost between $1,000 and $1,500 for an eight-week supply—a considerable amount of money for unpredictable results.

Stimulants

Stimulants may be used to reduce tiredness and increase alertness, competitiveness, and aggression. They are more likely to be used in competition but may be used during training to increase the intensity of the training session. Several major categories of stimulants include amphetamines, caffeine, and cocaine.

The first Olympic death attributed to doping occurred at the 1960 Summer Olympic Games in Italy. During the cycling road race, Danish

cycler Knut Enemark Jensen fell from his bicycle, fractured his skull, and later died. A coroners report declared that he was under the influence of amphetamines. His death would lead the IOC to form a medical commission to institute drug testing at the 1968 Olympics.

A new stimulant, bromantan, made its first appearance at the 1996 Olympic Games in Atlanta. This novel agent was found in urine samples of five Olympic athletes. Athletes use bromantan to strengthen their immune system to combat heat and humidity. In addition, this drug can mask the presence of other drugs.

Amphetamines

Amphetamines stimulate the central nervous system and induce a fight-or-flight response. Because of the stimulatory effects, it is hypothesized that these drugs may enhance all types of performance.

Amphetamines increase arousal, which might increase rates of breathing and air exchange in the lungs. Amphetamines bind to adrenergic receptors and exert effects such as increased blood pressure, heart rate, and metabolic rate. In addition, they increase the plasma-free fatty acid concentration in healthy subjects, thus providing fuel for muscles and sparing muscle glycogen, thereby delaying the onset of muscle fatigue.

Chandler and Blair (1980) compared the effects of amphetamines and placebo in six recreationally trained athletes. They noted significant improvements in knee extension strength, sprint acceleration, and anaerobic capacity. Time to exhaustion and maximal heart rate were increased after amphetamine administration. However, amphetamines may not actually delay fatigue, but rather mask its effects as previously shown in experiments conducted on soldiers in the battlefield.

> What about athletes with ADHD in which treatment involves amphetamines? Should athletes be forced to abstain from this medication in order to compete? If yes, is this a form of discrimination?

Amphetamines are prohibited during competition, yet athletes with attention deficit hyperactivity disorder (ADHD) often require these banned medications as treatment. In sports competition, this situation is controversial. Although there are problems with their amphetamines insofar as the IOC is concerned, it seems unfair to penalize people with ADHD by making them give up their medication, even for a few days, in order to compete.

Caffeine

Caffeine is present in coffee, soft drinks, and many nonprescription drugs. It is one of a few substances with documented efficiency and minimal side effects. It affects signaling in cells and increases production of chemicals that allow the body to adapt to the stress created by physical exercise. Caffeine significantly increases ventilation at rest, lengthens task endurance time, and reduces perception of fatigue. Like amphetamines, caffeine mobilizes fat and helps to preserve glycogen stores in muscle. By stimulating the central nervous system, acting as a diuretic, and producing metabolic and cardiac effects, caffeine improves physical performance and endurance during prolonged physical activity.

Stuart and colleagues investigated the effects of caffeine in a performance test simulating physical and skill demands of a rugby game.[3] The study included nine competitive male rugby players who consumed either caffeine (6 milligrams per kilogram of body weight) or placebo seventy minutes before performing a rugby test. Each test consisted of seven circuits, and each circuit included stations for measurement of sprint, power generation, and accuracy in passing balls rapidly. Caffeine produced a 51 percent increase in mean epinephrine (adrenaline) concentration. In addition, physical enhancements in the rugby players were mediated partly through a reduction of fatigue and partly by enhanced performance. The authors concluded that caffeine is likely to produce substantial enhancement of several aspects of high-intensity team-sport performance.

Cocaine

Cocaine has two main pharmacological actions. It is both a local painkiller and a central nervous system stimulant and is the only drug known to possess both of these properties. As a stimulant, cocaine affects a number of neurotransmitter systems. With continued escalating use of cocaine, the user becomes progressively tolerant to the positive effects whereas the negative effects steadily intensify. Few studies suggest that performance gains are incurred from cocaine use. The sense of euphoria may provide the illusion of better performance when, in actuality, performance is not improved, but maybe even impaired.

PAINKILLERS

Pain is the body's way of signaling injury. Chances are good that more pain equals worse injury. By consuming narcotics, the athlete can mask the pain and continue to play, thus placing the athlete in great jeopardy with respect to tissue overload and failure. One study examined the attitudes of

student athletes toward the use of painkilling drugs.[4] Of 563 student athletes at two Division I NCAA universities, 29 percent responded that there was nothing wrong with using painkilling drugs on the day of competition (when injured) to cope with pain.

Cyclo-oxygenase-2-specific inhibitors are emerging as primary treatment for sports injuries because of their analgesic and anti-inflammatory effects. Specifically, they decrease excessive inflammation and the pain associated with inflammation. The overall effect produces less swelling, leading to better healing.

Beta-adrenergic Agents

Beta Blockers

Various cells in the body express beta-adrenergic receptors on their surface. Beta-adrenergic blocking agents (beta-blocking agents, or more commonly, beta blockers) block these receptors and are used in the treatment of high blood pressure. Beta blockers work by affecting the response to some nerve impulses in certain parts of the body. As a result, they decrease the heart's need for blood and oxygen, thereby reducing its workload. They also help the heart to beat more regularly.

Beta blockers can reduce heart rate and tremors and improve performance in sports that are not physiologically challenging but require accuracy (e.g., pistol shooting). However, beta blockers may work so well that they can actually impair aerobic performance by slowing down the heart too much.

> What about when the athlete has a true medical condition? Should that athlete be penalized for taking a prescription medication?

Beta-2 Agonist

Other agents can activate beta-adrenergic receptors and produce a stimulant-like effect in the body. Short-acting beta-2 agonists (also called quick acting or rescue medications) relieve asthma symptoms very quickly by immediately opening the airways. Long-acting forms provide control, not quick relief.

Beta-2 agonists can act as both stimulants and anabolic agents. Several studies have shown that these drugs increase skeletal muscle mass or function. Clenbuterol is often mistaken in the popular media as a steroid, although in fact it is classified as a beta-2 agonist.

In a study of clenbuterol, muscle strength and cross-sectional area were examined both before and after surgery in twenty healthy men.[5] The results suggested that clenbuterol treatment was associated with a more rapid rehabilitation of strength in knee extensor muscles. However, the precise mechanism of action of the clenbuterol-mediated growth-stimulating effect is not clear.

Regulation and Testing of Substances

In the mid-1960s, sports federations banned doping, and the IOC followed suit in 1967. In the late 1990s, the IOC took initiative in a more organized battle against doping and formed the WADA in 1999 (see Table 10.1). Regulation of substances is particularly challenging because different countries have different rules. For example, in France, creatine is a banned substance, whereas in the United States it is not. Ephedra regulation varies across nations as well.

The incentives to win are enough to drive athletes to misuse performance enhancers, especially ones undetectable by standard measures. Some

Table 10.1 The WADA 2006 Prohibited List

Substances and methods prohibited at all times
Anabolic agents
Hormones and related substances
Beta-2 agonists
Agents with anti-estrogen activity
Diuretics and other masking agents
Enhancement of oxygen transfer
Chemical and physical manipulation (tampering with samples)
Gene doping
Substances and methods prohibited in competition
Stimulants
Narcotics
Cannabinoids (e.g., hashish, marijuana)
Glucocorticosteroids (except topical application)
Substances prohibited in particular sports
Alcohol (archery, automobile racing, billiards, karate, motorcycling, powerboating, events involving shooting, etc.)
Beta-blockers (archery, billiards, chess, gymnastics, shooting, skiing, wrestling, etc.)

Note: See Section Three for complete list.

Table 10.2 Drug Elimination from the Urine

Drug	Approximate Elimination Time
Stimulant (e.g., amphetamines)	1–7 days
Cocaine	
Occasional use	6–12 hours
Repeated use (within 48 hours)	3–5 days
Codeine and narcotics in cough remedies	24–48 hours
Tranquilizers	4–8 days
Marijuana	3–5 weeks
Anabolic steroids	
Injectable type	6–8 months
Oral type	3–6 weeks
Ephedrine in OTC cold medications	48–72 hours

research teams are on the hunt for better drugs that are more effective, less toxic, and less detectable. Other research teams are trying to design better tests that detect more drugs (at lower levels), cost less, are easy to use and read, and have fewer false-positive results.

Testing techniques typically consist of a screening test followed by a confirmation test. These tests are generally conducted using the athlete's urine, but different drugs remain in the urine for varying lengths of time (see Table 10.2). Athletes will closely time their doping in order to pass a drug screening.

Two samples are taken for the drug test: Sample A and Sample B. The initial testing uses Sample A. Sample B is stored for secondary testing as needed. In the case of a failing Sample A, the B sample will be used to either clear or confirm the doping allegations.

Hair analysis has been accepted in various court cases and is emerging in doping control for sports. It may be a useful adjunct to conventional drug testing in sports because hair can provide a more accurate history of drug use than urine. Hair testing can confirm repetitive abuse and identify the exact nature of the parent compound.

Problems arise with doping accusations when the athlete has a medical condition warranting a particular drug. For example, in the 2003 World Track and Field Championships, Kelli White won a rare sprint double. After her 100-meter victory, she tested positive for modafinil (a drug generally prescribed to treat narcolepsy and sometimes off-label for ADHD). This sprinter later informed the International Association of Athletic Federations (IAAF) that she was prescribed modafinil for the treatment of narcolepsy and that she has a positive family history of this illness. The

IAAF reviewed her case and felt that modafinil fell under the umbrella of substances related to stimulants. They did not accept her explanation and referred the case onward. Athletes treated with amphetamines for ADHD are faced with similar charges. How should one verify an alleged medical diagnosis?

BALCO Investigation

The Bay Area Laboratory Co-Operative (BALCO) was a California-based medical lab that specialized in testing athletes for nutritional levels. BALCO sold sophisticated blood- and urine-testing services to athletes, while the company's subsidiary (SNAC, or Scientific Nutrition for Advanced Conditioning) offered an array of supplements, including popular zinc and magnesium products. BALCO and SNAC boasted a client list that included scores of elite athletes, including Giants slugger Barry Bonds, Raiders linebacker Bill Romanowski, and other star athletes from football and track and field.

Victor Conte was the founder and owner of BALCO. In 1988, he provided free testing and supplements for a group he called BALCO Olympians. In June 2003, the U.S. Anti-Doping Agency (USADA) received an anonymous phone call from a man who said he was a high-profile track and field coach. The anonymous caller named athletes he believed to be using an undetectable steroid. He cited Conte as the source of the drug and offered as evidence a used syringe with the substance in it. This new drug was named tetrahydrogestrinone (THG) and was closely related to the steroids gestrinone and trenbolone yet was altered slightly to avoid detection.

In September 2003, officials from the IRS, the FDA, the San Mateo Narcotics Task Force, and the USADA raided BALCO. They reportedly found lists of athlete clients and an off-site storage facility harboring containers with labels that indicated contents such as steroids and human growth hormone.

A month and a half later, the anti-doping agency announced another element of the major doping scandal. Terry Madden, head of the organization, told of the anonymous tipster and the designer steroid, and he named Conte and BALCO as the source of the drug. Quickly following the announcement, names of athletes who had tested positive for THG leaked out. Although the outreach was global, the scandal cut deepest in Major League Baseball. The sport announced that 5 percent to 7 percent of its 1,200 players tested positive for steroids that year despite advance warning of testing.

Barry Bonds's childhood friend and personal trainer, Greg Anderson, became a target of the investigation. Two days after BALCO was raided, federal agents broke down the door of Anderson's condominium and reportedly seized steroids, $60,000 in cash, and documents with the names of athletes and details of their use of performance-enhancing drugs.

In July 2005, federal prosecutors announced that they had dropped forty counts of a forty-two-count indictment against the men accused of providing the drugs to the elite athletes. In exchange, the men pleaded guilty to felony charges that left them with relatively brief prison terms or no jail time at all.

In August 2006, a federal judge sentenced Patrick Arnold, an executive with a nutritional supplements laboratory, to three months in prison and three months of house arrest. Arnold was indicted on steroid conspiracy and drug misbranding charges for distributing three different steroid-like substances that had been synthesized to be undetectable on doping tests. The most famous doping agent was "the clear" (THG), which the government says BALCO provided to elite athletes.

Arnold won fame in 1998 as the marketer of Andro, a legal steroid-like substance that St. Louis Cardinals star Mark McGwire was using when he broke the single-season record for homeruns. Initially, Arnold synthesized a long-forgotten steroid called norbolethone, originally created in the 1960s by Wyeth Laboratories in Philadelphia to treat children with growth problems. Norbolethone had never been manufactured due to potential toxic effects. Arnold learned of the drug from a pharmacology textbook and synthesized it, believing it would never be detected in drug tests. Arnold was also accused of synthesizing a third designer steroid called DMT, or Madol.

SURGERY

Tommy John Surgery

Physicians call it UCL—ulnar collateral ligament reconstruction—but baseball players and fans call it the *Tommy John surgery*, after the pitcher who was the first to have the surgery. Pioneered by Frank Jobe in 1974, the surgery involves the removal of a tendon from the wrist or hamstring. This tendon is then grafted into the elbow and woven into a figure-eight pattern through tunnels drilled in the arm bones. The surgery leaves a four-inch, telltale scar on the elbow. Rehabilitation is a long process; the athlete will be medically ready to return to play after twelve to fifteen months but will require another year to return to presurgery form. Even

with this recovery time, the results of the surgery are almost always astounding. Athletes may acquire up to six times the strength of their normal arm.

An orthopedic surgeon practicing in Alabama estimated that about 20 percent of those having UCL surgery are big leaguers, 20 to 25 percent are minor leaguers, and the majority are college or high school athletes.[6] A *USA Today* report in 2003 stated that at least one in nine major league pitchers has had the procedure.

Major League owners are so confident with the outcome of the surgery that one free agent, Jon Lieber, was signed to a two-year contract with a $3.5 million guaranteed salary when he was just five months into his rehabilitation.

Surgery plus children can equal a sticky situation. For example, should a sixteen-year-old athlete be forced to undergo an unnecessary surgery that would improve short-term or long-term performance? What if the teen said no to the procedure, but the parent insisted and exercised the right to make medical decisions for the minor? Should the teen be denied a procedure if he or she does not desire it? Should a minor athlete be forced to undergo an unnecessary surgery that would improve short-term or long-term performance?

LASIK

Tiger Woods had LASIK surgery (laser eye surgery, Laser-Assisted in Situ Keratomileusis) while on a losing streak and afterward won seven of his next ten tournaments. As reported in a 2002 *Golf Digest* article, before laser eye surgery, Woods without contact lenses could barely see past his own shadow.[7] His surgeon stated, "He could only count my fingers a foot from his face." However, now Woods's post-LASIK vision is 20/15 without corrective lenses.

Athletes are not the only ones seeking this surgery; it is becoming increasingly popular among umpires as well. Obviously, it is not in an umpire's best interest to be seen wearing glasses. Yet, statistically it is highly unlikely for men and women the age of the majority of umpires to not need glasses. This surgery is perfect for them, and no one ever has to know.

During LASIK surgery, the surgeon creates a flap on the cornea of the eye. The flap is then peeled back and a laser is used to reshape the cornea. Once the surgeon replaces the flap, the patient can see improvements almost immediately. Although thousands of people are seeking this surgery, it is limited to those over the age of twenty years, the age when the eyes finally stop growing and changing.

Would it be okay for a surgeon to do LASIK surgery to improve an athlete's vision and thus performance? How about doing Tommy John surgery on a pitcher for the sole purpose of enhancing performance?

Cosmetic Surgery

A 2001 article in *The Times* (London) described the results of a study by the Society for Cosmetic Surgery in Brazil.[8] Reportedly, female Brazilian volleyball players were improving their athletic performance with breast enhancement. The authors of the study suggested that the benefits may not be physical, but likely psychological. Several of the players who underwent the surgery declared that they felt more beautiful and self-confident as a result. Scientific evidence demonstrates that being confident and having a high level of self-esteem does improve performance.

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CHAPTER 11

Issue: Who Is Liable?

Clearly, legal problems occur in sports medicine as well as in other sports-related fields. Many of the issues can be directed to one all-important question: to whom do sports physicians owe their allegiance—to the club, team, or the athletes—and visa versa?

STANDARD OF CARE

Standard of care is a diagnostic and treatment process that a clinician should follow for a certain type of patient, illness, or clinical circumstance. In legal terms, standard of care is determined by how similarly qualified practitioners would have managed a patient's care under the same or similar circumstances. Physicians' duties are much the same as they would be in any other setting; the standard of care remains the same regardless of the environment. So who or what sets the standard of care, specifically in sports medicine?

A higher standard of care is mandated when the physician attains or claims specialist status. Physicians who achieve certification or diploma status must adhere to the standard of care of the specialist. For example, a chiropractor who serves as a high school team physician and sets a broken finger during a game will be held to the same standard of care as an orthopedist specialist. Physicians who claim to have achieved specialty status, yet lack the higher credentials, are still held to the higher standard.

> Conflict of interest on a physician's part occurs when a physician has financial interest in the team he serves.

Historically, courts have not recognized sports medicine as a separate medical specialty, presumably because no national medical specialty board certification or standardized training exists. Therefore, the applicable legal standard of physician conduct has been *good medical practice* within the physician's type of practice. In other words, what is commonly done by physicians in the same specialty generally serves as the standard by which a physician's conduct is measured. Courts have traditionally equated good medical practice with what is customarily and usually done by physicians under similar circumstances.

This historical approach is evolving into another type of standard of care. A few legal cases have proposed a standard of care based on what *should* have been done under the circumstances, as opposed to what *usually* is done. With science advancing at the speed of light, physicians have a legal obligation to keep abreast of new developments and advances in sports medicine, and they may be liable for using outdated treatment methods that no longer have a sound medical basis or that do not currently constitute appropriate care.

In malpractice lawsuits involving a medical specialist, the trend is to apply a national standard of care. A national standard of care is ensured by national specialty boards, standardized training, and certification procedures. A national standard of care is preferable because appropriate sports medicine care and treatment should never vary with the geographic location in which they are provided.

As sports medicine continues to develop as a medical specialty, it is likely that courts will maintain that a national standard of care applies to team physicians. This movement will increase the quality of sports medicine care to athletes and help to establish a nationwide pool of experts available for sports medicine malpractice cases.

On the field, doctors often must meet the applicable standard of care under conditions much less favorable than those found in the office. Team physicians may face extreme pressure from coaches, team management, fans, or athletes to provide medical clearance or treatment enabling immediate return to play. The team physician's judgment should be governed only by medical considerations rather than by the team's need for the services of the player or the athlete's strong desire to play.

In *Welch v. Dunsmuir Joint Union High School District*, a physician was found negligent for failing to promptly tend to an injured football player and to supervise his removal from the playing field. The physician allowed the player to be moved without a stretcher, an action that was determined to be an improper medical practice in light of the

player's symptoms and thus was deemed the cause of his permanent paralysis.

Malpractice and Negligence

The team physician generally has the primary responsibility for medically clearing athletes to participate in a sport or to return to play after an injury. Working on the field as opposed to in the office poses several challenges and opens the physician up for malpractice and negligence lawsuits.

The team physician must work in a pressure-cooker atmosphere and yet make accurate, split-second decisions. It is unlikely the physician will have time to record all the events, thus documentation may not necessarily be up to the high standards of the medical care given. Being in a courtroom with nothing more than the physician's recollection of what happened is a recipe for disaster. Athletes and their families have sued physicians for injury or death that they allege was caused by reliance on the advice that they thought was medically safe.

In *Gardner v. Holifield*, a deceased basketball player's mother alleged that a cardiologist misinterpreted two echocardiograms. The echocardiograms were ordered to confirm an initial diagnosis of Marfan syndrome suspected after a routine physical examination.

In *Classen v. Izquierdo*, a court ruled that a ringside physician's refusal to stop a boxing match in which a participant received several blows to the head that ultimately killed him may constitute malpractice. The court held that physicians have a duty to conform to "good and accepted" standards of medical care when determining whether an athlete should continue participating in a sport.

In *Buoniconti v. Wallace*, Marc Buoniconti, a linebacker for the Citadel, was permanently paralyzed while making a tackle during a 1985 college football game. Buoniconti filed a negligence action against Wallace, the school's team physician, on the grounds that Wallace failed to inform him of his spinal abnormality. He claimed that Wallace permitted him to play with a serious neck injury and to use equipment that placed his neck in a position that made it vulnerable to being broken. Wallace denied any misconduct and argued that a dangerous and illegal tackling technique caused the injury. The jury found Wallace not liable for Buoniconti's injuries.

In *Martin v. Casagrande*, an orthopedist was held liable for failing to diagnoses a knee injury. Rick Martin, a professional hockey player, sued

the team doctor after sustaining a knee injury from a collision with an opposing goaltender. Missing twenty games, the player underwent arthroscopic surgery by Casagrande, who found no ligament damage and diagnosed the injury as a sprained knee. A second surgeon performed arthroscopy and found two lateral meniscus tears and other defects. Martin claimed Casagrande failed to diagnose and intentionally concealed the risks and the true condition of his knee. He accused Casagrande of conspiring to keep him in the game despite him not being well enough to play. The courts dismissed the conspiracy charge, but medical malpractice resulted in $2.5 million verdict in favor of Martin.

A physician may be liable under tort law for harm caused to an athlete by improperly prescribed steroids. In *State Medical Board of Ohio v. Murray*, the Ohio Supreme Court upheld the revocation of a physician's medical license for prescribing steroids to approximately 200 patients solely to enhance their athletic ability. The physician's conduct violated a state statute regulating the practice of medicine and constituted a failure to use reasonable care in the administration of drugs.

Return to Play

Return-to-play (RTP) decisions are a great challenge in sports medicine. There are four facets regarding RTP decisions: socioeconomic, political, legal, and medical. To avoid potential legal liability, the team physician should refuse clearance of an athlete if he or she believes there is a significant medical risk of harm from participation, irrespective of the team's need for the player or the player's personal motivations. Returning to play too soon can result in malpractice and negligence lawsuits.

In *Robitaille v. Vancouver Hockey Club, Ltd*, a Canadian appellate court upheld a damages award against a hockey team for requiring a player to continue playing with a neck and shoulder injury, ultimately resulting in a spinal cord injury. The player was accused of faking the injury by the team's coach and general manager, both of whom threatened to suspend him unless he played. The court awarded punitive damages against the team for the reckless disregard of the player's health.

In *Mikkelsen v. Haslam*, the plaintiff alleged that a physician negligently provided her with medical clearance to snow ski after hip replacement surgery. The jury found the physician negligent based on undisputed testimony that advising a total hip replacement patient that skiing is permissible "is a departure from orthopedic medical profession standards."[1]

Merril Hoge, a Chicago Bears fullback, contended that he was cleared to play by the team physician too soon after suffering a concussion. He claimed he was forced into retirement from the NFL. The jury found sufficient evidence and awarded Hoge $1.45 million for loss of income caused by his premature retirement from football and $100,000 for pain and suffering caused by his subsequent concussions.

Social and economic forces probably have the greatest influence on a player's RTP decision. Because money can drive the game, professional athletes, coaches, and team owners must consider substantial income and endorsement benefits at stake. The economic implications of injury also affect collegiate and high school athletes who are maintaining or pursuing scholarships. Along with amateur athletes, who hope to attain fame and fortune, and their families, professional athletes seek economic gain through athletic prowess. Being off the field is being off the minds of the fans and scouts.

Disagreements among healthcare providers, second-opinion physicians, trainers, and therapists can create unnecessary stress. Often, political stress among professionals can influence when a player returns to play. There should be an agreed-on system established by physicians, trainers, and regulatory institutions to determine who makes the final decision. The process should include a chain of command, a method of communicating the decisions to the appropriate personnel, a method of documentation, and a system for protecting the privacy of the player.

Such consensus statements are quickly becoming remedies for political stresses. They are laying the groundwork for legal issues in RTP decisions. Sports medicine professionals are dealing with certain injuries according to rules—federal, state, local, or those specific to the school or team.

The medical component of RTP decisions is perhaps the least defined component of all. Although expected to be straightforward, the medical aspects vary greatly depending on the education, training, and experience of the attending sports medicine professional. The necessities for return to play include normal strength, painless range of motion, and stable spinal column. Return to an unsafe environment is contraindicated, even in players lacking a history of cervical spine problems. Many professionals claim that physicians should not make the RTP decision—that it should be a team decision.

The social aspects of sports sometimes compel athletes to return to play too soon. Olympic-level athletes withstand untold pressures to represent their countries. Many times, athletes are coerced to train despite injuries.

Concussions

There is probably not a more controversial topic than returning to play after a concussion. The decision depends on several variables: severity of concussion, number of concussions, and time lapsed since last concussion. Currently, no scientifically validated system of grading the severity of sports-related concussions exists. However, there are at least twenty-eight published anecdotal severity scales, and three classification schemes are widely accepted.

Scientific literature establishes that neuropsychologic tests are useful in detecting the subtle changes that occur following concussions. The identification of these deficits and subsequent recovery of function can be important components in making RTP decisions. The tests involve assessment of memory, learning, attention, concentration, and information processing. It is argued that neuropsychology has a unique, but not exclusive, role in the decision-making process.

After a concussion, the chance of second impact syndrome increases if the player is returned to play too soon. The second trauma can be minor, yet may result in devastating injury or even death.

LIABILITY

Good Samaritan Statutes

While enjoying some mall walking, an old man suddenly has a heart attack and drops to the floor unconscious and not breathing. Passersby leap to the old man's side and begin performing CPR. In the process, one of the man's ribs is broken. After an extended recovery in the hospital, the man decides to sue the Good Samaritan for breaking his rib. Does he have a case?

Good Samaritan laws have been instituted to protect individuals coming to the medical assistance of others. To be covered, the individual must meet certain criteria: (1) the individual must be a volunteer not seeking compensation and (2) the situation must be an emergency. Good Samaritan statutes generally provide that an injured person cannot succeed in a lawsuit against someone who offers assistance during an emergency. One typical exception is if the injured party is able to show that the volunteer committed willful and wanton misconduct—not simply *unreasonable* conduct.

> Should volunteer physicians be covered under Good Samaritan statutes?

Many high school team or event physicians consider themselves protected under Good Samaritan laws because they are performing a service out of goodwill. However, these statutes are unlikely to help those serving as a team physicians. Some argue that a volunteer team physician falls within the intended Good Samaritan protection because often in high school sports the team physician is a volunteer who does not seek compensation and who responds to emergency situations.

In reality, the team physician is not a volunteer. He or she has a duty to assist injured players and has agreed to do so, even though he or she may not be compensated. Furthermore, many of the situations are not life threatening and, consequently, may not constitute an emergency.

Some states have recognized this ambiguity and passed team physician laws to extend the protection of the Good Samaritan statutes to volunteer team physicians. Nevertheless, malpractice risks are unresolved completely by Good Samaritan acts.

Traveling Team Physicians

Many team physicians put themselves in legal jeopardy by treating their own team members during out-of-state competition, even though at least eighteen states prohibit such practice. Many states require the physician to be licensed in that particular state. However, in some states, visiting physicians may apply for a courtesy license to provide such care.

In one survey, associates questioned sixty-three team physicians from thirty states about licensure at an annual meeting of the American Medical Society for Sports Medicine.[2] Reportedly, most physicians (68 percent) held a license in only one state, yet 70 percent travel with teams to out-of-state events, and 93 percent distribute medications on the road. Interestingly, 71 percent were unaware of any state law that would limit their practice when traveling with the team.

State laws are not the only concern, though. Physicians may not be covered by malpractice insurance if they are practicing out of state. They are advised to consult with their liability insurance carriers to be certain that they covered wherever an event is held. Most liability coverage policies state that if a physician is practicing medicine without a license then liability coverage is null and void.

Validity of Liability Waivers

Athletes and sports medicine professionals may allocate their respective legal responsibility to each other by contract. An athlete may waive his or her legal right to recover for future harm attributable to another's wrongful conduct unless such an agreement violates public policy. Should

an adult athlete (especially a professional one) and a team physician be permitted to establish the bounds of their relationship by contract? Some courts uphold releases of liability from future negligence, barring conduct such as intentional, reckless, or grossly negligent torts. Because the team physician–athlete relationship is different from a general physician–patient relationship, should courts uphold liability waivers in some circumstances? Should a court invalidate a waiver that releases a team physician from liability for negligent medical care rendered to an athlete on public policy grounds?

A waiver of legal rights by an athlete who is a minor is usually not enforceable, even if a waiver is also signed by a parent or guardian. Minors have only a limited legal capacity to enter into contracts.

Many believe these all-inclusive waivers are unethical and unenforceable. An adult athlete (fully informed of the risks of playing with an injury, or who desires a physician to use innovative therapy in treating an injury) may choose to release a physician from potential negligence liability in return for a RTP decision or an unproven and risky therapy.

Because the team physician–athlete relationship is different from a general physician–patient relationship, it could be argued that courts should uphold liability waivers in some circumstances. However, this may contradict a team physician's obligation to protect an athlete's health and discourage athletic participation that exposes an athlete to risk of serious harm. A court might invalidate a waiver that releases a team physician from liability for negligent medical care rendered to an athlete on public policy grounds. This issue has not yet been resolved.

> Should an adult athlete (fully informed of the risks of playing with an injury) be permitted to release a physician from potential negligence liability in return for a RTP decision?

REHABILITATION

Many league rules prohibit the involuntary termination of a player's contract while he or she is recovering from a sports-related injury. If players refuse to settle a contract, they may be forced to participate in a strenuous rehabilitation program designed to coerce them into voluntarily leaving the team. The Fifth Circuit observed that forcing players to choose either the contract termination pay or an excessively demanding rehabilitation program involved a labor dispute that was subject to mandatory arbitration under the terms of the Collective Bargaining Agreement (CBA).

Should an athlete who desires a physician to use innovative therapy in treating an injury be permitted to release the physician from potential negligence liability for providing a risky unproven treatment?

A professional athlete is entitled to workers' compensation benefits for aggravation of an injury caused by improper treatment by the team's medical personnel. Professional teams have a contractual obligation under the league CBA and standard player contracts to provide medical care to their athletes. Any bodily injury due to negligent medical treatment is considered a compensable injury.

NOTES

1. 764 P. 2d 1384 (Utah App. 1988).
2. Davis. At 2000 annual conference of American Medical Society for Sports Medicine.

CHAPTER 12

Issue: Who Has The Right To Know and To Tell

CONFIDENTIALITY

Confidentiality is especially important in sports medicine. When a high-profile athlete requires medical treatment, oftentimes the occurrence will be kept strictly confidential. Any leak of information to the media could render the treatment facility, as well as the staff, susceptible to libel lawsuits—not to mention that it would be a major HIPAA violation. Furthermore, reported injuries can influence the marketability of the athlete. Injured athletes may have a harder time obtaining compensation equivalent to their peers.

Insurance companies have their say, too. The club is obliged to insure its athletes against personal injuries. Insurance companies may refuse to cover cases where a negligent medical treatment was applied. They can even sue the physician for reimbursement. Thus, it is extremely important to keep medical confidentiality, both to agencies and to the media.

> If an athlete has insurance and forgoes submitting a claim for injury, does the insurance company have a right to know about the injury?

Sports culture plays an additional role in athlete confidentiality. Circumstances often place sports physicians in a position where they are

called to release information to other team physicians, including those from the same team or other neutral sports physicians, regarding an injured player. There must be a legal balance between consulting with a specialist about a player's injuries and respecting and upholding the athlete's privacy rights. Furthermore, when a team physician is financially compensated by the team or the school, he is bound to communication with the team manager, coaches, and owners. The athlete must be made aware of this relationship from the start. Sports physicians deal with sharing information about an athlete at all levels, including when the athlete moves from high school to college or is traded at the professional level.

Unauthorized disclosure of information about an athlete's medical condition to third parties violates a physician's ethical obligation to maintain patient confidence. Such unauthorized disclosure may expose the physician to legal liability for invasion of privacy. A physician could face charges of independent tort for unprivileged revelation of medical information to third parties—or for defamation or intentional infliction of emotional distress if the information is false. Even accurate disclosure, however, may subject the team physician to liability for breach of the common-law duty of confidentiality that is owed to the athlete.

HIPAA

The Health Insurance Portability and Accountability Act (HIPAA) regulates how team physicians and members of the healthcare team communicate and handle patient medical information. In general, sports medicine shares the same concerns with general medicine concerning the HIPAA regulations. However, the biggest concerns revolve around directives that cover oral and written communication.

Primary-care sports medicine requires the physician to be involved in frequent consultations with orthopedic surgeons, athletic trainers, physical therapists, and coaches. Team physicians may be prohibited from consulting with specialists and athletic trainers about a player's injuries without the written consent of the athlete. The act raises further questions about the communication between physicians and teams or schools: is it legal? The information about an athlete needs to be shared or transferred when the athlete moves from high school to college or is traded at the professional level. The HIPAA can affect how this information is passed.

The enforcement of HIPAA is increasing births of hybrid entities, such as the sports-medicine department at Stanford University, where treatment is crossing academic, athletic, clinic, and hospital lines. The HIPPA has also ushered in a new classification scheme for athletic trainers. In some

states, athletic trainers are not licensed by the state and, therefore, are not considered healthcare professionals in the eyes of the law. However, many major universities and colleges are opting to include athletic trainers as covered entities in their definition of healthcare. See Section Three, *Annotated Primary Source Documents* for an example of a HIPAA form.

DEFAMATION

Sports medicine is especially susceptible to defamation and breaches of confidentiality. Any leak to the media concerning an athlete's injury can render the athlete less marketable. The publicized injury can lead to less money for the next contract. The media often complicates the problem. Many tabloids offer lucrative sums to individuals for the exchange of information. An athlete treated at a public hospital has to deal with the possibility of the X-ray technician, phlebotomist, security guard, or some other medical or security personnel selling out. While the reporting agency may pay lots of money for the information, the athlete may suffer the biggest cost.

Many court cases illustrate the insidious creep of defamation into sports medicine. In *Chuy v. the Philadelphia Eagles Football Club*, a football player alleged that the team physician defamed him by falsely informing the media that he had a potentially fatal blood disease. He also claimed that it caused him to suffer severe emotional distress. The Third Circuit held that the physician's knowing misrepresentation of the plaintiffs medical condition was "intolerable professional conduct" that established liability for intentional infliction of emotional distress. Ultimately, though, the court upheld the jury's dismissal of the case, because there was no evidence that the plaintiff's reputation had been harmed by the physician's statement.

Defamation in sports hits the media too. Former boxer Randall "Tex" Cobb sued *Sports Illustrated* and Time, Inc., over a 1993 article that said he had used cocaine and knowingly participated in a fixed match in which he defeated Paul "Sonny" Barch (*Cobb v. Time, Inc*.). A United States federal appeals court threw out a 10.7-million-dollar libel verdict, unanimously rejecting the verdict, because there was no evidence that the magazine published the story with "actual malice."

PREMATURE RELEASE OF DOPING RESULTS

Bernard Lagat, an athlete who tested positive for the blood-booster erythropoietin in an out-of-competition test in August 2003, was suspended by the IAAF (International Association of Athletics Federations). However, the

B-sample taken later that year came back negative, and his suspension was lifted. Lagat had sued the IAAF for falsely accusing him of doping, and sought $604,000 in damages from the IAAF and WADA (World Anti-Doping Agency). The IAAF agreed to exonerate the Olympic silver medalist of any doping offense if he dropped the lawsuit, and the world-governing body of athletics accepted the compromise proposal, because it had always considered Lagat innocent of any doping offense.

The news of the positive A-sample was leaked prematurely by the Kenyan federation. IAAF spokesman Nick Davies told the Associated Press in a telephone interview: "We regretted the leak then and we regret

> Should doping allegations be released when the A-sample fails? Should the officials wait until the A-sample is confirmed? How about until the B-sample is confirmed?

it now, because if it weren't for the leak, the athlete wouldn't have been in such a situation."[1]

Perhaps the most well-known doping-related defamation scandal involves Marion Jones, winner of five medals at the 2000 Summer Olympics in Sydney, Australia. On a *20/20* episode in December 2004, Victor Conte, the mastermind of BALCO, alleged that Jones was using banned substances when she won five medals. Conte declared that he supplied Jones with an array of banned performance-enhancing drugs in 2000 and 2001. Jones filed a 25-million-dollar lawsuit later that month. Victor Conte quietly agreed to settle the defamation lawsuit brought by the Olympic champion. Terms of the settlement were not disclosed.

Marion Jones's comeback came in a laboratory, where her B-sample turned up clean. This stunning twist cleared her to compete and validated a long list of triumphs sullied by years of doping allegations.

Howard Jacobs, one of Jones's attorneys, stated, "I believe there are issues with that test . . . . It's a difficult test. From what I saw on the A-sample, it was questionable as to whether it should've been called a positive. I can't say

> Should an athlete have to wait several years to have her name cleared with a clean B-sample?

I was shocked that the B [sample] came back negative based on what the A [sample] looked like."[2]

Jacobs ridiculed the leaking of positive tests, declaring that doping cases should not be made public until they are resolved; yet, most are reported once a positive A-sample is confirmed. "This is [a] perfect illustration of why this new trend of leaking A-positives is a horrible thing," Jacobs said. "This whole thing should have happened anonymously. Marion should've been able to keep competing, and no one should have known about it."[3]

Several other public officials express strong sentiment concerning confidentiality and doping. The following is from a testimony by Terry Madden, CEO of the USADA before the Senate Committee on Commerce, Science, and Transportation on May 24, 2005:

> Significantly, while USADA believes the privacy rights of individuals accused of doping must be respected, no individual's privacy right should outweigh the rights of all athletes to compete in clean sport and to be assured that those who break the rules are appropriately sanctioned. For these reasons, in the USADA system, once an athlete has been found to have committed a violation there is complete public disclosure of the athlete's name and the nature of the offense.

On August 1, 2005, Rafael Palmeiro, an MLB player, was suspended for ten days after testing positive for steroids. The baseball players' union expressed concerned that baseball, as part of its anti-steroids push, might have violated Palmeiro's privacy rights by leaking information to the media about when Palmeiro failed his drug test and which steroid was uncovered.

NOTES

1. http://www.nytimes.com/aponline/sports/AP-OLY-Lagat-Doping.html.
2. By Eddie Pells, Associated Press, September 6, 2006.
3. By Eddie Pells, Associated Press, September 6, 2006.

CHAPTER 13

Issue: Medical Advertising

Medical advertising is a booming market: just try to find someone who has never heard of *The Little Purple Pill*. But until just over twenty years ago, medical advertising was prohibited in the United States. After more than six months of negotiation in 1999, the American Medical Association yielded to a dictate by the Federal Trade Commission (FTC) to finally abandon the medical profession's time-honored view that advertising by physicians is inherently unethical.

Pharmaceutical companies have since begun advertising directly to the consumer. However, they are not the only ones. Advertising for physicians is a dry deal, and few are venturing out alone into the wetlands. Physicians are uniting in groups and promoting their services. Billboards with hospital and clinic advertisements litter the highways.

SPONSORSHIP

Sports-related physicians have one avenue of compensation, though. If they can attach their name to a popular team or athlete, they can ride on the jersey hem of the players. If the team or the athlete is nationally or internationally acclaimed, the deal can be especially lucrative for the physician.

> Should the physician reveal the nature of his professional affiliation with a team?

Most teams choose physicians carefully with respect to their credentials; however, there are reports of teams accepting bids for the position. *Sports Illustrated* reported, in 1995, that NFL teams began putting jobs of "team physician" out for bid. According to recent reports, seven teams in the NFL and twelve teams in the NBA have marketing arrangements with their team physicians. Club officials say that the publicity generated by a physician's association with a team provides a significant boost to his or her practice. Physicians say this is overrated, but medical groups pay for the right to treat the stars and advertise it anyway.

The cost for this sort of advertising (sponsorship) may not be cheap. Physicians can *earn* endorsement rights by purchasing game or season tickets in bulk. Team physicians, on the other hand, are paid by the team—albeit not much. One physician claims he got $15,000 a year and two seats for each game from the Philadelphia Flyers. Former Los Angeles Raiders physician, Rob Huizenga, says in his book, *You're Okay, It's Just a Bruise*, that he was paid only $24,000 a year.

Although the salary may not be the best, serving as a team physician has great rewards, such as visibility and the marketing power. People are drawn to these physicians, and athletes often self-refer to team physicians of highly visible sports teams. They assume that higher-paid athletes use only the best physicians (a belief that is generally true).

In a study by Berstein,[1] the authors prepared ethical, sports-related scenarios and asked practicing team physicians in the Ivy League, NFL, and NHL, as well as professional ethicists, to read the scenario and answer various ethical questions. One such scenario described a situation of medical advertising. In brief, a physician obtained team physician acknowledgement by purchasing several game tickets. He publicly advertised his affiliation with the team. A patient came to him in need of knee surgery and claimed he knew the doctor must be the best because he operated on the team. However, unbeknownst to the patient, the physician was a general orthopedist who was not a surgeon and had never even seen a team athlete in his office. Should the physician reveal his affiliation with the team? Should he continue with the surgery or refer the patient to a more qualified physician? This is a hypothetical scenario, but yet, one that has probably occurred at some point.

SELFLESSNESS

Many physicians use their patients as advertisements. Any physician who has the opportunity to treat a high-profile athlete must remain selfless and refrain from misusing the opportunity. For example, a

sports-medicine physician should refer the patient to a specialist, if appropriate. The physician should not withhold any consultation so that she can take personal credit for the treatment of the athlete. In the case of severely injured athletes, the physician should not use the athlete in the service of the physician's own narcissistic or professional need. In other words, she should treat the athlete, not his career, and should see the athlete as a patient, not as an opportunity to take credit for saving the athlete's career.

Many volunteer physicians for high school are compensated. They receive recognition and free advertising in lieu of services. It is important for these physicians to evaluate whether they are performing the service out of goodwill or greed.

What about pioneers in medicine? Should a physician ever perform a procedure she is unfamiliar with, or should she refer the patient to a more qualified physician? What if the physician is a resident who is still learning? Furthermore, is there an issue with a physician repeatedly calling for more research into a specific area when the research will benefit only the physician?

Untruthful Advertising and False Claims

False and deceptive advertising by physicians destroys the trust relationship between the physician and patient. This relationship is essential to high-quality medical care. A physician's misrepresentation may harm patients by making them less likely to seek the treatments they need or more vulnerable to accepting treatments that are not essential.

Truthful advertising has substantial legal protections, and physician advertising that is untruthful is not protected by federal or state antitrust laws and is not protected from state regulation under the First Amendment. Many state consumer-protection laws and medical practice acts prohibit false or deceptive physician advertising. These laws generally empower a state attorney general to sue physicians who engage in false advertising. In addition, patients who have been injured by false or misleading physician advertising may be able to sue the physician involved for damages under consumer-protection statutes or common-law fraud claims. Furthermore, state medical licensure boards often have the authority to discipline physicians who engage in false advertising.

Physician advertising that is false, deceptive, or misleading within the meaning of Section 5 of the FTC Act is illegal. The FTC has the authority to sue physicians who disseminate false or deceptive advertising and, under some circumstances, may levy fines.

The FTC has developed four general rules to determine whether physician advertisements are truthful and not false, deceptive, or misleading. The four rules are:

1. Advertisements should be accurate and not contain *explicitly false claims or misrepresentations of material fact*. Generally, a false claim or a misrepresentation of fact would be material if it would be likely to affect the behavior or actions of an ordinary and prudent person regarding a physician or physician service.
2. Advertisements should not contain *material implied false claims or implied misrepresentations of material fact*. An advertisement that does not contain direct false claims or misrepresentations should not by implication create false or unjustified expectations about the physician or physician services being publicized. An implied false claim or misrepresentation would be material if it would be likely to affect the behavior of an ordinary and prudent person toward a physician or physician service.
3. There should be *no omissions of material fact* from advertisements. In advertisements, disclosures of information are necessary where omission would make the advertisement as a whole misleading to an ordinary and prudent person or an average member of the audience to whom it is directed.
4. Physicians should be able to *substantiate* material claims and personal representations made in an advertisement.

Should patient testimonials be used in physician advertising?

EXAGGERATED CLAIMS

In the Wild West, during the 18th and 19th centuries, many medical practitioners were unlicensed, untrained quacks who often derived their incomes from exaggerated claims of efficacy. They supported their treatments with testimonials from patients. Whether the testimonies were legitimate or not was another issue. When organized medicine evolved into professional societies in the late-nineteenth and early twentieth centuries, most organizations imposed a ban on advertising of professional services, as an integral part of professionalism. Today, the Texas Medical Board still prohibits the use of testimonials in physician advertising.

Other organizations are open to the judicious use of testimonials; however, some restrictions remain. If a testimonial is misleading regarding a

physician's skill or quality of professional services, such endorsements are not permitted. Ethical obligations to share medical knowledge and skills make it improbable that a physician is likely to have unique skills or equipment, and any advertisement that makes such a claim would be questioned. Claims regarding competence and quality of care supported by objective data are permissible, and certain other claims may be justifiable in a restricted geographic area.

> Is it generally considered ethical to embark on a treatment without any clinical trials of efficacy or safety when using a drug for a new purpose?

It is important for physicians to base claims on evidence-based medicine. Suppose a doctor has an idea to use an already-FDA-approved drug for a novel off-label use based on a few mice studies. Without any human studies as a basis, he obtains a single-use patent through the U.S. Patent Office for treatment of all arthritic diseases with a drug, which is FDA-approved for bacterial infections. He injects the drug near the joints as a gimmick and trademarks the procedure as *Jointcure*. He begins to heavily advertise this procedure on radio, magazines, and the Internet, all the while calling it a magic bullet and a miracle cure. People flock to him by the thousands and, after two years, he makes nearly $2 million on this procedure, despite no human proof of efficacy. The physician's actions are dubious at best and potentially illegal.

> Is it a scam for a doctor to continue charging $2,000 to $3,000 per treatment for a drug that costs him $150 and for which there are no controlled studies?

Advertisements for medical services carry a greater responsibility than advertisements for cars, deodorant, or athletic shoes. Patients are vulnerable, due to the professional nature of physician services: the gap of knowledge between the patient and the physician. In addition, claims of superiority may raise the standard of care from one of a reasonably prudent physician to that of a superior physician—or even a specialist. This higher standard of care is a more difficult level for the physician to meet and for a defense attorney to defend in court. Is it

considered charlatanism when a doctor advertises a scientifically unproven, untested treatment to the masses with advertising reaching over four million people?

NOTE

1. Bernstein, J., Perlis, C., Bartolozzi, A.R. Normative ethics in sports medicine. *Clin Orthop Relat Res* 2004 March;(420):309–318.

CHAPTER 14

Issue: Nutrition

For athletes, nutrition and supplement use is a common way to augment a steady training program. Arguments that have gone on for years about the best diet for optimal athletic performance will likely *continue* for years, as well. Big questions in sports nutrition are what to eat and when to eat, as well as eating during training versus eating before competition.

The American Dietetic Association (ADA) and the Canadian Dietetic Association (CDA) prepared a position stand regarding nutrition for physical fitness and athletic performance for adults. These organizations recommended appropriate selection of food and fluids, timing of intake, and supplement choices for optimal health and exercise performance. Specifically, they review the current scientific data related to athletes' nutrient, energy, and fluid needs, assessment of body composition, strategies for weight change, the use of supplements, and nutrition recommendations for vegetarian athletes. See Section Three, *Annotated Primary Source Documents* for a reprint of the ADA/CDA position stand on nutrition for athletes.

WHAT TO EAT

Carbohydrates and Protein

The Acceptable Macronutrient Distribution Range (AMDR) for carbohydrates is 45% to 65% of total calories. Protein is an important macronutrient in the diet; most Americans are already currently consuming enough (AMDR = 10% to 35% of calories) and do not need to increase their intake.

The needs of athletes may or may not be the same as an average individual. During times of high physical activity, energy and macronutrient needs (especially carbohydrate and protein intake) must be met in order to maintain body weight, replenish glycogen stores, and provide adequate protein for building and repairing tissue. The debate over high-protein diets and power athletes is an old one. There is much controversy over what percentage of an athlete's diet should be devoted to carbohydrates.

Fats

Fats supply energy and essential fatty acids and serve as a carrier for the absorption of the fat-soluble vitamins A, D, E, and K and carotenoids. They also serve as building blocks for membranes and help regulate numerous biological functions. Dietary fat is found in both animal and plant foods and is classified as *monounsaturated*, *polyunsaturated*, and *saturated*.

Fat intake should be adequate to provide essential fatty acids and fat-soluble vitamins, as well as to help provide adequate energy for weight maintenance. Overall, diets should provide moderate amounts of energy from fat (20% to 25% of energy). American Heart Association (AHA) recommends we consume less than 7% of calories from saturated fat.

Research indicates that an excessive intake of saturated fats tends to raise blood-cholesterol levels, thereby increasing risk for heart disease. Another newcomer in the fat realm—trans-fatty acids—are the end products of a process called *hydrogenation*. These fats may play a negative role in health, and many nutrition professionals are advising a limited intake. The AHA recommends a trans-fat intake of less than 1% of calories.

The bottom line is that athletes should monitor the amount of fat intake as well as the type of fats being consumed.

Hydration

It has been estimated that three of every four Americans are chronically dehydrated, placing themselves at increased risk for heat illness and other health problems. As little as a 2% to 3% decrease in body water has been found to hamper performance and cardiovascular function. It stands to reason that athletes should be well hydrated before beginning exercise.

In 2002, a unique study compared the hydration status of endurance athletes as they consumed low, moderate, and high amounts of protein. Although these athletes were not trying to lose weight, the high-protein diet they consumed was roughly 30% of total caloric intake, proportionally comparable with many popular high-protein diets. The results of the study demonstrated that as the amount of consumed protein went up, the

degree of hydration progressively went down. During the period in which athletes were consuming the highest amounts of protein, their kidney function reached abnormal ranges. Other tests indicated that the high-protein diet caused the kidney to produce urine that was more concentrated. Interestingly, though, the athletes reported no difference in how thirsty they felt.

The researchers believe the bottom line is clear for athletes and non-athletes alike: when consuming high-protein diets, fluid intake should be increased. In fact, they suggested drinking more water, regardless of the diet.

Athletes should drink enough fluid during and after exercise to balance fluid losses. Consumption of sport drinks containing carbohydrates and electrolytes during exercise can provide fuel for the muscles, help maintain blood-glucose levels and the thirst mechanism, and decrease the risk of dehydration or imbalance of electrolytes.

Foods to Avoid before Exercise

Any foods with a lot of fat can be very difficult and slow to digest. These high-fat foods remain in the stomach for a long time. If eaten as a pre-event meal, they will likely be with the athlete through competition and can affect performance. The more food in the stomach, the more blood flow there—and the less blood available for the muscles.

Caffeine acts as a stimulant on the central nervous system. It had been thought to boost endurance by stimulating a greater use of fat for energy and, thereby, reserving glycogen in the muscles. However, not all research supports this hypothesis.

Caffeine can have serious side effects for some people. Those who are very sensitive to its effects may experience nausea, muscle tremors, and headaches. Furthermore, excessive caffeine acts as a diuretic, and can promote dehydration, which decreases performance. It is important for the athlete to keep in mind doping rules, too—many competitions have banned caffeine in certain quantities during international events.

Suggested Pre-Competition Foods[1]

One Hour or Less before Competition

- Fruit or vegetable juice (such as orange, tomato, or V-8)
- Fresh fruit (such as apples, watermelon, peaches, grapes, or oranges)
- Energy gels
- Up to one and a half cups of a sport drink (such as Gatorade)

Two to Three Hours before Competition

- Fresh fruit
- Fruit or vegetable juices
- Bread or bagels
- Low-fat yogurt or sport drink

Three to Four Hours before Competition

- Fresh fruit
- Fruit or vegetable juices
- Bread or bagels
- Pasta with tomato sauce
- Baked potatoes
- Energy bar
- Cereal with low-fat milk
- Low-fat yogurt
- Toast/bread with limited peanut butter, lean meat, or low-fat cheese
- Thirty ounces of a sport drink

SUPPLEMENTS

Athletes often look for alternative nutrition to help them perform at their best. Supplements are a fast-growing, multimillion-dollar business that offers athletes an edge. As nutritionists and health professionals debate the merits of sports supplements and look toward further research, consumers continue to buy.

A supplement is something added to the diet, typically to make up for a nutritional deficiency. Supplements often include vitamins, amino acids, minerals, herbs, and/or other botanicals. Nutritional supplements can be classified into four categories:

- Metabolic fuels (carbohydrate, lactate, fat)
- Cellular components that improve metabolism (creatine, carnitine, vitamins)
- Anabolic substances that enhance performance (protein, amino acids, chromium, plant sterols, herbals)
- Substances that enhance recovery (fluids, electrolytes, herbals)

Popular Supplements

Among all the marketed supplements, the most popular are energy boosters, fat burners, muscle gainers, and workout-recovery enhancers.

Other supplements include herbals, vitamins and minerals, and weight-loss agents.

Vitamins Vitamins are essential for the body to function properly. Everyone undoubtedly knows that the calcium in milk makes a body strong. However, research has shown that some vitamins may go beyond basic body function and actually *enhance* athletic performance. B-vitamins (thiamin, riboflavin, vitamin B-6, B-12, and folate), used both to convert proteins and carbohydrates into energy and for cell repair and production, may be linked to performance in high-level athletes.

Researchers at Oregon State University demonstrated that athletes who lack B-vitamins have reduced high-intensity exercise performance and are less able to repair damaged muscles or build muscle mass than their peers who eat a diet rich with B-vitamins. Furthermore, even a small B-vitamin deficiency could result in reduced performance and recovery.

Individual requirements for B-vitamins depend upon the type and intensity of exercise, the amount of nutrients lost (i.e., through sweat and urine), and individual differences in diet. According to these researchers, the USRDA (U.S. Recommended Daily Allowance) for B-vitamin intake may be inadequate for athletes. Athletes who limit calories or have restricted eating plans may be at a greater risk for B-vitamin deficiencies.

This study indicates exercise may increase an athlete's requirement for riboflavin and vitamin B-6; however, the data for folate and vitamin B-12 were limited. The researchers recommend that athletes who have poor or restricted diets should consult with a physician about supplementing their regimen with a multivitamin/mineral supplement.

Creatine To meet the demands of a high-intensity exercise, such as sprinting or power sports, muscles generate energy from chemical reactions. One such chemical byproduct, phosphocreatine, can fuel the first few seconds of a high-intensity effort. Creatine supplements seem to work by increasing the storage of phosphocreatine, making more fuel available to the muscles and thus enabling them to work harder and fatigue slower. More and more research is beginning to look at possible benefits of creatine.

Creatine Claims:

- Improves high-power performance of short duration
- Increases muscle mass
- Delays fatigue
- Increases creatine and phosphocreatine in muscles

Research Shows:

- Improves high-power performance during a series of repetitive high-power-output exercise sessions
- Requires high-intensity training to be effective (does not replace training)
- Does not increase endurance
- Does not exert an anabolic effect
- May augment gains in muscle hypertrophy during resistance training, especially in those with compromised skeletal muscle due to injury or disease

Caution is strongly advised with creatine consumption. Reports of use indicate a propensity for muscle cramping, strains, and pulls. In addition, there is an increased risk for renal stress and damage. Because of an increased risk of heat illness, athletes should increase fluid intake with creatine use.

SPORT DRINKS

Sport drinks are becoming increasingly popular as we are all being encouraged to adopt a healthier lifestyle with regular exercise. These drinks contain everything from pure water to exotic herbal concoctions. Many get their boost feeling because they contain some form of caffeine combination (i.e., caffeine, guarana, green tea) in addition to some carbohydrate. Because caffeine amounts are generally not included on the label, athletes can consume the drink and unknowingly be at risk for a positive caffeine test—a doping violation in many competitions.

Research has debated the benefits of water versus sport beverages. Various clinical studies support the use of a carbohydrate-electrolyte beverage to improve performance of intermittent-moderate to high-intensity exercises such as soccer and ice hockey.

One study compared the consumption of a light meal versus specific commercial sport drinks observed the resulting effect on time to exhaustion during simulated-combat maneuvers. The test consisted of three activities: a two-hour march, a subsequent one-hour run, and a run to exhaustion. During the test, the subjects consumed either a commercial sport drink (Ergo, Go Sports, and Gatorlode) or a light meal from a combat ration.

The researchers concluded that the amount of calories ingested was responsible for the differences noted in time to exhaustion. They further suggested that the sport drinks represent a readily available source of energy and fluid that can be used to replace and/or supplement the current combat rations.

Many sport drinks are based on acidic fruits and may contribute to erosion of tooth enamel. Studies have shown that several sport drinks are more acidic than even orange juice and were found to be quite erosive. Clinicians and dentists are using this information when counseling patients with tooth surface loss who use fruit based sport drinks regularly.

While the debate continues over using water or sport drinks to maintain hydration in athletes, some interesting new research shows that the consumption of chocolate milk immediately following exercise actually helps athletes recover better from intense workouts. The research illustrated that chocolate milk's unique combination of calcium, protein, and carbohydrates provides the energy and nutrients needed to strengthen bones, rebuild muscle cells, and recover more quickly after vigorous exercise.

When to Eat

Athletes need to carefully plan their eating to prevent any distracting symptoms of hunger during competition or training and to maintain energy stores during competition. Athletic activity on a full stomach may result in stomach upset, nausea, or cramping. Optimally, in order to ensure enough energy and reduce stomach discomfort, athletes should allow a meal to fully digest before the start of any event. This generally takes one to four hours, depending upon what and how much was eaten.

The closer to the time of the event, the less an athlete should eat. In a time crunch, he can eat or drink something easily digestible about twenty to thirty minutes before the event. If the time of the event is at hand, he should have a liquid meal (rather than a solid one), because the stomach digests liquids faster. For all-day competition or training, meal planning is absolutely essential.

According to an IDEA Health and Fitness Association press release (www.ideafit.com), good nutrition is about more than just what someone eats. *When* you eat is equally important, as research indicates that what athletes eat before, during, and after a training session make a big difference to performance and recovery.

Some of the key information shared by IDEA experts, committee members, and spokespersons include:

- Ingesting ideal nutrient combinations at optimal times enhances performance and recovery while improving muscle integrity

- Combining carbohydrates and protein at the right time will improve training and workouts
- Nutrient timing isn't just for athletes—these strategies can benefit everyday exercisers
- Increasing daily intakes of dietary calcium is a new way to combat the obesity epidemic
- Surviving the latest low-carbohydrate diet craze is as simple as knowing the difference between good and bad carbohydrates and knowing the top twenty most nutrient-dense carbohydrates

SAFETY AND REGULATION

Everyone knows the pharmaceutical industry is very tightly regulated by the government. However, the government has little to say about nutritional supplements. Products classified as dietary supplements are not required to meet any FDA standards. Therefore, the product label does not always accurately describe the contents of the container. For example, the components of the supplement may not be standardized or pure. Contamination of supplements not only can cause health problems, but also may cause an athlete to fail a doping test.

Should the FDA regulate nutritional supplements?

Most nutritional supplements have very little or no research to validate their claims or even to attest to their safety. Other supplements may have extensive research on effectiveness, yet lack any investigations into safety. For example, although creatine has been used by athletes for over ten years, there is very little research regarding safety or long-term effects.

Most folks would never consider volunteering for medical research and agreeing to ingest foreign substances to see what happens. However, everyone who consumes sports-nutrition supplements is, in effect, doing just that. Add to the never-ending quest for a competitive edge, toss in a few celebrities touting supplements, and soon you have a recipe for a large-scale observational experiment on sports supplements—a study in which the subjects actually pay to take part and don't even know that they are test subjects.

Nutritional supplements are not:

- Required to meet the same safety requirements as over-the-counter or prescription drugs or food ingredients
- Held to specific manufacturing standards

- Guaranteed to meet product-potency or purity ratings
- Required to prove the effectiveness of any health claim they make
- Required to meet safety or efficacy testing prior to going to the market

Because there are no regulations that guarantee the safety or purity of something sold as a supplement, most health risks of supplements are discovered after the product is on the market. Supplements that are pulled from the market are usually linked to a reported serious health risk or death. In fact, the FDA will not remove a product from the market unless it is proven to cause a medical problem.

Ephedra, also called *ma huang*, is a naturally occurring substance derived from plants. Its principal active ingredient is ephedrine, which, when chemically synthesized, is regulated as a drug. In recent years, ephedra products have been extensively promoted to aid weight loss, enhance sports performance, and increase energy. It acts by stimulating the central nervous system and accelerating heart rate and blood pressure (among other effects). In December of 2003, the FDA issued a consumer alert on the safety of dietary supplements containing ephedra. The alert advised consumers immediately to stop buying and using ephedra products. On April 12, 2004, the agency's final rule ultimately banned the sale of dietary supplements containing ephedra.

The FDA has developed a website where consumers can report any serious side effects for drugs or supplements. Anyone who experiences an adverse side effect should register the complaint with FDA MedWatch at http://www.fda.gov/medwatch.

As a last note, supplement use should be considered in terms of physical safety, in addition to competition regulation. Those competing at the college level need to know that the NCAA closely regulates the use of dietary supplements—and bans the use of most.

NOTE

1. Information in this section from Pure Endurance Nutraceuticals, at http://www.pureendurance.net/eating_for_competition.

CHAPTER 15

Issue: How Much Is Too Much?

When the athlete takes life-threatening risks, who says enough is enough? Despite potentially grave injuries, athletes continually return to play. These return-to-play (RTP) decisions are ushering in the emergence of neuropsychology in sports medicine.

Psychiatrists have worked with athletes for many years. Historically, their primary focus was on issues of substance abuse treatment and prevention. In 1992, the International Society for Sport Psychiatry was created, with Dan Begel as the inaugural president. Since then, sports psychology has infiltrated the American Academy of Child and Adolescent Psychiatry and the American Psychiatric Association, as well as competition and training. There have been many developments in this emerging field, including an article in the *New England Journal of Medicine* that raised awareness of the potential problems in women's gymnastics.

Various psychopathologies can develop in conjunction with sports participation. Such combinations include attention deficit disorder, substance abuse, depression and suicidal tendencies, and eating disorders.

HOW YOUNG IS TOO YOUNG?

Research has shown that children are susceptible to serious injuries that may adversely affect their growth and development. A review article by Rice[1] and colleagues is titled "Children and Marathoning: How Young Is Too Young?" (This article poses yet another question for the neuropsychologists.)

Should children be permitted to train and participate in marathons? How young is too young?

"Little Hercules," ten-year-old Richard Sandrak, is one of the strongest humans in the world pound-for-pound. He began training at three years old. By the age of eight years, he was able to bench press 210 pounds, while only weighing seventy pounds himself.

Sandrak's father allowed him to eat only according to a strict diet consisting of liquid nutrients and vegetables. It is alleged, though it has never been substantiated, that he was given numerous anabolic steroids. Richard himself is reportedly upset by such accusations, asserting that he has passed numerous age and drug tests with clean results. Nevertheless, he continues to shake off the allegations and persist in the diligent care of his physique and health.

Some folks may consider Sandrak an example of too much, too soon. However, others recognize the efforts made to teach youngsters how to take proper care of their bodies and health, and they advocate Sandrak's vigilance.

Preconditioning

Regular participation in recreational sports throughout the year is associated with higher levels of muscular strength and aerobic power in children. One study examined the association between seasonal participation in recreational sports and its influence on physical fitness measures in children. A total of forty-four children (twenty boys and twenty-four girls, all in the fifth grade) were tested for flexibility, upper-body strength, upper-body power, and lower-body power and were assessed for seasonal participation rates in recreational sports. The study revealed a significant correlation between sport-participation rates and performance on selected physical-fitness tests. Furthermore, children participating in recreational sport programs throughout the year (fall, winter, and spring) performed significantly better in tests of strength and power than children who did not participate in any sport or who participated in only one sport.

Is year-round training performed under the guise of preconditioning?

Year-round training can keep a child physically fit. However, excessive, daily training can be deleterious to a young athlete's physical and mental

well-being. Yet, year-round training often exists under the guise of preconditioning.

True preconditioning can be beneficial, though, if accomplished over a four-week period with a mandatory period of rest. Athletic participation must be guided by a gradual increase of skills performance, and further training beyond the preconditioning should be carefully discerned. A proper preconditioning program is a dynamic process that accounts for all the variables in training, including psychological maturity and the welfare of the child. Ultimately, the sport environment should be a wholesome and emotionally rewarding experience.

When Sports No Longer Is a Game

A commentator during a baseball game once described an interview with a famous baseball player and told how the player's father insisted that he always be willing to "play hurt." How common is this in youth sports today? Most would agree that playing with an injury is very common, regardless of age. But for children, is this actually fun? Do they consider pain part of the experience? When did sports become something other than fun time?

The goals a coach sets forth for young children tend to establish the tone of the spirit of the game. Yet, coaches' perceptions of what is important for young children have not been carefully investigated. One study queried twenty-nine coaches of a recreational basketball program of children ranging in age from six to ten years old. Of the twelve goals, feeling part of a team, learning to do one's best, and having fun and excitement were most highly rated as extremely important, while becoming popular rated the lowest as not being important. Results of this single study revealed that coaches, in general, clearly define their goals and priorities, and these goals seem developmentally appropriate for the children.

Older children, like adults, use sports as a determinant of social status. Boys and girls in fourth, fifth, and sixth grades were asked what was the most important criterion for determining popularity. Results of the study indicated that appearance is more important than academic achievement in determining popularity for girls. For boys, sports is the most important determinant of popularity and becomes more important for boys with each higher grade level.

> What should sports mean to children? Fun, competition, teamwork, etc.? Can it conceivably be all three?

Achievement-by-Proxy Disorder

Dr. James Andrews, a sports orthopedist, said, "You get a kid on the operating table, and you say to yourself, 'It's impossible for a thirteen-year-old to have this kind of wear and tear.' We've got an epidemic going on."[2]

When children have talent and promise, coaches, parents, and even sports medicine physicians can have a blind spot to possible emotional neglect and physical abuse. Achievement-by-proxy (ABP) disorder, first coined by Ian Tofler, M.D.and colleagues, describes a situation when parents go beyond healthy ambitions for the child and begin to live vicariously though them and their successes.

> Should a child ever be allowed to play with an injury?

Sports medicine physicians need to be aware of telltale signs of ABP disorder. Tofler and colleagues recommend certain red flags for recognition of this disorder.[3] The stages of behaviors in ABP disorder can range from normal to distinct abuse (see Table 15.1).

Signs of ABP disorder include:

- Parents making life decisions based on a child's activity. For example, selling their home and moving to another city, getting a second or third job so that their child can work full-time as a gymnast, or removing their child from regular school.
- Parents allowing the coach to make all decisions in the child's life. They may even suggest that the coach take custody of the child so that the child can live and breathe the sport.
- Parents, the young competitor, the coach, the orthopedic surgeon, and the team manager all being aware of an injury, but all in agreement that the decision to compete with a broken wrist is the child's to make.
- A child who develops psychosomatic illnesses—like malingering, hypochondria, and pain disorders—that help the child consciously or unconsciously escape from or avoid training or competition. Psychiatric illnesses such as depression, anxiety, and substance abuse may be unmasked by the stresses of competition.

No Pain, No Gain

Athletes sometimes push themselves, both in body and in mind, to excessive levels. When they feel as though they are not as talented as others are, they sometimes train obsessively as an attempt to compensate.

Table 15.1 Stages of Behaviors in ABP Disorder

Normal	Risky Sacrifice	Objectification	Potential Abuse	Distinct Abuse
• Parental pride	• Family may move to better location	• Child is more an object than a person	• Child is exploited (instrument of adult's goals)	• Physical, emotional, and/or sexual abuse
• Ambition	• Second mortgage	• Child is increasingly defined by one activity	• Role reversal: Parent is financially dependent on child's performance	• Power differential and vulnerability most obvious on verge of athletic success
• Normal reciprocal parent/child sacrifice	• Parent gives up job to manage child	• Increased pressure to perform to gratify others	• Child competes injured and conspires with adult's goals	

Information modified from reference: Tofler et al, 2005

ABP = achievement-by-proxy

Excessive training can lead to an overtraining syndrome characterized by a negative response of the body to training stress. Despite lengthy and diligent workouts, the athlete's performance actually decreases. The effects are particularly noticeable in swimming, running, and cycling. Symptoms of overtraining syndrome include elevated resting heart rate and blood pressure, muscle soreness, weight loss and loss of body fat, changes in hormone levels, insomnia, and predisposition for illness and injury. As the athlete trains, the body performance will falter, thus driving the athlete to train harder. Overtraining syndrome can set into motion a cycle of unhealthy choices. To prevent overtraining syndrome from creeping up, athletes should keep training logs to help assess training levels and appropriateness.

Competitive sports engage many of the body's systems to a major extent. Oftentimes, the nervous, immune, and metabolic systems are greatly stressed. Studies showed that intense activity at a seven-day soccer camp caused the athletes to experience lowered concentrations of non-killer cells and T-helper cells, both very important immune-related cells in the body.

Two consecutive games in twenty-four hours produced disturbances in the testosterone-cortisol ratio, resulting in a hormonal imbalance.

> Do women who train excessively need intervention? What if they exhibit signs and symptoms of the female athlete triad syndrome?

Neuropsychologists also deal with the female athlete triad syndrome (a collection of pathologies, including eating disorders, amenorrhea, and osteoporosis, brought on by excessive training in women). Pressure placed on young women to achieve or maintain unrealistically low body weight underlies development of the triad syndrome. Females training for sports in which low body weight is emphasized for athletic activity or appearance are at greatest risk. The syndrome is characterized by disordered eating, menstrual irregularity, and decreased bone mass. The syndrome can actually decrease physical performance but, more importantly, can also cause morbidity and mortality.

One study sought to estimate the prevalence of female athlete triad syndrome among high school athletes. Participants in the study consisted of 170 girls representing eight sports from six high schools in southern California. The authors evaluated the three criteria for the triad syndrome. Among all athletes, 18.2%, 23.5%, and 21.8% met the criteria for disordered eating, menstrual irregularity, and low bone mass, respectively. Ten girls met criteria for two components of the triad, and two girls met criteria for all three components.

Although the prevalence of the full female-athlete triad was low in the study, a substantial percentage of the athletes may be at risk for long-term health consequences associated with disordered eating, menstrual irregularity, or low bone mass. In this study, two criteria were evaluated with a questionnaire. It is entirely possible that the answers on the questionnaires were not totally candid or accurate, and, therefore, the prevalence of the triad syndrome may be much greater.

The International Olympic Committee Medical Commission published a position stand on the female athlete triad syndrome. Included in the position stand is information on the diagnosis and management of the syndrome, in addition to information on issues and problems regarding referral, evaluation, and treatment phases. However, more research is needed on causes, prevalence, treatment, and consequences. All individuals working with physically active girls and women should be educated about the female athlete triad syndrome and should develop plans to prevent, recognize, treat, and reduce its risks.

Designer Athletes

Since the 1980s, human growth hormone has been approved for children with a hormone deficiency that makes them much shorter than average. This treatment increases the height of healthy children, too. By 1996, such off-label use accounted for 40% of human growth hormone prescriptions.

> The case against perfection: what's wrong with designer children, bionic athletes, and genetic engineering?

Science today affords parents the option to choose the height—and even the sex—of their child. Drugs today can enhance memory, promote calmness and concentration, increase aerobic performance, and so on. Healthy individuals are undergoing surgeries such as LASIK and Tommy John to improve athletic ability.

How much of this is considered excessive and over the top? How far are athletes or parents of athletes willing to go for performance enhancement? See Chapter 13 for more on the future of designer athletes.

Steroids

The fact is that many athletes use anabolic steroids, and such use is not likely to change. Steroids bestow certain desired characteristics, including changes in muscle mass and even an aggressive edge. Some would say the aggression is an adverse effect, while others disagree. Despite all the claims to the credit of steroids, the inherent risks cannot be overlooked. Overdose or prolonged use of steroids will render major side effects. Steroid abuse can cause jaundice (yellowish pigmentation of skin, tissues, and body fluids, due to improper functioning of the liver) or liver cancer. Furthermore, steroid use/abuse can cause fluid retention, high blood pressure, increases in LDL (bad cholesterol), and decreases in HDL (good cholesterol). Other side effects include kidney tumors, severe acne, and trembling. People who inject anabolic steroids run the additional risk of contracting or transmitting HIV/AIDS or hepatitis.

Other side effects of steroids are age- and sex-specific. Men may experience shrinking of the testicles, reduced sperm count, infertility, baldness, development of breasts, and increased risk for prostate cancer. Women may develop growth of facial hair, baldness, changes in or cessation of the

menstrual cycle, enlargement of the clitoris, and a deepened voice. Adolescents can suffer premature growth cessation through premature skeletal maturation and accelerated puberty changes; adolescents risk stunting

> Suppose, for the sake of argument, that muscle-enhancing gene therapy, unlike steroids, turned out to be safe, or at least no riskier than a rigorous weight-training regimen. Would there be a reason to ban its use in sports?

their growth if they take anabolic steroids before the typical adolescent growth spurt.

Evidence-Based Medicine and Innovative Therapies

Most medicine today is evidence-based, a conscientious and judicious use of the current best medical evidence for making decisions about the care of a patient. Using evidence-based medicine requires new skills of the physician, including efficient literature-searching and the application of rules of evidence in evaluating the literature. Evidence-based medicine goes back to the nineteenth century but has more recently been ushered in by the explosion of scientific and medical information. Every few years, the literature doubles in size, and now there are more than 100,000 scientific and medical journals. Much of the current literature negates or contradicts the previous research.

> Half of what you are taught as medical students will in ten years have been shown to be wrong. And the trouble is none of your teachers know which half.
>
> Dr. Sydney Burwell, 1956, Dean, Harvard Medical School[4]

Sports medicine, a relatively new field of medicine, tends to be less evidence-based than the other disciplines. Athletes are willing to try cutting-edge therapies in hope of faster and stronger recoveries. Many of these therapies are yet unproven in effectiveness. Theoretically, there is nothing wrong with using a cutting-edge technology or therapy, as long as everyone involved knows the inherent risks. Should athletes try new therapies that lack supportive evidence? How do we obtain evidence without trying the therapy?

To operate or not to operate, that is a question. Robbart van Linschoten and colleagues are performing a wait-and-see trial. The PEX Study is a randomized, clinical trial comparing exercise therapy with usual care. The specific objective is to examine the outcome of exercise therapy supervised by a physical therapist versus a clinically accepted wait-and-see approach. This research will address both effectiveness and cost of supervised exercise therapy in patients with patellofemoral pain syndrome (pain under and around the kneecap, frequently seen in younger and active patients). The clinical strategy of treatment usually involves decreasing activities that provoke the pain and reassuring the patient on the presumed good outcome. In this study, 136 patients (adolescents and young adults) with patellofemoral pain syndrome are to receive either three months of exercise therapy or usual clinical care. The patients will be assessed for pain, knee function, and perception of recovery. This trial started in April 2005 and will finish in June 2007. The first results will be available around December 2007.

NOTES

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SECTION THREE

References and Resources

APPENDIX A

Annotated Primary Source Documents

I: SAMPLE SCREENING PACKET*

Following is a sample athletic-screening packet from the Waynesburg College Department of Athletics (Waynesburg, PA). Included in the packet are various legal documents, such as:

- A preparticipation examination questionnaire and a health-care provider form

  These forms address the overall medical history and health of the athlete.

- A liability release

  This form acknowledges the athlete's understanding of the inherent risks involved with participation in the sport. Furthermore, by signing, the athlete voluntarily agrees to waive all claims.

- An informed consent

  This form grants permission to proceed with any needed medical or minor surgical treatment in the best interests of the student-athlete.

- An HIPAA form

  Among other things, this grants the sports medicine personnel permission to release information regarding protected health information and any related information regarding any injury or illness during training and participation. By signing this form, the athlete releases the athletic training staff from any and all legal responsibility or liability that may arise from this authorization.

* Courtesy of Nathan Wilder, MS, ATC, CSCS.

PREPARTICIPATION EXAM

The information provided on this form will help the Athletic Training Staff at Waynesburg College best care for any injuries and illnesses that you may sustain while participating in intercollegiate athletics. Please answer all the questions to the best of your ability. Accuracy of the information provided is essential. Please be thorough when filling out this form; this will expedite your athletic medical clearance, upon your arrival to campus, by our medical team.

Personal Information: ☐FR ☐SO ☐JR ☐SR **Date: ____/____/____**

First Name: _____ Last Name: _____

Date of Birth: ____/____/____

Social Security Number: ___-___-___ Age: _____ Sport: _____

Home Address: _____ Campus/Local Address: _____

City: _____ City: _____

State: _____ State: _____

Zip: _____ Zip: _____

Home Phone: ____-____-____ Local Phone: ____-____-____

Cell Phone: ____-____-____ Email: _____

Emergency Contact Information:

First Name: _____ Last Name: _____

Home Address: _____ Work Address: _____

City: _____ City: _____

State: _____ State: _____

Zip: _____ Zip: _____

Home Phone: ____-____-____ Work Phone: ____-____-____

Cell Phone: ____-____-____ Email: _____

Relationship to Athlete: _____

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51 West College Street • Waynesburg, PA 15370 • 724-852-3306
http://www.waynesburg.edu/depts/sportmed/

****The information provided on this form will be maintained in total confidentiality and will not be shared without your express written consent.**

Personal Medical History:

Medical Alerts: Check all of the following that pertain to your present medical condition

☐ Allergies	☐ Heart murmur	☐ Concussion	☐ Heat illness
☐ Asthma	☐ High blood pressure	☐ Diabetes	☐ Sinusitis
☐ Wear contacts/glasses	☐ Marfan's syndrome	☐ Fractures	☐ Surgery
☐ Loss of a paired organ	☐ Sickle-cell trait	☐ Past orthopedic injury	☐ Seizures/epilepsy
☐ Sudden death	☐ Taking medications	☐ Mental illness	

Have you ever been hospitalized? For what? _____	☐ YES	☐ NO
Have you ever been restricted from participating in sports?	☐ YES	☐ NO
Is there any reason why you should not participate in athletics at Waynesburg College?	☐ YES	☐ NO
Are you presently under the care of a personal physician?	☐ YES	☐ NO

Cardiac:

Have you ever had chest pain and/or shortness of breath during exercise?	☐ YES	☐ NO
Have you ever felt dizzy, lightheaded, and/or passed out during or after exercise?	☐ YES	☐ NO
Have you ever found it more difficult to breath than normal during or after exercise?	☐ YES	☐ NO
Have you ever been diagnosed with a heart murmur?	☐ YES	☐ NO
Have you ever had an electrocardiogram (EKG) or echocardiogram of your heart?	☐ YES	☐ NO
Has anyone in your family died unexpectedly before the age of 50, due to a heart problem?	☐ YES	☐ NO
Have you ever been diagnosed with high cholesterol or high blood pressure?	☐ YES	☐ NO
Have you ever been diagnosed with Marfan's syndrome, hypertrophic cardiomyopathy, dilated cardiomyopathy, or long QT syndrome?	☐ YES	☐ NO

Respiratory:

Do you cough, wheeze, or have trouble breathing during or after exercise?	☐ YES	☐ NO

Heat-Related Problems:		
Have you ever had a rash or hives develop during and/or after exercise?	☐ YES	☐ NO
Have you ever had problems exercising in the heat?	☐ YES	☐ NO
Have you ever collapsed after exercise in the heat?	☐ YES	☐ NO
Have you ever had problems with excessive dehydration?	☐ YES	☐ NO
Have you ever been diagnosed with hyponatremia?	☐ YES	☐ NO
Have you ever been diagnosed with a heat illness?	☐ YES	☐ NO
Mouth and Teeth:		
Have you ever been told you have gingivitis or gum disease?	☐ YES	☐ NO
Do you wear a dental apparatus of any kind (i.e., braces or retainers)?	☐ YES	☐ NO
Have you visited a dentist in the last year?	☐ YES	☐ NO
Have you had a tetanus shot within the last 5 years?	☐ YES	☐ NO
Eyes:		
If you wear contacts or glasses for athletics: which? ☐ Contacts ☐ Glasses		
Do you have any type of vision defect?	☐ YES	☐ NO
Have you ever been diagnosed with color-blindness?	☐ YES	☐ NO
Have you ever been diagnosed with glaucoma?	☐ YES	☐ NO
Have you ever been diagnosed with a retinal detachment?	☐ YES	☐ NO
Have you ever suffered from blurry vision or double vision?	☐ YES	☐ NO
Ears, Nose, and Throat:		
Have you ever had significant problems with your ears, nose, or throat?	☐ YES	☐ NO
Have you ever had surgery (tubes) on your ears?	☐ YES	☐ NO
Do you frequently get ear infections?	☐ YES	☐ NO
Have you ever been diagnosed with a perforated eardrum?	☐ YES	☐ NO
Have you ever been diagnosed with swimmer's ear?	☐ YES	☐ NO
Have you ever fractured your nose?	☐ YES	☐ NO
Do you have any difficulty breathing through your nose?	☐ YES	☐ NO
Have you ever been diagnosed with sinusitis?	☐ YES	☐ NO
Have you ever been told you have postnasal drip?	☐ YES	☐ NO
Do you have frequent episodes of a sore throat?	☐ YES	☐ NO

Have you ever had problems with your tonsils or adenoids?	☐ YES	☐ NO
Have you ever had surgery on your nose or throat?	☐ YES	☐ NO

Personal Behaviors:

Do you use stimulants (Benzedrine, amphetamines, etc.) for any reason?	☐ YES	☐ NO
Do you smoke cigarettes, cigars, or pipes?	☐ YES	☐ NO
Do you use chewing tobacco, snuff, or smokeless tobacco of any kind?	☐ YES	☐ NO
Do you drink alcohol?	☐ YES	☐ NO
Have you ever used/tried marijuana, cocaine, or any other illicit "street" drugs?	☐ YES	☐ NO
Do you feel stressed out? If yes, do you have support to deal with the stress?	☐ YES	☐ NO

Nutrition:

Have you had a weight change (loss/gain) of greater than 10 pounds in the past year?	☐ YES	☐ NO
Are you a vegetarian?	☐ YES	☐ NO
Do you regularly lose weight to participate in your sport?	☐ YES	☐ NO
Do you feel comfortable with your present weight?	☐ YES	☐ NO
Have you ever felt forced to limit your food intake due to concerns about your weight?	☐ YES	☐ NO
Have you had a history of anorexia/bulimia and/or other eating disorders?	☐ YES	☐ NO
Have you ever taken any supplements for improved performance?	☐ YES	☐ NO

Are you presently taking any of the following supplements for diet or performance?

Vitamins	☐ YES	☐ NO	Creatine phosphate	☐ YES	☐ NO
Sleeping pills	☐ YES	☐ NO	Antihistamines	☐ YES	☐ NO
Diet pills	☐ YES	☐ NO	Ephedrine	☐ YES	☐ NO
Anabolic steroids	☐ YES	☐ NO	Amino acids	☐ YES	☐ NO
Androstenedione	☐ YES	☐ NO	Bronchiodilators	☐ YES	☐ NO
Other	☐ YES	☐ NO	Ripped Fuel	☐ YES	☐ NO

Immunizations:

Have you had a tetanus shot in the last 5 years?	☐ YES	☐ NO
Have you been vaccinated for hepatitis B?	☐ YES	☐ NO

If yes to any of the above sections, please explain:

Illnesses: Please check all of the following that you have or have had

Fever blisters	☐ YES	☐ NO	Hepatitis B	☐ YES	☐ NO
Night sweats	☐ YES	☐ NO	Contact with HIV	☐ YES	☐ NO
Scarlet fever	☐ YES	☐ NO	Syphilis	☐ YES	☐ NO
Rheumatic Fever	☐ YES	☐ NO	Chicken pox	☐ YES	☐ NO
Endocarditis	☐ YES	☐ NO	Pericarditis	☐ YES	☐ NO
Smallpox	☐ YES	☐ NO	Whooping cough	☐ YES	☐ NO
Typhoid fever	☐ YES	☐ NO	Gonorrhea	☐ YES	☐ NO
Stomach trouble	☐ YES	☐ NO	Chronic colds	☐ YES	☐ NO
Lactose intolerance	☐ YES	☐ NO	Sugar in urine	☐ YES	☐ NO
Indigestion	☐ YES	☐ NO	Protein in urine	☐ YES	☐ NO
Cancer	☐ YES	☐ NO	Rectal bleeding	☐ YES	☐ NO
Cysts	☐ YES	☐ NO	Rectal itching	☐ YES	☐ NO
Skin trouble	☐ YES	☐ NO	Gallbladder trouble	☐ YES	☐ NO
Rheumatism	☐ YES	☐ NO	Appendicitis	☐ YES	☐ NO
Psychiatric problem	☐ YES	☐ NO	Liver trouble	☐ YES	☐ NO
Fear of high places	☐ YES	☐ NO	Athlete's foot	☐ YES	☐ NO
Neuritis	☐ YES	☐ NO	Jock itch	☐ YES	☐ NO
Depression	☐ YES	☐ NO	Ringworm	☐ YES	☐ NO
Hypoglycemia	☐ YES	☐ NO	Lyme disease	☐ YES	☐ NO
Anemia	☐ YES	☐ NO	Gout	☐ YES	☐ NO
Sickle-cell anemia	☐ YES	☐ NO	Heartburn	☐ YES	☐ NO
Frequent vomiting	☐ YES	☐ NO	Herpes	☐ YES	☐ NO
Constipation	☐ YES	☐ NO	Tuberculosis	☐ YES	☐ NO
Bronchitis	☐ YES	☐ NO	Thyroid disease	☐ YES	☐ NO
Mumps	☐ YES	☐ NO	Malaria	☐ YES	☐ NO
Polio	☐ YES	☐ NO	Jaundice	☐ YES	☐ NO
Urinary tract infection	☐ YES	☐ NO	Kidney stones	☐ YES	☐ NO
Mononucleosis	☐ YES	☐ NO	Hemorrhoids	☐ YES	☐ NO
Painful urination	☐ YES	☐ NO	Insomnia	☐ YES	☐ NO
Gallstones	☐ YES	☐ NO	Motion sickness	☐ YES	☐ NO
Measles	☐ YES	☐ NO	Other	☐ YES	☐ NO

If yes to any of the above, or if you have had another condition not listed, please explain:

Allergies: (check all allergies that you have)

Medications:

Aspirin	☐ YES	☐ NO	Penicillin	☐ YES	☐ NO
Codeine	☐ YES	☐ NO	Erythromycin	☐ YES	☐ NO
Sulfa drugs	☐ YES	☐ NO	Ibuprofen	☐ YES	☐ NO
Iodine	☐ YES	☐ NO	Acetaminophen	☐ YES	☐ NO
Oral anti-inflammatory	☐ YES	☐ NO	Anesthesia	☐ YES	☐ NO

Do you carry an EpiPen in case of emergency?

Food, Seasonal, and Other Allergies:

Nuts	☐ YES	☐ NO	Dust	☐ YES	☐ NO
Seafood	☐ YES	☐ NO	Mold	☐ YES	☐ NO
Milk	☐ YES	☐ NO	Grass	☐ YES	☐ NO
Pet dander	☐ YES	☐ NO	Pollen	☐ YES	☐ NO
Bee stings	☐ YES	☐ NO	Wasp stings	☐ YES	☐ NO
Latex	☐ YES	☐ NO	Other	☐ YES	☐ NO

Do you currently receive allergy shots on a regular basis?

If you have other allergies, please explain:

Medications: Please check any medications you are presently taking

Accutane	☐ YES	☐ NO	Klonopin	☐ YES	☐ NO
Albuterol inhaler	☐ YES	☐ NO	Midol	☐ YES	☐ NO
Amoxicillin	☐ YES	☐ NO	Minocylene	☐ YES	☐ NO
Advil	☐ YES	☐ NO	Paxil	☐ YES	☐ NO
Aspirin	☐ YES	☐ NO	Proventil	☐ YES	☐ NO
Atrovent	☐ YES	☐ NO	Tetracyline	☐ YES	☐ NO
Benadryl	☐ YES	☐ NO	Ritalin	☐ YES	☐ NO
Ceclor	☐ YES	☐ NO	Sudafed	☐ YES	☐ NO
Claritin	☐ YES	☐ NO	Sulfas	☐ YES	☐ NO
Ibuprofin	☐ YES	☐ NO	Tavist	☐ YES	☐ NO
Keflex	☐ YES	☐ NO	Tylenol	☐ YES	☐ NO
Zantac	☐ YES	☐ NO	Zoloft	☐ YES	☐ NO
Insulin	☐ YES	☐ NO	Tagamet	☐ YES	☐ NO
Naproxin	☐ YES	☐ NO	Codeine	☐ YES	☐ NO
Allergy shots	☐ YES	☐ NO	Celebrex	☐ YES	☐ NO
Singular	☐ YES	☐ NO	Flonase/Rhinocort	☐ YES	☐ NO
Ventolin	☐ YES	☐ NO	Birth control pills	☐ YES	☐ NO
Clarinex	☐ YES	☐ NO	Other	☐ YES	☐ NO

If yes to any of the above, or if you are taking other medications, please explain:

Orthopedic Injuries:

Head and Brain:

Have you ever had a head injury/concussion?	☐ YES	☐ NO
If yes, date of last concussion: _____		
If yes, number of concussions: _____Dates:_____		
Have you ever been knocked out and/or lost your memory due to a head injury?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your head?	☐ YES	☐ NO
Do you suffer from headaches or migraines?	☐ YES	☐ NO
Have you ever had any type of skull fracture?	☐ YES	☐ NO

If yes to any question, please explain:

Neck:

Have you ever sustained a serious neck or cervical injury?	☐ YES	☐ NO
Did you ever have numbness, burning, or sharp pain in your arms or legs?	☐ YES	☐ NO
Have you ever had an injury producing weakness/numbness of your arms, legs, or both?	☐ YES	☐ NO
Have you ever had a burner or stinger (stretched or pinched nerve)?	☐ YES	☐ NO
Do you currently have any weakness due to a neck or spinal injury?	☐ YES	☐ NO
Have you ever been diagnosed with cervical stenosis?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your neck?	☐ YES	☐ NO
Have you ever had neck surgery?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following neck conditions? Check all that apply	☐ YES	☐ NO

☐ Sprain ☐ Dislocation ☐ Stiff Neck
☐ Pinched nerve ☐ Fracture ☐ Strain

If yes to any question, please explain:

Shoulder and Upper Arm:

Have you ever had a significant shoulder-joint injury?	☐ YES	☐ NO
Has your shoulder ever felt like it was unstable or slipping out of place?	☐ YES	☐ NO
Has your shoulder ever come out of place and had to have been put back in by another person?	☐ YES	☐ NO
Do you have any problems with your shoulder when trying to throw?	☐ YES	☐ NO
Do you have any problems with your shoulder with overhead activities?	☐ YES	☐ NO
Have you ever had shoulder surgery?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your shoulder?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following shoulder conditions?	☐ YES	☐ NO

☐ Clavicle fracture	☐ R	☐ L	☐ Rotator cuff strain/tear	☐ R	☐ L
☐ Biceps tendonitis	☐ R	☐ L	☐ Rotator cuff tendonitis	☐ R	☐ L
☐ Shoulder impingement	☐ R	☐ L	☐ Separation/dislocation	☐ R	☐ L
☐ Stingers/burners	☐ R	☐ L	☐ Sprain	☐ R	☐ L

If yes to any question, please explain:

Elbow and Forearm:

Have you ever had a history of elbow/forearm injury?	☐ YES	☐ NO
Have you ever had any chronic pain on the inside or outside of the elbow/forearm?	☐ YES	☐ NO
Have you ever had any numbness or tingling around the elbow or in the hands?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your elbow?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following elbow/forearm conditions?	☐ YES	☐ NO

☐ Sprain	☐ R	☐ L	☐ Fracture	☐ R	☐ L
☐ Dislocation	☐ R	☐ L	☐ Forearm splints	☐ R	☐ L
☐ Tennis elbow	☐ R	☐ L	☐ Strain	☐ R	☐ L

If yes to any question, please explain:

Wrist, Hand, and Finger:

Have you ever had a history of wrist, hand, or finger injury?	☐ YES	☐ NO
Have you ever had any numbness or tingling in your hand, wrist, or finger?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your hand, wrist, or finger?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following wrist, hand, or finger conditions?	☐ YES	☐ NO

☐ Sprain	☐ R	☐ L	☐ Strain	☐ R	☐ L
☐ Fracture	☐ R	☐ L	☐ Dislocation	☐ R	☐ L
☐ Carpal tunnel	☐ R	☐ L	☐ Tendinitis	☐ R	☐ L

If yes to any question, please explain:

Ribs, Thorax, and Chest:

Have you ever had a history of rib, thorax, or chest injury?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your ribs or chest?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following rib, thorax, or chest conditions?	☐ YES	☐ NO

☐ Sprain	☐ R	☐ L	☐ Strain	☐ R	☐ L
☐ Bruise	☐ R	☐ L	☐ Fracture	☐ R	☐ L
☐ Pneumothorax	☐ R	☐ L	☐ Cartilage separation	☐ R	☐ L

If yes to any question, please explain:

Abdomen:

Have you ever had a history of abdominal injury?				☐ YES	☐ NO
Have you ever had significant pain in your left shoulder after being hit in the abdomen?				☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your abdomen?				☐ YES	☐ NO
Have you ever been diagnosed with any of the following abdominal conditions?				☐ YES	☐ NO
☐ Strain	☐ R	☐ L	☐ Bruise	☐ R	☐ L
☐ Abdominal hernia	☐ R	☐ L	☐ Spleen injury	☐ R	☐ L
☐ Liver injury			☐ Intestine injury		

If yes to any question, please explain:

Lumbar Spine and SI Joint:

Have you ever had a history of lower back or sacroiliac pain?				☐ YES	☐ NO
Have you ever had numbness or tingling in your thigh or lower leg as a result of injury?				☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your lumbar spine or SI?				☐ YES	☐ NO
Have you ever been diagnosed with any of the following lumbar spine or SI conditions?				☐ YES	☐ NO
☐ Sprain	☐ R	☐ L	☐ Strain	☐ R	☐ L
☐ Bruise	☐ R	☐ L	☐ Fracture/stress Fx	☐ R	☐ L
☐ Herniated disc	☐ R	☐ L	☐ Spondyloysis	☐ R	☐ L

If yes to any question, please explain:

Hip and Groin:

Have you ever had a history of hip or groin pain?	☐ YES	☐ NO
Have you ever had swollen lymph nodes in your groin?	☐ YES	☐ NO
Have you ever had a history of an inguinal hernia?	☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your hip and groin?	☐ YES	☐ NO
Have you ever been diagnosed with any of the following hip or groin conditions?	☐ YES	☐ NO

☐ Sprain	☐ R	☐ L	☐ Strain	☐ R	☐ L
☐ Fracture/stress fracture	☐ R	☐ L	☐ Bruise	☐ R	☐ L

If yes to any question, please explain:

Thigh:

Have you ever had a history of thigh injury?				☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your thigh?				☐ YES	☐ NO
Have you ever been diagnosed with any of the following thigh conditions?				☐ YES	☐ NO
☐ Strain	☐ R	☐ L	☐ Bruise	☐ R	☐ L
☐ Fracture	☐ R	☐ L			

If yes to any question, please explain:

Knee:

Have you ever had a history of a knee injury?				☐ YES	☐ NO
Has your knee ever been swollen?				☐ YES	☐ NO
Have you ever felt a pop or snap in your knee or the sensation of giving out?				☐ YES	☐ NO
Do you currently wear any type of protective knee bracing?				☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your knee?				☐ YES	☐ NO
Have you ever been diagnosed with any of the following knee conditions?				☐ YES	☐ NO
☐ Sprain	☐ R	☐ L	☐ Strain	☐ R	☐ L
☐ Fracture	☐ R	☐ L	☐ Bruise	☐ R	☐ L
☐ Tendinitis	☐ R	☐ L	☐ Dislocation	☐ R	☐ L

If yes to any question, please explain:

Lower Leg:

Have you ever had a history of lower leg injury?				☐ YES	☐ NO
Have you ever had pain along the inside or your shin?				☐ YES	☐ NO
Do you get pain in your lower leg while you run?				☐ YES	☐ NO
Do you ever get tightness in the front of your leg while running?				☐ YES	☐ NO
Have you ever experienced tingling in your toes while running?				☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your lower leg?				☐ YES	☐ NO
Have you ever been diagnosed with any of the following lower leg conditions?				☐ YES	☐ NO
☐ Strain	☐ R	☐ L	☐ Bruise	☐ R	☐ L
☐ Fracture	☐ R	☐ L	☐ Stress fracture	☐ R	☐ L
☐ Compartment syndrome	☐ R	☐ L	☐ Shin splints	☐ R	☐ L

If yes to any question, please explain:

Ankle:

Have you ever had a history of an ankle injury?					☐ YES	☐ NO
Do you currently wear any type of protective ankle bracing or taping?					☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your ankle?					☐ YES	☐ NO
Have you ever been diagnosed with any of the following ankle conditions?					☐ YES	☐ NO
☐ Sprain	☐ R	☐ L	☐ Strain		☐ R	☐ L
☐ High ankle sprain	☐ R	☐ L	☐ Bruise		☐ R	☐ L
☐ Fracture/stress fracture	☐ R	☐ L	☐ Tendinitis		☐ R	☐ L

If yes to any question, please explain:

Foot and Toes:

Have you ever had a history of foot injury?					☐ YES	☐ NO
Have you ever had X-rays, MRIs, CT scans, or other tests of your foot?					☐ YES	☐ NO
Have you ever been diagnosed with any of the following foot conditions?					☐ YES	☐ NO
☐ Sprain	☐ R	☐ L	☐ Strain		☐ R	☐ L
☐ Fracture	☐ R	☐ L	☐ Bruise		☐ R	☐ L
☐ Tendinitis	☐ R	☐ L	☐ Turf Toe		☐ R	☐ L

If yes to any question, please explain:

Surgery: Have you had surgery in the past? ☐ R ☐ L

Please list all surgical procedures	Reason	Body part	Date
1.			
2.			
3.			
4.			
5.			

Females Only:

When was the onset of your menstrual cycle? Age:_____ Month:_____ Year:_____

Have you had a menstrual period within the past 12 months? ☐ YES ☐ NO

When was your most recent menstrual period? _____

How much time do you usually have between cycles? _____

In the past 12 months, have you stopped menstruating? ☐ YES ☐ NO

In the past 12 months, have you had painful or heavy menstrual periods? ☐ YES ☐ NO

In the past 12 months, have you had any unusual discharge from your vagina? ☐ YES ☐ NO

Do you take any medications during your menstrual periods? ☐ YES ☐ NO

If yes, what type? _____

Do you take birth control pills? ☐ YES ☐ NO

If yes, what brand? _____

Have you ever had breast problems? ☐ YES ☐ NO

Have you had a pelvic examination within the last year? ☐ YES ☐ NO

Approx. date of last gynecological exam: _____-_____-_____

Have you ever been diagnosed with endometriosis? ☐ YES ☐ NO

Males Only:

Have you ever been diagnosed with epididymitis? ☐ YES ☐ NO

Have you ever lost a testicle? ☐ YES ☐ NO

Have you ever suffered a testicular torsion? ☐ YES ☐ NO

Have you ever been diagnosed with testicular cancer? ☐ YES ☐ NO

Do you have undescended testicles? ☐ YES ☐ NO

Have you ever had any other testicular problems? ☐ YES ☐ NO

If yes, please explain: _____

Family Health History: For each full-blood relative, indicate if they have or have had any of the following

	No History	Mother/ Father	Brother/ Sister	Grandparent
High blood pressure	☐	☐	☐	☐
Heart attack/chronic heart disease	☐	☐	☐	☐
High cholesterol	☐	☐	☐	☐
Marfans Syndrome	☐	☐	☐	☐
Sickle-cell anemia	☐	☐	☐	☐
Epilepsy	☐	☐	☐	☐
Diabetes	☐	☐	☐	☐
Alcohol/drug abuse	☐	☐	☐	☐
Mental illness	☐	☐	☐	☐
Cancer	☐	☐	☐	☐
Kidney disease	☐	☐	☐	☐
Stroke	☐	☐	☐	☐
Neurological disorders	☐	☐	☐	☐

Athlete's Signature: _____ **Date:** _____/_____/_____

Reviewed by: _____ **Date:** _____/_____/_____

(Certified Athletic Trainer)

ALL STUDENT ATHLETES WILL HAVE A GENERAL AND ORTHOPEDIC PHYSICAL EXAMINATION BY THE WAYNESBURG COLLEGE ATHLETIC TRAINING STAFF AND TEAM PHYSICIANS UPON THEIR ARRIVAL TO CAMPUS.

Liability Release

First Name: _____ Last Name: _____

Date of Birth: ____/____/____

Social Security Number: ___-___-___ Age: _____

I, _____, hereby acknowledge that I have voluntarily applied to participate in the following intercollegiate athletics programs at Waynesburg College. Please check all that apply.

☐ Football	☐ Volleyball	☐ Men's soccer	☐ Women's soccer
☐ Women's tennis	☐ Men's tennis	☐ Women's cross country	☐ Men's cross country
☐ Men's basketball	☐ Women's basketball	☐ Wrestling	☐ Men's track
☐ Baseball	☐ Softball	☐ Women's track	☐ Club volleyball
☐ Cheerleading	☐ Men's golf	☐ Women's golf	

Due to the nature of the physical strain, contact, and/or collisions that are part of athletic participation, I understand the risk of serious physical injury, including catastrophic injury, does exist. I understand that the dangers and risks include, but are not limited to, death; serious head, neck, and spinal injuries; paralysis; injury or impairment to the musculoskeletal system or other areas of the body; general health and well-being. I also understand that other participants, the coaching staff, team physicians, board-certified athletic trainers, officials, and/or spectators could possibly engage in conduct, including negligent conduct, that may increase the risk of injury to me.

I hereby knowingly assume responsibility for any and all such risks and any and all resulting injury, disease, illness, or damage to my person arising from traveling to, participating in, or returning from athletic practices, competitions, or any other athletics-related event. I do hereby voluntarily choose to participate in intercollegiate athletics, in spite of the inherent risks.

Furthermore, I attest that I am physically and mentally fit and sufficiently trained for intercollegiate athletics. I do not have any medical record or history that could be aggravated by my participation in my particular sport. I also attest that I know and understand the rules of my sport, and I promise to follow these rules and not to utilize illegal or unsafe techniques or engage in conduct that may put others or myself at increased risk. I also agree to assume responsibility for taking good care of all equipment issued to me and reporting any defects to the equipment manager or a board-certified athletic trainer. I also assume full responsibility for immediately reporting any and all injuries to the athletic training staff in a timely manner (within 24 hours of the occurrence).

I hereby release and discharge Waynesburg College and its affiliated organizations, owners, offices, employees, agents, or contractors from all actions, claims, or demands that I and my heirs, guardians, legal representatives, or assigns now have—or may hereafter have—for injury, illness, or damage resulting from negligence or other acts associated with my participation in this activity.

I have carefully read this agreement and fully understand its contents. I am aware that this is a release of liability and a contract between myself and Waynesburg College, and I sign of my own free will.

Athlete's Signature: _____ **Date: ____/_____/_____**

Parent/Guardian's Signature:_____ **Date: ____/_____/_____**

(If athlete is under 18 years of age)

INFORMED CONSENT

Personal Information:

First Name: _____ Last Name: _____ Date of Birth: _____

Social Security Number: _____ - _____ - _____ Age: _____ Sport(s): _____

Waynesburg College employs certified athletic trainers (ATCs) who are qualified to assess, treat, and rehabilitate most injuries you may incur while participating in our intercollegiate athletic program. The staff athletic trainers' qualifications include: board certification by the National Athletic Trainers' Association, certification by the Pennsylvania State Board of Medicine, certification in First Aid/AED and Cardiopulmonary Resuscitation for the Professional Rescuer, and a minimum of a bachelor's degree in the athletic training field. Waynesburg College may also allow students from the Athletic Training Advanced Program (ATAP) to assess, treat, and rehabilitate your injuries at the discretion of, and under the supervision of, the staff certified athletic trainers.

I hereby grant my permission to the Waynesburg College team physicians, athletic training staff, and athletic training students to assess, treat, and rehabilitate any injury that I may suffer as a result of my participation in the Waynesburg College intercollegiate athletic program. I understand that any treatment, medical, or surgical care that is provided to me will be done only if it is considered medically necessary for my health.

I hereby grant my permission to the Waynesburg College team physicians and athletic training staff to refer me, as they deem appropriate, to the appropriate

medical personnel or to a hospital or any other medical facility for treatment of any injury or illness that I may suffer as a result of my participation in the Waynesburg College intercollegiate athletic program.

Athlete's Signature: _____ **Date: _____**

Parent/Guardian's Signature: _____ **Date: _____**

(If athlete is under 18 years of age)

HIPAA Form

Due to the concern over medical record confidentiality, it is necessary for the athletic training staff at Waynesburg College to obtain your written authorization to gather and release your medical information. By signing this form, you release the athletic training staff at Waynesburg College of any and all legal responsibility or liability that may arise from this authorization.

I hereby authorize the physicians, certified athletic trainers, athletic training staff, and other health-care personnel representing Waynesburg College to release information regarding my protected health information and any related information regarding any injury or illness during my training for and participation in intercollegiate athletics. This protected health information may concern my medical status, medical condition, injuries, prognosis, diagnosis, athletic participation status, and related, personally identifiable health information. This protected health information may be released to other health-care providers (health-service nursing staff and psychological counselors), parents/guardians, hospitals and/or medical clinics and laboratories, athletic coaches, strength and conditioning coaches, medical insurance coordinators, insurance carriers, medical-supply vendors and/or service companies, academic counselors, athletic and/or university administrators, chaplains and/or clergy members, NCAA Injury Surveillance System, sports-information staff, and members of the media.

I understand that my authorization/consent for the disclosure of my protected health information is a condition for participation as an intercollegiate athlete for Waynesburg College. I understand that my protected health information is protected by federal regulations under either the Health Information Portability and Accountability Act (HIPAA) or the Family Educational Rights and Privacy Act of 1974 (the Buckley Amendment) and may not be disclosed without either my authorization under HIPAA or my consent under the Buckley Amendment. I understand that once information is disclosed per my authorization/consent, the information is subject to redisclosure and may no longer be protected by HIPAA and/or the Buckley Amendment.

I understand that a record will be kept of any release of my medical information and the nature of the injury requiring such a release. I have had an opportunity to ask questions regarding this release and the process by which medical information

may be released. All of my questions have been answered to my satisfaction. Having read and understood the above, I freely sign this release of medical-information authorization.

I understand that I may revoke this authorization/consent at any time by notifying, in writing, the head athletic trainer; if I do, it will not have any effect on actions Waynesburg College took in reliance on this authorization/consent prior to receiving the revocation. This authorization/consent expires 5 years from the date it is signed.

_____	_____
Signature of Student-Athlete	**Date**
_____	_____
Witness	**Date**

II: WADA 2007 Prohibited List International Standard*

Illegal drug use in sports is standardized by a prohibited list, first published in 1963 under the leadership of the International Olympic Committee (IOC). Since 2004, the World Anti-Doping Agency (WADA) has been responsible for the preparation and publication of the list.

The list is a cornerstone of harmonization and international competition. It is an international standard identifying substances and methods prohibited in competition, out of competition, and in particular sports. WADA classifies both doping substances and methods by categories (e.g., steroids, stimulants, gene doping).

*The 2007 Prohibited List International Standard. World Anti-Doping Agency, September 16, 2006. Please be advised that this information is subject to change at anytime and that in case of any discrepancy between this information and the World Anti-Doping Code (Code), the Code prevails. The official text of the Prohibited List shall be maintained by the World Anti-Doping Agency and shall be published in English and French. In the event of any conflict between the translations and original English text posted at www.wada-ama.org, the English version shall prevail. Reprinted with permission.

WORLD
ANTI-DOPING
AGENCY

The World Anti-Doping Code

THE 2007 PROHIBITED LIST

INTERNATIONAL STANDARD

The official text of the *Prohibited List* shall be maintained by *WADA* and shall be published in English and French. In the event of any conflict between the English and French versions, the English version shall prevail.

This List shall come into effect on 1 January 2007

THE 2007 PROHIBITED LIST

WORLD ANTI-DOPING CODE

Valid 1 January 2007

The use of any drug should be limited to medically justified indications

Substances And Methods Prohibited At All Times (In- And Out-Of-Competition)

Prohibited Substances

S1. Anabolic Agents

Anabolic agents are prohibited.

Anabolic Androgenic Steroids (AAS)

a. Exogenous* AAS, including:
1-androstendiol (5α-androst-1-ene-3β,17β-diol)**; 1-androstendione** (5α-androst-1-ene-3,17-dione)**; bolandiol** (19-norandrostenediol)**; bolasterone; boldenone; boldione** (androsta-1,4-diene-3,17-dione)**; calusterone; clostebol; danazol** (17α-ethynyl-17β-hydroxyandrost-4-eno[2,3-d]isoxazole)**; dehydrochlormethyltestosterone** (4-chloro-17β-hydroxy-17α-methylandrosta-1,4-dien-3-one)**; desoxymethyltestosterone** (17α-methyl-5α-androst-2-en-17β-ol)**; drostanolone; ethylestrenol** (19-nor-17α-pregn-4-en-17-ol)**; fluoxymesterone; formebolone; furazabol** (17β-hydroxy-17α-methyl-5α-androstano[2,3-c]-furazan)**; gestrinone; 4-hydroxytestosterone** (4,17β-dihydroxyandrost-4-en-3-one)**; mestanolone; mesterolone; metenolone; methandienone** (17β-hydroxy-17α-methylandrosta-1,4-dien-3-one)**; methandriol; methasterone** (2α, 17α-dimethyl-5α-androstane-3-one-17β-ol)**; methyldienolone** (17β-hydroxy-17α-methylestra-4,9-dien-3-one)**; methyl-1-testosterone** (17β-hydroxy-17α-methyl-5α-androst-1-en-3-one)**; methylnortestosterone** (17β-hydroxy-17α-methylestr-4-en-3-one)**; methyltrienolone** (17β-hydroxy-17α-methylestra-4,9,11-trien-3-one)**; methyltestosterone; mibolerone; nandrolone; 19-norandrostenedione** (estr-4-ene-3,17-dione)**; norboletone; norclostebol; norethandrolone; oxabolone; oxandrolone; oxymesterone; oxymetholone; prostanozol** ([3,2-c]pyrazole-5α-etioallocholane-17β-tetrahydropyranol)**; quinbolone; stanozolol; stenbolone; 1-testosterone** (17β-hydroxy-5α-androst-1-en-3-one)**; tetrahydrogestrinone** (18a-homo-pregna-4,9,11-trien-17β-ol-3-one)**; trenbolone** and other substances with a similar chemical structure or similar biological effect(s).

b. Endogenous** AAS:

androstenediol (androst-5-ene-3β,17β-diol); **androstenedione** (androst-4-ene-3,17-dione); **dihydrotestosterone** (17β-hydroxy-5α-androstan-3-one) ; **prasterone** (dehydroepiandrosterone, DHEA); **testosterone** and the following metabolites and isomers:

5α-androstane-3α,17α-diol; 5α-androstane-3α,17β-diol; 5α-androstane-3β, 17α-diol; 5α-androstane-3β,17β-diol; androst-4-ene-3α,17α-diol; androst-4-ene-3α,17β-diol; androst-4-ene-3β,17α-diol; androst-5-ene-3α,17α-diol; androst-5-ene-3α,17β-diol; androst-5-ene-3β,17α-diol;4-androstenediol (androst-4-ene-3β,17β-diol)**; 5-androstenedione** (androst-5-ene-3,17-dione)**; epi-dihydrotestosterone; 3α-hydroxy-5α-androstan-17-one; 3β-hydroxy-5α-androstan-17-one; 19-norandrosterone; 19-noretiocholanolone.**

Where an anabolic androgenic steroid is capable of being produced endogenously, a *Sample* will be deemed to contain such *Prohibited Substance* where the concentration of such *Prohibited Substance* or its metabolites or markers and/or any other relevant ratio(s) in the *Athlete*'s *Sample* so deviates from the range of values normally found in humans that it is unlikely to be consistent with normal endogenous production. A *Sample* shall not be deemed to contain a *Prohibited Substance* in any such case where an *Athlete* proves that the concentration of the *Prohibited Substance* or its metabolites or markers and/or the relevant ratio(s) in the *Athlete*'s *Sample* is attributable to a physiological or pathological condition.

In all cases, and at any concentration, the *Athlete*'s sample will be deemed to contain a *Prohibited Substance* and the laboratory will report an *Adverse Analytical Finding* if, based on any reliable analytical method (e.g. IRMS), the laboratory can show that the *Prohibited Substance* is of exogenous origin. In such case, no further investigation is necessary.

If a value in the range of levels normally found in humans is reported and the reliable analytical method (e.g. IRMS) has not determined the exogenous origin of the substance, but if there are indications, such as a comparison to endogenous reference steroid profiles, of a possible *Use* of a *Prohibited Substance*, further investigation shall be conducted by the relevant *Anti-Doping Organization* by reviewing the results of any previous test(s) or by conducting subsequent test(s), in order to determine whether the result is due to a physiological or pathological condition, or has occurred as a consequence of the exogenous origin of a *Prohibited Substance*.

When a laboratory has reported a T/E ratio greater than four (4) to one (1) and any reliable analytical method (e.g. IRMS) applied has not determined the exogenous origin of the substance, further investigation may be conducted by a review of previous tests or by conducting subsequent test(s), in order to determine whether the result is due to a physiological or pathological condition, or has occurred as a consequence of the exogenous origin of a *Prohibited Substance*. If a laboratory reports, using an additional reliable analytical method (e.g. IRMS), that the *Prohibited Substance* is of exogenous origin, no further investigation is necessary and the *Sample* will be deemed to contain such *Prohibited Substance*.

When an additional reliable analytical method (e.g. IRMS) has not been applied and a minimum of three previous test results are not available, a longitudinal profile of the *Athlete* shall be established by performing a minimum of three no advance notice tests in a period of three months by the relevant *Anti-Doping Organization*. If the longitudinal profile of the *Athlete* established by the subsequent tests is not physiologically normal, the result shall be reported as an *Adverse Analytical Finding*.
In extremely rare individual cases, boldenone of endogenous origin can be consistently found at very low nanograms per milliliter (ng/mL) levels in urine. When such a very low concentration of boldenone is reported by a laboratory and the application of any reliable analytical method (e.g. IRMS) has not determined the exogenous origin of the substance, further investigation may be conducted by subsequent tests. When an additional reliable analytical method (e.g. IRMS) has not been applied, a longitudinal profile of the athlete shall be established by performing a minimum of three no advance notice tests in a period of three months by the relevant *Anti-Doping Organization*. If the longitudinal profile of the *Athlete* established by the subsequent tests is not physiologically normal, the result shall be reported as an *Adverse Analytical Finding*.

For 19-norandrosterone, an *Adverse Analytical Finding* reported by a laboratory is considered to be scientific and valid proof of exogenous origin of the *Prohibited Substance*. In such case, no further investigation is necessary.

Should an *Athlete* fail to cooperate in the investigations, the *Athlete*'s *Sample* shall be deemed to contain a *Prohibited Substance*.

Other Anabolic Agents, including but not limited to:

Clenbuterol, tibolone, zeranol, zilpaterol.

For purposes of this section:
[*] *"exogenous" refers to a substance which is not ordinarily capable of being produced by the body naturally.*
[**] *"endogenous" refers to a substance which is capable of being produced by the body naturally.*

S2. Hormones And Related Substances

The following substances, including other substances with a similar chemical structure or similar biological effect(s), and their releasing factors, are prohibited:

1. **Erythropoietin (EPO);**
   Growth Hormone (hGH), Insulin-like Growth Factors (e.g. IGF-1), Mechano Growth Factors (MGFs);

Gonadotrophins (LH, hCG), prohibited in males only;
Insulin;
Corticotrophins.

Unless the *Athlete* can demonstrate that the concentration was due to a physiological or pathological condition, a *Sample* will be deemed to contain a *Prohibited Substance* (as listed above) where the concentration of the *Prohibited Substance* or its metabolites and/or relevant ratios or markers in the *Athlete*'s *Sample* so exceeds the range of values normally found in humans that it is unlikely to be consistent with normal endogenous production.

If a laboratory reports, using a reliable analytical method, that the *Prohibited Substance* is of exogenous origin, the *Sample* will be deemed to contain a *Prohibited Substance* and shall be reported as an *Adverse Analytical Finding*.

The presence of other substances with a similar chemical structure or similar biological effect(s), diagnostic marker(s) or releasing factors of a hormone listed above or of any other finding which indicate(s) that the substance detected is of exogenous origin, will be deemed to reflect the use of a *Prohibited Substance* and shall be reported as an *Adverse Analytical Finding*.

S3. Beta-2 Agonists

All beta-2 agonists including their D- and L-isomers are prohibited.

As an exception, formoterol, salbutamol, salmeterol and terbutaline when administered by inhalation, require an abbreviated Therapeutic Use Exemption.

Despite the granting of any form of Therapeutic Use Exemption, a concentration of salbutamol (free plus glucuronide) greater than 1000 ng/mL will be considered an *Adverse Analytical Finding* unless the *Athlete* proves that the abnormal result was the consequence of the therapeutic use of inhaled salbutamol.

S4. Agents With Anti-Estrogenic Activity

The following classes of anti-estrogenic substances are prohibited:

Aromatase inhibitors including, but not limited to, anastrozole, letrozole, aminoglutethimide, exemestane, formestane, testolactone.

Selective Estrogen Receptor Modulators (SERMs) including, but not limited to, raloxifene, tamoxifen, toremifene.

Other anti-estrogenic substances including, but not limited to, clomiphene, cyclofenil, fulvestrant.

S5. Diuretics And Other Masking Agents

Masking agents are prohibited. They include:

Diuretics*, epitestosterone, probenecid, alpha-reductase inhibitors (e.g. **finasteride, dutasteride), plasma expanders (**e.g. **albumin, dextran, hydroxyethyl starch)** and other substances with similar biological effect(s).

Diuretics include:

acetazolamide, amiloride, bumetanide, canrenone, chlorthalidone, etacrynic acid, furosemide, indapamide, metolazone, spironolactone, thiazides (e.g. **bendroflumethiazide, chlorothiazide, hydrochlorothiazide), triamterene**, and other substances with a similar chemical structure or similar biological effect(s) (except for drosperinone, which is not prohibited).

*A Therapeutic Use Exemption is not valid if an *Athlete*'s urine contains a diuretic in association with threshold or sub-threshold levels of a *Prohibited Substance*(s).

PROHIBITED METHODS

M1. Enhancement of Oxygen Transfer

The following are prohibited:

1. Blood doping, including the use of autologous, homologous or heterologous blood or red blood cell products of any origin.
2. Artificially enhancing the uptake, transport or delivery of oxygen, including but not limited to perfluorochemicals, efaproxiral (RSR13) and modified haemoglobin products (e.g. haemoglobin-based blood substitutes, microencapsulated haemoglobin products).

M2. Chemical And Physical Manipulation

Tampering, or attempting to tamper, in order to alter the integrity and validity of *Samples* collected during *Doping Controls* is prohibited. These include but are not limited to catheterisation, urine substitution and/or alteration.

Intravenous infusions are prohibited, except as a legitimate medical treatment.

M3. Gene Doping

The non-therapeutic use of cells, genes, genetic elements, or of the modulation of gene expression, having the capacity to enhance athletic performance, is prohibited.

Substances And Methods Prohibited In-Competition

In addition to the categories S1 to S5 and M1 to M3 defined above, the following categories are prohibited in competition:

Prohibited Substances

S6. Stimulants

All stimulants (including both their (D- & L-) optical isomers where relevant) are prohibited, except imidazole derivatives for topical use and those stimulants included in the 2007 Monitoring Program[*].

Stimulants include:

Adrafinil, adrenaline[**], amfepramone, amiphenazole, amphetamine, amphetaminil, benzphetamine, benzylpiperazine, bromantan, cathine[***], clobenzorex, cocaine, cropropamide, crotetamide, cyclazodone, dimethylamphetamine, ephedrine[****], etamivan, etilamphetamine, etilefrine, famprofazone, fenbutrazate, fencamfamin, fencamine, fenetylline, fenfluramine, fenproporex, furfenorex, heptaminol, isometheptene, levmethamfetamine, meclofenoxate, mefenorex, mephentermine, mesocarb, methamphetamine (D-), methylenedioxyamphetamine, methylenedioxymethamphetamine, p-methylamphetamine, methylephedrine[****], methylphenidate, modafinil, nikethamide, norfenefrine, norfenfluramine, octopamine, ortetamine, oxilofrine, parahydroxyamphetamine, pemoline, pentetrazol, phendimetrazine, phenmetrazine, phenpromethamine, phentermine, 4-phenylpiracetam (carphedon), prolintane, propylhexedrine, selegiline, sibutramine, strychnine, tuaminoheptane and other substances with a similar chemical structure or similar biological effect(s).

[*] The following substances included in the 2007 Monitoring Program (bupropion, caffeine, phenylephrine, phenylpropanolamine, pipradol, pseudoephedrine, synephrine) are not considered as *Prohibited Substances*.

[**] **Adrenaline** associated with local anaesthetic agents or by local administration (e.g. nasal, ophthalmologic) is not prohibited.

[***] **Cathine** is prohibited when its concentration in urine is greater than 5 micrograms per milliliter.

[****] Each of **ephedrine** and **methylephedrine** is prohibited when its concentration in urine is greater than 10 micrograms per milliliter.

A stimulant not expressly mentioned as an example under this section should be considered as a Specified Substance only if the *Athlete* can establish that the substance is particularly susceptible to unintentional anti-doping rule violations because of its general availability in medicinal products or is less likely to be successfully abused as a doping agent.

S7. Narcotics

The following narcotics are prohibited:

buprenorphine, dextromoramide, diamorphine (heroin), fentanyl and its derivatives, hydromorphone, methadone, morphine, oxycodone, oxymorphone, pentazocine, pethidine.

S8. Cannabinoids

Cannabinoids (e.g. hashish, marijuana) are prohibited.

S9. Glucocorticosteroids

All glucocorticosteroids are prohibited when administered orally, rectally, intravenously or intramuscularly. Their use requires a Therapeutic Use Exemption approval.

Other routes of administration (intraarticular/periarticular/peritendinous/epidural/intradermal injections and inhalation) require an Abbreviated Therapeutic Use Exemption except as noted below.

Topical preparations when used for dermatological (including iontophoresis/phonophoresis), auricular, nasal, ophthalmic, buccal, gingival and perianal disorders are not prohibited and do not require any form of Therapeutic Use Exemption.

Substances Prohibited In Particular Sports

P1. Alcohol

Alcohol (ethanol) is prohibited *in-competition* only, in the following sports. Detection will be conducted by analysis of breath and/or blood. The doping violation threshold (haematological values) for each Federation is reported in parenthesis.

- Aeronautic (FAI) (0.20 g/L)
- Archery (FITA, IPC) (0.10 g/L)
- Automobile (FIA) (0.10 g/L)
- Boules (CMSB IPC bowls) (0.10 g/L)
- Karate (WKF) (0.10 g/L)

- Modern Pentathlon (UIPM) for disciplines involving shooting (0.10 g/L)
- Motorcycling (FIM) (0.10 g/L)
- Powerboating (UIM) (0.30 g/L)

P2. Beta-Blockers

Unless otherwise specified, beta-blockers are prohibited *in-competition* only, in the following sports.

- Aeronautic (FAI)
- Archery (FITA, IPC) (also prohibited *out-of-competition*)
- Automobile (FIA)
- Billiards (WCBS)
- Bobsleigh (FIBT)
- Boules (CMSB, IPC bowls)
- Bridge (FMB)
- Curling (WCF)
- Gymnastics (FIG)
- Motorcycling (FIM)
- Modern Pentathlon (UIPM) for disciplines involving shooting
- Nine-pin bowling (FIQ)
- Sailing (ISAF) for match race helms only
- Shooting (ISSF, IPC) (also prohibited *out-of-competition*)
- Skiing/Snowboarding (FIS) in ski jumping, freestyle aerials/halfpipe and snowboard halfpipe/big air
- Wrestling (FILA)

Beta-blockers include, but are not limited to, the following:

acebutolol, alprenolol, atenolol, betaxolol, bisoprolol, bunolol, carteolol, carvedilol, celiprolol, esmolol, labetalol, levobunolol, metipranolol, metoprolol, nadolol, oxprenolol, pindolol, propranolol, sotalol, timolol.

Specified Substances*

"Specified Substances"* are listed below:

- All inhaled Beta-2 Agonists, except salbutamol (free plus glucuronide) greater than 1000 ng/mL and clenbuterol;
- Probenecid;
- Cathine, cropropamide, crotetamide, ephedrine, etamivan, famprofazone, heptaminol, isometheptene, levmethamfetamine, meclofenoxate,

- p-methylamphetamine, methylephedrine, nikethamide, norfenefrine, octopamine, ortetamine, oxilofrine, phenpromethamine, propylhexedrine, selegiline, sibutramine, tuaminoheptane, and any other stimulant not expressly listed under section S6 for which the Athlete establishes that it fulfils the conditions described in section S6;
- Cannabinoids;
- All Glucocorticosteroids;
- Alcohol;
- All Beta Blockers.

* "*The Prohibited List may identify specified substances which are particularly susceptible to unintentional anti-doping rule violations because of their general availability in medicinal products or which are less likely to be successfully abused as doping agents*." A doping violation involving such substances may result in a reduced sanction provided that the "*...Athlete can establish that the Use of such a specified substance was not intended to enhance sport performance...*"

III: ADA Recommendations for Athletes

The American Dietetic Association and the Canadian Dietetic Association prepared a position stand regarding nutrition for physical fitness and athletic performance for adults. These organizations recommended appropriate selection of food and fluids, timing of intake, and supplement choices for optimal health and exercise performance. Specifically, they reviewed the current scientific data related to athletes' nutrient, energy, and fluid needs; assessment of body composition; strategies for weight change; the use of supplements; and nutrition recommendations for vegetarian athletes.

Following is a reprint of the 2000 publication of the stand in the *Canadian Journal of Dietetic Practice and Research.*

Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance*

ABSTRACT

It is the position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition. These organizations recommend appropriate selection of food and fluids, timing of intake, and supplement choices for optimal health and exercise performance. This position paper reviews the current scientific data related to the energy needs of athletes, assessment of body composition, strategies for weight change, the nutrient and fluid needs of athletes, special nutrient needs during training, the use of supplements and nutritional ergogenic aids, and the nutrition recommendations for vegetarian athletes. During times of high physical activity, energy and macronutrient needs—especially carbohydrate and protein intake—must be met in order to maintain body weight, replenish glycogen stores, and provide adequate protein for building and repair of tissue. Fat intake should be adequate to provide the essential fatty acids and fat-soluble vitamins, as well as to help provide adequate energy for weight maintenance. Overall, diets should provide moderate amounts of energy from fat (20% to 25% of energy); however, there appears to be no health or performance benefit to consuming a diet containing less than 15% of energy from fat. Body weight and composition can affect exercise performance, but should not be used as the sole criterion for sports performance; daily weigh-ins are discouraged. Consuming adequate food and fluid before, during, and after exercise can help maintain blood glucose during exercise, maximize exercise performance, and improve recovery time. Athletes should be well-

*Following is a reprint of the position of the American Dietetic Association and Dietitians of Canada: Nutrition and Athletic Performance. American Dietetic Association 2000;100:1543–1556. Reprinted with permission.

hydrated before beginning to exercise; athletes should also drink enough fluid during and after exercise to balance fluid losses. Consumption of sport drinks containing carbohydrates and electrolytes during exercise will provide fuel for the muscles, help maintain blood glucose and the thirst mechanism, and decrease the risk of dehydration or hyponatremia. Athletes will not need vitamin and mineral supplements if adequate energy to maintain body weight is consumed from a variety of foods. However, supplements may be required by athletes who restrict energy intake, use severe weight-loss practices, eliminate one or more food groups from their diet, or consume high-carbohydrate diets with low micronutrient density. Nutritional ergogenic aids should be used with caution, and only after careful evaluation of the product for safety, efficacy, potency, and whether or not it is a banned or illegal substance. Nutrition advice, by a qualified nutrition expert, should only be provided after carefully reviewing the athlete's health, diet, supplement and drug use, and energy requirements.

Over the past 20 years, research has clearly documented the beneficial effects of nutrition on exercise performance. There is no doubt that what an athlete eats and drinks can affect health, body weight and composition, substrate availability during exercise, recovery time after exercise, and, ultimately, exercise performance. As the research and interest in sport nutrition has increased, so has the sale of ergogenic aids, supplements, herbal preparations, and diet aids, all aimed at improving sports performance. The manufacturers of these products frequently make unsubstantiated claims to entice the athlete to use their products. The athlete who wants to optimize exercise performance needs to follow good nutrition and hydration practices, use supplements and ergogenic aids carefully, minimize severe weight loss practices, and eat a variety of foods in adequate amounts. This position is focused on adult athletes, rather than children or adolescents, and does not focus on any particular type of athlete or athletic event. Moreover, the position is intended to provide guidance to dietetics and health professionals working with athletes, and is not directed to individual athletes themselves.

Position Statement

It is the position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine that physical activity, athletic performance, and recovery from exercise are enhanced by optimal nutrition. These organizations recommend appropriate selection of food and fluids, timing of intake, and supplement choices for optimal health and exercise performance.

Key Points

The following key points summarize the current energy, nutrient, and fluid recommendations for active adults and competitive athletes noted in this posi-

tion paper. Sport nutrition experts can further adjust these general recommendations to accommodate the unique concerns of individual athletes regarding health, sports, nutrient needs, food preferences, and body weight and body composition goals.

- During times of high-intensity training, adequate energy needs to be consumed to maintain body weight, maximize the training effects, and maintain health. Low-energy intakes can result in loss of muscle mass, menstrual dysfunction, loss or failure to gain bone density, and increased risk of fatigue, injury, and illness.
- Body weight and composition can affect exercise performance but should not be used as the sole criterion for participation in sports; daily weigh-ins are discouraged. Optimal body-fat levels vary depending upon the sex, age, and heredity of the athlete, as well as the sport itself. Body-fat assessment techniques have inherent variability, thus limiting the precision with which they can be interpreted. If weight loss (fat loss) is desired, it should start early—before the competitive season—and involve a trained health and nutrition professional.
- Carbohydrates are important to maintain blood-glucose levels during exercise and to replace muscle glycogen. Recommendations for athletes range from 6 to 10 g/kg body weight per day. The amount required depends upon the athlete's total daily energy expenditure, type of sport performed, sex of the athlete, and environmental conditions.
- Protein requirements are slightly increased in highly active people. Protein recommendations for endurance athletes are 1.2 to 1.4 g/kg body weight per day, whereas those for resistance- and strength-trained athletes may be as high as 1.6 to 1.7 g/kg body weight per day. These recommended protein intakes can generally be met through diet alone, without the use of protein or amino acid supplements, if energy intake is ad- equate to maintain body weight.
- Fat intake should not be restricted, because there is no performance benefit in consuming a diet with less than 15 % of energy from fat, compared with 20 % to 25 % of energy from fat. Fat is important in the diets of athletes, as it provides energy, fat-soluble vitamins, and essential fatty acids. Additionally, there is no scientific basis on which to recommend high-fat diets to athletes.
- The athletes at greatest risk of micronutrient deficiencies are those who restrict energy intake or use severe weight-loss practices, eliminate one or more food groups from their diet, or consume high-carbohydrate diets with low micronutrient density. Athletes should strive to consume diets that provide at least the RDAs/DRIs for all micronutrients from food.

- Dehydration decreases exercise performance; thus, adequate fluid before, during, and after exercise is necessary for health and optimal performance. Athletes should drink enough fluid to balance their fluid losses. Two hours before exercise, 400 to 600 mL (14 to 22 oz) of fluid should be consumed, and, during exercise, 150 to 350 mL (6 to 12 oz) of fluid should be consumed every 15 to 20 minutes, depending on tolerance. After exercise, the athlete should drink adequate fluids to replace sweat losses during exercise. The athlete needs to drink at least 450 to 675 mL (16 to 24 oz) of fluid for every pound (0.5 kg) of body weight lost during exercise.
- Before exercise, a meal or snack should provide sufficient fluid to maintain hydration, be relatively low in fat and fiber to facilitate gastric emptying and minimize gastrointestinal distress, be relatively high in carbohydrate to maximize maintenance of blood glucose, be moderate in protein, and be com- posed of foods familiar and well-tolerated by the athlete.
- During exercise, the primary goals for nutrient consumption are to replace fluid losses and provide carbohydrate (approximately 30 to 60 g per hour) for the maintenance of blood-glucose levels. These nutrition guidelines are especially important for endurance events lasting longer than an hour, when the athlete has not consumed adequate food or fluid before exercise, or if the athlete is exercising in an extreme environment (heat, cold, or altitude).
- After exercise, the dietary goal is to provide adequate energy and carbohydrates to replace muscle glycogen and to ensure rapid recovery. If an athlete is glycogen-depleted after exercise, a carbohydrate intake of 1.5 g/kg body weight during the first 80 minutes, and again every 2 hours for 4 to 6 hours, will be adequate to replace glycogen stores. Protein consumed after exercise will provide amino acids for the building and repair of muscle tissue. Therefore, athletes should consume a mixed meal providing carbohydrates, protein, and fat soon after a strenuous competition or training session.
- In general, no vitamin and mineral supplements should be required if an athlete is consuming adequate energy from a variety of foods to maintain body weight. Supplementation recommendations unrelated to exercise—such as folic acid in women of childbearing potential—should be followed. If an athlete is dieting, eliminating foods or food groups, is sick or recovering from injury, or has a specific micronutrient deficiency, a multivitamin/mineral supplement may be appropriate. No single nutrient supplements should be used without a specific medical or nutritional reason (e.g., iron supplements to reverse iron-deficiency anemia).

- Athletes should be counseled regarding the use of ergogenic aids, which should be used with caution and only after careful evaluation of the product for safety, efficacy, potency, and legality.
- Vegetarian athletes may be at risk for low energy, protein, and micronutrient intakes because of high intakes of low-energy–dense foods and the elimination of meat and dairy from the diet. Consultation with a registered dietitian will help to avoid these nutrition problems.

Energy Requirements

Meeting energy needs is the first nutrition priority for athletes. Achieving energy balance is essential for the maintenance of lean-tissue mass, immune and reproductive function, and optimum athletic performance. Energy balance is defined as a state when energy intake (the sum of energy from food, fluids, and supplement products) equals energy expenditure (the sum of energy expended as basal metabolism, the thermic effect of food, and any voluntary physical activity) (1). Inadequate energy intake relative to energy expenditure compromises performance and the benefits associated with training. With limited energy intake, fat and lean tissue mass will be used by the body for fuel. Loss of muscle results in the loss of strength and endurance. In addition, chronically low energy intake often results in poor nutrient intake, particularly of the micronutrients. In the 1989 Recommended Dietary Allowances (RDAs) (2), mean energy requirements for women and men who are slightly to moderately active and between 19 to 50 years of age were established as 2,200 and 2,900 kcal per day, respectively. Expressed alternatively, normally active people are counseled to consume an energy intake of 1.5 to 1.7 times resting energy expenditure or at a rate of 37 to 41 kcal/kg body weight per day (2). Energy expenditure is influenced by heredity, age, sex, body size, fat-free mass, and the intensity, frequency, and duration of exercise. For athletes, the recommendation is made to evaluate the kind of exercise performed for its intensity, frequency, and duration, and then to add this increment to the energy needed for normal daily activity (8,4,5). For example, a 70 kg male runner who runs 10 miles per day at a 6-minute pace would require approximately 1,068 kcal per day to cover the energy expenditure of running (0.253 kcal/min/kg) (6), plus the energy cost of normal daily activities (70 kg x 37 to 41 kcal/kg body weight) for normal activity. Thus, this athlete would need approximately 3,653 to 3,933 kcal per day to cover the total cost of energy expenditure. Ultimately, however, numeric guidelines for energy intake, such as those cited above, can only provide a crude approximation of the average energy needs of an individual athlete. Any athlete needs to consume enough energy to maintain appropriate weight and body composition while training for a sport. Usual energy intakes for male endurance athletes range from 3,000 to 5,000 kcal per day (7). Although usual energy

intakes for many intensely training female athletes may match those of male athletes per kg of body weight, some consume less energy than they expend. This low-energy intake can lead to weight loss and disruption of reproductive function, and is often seen with energy intakes of less than 1,800 to 2,000 kcal per day (6–11). Although resistance exercise usually requires less energy than endurance exercise, the total energy needs of athletes participating in strength training and bodybuilding may be as high as those of endurance athletes, because of their increased body size and high levels of fat-free mass. In circumstances in which an increase in lean body mass is the goal, energy intake must be sufficient to meet the needs for muscle growth. Thus, many strength athletes may need 44 to 50 kcal/kg body weight/day, and those in serious training may have even higher energy requirements (more than 50 kcal/kg body weight/day) (12,18).

Weight Change

It is often the case that an athlete will want to increase or decrease body weight to meet the demands of a sport. In either case, weight change should be accomplished slowly during the off-season, or at the beginning of the season, before competition begins. Weight gain can be accomplished by the incorporation of additional energy into the diet (500 to 1,000 kcal per day), in conjunction with increased strength training to promote the accretion of the tissue desired. How quickly weight gain occurs will depend on the athlete's genetic makeup, degree of positive energy balance, number of rest and recovery days per week, and type of exercise training program. Weight loss is somewhat more problematic, as diminished energy intake can compromise nutrient intake and exercise performance while decreasing both body fat and muscle mass (14,15). Consultation with a registered dietitian trained in sport nutrition can help athletes maintain a healthful diet while reducing total energy intake to allow gradual weight loss (approximately 1 to 2 lbs/week or 0.5 to 1.0 kg/week). The process begins with the identification of what constitutes a realistic, healthful body weight based on genetic, physiologic, social, sport, and psychological factors. A healthful weight is one that can be realistically maintained, allows for positive advances in exercise performance, minimizes the risk of injury or illness, and reduces the risk factors for chronic disease. Figure 1 shows strategies to help health professionals work with athletes to identify and maintain healthful body weights. Failure to meet weight-loss goals may result in severe consequences, such as being cut from the team, restricted participation, or elimination from competition. This may result in chronic dieting by many athletes to maintain lower-than-healthful body weights, which, in turn, can lead to disordered eating and, in severe cases, clinical eating disorders. Nutrition strategies for identification, intervention, and treatment of eating disorders in athletes have been presented elsewhere (16–19). When pressure to achieve a weight goal is high, athletes

are likely to attempt any weight-loss method to achieve success, regardless of the health consequences. Weight loss can be especially problematic for female athletes who generally are smaller, and thus may have lower energy needs than male athletes. In women, low-energy intake, in conjunction with high-energy output, has been associated with alterations in the secretion of the pituitary gonadotropins (luteinizing hormone [LH] and follicle-stimulating hormone [FSH]) (10,20). This, in turn, results in changes in ovarian hormone secretions, leading to amenorrhea and loss of (or failure to gain) bone mass in young female athletes (21). It has been proposed that energy availability (amount of energy intake unused after energy for activity has been provided) determines the health of the body, and that curtailing energy intake to attain some body weight or fat standard may result in insufficient energy being available to maintain all vital functions (8,10,22). Thus, a negative energy balance, due to chronic dieting or undereating in conjunction with heavy exercise, may alter the energy flux and create a negative "energy drain," which compromises reproductive function and bone health. Incorporation of additional energy into the diets of these women has resulted in the return of menstrual function and the improvement in overall nutritional status (8,28). Although failure of reproductive function in male athletes has not been extensively investigated, Loucks (24) has identified changes in LH and FSH secretion in men that mimic those of women in response to changes in energy availability.

Body Composition

Body composition and weight are 2 of the many factors that contribute to optimal exercise performance. Taken together, these 2 factors may affect an athlete's potential for success within a given sport. Body weight can influence an athlete's speed, endurance, and power, whereas body composition can affect an athlete's strength, agility, and appearance. Most athletes require a high strength-to-weight ratio to achieve optimal athletic performance, and because body fat adds to weight without adding to strength, low body fat percentages are often emphasized within many sports (25). However, too little body fat results in deterioration of health and performance (22,26). Athletic performance cannot be accurately predicted based solely on body weight and composition (27). The primary reason for determining an athlete's body composition is to obtain information that may be beneficial in improving athletic performance (28). Therefore, the determination of an athlete's optimal body weight and composition for health and competition should be done individually, because these factors are strongly influenced by age, sex, genetics, and the requirements of the sport. Yet, some sports dictate that athletes make changes in body weight and composition that may not be optimal for the athlete. For example, weight-class sports—such as wrestling or lightweight rowing—may require athletes to lose or gain weight to qualify for a specific weight category. Sports

with an aesthetic component—such as dance, gymnastics, and figure skating—may pressure athletes to lose weight and body fat to have a lean physique, although their current weight for health and performance may be optimal. With extreme energy restrictions, both muscle and fat mass are lost, which may adversely influence an athlete's performance. Thus, an athlete's optimal competitive body weight and relative body fatness should be determined when an athlete is healthy and performing at his or her best (29).

Body Composition and Sport Performance

Percentage-of-body-fat values for athletes varies depending on the sex of the athlete and the sport itself. Male athletes with the lowest estimates of body fat (less than 6%) include middle- distance and long-distance runners and body-builders, whereas male basketball players, cyclists, gymnasts, sprinters, jumpers, triathletes, and wrestlers average between 6% to 15% body fat (26,30). Male athletes involved in power sports, such as football, rugby, and ice and field hockey, have slightly more variable body-fat levels (6% to 19%). Female athletes with the lowest estimates of body fat (6% to 15%) participate in body- building, cycling, triathlons, and running events; higher fat levels are found in female athletes participating in racquetball, skiing, soccer, swimming, tennis, and volleyball (10% to 20%) (26,80). The estimated minimal level of body fat compatible with health is 5% for males and 12% for females (81); however, optimal body-fat percentages for an individual athlete may be much higher than these minimums and should be determined on an individual basis. Athletes who strive to maintain body-weight or body-fat levels that are inappropriate, or have body-fat percentages below these minimal levels, may be at risk for an eating disorder or other health problems related to poor energy and nutrient intakes (8,11,18,22,28,82–34).

Assessment of Body Composition

Methods for assessment of body composition are based on either a 2-component or a multicomponent model and use several different measurement techniques. Two-component models divide the body into either fat mass (all lipids within the body) or fat-free mass (the remainder after fat is subtracted). The multicomponent model divides the body into 3 or more components. For example, the 8-component model divides the body into fat mass and 2 components of fat-free mass (bone mineral and lean tissue). The criterion methods most commonly used to assess components of body composition in athletes are based on a 2-component or a multicomponent model. Though a multicomponent criterion model is preferred for assessing body composition because, it provides more accurate estimates, measurement techniques required for this model are not readily available to most athletes. A 2-component criterion model typically uses hydrodensitometry (hydro- static weighing) or plethysmography (BODPOD) measurement techniques, and a 8-component model uses dual-

energy x-ray absorptiometry (DEXA) measurements. The most common methods used to measure body composition in field or clinical settings include anthropometry (skinfolds), bioelectrical impedance analysis (BIA), and near-infrared interactance. These field methods are validated using either 2-component or multicomponent criterion models (35). When using these field methods, care should be taken in choosing the appropriate validated prediction equation for estimating body composition, based on an athlete's demographics (age, sex, level of adiposity, ethnicity, and physical activity), in order to obtain accurate estimates (36). The relative validity of any body composition field method depends on its accuracy compared with the criterion method and its reliability (reproducibility) (31). DEXA and hydrostatic weighing (hydrodensitometry) are 2 widely used criterion methods from which field methods of body composition assessment for athletes are developed (87–42). Regardless of the method used, athletes and coaches should know the errors associated with the body composition assessment method being used. With carefully applied skinfold or BIA methods, it is possible to estimate relative body fat percentage with an error of 8% to 4%, and to estimate fat-free mass within 2.5 to 8.5 kg (27,81,35). Thus, if the actual body fat percentage is 15%, then predicted values could range from 1296 to 18% (assuming a 3% error). If the actual fat-free mass is 50 kg, then predicted values could range from 47.5 to 52.5 kg, assuming an error of 2.5 kg. If inappropriate prediction equations for a method are used, poor measurement techniques applied, or if the measurement equipment is poorly maintained and calibrated, the errors associated with the body-composition estimate will be much larger. Because of the errors associated with body composition assessment methods, it is inappropriate to set a specific body-fat percentage goal for an individual athlete. Instead, a range of target percentages of body-fat values should be recommended.

Macronutrient Requirements For Exercise

The fuel burned during exercise depends on the intensity and duration of the exercise performed, the sex of the athlete, and prior nutritional status. All other conditions being equal, an increase in the intensity of an exercise will increase the contribution of carbohydrate to the energy pool (43,44). As the length of the exercise continues, the source of this carbohydrate may shift from the muscle glycogen pool to circulating blood glucose, but, in all circumstances, if blood glucose cannot be maintained, the intensity of the exercise performed will decrease (45). Fat contributes to the energy pool over a wide range of exercise intensities, being metabolized at somewhat the same absolute rate throughout the range; however, the proportion of energy contributed by fat decreases as exercise intensity increases, because the contribution of carbohydrate increases (46). Protein contributes to the energy pool at rest and during exercise, but in fed individuals it probably provides less than

5% of the energy expended (47,48). As the duration of exercise increases, protein may contribute to the maintenance of blood glucose through gluconeogenesis in the liver. In experiments in which subjects are tested in a fasting state, the contribution of fat to the energy pool will be greater than in people who are tested postprandially, when exercise performed is moderate (approximately 50% of maximal oxygen uptake [VO, max]) (49). With exercise of higher intensity (greater than 65% of VO, max), neither prior feeding nor training markedly affects the fuel used (49). Data are not presently available, however, to suggest that athletes need a diet substantially different from that recommended in the Dietary Guidelines for Americans (50) or the Nutrition Recommendations for Canadians (51) (55% to 58% of energy from carbohydrate, 12% to 15% of energy from protein, and 25% to 30% of energy from fat). Although high carbohydrate diets (more than 60% of energy intake) have been advocated in the past, the use of proportions in making dietary recommendations may actually be misleading in terms of providing optimum nutrition. When energy intake is 4,000 to 5,000 kcal per day, even a diet containing 50% of the energy from carbohydrate will provide 500 to 600 g of carbohydrate (or approximately 7 to 8 g/kg for a 70 kg athlete), which is sufficient to maintain muscle glycogen stores from day to day (52,53). Similarly, if protein intake in such a diet was even as low as 10% of energy intake, absolute protein intake (100 to 125 g per day) would exceed the recommendations for protein intake for athletes (1.2 to 1.7 g per day or 84 to 119 g in a 70 kg athlete, see the following discussion on nitrogen balance in men). Conversely, when energy intake is less than 2,000 kcal per day, even a diet providing 60% of the energy from carbohydrate may not provide sufficient carbohydrate to maintain optimal carbohydrate stores (4 to 5 g/kg in a 60 kg athlete). Typically, diets containing 20-25% energy from fat have been recommended to facilitate adequate carbohydrate intake and to assist in weight management where necessary. Thus, specific recommendations for individual energy components may be more useful when they are based on body size, weight and body composition goals, the sport being performed, and sex of the athlete. Protein needs of athletes have received considerable investigation, not only in regard to whether athletes' protein requirements are increased, but also in relation to whether individual amino acids are a benefit to performance. Mechanisms suggested to increase athletes' protein requirements include the need to repair exercise-induced microdamage to muscle fibers, use of small amounts of protein as an energy source for exercise, and the need for additional protein to support gains in lean tissue mass (54,55). If protein needs are increased, the magnitude of the increase may depend on the type of exercise performed (endurance vs resistance), the intensity and duration of the activity, and, possibly, the sex of the participants. For endurance athletes, nitrogen balance studies in men suggest a protein recommendation of 1.2 g/kg per day (56). Little information is available regarding requirements of endurance ath-

letes who are women. Resistance exercise is thought to increase protein requirements even more than endurance exercise, and it has been recommended that experienced male bodybuilders and strength athletes consume 1.6 to 1.7 g/kg body weight per day to allow for the accumulation and maintenance of lean tissue (55,57). Again, data on female strength athletes are not available. Athletes should be aware that increasing protein intake beyond the recommended level is unlikely to result in additional increases in lean tissue, because there is a limit to the rate at which protein tissue can be accrued (54), whereas other sources have suggested an intake of 1.2 to 1.4 g/kg per day (55). It must be ensured that energy intake is adequate—otherwise, protein will be used as an energy source, falsely elevating estimates of the requirements under conditions of energy balance. It is worth noting that the customary diets of most athletes provide sufficient protein to cover even the increased amounts that may be needed (7). The use of individual amino acids to enhance performance has also been studied. One proposal is that administration of branched chain amino acids (BCAA) may enhance endurance performance by delaying the onset of central nervous system fatigue (58). It has also been proposed that BCAA may extend performance by serving as substrates for energy expenditure (59). The results of human studies, however, have been inconsistent (60–68). Because the safety and efficacy of these mixtures has not been established, their use cannot be advocated. Some studies (64,65) have proposed a positive effect of relatively high-fat diets (more than 70% of energy intake) on athletic performance. Careful evaluation of these studies shows little evidence supporting this concept (66). Fat is a necessary component of a normal diet, providing energy and essential elements of cell membranes and associated nutrients such as vitamins E, A, and D. However, the long-term negative effects of high-fat diets on health are well known. The Dietary Guidelines for Americans and Nutrition Recommendations for Canadians make recommendations for the proportion of energy from fatty acids (10% saturated, 10% polyunsaturated, 10% monounsaturated) (50,51). Athletes should follow these general recommendations, and should also ensure that their fat intakes are not excessively low. The 1999 study by Dreon and colleagues (67) suggests that there are negative effects on blood lipid profiles in some people when total dietary fat intake is less than 15% of energy.

Vitamins And Minerals

Micronutrients play an important role in energy production, hemoglobin synthesis, maintenance of bone health, adequate immune function, and the protection of body tissues from oxidative damage. They are also required to help build and repair muscle tissue following exercise. Theoretically, exercise may increase or alter the need for vitamins and minerals in a number of ways. Exercise stresses many of the metabolic pathways in which these micronutrients are required, thus exercise training may result in muscle biochemical

adaptations that increase micronutrient needs. Exercise may also increase the turnover of these micronutrients, thus increasing loss of micronutrients from the body. Finally, higher intakes of micronutrients may be required to cover increased needs for the repair and maintenance of the lean tissue mass in athletes. It is assumed that the current RDAs and Dietary Reference Intakes (DRIs) are appropriate for athletes, unless otherwise stated (2,68,69). Athletes at the greatest risk of poor micronutrient status are those who restrict energy intake or use severe weight-loss practices, eliminate one or more of the food groups from their diet, or consume high-carbohydrate, low-micronutrient–dense diets. Athletes participating in these types of behaviors may need to use a multivitamin and mineral supplement to improve overall micronutrient status. Supplementation with single micronutrients is discouraged, unless clear medical, nutritional, or public health reasons are present, such as the supplementation of iron to treat iron deficiency anemia or folic acid to prevent birth defects. The B-complex vitamins have 2 major functions directly related to exercise. Thiamin, riboflavin, vitamin B-6, niacin, pantothenic acid, and biotin are involved in energy production during exercise (4,70-74), whereas folate and vitamin B-12 are required for the production of red cells, protein synthesis, and in tissue repair and maintenance (75). Limited research has examined whether exercise increases the need for some of the B-complex vitamins, especially vitamin B-6, riboflavin, and thiamin (70,71,73,75,76). Available data were not sufficiently precise to set separate recommendations for athletes or to quantitatively link recommendations to energy expenditure (69). Nevertheless, the data available suggest that exercise may slightly increase the need for these vitamins perhaps up to twice the current recommended amount (72). These increased needs can generally be met by the higher energy intakes required of athletes to maintain body weight. The antioxidant nutrients—such as vitamins A, E, and C, beta carotene, and selenium—play an important role in protecting the cell membranes from oxidative damage. Because exercise can increase oxygen consumption by 10- to 15-fold, it has been hypothesized that chronic exercise produces a constant "oxidative stress" on the muscles and other cells (77,78). In addition, muscle-tissue damage caused by intense exercise can lead to lipid peroxidation of membranes. Although there is some evidence that acute exercise may increase levels of lipid peroxide byproducts (79), habitual exercise has been shown to result in an augmented antioxidant system and a reduction of lipid peroxidation (77). Thus, a well-trained athlete may have a more developed endogenous antioxidant system than a sedentary person (80). Research examining whether exercise increases the need for the antioxidant nutrients is equivocal and controversial; thus, there is no clear consensus on whether supplementation of antioxidant nutrients is necessary (77,79,80). The lack of consensus is especially true for the athlete with adequate or above-adequate blood levels of the antioxidant vitamins (77). Those athletes at greatest risk for poor antioxidant

intakes are athletes following a low-fat diet, those who restrict energy intakes, or those with limited dietary intakes of fruits and vegetables. The primary minerals low in the diets of athletes—especially female athletes—are calcium, iron, and zinc. (11,81). Low intakes of these minerals can usually be attributed to energy restriction or avoidance of animal products such as meat, fish, poultry, and dairy products. Calcium is especially important for the building and repair of bone tissue and the maintenance of blood-calcium levels. Inadequate dietary calcium increases the risk of low bone mineral density and stress fractures. Female athletes are at greatest risk for low bone mineral density if energy intakes are low, dairy products are eliminated from the diet, and menstrual dysfunction is present (8,22). Vitamin D is also required for adequate calcium absorption, regulation of serum calcium levels, and promotion of bone health. The 2 primary sources of vitamin D are fortified foods, (such as milk), and the production of vitamin D by ultraviolet conversion in the skin. Athletes who live at northern latitudes or who train primarily indoors throughout the year—such as gymnasts and figure skaters—may be at risk for poor vitamin D status, especially if foods fortified with vitamin D are not consumed (82). These athletes would benefit from vitamin D supplementation at the level of the DRI (5 pg/day or 200 international units [IU] vitamin D) (68). Iron plays an important role in exercise, as it is required for the formation of hemoglobin and myoglobin, which bind oxygen in the body, and for enzymes involved in energy production. Iron depletion (low iron stores) is one of the most prevalent nutrient deficiencies observed in athletes, especially female athletes. The impact of iron depletion on exercise performance is limited, but if this condition progresses to iron deficiency anemia (low hemoglobin levels), exercise performance can be negatively affected (4,81). The high incidence of iron depletion in athletes is usually attributed to poor energy intakes; avoidance of meat, fish, and poultry that contain iron in the readily available heme form; vegetarian diets that have poor iron bioavailability; or increased iron losses in sweat, feces, urine, or menstrual blood. Athletes—especially females, long-distance runners, and vegetarians—should be screened periodically to assess iron status. Changes in iron storage (low-serum ferritin concentrations) will occur first, followed by low-iron transport (low serum iron concentrations), and, eventually, iron deficiency anemia (low hemoglobin and hematocrit concentrations). Because reversal of iron deficiency anemia can require 8 to 6 months, it is advantageous to begin nutrition interventions before iron deficiency anemia can develop. Although depleted iron stores are more prevalent in female athletes, the incidence of iron deficiency anemia in female athletes is similar to the 9% to 11% found in the general female population (81,83). A transient decrease in ferritin and hemoglobin may be experienced by some athletes at the initiation of training. These decreases are the result of an increase in plasma volume, which causes hemodilution and appears to have no negative effect on performance (81). If an athlete appears

to have iron deficiency anemia but does not respond to nutrition intervention, then low hemoglobin values may be the result of changes in plasma volume, and not poor nutritional status (4). Chronic iron deficiency anemia resulting from poor iron intake can seriously affect health and exercise performance and needs medical and nutritional intervention. In the United States, it is estimated that the zinc content of the food supply is approximately 12.3 mg of zinc per person, with 70% of the zinc coming from animal products (84). Based on survey data, approximately 90% of men and 81% of women have zinc intakes that are below the 1989 RDAs (15 mg and 12 mg, respectively) (85). This nutritional shortfall is also seen in athletes, particularly females (11). The impact of these low zinc intakes on zinc status is difficult to measure, because clear assessment criteria have not been established, and plasma zinc concentrations may not reflect changes in whole-body zinc status (86). Because of the role zinc plays in growth, building, and repair of muscle tissue, and energy production, it is prudent to assess the diets of active females for adequate zinc intake.

Hydration

Exercise performance is optimal when athletes maintain fluid balance during exercise; conversely, exercise performance is impaired with progressive dehydration (87–91). Moreover, dehydration increases the risk of potentially life-threatening heat injury, such as heat stroke (92). Accordingly, athletes should attempt to remain well-hydrated before and during exercise. The American College of Sports Medicine Position Stand on Exercise and Fluid Replacement (93) and the National Athletic Trainers' Association (NATA) Position Statement on Fluid Replacement for Athletes (94) provide comprehensive overviews of the research and recommendations on maintaining hydration during exercise. The following information summarizes the key points from these position stands and provides recommendations for special environmental conditions.

Water and Electrolyte Balance

- **Losses during exercise**
  Athletes dissipate the metabolic heat produced during physical activity by radiation, conduction, convection, and by vaporization of water. In hot, dry environments, evaporation accounts for more than 80% of metabolic heat loss. Sweat rates will vary depending on variables such as body size, exercise intensity, ambient temperature, humidity, and acclimation, but can exceed 1.8 kg (approximately 1,800 mL) per hour (93). In addition to water, sweat also contains substantial amounts of sodium (an average of approximately 50 mmol/L, or about 1 g/L, although concentrations vary widely), modest amounts of potassium, and small amounts of minerals such as iron and calcium.

- **Gastric emptying and Intestinal Absorption Of Fluids During Exercise**
  Euhydration (and the associated maintenance of physiological function and performance) can be accomplished during exercise only if the rate of fluid ingestion and absorption equals the rate of fluid loss through sweating (and, in events of longer duration, urination). Fluid balance during exercise is not always possible because maximal sweat rates exceed maximal gastric emptying rates, which, in turn, limit fluid absorption. In most cases, however, rates of fluid ingestion by athletes during exercise fall short of amounts that could be emptied from the stomach and absorbed by the gut. For example, athletes often consume less than 500 mL per hour during competition (98), whereas gastric emptying rates of more than 1 L per hour are possible (90). Gastric emptying is maximized when the amount of fluid in the stomach is high. It is reduced with hypertonic fluids or when carbohydrate concentration is greater than or equal to 8%; however, fluids containing 4% to 8% carbohydrate can generally be emptied at over 1 L per hour, in most people, when gastric volume is maintained at or above 600 mL (98,94).
- **Dehydration, hypohydration, and hyponatremia**
  Disturbances of fluid and electrolyte balance that can occur in athletes include dehydration, hypohydration, and hyponatremia (95). In their most severe forms, all can be life-threatening. Exercise-induced dehydration develops as a consequence of fluid losses that exceed fluid intake. In contrast, hypohydration occurs when athletes dehydrate themselves before beginning a competitive event, and can be induced by prior fluid restriction, exercise practices, diuretic use, or sauna exposure. In most cases, hypohydration is practiced by athletes competing in sports with weight categories (eg., wrestling, boxing, lightweight crew, weight lifting, and judo). Hyponatremia (low blood-sodium concentrations of less than 130 mmol/L) can develop either as a result of prolonged, heavy sweating with failure to replace sodium, or when excess water is retained in the body (96). Although endurance athletes are more likely to suffer from dehydration than from overhydration, the latter is not uncommon. For example, 11 of 605 athletes entered in the New Zealand Ironman triathlon developed severe hyponatremia, and 8 of these athletes were likely overhydrated, as they had either maintained or gained up to 5% of body weight during the race (97).

Fluid and Electrolyte Recommendations

- **Before exercise**
  Athletes should be well-hydrated when beginning to exercise. In addition to drinking generous amounts of fluid in the 24 hours before

an exercise session, the ACS.M. and the NATA recommend drinking 400 to 600 mL of fluid 2-3 hours before exercise (98,94). Such a practice should optimize hydration status while allowing enough time for any excess fluid to be excreted as urine before beginning to exercise.

- **During exercise**
  Athletes should attempt to drink enough fluid to maintain fluid balance, as even partial dehydration can compromise performance. If fluid balance cannot be maintained, the maximal amounts that can be tolerated should be ingested. Optimal hydration can be facilitated by drinking 150 to 350 mL (6 to 12 oz) of fluid at 15- to 20-minute intervals, beginning at the start of exercise (93). Beverages containing carbohydrate in concentrations of 4% to 8% are recommended for intense exercise events lasting longer than 1 hour (93). These beverages are also suitable for hydration during exercise events lasting less than 1 hour, although plain water is appropriate under these conditions. There appears to be little physiologic need to replace electrolytes during a single exercise session of moderate duration (eg, less than 3 to 4 hours), particularly if sodium was present in the previous meal. However, including sodium in amounts between 0.5 and 0.7 g/L is recommended during exercise lasting longer than 1 hour because it may enhance palatability and the drive to drink, therefore increasing the amount of fluid consumed (93). It should be noted that this amount of sodium exceeds that typically available in commercial beverages. Including sodium in fluid replacement beverages may also help prevent hyponatremia in susceptible people (93,98). Although most athletes who drink more fluid than they lose as sweat simply excrete the excess fluid as urine, in some people it is retained (973). If the fluid contains sodium, it could help prevent the dilution of serum sodium levels, thereby decreasing the risk of hyponatremia. Limiting fluid intake so that it does not exceed sweat rate can also decrease risk of hyponatremia.
- **After exercise**
  In most cases, athletes do not consume enough fluids during exercise to balance fluid losses, and thus complete their exercise sessions dehydrated to some extent. Consuming up to 150% of the weight lost during an exercise session may be necessary to cover losses in sweat, plus obligatory urine production (99). Including sodium either in or with fluids consumed postexercise reduces the diuresis that occurs when only plain water is ingested (94,100). Sodium also helps the rehydration process by maintaining plasma osmolality and thereby the desire to drink. Because most commercial sport drinks do not contain enough sodium to optimize postexercise fluid replace-

ment, athletes can rehydrate in conjunction with a sodium-containing meal (101). High-sodium items include soups, pickles, cheeses, processed meats, pizza, pretzels, and popcorn. Use of condiments such as soy sauce and ketchup, as well as salting food at the table, also increases sodium intake.

Special Environmental Conditions

- **Hot and humid environments**
  The risks of dehydration and heat injury increase dramatically in hot, humid environments (102). If the ambient temperature exceeds body temperature, heat cannot be dissipated by radiation. Moreover, if the relative humidity is high, the potential to dissipate heat by evaporation of sweat is substantially reduced—at a relative humidity of 100%, vaporization of sweat does not occur. Instead, in humid environments, sweat drips from the body, leading to nonfunctional fluid loss. When temperature and humidity are both high, there is a very high risk of heat illness, and competitive events should be postponed, rescheduled, or canceled (94,102). If competitive events do occur under these conditions, every precaution should be taken to assure that athletes are well hydrated, have ample access to fluids, and are monitored for heat-related illness (94).
- **Cold environments**
  Although the risk of dehydration is greater in hot environments, dehydration is not uncommon in cool or cold weather (103). Factors that could contribute to dehydration under these conditions include respiratory fluid losses in cold, dry environments, as well as sweat losses that may be high if insulated clothing is worn during intense exercise. Dehydration could also occur as a result of low rates of fluid ingestion: if an athlete is chilled and available fluids are cold, the incentive to drink would clearly be reduced. Finally, the difficulty of removing multiple layers of clothing to urinate may cause some athletes, especially women, to voluntarily limit their fluid intake (104).
- **Altitude**
  Exposure to altitudes higher than 2,500 m (8,200 ft) may result in fluid losses beyond those associated with any exercise that might be performed. These losses are the result of mandatory diuresis and high respiratory water losses, accompanied by decreased appetite, which lead to an increased need for fluid intake. The diuresis is considered by some to be an indication of successful acclimatization (105), although others (106) have suggested that at least part of the diuresis can be minimized by adequate energy intake and maintenance of body weight. Under circumstances of weight maintenance,

this diuresis is of a magnitude of about 500 mL per day and lasts for about 7 days (106). Respiratory water losses may be as high as 1,900 mL per day in men (107) and 850 mL in women (108). Thus, fluid intake at high altitude should be increased to as much as 8 to 4 L per day to assure optimal kidney function.

The Training Diet

Recommendations for athletes' intakes of energy, macronutrients, vitamins, and minerals are described elsewhere in this document. These recommendations are often presented in terms of milligram or gram amounts of nutrients (eg, 6 to 10 g carbohydrate/kg body weight) and must be translated into food choices consistent with food preferences and training schedules of athletes (109). The foundations (proportion of energy from protein, fat, and carbohydrate) for the training diets of athletes, however, do not differ substantively from current recommendations for the general population. Thus, the training diet should incorporate the principles outlined in the Dietary Guidelines for Americans (50) and Canada's Guidelines for Healthy Eating (110), and be based on the 1992 US food guide (US Food Guide Pyramid) (1113) or the 1992 Canadian food guide (Canada's Food Guide to Healthy Eating [112]). The fundamental differences between an athlete's diet and that of the general population are that athletes require additional fluid to cover sweat losses and additional energy to fuel physical activity. As discussed earlier, it is appropriate for much of the additional energy to be supplied as carbohydrate. Though in some cases, needs for other nutrients also increase (eg, protein, B-complex vitamins), the proportional increase in energy requirements appears to exceed the proportional increase in needs for other nutrients. Accordingly, as energy requirements increase, athletes should first aim to consume the maximum number of servings specified in both food guides from carbohydrate-based food groups (breads, cereals and grains, vegetables, and fruits). For many athletes, however, energy needs will exceed the amount of energy (kcals per day) in the upper range of servings for these food groups as provided by both food guides. To maintain dietary variety, these athletes may also increase the number and/or size of servings of dairy products and protein foods, but should aim to keep the proportions of energy provided by different food groups consistent with those identified in both food guides. Conversely, athletes who are small and/or have lower energy needs will need to pay greater attention to making nutrient-dense food choices to obtain adequate carbohydrate, protein, and micronutrients. The other issue that arises in a discussion of the diet of athletes relates to the timing of meals and snacks. Common sense dictates that food and fluid intake around workouts needs to be determined on an individual basis and will depend, in part, on an athlete's gastrointestinal characteristics, as well as the intensity of the workout. For example, an athlete might tolerate a snack consisting of milk and a sandwich 1 hour before a low-intensity

workout, but would be uncomfortable if the same meal was consumed before a very hard effort. In any case, athletes in heavy training or doing multiple daily workouts may need to eat more than 3 meals and 3 snacks per day and should consider every possible eating occasion (113). For example, they should consider eating in close proximity to the end of a workout, having more than one afternoon snack, or eating a substantial snack before bed.

Pre-exercise Meal

Eating before exercise, as opposed to exercising in the fasting state, has been shown to improve performance (114–116). The meal or snack consumed before competition or an intense workout should prepare athletes for the upcoming activity, and leave him or her neither hungry nor with undigested food in the stomach. Accordingly, the following general guidelines for meals and snacks should be used: sufficient in fluid to maintain hydration, low in fat and fiber to facilitate gastric emptying and minimize gastrointestinal distress, high in carbohydrate to maintain blood glucose and maximize glycogen stores, moderate in protein, and composed of foods familiar to the athlete. The size and timing of the pre-exercise meal are interrelated. Because most athletes do not like to compete on a full stomach, smaller meals should be consumed in closer proximity to the event to allow for gastric emptying, whereas larger meals can be consumed if more time is available before exercise or competition. Amounts of carbohydrate used in studies in which performance was enhanced have ranged from approximately 200 to 300 g carbohydrate for meals consumed 3 to 4 hours before exercise (114–117). The recommendations on carbohydrate consumption within 1 hour before activity have been controversial. Early research suggested that this practice leads to hypoglycemia and premature fatigue (118); however, more recent studies report either no effect or beneficial effects of pre-event feeding on performance (53,114,119–121). Current data are mixed concerning whether the glycemic index of carbohydrate in the preexercise meal affects performance (122,123). Although the above guidelines are sound and work well on average, the individual needs of the athlete must be emphasized. For example, some athletes consume and enjoy a substantial meal (eg, pancakes, juice, and scrambled eggs) 2 to 4 hours before exercise or competition; however, others may suffer severe gastrointestinal distress following such a meal and need to rely on liquid meals. Athletes should always ensure that they know what works best for themselves by experimenting with new foods and beverages during practice sessions and planning ahead to ensure they will have access to these foods at the appropriate time.

During Exercise

Whether or not carbohydrate consumption in amounts typically provided in sport drinks (4% to 8%) improves performance in events lasting 1 hour or less

has been controversial. Current research now supports the benefit of this practice (88,124,125,126–129), especially in athletes who exercise in the morning after an overnight fast, when liver glycogen levels are low. Thus, providing exogenous carbohydrate under these conditions would help maintain blood glucose levels and improve performance. Accordingly, performance advantages in short-duration activities may not be apparent when exercise is done in the nonfasting state. For longer events, consuming 0.7 g carbohydrate/kg body weight per hour (approximately 30 to 60 g per hour) has been shown unequivocally to extend endurance performance (52). Consuming carbohydrates during exercise is even more important in situations when athletes have not carbohydrate-loaded, consumed pre-exercise meals, or restricted energy intake for weight loss. Carbohydrate intake should begin shortly after the onset of activity; consuming a given amount of carbohydrate as a bolus after 2 hours of exercise is not as effective as consuming the same amount at 15- to 20-minute intervals during the first 2 hours of activity (130). The carbohydrate consumed should yield primarily glucose; fructose alone is not as effective and may lead to diarrhea, although mixtures of glucose and fructose seem to be effective (52). If the same total amount of carbohydrate and fluid is ingested, the form of carbohydrate does not seem to matter—some athletes may prefer to use a sport drink, whereas others may prefer to eat a solid or gel and consume water. As described elsewhere in this document, adequate fluid intake is also essential for maintaining endurance performance.

FIG 1. Weight management strategies for athletes. Source: reference 84.

Setting and monitoring goals

- Set realistic weight and body composition goals. Ask the athlete:
  —What is the maximum weight that you would find acceptable?
  —What was the last weight you maintained without constantly dieting?
  —How did you derive your goal weight?
  —At what weight and body composition do you perform best?
- Encourage less focus on the scale and more on healthful habits, such as stress management and making good food choices.
- Monitor progress by measuring changes in exercise performance and energy level, the prevention of injuries, normal menstrual function, and general overall well-being.
- Help athletes to develop lifestyle changes that maintain a healthful weight for themselves—not for their sport, for their coach, for their friends, for their parents, or to prove a point.

Suggestions for food intake

- Low-energy diets will not sustain athletic training. Instead, decreases in energy intake of 10% to 20% of normal intake will lead to weight loss without the athlete feeling deprived or overly hungry.

Strategies such as substituting lower-fat foods for whole-fat foods, reducing intake of energy-dense snacks, and doing activities other than eating when not hungry can be useful.
- If appropriate, athletes can reduce fat intake but need to know that a lower-fat diet will not guarantee weight loss if a negative energy balance (reduced energy intake and increased energy expenditure) is not achieved. Fat intake should not be decreased below 15% of total energy intake, because some fat is essential for good health.
- Emphasize increased intake of whole grains and cereals, beans, and legumes.
- Five or more daily servings of fruits and vegetables provide nutrients and fiber.
- Dieting athletes should not skimp on protein and need to maintain adequate calcium intakes. Accordingly, use of low-fat dairy products and lean meats, fish, and poultry is suggested.
- A variety of fluids—especially water—should be consumed throughout the day, including before, during, and after exercise workouts. Dehydration as a means of reaching a body-weight goal is contraindicated.

Other weight-management strategies

- Encourage athletes not to skip meals, especially breakfast, and not to let themselves get too hungry. They should be prepared for times when they might get hungry, including keeping nutritious snacks available for those times.
- Athletes should not deprive themselves of favorite foods or set unrealistic dietary rules or guidelines. Instead, dietary goals should be flexible and achievable. Athletes should remember that all foods can fit into a healthful lifestyle; however, some foods are chosen less frequently. Developing lists of "good" and "bad" food is discouraged.
- Help athletes identify their own dietary weaknesses and plan strategies for dealing with them.
- Remind athletes that they are making lifelong dietary changes to sustain a healthful weight and optimal nutritional status rather than going on a short-term "diet" that they will someday go off.

FIG 2. Guidelines for evaluating the claims of ergogenic aids. Adapted from the following references: 84,148,151–154.

Evaluate the scientific validity of an ergogenic claim

- Does the amount and form of the active ingredient claimed to be present in the supplement match that used in the scientific studies on this ergogenic aid?
- Does the claim made by the manufacturer of the product match the science of nutrition and exercise as you know it?

- Does the ergogenic claim make sense for the sport for which the claim is made?

Evaluate the Quality Of The Supportive Evidence For Using The Ergogenic Aid

- What evidence is given for using the ergogenic aid (testimonial vs scientific study)?
- What is the quality of the science? What is the reputation of the author and the journal in which the research is published? Was the research sponsored by the manufacturer?
- Does the experimental design meet the following criteria?
  —hypothesis driven; double-blind placebo controlled;
  —adequate and appropriate controls used and
  —appropriate dose of the ergogenic substance/placebo used.
- What research methods were used, and do they answer the questions asked? Are the methods clearly presented so the study results could be reproduced?
- Are the results clearly presented in an unbiased manner, with appropriate statistical procedures, limitations addressed, and adverse events noted? Are the results physiologically feasible, and do the conclusions follow from the data?

Evaluate the safety and legality of the ergogenic aid

- Is the product safe? Will its use compromise the health of a person? Does the product contain toxic or unknown substances, or substances that alter nutrient metabolism? Is the substance contraindicated in people with a particular health problem?
- Will use of the product preclude other important elements in performance? For example, does the product claim to replace food or good training practices?
- Is the product illegal or banned by any athletic organizations?

Postexercise Meal

The timing and composition of the postcompetition or postexercise meal or snack depend on the length and intensity of the exercise session (i.e., whether glycogen depletion occurred), and when the next intense workout will occur. For example, most athletes will finish a marathon with depleted glycogen stores, whereas glycogen depletion would be much less marked following a 90-minute training run. However, most athletes competing in a marathon in the morning will not be doing another race or hard workout in the afternoon. Timing and composition of the postexercise meal are thus less critical for these athletes. Conversely, a triathlete participating in a 90-minute run in the

morning and a 8-hour cycling workout in the afternoon needs to maximize recovery between training sessions, and the postworkout meal assumes considerable importance in meeting this goal.

Timing of postexercise carbohydrate intake affects glycogen synthesis over the short term. Consumption of carbohydrates beginning immediately after exercise (1.5 g carbohydrate/kg at 2-hour intervals is often recommended) results in higher glycogen levels at 6 hours postexercise than when ingestion is delayed for 2 hours (181,132). The highest reported rates of postexercise glycogen synthesis occurred in individuals fed 0.4 g carbohydrate/kg every 15 minutes for 4 hours after glycogen depleting exercise (188). It should be noted that this represents a very high-energy load (almost 2,000 kcal for a 75-kg athlete) that may exceed the energy expended during the exercise session itself. The above practices regarding timing of ingestion do not need to be adhered to by athletes who take one or more days between intense training sessions, because when sufficient carbohydrate is provided over a 24-hour period, the timing of intake does not appear to affect the amount of glycogen stored (184). Nevertheless, consuming a meal or snack in close proximity to the end of exercise may be important for athletes to meet daily carbohydrate and energy goals. The type of carbohydrate consumed can also affect post- exercise glycogen synthesis. When comparing simple sugars, glucose and sucrose appear equally effective when consumed at a rate of 1.5 g/kg body weight for 2 hours; fructose alone is less effective (135). With regard to whole foods, consumption of carbohydrates with a high glycemic index results in higher muscle glycogen levels 24 hours after exercise, as compared with the same amount of carbohydrates provided as foods with a low glycemic index (136). The usefulness of these findings, however, must be considered in conjunction with the athlete's overall diet, and should likely be reserved for occasions when maximizing postexercise glycogen synthesis is critical. When isocaloric amounts of carbohydratesor carbohydrates plus protein and fat are provided following endurance (137) or resistance (138) exercise, glycogen synthesis rates are similar. Accordingly, in contrast to what was suggested in earlier research (139), adding protein does not appreciably enhance glycogen repletion. Nevertheless, including protein in a postexercise meal may provide needed amino acids for muscle protein repair and promote a more anabolic hormonal profile (140).

Supplements And Ergogenic Aid

The marketing of ergogenic aids (items claiming to increase work output or performance) is an international, multimillion dollar business that preys on the desires of athletes to be the best, and when one item does not work or is discredited by research, another comes along to take its place. Nutrition related ergogenic aids are particularly problematic. In the United States, the Dietary Supplement Health and Education Act of 1994 (141) allows supplement manufacturers to make claims regarding the effect of products on the

structure function of the body, as long as they do not claim to "diagnose, mitigate, treat, cure, or prevent" a specific disease. As long as a special supplement label indicates the active ingredients and the entire ingredient list is provided, claims for enhanced performance—be they valid or not—can be made. The advent of the Internet means that a greater variety of products are more readily available, increasing the pressure on the experts to keep up-to-date on both the science and the claims of ergogenic aids (142). Evaluating nutrition-related ergogenic aids requires attention to the following factors: validity of the claim relative to the science of nutrition and exercise; quality of the supportive evidence provided (placebo-controlled scientific studies versus testimonials); and health and legal consequences of the claim (148) (see Figure 2). In general, most ergogenic aids can be classified into one of the following categories: those that perform as claimed, those that may perform as claimed but for which there is insufficient evidence of efficacy at this time, those that do not perform as claimed, and those which are dangerous, banned, or illegal, and consequently should not be used. With regard to legality in terms of use by competing athletes, both national (National Collegiate Athletic Association, United States Olympic Committee, Canadian Olympic Association) and international sports organizations (International Olympic Committee) limit the use of certain ergogenic aids and require random urine testing of athletes to ensure that these products are not consumed. However, the ethical issue of using performance-enhancing substances that are not banned has not been resolved (144–146). Currently, the use and recommendation of ergogenic aids to athletes is controversial. Some health care professionals discourage the use of all ergogenic aids, though others suggest they be used with caution and only after careful examination of the product for safety, efficacy, potency, and legality. Athletes should not use nutritional ergogenic aids until they have carefully evaluated the product, as indicated above, and discussed the use of the product with a qualified nutrition or health professional.

The Vegetarian Athlete

Some athletes choose to follow vegetarian diets. Nutrition recommendations for these athletes should be formulated with consideration of the effects of both vegetarianism and exercise. The position of the American Dietetic Association on vegetarian diets (147) provides appropriate dietary guidance that should be considered in conjunction with the information provided herein. Vegetarianism does not necessarily affect energy needs, though energy availability could be reduced slightly if a vegetarian has an extremely high fiber intake. As with all athletes, monitoring body weight and composition is the preferred means of determining if energy needs are satisfied. Some people—especially women—may switch to vegetarianism as a means of restricting energy intake to attain the lean body habitus favored in some sports. Occa-

sionally, this may be a step toward development of an eating disorder (148). Because of this association, coaches and trainers should be alert when an athlete becomes vegetarian, and ensure that appropriate weight is maintained. Studies consistently report that vegetarians have lower protein intakes than omnivores. Although the protein quality of a vegetarian diet is adequate for adults (2,51,149), plant proteins are not as well-digested as animal proteins (2). Thus, to adjust for incomplete digestion, an increase of about 10% in the amount consumed may be made (2). Accordingly, recommended protein intakes for vegetarian athletes would be about 1.3 to 1.8 g/kg body weight, using recommendations for athletes as a baseline (53,54,57). Vegetarian athletes with relatively low energy intakes may need to choose foods carefully, to ensure that their protein intakes are consistent with these recommendations. Vegetarian athletes may be at risk for low intakes of vitamins B-12 and D, riboflavin, iron, calcium, and zinc, because many of these nutrients are high in animal products. Iron is a nutrient that may be of particular concern to vegetarian athletes. Because of the lower bioavailability of iron in plant based diets, the iron stores in vegetarians are generally lower than those of omnivores, despite total iron intakes that are similar or even higher (150). When combined with data indicating that exercise may increase iron requirements, it is possible that vegetarian athletes, especially women, may be at greater risk of developing poor iron status. Accordingly, it would be prudent for iron status to be monitored routinely in female vegetarian athletes.

Roles And Responsibilities Of Health Care Professionals

Every competitive and recreational athlete needs adequate fuel, fluids, and nutrients to perform at their best. It is the role of the sports nutrition expert to advise athletes regarding appropriate nutrition needs before, during, and after exercise, and for the maintenance of good health and optimal body weight and composition. Qualified health and nutrition professionals can help athletes and active people in the following ways:

- Educate athletes about energy requirements for their sport and the role of food in fueling the body. Discourage unrealistic weight and body composition goals and emphasizing the importance of adequate energy intake for good health, prevention of injury, and exercise performance.
- Assess the body size and composition of an athlete for the determination of an appropriate weight and composition for the sports in which he or she participates. Provide the athlete with nutritionally sound techniques for maintaining an appropriate body weight and composition without the use of fad or severe diets. Undue pressure on athletes for weight loss or the maintenance of a lean body build can increase the risk of restrictive eating behaviors, and, in extreme cases, lead to a clinical eating disorder.

- Assess the athlete's typical dietary and supplement intake during training, competition, and the off-season. Use this assessment to provide appropriate recommendations for energy and nutrient intakes for the maintenance of good health, appropriate body weight and composition, and optimal sport performance throughout the year. Give specific guidelines for making good food and fluid selections while traveling and eating away from home. Assess the fluid intake and weight loss of athletes during exercise and make appropriate recommendations regarding total fluid intake and fluid intake before, during, and after exercise. Help athletes to determine appropriate types and amounts of beverages to use during exercise, especially if the athlete is exercising in extreme environments.
- For athletes such as the vegetarian athlete with special nutrition concerns, provide appropriate nutrition guidelines to assure adequate intakes of energy, protein, and micronutrients.
- Carefully evaluate any vitamin/mineral or herbal supplements, ergogenic aids, or performance-enhancing drugs an athlete wants to use. These products should be used with caution and only after a careful review of their legality and the current literature pertaining to the ingredients listed on the product label; these products should not be recommended until after evaluating the athlete's health, diet, nutrition needs, current supplement and drug use, and energy requirements. All nutrition recommendations for athletes should be based on current scientific data and the needs of athletes as individuals. Health care professionals should work with athletes, coaches, and family members to build rapport and to provide athletes with the best-possible environment for meeting sports-related nutrition goals.

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Authors

—American Dietetic Association: Melinda M. Manore, PhD, RD, FACS.M. (Arizona State University, Tempe, Ariz)
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—American College of Sports Medicine: Gail E. Butterfield, PhD, RD, FACS.M. (Dr. Butterfield passed away on December 27, 1999. This position is dedicated to her contributions in the field of nutrition and sports medicine).

Reviewers:

—American Dietetic Association: Nancy Clark, MS, RD, FACS.M. (SportsMedicine Brookline, Brookline, Mass); Susan M. Kleiner, PhD, RD (High Performance Nutrition, Mercer Island, Wash); Suzanne Nelson, DSc (University of Washington, Seattle, WA); Stella Volpe, PhD, RD, FACS.M. (University of Massachusetts, Amherst, MA).
—Dietitians of Canada: Maryilyn Booth, MSc, RD (private practice, Ontario, Canada); Susie Langley, MS, RD (private practice, Ontario, Canada); Heidi Smith, BSc, RD (University of Guelph, Ontario, Canada); Heather Schmurr, RD (private practice, Alberta, Canada).
—American College of Sports Medicine: Elizabeth Applegate, PhD, FACS.M. (University of California-Davis, Davis, Calif); Nancy Clark, MS, RD, FACS.M. (SportsMedicine Brookline, Brookline, Mass); Linda Houtkooper, PhD, RD (University of Arizona, Tucson, Ariz); William J. Kraemer, PhD, FACS.M. (Ball State Univer-

sity, Muncie, Ind); Scott Powers, PhD, FACS.M. (University of Florida, Gainesville); Janice Thompson, PhD, FACS.M. (University of New Mexico, Albuquerque).

Members of the Association Positions Committee Workgroup:

Ethan Bergman, PhD, RD, FADA; Nancy Wooldridge, MS, RD; Pauline Landhuis, MS, RD; Kristine Clark, PhD, RD, FACS.M. (content advisor).

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APPENDIX B

Timeline of Sports Medicine Issues

Unknown	Sports begins as a contest of hunting and combat skills needed to provide for and protect primitive humans.
776 BCE	First recorded date of the Olympics.
5th Century BCE	In ancient Greece and ancient Rome, physical education is necessary, because training and athletic contests first become a part of everyday life.
444 BCE	Iccus of Tarentum writes the first known textbook on athletic training.
2nd Century CE	The first *team doctor*, Galen, is appointed to the gladiators.
5th Century CE	Specialists are responsible for the care of athletes. The first use of therapeutic exercise is credited to Herodicus.
1898	Lizzie Arlington becomes the first woman ever to sign a professional baseball contract.
1919	Contract is signed that shipped Babe Ruth from Boston to the Bronx; dubbed *The Curse of the Bambino.*
1928	The term *sports medicine* is coined at the Olympics in St. Moritz when a committee comes together to plan the First International Congress of Sports Medicine.
1928	The International Federation of Sports Medicine is created.
1938	Augustus Thorndike, MD, publishes *Athletic Injuries, Prevention, Diagnosis, and Treatment*, the first general American text of sports medicine.
1949	Hughston Sports Medicine Hospital, the first hospital of its kind, is established.
1950s	The National Athletic Trainers Association (NATA) is organized.

1954 The American College of Sports Medicine (ACSM) is founded.

1960 The first Olympic death attributed to doping occurs.

1963 Illegal drug use in sports is standardized by a prohibited list, first published under the leadership of the International Olympic Committee.

1968 At the summer Olympics, Dr. J. C. Kennedy, a founding father of the Canadian Academy of Sport Medicine, concludes that competing athletic teams should be accompanied by qualified and well-organized medical care.

1968 The first Olympic athlete to test positive for illegal doping use is Hans-Gunnar Liljenwall, a Swedish pentathlete at the Summer Olympics who loses his bronze medal for alcohol use.

1972 Dr. J. C. Kennedy is appointed chief medical officer of the first *true* medical team at the 1972 Summer Olympics in Munich, Germany.

1972 The American Journal of Sports Medicine is first published.

1972 *Canterbury v. Spence.*

1973 Drs. Robert K. Kerlan and Frank Jobe founded the Kerlan-Jobe Orthopedics Clinic for sports medicine, which is still considered one of the top centers in the nation.

1973 The Rehabilitation Act is passed.

1974 Ulnar collateral ligament reconstruction surgery (or "Tommy John surgery") is pioneered by Dr. Frank Jobe.

1977 *Kampmeier v. Nyquist.*

1979 *Southeastern Community College v. Davis.*

1987 *School Board of Nassau County, Florida v. Arline.*

1987 *Krueger v. San Francisco Forty Niners.*

1989 The American Board of Medical Specialties recognizes sports medicine as a subspecialty.

1990 *Penny v. Sands.*

1990 The American Disabilities Act is passed.

1990 *Martin v. Casagrande*.

1992 *Gathers v. Loyola Marymount University.*

1996 The Health Insurance Portability and Accountability Act is passed.

1996 *Elitt v. USA Hockey.*

2000 *Doe v. Woodford County Board of Education.*

2001 Troy Aikman, former Dallas Cowboys quarterback, retires.

2001 *PGA Tour, Inc v. Martin.*

2003 Laffit Pincay Jr., a Hall of Fame jockey, ends his career with a record 9,530 winning mounts.

2003 Officials from the IRS, the FDA, the San Mateo Narcotics Task Force, and the USADA raid BALCO.

2005 Jose Canseco's book, *Juiced: Wild Times, Rampant 'Roids, Smash Hits, and How Baseball Got Big*, is published.

APPENDIX C

Glossary

Achievement-by-proxy (ABP) disorder: A disorder that describes a situation when parents go beyond healthy ambitions for their children's success and begin to live vicariously though them and their accomplishments.

ADA: American Dietetic Association.

AHA: American Heart Association.

Anterior cruciate ligament (ACL): A ligament in the knee.

Arthroscopy: A surgery in which an instrument is inserted into the cavity of a joint in order to view the contents.

Avascular necrosis (AVN): Death of a bone due to lack of blood supply.

BALCO: Bay Area Laboratory Co-operative; a California-based medical lab that specialized in testing athletes for nutritional levels. The laboratory was involved in a major doping scandal.

Bionics: The replacement or enhancement of organs or other body parts by mechanical versions.

Blood doping: A performance-enhancement technique involving either a blood transfusion of red blood cells or administration of the drug erythropoietin.

Cloning: The technique used to develop cells, tissues, or organisms that are genetically identical.

Computed tomography: An imaging technique that uses X-rays and permits a three-dimensional view of structures, especially bones.

Concussion: Limited periods of unconsciousness caused by head trauma.

Defamation: The act of slander.

Gene doping: The use of gene therapy to increase or enhance performance.

Gene therapy: The application of genetic-engineering techniques to replace defective genes.

HIPAA: Health Insurance Portability and Accountability Act.

IOC: International Olympic Committee.

LASIK: Eye surgery to correct nearsightedness; Laser In-Situ Keratomileusis.

Libel: Written defamation.

Magnetic resonance: An imaging technique that uses nuclear medicine.

Malpractice: Professional misconduct; treatment falling short of the standard of care.

NBA: National Basketball Association.

NCAA: National Collegiate Athletic Association.

Negligence: Lack of proper care and attention; liable carelessness.

NFL: National Football League.

NHL: National Hockey League.

Performance enhancers: Any chemical, mental, or other technique that is used to increase the performance of an athlete.

Predisposing injury: An injury that makes it more likely that an athlete will sustain another injury.

Radiography: An imaging technique that uses X-rays.

Return-to-play (RTP) decisions: Decisions of when it is physically or emotionally safe to permit an injured athlete to return to play.

Rotator cuff: A group of small muscles that act as the steering mechanism for the shoulder.

Sports medicine: A branch of medicine that deals with injuries or illnesses resulting from participation in sports and athletic activities.

Standard of care: A diagnostic and treatment process that a clinician should follow for a certain type of patient, illness, or clinical circumstance.

Subdural hematoma: A form of traumatic brain injury in which blood collects between the layers of the brain.

Synovitis: Inflammation of the smooth, lubricated lining found in some joints, including the hip.

Tissue engineering: The use of cloning and gene therapy to change or affect tissues.

Tommy John surgery: Ulnar collateral ligament reconstruction; a surgery in which a tendon is grafted into the elbow and woven into a figure-eight pattern through tunnels drilled in the arm bones.

Ultrasonography: An imaging technique that uses sound waves of extremely high frequency.

USADA: United States Anti-Doping Agency.

WADA: World Anti-Doping Agency.

WNBA: Women's National Basketball Association.

APPENDIX D

Further Reading

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ORGANIZATIONS AND WEB RESOURCES

Ongoing education pertinent to the team physician is essential. Information regarding team physician-specific educational opportunities can be obtained from the following participating organizations:

- American Academy of Family Physicians (AAFP), 11400 Tomahawk Creek Pkwy., Leawood, KS 66211. 800-274-2237. www.aafp.org.

- American Academy of Orthopedic Surgeons (AAOS), 6300 N. River Rd., Rosemont, IL 60018. 800-346-AAOS. www.aaos.org.
- American College of Sports Medicine (ACSM), 401 W. Michigan St., Indianapolis, IN 46202. 317-637-9200. www.acsm.org.
- American Dietetic Association (ADA) 120 South Riverside Plaza, Suite 2000, Chicago, Illinois 60606-6995. www.eatright.org
- American Heart Association (AHA) 7272 Greenville Avenue, Dallas, TX 75231. www.americanheart.org/presenter.jhtml?identifier=1200000.
- American Medical Society for Sports Medicine (AMSSM), 11639 Earnshaw, Overland Park, KS 66210. 913-327-1415. www.amssm.org.
- American Orthopedic Society for Sports Medicine (AOSSM), 6300 N. River Rd., Suite 200, Rosemont, IL 60018. 847-292-4900. www.sportsmed.org.
- American Osteopathic Academy of Sports Medicine (AOASM), 7611 Elmwood Ave., Suite 201, Middleton, WI 53562. 608-831-4400. www.aoasm.org.
- International Olympic Committee. www.olympic–usa.org/.
- International Paralympic Committee (IPC), www.paralympic.org/release/Main_Sections_Menu/index.html.
- World Anti-Doping Agency (WADA). www.wada–ama.org/en/

NUTRITION RESOURCES

- *Winning Sports Nutrition* video and training manual, University of Arizona, 1995.
- *Nutrition for Athletes: A Handbook for Coaches* produced by the American Alliance for Health, Physical Education and Recreation, 1201 Sixteenth Street, NW, Washington DC 20036.
- *Sports Nutrition Guidebook*, by Nancy Clark, Leisure Press, 1996.
- *Eating for Peak Performance or Competition Nutrition* from Colorado Dairy Council, Inc., 12450 North Washington Ave., Thornton, CO 80241.
- Eating for Competition by Pure Endurance Nutraceuticals. Available at http://www.pureendurance.net/eating_for_competition.

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About the Author

JENNIFER MINIGH, PhD, is the owner and director of Medical Communication Consultants. Dr. Minigh has more than ten years of research and teaching experience in the areas of pharmacology, molecular genetics, and cancer. Her research has been published in several peer-reviewed journals and has been presented at various national and international conferences. In addition, Dr. Minigh has more than one hundred publications, including several pieces on topics related to sports medicine.