

Current Concepts in Prevention of Sports Injuries

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Abstract

Introduction: The contemporary surge in sports participation, from recreational to professional levels, has brought forth an undeniable enthusiasm for physical activity. However, this heightened engagement comes with an inherent risk of sports-related injuries, spanning various nature and severity. This article introduces the imperative need for a systematic and practical approach to prevent sports injuries, emphasizing the age-diverse demographic involved and the multifaceted motivations driving sports participation.

Materials and Methods: The "Rule of 10," presented in this paper, serves as a comprehensive guideline for sports injury prevention. The methodology encompasses a range of proactive measures addressing pre-season preparation, athlete education, and holistic strategies to mitigate injury risks. Each facet of the rule, from pre-season physical check-ups to emphasizing psychological preparedness, contributes to a cohesive and multifaceted injury prevention framework.

Conclusion: We through our review article have focused on the "Rule of 10" which advocates a holistic approach to sports injury prevention, integrating pre-season assessments, diverse training, and technology. It emphasizes resilience, education, and collective responsibility for athlete well-being.

Keywords: Agility, endurance, prevention, sports, strength.

Introduction

There is an ever-increasing surge for participation in sports, both recreational and professional, across all age groups. The encouragement and support of parents, sports associations, and government health organizations have been instrumental in this effort. The attraction of physical health, teamwork, camaraderie, celebrity, and a lucrative career through sports is like none other. Children harbor dreams of becoming their favorite athletes while adults channel their inner child on the sports field.

While physical activity has a multitude of health benefits, it also brings with it the

risk of injury. Every athlete, whether amateur or professional, has had a sports-related injury at some point in their lives. The nature and pattern of sports injury are often sports specific and can be of a soft tissue, ligamentous, or osteochondral nature. Technical faults such as improper warm-up, inadequate rest and rehabilitation, or repetitive wear and tear are some risk factors for sports injuries. These can be physically, emotionally, and psychologically challenging to overcome thereby underpinning the importance of programs to decrease the risk of injuries. Technological advancements in biomechanics have helped identify

mechanisms of sport-specific injuries and led to strategies to avoid them. International sports associations such as the Federation International de Football Association and the International Olympic Committee have also worked together to develop guidelines to reduce the prevalence of injuries and have strongly advocated for their implementation at the grassroots level. The adage "Prevention is better than cure" is fitting for the field of sports injuries. Our paper highlights this theme by providing a systematic and practical approach to the prevention of sports injuries.

Methods

Epidemiology

According to epidemiological research, every sixth injury observed by physicians in Scandinavia happens while participating in sport [1]. Sports participation is the cause of one-third of

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all hospitalized injuries in children [1]. During the years 1997 and 1998, there were an estimated 3.7 million emergency department visits due to sports and recreation in the United States. This accounted for almost 11% of all injury-related emergency room visits, with 2.6 million of those being between the ages of 5 and 24. The risk of injury clearly differs between sports, as documented by a study initiated by Patel et al. [2] in young athletes in the United States (Table 1).

Table 1: Injury rates by sport, high school sports-related injury surveillance study, United States, 2015–2016 school year [2].

Sport	Injury Rate per 1000 Athlete - Exposures
Overall Total	2.32
Boys' Soccer	1.87
Girls' Soccer	2.59
Girls' Volleyball	1.19
Boys' Basketball	1.48

Nonetheless, when injury severity is considered, a research group within the English Football Association discovered that the overall risk to professional sportsmen is unacceptably high - approximately 1000 times higher than for high-risk industrial vocations [3]. Some sorts of injuries, such as serious head and knee injuries, are particularly concerning. Head injuries are known to be common among alpine skiers and snowboarders, particularly among snowboarders, with the frequency of

these injuries growing year after year. With an 8% mortality rate among individuals hospitalized in hospital with head injuries, brain injury is the most prevalent reason for hospital admission and the most common cause of death among skiers and snowboarders [4]. Head injuries account for 4–22% of all football-related injuries. Various head injuries, such as facial fractures, contusions, lacerations, and eye injuries, have been observed during matches [5]. Because of the lack of standardization in defining and grading concussions [5], the estimated frequency of concussion - 0.5 injuries per 1000 match hours - is likely underestimated. In pivoting sports such as football, basketball, and handball, 15–25-year-old players had the highest incidence of anterior cruciate ligament (ACL) injuries. Women are three to five times as likely as men to develop this condition [6]. “The ACL is the most common cause of the ex-athlete,” Kennedy said in 1970. To put it another way, the treatment available at the time did not allow sportsmen to return to sport. Thanks to advancements in sports medical research and significant improvements in surgical methods and rehabilitation programs, this is no longer the case, at least in the short term. Today, most elite athletes are not only able to resume their sports career but also reach peak performance levels once they return

from injury. Therefore, while advancements in treatment modalities for sports injuries remain an important goal, it may be even more imperative to develop programs to decrease the risk of these injuries.

To promote physical activity safely and effectively, we must perform a comprehensive assessment of the overall health of our patients. Once established, a program for safe physical activity and promotion of injury prevention can be developed.

To address these concerns, we advocate a “Rule of 10,” a comprehensive set of strategies applicable to athletes and individuals engaged in sports. This rule encompasses:

1. Pre-season physical check-up: A proactive measure to assess an athlete's physical readiness before competition.
2. Communication about injuries: Encouraging athletes to communicate pain or discomfort promptly.
3. Cross-training and variety: Diversifying sports activities to prevent overexertion of specific muscles and joints.
4. Warming up: Emphasizing the importance of a robust warm-up routine.
5. Rest: Acknowledging the need for adequate rest between sessions and competitions.
6. Healthy diet: Advocating for a well-balanced and nutritious diet.

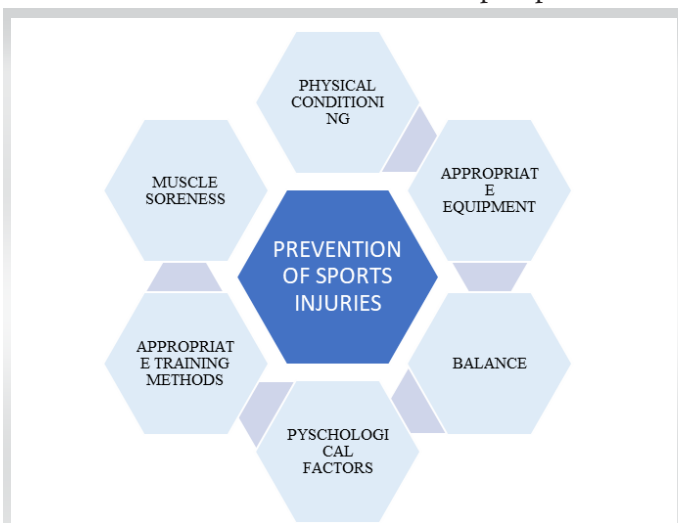


Figure 1: A systematic approach to sports injury prevention.

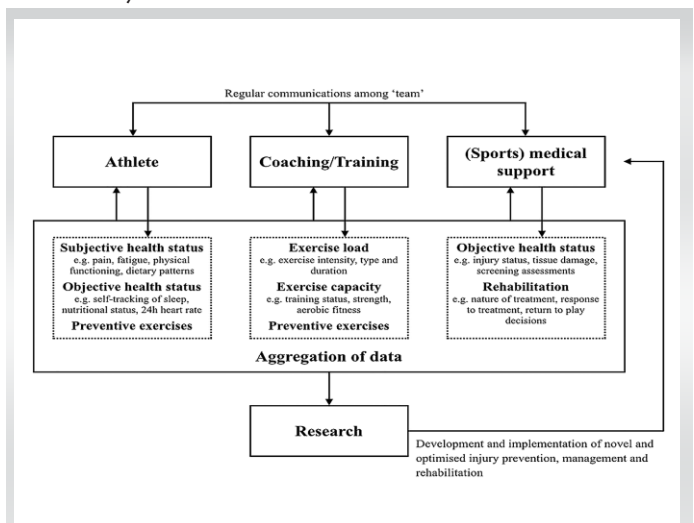


Figure 2: An integrated eHealth approach [22,23].

7. Hydration: Emphasizing the importance of proper hydration.
8. Appropriate equipment: Ensuring the use of suitable protective gear.
9. Proper technique/training: Educating athletes on correct techniques.
10. Early recognition of injuries: Prompt medical intervention for early injury management.

Results

The implementation of the "Rule of 10" serves as a comprehensive strategy to mitigate the risk of sports-related injuries. Each facet of this rule contributes to a holistic approach that encompasses pre-season preparation, athlete education, and proactive measures for injury prevention [Figure 1].

Pre-Season Physical Check-Up:

The initiation of a sports season should ideally commence with a thorough physical assessment of athletes. This proactive approach serves a dual purpose - identifying existing conditions that might predispose an athlete to injuries and preventing the exacerbation of latent issues during play. It was found that pre-season physical check-up reduces injury rates during the season by 8 to 10 percent [7]. The pre-season check-up becomes a crucial diagnostic tool, allowing healthcare professionals to tailor preventive strategies based on individual health profiles.

Communication about Injuries:

Educating young athletes about the importance of promptly reporting pain or discomfort is paramount. The resilience often associated with athletes might lead them to play through pain, inadvertently escalating minor issues into serious injuries. Encouraging open communication between athletes and their support network facilitates early intervention and prevents the progression of injuries.

Cross-Training and Variety:

Monotony in sports activities can lead to overuse injuries as the same muscle groups endure repetitive stress. Cross-training, involving engagement in various sports or activities, provides a respite for specific muscle groups while promoting overall fitness. This diversification is a key element in injury prevention, ensuring that no single set of muscles is overexerted.

Highlighting the Importance of Warming Up:

A comprehensive warm-up routine is foundational to injury prevention. Incorporating both static and active stretching techniques, warm-ups prepare muscles for the demands of play. Proper warm-ups enhance flexibility and reduce the risk of strains and sprains, setting the stage for optimal athletic performance. Lauersen et al. [8] showed that warm up exercise intervention reduced the risk of acute injury by 35.3%.

Encouraging Rest:

The significance of adequate rest cannot be overstated. Athletes, regardless of age, require sufficient recovery time between sessions, games, and competitions. Overuse injuries, often arising from inadequate rest, are prevalent among young athletes. Prioritizing rest in training schedules becomes an integral component of injury prevention.

Advocating a Healthy, Well-Balanced Diet:

Nutrition plays a pivotal role in an athlete's overall health and resilience against injuries. A well-balanced diet rich in fruits, vegetables, and lean proteins contributes to optimal physical condition. Nutritional support is not only essential for performance but also aids in the recovery process, reducing the susceptibility to injuries.

Emphasizing Hydration:

Dehydration poses a significant risk,

especially during physical exertion. Athletes are more susceptible to heat-related illnesses on hot and humid days. Emphasizing proper hydration before, during, and after games is crucial. Maintaining electrolyte balance is vital for sustained athletic performance and overall health.

Use of Appropriate Equipment:

Protective equipment is integral to injury prevention. Helmets, padding, and shoes designed specifically for the sport in question are essential. The appropriate gear serves as a physical barrier, minimizing the impact of collisions and falls, thus reducing the risk of severe injuries.

Emphasizing Proper Technique/Training Methods:

In every sport, there is a right and wrong way to execute movements. Educating athletes on proper techniques, such as tackling in football or throwing in baseball, mitigates the risk of injuries, particularly concussions. Adherence to established rules regarding training intensity and frequency further contributes to injury prevention.

Recognizing Injury and Seeking Medical Care Early:

Early recognition of injuries and prompt medical intervention are pivotal in preventing the escalation of minor issues into severe conditions. Athletes, coaches, and support staff should be trained to identify signs of injuries and seek professional medical care promptly. Timely intervention not only facilitates quicker recovery but also reduces the risk of long-term complications.

Discussion

Physical conditioning

The importance of physical conditioning in injury prevention cannot be overstated. Comprehensive conditioning regimens can assist in

avoiding re-injury by lowering the risk of injury, reducing the severity of an injury if one occurs, and reducing the chance of re-injury. Adequate muscular strength and balance, power, endurance, neuromuscular coordination, joint flexibility, cardiovascular endurance, and a good body composition for sport are all required for safe athletic performance [8]. Injury risk is reduced by improving specific aspects of fitness and conditioning.

For example, strengthening the muscles of a joint not only stabilizes the joint but also helps reduce injuries to the surrounding area. Fitness tests are used to assess the physical conditioning of athletes. These include:

Muscular power: Muscular strength/power can be assessed through a variety of tests. Lower body strength can be assessed through vertical jumps or by the countermovement jump. Upper body strength can be assessed through dynamometry (such as the handgrip test) and through medicine ball throw [10].

Muscular endurance: A variety of tests concentrating on different muscle groups can be used to assess muscular strength/endurance: bent arm hanging, bench press, pull-ups, push-ups, line-drill (LD) rope leaping, 1000, 500, and 200 m running at maximal effort, sit-ups [9].

Cardiovascular endurance: The American College of Sports Medicine recommends doing cardiovascular activity 3–5 times/week for 20–60 min at 60–90% of your maximum heart rate [11]. Multistage non-intermittent and multistage intermittent tests are used to assess aerobic endurance. The Yo-yo intermittent recovery test, which includes the Yo-yo levels 1, 2, and 3, was the most utilized test (80.0%) among the intermittent multistage tests.

Strength training (resistance/weight

training): Another important component of a comprehensive fitness program is strength training, which not only increases muscle but also strengthens bones, ligaments, and tendons, lowering the chance of injury. A decent strength training plan includes the use of weight machines, free weights, and medicine balls [12].

Flexibility: Flexibility, along with cardiovascular fitness and strength, is the final component of a well-rounded fitness program. There are numerous advantages to including stretching into your exercises or sports involvement [13]. Protecting the body from damage requires normal muscle length-tension and appropriate extensibility when stretched.

To enhance muscle strength, tension must be steadily increased and gradually challenged or subjected to greater loading. The Specific Adaptation to Imposed Demands principle asserts that when the body is subjected to varied levels of stress for varying lengths of time, it strives to cope by adapting specifically to the imposed demands [14]. Muscles around a joint, for example, can be developed and conditioned to offer optimal joint stabilization. High-altitude training can potentially improve one's endurance during intense exercise. It increases the aerobic capacity, lactic acid tolerance, and oxygen flow to muscles [15].

Balance: Balance training improves proprioceptive or kinesthetic sensibility, which is necessary for reducing the risk of injury or re-injury during practice or competition. When a joint or musculotendinous structure is injured, somatosensory information is disrupted, impairing motor control. As a result, the athlete's balancing tactics should be restored throughout therapy [16]. Recurrence of injury will be reduced as a result of this. Balancing training exercises must be tailored to the unique types of

balance tactics required by the athlete's sport [17].

Appropriate equipment: Shoes are the most important element of track and field equipment, and they should be chosen individually and carefully [18]. For any athlete, the right shoes can imply the difference between a low and high risk of injury. Training in shoes that are not properly fitting might generate chronic aberrant pressures on the foot, which can lead to stress injuries or structural deformities. A plethora of shoes have been created because of the recent revolution in shoe research, design, and production. The athlete's shoes, on the other hand, must match biomechanical standards and respond to the demands of the specific event. The value of protective equipment in any sport cannot be overstated; it prevents injuries.

Psychological factors

To lessen the chance of injury, athletes must be mentally prepared for training and competition. According to research, there is a link between stressful living conditions, particularly those with high negative stress, and injury occurrence [19]. Reduced flexibility and lack of motor coordination arise from increased tension in the antagonist and agonist muscle groups. Muscle tension slows reaction time, limiting the athlete's ability to react. Both mental and physical exhaustion might contribute to harm. It takes a large amount of energy to sustain a high degree of focus and concentration. Athletes who have been injured understand that they must be mentally prepared to return to sport to avoid re-injury. The role of attentional focus and muscular tension can be a major problem [20].

Tips for preventing injuries

1. Maintain rhythmic breathing during stretches; inhale as you elongate the muscle and exhale during release. Avoid

breath-holding, as it may lead to muscle contraction instead of a proper stretch.

2. Acknowledge pain as an early indicator of potential injury. Listening to your body and addressing discomfort promptly can help prevent more severe issues.

3. Prioritize taking breaks in your physical activity routine. While staying active is crucial, giving your body adequate time to recover after intense workouts is equally important.

4. Implement the P.R.I.C.E method for self-assistance in treating mild sprains, strains, and minor sports injuries at home:

- Protection: Safeguard the injured area from further harm.
- Rest: Allow sufficient time for the body to recover; recovery duration may vary from days to weeks or even months.
- Ice: Apply ice to reduce swelling and alleviate pain.
- Compression: Use compression techniques to support the injured area and minimize swelling.
- Elevation: Elevate the injured limb or area to further reduce swelling.

Adhering to these injury prevention tips can contribute to a safer and more sustainable approach to physical activity and sports participation.

Role of technology to prevent injuries in sports

In the contemporary era, digital technology reigns supreme, with almost global Internet accessibility and an estimated 90% of the world's population owning a mobile phone [21]. E-Health has become a tangible reality not only in sports medicine but also in various medical domains, with its significance expected to expand further.

According to the World Health Organization (WHO), E-Health is characterized as "medicine and public health practice facilitated by electronic processes and communication." Leveraging today's technological advancements, online systems have the

capability to enable self-monitoring and provide tailored feedback to individual users.

E-Health in practice

Mobile Health (m-Health)

The integration of eHealth holds immense potential for enhancing clinical, rehabilitative, and preventive care across various domains, including sports medicine [21]. While technological solutions for specialized care optimization are accessible, it's noteworthy that these innovations are also increasingly available to the general public. This discussion centers on mHealth, a branch of sports medicine leveraging mobile devices.

With smartphones becoming ubiquitous, the hardware necessary for m-Health is now in the hands of the majority. A variety of tracking devices, including global positioning systems and accelerometers, are either embedded in contemporary smartphones or available as external attachments (e.g., heart rate monitors and scales). These devices transform the phone into a central hub for collecting, streamlining, and analyzing health data. The widespread use and technological capabilities of smartphones present ample opportunities for advancing m-Health practices.

Mobile Communications

Contrary to the common belief that creating specialized applications is a prerequisite for clinical support, widely used consumer applications can serve valuable roles. A case in point is WhatsApp, a free messaging application utilizing phone internet connections. Beyond its conventional use for personal communication, WhatsApp proves to be a valuable tool in athlete care communications, facilitating seamless interaction between therapists and athletes [21]. This highlights the adaptability of existing, commonly used applications in fostering effective

eHealth practices.

Integrating Processes

It is possible to provide an integrated approach that encompasses all the sports medicine features listed above: research, implementation, and care, using the current resources. Various types of information, ranging from pre-season assessments to injury reports and subsequent injury follow-up, can be acquired from one athlete or a group of athletes during a season [22]. We now have the scientific tools to tackle contemporary enigmas in sports medicine research thanks to this integrated strategy [23] [Fig. 2].

Conclusion

In recognizing the symbiotic relationship between physical conditioning and injury prevention, we underscore the importance of tailored fitness regimens that encompass muscular strength, endurance, cardiovascular health, flexibility, and balance. These components collectively contribute to the resilience of the athlete, reducing the risk, severity, and recurrence of injuries.

As we navigate the dynamic landscape of sports medicine, our integrated approach, spanning research, implementation, and care, paves the way for a comprehensive understanding of contemporary challenges. By adhering to the principles outlined in this paper, we not only fortify the physical resilience of athletes but also cultivate a culture of proactive health management within the realm of sports.

In conclusion, the commitment to injury prevention extends beyond the realm of individual athletes to encompass the collective efforts of coaches, healthcare providers, and sports organizations. Through continued research, education, and the conscientious application of preventative measures, we can foster an environment where the pursuit of athletic excellence coexists

harmoniously with the preservation of the athlete's well-being. In doing so, we not only safeguard the current generation of athletes but lay the foundation for a legacy of health and longevity in the sporting arena.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

References

- Bahr R, van Mechelen W, Kannus P. Prevention of sports injuries. In: Kjær M, Krogsgaard M, Magnusson P, Engebretsen L, Roos H, Takala T, et al., editors. *Textbook of Sports Medicine. Basic Science and Clinical Aspects of Sports Injury and Physical Activity*. Oxford: Blackwell Science; 2002. p. 299-314.
- Patel DR, Yamasaki A, Brown K. Epidemiology of sports-related musculoskeletal injuries in young athletes in United States. *Transl Pediatr* 2017;6:160-6.
- Drawer S, Fuller CW. Evaluating the level of injury in English professional football using a risk based assessment process. *Br J Sports Med* 2002;36:446-51.
- Engebretsen L, Bahr R. Why is injury prevention in sports important? In: *Sports Injury Prevention*. Hoboken, NJ: Wiley-Blackwell; 2009. p. 1-6.
- Andersen TE, Árnason A, Engebretsen L, Bahr R. Mechanisms of head injuries in elite football. *Br Journal Sports Med* 2004;38:690-6.
- Griffin LY, Albohm MJ, Arendt EA, Bahr R, Beynon BD, Demaio M, et al. Understanding and preventing noncontact anterior cruciate ligament injuries: A review of the Hunt Valley II meeting, January 2005. *Am J Sports Med* 2006;34:1512-32.
- Nakase K, Shitara H, Tajika T. An analysis of pre-season risk factors for low back injury in high-school baseball pitchers: a prospective study. *Sci Rep*. 2021 Jun 1;11(1):11415.
- Lauersen J.B., Bertelsen D.M., Andersen L.B. The effectiveness of exercise interventions to prevent sports injuries: A systematic review and meta-analysis of randomised controlled trials. *Br. J. Sports Med*. 2014;48:871–877.
- Barengo NC, Meneses-Echávez JF, Ramírez-Vélez R, Cohen DD, Tovar G, Bautista JE. The impact of the FIFA 11+ training program on injury prevention in football players: A systematic review. *Int J Environ Res Public Health* 2014;11:11986-2000.
- Árnason A, Andersen TE, Holme I, Engebretsen L, Bahr R. Prevention of hamstring strains in elite soccer: An intervention study. *Scand J Med Sci Sports* 2008;18:40-8.
- Hagel BE, Pless IB, Goulet C, Platt RW, Robitaille Y. Effectiveness of helmets in skiers and snowboarders: Case-control and case crossover study. *BMJ* 2005;330:281.
- Sulheim S, Holme I, Ekeland A, Bahr R. Helmet use and risk of head injuries in alpine skiers and snowboarders. *JAMA* 2006;295:919-24.
- Olsen OE, Myklebust G, Engebretsen L, Holme I, Bahr R. Exercises to prevent lower limb injuries in youth sports: Cluster randomised controlled trial. *BMJ* 2005;330:449.
- Quarrie KL, Gianotti SM, Hopkins WG, Hume PA. Effect of nationwide injury prevention programme on serious spinal injuries in New Zealand rugby union: Ecological study. *BMJ* 2007;334:1150.
- Sadigursky, D., Braid, J.A., De Lira, D.N.L. et al. The FIFA 11+ injury prevention program for soccer players: a systematic review. *BMC Sports Sci Med Rehabil* 9, 18 (2017).
- Kujala UM, Sarna S, Kaprio J, Koskenvuo M. Hospital care in later life among former world-class Finnish athletes. *JAMA* 1996;276:216-20.
- Belval LN, Hosokawa Y, Casa DJ. Practical Hydration Solutions for Sports. *Nutrients*. 2019 Jul 9;11(7):1550.
- Irrgang JJ, Whitney S, Cox E. Balance and proprioceptive training for rehabilitation of the lower extremity. *J Sport Rehabil* 1994;3:68-93.
- Dhillon H, Dhillon S, Dhillon MS. Current concepts in sports injury rehabilitation. *Indian J Orthop* 2017;51:529-36.
- Pease DG. Psychologic factors of rehabilitation. In: Andrews JR, Harrelson GL, editors. *Physical Rehabilitation of the Injured Athlete*. 2nd ed. Philadelphia: W. B. Saunders Co; 1996. p. 1-12.
- Prentice W. *Arnheim's Principles of Athletic Training*. 12th ed. Boston: McGraw Hill; 2005.
- Engebretsen L, Bahr R, Cook JL, Derman W, Emery CA, Finch CF, et al. The IOC centres of excellence bring prevention to sports medicine. *Br J Sports Med* 2014;48:1270-5.
- Verhagen E, Bolling C. Protecting the health of the @hlete: How online technology may aid our common goal to prevent injury and illness in sport. *Br J Sports Med* 2015;49:1174-8.

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