

## REVIEW ΑΝΑΣΚΟΠΗΣΗ

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### Message 7: “Play sports safely”

Sports constitute a major part of everyday activities, especially in younger individuals. Since sport injuries account for about 20% of all home and leisure injuries and can lead to substantial morbidity and disability, the existence of adequate epidemiological information is essential for the development of sound preventive strategies among the countries of the European Union (EU). This paper aims: (a) to describe the magnitude and the socio-economic burden of sport injuries in the countries of the EU, (b) to outline underlying risk factors and (c) to present evidence based preventive practices that reduce the likelihood of sports injury occurrence. This information has been used in the development of messages comprising the European Code Against Injuries (ECAI).

#### 1. DEFINITION

Participation in athletic activities has been traditionally considered a major contributor towards a healthy lifestyle and has become of prime importance in the contemporary era due to sedentary patterns of living. By definition, sport refers to physical activity, requiring muscle use of significant intensity and/or duration. Any sport activity results in physiological metabolic adaptations occurring at both the acute (exercise) and chronic (training) phase of the activity. These conditions are clearly distinguished from the adverse effects (sport injuries) resulting from extreme (trauma) or improper athletic activity (overtraining-repetitive stress). Although adverse effects may have an impact on the body function, musculoskeletal elements i.e. muscles, bones, tendons and ligament tissues are the predominantly affected system. The exact site and nature of injury varies according to the sport type, athlete's age and conditions of the competition. Sport injuries among professionals are not distinguished from those occurring

among amateurs according to the definition above, because the potential mechanism of injury and the proposed preventive measures are largely of similar nature.<sup>1-4</sup>

#### 2. MAGNITUDE OF THE PROBLEM

Existing ICD codification did not allow, at least until recently, separation of sport related deaths among all causes of death reported in the WHOSIS database. Ad hoc research shows, however, that sport injuries are common spanning across all age groups, given the large proportion of the population involved in athletic activities, either in schools, organized sport centers, outdoor or even at home. In fact, sport activities account for about 20% of all “home and leisure accidents”. Preferred sport activities vary with age, body type, time devoted to sports and resources available. Injuries are the same end result, however, owing to a combination of intrinsic and extrinsic factors, with the former related to the health and fitness status of those practicing sports, whereas the latter to the

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Μήνυμα 7: «Αθληθείτε  
με ασφάλεια»

Περίληψη στο τέλος του άρθρου

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nature of the athletic activity practiced, the conditions of the environment and the equipment used.

It has been estimated that about 1.5 million sport injuries are sustained annually among the 7 million high school students in the USA, who actively participate in sports.<sup>5,6</sup> Similarly, in a recently published Canadian survey, about two thirds of teenage students reported a history of sport injury, while almost half of them required medical supervision and 8% had to be referred to the hospital emergency department for immediate care.<sup>7</sup> High sport injury rates are also reported for other age groups, including older people. Within the European Union, sport injuries seem to represent a considerable public health problem with an estimated number of over 40,000 injuries per year reported in the Netherlands and over 200,000 in the United Kingdom.<sup>8</sup>

The high incidence of sport injuries in conjunction with the fact that they mainly affect active population segments spanning from the adolescent period to retirement age result in considerable financial loss both in terms of healthcare delivery costs as well as loss of productivity and deterioration in the quality adjusted life expectancy, let aside the social burden due to sport-associated deaths and disabilities. From a public health perspective, sport injuries impose high costs given their frequency and hospitalization rates. There is a paucity of publications regarding the magnitude of sport injury in the European Union area. Data deriving from the European Home and Leisure Accident Surveillance System (EHLASS) regarding sport injuries among children were analyzed in six European countries namely Austria, Denmark, France, Greece, The Netherlands, and the United Kingdom and showed that about 4% of all persons injured during sports require hospitalization.<sup>8</sup>

Similar figures have been reported in the USA.<sup>9</sup> Of those who were hospitalized for a sport injury, some require expensive surgical and/or specialized treatment while others are referred to chronic rehabilitation units. In a recent study conducted in North Carolina, the statewide annual cost from school sport injuries was estimated at about 10 million dollars for medical costs, 45 million for human capital cost and 145 million for comprehensive cost, which corresponds to a mean cost of 709\$, 2223\$ and 10,432\$ per injury, respectively.<sup>10</sup>

Increased participation and improved access to organized sport activity in urban environment has led to a rapid increase of sport injuries that has been depicted in a number of nationwide and international comparative studies. For instance, in Finland, a 49% increase has

been reported between 1988 and 2003. It is feared that the increasing trend is so sharp that sport injury will soon be the most common category of hospital-treated injury.<sup>11,12</sup> Although this is not a universal trend, it is likely that this phenomenon is strongly associated with socio-demographic factors.

### 3. RISK FACTORS

A variety of factors that interact dynamically contribute to the occurrence of sport injuries, which are generally classified into two major categories:

- a) *Intrinsic* (personal, host) risk factors, which are biological and psychological characteristics predisposing a person to injury and
- b) *Extrinsic* (environmental) risk factors, which are related to the type of sport activity, the manner in which sport is practiced, the environmental conditions and the equipment used.<sup>13,14</sup>

#### 3.1. Demographic risk factors

The risk for sport injury has been found to increase according to population density, with a minimal risk for the countryside and for the non-Caucasian population. Other positive predictors of sport injury proneness are related to the body type characteristics (weight, height, fitness). Sex and age are also important predictors of sport injury, due to different predominant activity preference. For instance, accidents in "team sports with ball", namely football, are mostly affecting males (80%), aged 5 to 24 years (40%). On the other hand, accidents with "animal sports", namely riding, are mostly affecting females (90%) and the children aged 5 to 14 years.<sup>15-18</sup> Adolescents are at a higher risk to sustain a sport injury due to their frequent involvement with exercise, especially in professional training and competitive sports.

#### 3.2. Environmental risk factors

Some sport activities are by nature of higher injury risk than others, including many popular team sports, such as basketball, football, soccer and snowboarding, although the nature of preferred sport activity varies widely among the EU member states.<sup>8</sup> In a recent study conducted in Scotland using the Home and Leisure Accident Surveillance System (HASS/LASS), male sport participation in adolescence increased considerably with more than half of the injuries being football-related, both in informal and organized setting. The most frequent accident mechanisms

during play and leisure are falls (53%), collisions (20%) and “crushing, cutting, piercing” (12%). “Team sports with ball”, “sports with racket” (e. g. tennis), and “non-motorized wheel sports” (e. g. bicycling) account for almost 60% of all sports related accidents.

In about half of all sport injuries, a previous relevant medical history has been recorded. This finding indicates both the increased proneness of the recovered tissue for repeated damage and the continued presence of increased risk in the affected population due to its lifestyle, the modification of which should be targeted as a priority of the public health strategies for sport injury prevention. Furthermore, competitive sport related injuries are proportionally more common than those associated with amateur sports. Lack or inadequate use of protective equipment, insufficient training, unsatisfactory type of terrain and adverse weather conditions are all associated with higher sport injury risk. Moreover, bad training practices, such as lack or insufficient warm-up stage may also lead to an injury.

Current understanding of the etiologic of sport injury remains largely vague despite intensive research in recent years. Even the best available models can only justify a minority of the underlying pathophysiologic mechanisms in the different types of sport injuries.<sup>19–25</sup>

### 3.3. Behavioural risk factors

Behavioral and psychological parameters have been shown to play a significant role in the determination of sport injury proneness. In particular, men appear to be more accident prone than women in the sports field, a finding consistent with similar observations for other types of injury. This sex-specific differentiation may even reach a ratio of 3:1. The risk is further enhanced among

individuals with a history of sedentary life, especially when combined with smoking and generally unhealthy lifestyle.<sup>26–29</sup> Illegal behaviour during sport activity is recognized as an independent risk factor for injury, accounting for 0.24 injuries per 1,000 athletic exposures, according to USA statistics. Injuries associated with illegal conduct are more frequently severe, e.g. concussions and head or face trauma. Although illegal activity was reported in only 6% of knee injuries, 20% of these lesions required surgical treatment due to their severity.<sup>5,21</sup> A comprehensive list including most common risk factors associated with sport injuries is provided in table 1.

## 4. EFFECTIVE PREVENTIVE PRACTICES

Injuries occurring during sport activities can be prevented to a high extent by adopting safe measures, which are grossly divided to passive and active ones. Areas that should be considered in order to maximize the anticipated gains when developing an optimal strategy for the prevention of sports injuries include: (a) the level of training – preparatory exercise and proper diet prior to intensive physical activity, (b) the type of sport practiced (e.g. contact or non-contact, team or individual, strength or stamina-based), (c) the playing conditions (environmental adaptations) and (d) the equipment used by the athletes. Basic principles largely accepted as successful elements of sport injury prevention strategies are shown in table 2. On a theoretical basis, the concept of injury prevention both in general and with regards to sports in particular, can be analyzed in three levels.<sup>30–34</sup>

(a) *Primary Prevention* aiming to avoid the possibility that an injury will occur. It involves a continuum of passive, active and blended strategies.

– *Passive prevention strategies* require no individual or

**Table 1.** Extrinsic and intrinsic factors for sport injury

Extrinsic factors - environment	Intrinsic factors - contestants
Sport type – nature of activity	Co morbidities – co-existing disease
Intensity	Sex
Duration-Frequency	Age
Informal/Competitive setting	Injury History
Organized/Amateur setting	Smoking/Drug/Alcohol Use
Equipment used	Physical Activity History
Training parameters	Body composition - BMI
Weather/Environment/Terrain	Anatomic structure

**Table 2.** Basic principles of sport injury prevention

Tips for sport injury prevention
Pre-participation examination
Proper hydration and good nutritional status
Adequate methods for training and conditioning
Correct use of equipment
Proper playing conditions (field/surfaces of play)
Paying attention to the environmental conditions
Playing within the rules of the game
Awareness of the overuse injuries

repetitive action and are generally most effective. They encompass measures such as providing optimal conditions for the game, in particular scheduling of the game and the competition field. Sample interventions of this type include: break-away bases in baseball and softball, early morning starts in summer road races, and exclusion of athletes who suffer from herpes dermatitis from participation in contact sports. Given that the large majority of sport injuries occur in schools or organized sport facilities measures targeting the conditions of these areas are expected to yield high gains in the improvement of sport injury statistics.<sup>35-40</sup>

- *Active prevention strategies* comprise voluntary measures and rely on repetitive, individual action. To this end, they require an athlete to cooperate or to make behavioural changes, such as the adoption of healthy nutrition and exercise habits and avoidance of consumption of harmful substances. There are reports showing a significant decline in the number of sport injuries, when special fitness programs are applied in combination with continuous sport education and use of state of the art equipment.<sup>40,41</sup>
  - *Blended strategies* require a certain degree of cooperation from the athlete. Respecting the rules of the game is a blended strategy example. Defining standards of conduct for all players and allowing them to expect certain responses to ensure sport safety. Proper use of protective equipment is acknowledged as an essential preventive measure. Identified barriers to the successful implementation of these interventions are the high level of competition in modern sport, as well as the natural impulsive nature of teenagers and young adolescents.
- (b) *Secondary Prevention* aiming to respond and treat a sport injury in the best possible way in order to avoid the occurrence of permanent damage. This strategy is of prime importance for professional athletes who are

expecting to receive optimal treatment in organized centers by skilled health professionals.<sup>42,43</sup>

- (c) *Tertiary Prevention* aiming to adopt safety measures in order to avoid the repetition of an injury, given that the injured individuals as a rule derive from high-risk groups, which comprise the hard-core segments to behavioural change.

## 5. CONCLUSION

Sport injury constitutes a frequent type of injury, on the rise in several EU countries during the last decades. Among the *intrinsic* risk and *extrinsic* factors, which may be held responsible for this increase, are the contemporary lifestyles as well as involvement in more high-risk sport activities. By contrast, several evidence based practices and measures are nowadays available, which if adopted on individual level can substantially reduce the sport related risk. These can be distinguished in three levels (a) primary including passive, active and blended strategies, (b) secondary and (c) tertiary measures. More specifically the following preventive measures are strongly recommended:

- Make sure you and/or your child use sport appropriate protective equipment; check the condition of the protective equipment and the sports area.
- Be aware of sport specific recommendations and regulations and follow them. Make sure that other participants do the same.
- Warm-up muscles for a minimum of five minutes, before participating in sports.
- Be realistic about your own physical performance and exercise within your limits.
- Encourage your child to participate in organized sports where there are certified coaches, trained in the prevention, recognition and immediate care of injuries.

## ΠΕΡΙΛΗΨΗ

### Μήνυμα 7: «Αθληθείτε με ασφάλεια»

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Οι αθλητικές δραστηριότητες είναι σημαντικό τμήμα της καθημερινότητας, ειδικότερα των νέων. Δεδομένου ότι οι τραυματισμοί κατά την άθληση αντιστοιχούν περίπου στο 20% των ατυχημάτων στο σπίτι και κατά τον ελεύθερο χρόνο καθώς και ότι αποτελούν σημαντική αιτία νοσηρότητας και αναπηρίας, ιδιαίτερως σημαντική κρίνεται η ύπαρξη επιδημιολογικής γνώσης που θα συντελέσει στην ανάπτυξη πρακτικών πρόληψης στις χώρες της Ευρωπαϊκής Ένωσης. Αυτή η εργασία στοχεύει: (α) να περιγράψει την έκταση του προβλήματος και τις κοινωνικο-οικονομικές επιπτώσεις των αθλητικών ατυχημάτων στις χώρες της Ευρωπαϊκής Ένωσης, (β) να επισημάνει τους υποκείμενους παράγοντες κινδύνου, και (γ) να παρουσιάσει τις επιστημονικά αποδεδειγμένες πρακτικές που μειώνουν την πιθανότητα αθλητικών ατυχημάτων. Μερικές από αυτές τις πρακτικές έχουν συμπεριληφθεί στον Ευρωπαϊκό Κώδικα Κατά των Ατυχημάτων, προκειμένου το κοινό να ενημερωθεί σχετικά με την πρόληψη των ακούσιων τραυματισμών.

**Λέξεις ευρετηρίου:** Αθλήματα, Ευρωπαϊκός Κώδικας Κατά των Ατυχημάτων, Πρόληψη

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