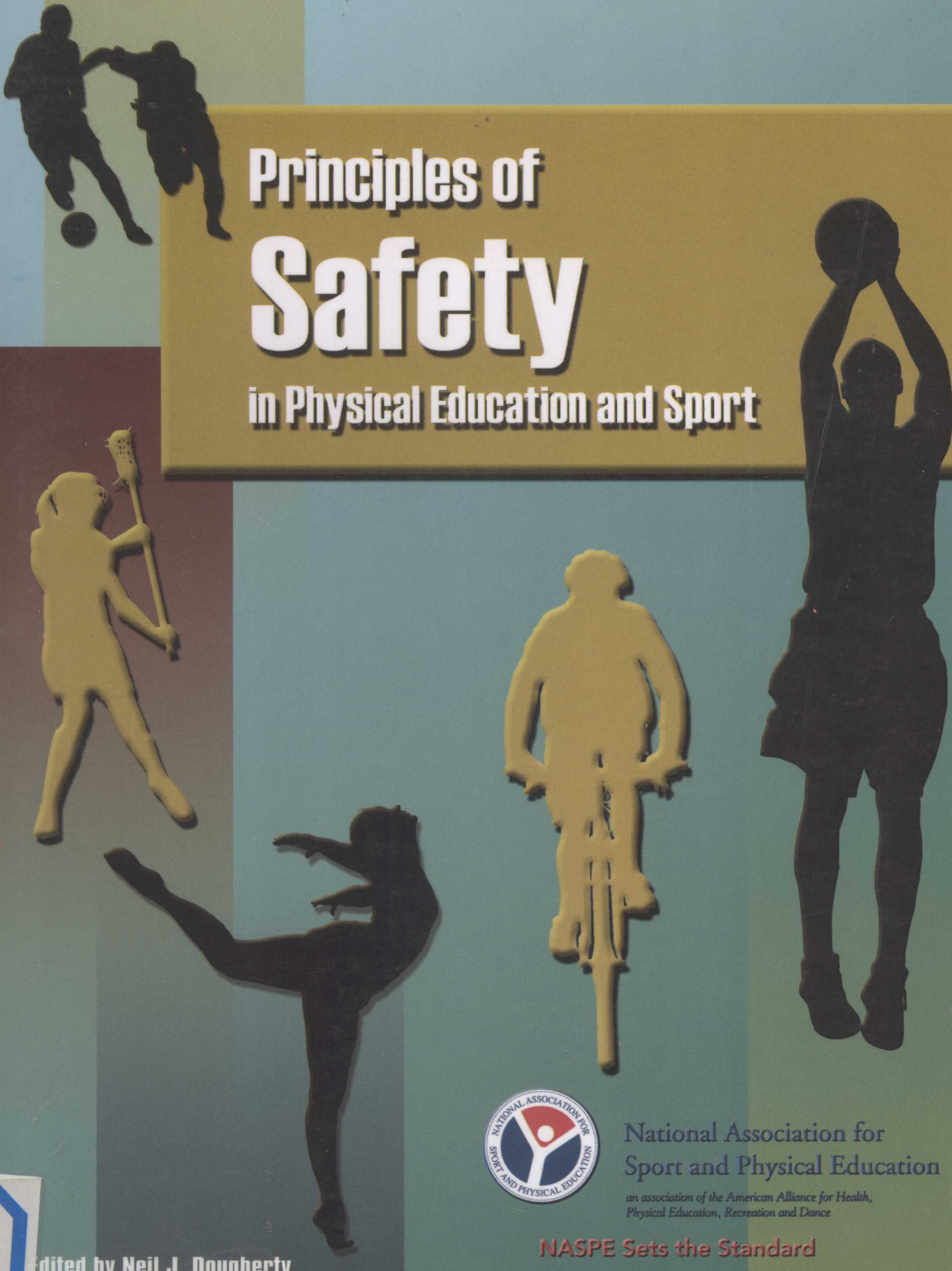
Principles of Safety in Physical Education and Sport



Edited by Neil J. Dougherty

National Association for Sport and Physical Education

an association of the American Alliance for Health, Physical Education, Recreation and Dance

NASPE Sets the Standard

Principles of Safety in Physical Education and Sport

4th Edition

Edited by
Neil J. Dougherty
Rutgers University
New Brunswick, N.J.

A project from the

National Association for
Sport and Physical Education
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NASPE Sets the Standard

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I would like to extend my sincere thanks to the individual authors who collaborated on this project. Chosen because of their professional knowledge and prominence, these authors committed an enormous amount of time and energy to producing a book in which they all — justifiably — can take great pride.

I also want to acknowledge the efforts of the NASPE staff. Always open-minded and supportive, they were, nevertheless, unyielding in their commitment to professional excellence. One can't work with such people and fail to recognize why NASPE is such a successful and highly respected professional association.

Neil J. Dougherty, Editor
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Principles of Safety in Physical Education and Sport

Preface

The ever-present threat of litigation in connection with student injuries, the inescapable fact that guidelines and recommendations from the National Association for Sport and Physical Education (NASPE) are often considered in assessing potential liability and — most important — the desire to promote the safest programs possible precipitated NASPE's developing the first edition of *Principles of Safety in Physical Education* and Sport in 1987.

This edition — the 4th — follows the same quality of authorship and validity of content that led to the first three editions being used widely across education settings. Just as with its predecessors, the 4th edition is designed to provide physical education professionals with a straightforward and complete resource of those factors that they must consider when providing safe units of instruction in the physical activity forms taught commonly in physical education programs.

Through the use of many checklists, the authors have provided essential information in a manner that helps readers incorporate key safety concepts in developing unit and lesson plans, as well as for quick pre-class safety checks.

This book will help physical educators implement safe and well-balanced programs of activities in physical education. And it will help students participate safely in various sports and activities, providing them with lessons in safety that they can carry with them throughout their lifetimes.

Principles of Safety in Physical Education and Sport serves as a companion resource to another NASPE book: *Physical Activity & Sport for the Secondary School Student.* The latest edition of this comprehensive and authoritative textbook provides authoritative help for teachers and students on acquiring skill and technique, designing lessons and game strategies, ensuring the proper equipment and facilities, and explaining scoring, rules and etiquette for a host of sports and activities included in contemporary physical education programs.

Taken together, these two books provide physical education professionals with the tools they need to design and implement exemplary physical activity programs in a safe and beneficial manner.

Charlene R. Burgeson, Executive Director
National Association for Sport and Physical Education

Principles of Safety in Physical Education and Sport

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CHAPTER 1

The Injury Problem

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Disease is a high-profile killer. Telethons and foundations raise awareness and funds to support the important and specialized work of trying to find cures for a whole host of diseases that, in a variety of terrible forms, are a major cause of death in the United States. Injury, on the other hand, presents a much lower-profile cause of pain, suffering, loss of time at work and/or school, financial mayhem and liability. Injuries are insidious in that few people realize either the nature or magnitude of their impact on our lives.

Scope of the Problem

Injuries touch most people in a variety of ways across the lifespan, from the nearly inconsequential to the traumatic. Injury, as a category, is the single-greatest killer of children and youths, accounting for 51 percent of deaths among people ages 1–14. Some estimate that at least one adolescent (ages 10–19) dies of an injury every hour of every day, and about 15,000 adolescents die each year of injury (Runyan & Gerken, 1989); about 6.4 percent of all deaths among U.S. residents are attributable to injuries (Annest, et al., 1998).

Although not all injuries lead to death, on any given day, more than 170,000 injuries occur that are serious enough to require medical care (National Center for Health Statistics, 1987), and these injuries are costly.

The cost to society for sports-related injuries to people age 65 and older grew from about $364 million in 1990 to about $516 million in 1996 (Rutherford & Schroder, 1998). Estimates for the cost to society of sports-related injuries among baby boomers (ages 35-54) ran about $18.7 billion in 1998 (Rutherford, 2000), and sports-related injuries to youths (age 0-14) cost society a little more than $49 billion in 1997 (National Youth Sports Safety Foundation, 2000).

Clearly, injuries — especially sports-related injuries — are not limited to the young, anymore. Sports-related injuries have increased substantially among the baby boom generation and in those age 65 and older. (Table 1 presents the top sources of sports-related injuries across age groups for 1999.)

The unpowered scooter appears to present a growing source of injuries across ages, accounting for 27,600 incidences of injuries from January through October 2000 (Rutherford & Ingle, 2001).

Table 1. Top 5 Sports-Related Injury Activities Across Age Groups for 1999
(in thousands)

Ages 0-14		**15 - 24**		**25-64**		**65+**	
1. Bicycles	378.3	Basketball	273.3	Bicycles	136.2	Ex. & Equip.	13.7
2. Playground	231.6	Football	160.8	Basketball	127.5	Bicycles	13.5
3. Basketball	195.8	Base/Softball	89.6	Base/Softball	109.7	Swimming	4.6
4. Football	173.3	Bicycles	86.3	Ex. & Equip	105.7	Rqt. Sports	3.9
5. Base/Softball	138.7	Soccer	65.8	Swimming	45.4	ATVs	1.9

Source: *Consumer Product Safety Review*, Fall 2000, pp. 3-4.

Statistics on the full impact of injuries are difficult to gather because agencies that collect data on the topic have a variety of definitions for the term. That variance is partially a result of the fact that different agencies have different purposes for such data collection (e.g., knowing what injuries require treatment versus determining the cause of such injuries) and because agencies differ in their responsibilities to the participating individuals (e.g., national survey systems versus a local coaching staff). Hence, comparing injury or fatality rates for the general population to those for athletes is difficult to do because of the lack of information and because of different criteria used in collecting the data.

Nonetheless, experts in epidemiology and public health say that nearly two-thirds of all illnesses and injuries could be prevented, and nowhere is that more relevant than with sports-related injuries. Although many people assume that most sports injuries are the result of "accidents," these accidents often are the result of factors that lead predictably to injuries. Often, these accidents and injuries track directly to social, environmental and behavioral factors that, if regulated, would result in dramatic reductions in deaths and injuries.

The fact that injuries often are considered "accidental" or as part of the inherent risk of sports is one of the major reasons why these social, environmental and behavioral factors remain uncontrolled and, thus, why accidents and injuries continue to occur. If such accidents and injuries were perceived as predictable results of the lack of public health and accident control policies, reducing "accidents" in terms of both frequency and severity likely would become a top priority.

Perceptions of injuries and their causes are shaped by operational definitions. Definitions serve two functions:

1. They provide a specific focus as to what is to be studied.
2. They provide peripheral boundaries concerning what to include and what to exclude from the topic to be analyzed.

Paradoxically, definitions can be both enlightening and obstructing at the same time. Whereas it's necessary to limit the field of possibilities when trying to study a phenomenon, overly restrictive definitions can limit potential insights. Attributing the cause of injuries to "accidents," for example, contributes to perceptions of helplessness and unpredictability in the search for injury prevention strategies. And, as noted earlier, when different groups (with different motives) collect data on injuries while using different definitions, trends and patterns of injuries may be hidden from policymakers. With caveats stated, we'll try to address the definition of injuries.

Defining an Injury

Haddon (1980) defined injury as "damage or trauma to the body caused by exchanges with environmental energy that are beyond the body's resilience" (p. 1). Two practical considerations are often part of injury definitions:

1. An injury is deemed to have occurred if the victim loses time from an activity such as work, school or play. For example, the National Athletic Injury/Illness Reporting System (NAIRS) defines a reportable injury as "any injury/illness [that] causes the cessation of an athlete's customary participation throughout the *participation day following day of onset.*" Thus, time lost from practice often serves as the threshold

for determining whether the damage an athlete has sustained is severe enough to be classified as an injury.

2. The second practical consideration is the referral to a medical professional such as a trainer, nurse, physician or emergency staffer. Bumps, bruises and chronic stiffness that don't necessitate a visit for medical treatment rarely are counted in injury statistics. Typically, only if their severity prompts a formal visit to a medical professional do they merit classification as an injury.

A number of efforts have been made to classify the severity of injuries with a score or rating that would allow comparisons across different types of injuries (cf., Baker, et al., 1974; Committee on Medical Aspects of Automotive Safety, 1971).

Within the context of sports, distinctions are often made between injuries *directly or indirectly* attributable to participation in a sport. Damage sustained from mechanical energy tends to be associated more commonly with injuries resulting from accidents termed "directly attributable" to sport than to other forms of energies. For example, being hit by a ball or bat is likely to be seen as attributable directly to sport, whereas heat stroke caused by a lack of water while training in hot, humid conditions is more likely to be classified as an indirect sports injury.

Classification as either acute or chronic is another common distinction made with regard to sport injuries. The American Academy of Orthopedic Surgeons (1991) characterized acute injuries as a sudden onset or "sudden crisis, followed by a fairly predictable, [al]though often lengthy, resolution to healing" (p. 104). Chronic injuries are characterized by "insidious onset, implying a gradual development of structural damage," which may result in a condition that "lasts months or even years and is characterized by persistence of the symptoms" (p. 104).

In the following section, we discuss injury prevention, once again drawing distinctions between the related but different concerns of safety and risk.

Defining Safety

Although the term "safety" is generally understood, its scientific meaning is often quite vague. An activity is safe, according to Lowrance (1976), if its risks are deemed acceptable; acceptability is a matter of personal and societal value judgments. Thus, what is judged "safe" varies from time to time and from situation to situation.

Furthermore, Lowrence argues that what typically is measured scientifically is not safety but degree of risk. An activity is judged safe if the risks associated with it are judged acceptable. Stated differently, risk is the calculation of the probability of harm, a scientific measurement; safety involves judgment regarding the acceptability of those risks, a value judgment. Thus, risks are something we measure, whereas safety is something we must judge.

Defining Risk

Thygerson (1986) defines "risk" as "possible loss or the chance of a loss" (p. 39). Theoretically, measuring risk is quite straightforward. Taking the population data, the exposure data and the injury data into consideration, the calculations for determining risk are quite simple. But, from a practical standpoint, measuring such risks is rarely carried out because gathering the appropriate data is often quite a substantial task.

Three general methods of measuring risk:

1. Relative risk methods.
2. Probability of occurrence methods.
3. Relative exposure rate methods.

1. **Relative risk methods.** An activity or hazard is rated according to a standard that can be ranked along a dimension of more or less. A boxing glove with nine ounces of padding, for example, is considered more risky to use than a glove with 12 ounces of padding. A rating scale can reflect the approximate degree of risk, as well. In women's artistic gymnastics, for example, athletes select skills rated from level "a" (easy) to level "d" (extremely risky).

2. **Probability of occurrence.** One can estimate the likelihood of future injuries accurately if records have been kept over reasonable periods of time for sizable populations that will continue the activity under similar conditions. Just as the National Safety Council can predict the number of fatalities for a given holiday period, the American Football Coaches Association's Committee on Football Injuries can predict the number of football-related fatalities for the upcoming season.

   Both groups have compiled a long history of fatality statistics that allow such prediction. If the future circumstances change from the situation upon which the original data were based, the estimates would differ more radically from the actual observed fatalities. For example, if the weather changed (e.g., it rained) or a rule change were implemented (e.g., spearing were eliminated in football), the actual number of deaths or injuries would change.

3. **Relative exposure.** To compare different risks, they can be portrayed in terms of exposure rates. Table 2 reports the number of cervical cord injuries attributable directly to participating in high school and collegiate football across a 20-year period from 1980 to 1999. The data show that secondary schools registered a mean number of 6.95 cervical injuries annually, compared to only 1.05 in collegiate programs. That indicates that secondary school programs reported about seven times more cervical injuries than did collegiate programs during both decades. But that comparison is misleading. When one compares cervical injuries per 100,000 between collegiate and secondary school athletes, the rate of collegiate injuries

almost triples the rate of the younger athletes *(see Table 3)*. Thus, the actual risk of spinal cord injuries appears to be significantly lower for secondary school athletes.

Depending on the degree of sophistication of the measurement of exposure, exposure rates can take into consideration not only the number of participants but also the number of practices, number of hours per practice and the number of actual sporting attempts. One advantage of using that technique to express risk is that one can compare different sports or different dimensions on a rate basis *(see Table 1)*. For example, Reif (1981) estimated that, whereas the risk of death in collegiate football was one in 33,000 exposures, the risk of injury or long-term disability was as high as one in 18 exposures. In this estimate, exposures were based on a per-year basis, in which 25 days of participation per year were assumed.

Table 2. Cervical Cord Football Injuries from Sandlot, Pro and Semipro, High School and College 1980 - 1999

5-Year Block	Sandlot	Pro and Semipro	High School	College
1980-84	3	1	40	7
1985-89	0	1	41	6
1990-94	0	3	27	3
1995-99	1	1	31	6
Annual Mean	0.20	0.30	6.95	1.05

Source: Mueller & Cantu (2000), *Annual Survey of Catastrophic Football Injuries,* National Center for Catastrophic Sport Injury Research, Chapel Hill, North Carolina, 2000.

Table 3. Incidence of Cervical Cord Football Injuries per 100,000 Participants:* High School and College 1980 - 1999

Year	Secondary School	College
1980-84	0.62	1.87
1985-89	0.61	1.60
1990-94	0.36	0.80
1995-99	0.40	1.60
20-Year Rate (mean)	0.50	1.47

*Rates based on 75,000 college players, 1.3 million secondary school players from 1980-88 and 1.5 million secondary school players from 1989-99.

Source: Mueller & Cantu (2000), *Annual Survey of Catastrophic Football Injuries,* National Center for Catastrophic Sport Injury Research, Chapel Hill, North Carolina, 2000.

Overuse Syndrome Injuries

Overuse injuries are the result of purposeful, repetitive training. They're clearly injuries, but they're not accidental. In fact, they're clearly predictable, and they're often endured intentionally in the quest for higher performance levels. Once restricted to adults who worked at repetitive clerical jobs or played tennis only on weekends, overuse injuries now occur with increasing regularity in highly trained children.

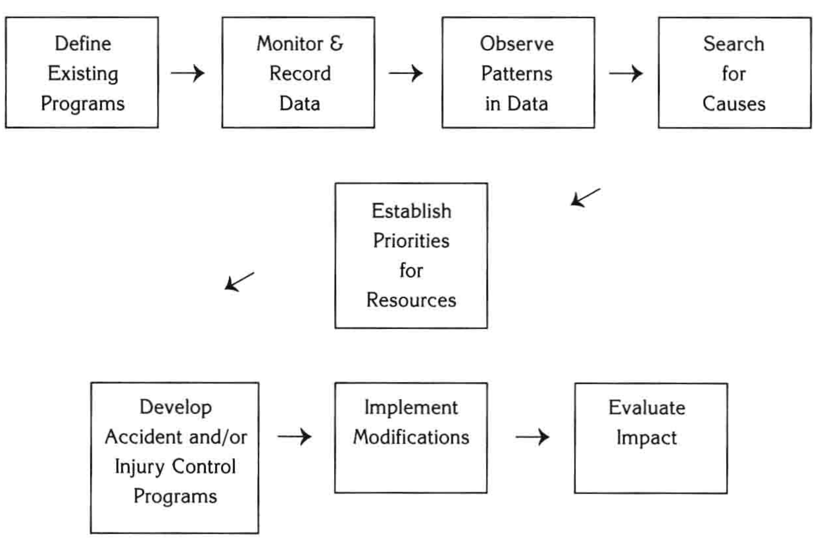
Children are particularly susceptible to these types of injuries, says Micheli (1986), for two reasons. First, the growing cartilage of the joint surfaces might be more susceptible to stress — especially shear stresses — both in terms of single-impact trauma (e.g., growth plate fractures) and repetitive microtrauma (e.g., Osgood-Schlatter disease, patellofemoral stress syndrome).

Second, the process of growth itself renders children more susceptible to certain injuries. As growth occurs in the bones, the muscle/tendon unit spanning the bones and joints becomes progressively tighter with growth, particularly during growth spurts. That reduced flexibility heightens the child's chances of both single-impact injuries and repetitive microtrauma because of increased tension across the joints and growing surfaces.

Understanding the Injury Problem

Understanding and controlling the injury problem in physical education and sport requires a multistep approach. Figure 1 presents a model for analyzing injuries in sport.

Figure 1. A Model for Analyzing Injuries in Sport



Define Existing Programs

First, one must designate the specific programs to be analyzed. At first glance, this step might seem obvious; on closer inspection, a variety of complicating factors become evident. If, for example, you wish to analyze football in terms of injury occurrence, you must decide what constitutes "football." Does your study include only organized programs? Will you include instructional classes, intramurals or "sandlot" games? Are you looking only at injuries during games, or will you also include practices?

The problems associated with collecting data from organized programs are likely to differ from those encountered while collecting data from parks, playgrounds and "sandlot" football. In addition, you must decide if you're interested in injuries attributable both directly and indirectly to the activity or sport. An injury resulting from tackling, for example, is likely to be the direct result of playing football, whereas a stroke occurring to an athlete on the sidelines might be unrelated to participation in the sport.

Other injuries might stem from a combination of factors, some direct and some indirect. Heat exhaustion can be attributable both to weather conditions and to wearing heavy uniforms and intense training regimens during high-heat/humidity conditions.

Monitoring and Data Collection

Once you've specified the conditions defining the sport, analyzing injury patterns requires one to monitor the frequency, type and severity of injuries accurately, as well as the circumstances under which they occur. Here again, the problem of definition arises. What constitutes an accident or an injury? Depending on the monitoring institution's purpose, the definitions of injuries can differ dramatically.

A coach concerned about young athletes' welfare might define injury as a bruise that creates discomfort. An organization concerned about medical treatment might define injury as any physical problem that requires medical treatment. A league concerned about the severity of accidental injury might define injury as any physical problem that requires the athlete to miss a day or more of training or competition. The data collected under each of these examples can be quite different and can reflect decidedly different patterns.

Collecting accident and/or injury statistics appears deceptively simple. Even assuming that one has established clear and adequate definitions of accident and injury, the substantial problems of collecting, storing and retrieving data remain. Not only must one develop and provide data forms *(see Chapter 3)*, but the responsibility for reporting the data must be assigned to those who have the authority to obtain the appropriate descriptive data.

Collecting data requires time, effort and material supplies, not to mention time away from other tasks often thought to be more pressing.

Subtle and not-so-subtle distortions of injury data are quite common. Coaches and administrators often feel pressure to portray their programs in as positive a light as possible.

Documenting injuries often appears to be self-defeating to people held responsible for safety. An administrator who introduces an effective injury-reporting system should be prepared to explain to superiors why he or she is now reporting a dramatic increase in injuries!

Even the athletes themselves often minimize their injury reporting to avoid playing restrictions. Deferring injury complaints and avoiding reporting injuries plays a major role in distorting injury-surveillance data.

Pattern Analysis

Examining the data often reveals patterns that aren't obvious to the casual participant because these patterns occur over long periods of time or across large populations of athletes. For example, Sands (1984) found that the women collegiate gymnasts he studied were significantly more likely to be injured in November and January than in any other months of the season and that the most common types of injuries occurred from the knee down. Further, Sands found that heavier, taller gymnasts were more prone to injury than lighter, shorter ones.

Some of those findings are obvious; few coaches would be surprised to find that heavier gymnasts are more prone to injury. Other findings are not so obvious or easily interpreted. The answer to why injuries occur more often in one month over another, for example, requires further information and analysis.

Klafs and Arnheim (1981) concluded that injuries in high school sports were more likely to occur during the first three to four weeks of practice because athletes often lacked needed flexibility, were overweight or had little cardiovascular conditioning when they first reported to practice. Those patterns have changed over time, as more trainers advocate what Arnheim and Prentice (2000) describe as "periodization" (p. 76): the different training and conditioning needs of serious athletes year-round rather than just during preseason and in-season competition. Consequently, the search for patterns of injury incidence requires substantive searching for underlying explanations.

The Little League's analysis of injury patterns in organized youth baseball revealed a number of obvious and obscure factors contributing to injury. Klafs and Arnheim (1981) suggested that "the elimination of steel spikes and the on-deck-circle, screening dugouts, mandating the use of face and head protectors for the batters, and installing breakaway bases ... all ... resulted in a decrease in injuries" (p. 9).

More recent studies of bike-helmet usage have indicated the merits of wearing helmets on bikes (e.g., reduce risk of head injury up to 85 percent) but not on playground equipment, and studies of the effectiveness of public education programs suggest substantive improvements in helmet use and ownership from 1991 to 1998 (Rodgers, 1999).

Determine Causes

Once the descriptive data have indicated certain patterns, one must determine the patterns' cause. Why do injuries typically occur during the third and fourth week of training? One explanation might be that this is the period during which athletes are shifting their training emphasis from conditioning to sport-specific game skills. An equally plausible explanation might be that, during the fall sports season, the third and fourth weeks are a period during which the athletes are more tired and distractible; they have switched from a summer schedule to a winter schedule in which they are attending academic classes, as well as training on the athletic field.

In fact, both of those reasons — in combination with others — might cause the increased injury rate. Multiple causation of a class of injuries is more often the case than not. Attributing the "cause" of injuries to a single antecedent event often is incomplete, if not directly misleading.

Some safety experts say that the human element is the fundamental cause of virtually all accidents. Such a statement focuses on controlling human behavior as the main basis for reducing accidents and injuries. Safety-education programs, reward-and-punishment contingencies for safe and unsafe behaviors, respectively, and identifying accident-prone individuals are all safety approaches that rely on the assumption that human frailties create accidents and injuries.

Clearly, in some circumstances, human error leads to increased accident and injury rates. Those who lack knowledge of accepted safety practices might be more prone to injury. For example, athletes who haven't been taught the fundamentals of falling safely appear to be at a higher risk than athletes who have.

Nonetheless, the assumption that learning falling skills automatically leads to reduced risk is unwarranted. Athletes who feel in control of the risk because they believe their skill at falling protects them actually might attempt more risky maneuvers and, thereby, increase their exposure to risk. The fact that as many accomplished swimmers as nonswimmers drown each year suggests that increased skill doesn't guarantee a lower accident rate.

Furthermore, unsafe behavior can occur even when the person knows what constitutes safe behavior. When safe behavior is inconvenient, uncomfortable or "unheroic," or it reduces one's effectiveness at the sport, unsafe behavior becomes predictable. Often, the value of behaving safely is less prominent than the value of the unsafe behavior.

For example, the absence of injury is more difficult for a soccer player to observe than the fact that he or she can run faster without shin guards. In such cases, coaches and administrators must arrange the circumstances so that the athlete realizes that safety is important. *Example:* A rule barring any soccer player from playing without wearing proper equipment will show the need to wear shin guards.

Whereas careless human behavior often plays the culprit in creating accidents and injuries, perceptive analyzers of safety should remain alert to opposing points of view. Robertson (1983) pointed out that, although many "experts" insist that the injury problem is essentially a human-behavioral problem, some of those opinions might be deliberately self-serving. That is, such opinions are offered by those who manufacture or provide the hazardous equipment and/or activity and, thus, who might wish to avoid regulation and being held responsible.

Such biased perspectives also can come from those in the "human services" sectors, including educators, behavioral scientists, police and others who benefit from labor-intensive behavior-change programs.

> As Robertson (1983) stated:
>
> The widespread acceptance of the premise of correctable human error cannot be entirely attributed to brainwashing by those with obvious self-interests, however. The assumption that human beings are, for the most part, rational actors in complete control of their actions is embedded in our mores and laws. To question the assumption is to question both a cultural theme and a basis for self-esteem. It is true that in many contexts this cultural myth is harmless. Where split-second decisions mean the difference between life and death or health and disability, however, as is frequently the case in handling highly concentrated energy, reliance on the myth of the rational, fully informed, constantly alert, lightning-quick human being is, paradoxically, an irrational act (pp. 65-66).

Establish Priorities

Clearly, some types of injuries warrant more concern than others. Yet, while fatalities warrant a higher priority than minor cuts and abrasions, acquired immune deficiency syndrome (AIDS) and human immunodeficiency virus (HIV) have focused renewed attention on cuts and abrasions relative to participants' safety in athletic events.

Some injury-prevention methods also are more feasible and/or require less resource investment than others. Providing access to water during training to reduce heatstroke, for example, requires less resource investment than building a foam pit for safe landings in high-risk gymnastic skills.

Although the arguments over the value of a human life have both philosophic and practical overtones, the issue is one that goes beyond the scope of this chapter *(see Thygerson, 1986, Chapter 6)*. Any reader who feels that practical value considerations are not a current issue is invited to sit in on a jury trial in civil litigation following an accidental death.

Develop Effective Prevention Programs

Haddon (1980) outlined 10 strategies for controlling injuries once their causes have been determined. Those who use that list to analyze injury-control options should realize that effective analysis requires considering all options initially. Whereas some options are already in use and/or are applied easily, others appear difficult, if not impossible, to implement and often are casually dismissed during the initial stages of injury-control analysis. One should set aside the practical aspects of implementation until after outlining all possibilities.

Haddon's 10 strategies for controlling injuries:

1. Eliminate the hazard. Certainly, one can reduce sports injuries by eliminating the sports or activities that cause injuries. Although few would advocate the wholesale elimination of sport, a variety of examples show steps taken to eliminate specific sports. In 1977, the American Academy of Pediatrics advocated banning trampolines from instructional programs and eliminating it as a competitive sport. Periodic cries for the elimination of boxing (usually prompted by a death) are relatively commonplace. The swinging rings in gymnastics have been eliminated both in physical education classes and in competition. In a different venue, commercial motels and hotels throughout the United States have virtually eliminated diving boards from their recreational swimming pools.

A less dramatic interpretation of this strategy might include the elimination of select parts of activities. For example, eliminating the full-contact aspect of tackle football to play touch or flag football would be another way to "eliminate" hazards while preserving the spirit of the game.

2. Reduce the amount of the hazard. Often, sports have been modified to reduce the amount or degree of risk that participants incur. This strategy involves a quantitative intervention. That is, the basic nature of the activity is not changed; participation is simply scaled down. For example, young platform divers train and compete on 5-, 6-, and 7-meter platforms rather than the 10-meter tower required by international rules.

Limiting the degree of vertical drop on novice ski trails to intentionally curtail the speeds that beginner skiers can attain reduces the amount of hazard. Similarly, specifying shortened playing periods and age categories and weight classes for young, less experienced players provides a quantitative degree of hazard reduction.

3. Prevent or reduce the likelihood that already-existing hazards will release. In this category of interventions, one should focus attention on changing the conditions under which performers will continue the activity. In gymnastics, for example, performers are concerned about slipping off of some pieces of apparatus. To be competitive, they must include skills in their routines that involve the risk of leaving the apparatus unexpectedly. Using magnesium carbonate ("chalk" or "mag") to lower the likelihood of slipping is an example of reducing the likelihood of such an occasion.